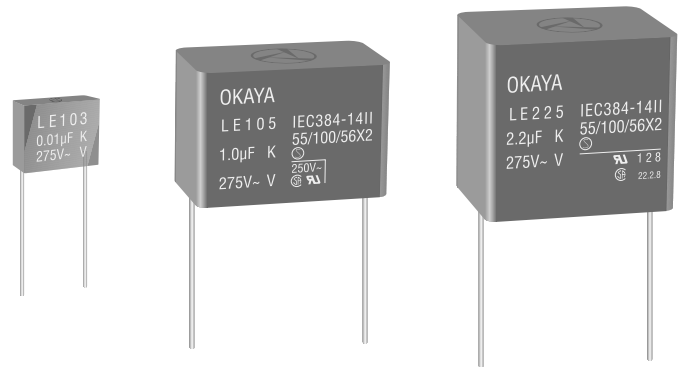
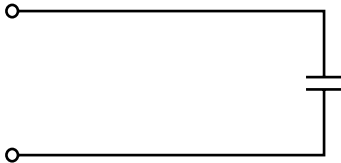


LE SERIES



- New smaller size
- Wide temperature range
- Best price/performance series
- Cost effective

Safety Agency : Standard	File No.
UL : UL-1414, UL1283	E47474, E78644
cUL (CSA) : C22.2, No. 0,1 C22.2 No. 8	E47474, E78644
SEMKO : IEC384-14 II/EN132400	9626047



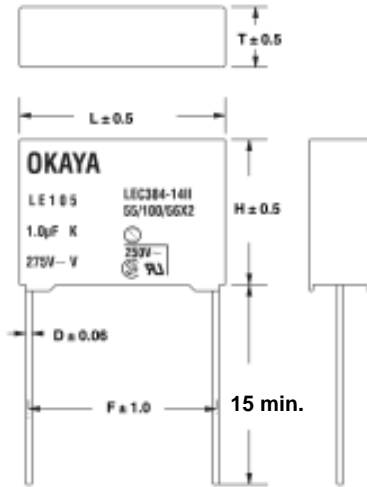
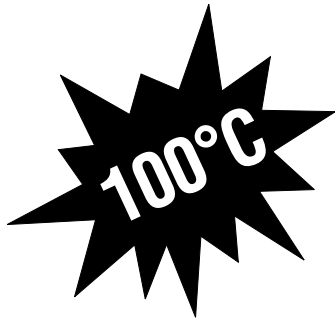
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -55° ~ +100°C

Safety Standard	Class	Model number	Capacitance Cx (±10%)	Dissipation Factor Tarδ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
 	X2	LE103	0.01	0.01 max. at 1kHz	L-L 1250Vrms 50/60Hz 60 Sec. L-Case 2000Vrms 50/60Hz 60 Sec.	L-L 15000Mohm min. @100Vdc	L-Case 300000Mohm min. @100Vdc
		LE153	0.015				
		LE223	0.022				
		LE333	0.033				
		LE473	0.047				
		LE683	0.068				
		LE104	0.1				
		LE154	0.15				
		LE224	0.22				
		LE334	0.33				
		LE474	0.47				
		LE684	0.68				
		LE105	1.0				
		LE155	1.5				
LE225	2.2						

MECHANICAL SPECIFICATIONS

- Case: Standoffs provided for improved cleanability
- Case material: Polybutylene Terephthalate (RF-PBT)
UL-94 Flame Class V-O
- Potting Material: UL-94 Flame Class V-O
- Leads: Tinned Copper Clad Steel
- Capacitor: Metallized Polypropylene Film



MECHANICAL DIMENSIONS

Safety Standard	Class	Model number	Capacitance Cx (±10%)	Outside Dimension mm				
				L	H	T	F	D
	X2	LE103	0.01	12.0	10.5	4.5	10.0	0.6
		LE153	0.015			5.5		
		LE223	0.022					
		LE333	0.033					
		LE473	0.047	11.0	5.0			
		LE683	0.068		5.0			
		LE104	0.1					
		LE154	0.15	11.5	5.5	15.0		
		LE224	0.22	14.0	6.5			
		LE334	0.33	15.0	8.0			
		LE474	0.47	17.5	9.5			
		LE684	0.68	25.5	17.5	8.5	22.5	0.8
		LE105	1.0		19.5	10.5		
		LE155	1.5		22.0	12.0		
LE225	2.2	30.5	24.5	15.0	27.5			
			28.0	18.0				

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Contact Okaya on the Internet at: <http://www.okaya.com>
E-mail: sales@okaya.com

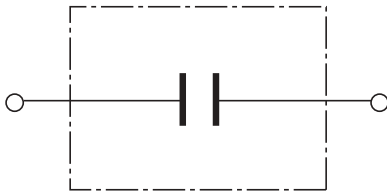
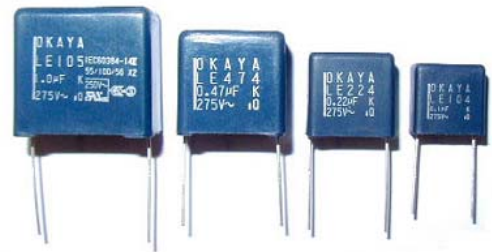
Okaya Electric America, Inc.
503 Wall Street, Valparaiso, Indiana 46383
Tel: 800-852-0122
Fax: 219-477-4856
North American Sales and Technical Support

LE-M SERIES

- Our best price/performance series for high volume applications.
- Smaller size of LE series.
- Lead free.

Safety Agency : Standard	File No.
UL : UL-1414, UL-1283	E47474, E78644
cUL (CSA) : C22.2, No. 0,1 C22.2 No. 8	E47474, E78644
SEMKO : IEC60384-14 II/EN132400	28277
CENELEC ENEC	SE/0142-1

*1 The design of ENEC mark shows in the right figure. *1
14 indicates as the identity number of SEMCO.



ELECTRICAL SPECIFICATIONS

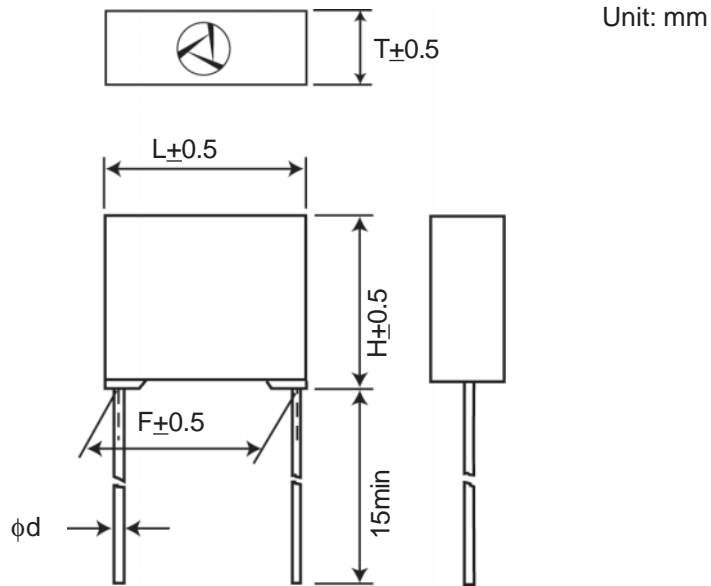
Operating temp. range: -55 ~ +100°C

Safety Standard	Class	Model number	Capacitance Cx (μF±10%)	Dissipation Factor Tan	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
 *2	X2	LE104-M	0.1	0.01 max. at 1kHz	L-L 1,000Vrms 50/60Hz 60 Sec.	L-L 15,000M ohm min. at 100Vdc	L-Case 100,000M ohm min. at 500Vdc
		LE154-M	0.15				
		LE224-M	0.22				
		LE334-M	0.33				
		LE474-M	0.47		L-Case 2000Vrms 50/60Hz 60 Sec.	L-L 5000 ohm • F min. at 100Vdc	
		LE684-M	0.68				
		LE105-M	1.0				
		LE155-M	1.5				
LE225-M	2.2						

*2 This series has European approvals which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive




MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Plated Copper Clad Steel,
 Capacitor: Metallized Polypropylene Film



Other lead lengths available --- consult factory

MECHANICAL DIMENSIONS

Safety Standard	Class	Model number	Capacitance Cx (μF±10%)	Outside Dimension mm				
				L	H	T	F	d
  	X2	LE104-M	0.1	12.0	11.5	6.5	10.0	0.6
		LE154-M	0.15	14.0		7.0		
		LE224-M	0.22		8.5			
		LE334-M	0.33		10.0			
		LE474-M	0.47		11.5	15.0		
		LE684-M	0.68		17.0			
		LE105-M	1.0		22.5	10.0	20.0	
		LE155-M	1.5	26.0	12.0			
LE225-M	2.2	26.0	22.0	22.5	0.8			
			25.0			17.0		

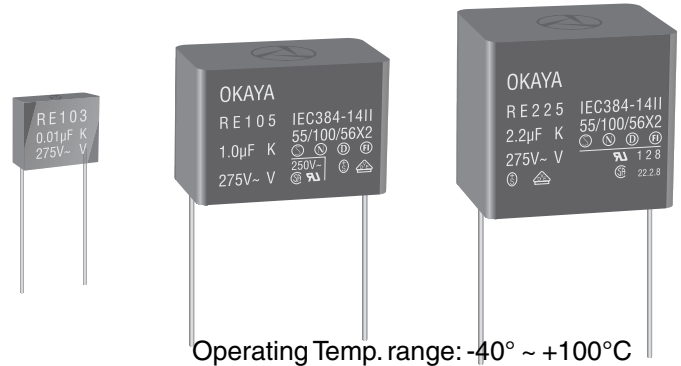
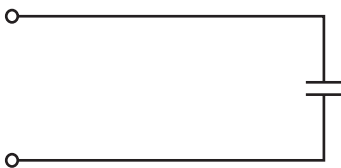
Fax Back Document #1109

RE SERIES

- New smaller size
- Wide temperature range
- Best price/size/performance series
- Cost effective



Safety Agency : Standard	File No.
UL : UL-1414, UL-1283	E47474, E78644
CSA : C22.2, No. 0,1 C22.2 No. 8	LR37404, LR68886, LR104926
VDE : IEC60384-14 II/EN132 400	94750
SEV : IEC60384-14 II/EN132 400	97,1 10224, 02
SEMKO : IEC60384-14 II/EN132 400	9717020/01
FIMKO : IEC60384-14 II/EN132 400	195312-01
DEMKO : IEC60384-14 II/EN132 400	306582
NEMKO : IEC60384-14 II/EN132 400	P97101052



ELECTRICAL SPECIFICATIONS

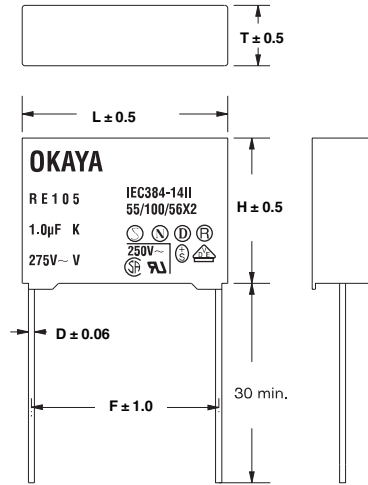
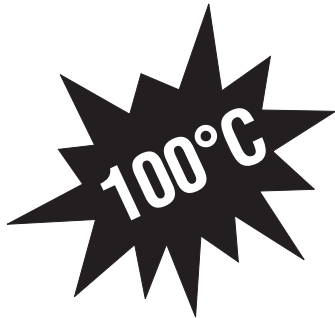
Operating Temp. range: -40° ~ +100°C

Safety Standard	Class	Model number	Capacitance Cx (F-10%)	Dissipation Factor Tanδ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
	X2	RE103	0.01	0.01 max. at 1kHz	L-L 1500Vrms 50/60Hz at 1kHz 2 Sec. L-Case 2000Vrms 50/60Hz at 1kHz 60 Sec.	L-L 15000Mohm min. @ 500Vdc	L-Case 300000Mohm min. @ 500Vdc
		*RE123	0.012				
		RE153	0.015				
		*RE183	0.018				
		RE223	0.022				
		*RE273	0.027				
		RE333	0.033				
		*RE393	0.039				
		RE473	0.047				
		*RE563	0.056				
		RE683	0.068				
		*RE823	0.082				
		RE104	0.1				
		*RE124	0.012				
		RE154	0.15				
		*RE184	0.18				
		RE224	0.22				
		*RE274	0.27				
		RE334	0.33				
		*RE394	0.39				
		RE474	0.47				
		*RE564	0.56				
		RE684	0.68				
		*RE824	0.82				
		RE105	1.0				
*RE125	1.2						
RE155	1.5						
*RE185	1.8						
RE225	2.2						

*Non-Stock: Consult Factory

MECHANICAL SPECIFICATIONS

- Case: Standoffs provided for improved cleanability
- Case material: Polybutylene Terephthalate (RF-PBT)
UL-94 Flame Class V-O
- Potting Material: UL-94 Flame Class V-O
- Leads: Tinned Copper Clad Steel
- Capacitor: Metallized Polypropylene Film



MECHANICAL DIMENSIONS

Safety Standard	Class	Model number	Capacitance Cx (F-10%)	Outside Dimension mm				
				L	H	T	F	D
	X2	RE103	0.01	12.0	10.5	4.5	10.0	0.6
		RE123	0.012					
		RE153	0.015					
		RE183	0.018					
		RE223	0.022					
		RE273	0.027					
		RE333	0.033					
		RE393	0.039					
		RE473	0.047					
		RE563	0.056					
		RE683	0.068					
		RE823	0.082					
		RE104	0.1					
		RE124	0.012					
		RE154	0.15					
		RE184	0.18					
		RE224	0.22					
		RE274	0.27					
		RE334	0.33					
		RE394	0.39					
		RE474	0.47					
		RE564	0.56					
		RE684	0.68					
		RE824	0.82					
		RE105	1.0					
RE125	1.25							
RE155	1.5							
RE185	1.8							
RE225	2.2							

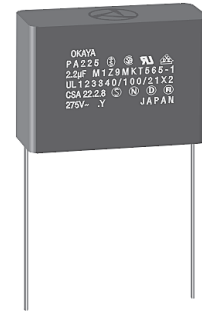
Fax Back Document #1101

PA SERIES

- Wide temperature range
- Best price/performance series
- Popular size configuration



Safety Agency : Standard	File No.
UL : UL-1414 UL1283 (250VAC)	E47474, E78644
CSA : C22.2, No. 0,1 No.8 (250VAC)	LR68886 / LR37404
VDE : IEC384-14 II /EN132400	10529-4670-8022
SEV : IEC384-14 II /EN132400	95.6 60132,01
SEMKO : IEC384-14 II /EN13240	9544164
FIMKO : IEC384-14 II /EN13240	187154
DEMKO : IEC384-14 II /EN13240	304862
NEMKO : IEC384-14 II /EN13240	P95104056



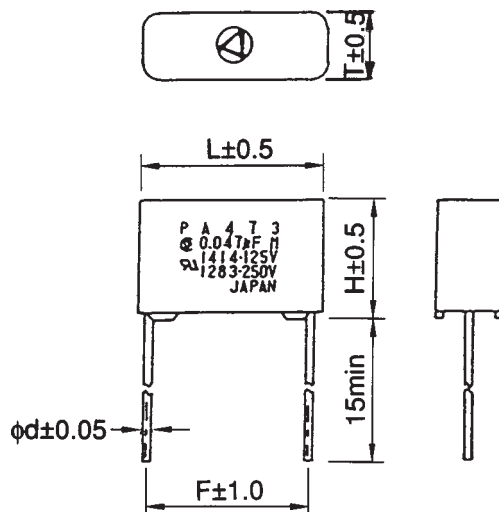
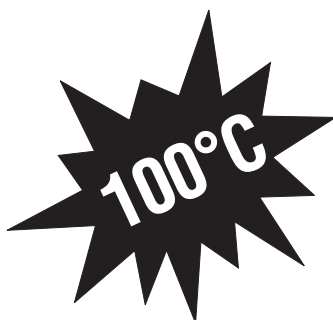
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -40° ~ +100°C

Safety Standard	Class	Model number	Capacitance Cx (μF±20%)	Dissipation Factor Tan δ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
 	X2	PA103	0.01	0.01 max. (at 1000± 100Hz)	1500VAC 2121VDC 2 Sec.	PA 103 ~ 334 15,000 MΩ min.	100,000 MΩ min. (at 20°C 500VDC)
		PA123	0.012				
		PA153	0.015				
		PA183	0.018				
		PA223	0.022				
		PA273	0.027				
		PA333	0.033				
		PA393	0.039				
		PA473	0.047				
		PA563	0.056				
		PA683	0.068				
		PA823	0.082				
		PA104	0.1				
		PA124	0.12				
		PA154	0.15				
		PA184	0.18				
		PA224	0.22				
		PA274	0.27				
		PA334	0.33				
		PA394	0.39				
		PA474	0.47				
		PA564	0.56				
		PA684	0.68				
		PA824	0.82				
		PA105	1.0				
PA125	1.2						
PA155	1.5						
PA185	1.8						
PA225	2.2						

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Capacitor: Metallized Polyester Film



SUPPRESSION CAPACITORS

MECHANICAL DIMENSIONS

Other lead lengths available—consult factory.

Safety Standard	Model number	Capacitance Cx (μF±20%)	Outside Dimension mm				
			L	H	T	F	D
	PA103	0.01	17.0	12.0	5.0	15.0	0.6
	PA123	0.012					
	PA153	0.015					
	PA183	0.018					
	PA223	0.022					
	PA273	0.027					
	PA333	0.033					
	PA393	0.039					
	PA473	0.047					
	PA563	0.056	25.0	12.5	5.5	22.5	0.8
	PA683	0.068					
	PA823	0.082					
	PA104	0.1					
	PA124	0.12					
	PA154	0.15					
	PA184	0.18	30.0	17.0	9.0	27.5	1.0
	PA224	0.22					
	PA274	0.27					
	PA334	0.33	30.0	19.5	10.0	22.5	1.0
PA394	0.39						
PA474	0.47						
PA564	0.56						
PA684	0.68						
PA824	0.82						
PA105	1.0	41.0	28.0	15.5	37.5	1.0	
PA125	1.2						
PA155	1.5						
PA185	1.8						
PA225	2.2						
PA275	2.7						

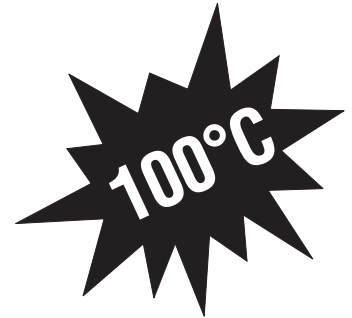
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PAB SERIES

- Wide temperature range
- Best price/performance series
- Popular size configuration
- Flexible wire leads



Safety Agency : Standard	File No.
UL : UL-1414 (250VAC)	E47474
CSA : C22.2, No. 0, 1 (250VAC)	LR37404
VDE : IEC384-14 II/EN132400	10529-4670-8024
SEV : IEC384-14 II/EN132400	95.1,10017
SEMKO : IEC384-14 II/EN132400	9447311
FIMKO : IEC384-14 II/EN132400	181280-02
DEMKO : IEC384-14 II/EN132400	303582
NEMKO : IEC384-14 II/EN132400	P95101021



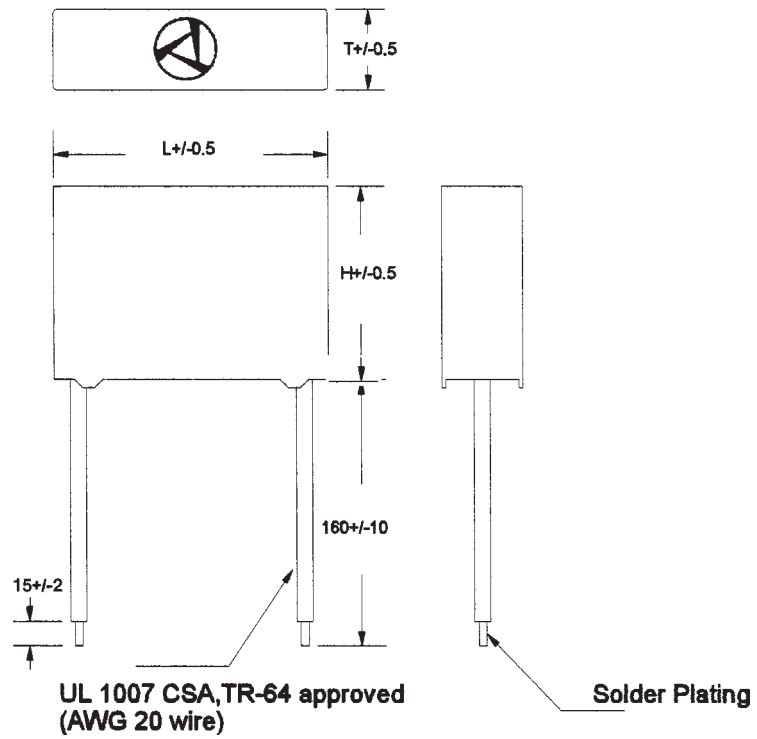
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -40° ~ +100°C

Safety Standard	Class	Model number	Capacitance Cx (µF±20%)	Dissipation Factor Tan δ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
	X2	PAB103	0.01	0.01 max. at 1kHz	L-L 1500Vrms 50/60Hz at 1kHz 60 Sec. L-Case 2000Vrms 50/60Hz at 1kHz 60 Sec.	L-L 15000Mohm min.@500Vdc	L-Case 10000Mohm min.@500Vdc
		PAB153	0.015				
		PAB223	0.022				
		PAB333	0.033				
		PAB473	0.047				
		PAB683	0.068				
		PAB104	0.1				
		PAB154	0.15				
		PAB224	0.22				

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Stranded Copper Wire
 Polyvinylchloride (PVC) Insulation
 Capacitor: Metallized Polyester Film



MECHANICAL DIMENSIONS

Safety Standard	Class	Model number	Capacitance Cx ($\mu\text{F} \pm 20\%$)	Outside Dimension mm			
				L	H	T	F
	X2	PAB103	0.01	17.0	12.0	5.0	15.0
		PAB153	0.015	17.0	12.0	5.0	15.0
		PAB223	0.022	17.0	12.0	5.0	15.0
		PAB333	0.033	17.0	12.0	5.0	15.0
		PAB473	0.047	17.0	12.5	5.5	15.0
		PAB683	0.068	17.0	13.5	6.5	15.0
		PAB104	0.1	17.0	15.0	8.0	15.0
		PAB154	0.15	25.0	16.0	6.5	22.5
		PAB224	0.22	25.0	17.5	8.0	22.5

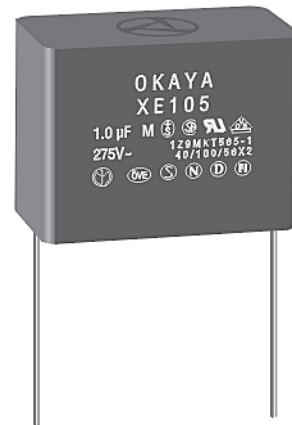
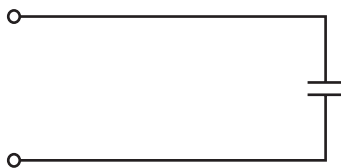
Fax Back Document #1103

XE SERIES



- Best performance series in most popular configurations
- Dielectric withstand voltage twice safety agency requirements
- High dv/dt, surge resistance and I/R ratings

Safety Agency : Standard	File No.
UL : UL-1414 (250VAC)	E47474
CSA : C22.2, No. 0, 1(250VAC)	LR68886 / LR37404
VDE : IEC384-14 II/EN132400	10529-4670-1019/8020
SEV : IEC384-14 II/EN132400	94.1 00826, 03/04
SEMKO : IEC384-14 II/EN132400	9433161
FIMKO : IEC384-14 II/EN132400	179796/180681
DEMKO : IEC384-14 II/EN132400	303214/303419
NEMKO : IEC384-14 II/EN132400	P95103746/P95100574
OVE : IEC384-14 II/EN132400	5429-211-00
IMQ : IEC384-14 II/EN132400	V4047, V4048



ELECTRICAL SPECIFICATIONS

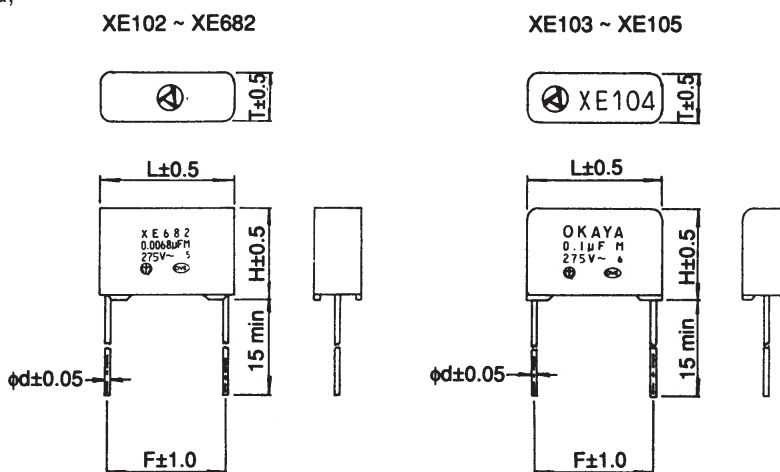
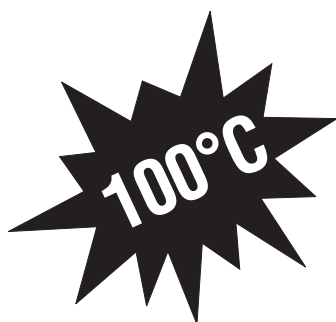
Operating temp. range: -40 ~ + 100°C

Safety Standard	Class*	Model number	Capacitance Cx (μF±20%)	Dissipation Factor Tan δ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
	X1, X2 and Y2	XE102	0.001	0.01 max. (at 1000 ± 100Hz)	XE 102 ~ 682 2000VAC/2700VDC 2 Sec. XE 103 ~ 105 1500VAC/2121VDC 2 Sec.	XE 102 ~ 334 15,000 MΩ min. XE 474 ~ 105 5,000 Ω •F min. (at 20°C 500VDC)	100,000 MΩ min. (at 20°C 500VDC)
		XE152	0.0015				
		XE222	0.0022				
		XE332	0.0033				
		XE472	0.0047				
		XE682	0.0068				
	X1, X2	XE103	0.01				
		XE153	0.015				
		XE223	0.022				
		XE333	0.033				
		XE473	0.047				
		XE683	0.068				
		XE104	0.1				
		XE154	0.15				
		XE224	0.22				
		XE334	0.33				
		XE474	0.47				
		XE684	0.68				
		XE105	1.0				

* X Class = 275VAC, Y Class - 250VAC

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Soldered Capacitor Element
 Lead Locator: Inspection marks on case for lead location
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film



Add "C6" suffix to p/n for 6mm lead length.
 Other lead lengths available—consult factory.

MECHANICAL DIMENSIONS

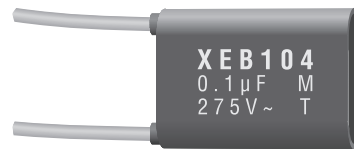
Safety Standard	Class	Model number	Capacitance Cx (μF±20%)	Outside Dimension mm				
				L	H	T	F	d
	X1, X2 and Y2	XE102	0.001	17.0	12.5	5.5	15.0	0.8
		XE152	0.0015					
		XE222	0.0022					
		XE332	0.0033					
		XE472	0.0047					
		XE682	0.0068					
	X1, X2	XE103	0.01	25.0	12.0	5.0	22.5	0.8
		XE153	0.015					
		XE223	0.022					
		XE333	0.033					
		XE473	0.047					
		XE683	0.068					
		XE104	0.1					
		XE154	0.15					
		XE224	0.22					
		XE334	0.33					
		XE474	0.47					
		XE684	0.68					
XE105	1.0							
				30.0	24.0	13.5	27.5	
				30.5	28.0	16.5		
				36.0	30.5	20.0	32.5	1.0

Fax Back Document #1104

XEB SERIES

- Long insulated flexible wire leads
- Larger devices have isolated external mounting tab
- Electrical capabilities equivalent to XE series

Safety Agency : Standard		File No.
UL	: UL-1414 (250VAC)	E47474
CSA	: CSA C22.2, No. 0, No. 1 (250VAC)	LR37404, LR68886
SEV	: IEC60384-14 II, EN132400	96,1 10800,01 96,1 10799,01



ELECTRICAL SPECIFICATIONS

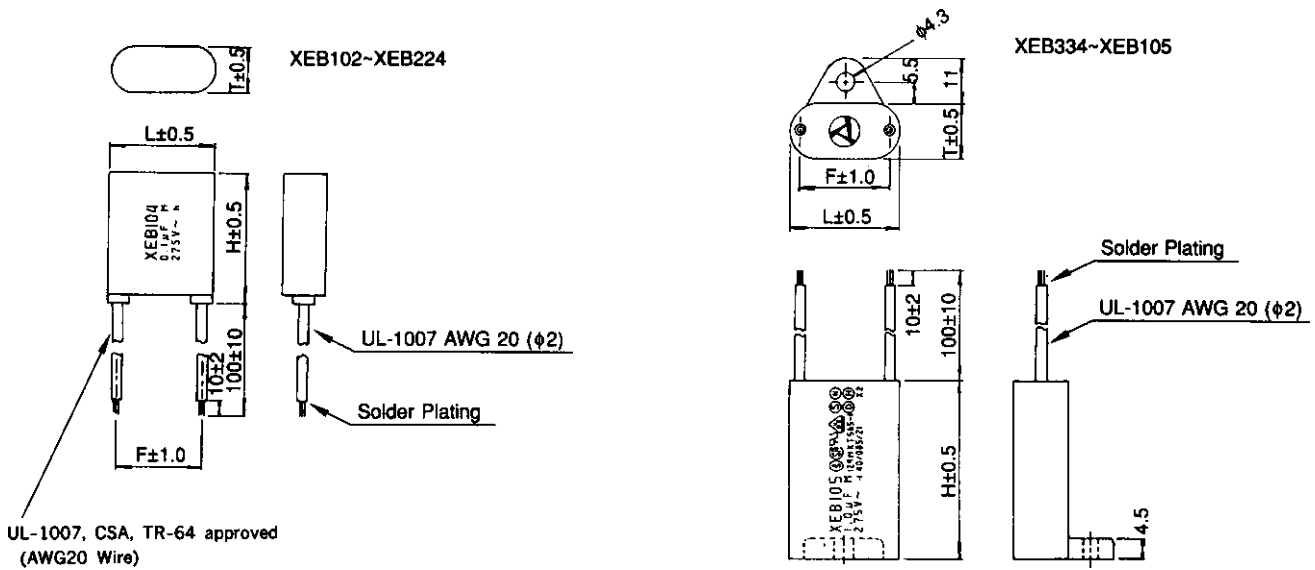
Operating temp. range: -40 ~ + 85°C

Safety Standard	Class*	Model number	Capacitance Cx (F-20%)	Dissipation Factor Tan δ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
	X2 and Y2	XEB102	0.001	0.01 max. (at 1000 ± 100Hz)	XEB 102 ~ 682 2000VAC/2700VDC 2 Sec. XEB 103 ~ 105 1250VAC/1414VDC 2 Sec.	XEB 102 ~ 334 15,000 MΩ min. XEB 474 ~ 105 5,000Ω•F min. (at 20 C 500VDC)	100,000 MΩ min. (at 20 C 500VDC)
		XEB152	0.0015				
		XEB222	0.0022				
		XEB332	0.0033				
		XEB472	0.0047				
		XEB682	0.0068				
	X2	XEB103	0.01				
		XEB153	0.015				
		XEB223	0.022				
		XEB333	0.033				
		XEB473	0.047				
		XEB683	0.068				
		XEB104	0.1				
		XEB154	0.15				
		XEB224	0.22				
		XEB334	0.33				
		XEB474	0.47				
		XEB684	0.68				
		XEB105	1.0				

* X Class = 275VAC, Y Class - 250VAC

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Stranded Copper Wire
 Polyvinylchloride (PVC) Insulation
 Soldered to Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film



MECHANICAL DIMENSIONS

Other lead lengths available—consult factory.

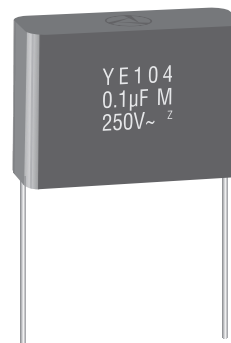
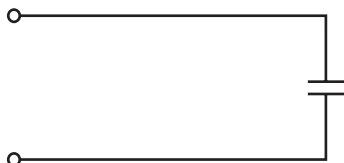
Safety Standard	Class	Model number	Capacitance Cx (F-20%)	Outside Dimension mm							
				L	H	T	F				
	X2 and Y2	XEB102	0.001	16.0	20.0	8.0	12.5				
		XEB152	0.0015								
		XEB222	0.0022								
		XEB332	0.0033								
		XEB472	0.0047								
		XEB682	0.0068								
	X2	XEB103	0.01	19.0	25.0	8.5	15.0				
		XEB153	0.015								
		XEB223	0.022								
		XEB333	0.033								
		XEB473	0.047								
		XEB683	0.068								
		XEB104	0.1					21.5	28.0	11.0	17.5
		XEB154	0.15								
		XEB224	0.22								
		XEB334	0.33								
		XEB474	0.47					30.0	39.0	16.0	26.0
		XEB684	0.68								
		XEB105	1.0								

Fax Back Document #1105

YE SERIES

- Y class rating up to 0.1µF not readily available elsewhere
- IEC65 Withstand voltage of 2KVAC for severe applications
- Highest dv/dt, Endurance

Safety Agency : Standard		File No.
UL	: UL-1414	E47474
CSA	: C22.2, No. 0, No. 1	LR37404, LR68886
SEMKO	: IEC60384-14II, EN132400	9643006/01
DEMKO	: IEC60384-14II, EN132400	306384
FIMKO	: IEC60384-14II, EN132400	193062-01
SEV	: IEC60384-14II, EN132400	96,5 50353.01
NEMKO	: IEC60384-14II, EN132400	P96103187
VDE	: IEC60384-14II, EN132400	94721



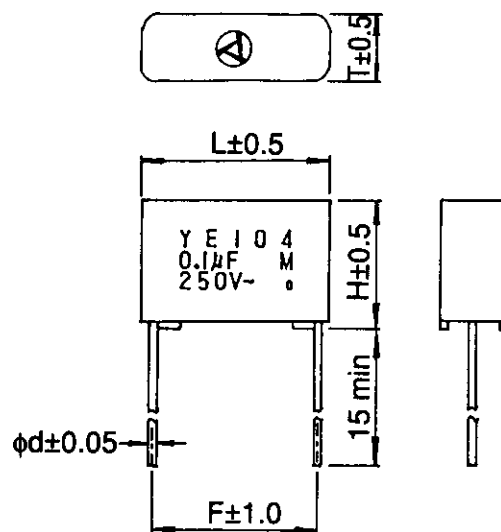
ELECTRICAL SPECIFICATIONS

Operating temp. range: -40 ~ + 85°C

Safety Standard	Class	Model number	Capacitance Cx (F-20%)	Dissipation Factor Tan δ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
	X2 and Y2	YE102	0.001	0.01 max. (at 1000 ±100Hz)	2000VAC/2700VDC 2 Sec.	30,000 MΩ min. (at 20 C 500VDC)	100,000 MΩ min. (at 20 C 500VDC)
		YE152	0.0015				
		YE222	0.0022				
		YE332	0.0033				
		YE472	0.0047				
		YE682	0.0068				
		YE103	0.01				
		YE153	0.015				
		YE223	0.022				
		YE333	0.033				
		YE473	0.047				
		YE683	0.068				
		YE104	0.1				

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Soldered to Capacitor Element
 Lead Locator: Inspection marks on case for lead location
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film



MECHANICAL DIMENSIONS

Add "C6" suffix to p/n for 6mm lead length.
 Other lead lengths available—consult factory.

Safety Standard	Class	Model number	Capacitance Cx (F-20%)	Outside Dimension mm				
				L	H	T	F	d
	X2 and Y2	YE102	0.001	13.0	10.0	4.0	11.0	0.8
		YE152	0.0015					
		YE222	0.0022					
		YE332	0.0033	17.0	12.0	5.0	15.0	
		YE472	0.0047					
		YE682	0.0068					
		YE103	0.01	25.0	12.5	5.5	22.5	
		YE153	0.015					
		YE223	0.022					
		YE333	0.033	30.0	16.0	6.5	27.5	
		YE473	0.047					
		YE683	0.068					
		YE104	0.1		17.5	8.0		
					19.5	10.0		

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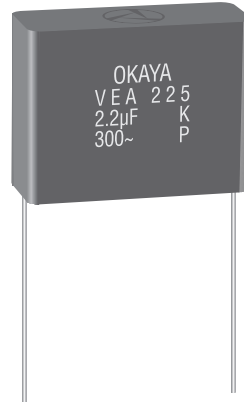
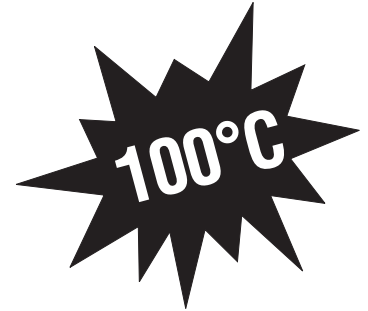
VEA SERIES

- Wide Temperature Range
- Single and 3-Phase Applications
- 10% Capacitance Tolerance
- 1.0 to 10.0 μF Values



Safety Agency : Standard	File No.
UL : UL-1283	E78644
CSA* : C22.2 No.8	E78644
SEMKO : IEC60384-14 II / EN132400	9851239/01

*cUL



ELECTRICAL SPECIFICATIONS

Operating Temp. range: -40° ~ +100°C

Safety Standard	Class	Model number	Capacitance Cx (F-10%)	Dissipation Factor Tanδ	Test Voltage	Insulation Resistance	
					Production	Between Line Terminals	Both Line Terminals to Case
	X2	VEA105K	1.0	0.002 max. at 1kHz	L-L 1000Vrms 1450VDC 60 Sec. L-Case 2000Vrms 50/60Hz 60 Sec.	L-L 5000ohm * F @500VDC	L-Case 30000Mohm @500VDC
		VEA155K	1.5				
		VEA225K	2.2				
		VEA305K	3.0				
		VEA335K	3.3				
		VEA475K	4.7				
		VEA685K	6.8				
VEA106K	10.0						

MECHANICAL SPECIFICATIONS

- Case: Standoffs provided for improved cleanability
- Case Material: Polybutylene Terephthalate (FR-PBT)
UL-94 Flame Class V-O
- Potting Material: UL-94 Flame Class V-O
- Leads: Tinned Copper Clad Steel
- Capacitor: Metallized Polypropylene Film

Figure 1

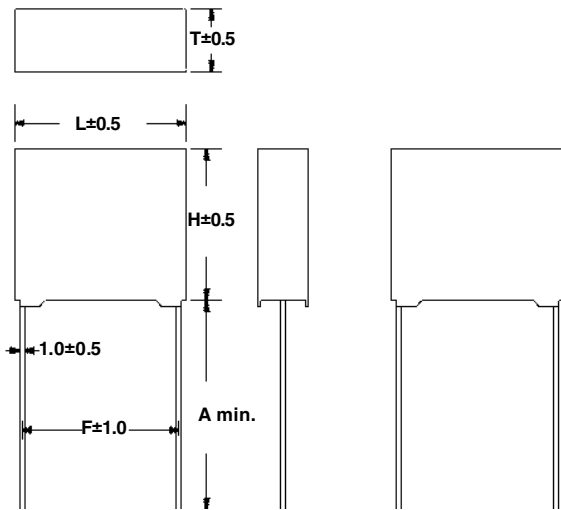
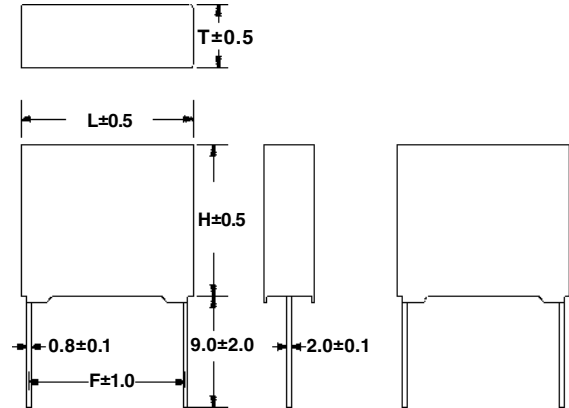


Figure 2



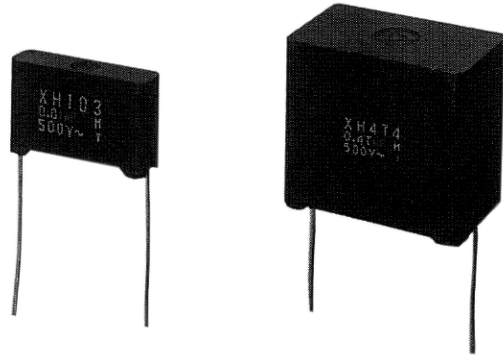
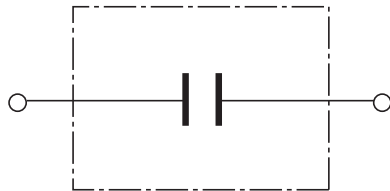
MECHANICAL DIMENSIONS

Model Number	L	H	T	F	A	Form
VEA105 K 25	30.5	24.5	15.0	27.5	25	fig-1
VEA105 K 50					50	fig-1
VEA155 K 25	41.0	28.0	15.5	37.5	25	fig-1
VEA155 K 50					50	fig-1
VEA225 K 25					25	fig-1
VEA225 K 50		32.5	17.5		50	fig-1
VEA305 K	49.5	33.0	20.5	45.0	-	fig-2
VEA305 K 50	47.5	31.0	20.0	43.5	50	fig-1
VEA335 K	49.5	33.0	20.5	45.0	-	fig-2
VEA335 K 50	47.5	31.0	20.0	43.5	50	fig-1
VEA475 K	59.5	35.5	21.5	55.0	-	fig-2
VEA475 K 50	57.5	34.0	19.5	53.5	50	fig-1
VEA685 K	59.5	43.5	30.5	55.0	-	fig-2
VEA685 K 50	57.5		29.0	53.5	50	fig-1
VEA106 K	59.5		30.5	55.0	-	fig-2
VEA106 K 50	57.5		29.0	53.5	50	fig-1

XH Series



- 500VAC rated
- 3-Phase high voltage applications.

Safety Agency: Standard		File No.
UL	: UL1283	E78644
TUV	: IEC60384-14II	J9650619



ELECTRICAL SPECIFICATIONS

Operating temp. range: -40 ~ +85C°

Safety Standard	Class	Model number	Capacitance Cx (±20%)	Dissipation Factor Tanδ	Insulation Resistance			
					Test Voltage	Production	Between line Terminals	Both Line Terminals to Case
 		XH102	0.001	0.01 max. at 1kHz	Terminal to Terminal 2200VAC			
		XH152	0.0015					
		XH222	0.0022					
		XH332	0.0033					
		XH472	0.0047					
		XH682	0.0068					
	X2	XH103	0.01		Terminal to Terminal 2200VAC	Terminal to Case 50/60Hz 60sec	15000MΩ min. at 500V _{DC}	100,000M Ω min. at 500V _{DC}
		XH153	0.015					
		XH223	0.022					
		XH333	0.033					
		XH473	0.047					
		XH683	0.068					
		XH104	0.1					
		XH154	0.15					
		XH224	0.22					
		XH334	0.33					
		XH474	0.47					

*2 This series has European approvals which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive

MECHANICAL SPECIFICATIONS:

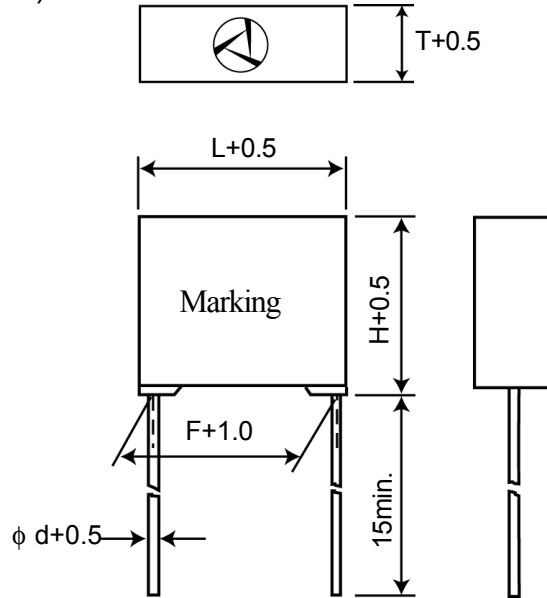
Case: Standoffs provided for improved cleanability

Case Material: Polybutylene Terephthalate (FR-PBT)
UL-94 Flame Class V-O



Potting Material: UL-94 Flame Class V-O

Leads: Tinned Copper Clad Steel,

Capacitor: Metallized Polypropylene Film



MECHANICAL DIMENSIONS

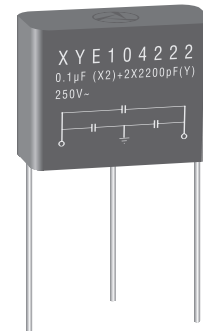
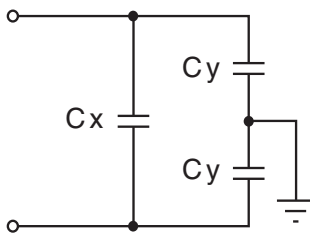
Safety Standard	Class	Model number	Capacitance Cx ($\pm 20\%$)	Outer Dimension (mm)				
				L	H	T	F	d
 		XH102	0.001	17.0	12.5	5.5	15.0	0.8
		XH152	0.0015					
		XH222	0.0022					
		XH332	0.0033		13.5	6.5		
		XH472	0.0047					
		XH682	0.0068					
	X2	XH103	0.01	25.0	16.0	6.5	22.5	
		XH153	0.015					
		XH223	0.022		17.5	8.0		
		XH333	0.033					
		XH473	0.047	19.5	10.0			
		XH683	0.068	30.0	22.0	11.0	27.5	
		XH104	0.1		24.5	13.5		
		XH154	0.15					
XH224	0.22	31.0	28.0	16.0	32.5			
XH334	0.33	36.0	33.5	22.0				
XH474	0.47					1.0		

Fax Back Document #1106

XYE-AN SERIES

- Space saving PWB capacitor network has one X & two Y caps
- Excellent common and differential mode capability in a wide capacitance range
- Installed cost saving with single package design

Safety Agency : Standard		File No.
UL	: UL1414	E47474
CSA	: C22.2, No. 0, No. 1	LR37404
SEV	: IEC60384-14II, EN132400	99,5 50353,01
SEMKO	: IEC60384-14II, EN132400	98 51098/01



ELECTRICAL SPECIFICATIONS

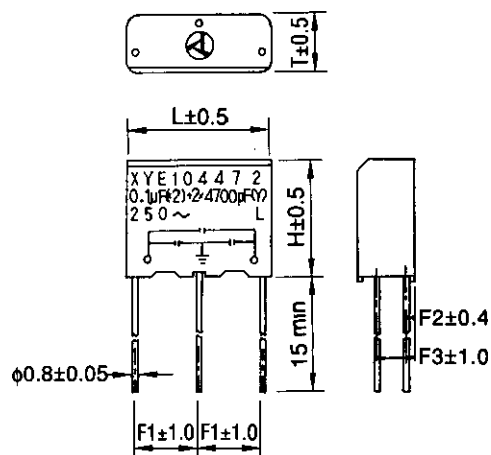
Operating temp. range: -40 ~ + 85°C

Safety Standard	Class	Model number	Capacitance		Dissipation Factor Tan δ	Test Voltage		Insulation Resistance	
			Cx (F-20%)	Cy (pF-20%)		Production	Between Line Terminals	Both Line Terminals to Case	
	X2 and Y2	XYE473472-AN	0.047	4700	0.01 max. (at 1000 – 100Hz)	X Cap. 1250VAC/1414VDC 2 Sec. Y Cap. 2000VAC/2700VDC 2 Sec.	XYE 473... ~ 324.. 15,000 MΩ min. XYE 474... ~ 105.. 5,000Ω • F min. (at 20 C 500VDC)	30,000 M Ω min. (at 20 C 500VDC)	
		XYE104102-AN	0.1	1000					
		XYE104222-AN	0.1	2200					
		XYE104332-AN	0.1	3300					
		XYE104472-AN	0.1	4700					
		XYE224102-AN	0.22	1000					
		XYE224222-AN	0.22	2200					
		XYE224332-AN	0.22	3300					
		XYE224472-AN	0.22	4700					
		XYE334102-AN	0.33	1000					
		XYE334222-AN	0.33	2200					
		XYE334472-AN	0.33	4700					
		XYE474102-AN	0.47	1000					
		XYE474222-AN	0.47	2200					
XYE474332-AN	0.47	3300							
XYE474472-AN	0.47	4700							

Insulation Resistance—Line to Case—100,000MΩmin.

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Soldered to Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film



SUPPRESSION CAPACITORS

MECHANICAL DIMENSIONS

Add "C6" suffix to p/n for 6mm lead length.
 Other lead lengths available—consult factory.

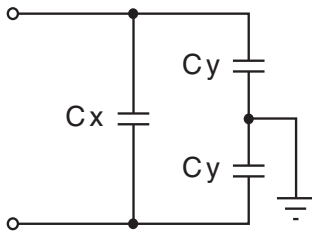
Safety Standard	Model number	Capacitance		Outside Dimension mm					
		Cx (F-20%)	Cy (pF-20%)	L	H	T	F1	F2	F3
	XYE473472-AN	0.047	4700	25.0	18.5	10.5	11.5	1.5	6.1
	XYE104102-AN	0.1	1000		20.0	12.0			7.1
	XYE104222-AN	0.1	2200						
	XYE104332-AN	0.1	3300						
	XYE104472-AN	0.1	4700						
	XYE224102-AN	0.22	1000		22.5	14.5			8.6
	XYE224222-AN	0.22	2200						
	XYE224332-AN	0.22	3300						
	XYE224472-AN	0.22	4700	30.0	26.0	19.0	13.5	1.8	9.7
	XYE334102-AN	0.33	1000						
	XYE334222-AN	0.33	2200						
	XYE334472-AN	0.33	4700						
	XYE474102-AN	0.47	1000						
	XYE474222-AN	0.47	2200						
	XYE474332-AN	0.47	3300						
XYE474472-AN	0.47	4700							

NOISE SUPPRESSION CAPACITORS XYE-BE (BN) Series 250 VAC

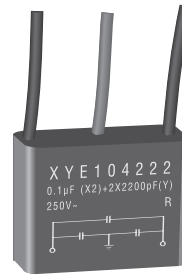
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XYE-BE(BN) SERIES

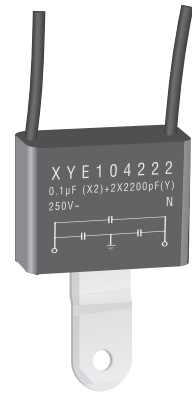
- Capacitor network has one X and two Y caps in a compact package
- Excellent common and normal mode capability in a wide capacitance selection
- Flexible wire leads available with optional lengths
- Y capacitors grounded to external mounting tab or common lead



Safety Agency : Standard		File No.
UL	: UL1414	E47474
CSA	: C22.2, No. 0, No. 1	LR37404
SEV	: IEC60384-14II, EN132400	99,5 50353,01
SEMKO	: IEC60384-14II, EN132400	98 51098/01



BN SERIES



BE SERIES

ELECTRICAL SPECIFICATIONS

Operating temp. range: -40 ~ + 85°C

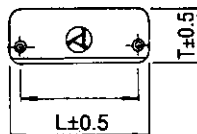
Safety Standard	Class	Model number	Capacitance		Dissipation Factor Tan δ	Test Voltage		Insulation Resistance	
			Cx (F-20%)	Cy (pF-20%)		Production	Between Line Terminals	Both Line Terminals to Case	
	X2 and Y2	XYE104102-BE (N)	0.1	1000	0.01 max. (at 1000 – 100Hz)	X Cap. 1250VAC/1414VDC 2 Sec. Y Cap. 2000VAC/2700VDC 2 Sec.	XYE 104... ~ 334... 15,000 MΩ min.	XYE 474... ~ 105... 5,000Ω • F min. (at 20 C 500VDC)	30,000 M Ω min. (at 20 C 500VDC)
		XYE104222-BE (N)	0.1	2200					
		XYE104332-BE (N)	0.1	3300					
		XYE104472-BE (N)	0.1	4700					
		XYE224102-BE (N)	0.22	1000					
		XYE224222-BE (N)	0.22	2200					
		XYE224332-BE (N)	0.22	3300					
		XYE224472-BE (N)	0.22	4700					
		XYE334102-BE (N)	0.33	1000					
		XYE334222-BE (N)	0.33	2200					
		XYE334472-BE (N)	0.33	4700					
		XYE474102-BE (N)	0.47	1000					
		XYE474222-BE (N)	0.47	2200					
		XYE474332-BE (N)	0.47	3300					
XYE474472-BE (N)	0.47	4700							

Insulation Resistance—Line to Case— 100,000MΩ min.

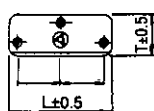
MECHANICAL SPECIFICATIONS:

Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Stranded Copper Wire
 Polyvinylchloride (PVC) Insulation
 Soldered to Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film

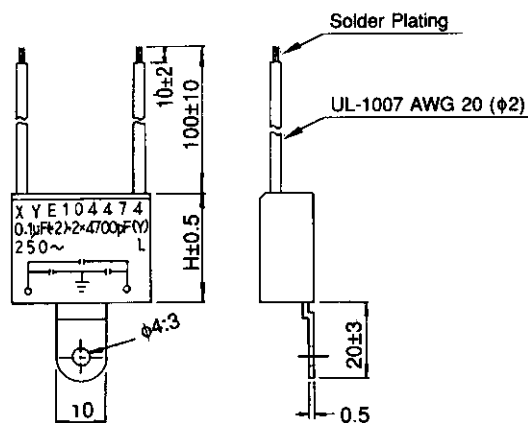
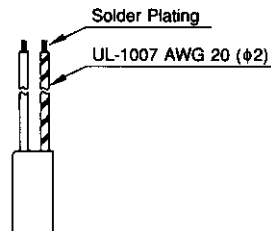
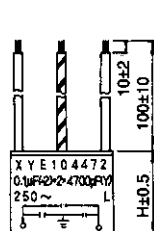
BE SERIES



BN SERIES



XYE104102~XYE224472



MECHANICAL DIMENSIONS

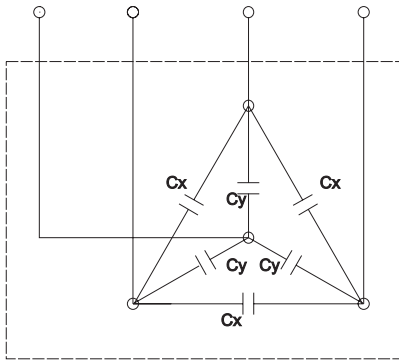
Other lead lengths available—consult factory.

Safety Standard	Model number	Capacitance		Outside Dimension mm		
		Cx (F-20%)	Cy (pF-20%)	L	H	T
	XYE104102-BE (N)	0.1	1000	26.0	20.0	12.5
	XYE104222-BE (N)	0.1	2200			
	XYE104332-BE (N)	0.1	3300			
	XYE104472-BE (N)	0.1	4700			
	XYE224102-BE (N)	0.22	1000		23.0	15.0
	XYE224222-BE (N)	0.22	2200			
	XYE224332-BE (N)	0.22	3300			
	XYE224472-BE (N)	0.22	4700	32.5	26.0	20.0
	XYE334102-BE (N)	0.33	1000			
	XYE334222-BE (N)	0.33	2200			
	XYE334472-BE (N)	0.33	4700			
	XYE474102-BE (N)	0.47	1000			
	XYE474222-BE (N)	0.47	2200			
	XYE474332-BE (N)	0.47	3300			
	XYE474472-BE (N)	0.47	4700			

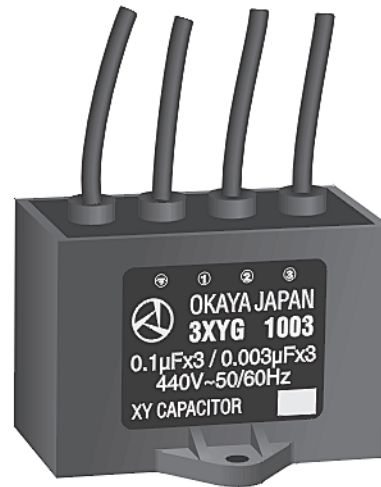
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3XYG SERIES

- 3-Phase (3) capacitor network
- Rated Voltage: 440VAC
- Two Lead Styles Bare Wire or Insulated Lead
- Compliment to RAV Series



Cx: X Capacitor
Cy: Y Capacitor



ELECTRICAL SPECIFICATIONS

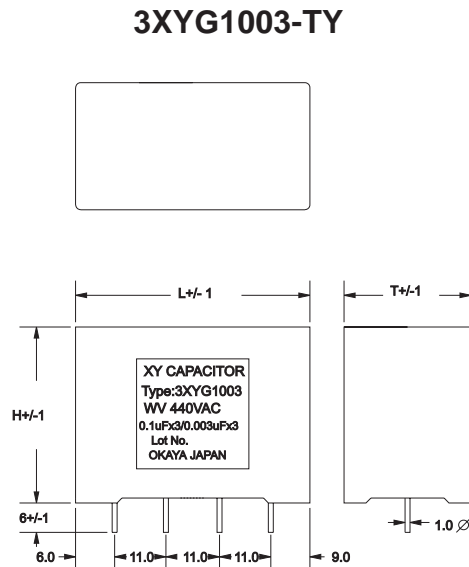
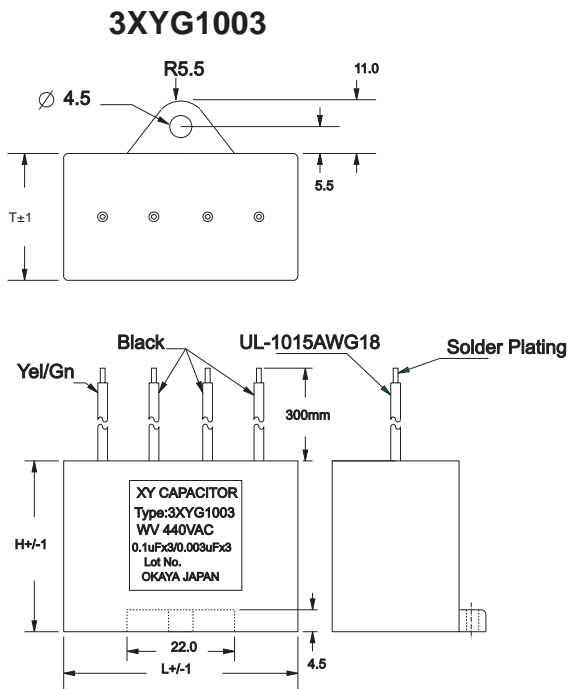
Operating temp. range: -40 ~ + 85°C

Model number	Capacitance (±20%)	Dissipation Factor Tan δ	Test Voltage	Insulation Resistance	
			Production	Between Line Terminals	Both Line Terminals to Case
3XYG 1003	CX: 0.1µFd CY: 3000pF	CX: 0.002 max. CY: 0.01 max.	CX: 2000VAC/2700DC 2 Sec.	10,000M Ω min. @20C 500VDC	15,000MΩ min. @20C 500VDC
3XYG 1003-TY			CY: 2000VAC/2700DC 2 Sec.		

Insulation Resistance—Line to Case— 100,000MΩ min.

MECHANICAL SPECIFICATIONS:

Case Material: Standoff provided for improved cleanability
 Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel or
 Tinned Stranded Copper Wire with
 Polyvinylchloride (PVC) Insulation
 Soldered to Capacitor Element
 Capacitor: Metallized Polypropylene film (X Cap)
 Metallized Polyester Film (Y Cap)



MECHANICAL DIMENSIONS

Model number	Capacitance ($\pm 20\%$)	Outside Dimension (mm)		
		L	H	T
3XYG1003	CX: 0.1 μ Fd	48.0	35.0	26.0
3XYG1003-TY	CY: 3000pF			

Rating:

Voltage: 450Vdc, 630Vdc
 Capacitance: 474, 105, 225 ± 10%
 Temperature: -40 ~ +85°C

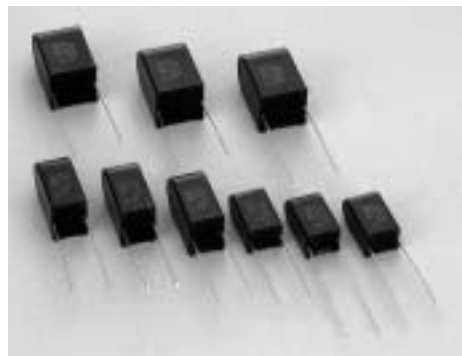
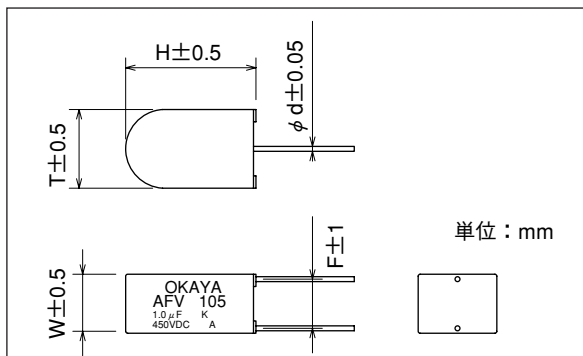
Features:

For use in active filters and snubbers for electronic circuits. Featuring metallized polypropylene films to increase the electric current withstand capability. 50% better dielectric withstand than the HCP Series and 3 ~ 5 times better than the HCE Series

The resin case is designed to consume a smaller footprint due to the reduced length and width. The case top features a raduis which allows for ventilated effects.

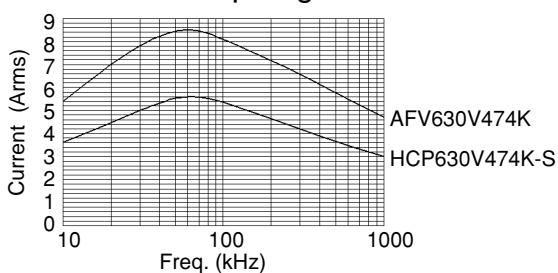
Applications:

Television and computer monitors and other 75 ~500W electronic circuitry.
 All electric equipment using switching power supplies or semiconductors requiring snubber circuitry.

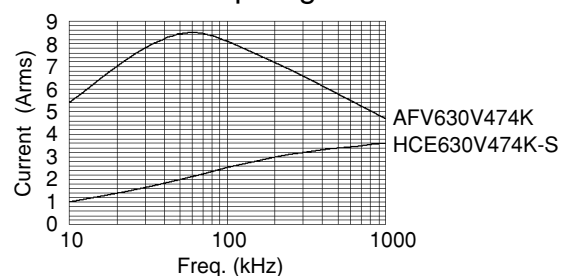


品名	W	H	T	F	d
AFV450V474K	12	21	10.5	10	0.8
AFV450V105K	12	26.5	16	10	1.0
AFV450V225K	17	27.5	17	15	1.0
AFV630V474K	12	26.5	16	10	1.0
AFV630V105K	17	27.5	17	15	1.0
AFV630V225K	20	36	26	17.5	1.0

HCP Amperage



HCE Amperage





Features

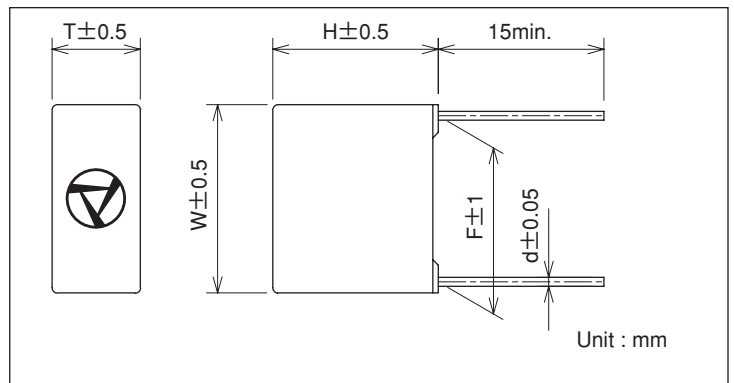
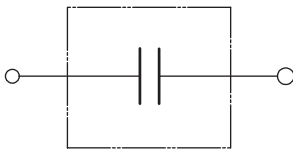
- Resin Case, Small in size
- Improved safety and suppressed self-healing

Application

- High frequency circuit, High voltage resonant circuit , Snubber circuit
- Protection of semiconductors such as IGBT, IPM and MOSFET.



Circuit diagram

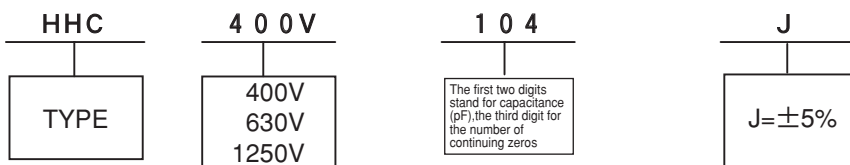


Unit : mm

Capacitance PART NO.	V μF	400V					630V					1250V					Dis. factor	Test voltage	Insulation resist.
		W	H	T	F	d	W	H	T	F	d	W	H	T	F	d			
102	0.001											17.0	12.0	5.0	15.0	0.8	0.001max (at 1000 ±100Hz)	Rated Voltage ×1.75 (2~5sec)	50000M Ω min (at 20°C 100VDC)
122	0.0012											∕	∕	∕	∕	∕			
152	0.0015											∕	∕	∕	∕	∕			
182	0.0018											∕	∕	∕	∕	∕			
222	0.0022											∕	∕	∕	∕	∕			
272	0.0027											∕	12.5	5.5	∕	∕			
332	0.0033											∕	∕	∕	∕	∕			
392	0.0039											∕	∕	∕	∕	∕			
472	0.0047											∕	∕	∕	∕	∕			
562	0.0056											∕	13.5	6.5	∕	∕			
682	0.0068											∕	∕	∕	∕	∕			
822	0.0082											∕	15.0	8.0	∕	∕			
103	0.01						17.0	12.0	5.0	15.0	0.8	∕	∕	∕	∕	∕			
123	0.012						∕	12.5	5.5	∕	∕	25.0	16.0	6.5	22.5	∕			
153	0.015						∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
183	0.018						∕	∕	∕	∕	∕	∕	17.5	8.0	∕	∕			
223	0.022						∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
273	0.027						∕	13.5	6.5	∕	∕	∕	∕	∕	∕	∕			
333	0.033	17.0	12.0	5.0	15.0	0.8	∕	15.0	8.0	∕	∕	∕	∕	∕	∕	∕			
393	0.039	∕	13.5	6.5	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
473	0.047	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
563	0.056	∕	15.0	8.0	∕	∕	25.0	16.0	6.5	22.5	∕	∕	∕	∕	∕	∕			
683	0.068	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
823	0.082	25.0	16.0	6.5	22.5	∕	∕	17.5	8.0	∕	∕	∕	∕	∕	∕	∕			
104	0.1	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
124	0.12	∕	17.5	8.0	∕	∕	∕	19.5	10.0	∕	∕	∕	∕	∕	∕	∕			
154	0.15	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
184	0.18	∕	19.5	10.0	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			
224	0.22	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕	∕			

● Model coding system

Operating temperature: -20 ~ +105C

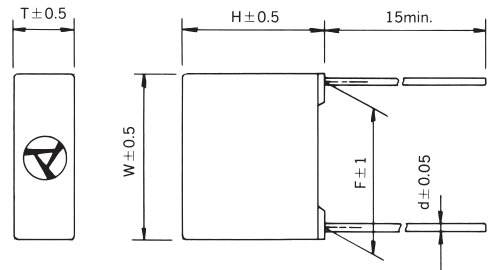


Features

- Resin Case, Small in size
- Improved safety and suppressed self-healing

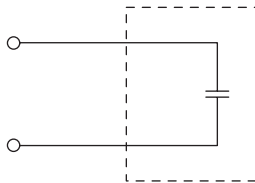
Application

- High frequency circuit, High voltage resonant circuit , Snubber circuit
- Protection of semiconductors such as IGBT, IPM and MOSFET.



Unit : mm

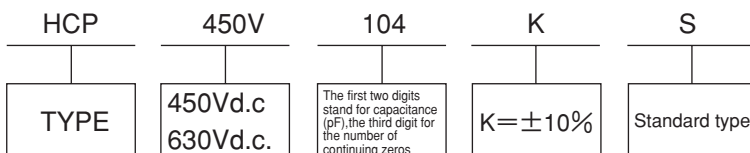
Circuit diagram



Capacitance PART NO.	Rated voltage μF	450VDC					630VDC					Dissipation factor	Test voltage	Insulation resistance
		W	T	H	F	d	W	T	H	F	d			
103	0.01						17.5	5.0	12.0	15.0	0.6	0.001max (f=1000 ±100Hz)	Rated voltage ×1.75 (2~5sec)	50000MΩ min (at 20°C 100VDC)
153	0.015						∕	∕	∕	∕	∕			
223	0.022						∕	∕	∕	∕	∕			
333	0.033						∕	∕	∕	∕	∕			
473	0.047	17.0	5.0	12.0	15.0	0.6	∕	5.5	12.5	∕	0.8			
683	0.068	∕	5.5	12.5	∕	0.8	∕	6.5	13.5	∕	∕			
104	0.1	∕	6.5	13.5	∕	∕	∕	8.0	15.0	∕	∕			
154	0.15	∕	8.0	15.0	∕	∕	25.0	∕	17.5	22.5	∕			
224	0.22	25.0	6.5	16.0	22.5	∕	∕	∕	∕	∕	∕			
334	0.33	∕	8.0	17.5	∕	∕	∕	10.0	19.5	∕	∕			
474	0.47	30.0	11.0	22.0	27.5	∕	30.0	11.0	22.0	27.5	∕			
684	0.68	∕	∕	∕	∕	∕	∕	13.5	24.5	∕	∕			
105	1.0	∕	13.5	24.5	∕	∕	30.5	16.0	28.0	∕	1.0			
155	1.5						41.0	15.5	∕	37.5	∕			
225	2.2						∕	17.5	32.5	∕	∕			

Operating temperature : -40~+85°C

● Model coding system

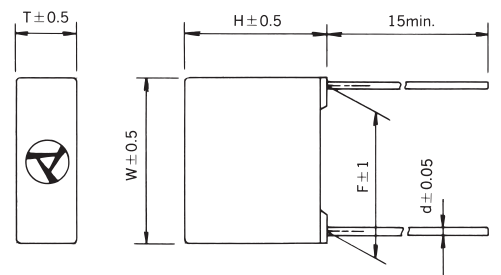


Features

- Resin Case, Small in size
- Improved safety and suppressed self-healing

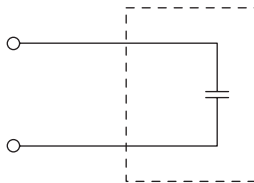
Application

- High frequency circuit, High voltage resonant circuit , Snubber circuit
- Protection of semiconductors such as IGBT, IPM and MOSFET.



Unit : mm

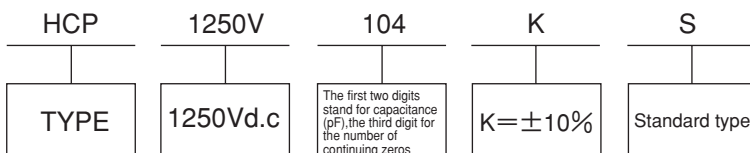
Circuit diagram



Capacitance PART NO.	Rated voltage μF	1250Vdc					Dissipation factor	Test voltage	Insulation resistance
		W	T	H	F	d			
103	0.01	17.0	8.0	15.0	15.0	0.8	Rated voltage ×1.75 (2~5sec)	50000MΩ min (at 20°C 100Vdc)	
153	0.015	25.0	6.5	16.0	22.5	∕			
223	0.022	∕	∕	∕	∕	∕			
333	0.033	∕	8.0	17.5	∕	∕			
473	0.047	∕	10.0	19.5	∕	∕			
683	0.068	30.0	11.0	22.0	27.5	∕			
104	0.1	∕	13.5	24.5	∕	∕			
154	0.15	30.5	16.0	28.0	∕	1.0			
224	0.22	41.0	15.5	∕	37.5	∕			
334	0.33	∕	∕	∕	∕	∕			
474	0.47	∕	17.5	32.5	∕	∕	20000Ω Fmin		

Operating temperature : -40~+85°C

● Model coding system



HIGH PULSE CAPACITOR

For high current capacitor C7NP_{SERIES}

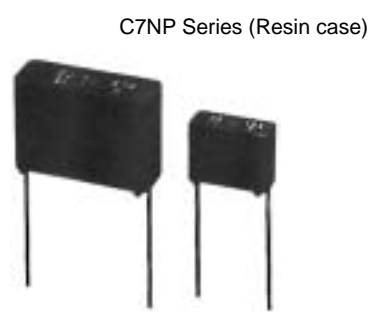


Features

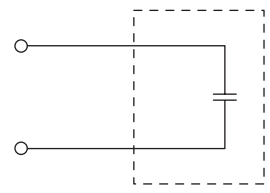
- High insulation resistance - More than 50,000 Ω at less than 0.33 μ F
- Low dissipation factor - less than 0.001 at 1,000Hz
- High surge withstand voltage and high current withstand capability

Application

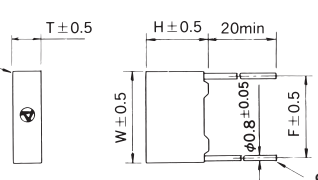
- High frequency circuit, Resonant circuit in high voltage, Snubber circuit, Protection of semiconductors
- Ultra-high impedance circuit, long time constant circuit



Circuit diagram



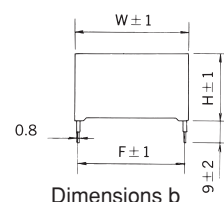
Case color in light blue



Dimensions a

Solder-plated soft copper wire leads

Unit : mm



Dimensions b



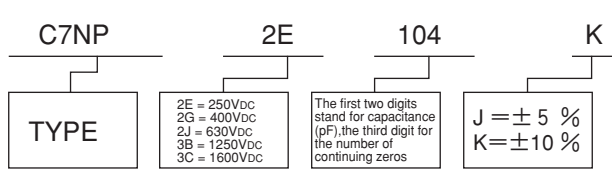
Solder-plated soft brass plate leads

Unit : mm

PART No	Capacitance μ F	2E (250VDC)					2G (400VDC)					2J (630VDC)					3 B (1250VDC)					3C (1600VDC)					Dissipation factor	Test voltage	Insulation resistance	
		W	T	H	F	d	W	T	H	F	d	W	T	H	F	d	W	T	H	F	d	W	T	H	F	d				
102	0.001																													
152	0.0015																													
222	0.0022																													
332	0.0033																													
472	0.0047																													
682	0.0068																													
103	0.01											17.0	6.5	13.5	15.0	0.8	a													
153	0.015																25.0	6.5	16.0	22.5										
223	0.022																													
333	0.033																													
473	0.047																													
683	0.068						17.0	6.5	13.5	15.0	0.8	a																		
104	0.1	17.0	6.5	13.5	15.0	0.8	a																							
154	0.15											25.0	6.5	16.0	22.5															
224	0.22																													
334	0.33	25.0	6.5	16.0	22.5																									
474	0.47																													
684	0.68																													
105	1.0	30.0	11.0	22.0	27.5																									
155	1.5																													
225	2.2																													
335	3.3	41.0	15.5		37.5																									
475	4.7																													
685	6.8																													
106	10.0	59.5	21.5	35.5	55.0		b																							
156	15.0																													
226	22.0																													

Operating temperature : -40 ~ +85°C

Model coding system



NOISE PULSE CAPACITOR

For high current capacitor HRC_{SERIES}



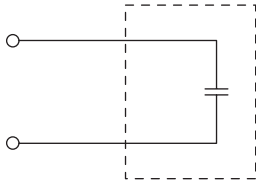
Features

- Best for high frequency and high current
- Current withstand capability more than twice the conventional model (twice as much as C7NP)

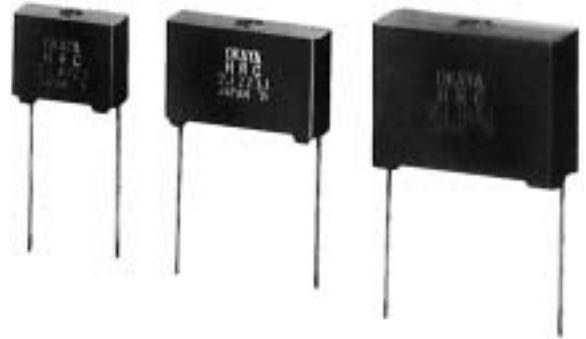
Application

- High frequency resonant circuit
- Resonant inverter circuit, Snubber circuit, Protection of semiconductors

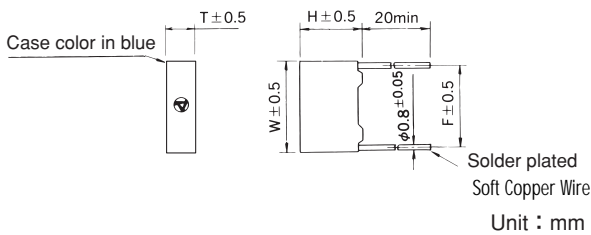
Circuit diagram



HRC Series (Resin case)



HRC

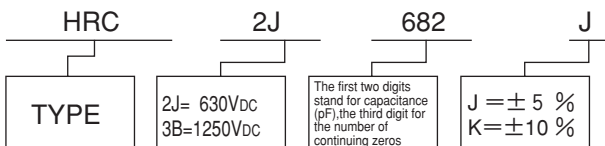


Unit : mm

Capacitance PART No.	Rated voltage μF	2J (630Vdc)				3B (1250Vdc)				Dissipation factor (f=1000±100Hz)	Test voltage Rated Voltage ×1.75 (2~5 sec)	Insulation resistance 50,000MΩ min (at 20 °C 100Vdc)
		W	T	H	F	W	T	H	F			
102	0.001	17.0	5.0	12.0	15.0	17.0	5.0	12.0	15.0	0.001max (f=1000±100Hz)	Rated Voltage ×1.75 (2~5 sec)	50,000MΩ min (at 20 °C 100Vdc)
152	0.0015	∕	∕	∕	∕	∕	∕	∕	∕			
222	0.0022	∕	5.5	12.5	∕	∕	5.5	12.5	∕			
332	0.0033	∕	6.5	13.5	∕	∕	6.5	13.5	∕			
472	0.0047	∕	∕	∕	∕	∕	8.0	15.0	∕			
682	0.0068	∕	∕	∕	∕	∕	∕	∕	∕			
103	0.01	∕	8.0	15.0	∕	25.0	6.5	16.0	22.5			
153	0.015	∕	∕	∕	∕	∕	10.0	19.5	∕			
223	0.022	25.0	6.5	16.0	22.5	∕	∕	∕	∕			
333	0.033	∕	8.0	17.5	∕	30.0	11.0	22.0	27.5			
473	0.047	∕	10.0	19.5	∕	∕	13.5	24.5	∕			
683	0.068	30.0	11.0	22.0	27.5	30.5	16.0	28.0	∕			
104	0.1	∕	∕	∕	∕	36.0	22.0	33.5	32.5			

Operating temperature -40°C ~ +85°C

Model coding system



NOISE SUPPRESSION CAPACITORS

Fax Back Document #1100

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• Safety Standards

Okaya noise suppression capacitors have been recognized by the following safety standards organizations:

Organization (country)	Applicable Standard	
	Household Appliances	Office Appliances and others
IEC	PUB 65	PUB 950
UL (USA)	UL-1414 (capacitor)	UL-1283 (filter)
CSA (Canada)	C22.2 No. 0 No. 1	C22.2 No.8
VDE (Germany)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
SEV (Switzerland)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
BS (Great Britian)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
SEMKO (Sweden)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
DEMKO (Denmark)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
NEMKO (Norway)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
EI (Finland)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
ÖVE (Austria)	-----	IEC384-14II(EN132400)
IMQ (Italy)	-----	IEC384-14II(EN132400)

- Electrical apparatus are classified roughly into two categories, i.e., (a) household appliances and (b) office appliances including office automation (OA) and others.
- The standards for noise suppression capacitors to be used in the household appliances are more strict than those in the office appliances and others.
- The products enumerated in the following pages (with a few exceptions) have been approved under standards applicable to the household appliances, so that you may use them for almost all applications.
- In order to avoid any accidents in machine applications which may experience unexpected abnormal surge voltage, or which are subjected to continuous 24-hour use, it is necessary to build in an extra measure of reliability. Here, the strict test conditions conducted by the above-mentioned safety standards organizations can be considered as one of the criteria from a reliability point of view.
- The product should be selected on the basis of a thorough consideration of such safety standards according to its application.

● **OUTLINE OF CAPACITOR CLASS RATINGS**

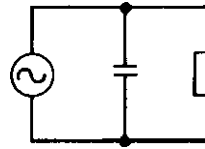
Capacitor are classified by the IEC into two categories (these designations are used by most European countries).

Class Y: Capacitors used in applications where damage to the capacitor may involve danger of electrical shock.

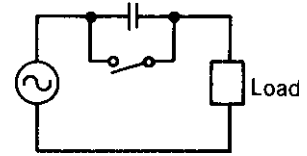
Class X: Capacitors used in applications where damage to the capacitor will not lead to the danger of electrical shock.

These X and Y Classifications are further divided into subcategories as shown in the tables.
(Ref. IEC 384-14, 2nd edition, 1993)

In addition, in North America, Designations of Across-the-Line capacitors, Antenna couplings, and Line bypass capacitors refer to the following applications:



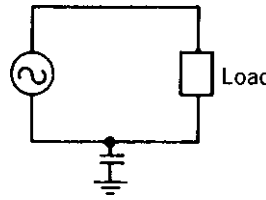
Class X: Across-the-line



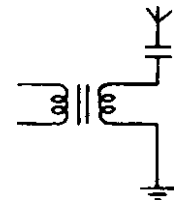
Class X: Across-the-line

Subclass	Peak Voltage	IEC 664 Category	Application
X1	>2.5kV <4.0kV	III	Hi-pulse
X2	<2.5kV	II	General
X3	<1.2kV	I	General

Subclass	Type Insulation	Voltage Range	Peak Voltage
Y1	Double	<250V	8.0kV
Y2	Basic	>150V <250V	5.0kV
Y3	Basic	<150V	None
Y4	Basic		2.5kV



Class Y: Line bypass



Class Y: Antenna coupling

● **SAFETY AGENCY TEST PARAMETERS**

INSULATION RESISTANCE TEST (OHMS)

	UL1283	UL1414	CSA	IEC384-14
X cap	NONE	500M	500M	15,000M
Y cap	2M			30,000M
CASE				

**WITHSTAND VOLTAGE TEST
(ONE MINUTE TEST)**

	UL1283 250V	UL1414 250V	CSA	IEC384-14
X cap	1000AC	1500AC	1000AC	WV x 4.3(DC)
Y cap	1500AC			1500AC
CASE				1500AC

ENDURANCE TEST

	UL1283	UL1414		CSA	IEC384-14	
		125V	250V		X2	Y
TEST VOLTAGE	WVx1.5	220	440	220	WVx1.25	WVx1.7
MAX VOLTAGE	NONE	440	880	440	1000	1000
TEST TIME HR	1000	1000	1000	1000	1000	1000

LIGHTNING SURGE TEST

IEC 384-14II Test:	1.2µsec x 50µsec wave form.
Repetition:	Three Times
Voltage Peak:	X1 cap - 4Kv, X2 cap - 2.5kV Y2 cap - 5kV

Okaya characterizes all capacitors using the standard test procedures outlined in JIS C 5102, 5150, 5151. These test parameters are confirmed by a Q.A. audit and are published as guaranteed specifications shown as "dielectric withstanding voltage".

Okaya performs 100% screen testing of all capacitors during the production process. These tests are subject to changes due to improvements in test equipment and procedures and are published for reference only.

NOISE SUPPRESSION CAPACITORS

• FEATURES

The design and manufacture of OKAYA AC capacitors incorporates many features which make them superior in noise suppression applications.

Both single and double wound construction of the metallized polyester and polypropylene films insure long term reliability.

Many series are oil impregnated to prevent annoying buzz and hum. This also provides additional protection against "Corona" by eliminating air gaps.

The electrical connection to the metallized film is made via a special multi-element solder which provides excellent surge current withstand capability and a decrease in Dissipation Factor.

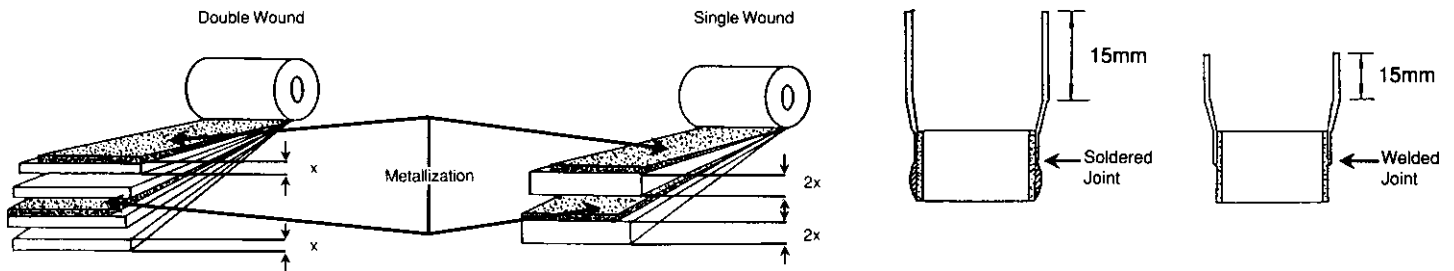
Lead wires are soldered or welded to provide a strong bond to the metallized element. This is

particularly important during wave soldering and the ability to withstand current surges while protecting equipment.

OKAYA's proprietary potting process prevents the outer case of the capacitor from exploding when exposed to "killer surges". Some competitive devices are designated "suitable for use with special enclosure only" by certain safety approval agencies.

OKAYA's AC capacitors employ a case made of FR-PBT (Polybutylene Terephthalate) which is impervious to most cleaning processes. The case and potting material are both rated UL94 Flame Class V-O.

OKAYA has one of the highest dv/dt ratings of any capacitor in its class. In many cases 1.5 to 4 times higher than competitive devices.



Class X dv/dt (v/μs)

Cap Val.	COMPETITOR			OKAYA	
	A	B	C	PA(X2)	XE(X1)
103	1200		1200	2800	3000
153	1200		1200	2800	3000
223	1200		1200	2400	2800
333	1200		1200	2400	2800
473	1200		1200	2000	2400
683	1200		1200	2000	2400
104	600		600	1600	2000
154	600	100	600	1600	2000
224	600	100	600	1200	1600
334	400	100	400	1200	1600
474	400	100	400	1000	1400
684	400	100	400	1000	1200
105	400	100		800	1000
155	400			800	
225	400			600	

Class Y dv/dt (v/μs)

Cap Val.	COMPETITOR			OKAYA		
	A	B	C	XA	XE	YE
102	2000	2000		3000	3000	3000
152	2000	2000		3000	3000	3000
222	2000	2000	2000	3000	3000	3000
332	2000	2000	2000	3000	3000	3000
472	2000	2000	2000	3000	3000	3000
682	1400	1400	1400	3000	3000	3000
103	1400	1400	1400			3000
153	1400	1400	1400			3000
223	1400	1400	1400			3000
333		1000	1000			2800
473		1000	1000			2600
683			1000			2400
104			600			2400

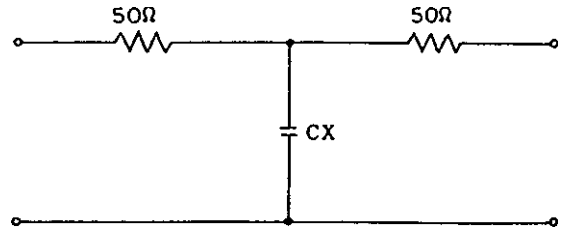
• INSERTION LOSS

The insertion loss of a capacitor is measured in a 50Ω system.

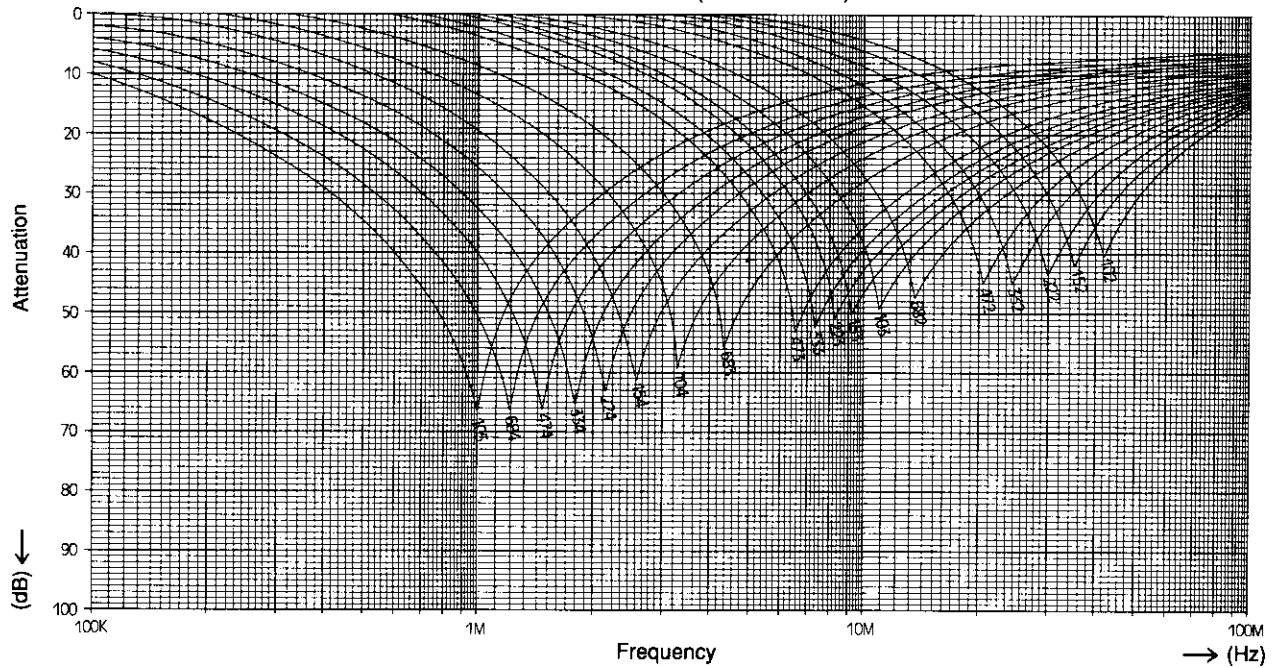
$$\text{Insertion Loss} = 20 \log_{10} (V2/V1) \text{ (dB)}$$

V1 Level without test sample

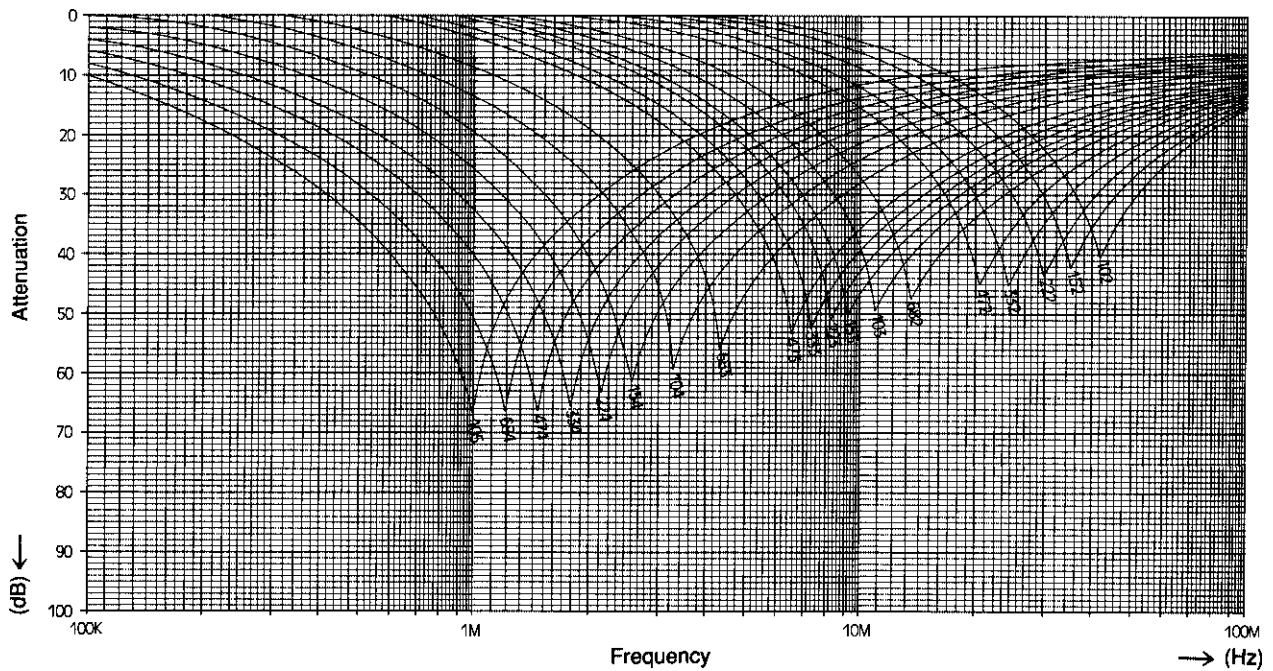
V2 Level with test sample



INSERTION LOSS (PA Series)



INSERTION LOSS (XE Series)



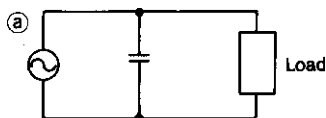
NOISE SUPPRESSION CAPACITORS

• APPLICATION EXAMPLES

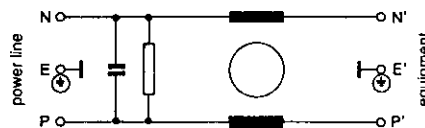
Electrical noise, which effects the correct operation of electrical equipment, can originate from sources both external and internal to the product. For example, high frequency noise can be generated by the rotation of a brush motor. As a counter measure to such noise, a capacitor can be introduced into the noise prevention circuitry to lower the circuit impedance. It is necessary to use a capacitor with excellent, high-frequency characteristics. This is why metallized polyester film is used by OKAYA as the capacitor dielectric in all AC noise suppression capacitors.

• Examples of Uses:

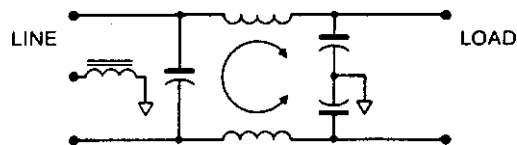
- a) Effective as countermeasure for low-energy noise produced by high frequencies in DC motor brushes. Applications include power tools using multi-pole brush motors, vacuum cleaners, mixers, etc.



- b) Here, a common coil is used to compose a filter circuit as a means of improving attenuation and expanding band range. Applications include a wide variety of office appliances, switching power units, etc.



- c) This shows countermeasures against common mode noise taken in addition to the measures shown in b).



*NOTE: For applications of the type shown in b) and c), see the OKAYA Noise Filter catalog.

• RATED CURRENT

The following is used to calculate the current for a supply voltage. Values for 250V rms, 50/60Hz are shown in the table (Precautions should be taken with regard to voltage fluctuation and permissible deviation of electrostatic capacitance when calculating maximum values.)

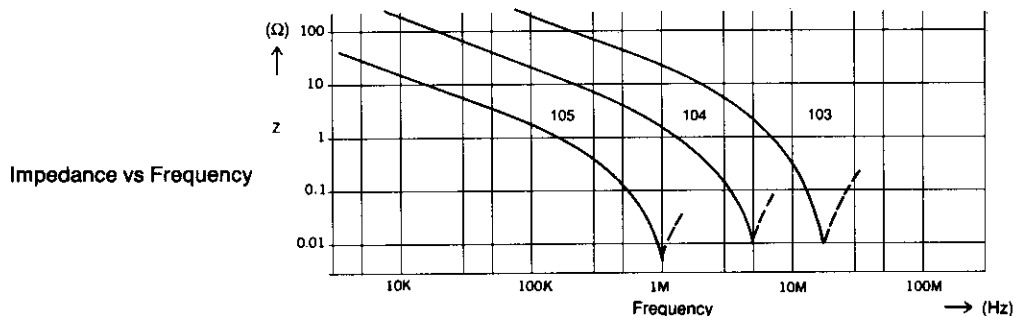
$$I = 2\pi fCE \quad (A)$$

- I: Current Amps (A)
- f: Operating frequency (Hz)
- C: Electrostatic capacitance Farads(F)
- E: Supply voltage RMS(V)

Frequency \ Capacitance μF	0.001	0.0015	0.0022	0.0033	0.0047	0.0068	0.01	0.015	0.022	0.033
50Hz	0.1	0.1	0.2	0.3	0.4	0.5	0.8	1.18	1.73	2.59
60Hz	0.1	0.1	0.2	0.3	0.4	0.6	0.9	1.41	2.07	3.11

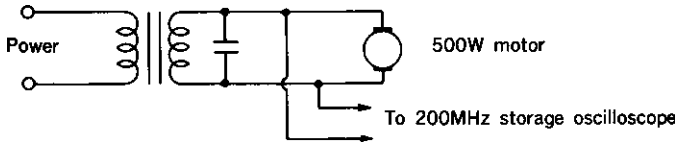
Frequency \ Capacitance μF	0.047	0.068	0.1	0.15	0.22	0.33	0.47	0.68	1.0
50Hz	3.69	5.34	7.85	11.8	17.3	25.9	36.9	53.4	78.5
60Hz	4.43	6.41	9.42	14.1	20.7	31.1	44.3	64.1	94.2

Unit : mA

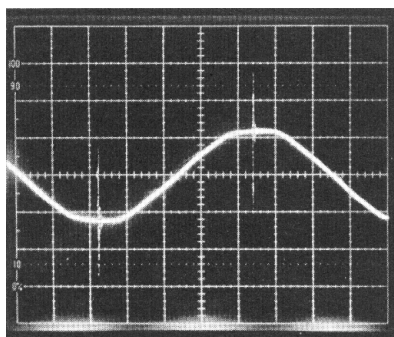


• **EXAMPLES OF NOISE SUPPRESSION EFFECTS**

Noise suppression capacitors are most widely applied as countermeasures to noise occurring in inverters, switching power units, brush motors, and to the full range of Office Automation equipment.

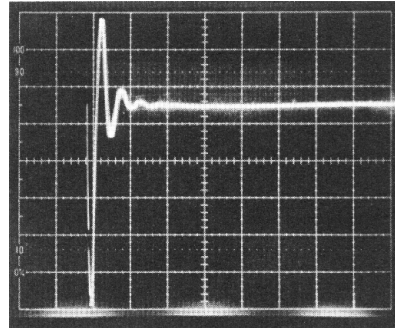


These illustrations show examples of the noise suppression effects produced with a 500W class brush motor used on a commercial 120V line. The load is driven through an isolation transformer.



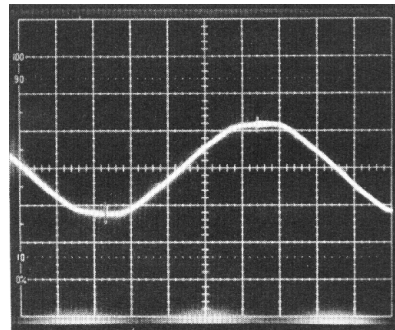
2msec/div
100V/div

A) This illustration shows the line waveform without any noise countermeasures. A damped oscillation wave of about 800Vp-p is visible at the instant of positive and negative peak.



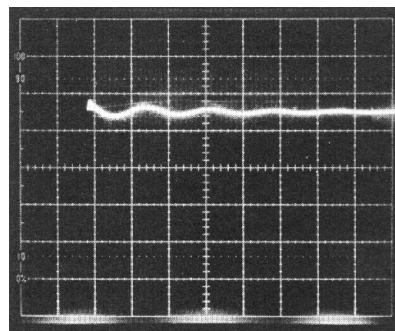
10µsec/div
100V/div

B) This illustration shows an observation of the noise component alone. (Time axis 10µsec/div.)



2msec/div
100V/div

C) This illustration shows the results of noise countermeasures taken by inserting an XE474 (0.47µF) capacitor in the line. A minute amount of noise appears to remain in the sine curve, but it is not considered significant.



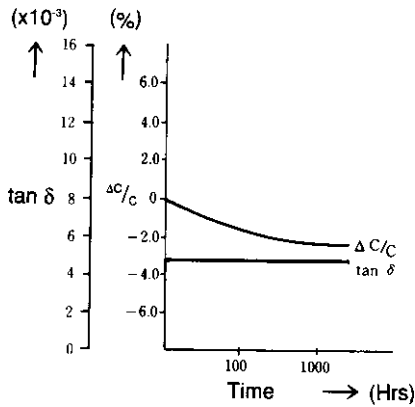
10µsec/div
100V/div

D) This illustration shows the same isolation of the noise at a time axis of 10µsec/div. By the insertion of the electrostatic capacitance of 0.47µF, the period of damping oscillation has become longer, but the peak voltage is well damped, thus producing excellent results.

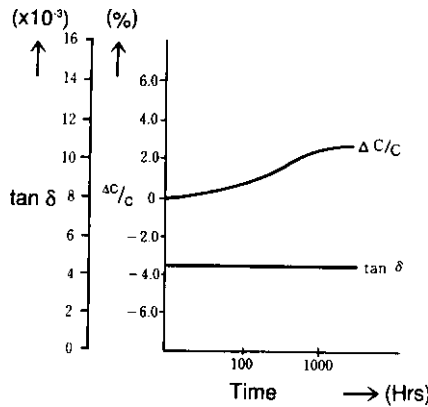
NOISE SUPPRESSION CAPACITORS

• PERFORMANCE CHARACTERISTICS

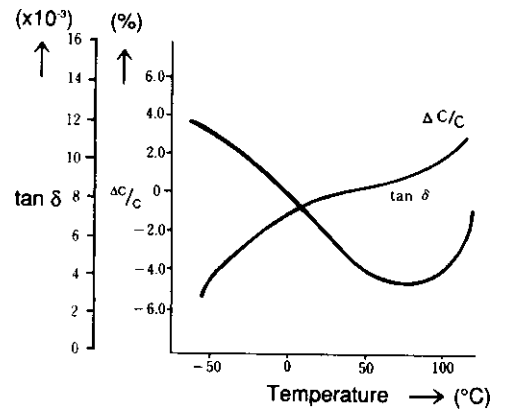
Temperature Endurance (XE type)



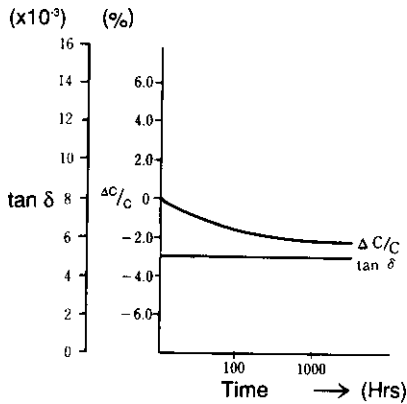
Damp Heat Endurance (XE type)



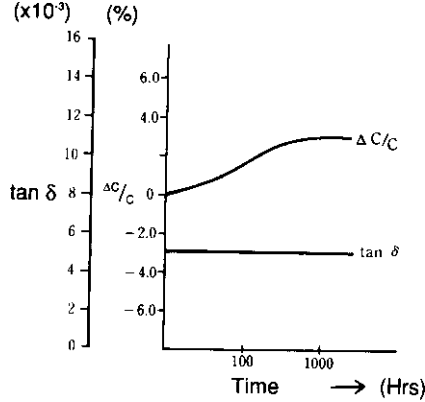
Temperature Characteristics (XE type)



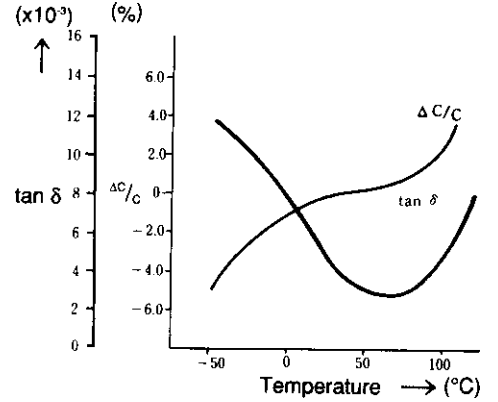
Temperature Endurance (PA type)



Damp Heat Endurance (PA type)



Temperature Characteristics (PA type)



• TEST CONDITIONS

Temperature Endurance:

While operating at maximum rated temperature and at 125% of rated voltage, input 500 Vrms (PA series) or 1000 Vrms (XE Series) four times per hour for 0.1 second.

Damp Heat Endurance:

60°C, 90~95% RH
100% Rated Voltage

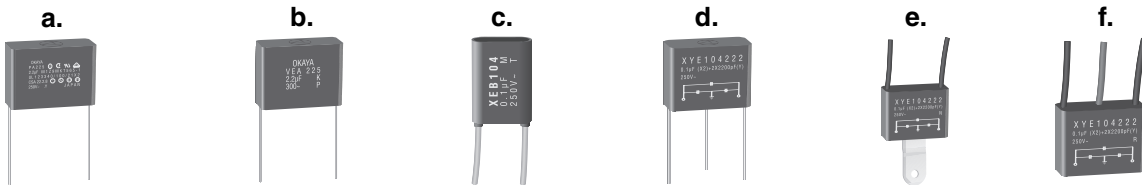
Temperature Characteristics:

-50°C to +100°C
100% Rated Voltage

• FORM

Rated Voltage	Safety Standard	Lead Type	Forms	Model
275V AC*		Bare Wire	a	PA Series
300V AC		Bare Wire	b	VEA Series
275V AC*		Bare Wire	a	RE Series
250V AC		Bare Wire	a	YE Series
275V AC*		Bare Wire	a	XE Series
250V AC		Flex Wire	c	XEB Series
250V AC		Bare Wire	d	XYE-AN
250V AC		Flex Wire	e	XYE-BN
250V AC		Flex Wire	f	XYE-BE

* UL and CSA = 250V AC



• APPLICATIONS

AC Motors
DC Motors
Brush Motors
Grinders
Motor Controls
Mixers
Dryers

Machine Tools
Washers
Power Supplies
Automotive
Lighting
Frequency Controls

Contact Protection
Industrial Controls
Robotics
NC Controls
CNC Controls
Antenna Coupling

AC Line Suppression
Vacuum Cleaners
Tumblers
Electric Switching
Power Snubbers
Mechanical Switching

• DESIGN CAUTIONS

1) When protecting switching contacts, always include a resistor in series with the noise suppression capacitors. See OKAYA's Spark Quencher section for products specifically designed for such applications.

2) In high speed circuits, the addition of a noise suppression capacitor may slow the response time of the circuit. For best response characteristics, do not use a larger capacitor than is absolutely necessary to suppress the noise level.

3) Noise suppression capacitors are most effective when located close to the offending noise source. Excessive lead length may cause abnormal oscillation and decrease the energy absorption capability of the capacitor.

4) When noise suppression capacitors are connected across power lines, care must be taken that the resulting in-rush current does not cause

the fuse or circuit breaker to open. Special consideration must be given to both the capacitor value and the breaker ratings.

5) OKAYA noise suppression capacitors are specifically designed for standard line frequencies and should not be used in circuits where normal operation will exceed 70Hz.

6) To prevent permanent damage to noise suppression capacitors, they should not be allowed to self-heat more than 5 degrees centigrade above ambient.

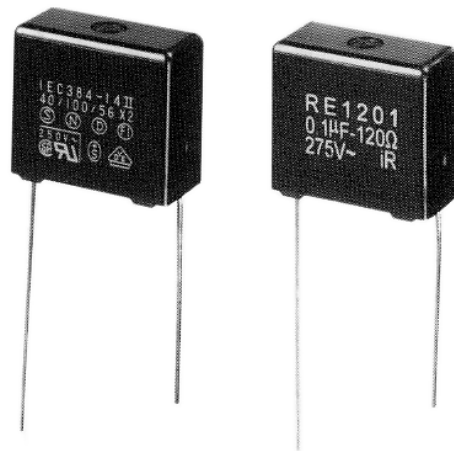
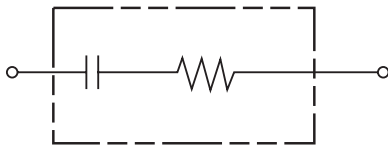
7) These products do absorb normal line surges. However they are not intended to absorb high-energy surges such as induced lightning. See OKAYA's Transient Voltage Suppressor section for products specifically designed for such applications.

RE SERIES

- Our best price/performance series for high volume appliances.
- AC or DC applications.
- Non-inductive, high pulse resistor.
- Good Peak Pulse withstand capability.

Safety Agency: Standard		File No.
UL	: UL-1414 (250V)	E47474
CSA*1	: C22.2, No.1 (250VAC)	LR37404
CE	: IEC60384-14II	F110590 (FIMKO)

*1cUL



ELECTRICAL SPECIFICATIONS

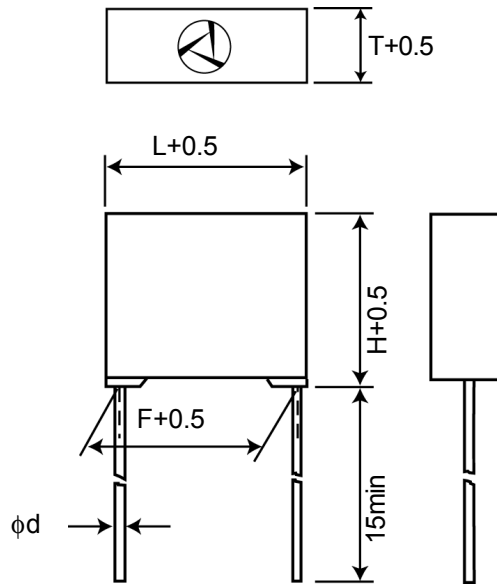
Operating temp. range: -40 ~ +100C°

Safety Standard	Class	Model number	Capacitance $\mu\text{F}\pm 20\%$	Resistance value $\Omega\pm 30\%$	Pulse condition				Peak applied voltage	Test voltage	Insulation resistance
					Peak voltage	Pulse width	Repetitive frequency	Pulse with X frequency			
 *2	X2	RE12001	0.01	120 (1/4W)	800V max.	50msec max.	120Hz max.	1.5 max.	1200V max.	Terminal to Terminal 1000Vrms 50/60Hz 60sec.	Terminal to Terminal 15,000M Ω min at 100V _{DC}
		RE120033	0.033					1.0 max.			
		RE1201	0.1					0.45 max.			
		RE1202	0.2	47 (1/2W)				0.15 max.			


*2 This series has European approvals which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Capacitor: Metallized Polypropylene Film



MECHANICAL DIMENSIONS

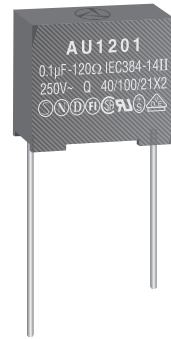
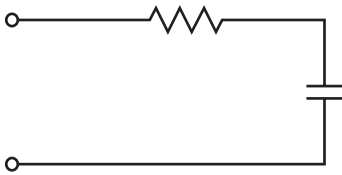
Safety Standard	Class	Model number	Capacitance $\mu\text{F}\pm 20\%$	Resistance value $\Omega\pm 30\%$	Outer Dimension (mm)				
					L	H	T	F	d
	X2	RE12001	0.01	120 (1/4W)	16.0	13.5	6.0	14.0	0.6±0.05
		RE120033	0.033		17.0	15.5	8.0	15.0	0.6±0.05
		RE1201	0.1	47 (1/2W)	24.5	17.0	8.5	22.5	0.75±0.07
		RE1202	0.2						

Fax Back Document #1201

AU SERIES

- Our best price/performance series for high volume appliances
- AC or DC applications
- ½ watt non-inductive, high pulse resistor
- Good Peak Pulse withstand capability

Safety Agency : Standard	File No.
UL : UL-1414 (125VAC)	E47474
CSA : C22.2 No. 0, 1 (125VAC)	LR37404
SEV : IEC60384-14 II/EN132400	93.1 01313.04
SEMKO : IEC60384-14 II/EN132400	9415208
FIMKO : IEC60384-14 II/EN132400	178357-01
DEMKO : IEC60384-14 II/EN132400	302908
NEMKO : IEC60384-14 II/EN132400	P9410 2376



ELECTRICAL SPECIFICATIONS

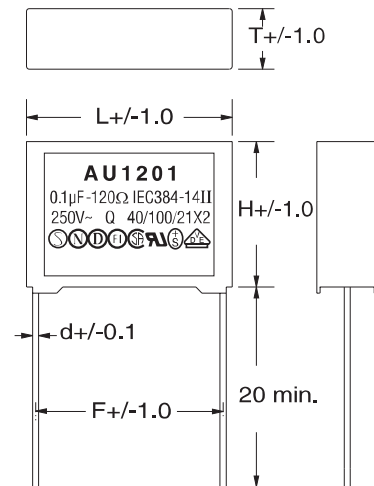
Operating temp. range : -40 ~ + 85°C

Safety Standard	Class	Model No.	Resistance $\Omega \pm 30\%$	Capacitance $F \pm 20\%$	Pulse condition (Max)			Peak Pulse Voltage	Test voltage JISC5102	Insulation resistance	
					Peak to Peak (P-P)	Pulse width	Repetitive frequency				
	X2	AU120033	120(%W)	0.033	700V max	20msec.max	120(60)Hz max	700V max	Line to Line 2000 Vdc 1200 Vrms 50/60Hz 2~5sec Line to Case 2000Vrms 50/60Hz 60sec	Line to Line 15,000M Ω min. Line to Case 100,000M Ω min. (at 20 C 500VDC)	
		AU1201	120(%W)	0.1		50msec.max					3(0.8)max
		AU047033	47(%W)	0.033		20msec.max					6(1.5)max
		AU0471	47(%W)	0.1		50msec.max					6(1.5)max
		AU010033	10(%W)	0.033		20msec.max					10(2.5)max
		AU0101	10(%W)	0.1		50msec.max					10(2.5)max

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Soldered Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film

SPARK QUENCHERS



Add "C6" suffix to p/n for 6mm lead length.
 Other lead lengths available—consult factory.
 All Dimensions in MM

MECHANICAL DIMENSIONS

Safety Standard	Class	Model No.	Resistance $\Omega \pm 30\%$	Capacitance $F \pm 20\%$	Dimensions			
					L	H	T	F
	X2	AU120033	120(%W)	0.033	20.0	17.0	8.0	17.5
		AU1201	120(%W)	0.1				
		AU047033	47(%W)	0.033				
		AU0471	47(%W)	0.1				
		AU010033	10(%W)	0.033				
		AU0101	10(%W)	0.1				

Fax Back Document #1202

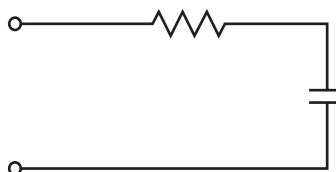
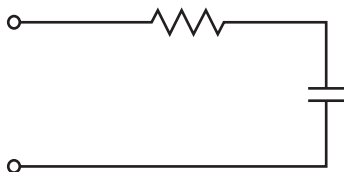
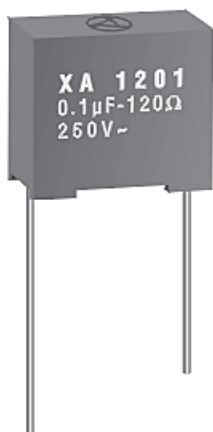
XA SERIES

- Small case size with superior performance
- PWB mounting
- Broad application in business equipment
- ¼ watt non-inductive, high pulse resistor

Safety Agency : Standard		File No.
UL	: UL-1414	E47474
CSA	: CSA C22.2 No.0, No.1	LR37404/LR68886
VDE	: VDE0565-1	10529-4670-1002

XAB SERIES

- Long insulated flexible wire leads
- AC or DC applications
- ¼ or ½ watt non-inductive, high pulse resistor



ELECTRICAL SPECIFICATIONS

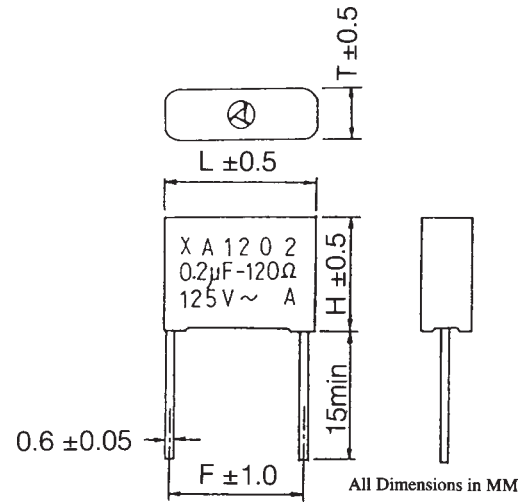
Operating temp. range : -40 ~ + 85°C

Safety Standard	Class	Model No.	Resistance $\Omega \pm 30\%$	Capacitance $\mu F \pm 20\%$	Pulse condition (Max)			Peak Pulse Voltage	Test voltage JISC5102	Insulation resistance	
					Peak to Peak (P-P)	Pulse width	Repetitive frequency				
	X2	XA120033	120(¼W)	0.033	700V max	20msec.max	120(60)Hz max	3(0.8)max	700V max	Line to Line 1200 Vrms 50/60Hz 2~5sec Line to Case 2000Vrms 50/60Hz 60sec	Line to Line 15,000MΩ min. Line to Case 100,000MΩ min. (at 20°C 500VDC)
		XA1201		0.1		50msec.max	120(60)Hz max	3(0.8)max			
XAB1201		0.1		50msec.max		120Hz max	3max				
XAB1202		120(½W)	0.2	50msec.max		120Hz max	3max				

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Soldered Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film

XA Series

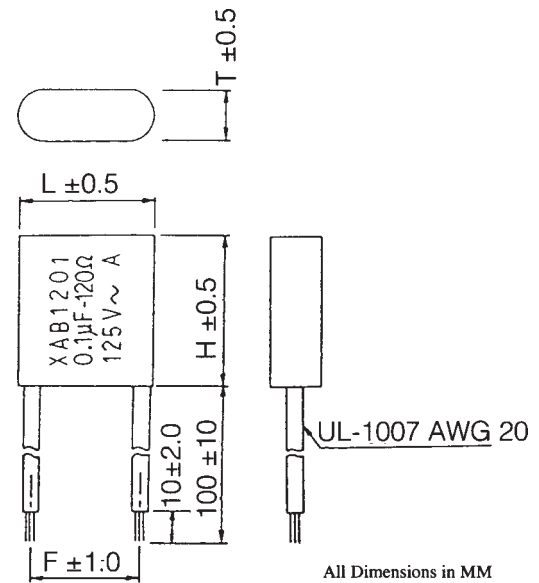


Add "C6" suffix to p/n for 6mm lead length.
 Other lead lengths available—consult factory.

MECHANICAL SPECIFICATIONS:

Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Copper Wire
 Polyvinylchloride (PVC) Insulation
 Soldered Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film

XAB Series



*Other lead lengths available—consult factory.

MECHANICAL DIMENSIONS

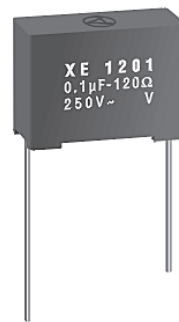
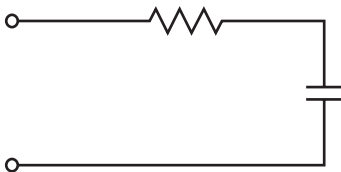
Safety Standard	Class	Model No.	Resistance $\Omega \pm 30\%$	Capacitance $\mu\text{F} \pm 20\%$	Dimensions			
					L	H	T	F
	X2	XA120033	120(¼W)	0.033	17.0	14.0	7.0	15.0
		XA1201		0.1	20.0	16.5	8.5	17.5
		XAB1201		0.1	18.0	23.5	8.5	15.0
—	—	XAB1202	120(½W)	0.2	19.0	25.0	8.5	15.0

Fax Back Document #1203

XE SERIES

- Our best size/performance series with broad applications in industrial controls
- Widest safety agency approvals
- High Peak Pulse withstand capability
- Large product selection range with ¼, ½, and 1 watt non-inductive, high pulse resistors

Safety Agency : Standard	File No.
UL : UL-1414	E47474
CSA : CSA C22.2 No.0, No.1	LR37404/LR68886
VDE : VDE0565-1	10529-4670-1002
SEMKO : SS443-04-14	8705137
DEMKO : Heavy Current Regulations Section 21 and IEC384-14	88929EC
NEMKO : NEMKO 132/85	E40433/E40434
EL : E384/14-82	116910-01, -02
SEV : SEV1055	87.1 01343.02



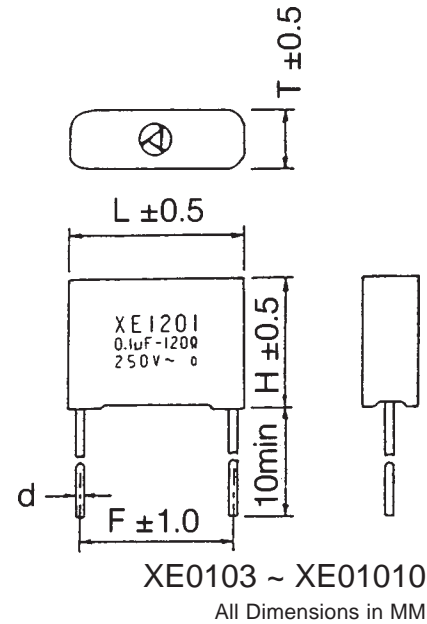
ELECTRICAL SPECIFICATIONS

Operating temp. range : -40 ~ +85°C

Safety Standard	Class	Model number	Resistance Ω ± 30%	Capacitance Cx (µF±20%)	Pulse condition (Max)				Peak pulse voltage	Test voltage JISC5102	Insulation resistance
					Peak to Peak (P-P)	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)			
	X2	XE01001	10(¼W)	0.01	800V max.	50msec max.	120Hz max.	4.5max	1200V max.	Line to Line 1250 Vrms 50/60Hz 60 sec	Line to Line 15,000MΩ min. Except XE0105, 0475, 01010 5000MΩ min. Line to Case 2000 Vrms 50.60Hz 60 sec 100,000MΩ min. (at 20°C 500VDC)
		XE04701	47(¼W)	0.01				3.0max			
		XE12001	120(¼W)	0.01				1.5max			
		XE22001	220(¼W)	0.01				0.8max			
		XE47001	470(¼W)	0.01				0.45max			
		XE010033	10(¼W)	0.033				3.0max			
		XE047033	47(¼W)	0.033				2.0max			
		XE120033	120(¼W)	0.033				1.0max			
		XE220033	220(¼W)	0.033				0.5max			
		XE470033	470(¼W)	0.033				0.25max			
		XE0101	10(½W)	0.1				1.5max			
		XE0471	47(½W)	0.1				1.0max			
		XE1201	120(½W)	0.1				0.45max			
		XE2201	220(½W)	0.1				0.2max			
		XE4701	470(½W)	0.1				0.1max			
		XE0102	10(½W)	0.2				0.5max			
		XE0472	47(½W)	0.2				0.3max			
		XE1202	120(½W)	0.2				0.15max			
		XE2202	220(½W)	0.2				0.08max			
		XE0103	10(1W)	0.3				0.2max			
XE0473	47(1W)	0.3	0.1max								
XE1203	120(1W)	0.3	0.05max								
XE2203	220(1W)	0.3	0.02max								
XE0105	10(1W)	0.5	0.18max								
XE0475	47(1W)	0.5	0.05max								
XE01010	10(1W)	1.0	0.15max								

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Copper Clad Steel,
 Soldered Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film



SPARK QUENCHERS

MECHANICAL DIMENSIONS

Add "C6" suffix to p/n for 6mm lead length.
Other lead lengths available—consult factory.

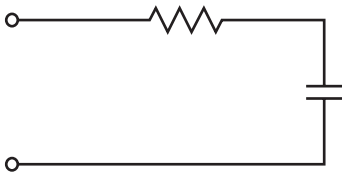
Safety Standard	Class	Model No.	Resistance $\Omega \pm 30\%$	Capacitance ($\mu F \pm 20\%$)	Dimensions						
					L	H	T	F	d		
	X2	XE01001	10(1/4W)	0.01	17.0	14.0	7.0	15.0	0.6±0.05		
		XE04701	47(1/4W)								
		XE12001	120(1/4W)								
		XE22001	220(1/4W)								
		XE47001	470(1/4W)								
				XE010033	10(1/4W)	0.033	17.5	15.0	8.0	15.0	0.6±0.05
				XE047033	47(1/4W)						
				XE120033	120(1/4W)						
				XE220033	220(1/4W)						
				XE470033	470(1/4W)						
				XE0101	10(1/2W)	0.1	23.5	17.5	8.5	20.0	0.8±0.07
				XE0471	47(1/2W)						
				XE1201	120(1/2W)						
				XE2201	220(1/2W)						
				XE4701	470(1/2W)						
				XE0102	10(1/2W)	0.2	30.0	20.0	11.0	27.5	0.8±0.07
				XE0472	47(1/2W)						
				XE1202	120(1/2W)						
				XE2202	220(1/2W)	0.3	40.0	28.0	16.0	36.5	1.0±0.10
				XE0103	10(1W)						
		XE0473	47(1W)								
		XE1203	120(1W)								
		XE2203	220(1W)								
		XE0105	10(1W)	0.5	47.0	33.5	22.0	43.5	1.0±0.10		
		XE0475	47(1W)								
		XE01010	10(1W)	1.0	47.0	33.5	22.0	43.5	1.0±0.10		

Fax Back Document #1204

XEB SERIES

- Flexible wire leads with mounting tabs on some models
- Our best performance series with broad applications in motor and controls
- Large product selection range with ¼, ½, and 1 watt non-inductive, high pulse resistors

Safety Agency : Standard	File No.
UL : UL-1414	E47474
CSA : CSA C22.2 No.0, No.1	LR37404/LR68886
VDE : VDE0565-1	10529-4670-1002
SEMKO : SS443-04-14	8705137
DEMKO : Heavy Current Regulations Section 21 and IEC384-14	88929EC
NEMKO : NEMKO 132/85	E40433/E40434
EL : E384/14-82	116910-01, -02
SEV : SEV1055	87.1 01343.02



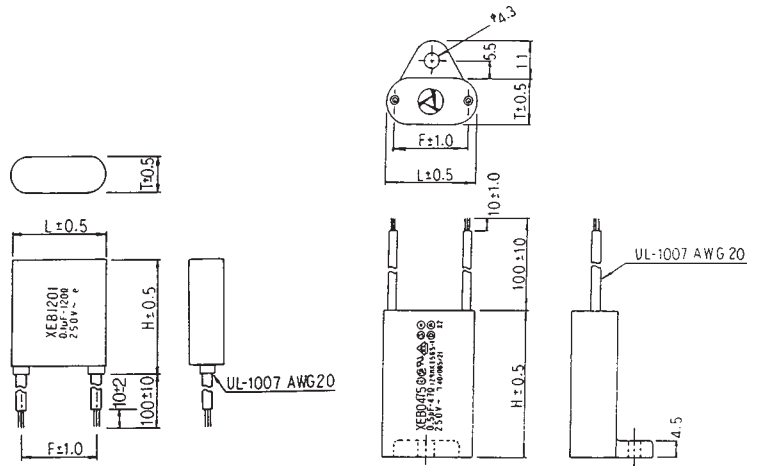
ELECTRICAL SPECIFICATIONS

Operating temp. range : -40 ~ + 85°C

Safety Standard	Class	Model number	Resistance Ω ±30%	Capacitance Cx (µF±20%)	Pulse condition (Max)				Peak pulse voltage	Test voltage JISC5102	Insulation resistance
					Peak to Peak (P-P)	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)			
	X2	XEB01001	10(¼W)	0.01	800V max.	50msec max.	120Hz max.	4.5max	1200V max.	Line to Line 15,000M Ω min.	
		XEB04701	47(¼W)					3.0max			
		XEB12001	120(¼W)					1.5max			
		XEB22001	220(¼W)					0.8max			
		XEB47001	470(¼W)					0.45max			
		XEB010033	10(¼W)					0.033			3.0max
		XEB047033	47(¼W)	2.0max							
		XEB120033	120(¼W)	1.0max							
		XEB220033	220(¼W)	0.5max							
		XEB470033	470(¼W)	0.25max							
		XEB0101	10(½W)	0.1							1.5max
		XEB0471	47(½W)					1.0max			
		XEB1201	120(½W)					0.45max			
		XEB2201	220(½W)					0.2max			
		XEB4701	470(½W)					0.1max			
		XEB0102	10(½W)					0.2			0.5max
		XEB0472	47(½W)	0.3max							
		XEB1202	120(½W)	0.15max							
		XEB2202	220(½W)	0.08max							
		XEB0103	10(1W)	0.3							0.2max
XEB0473	47(1W)	0.1max									
XEB1203	120(1W)	0.05max									
XEB2203	220(1W)	0.02max									
XEB0105	10(1W)	0.5	0.18max								
XEB0475	47(1W)		0.05max								
XEB01010	10(1W)		1.0	0.15max							

MECHANICAL SPECIFICATIONS:

Case: Standoffs provided for improved cleanability
 Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Stranded Copper Wire
 Polyvinylchloride (PVC) Insulation
 Soldered Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film



XEB...01 ~ XEB...2

XEB...3 ~ XEB...10

All Dimensions in MM

MECHANICAL DIMENSIONS

Other lead lengths available—consult factory.

Safety Standard	Class	Model No.	Resistance $\Omega \pm 30\%$	Capacitance $(\mu F \pm 20\%)$	Dimensions			
					L	H	T	F
	X2	XEB01001	10(¼W)	0.01	16.0	20.0	8.0	12.5
		XEB04701	47(¼W)					
		XEB12001	120(¼W)					
		XEB22001	220(¼W)					
		XEB47001	470(¼W)					
		XEB010033	10(¼W)					
		XEB047033	47(¼W)					
		XEB120033	120(¼W)					
		XEB220033	220(¼W)					
		XEB470033	470(¼W)					
		XEB0101	10(½W)	0.1	19.0	25.0	8.5	15.0
		XEB0471	47(½W)					
		XEB1201	120(½W)					
		XEB2201	220(½W)					
		XEB4701	470(½W)					
		XEB0102	10(½W)					
		XEB0472	47(½W)					
		XEB1202	120(½W)					
		XEB2202	220(½W)					
		XEB4702	470(½W)					
XEB0103	10(1W)	0.3	30.0	39.0	16.0	26.0		
XEB0473	47(1W)							
XEB1203	120(1W)							
XEB2203	220(1W)							
XEB0105	10(1W)						0.5	
XEB0475	47(1W)							
XEB01010	10(1W)	1.0	37.0	48.0	22.0	33.0		

Fax Back Document #1205

CRE SERIES

- Broad use in industrial applications
- Flexible wire leads
- External mounting tab
- ½ watt non-inductive, high pulse resistor

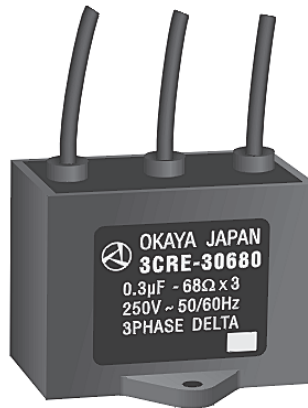
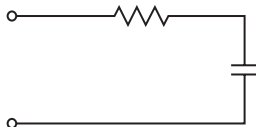
Safety Agency : Standard	File No.
UL : UL1283	E78644

3CRE/6CRE

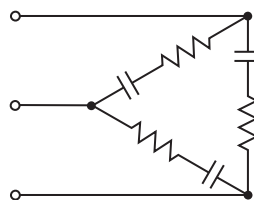
- For use in three phase industrial applications
- Two different circuit configurations for wide use conditions
- Flexible wire leads and external mounting tab
- ½ watt non-inductive, high pulse resistor



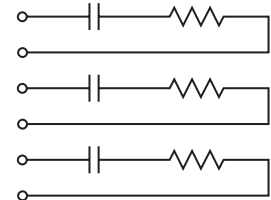
CRE



3CRE



6CRE



ELECTRICAL SPECIFICATIONS

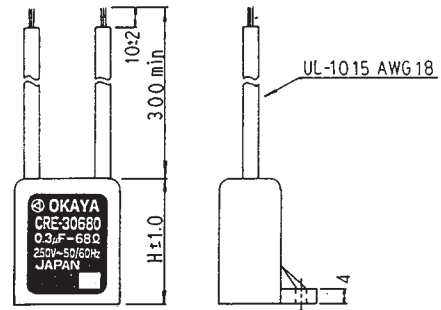
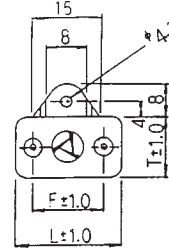
Operating temp. range : -40 ~ + 85°C

Safety Standard	Model No.	Capacitance Cx (µF±20%)	Resistance Ω ±30%	Pulse condition (Max)				Peak pulse voltage	Test voltage JISC5102	Insulation resistance
				Peak to Peak (P-P)	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)			
UL	CRE-10201	0.1	200(½W)	700V max	50msec.max	360Hz max	0.45max	800V max	Line to Line 625Vrms 50/60Hz 60sec. Line to Case 2000Vrms 50/60Hz 60sec.	Line to Line 10,000M Ω min. Line to Case 10,000M Ω min. (at 20°C 500 VDC)
	CRE-20151	0.2	150(½W)		50msec.max		0.15max			
	CRE-30680	0.3	68(½W)		70msec.max		0.1max			
	CRE-50500	0.5	50(½W)		70msec.max		0.07max			
	3CRE-30680	0.3/1phase	68(½W)/1phase		70msec.max		0.1max			
	3CRE-50500	0.5/1phase	50(½W)/1phase		70msec.max		0.07max			
	6CRE-50500	0.5/1phase	50(½W)/1phase		70msec.max		0.07max			

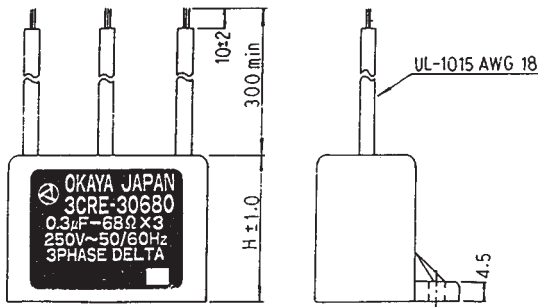
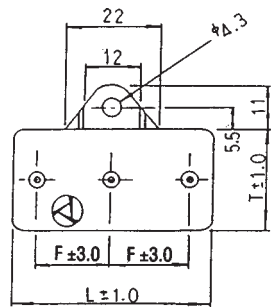
MECHANICAL SPECIFICATIONS:

Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Stranded Copper Wire
 Polyvinylchloride (PVC) Insulation
 Soldered Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film

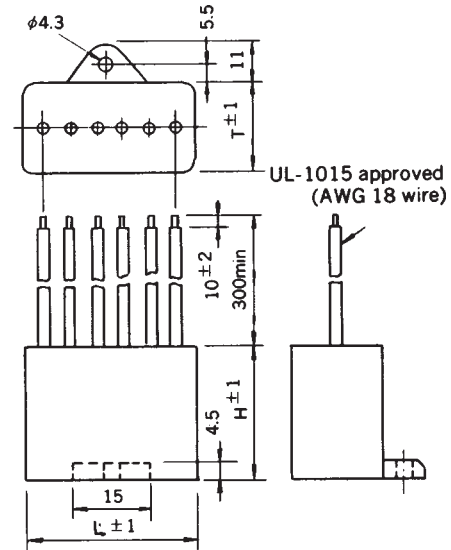
CRE



3CRE



6CRE



All Dimensions in MM

MECHANICAL DIMENSIONS

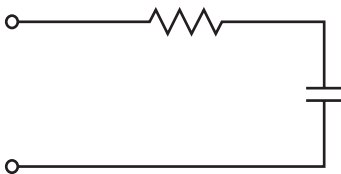
Other lead lengths available—consult factory.

Safety Standard	Model No.	Capacitance (μF±20%)	Resistance Ω±30%	Dimensions			
				L	H	T	F
	CRE-10201	0.1	200(½W)	23.0	26.0	14.0	13.0
	CRE-20151	0.2	150(½W)				
	CRE-30680	0.3	68(½W)	25.0	32.0	16.0	15.0
	CRE-50500	0.5	50(½W)				
	3CRE-30680	0.3/1phase	68(½W)1 phase	44.0	35.0	26.0	
	3CRE-50500	0.5/1phase	50(½W)1 phase				
	6CRE-50500	0.5/1phase	50(½W)1 phase	48.0	35.0	26.0	

Fax Back Document #1206

CRH SERIES

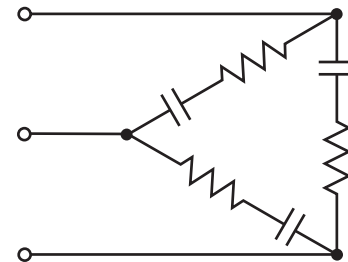
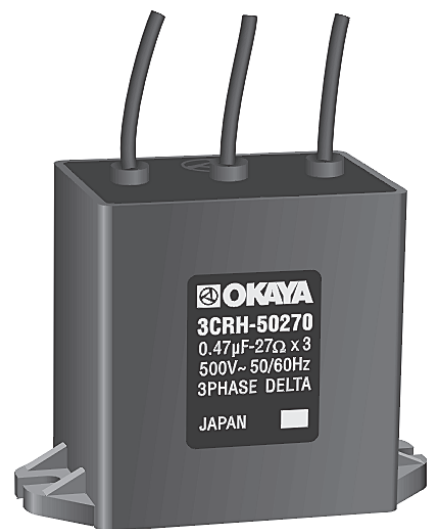
- 500 VAC rating for application in high voltage phase control
- Flexible wire leads with external mounting tab
- 6 and 10 watt non-inductive, high pulse resistors



Safety Agency : Standard	File No.
UL : UL1283	E78644

3CRH SERIES

- 500VAC rating for application in high voltage three phase control
- Flexible wire leads and external mounting tab
- 6 and 10 watt non-inductive, high pulse resistors



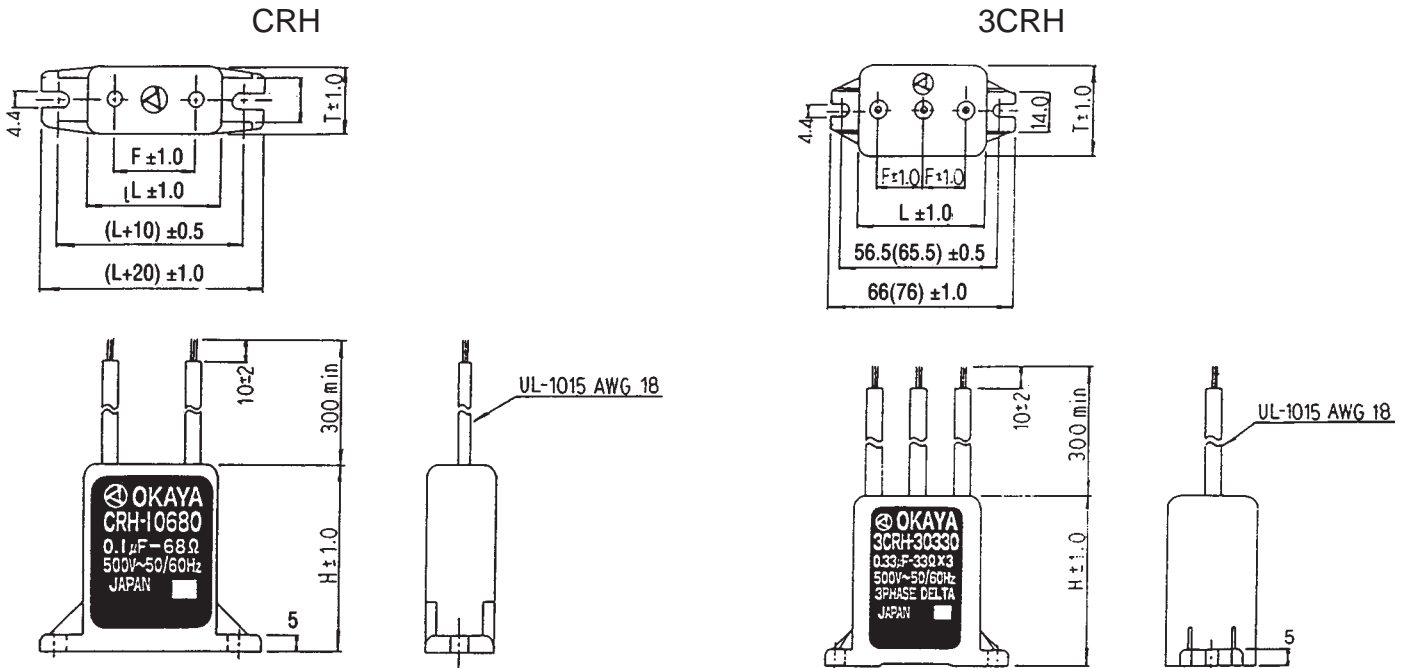
ELECTRICAL SPECIFICATIONS

Operating temp. range : -40 ~ +70°C

Safety Standard	Model No.	Capacitance Cx (μF±20%)	Resistance Ω ±30%	Pulse condition (Max)				Peak pulse voltage	Test voltage JISC5102	Insulation resistance
				Peak to Peak (P-P)	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)			
UL	CRH-10680	0.1	68(6W)	1000V max	50msec.max	720Hz. max	1.0max	1500V max	Line to Line 1250Vrms 50/60Hz 60sec. Line to Case 2000Vrms 50/60Hz 60sec.	Line to Line 10,000MΩ min. Line to Case 10,000MΩ min. (at 20°C 500 VDC)
	CRH-20470	0.22	47(6W)		70msec.max		0.3max			
	CRH-30330	0.33	33(6W)		100msec.max		0.2max			
	CRH-50270	0.47	27(10W)		100msec.max		0.2max			
	3CRH-30330	0.33/1phase	33(6W)/1phase		100msec.max		0.2max			
	3CRH-50270	0.47/1phase	27(10W)/1phase		100msec.max		0.2max			

MECHANICAL SPECIFICATIONS:

Case Material: Polybutylene Terephthalate (FR-PBT)
 UL-94 Flame Class V-O
 Potting Material: UL-94 Flame Class V-O
 Leads: Tinned Stranded Copper Wire
 Polyvinylchloride (PVC) Insulation
 Soldered Capacitor Element
 Capacitor: Double Wound, Oil Impregnated,
 Metallized Polyester Film



All Dimensions in MM

MECHANICAL DIMENSIONS

Other lead lengths available—consult factory.

Safety Standard	Model No.	Capacitance (μF±20%)	Resistance Ω ±30%	Dimensions			
				L	H	T	F
	CRH-10680	0.1	68(6W)	30.0	57.0	15.0	18.0
	CRH-20470	0.22	47(6W)				
	CRH-30330	0.33	33(6W)				
	CRH-50270	0.47	27(10W)	40.0	20.0	28.0	
	3CRH-30330	0.33/1phase	33(6W)1 phase	46.0	62.0	32.0	13.0
	3CRH-50270	0.47/1phase	27(10W)1 phase	56.0		40.0	18.0

SPARK QUENCHERS

Fax Back Document #1200

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• Safety Standards

Okaya spark quenchers have been recognized by the following safety standards organizations:

Organization (country)	Applicable Standard	
	Household Appliances	Office Appliances and others
IEC	PUB 65	PUB 950
UL (USA)	UL-1414 (capacitor)	UL-1283 (filter)
CSA (Canada)	C22.2 No. 0 No. 1	C22.2 No.8
VDE (Germany)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
SEV (Switzerland)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
BS (Great Britian)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
SEMKO (Sweden)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
DEMKO (Denmark)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
NEMKO (Norway)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
EI (Finland)	IEC384-14II(EN132400)	IEC384-14II(EN132400)
ÖVE (Austria)	-----	IEC384-14II(EN132400)
IMQ (Italy)	-----	IEC384-14II(EN132400)

- Electrical apparatus are classified roughly into two categories, i.e., (a) household appliances and (b) office appliances including office automation (OA) and others.
- The standards for noise suppression capacitors to be used in the household appliances are more strict than those in the office appliances and others.
- The products enumerated in the following pages (with a few exceptions) have been approved under standards applicable to the household appliances, so that you may use them for almost all applications.
- In order to avoid any accidents in machine applications which may experience unexpected abnormal surge voltage, or which are subjected to continuous 24-hour use, it is necessary to build in an extra measure of reliability. Here, the strict test conditions conducted by the above-mentioned safety standards organizations can be considered as one of the criteria from a reliability point of view.

● **SPARK QUENCHERS INTRODUCTION RC NETWORKS**

Recent developments in electronic equipment have shown the following trends:

- Increasing demands for numerical control machines, robotics and technically advanced appliances are requiring progressive electronic technologies.
- When employing integrated circuit and microcomputer technology, today's equipment is required to perform multifunctions in limited size.
- The denser the installation of components, the more the components must be miniaturized and of lighter weight.
- As a result, the following problems arise:
 - 1) Functional limits of magnetic relays and switches have narrowed due to increasing contact amperage.
 - 2) Miniaturization of electronic components has reduced their dielectric strength.
 - 3) Circuit noise has increased as a result of the coexistence of signal and power lines.
 - 4) Safety standards for electronic equipment and components have become increasingly restrictive.

Some key factors affecting circuit performance are:

- 1) Arcing between relay and switch contacts result in wear and binding.
- 2) Contact arcing, results in high frequency noise and abnormal high voltages.
- 3) The generation of back electromotive force (EMF) is due to the self-inductance of inductive loads.
- 4) The occurrence of high frequency noise is the result of contact chatter in magnetic relays and switches.

Back EMF, due to self-inductance, affects Silicon Control Rectifiers (SCRs) and Solid-state Relays (SSRs) and can result in the breakdown of other semi-conductor devices. Power line surges must also be carefully considered. Either may be a contributing factor in equipment malfunctions, failures and in extreme cases fire and/or electrical shock.

To illustrate these factors, consider that relay contact chatter is capable of inducing oscillations of several Kilohertz, contact arcing frequencies of several Megahertz and amplitudes 10 to 20 times normal circuit voltages. Voltage surges from external sources may approach thousands of volts.

To protect electronic equipment against costly failures or malfunctions, Okaya has developed advanced components to suppress contact arcing and filter unwanted electrical noise.

● **DETERMINING RC VALUE**

In general, the RC determining formula is regarded as quite complex, but since the RC combination has the decisive effect of integrating the rapid changes of the waveform to a smoothed average, the determination of RC values by complex formulas becomes unnecessary.

It is possible to select a suitable OKAYA Spark Quencher using the chart or the formulas shown below. Keep in mind that there is no one exact value of Spark Quencher which will satisfy all applications. The chart and formula are guidelines to give the user a starting point from which to work. The final selection must be evaluated in the application to determine its acceptability.

		LOAD CURRENT - AMPERES									MFD + OHMs	R+C Values
		0.05	0.1	0.2	0.3	0.5	1.0	2.0	3.0	5.0		
Source Voltage	125VAC or 125VDC	0.01 + 470	0.01 + 470	0.01 + 220	0.01 + 120	0.022 + 120	0.1 + 47	0.3 + 47	0.5 + 47	1.0 + 10	MFD + OHMs	R+C Values
	250VAC or 250VDC	0.01 + 470	0.01 + 470	0.01 + 470	0.01 + 470	0.022 + 120	0.1 + 120	0.3 + 120	0.5 + 47	1.0 + 47	MFD + OHMs	

$$C = \frac{I^2}{10}$$

C = Capacitance in MFD
 I = Load Current in Amps
 R = Resistance in Ohms
 V = Source Voltage

$$R = \frac{V}{10 (1 + \frac{50}{V}) I}$$

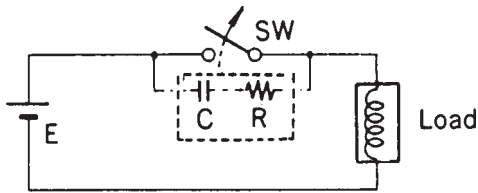
SPARK QUENCHERS

Spark Quenchers are easily selectable electronic components designed to prevent or substantially minimize the occurrence of arcing and noise generation in relay and switch contacts.

Spark Quenchers consist of specially designed capacitors and resistors connected in series. Spark discharges and induced noise are absorbed over a wide range by the accumulation characteristic and impedance of the capacitor, while the RC time constant delays and averages surge voltage and oscillations.

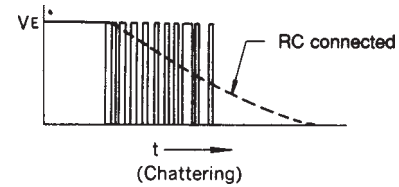
• EFFECT OF SPARK QUENCHER

Arc suppression



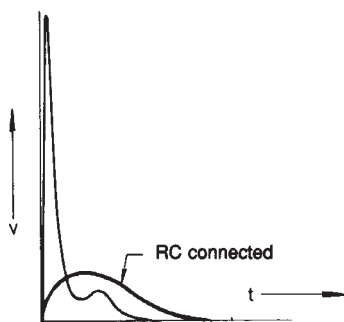
At the moment of switch opening, the RC combination absorbs and suppresses the energy of the arc by letting it bypass the switch.

Damping oscillation



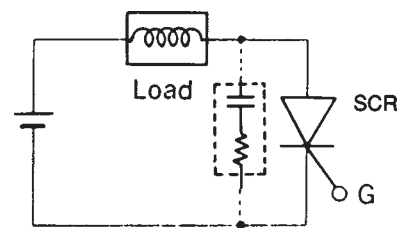
The RC combination absorbs the high frequency oscillations caused by mechanical vibrations such as relay contact chattering. Similarly the oscillations created by arcing are also averaged and suppressed by the RC combination regardless of their origin.

Back electromotive force suppression



With back electromotive force due to self-inductance, the surge voltage peak is suppressed by conducting it through the RC circuit on the low impedance side. The peak is absorbed by the capacitance of RC. The waveform is averaged and smoothed by the time constant of the RC; thus generated noise is eliminated or substantially minimized.

Dv/dt suppression



The RC combination allows the dv/dt of the "on" and "off" operation of thyristors or similar devices to decrease; thus surge voltages are suppressed and semi-conductor elements are protected. Even in the case of zero crossing circuits, such as AC circuits, protection is necessary since harmonic noise occurs when there is a gap between phases or current and voltage of the load circuit.

OKAYA Spark Quenchers have the following characteristics which make it possible to easily use them in a wide range of applications.

- 1) The Overload capacity is large.
- 2) They are not polarized; thus can be used in both AC and DC circuits.
- 3) They have a favorable effect on surge voltage and accompanying oscillations caused by contact chatter.
- 4) They are effective against spurious potentials having magnitudes below circuit voltage.
- 5) They offer a high degree of protection for semiconductor devices, and as thyristors and SCRs.
- 6) They improve the dv/dt ratio.

• **OUTLINE OF CAPACITOR CLASS RATINGS**

Capacitors are classified by the IEC into the following categories (these designations are used by most European countries):

Class Y: Capacitors used in applications where damage to the capacitor may involve the danger of electrical shock.

Class X: Capacitors used in applications where damage to the capacitor will not lead to the danger of electrical shock.

European Safety Agencies subdivide Class X into X1, X2 and X3 classifications. The test criteria for these subclasses is shown in the table.

Subclass	Peak Voltage on Service (kV)	Peak Voltage Test 1.2/50 μ sec. (kV)
X1	$>1.2\text{kV} \leq 4.0\text{kV}$	4.0kV
X2	$\leq 2.5\text{kV}$	2.5kV
X3	$\leq 1.2\text{kV}$	None

RC COMBINATION TABLE

$\mu\text{F} \backslash \Omega$	10	27	33	47	50	68	100	120	150	160	200	220	470	500
0.01	XE XEB			XE XEB				XE XEB				XE XEB	XE XEB	
0.033	XE XEB AU			XE XEB AU				XA XE XEB AU				XE XEB	XE XEB	
0.1	XE XEB AU			XE XEB AU		CRH		XA XAB XE XEB AU			CRE	XE XEB	XE XEB	
0.2	XE XEB			XE XEB				XAB XE XEB	CRE			XE XEB		
0.22				CRH										
0.3	XE XEB			XE XEB		CRE 3CRE		XE XEB				XE XEB		
0.33			CRH 3CRH											
0.47		CRH 3CRH												
0.5	XE XEB			XE	CRE 3CRE 6CRE									
1.0	XE XEB													

SPARK QUENCHERS

• GENERAL CONSTRUCTION

Spark Quenchers must have the capacity to store surge voltages and current energy, and afford protection against inductively induced potentials. The dielectric material of the OKAYA capacitors, used in Spark Quenchers, affords a very high degree of voltage withstand strength. All resistors are non-inductive solid slug type to insure a high degree of protection against pulse potentials. To provide additional protection for equipment and users, especially when these components are used in AC applications, all OKAYA Spark Quenchers are packaged in cases which meet UL-94 Flame Class V-O.

• SAFETY STANDARDS

Safety standards for capacitors used in conjunction with AC power sources have recently been adopted by many world wide standards agencies. OKAYA Spark Quenchers are fully tested to these standards (see Chart). As well, Okaya is able to offer some products with 500 VAC ratings.

• APPLICATIONS

A) Protection for contacts and from noise during switching operations of equipment such as radio, TV, copiers, mixers, coffee grinders, dryers, tool machine equipment, etc.

B) Protection of electronic instruments during operation of relays, solenoids, motors, etc.

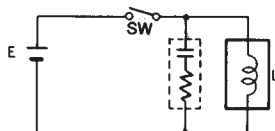
C) Electrical noise protection of semiconductor devices during control of triacs, thyristors, motors, welders, illumination equipment, etc.

• FORM

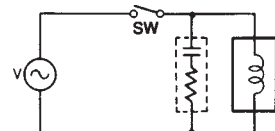
Line Voltage	Safety Standard	Lead Type	Forms	Model
125V/250V AC	UL • CE • A	Bare wire/Flex PVC wire	a/b	XA series/XAB series
125V/250V AC	UL CE A D N H D N	Bare wire	a	AU series
250V AC	UL CE A D N H D N	Bare wire	a	XE series
250V AC	UL CE A D N H D N	Flex PVC wire	b	XEB series
250V AC	UL	Flex PVC wire	d	CRE series
250V AC	UL	Flex PVC wire	e	3CRE series (3 phase delta connection)
500V AC	UL	Flex PVC wire	c	CRH series
500V AC	UL	Flex PVC wire	f	3CRH series (3 phase delta connection)
250V AC	UL	Flex PVC wire	g	6CRE series (3 individual circuits)



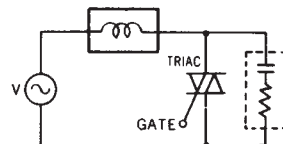
• APPLICATION EXAMPLES



Standard example in DC circuits.



Standard example in AC circuits.



For phase control circuits employing SCR or TRIAC, etc.

• **DESIGN CAUTIONS**

1) Using OKAYA Spark Quenchers will help prevent abnormal operation due to electrical noise and/or surge pulses. It is not recommended that these devices be used in circuits with frequencies greater than 70 Hz. When used in 3-phase, full wave rectified applications, care must be taken to insure that the Spark Quencher does not self heat by more than 5 degrees centigrade or permanent damage to the Spark Quencher may occur.

2) When protecting contacts feeding small circuit loads, it is recommended that the Spark Quencher be placed in parallel with the load, rather than the contacts, for the most effective application.

3) In high speed circuits, the addition of a Spark Quencher may slow the response time of the circuit. For best response characteristics, do not use a larger Spark Quencher than is absolutely necessary to suppress the noise level.

4) Spark Quenchers should be connected as close as possible to the noise source. Excessive lead length may allow abnormal oscillation and/or decrease energy absorption capacity.

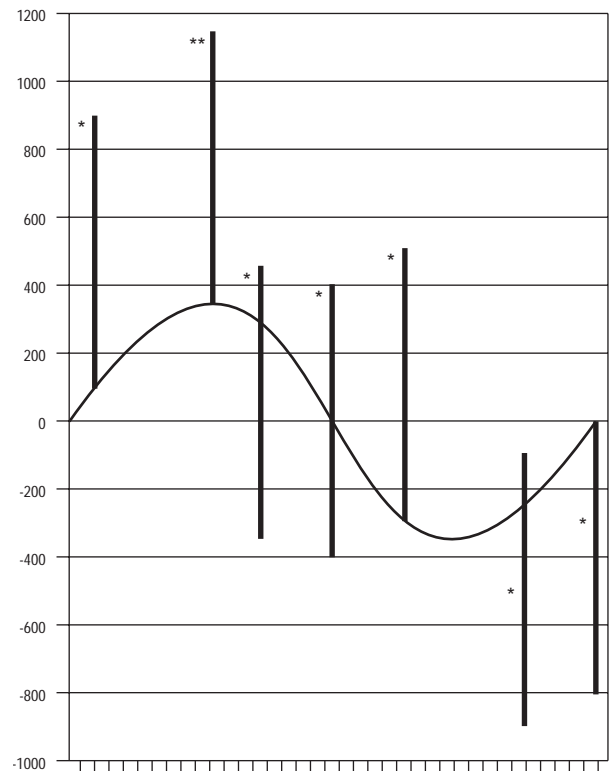
5) When a thyristor, triac or inverter circuit is to be protected by a Spark Quencher, care must be taken that high harmonic currents do not cause over heating of the Spark Quencher resistor. If heating occurs, we suggest the employment of a Spark Quencher with a lower resistance. The Spark Quencher must not self heat by more than 5 degrees centigrade. In inverter applications, it is recommended that an OKAYA noise suppression capacitor be used across the power lines, instead of the Spark Quencher.

6) While it may appear effective to protect contacts with a capacitor only, the capacitor discharge current will cause accumulative damage to the contacts when they close. The proper technique is to apply a Spark Quencher across either the contacts or the load.

• **EXPRESSION OF RATED VOLTAGE**

The rated voltage of OKAYA Spark Quenchers is expressed by the steady-state (line) voltage rating. They can, however, withstand much higher voltages from power surges. In this catalog, the maximum voltage (including the line voltage) that the Spark Quenchers can withstand is expressed as the "Peak Pulse Voltage". For example, the XE series is rated 250VAC RMS (350VAC Peak) maximum line voltage, but can withstand surge voltages up to 1200VAC (including Peak line voltage). "Pulse Condition" means the maximum voltage that can be input between terminals of the Spark Quencher (excluding line voltage) during operation. For example, when the XE series is used in a 250VAC RMS (350VAC Peak) line voltage application, it can withstand surge voltages up to 800VAC (P-P) above the Peak line voltage. The following drawing shows examples of both "Peak Pulse Voltage" and "Pulse Condition" for clarification.

"Pulse Condition"



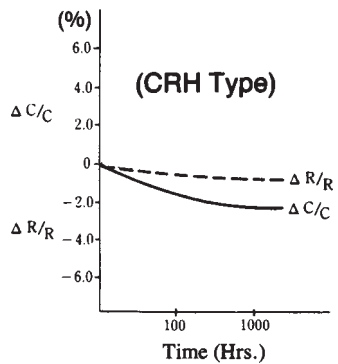
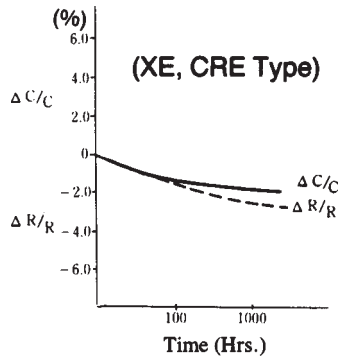
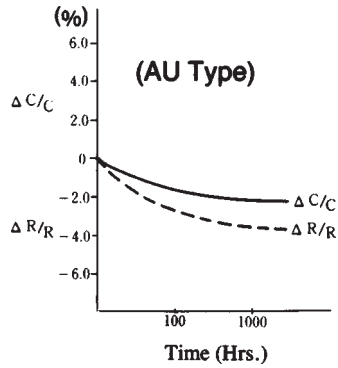
* Pulse Condition (Surge pulse p.p.)

** Peak Pulse Voltage (Peak line voltage plus surge pulse)

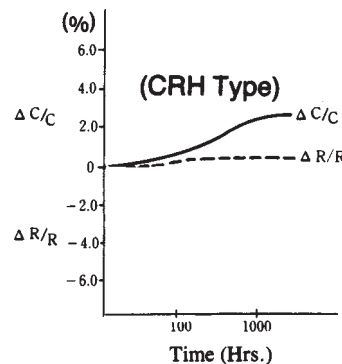
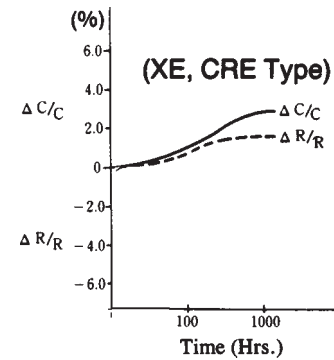
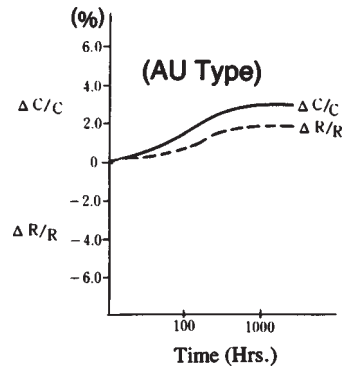
SPARK QUENCHERS

• PERFORMANCE CHARACTERISTICS

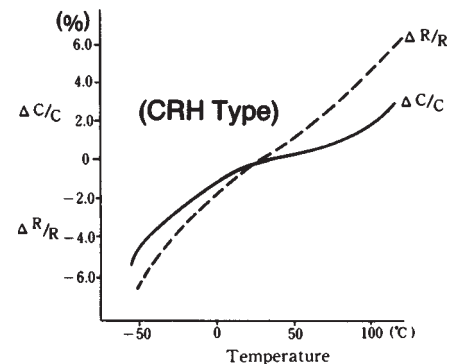
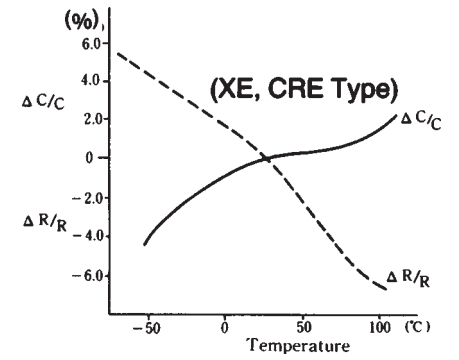
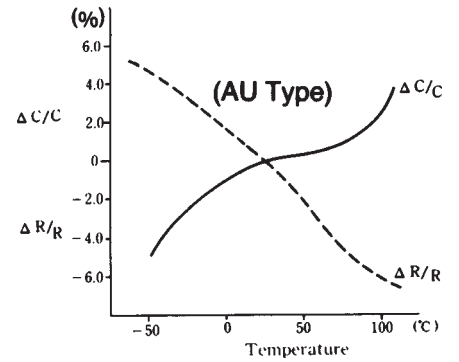
Temperature Endurance



Damp Heat Endurance



Temperature Characteristics



• TEST CONDITIONS

Temperature Endurance:

While operating at maximum rated temperature and at 125% of rated voltage, input the table voltages four times per hour for 0.1 second.

Model	Applied voltage
AU, CRE	880 Vrms
XE	1000 Vrms
CRH	1500 Vrms

Damp Heat Endurance:

60°C, 90~95% RH
100% Rated Voltage

Temperature Characteristics:

-50°C to ~100°C
100% Rated Voltage

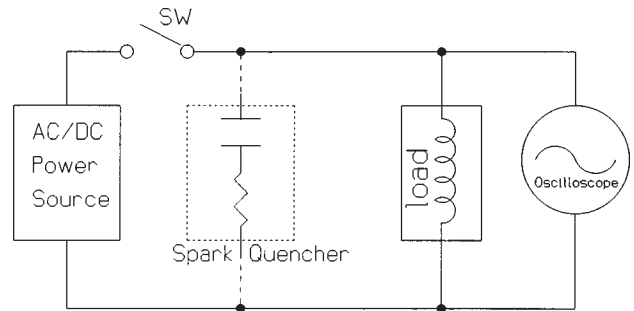
• **EXAMPLES OF ABSORPTION OF NOISE**

The following illustrations show examples of the operation of a variety of commonly used magnetic relays and contactors with and without a Spark Quencher. The ability of the Spark Quencher to integrate peak power surges and suppress high frequency oscillations is visibly demonstrated.

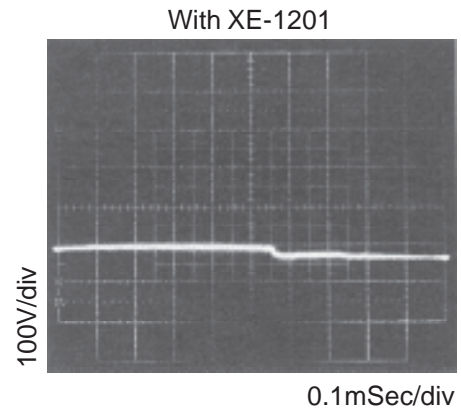
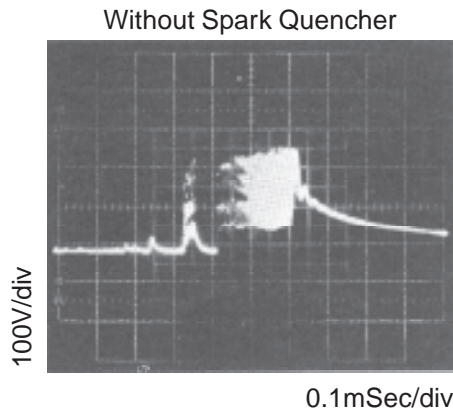
Without a Spark Quencher in the circuit, surge voltage becomes 10 to 30 times larger than the normal circuit voltage and the noise frequency approaches 10 MHz. Spark Quenchers effectively absorb high frequency oscillations induced by contact chattering and attenuate peak surge voltages.

In general, inductive load circuit malfunctions occur as a result of component dielectric breakdown induced by excessive peak potential, or unnecessary radiation accompanied by occurrences of high frequency oscillations due to rapid changes of voltage. Spark Quenchers are effective in preventing both types of electrical noise.

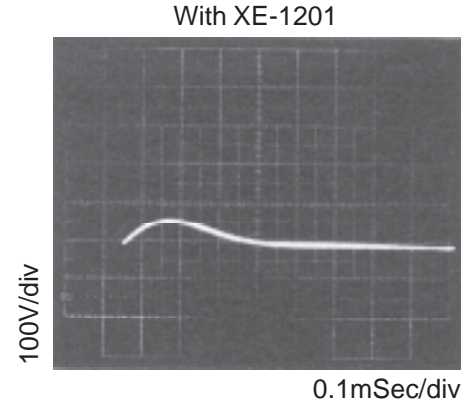
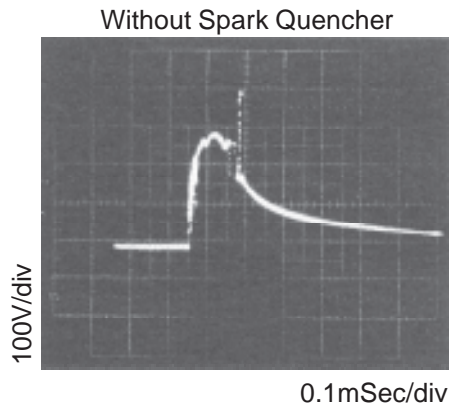
In the following illustrations of noise waves, note that the time base is quite small compared with the normal 50/60 Hz line (16-20 msec.).



Example 1. Magnetic relay closed in 12VDC circuit.

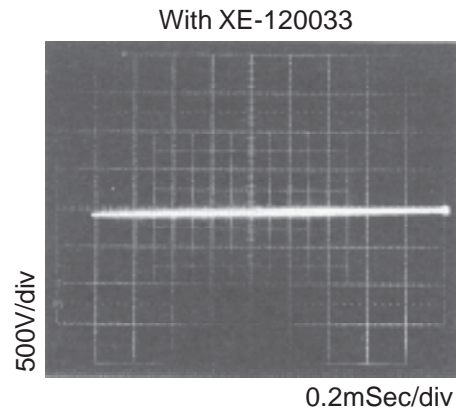
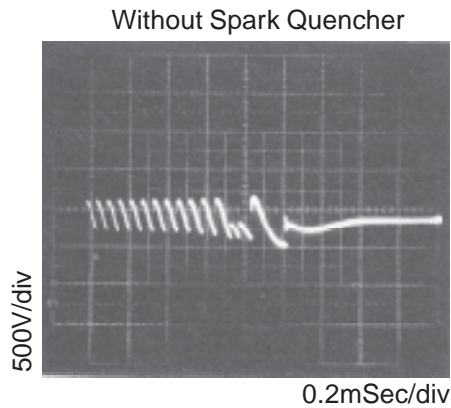


Example 2. Magnetic relay opened in 12VDC circuit.

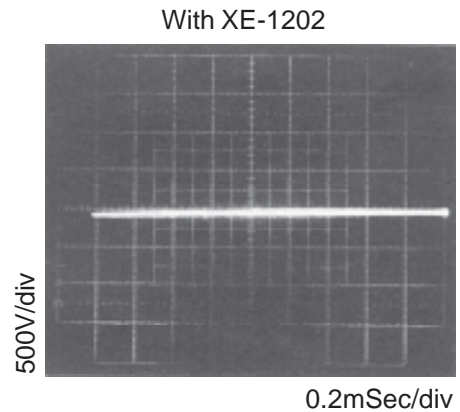
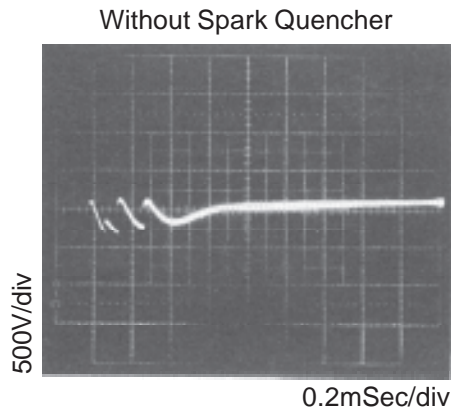


SPARK QUENCHERS

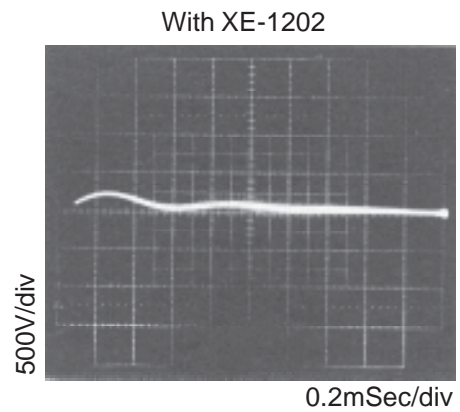
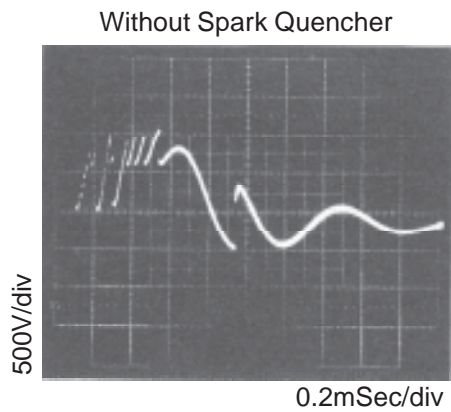
Example 3. Magnetic relay opened in 120VAC circuit.



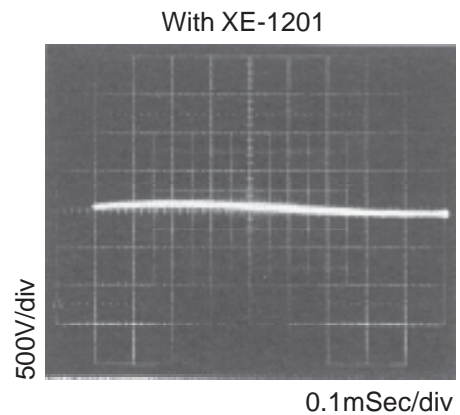
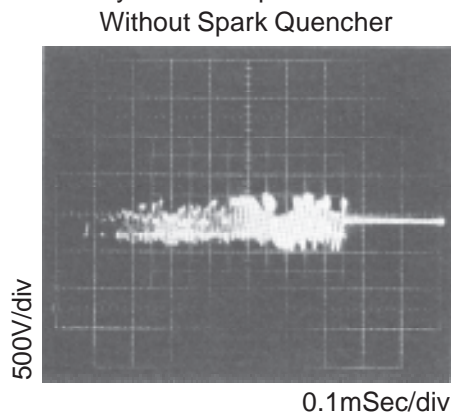
Example 4. Large magnetic relay opened in 120VAC circuit.



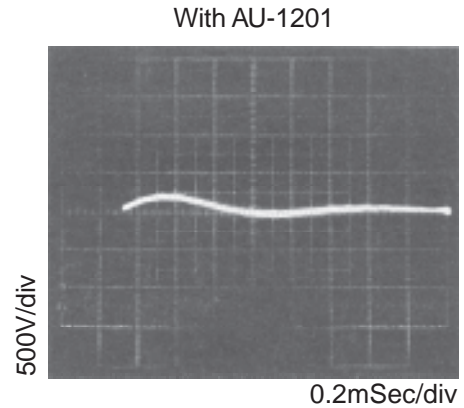
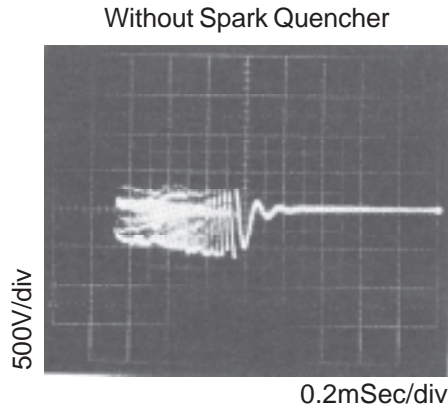
Example 5. Magnetic contactor opened in 240VAC circuit.



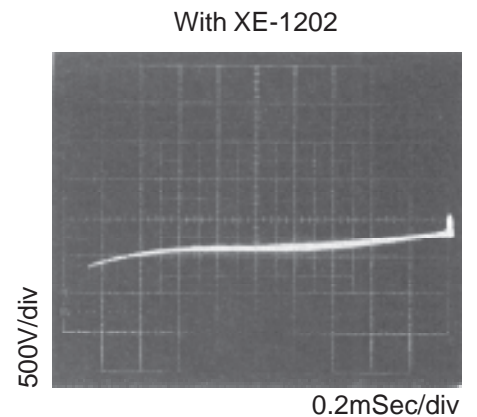
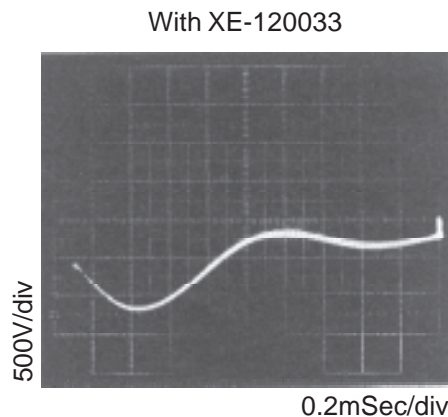
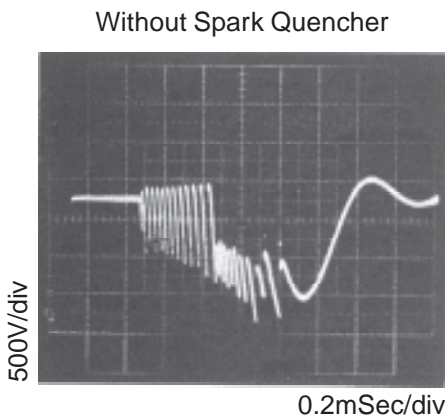
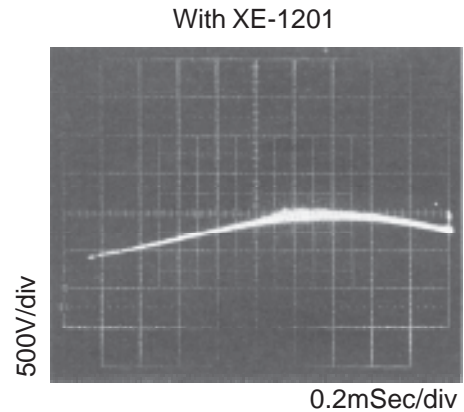
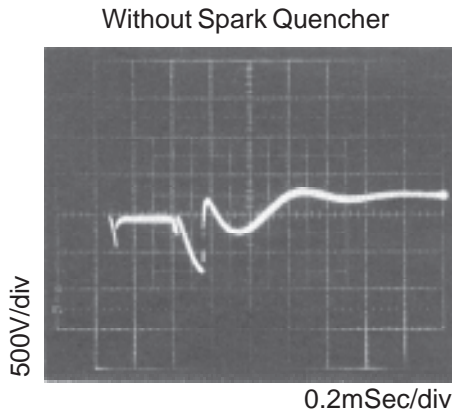
Example 6. Rotary solenoid opened in 120VAC circuit.



Example 7. Motor timer opened in 120VAC circuit.



Example 8. Induction motor opened in 240VAC circuit.



Two of the illustrations in example 8 are the result of the switch opening without Spark Quencher protection. The variation in the wave forms is due to the difference in the AC voltage at the instant of circuit opening.

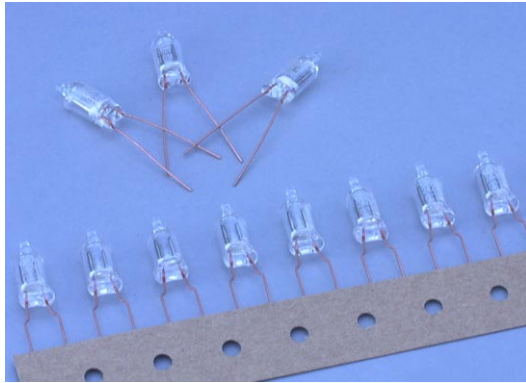
Three of the noise-graph illustrations are the result of the switch opening with Spark Quencher protection. Noise that occurs at the time of load disconnect is absorbed by the LRC loop. Proportionally as the capacitor becomes larger, the noise prevention becomes more effective.

• RA-V7

The RA-V7 Series utilizes micro-gap discharge technology, thus demonstrating extremely fast response characteristics in dark ambient conditions without the use of radioactive isotopes.

Applied as indirect lightning surge protection in the power line of equipment, this model is used with a series connected MOV between line and ground in the power line.

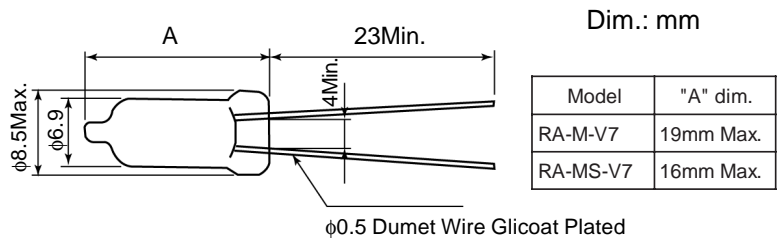
It may also be used within electronic circuits to protect from destructive impulse current while still permitting "Voltage Withstand Testing" without having to remove the RA-V7.



Safety Agency : Standard	File No.
UL : UL-1449 1985	E143446
UL : UL-1414	E47474
CSA : C22.2 No. 1 -94	LR105073
TÜV : IEC 384-14 1993	J9551103

FEATURES:

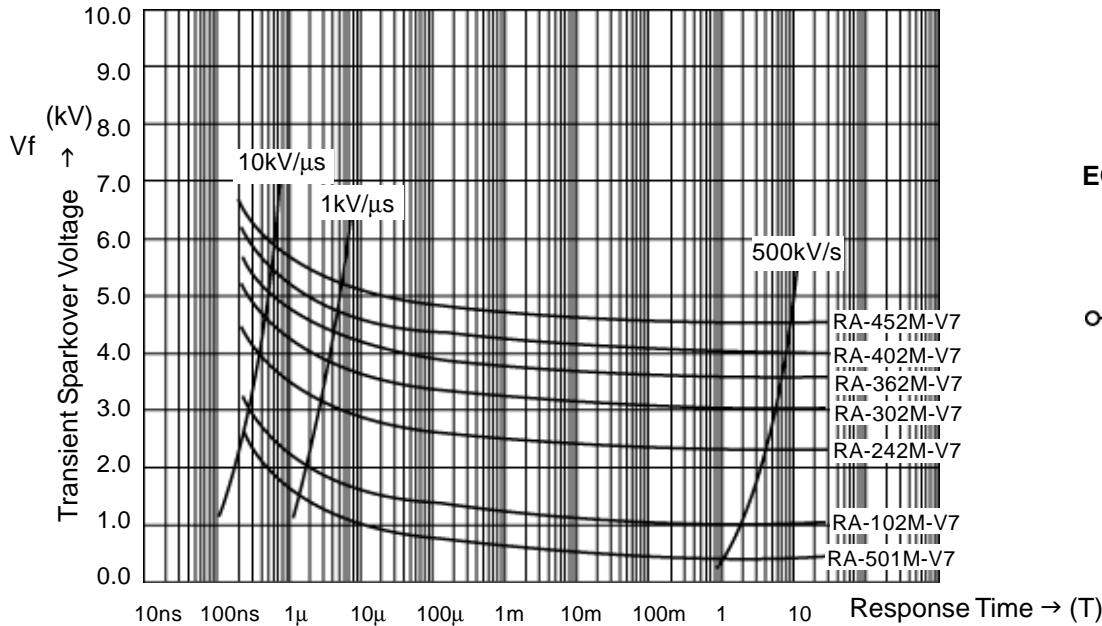
- Fast response time (see V-T Chart)
- This Surge Absorber is Bi-polar and will fail open if surge withstand capability is exceeded.
- Inter-terminal capacitance is extremely small, resulting in little influence on electronic circuits.
- High Insulation Resistance ($1 \times 10^9 \Omega \cdot \text{min.}$)
- Excellent Surge withstand capability (300 times at 100Amp, $8 \times 20 \mu\text{s.}$)
- Small size for compact circuit design.
- Available taped for auto insertion.
Add "Y" to model number. (RA-242M-V7-Y)



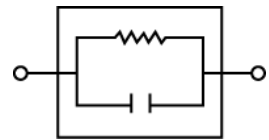
ELECTRICAL SPECIFICATIONS

Safety Standard	Model No.	D.C. Breakdown Voltage (when lighted)	Capacitance	Peak Surge Current	Repeat Surge Times	Voltage Withstand Test
UL	RA-501M(MS)-V7	500 (400~600)	2pF (max)	3500 Amp 3 times ($8 \times 20 \mu\text{sec}$)	100 Amp 300 times ($8 \times 20 \mu\text{sec}$)	-
	RA-601M(MS)-V7	600 (480~720)				-
	RA-102M(MS)-V7	1000 (800~1200)				-
	RA-152M(MS)-V7	1500 (1200~1800)				-
UL CB	RA-242M-V7	2400 (1920~2880)				AC 1250V 3sec.
UL CB CE	RA-302M-V7	3000 (2400~3600)				AC 1500V 1 min.
	RA-362M-V7	3600 (2880~4320)				AC 1800V 3sec.
UL CE	RA-402M-V7	4000 (3200~4800)				AC 2000V 60sec.
	RA-452M-V7	4500 (3600~5400)				
UL	RA-242MS-V7	2400 (1920~2880)				AC 1250V 3sec.
UL CE	RA-302MS-V7	3000 (3400~3600)				AC 1500V 60sec.
	RA-362MS-V7	3600 (2880~4320)				AC 1800V 3sec.
	RA-402MS-V7	4000 (3200~4800)				AC 2000V 60sec.
	RA-452MS-V7	4500 (3600~5400)				AC 2000V 60sec.

V - T CHARACTERISTICS



EQUIVALENT CIRCUIT DIAGRAM



LIGHTNING SURGE PROTECT FOR AC POWER LINES

	RA - 242M - V7	RA - 302M - V7	RA - 362M - V7
SPECIFICATION	RATED VOLTAGE AC125V 50/60Hz DC BREAKDOWN VOLTAGE 2400V± 20% VOLTAGE WITHSTANDING TEST AC1000V, 50/60Hz, 60S Max. AC1250V, 50/60Hz, 3S Max.	RATED VOLTAGE AC250V 50/60Hz DC BREAKDOWN VOLTAGE 3000V ± 20% VOLTAGE WITHSTANDING TEST AC1500V, 50/60Hz, 60S Max. AC1800V, 50/60Hz, 3S Max.	RATED VOLTAGE AC250V 50/60Hz DC BREAKDOWN VOLTAGE 3600V ± 20% VOLTAGE WITHSTANDING TEST AC1500V, 50/60Hz, 60S Max. AC1800V, 50/60Hz, 3S Max.
METHOD OF USE			
CASE ① φ 1 1 PHASE 	RA ; RA - 242M - V7 Z1 ; MOV φ10 Min., 270VMin. Z2 ; MOV φ10 Min., 270VMin.	RA ; RA - 302M - V7 Z1 ; MOV φ10 Min., 400VMin. Z2 ; MOV φ10 Min., 400VMin.	RA ; RA - 362M - V7 Z1 ; MOV φ10 Min., 400VMin. Z2 ; MOV φ10 Min., 400VMin.
CASE ② φ 1 1 PHASE 	RA ; RA - 242M - V7 Z1 ; MOV φ 10 Min., 200VMin. Z2 ; MOV φ 5 Min., 270VMin.	RA ; RA - 302M - V7 Z1 ; MOV φ 10 Min., 400VMin. Z2 ; MOV φ 5 Min., 270VMin.	RA ; RA - 362M - V7 Z1 ; MOV φ 10 Min., 400VMin. Z2 ; MOV φ 5 Min., 270VMin.
CASE ③ φ 3 3 PHASE 	———	RA ; RA - 302M - V7 Z1 ; MOV φ 10 Min., 400VMin. Z2 ; MOV φ 10 Min., 400VMin. Z3 ; MOV φ 10 Min., 400VMin.	RA ; RA - 362M - V7 Z1 ; MOV φ 10 Min., 400VMin. Z2 ; MOV φ 10 Min., 400VMin. Z3 ; MOV φ 10 Min., 400VMin.
CASE ④ φ 3 3 PHASE 	———	RA ; RA - 302M - V7 Z1 ; MOV φ 10 Min., 400VMin. Z2 ; MOV φ 10 Min., 400VMin. Z3 ; MOV φ 10 Min., 400VMin. Z4 ; MOV φ 5 Min., 270VMin.	RA ; RA - 362M - V7 Z1 ; MOV φ 10 Min., 400VMin. Z2 ; MOV φ 10 Min., 400VMin. Z3 ; MOV φ 10 Min., 400VMin. Z4 ; MOV φ 5 Min., 270VMin.

SURGE ABSORBERS

SURGE PROTECTORS

RAM-B Series

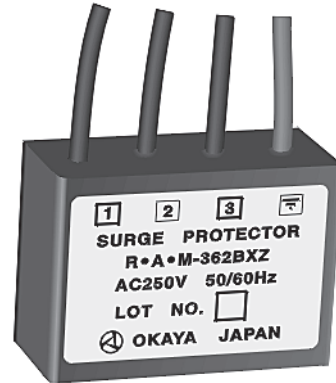
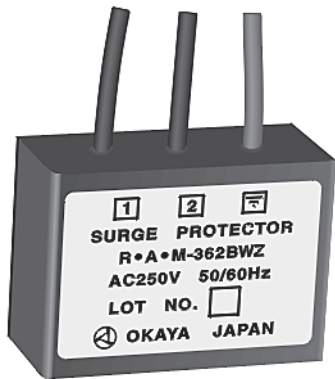
Fax Back Document #1416

• **RAM-B Series**

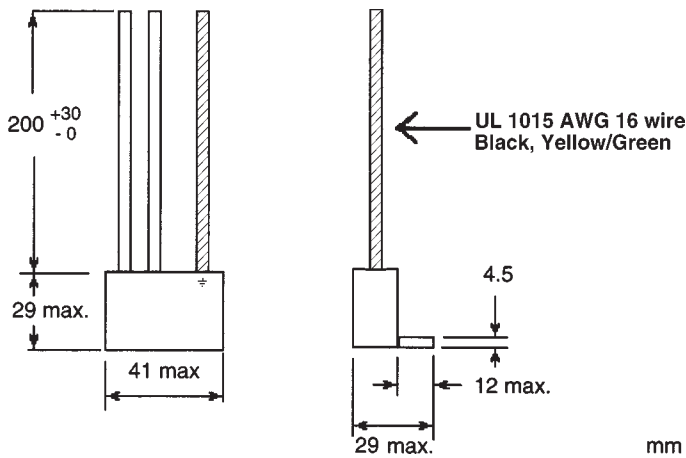
These Models are designed for use in power circuit applications which may require European (CE) Mark.

It is designed to protect against "Common Mode" Noise Transient Surges.

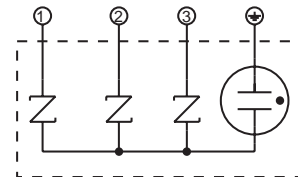
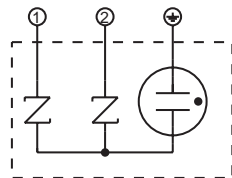
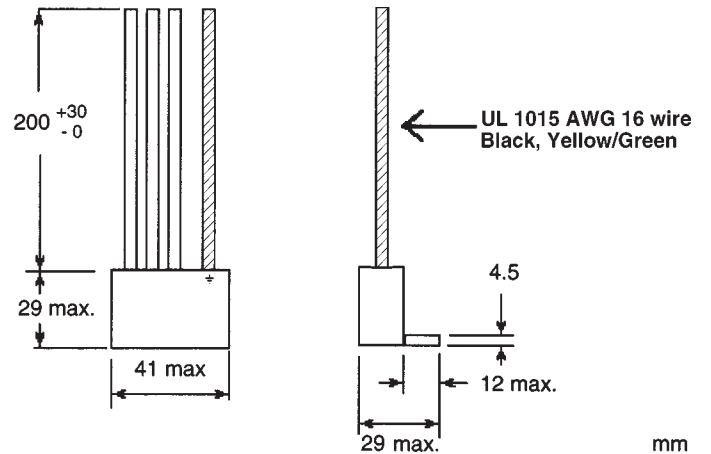
Safety Agency : Standard	File No.
TUV: IEC 384-14 1993	J9650111



BWZ



BXZ



ELECTRICAL SPECIFICATIONS

Model No.	**Clamp Voltage $V_{1.0}$ (V) $\pm 10\%$	DC Breakdown Voltage $\pm 20\%$ (L-L)	Peak Surge Current 8/20 μ S	Insulation Resistance (500 VDC)	Voltage Withstand Test	Cap. (typ.)	Max Line Voltage (RMS)	Operating Temp. Range
RAM-242BWZ	940V	2400V	2000 Amp	10^9	1500VAC 60 Sec.	2 pF(L-G)	140 V	-20° to +70°C
RAM-302BWZ		3000V					300 V	
RAM-362BWZ		3600V					3 ϕ 300V	
RAM-362BXZ		3600V						

** Equivalent Varistor Voltage at 1mA. Surge Life Test (8/20 μ Sec) @ 100Amp - 300 Times

SURGE PROTECTORS



Fax Back Document #1417

• RAM-LAS Series

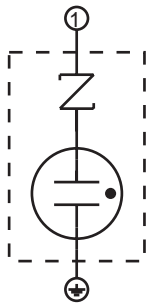
Specifically designed for AC power line applications which may require European (CE) Mark.

Applied as indirect lightning surge protection in the power line of equipment, these models utilize micro-gap gas discharge technology, and a series connected MOV between line and ground, thus demonstrating extremely fast response characteristics in dark ambient conditions without the use of radioactive isotopes.

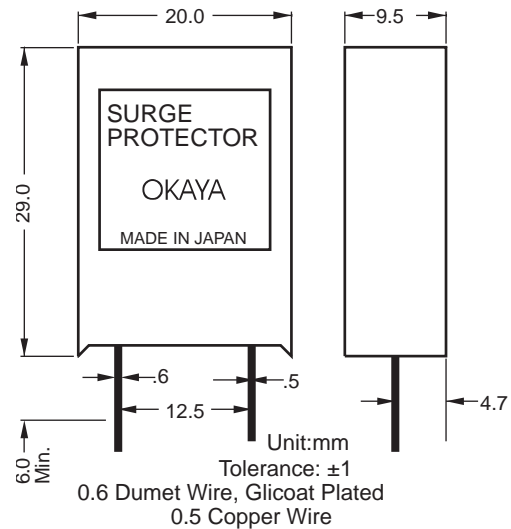
It may also be used within electronic circuits to protect from destructive impulse current while still permitting "Voltage Withstand Testing" without having to remove the RAM-LA.

FEATURES:

- Fast response time
- This Surge Absorber is Bi-polar and will fail open if surge withstand capability is exceeded.
- Inter-terminal capacitance is extremely small, resulting in little influence on electronic circuits.
- High Insulation Resistance ($1 \times 10^9 \Omega \text{min.}$)
- Excellent Surge withstand capability (300 times at 100Amp, $8 \times 20 \mu\text{s.}$)



Safety Agency	Standard	File No.
UL	: UL 1449	E143446
UL	: UL1414	E47474
CSA	: C 22.2 No. 0,8	LR105073-2
TÜV	: IEC 384-14 1993	J9650111



SURGE ABSORBERS

ELECTRICAL SPECIFICATIONS

Safety Standard	Model No.	DC Breakdown Voltage $R=1M \Omega$, 100-500 V/Sec.	Insulation Resistance	Cap.	Peak Surge Current	Repeat Surge Times	Voltage Withstand Test	Max Line Voltage
UL	RAM-242LAS	2400 \pm 20%	1000 M Ω (DC 500V)	2 pF (max)	2000 Amp 3 times ($8 \times 20 \mu\text{sec}$)	100 Amp 300 times ($8 \times 20 \mu\text{sec}$)	AC 1250V 3 sec.	125Vrms
	RAM-302LAS	3000 \pm 20%					AC 1500V 1 min.	250Vrms
RAM-362LAS	3600 \pm 20%	AC 1800V 3 sec.					250Vrms	

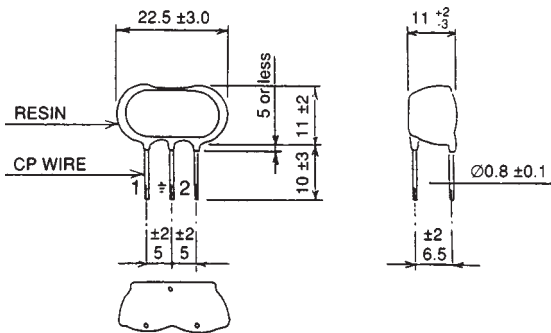
Fax Back Document #1406

● **RAV-LDEZ:**

Designed specifically for use in AC power line applications. This model uses specially treated discharge electrodes for greatly enhanced noise immunity test and surge life making it optimum for the protection of single-phase power supply circuits.

Safety Agency : Standard	File No.
UL : UL-1449	E143446
CSA : C22.2 No. 8 M1986	LR105073

● **RAV-401LDEZ**

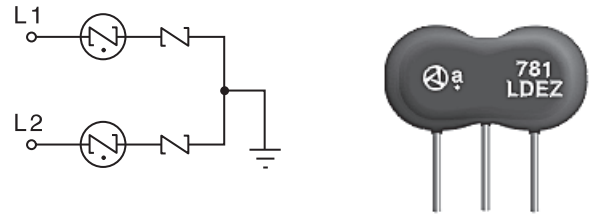


● **Use of Surge Protectors:**

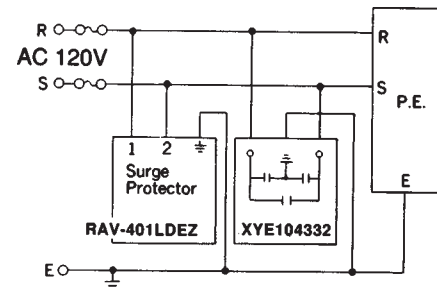
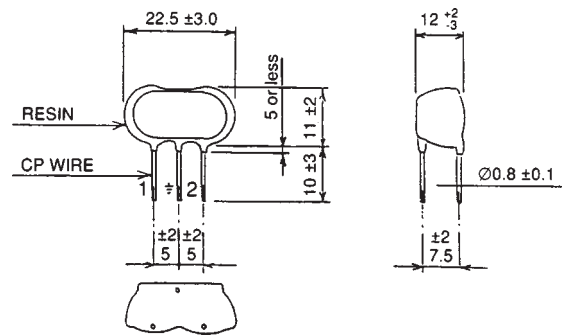
Okaya Surge protectors in combination with Okaya XYE series filter capacitors offer superb lightning surge suppression. Capacitor XYE-104332 will equalize excessive currents aiding the surge protector in absorbing the lightning surge. This parts combination is equally effective against severe noise.

● **Noise Margin Test:**

Noise margin testing usually requires the physical disconnection of lightning surge protection components. Such disconnection often is difficult and time consuming. Okaya's RAV-LDEZ series allow noise margin testing without any such disconnection as they are designed to withstand the rigors of testing.



● **RAV-781LDEZ**



Model Number	RAV-401LDEZ	RAV-781LDEZ
Power source	Single-phase 135VAC 50//60Hz	Single-phase 270VAC 50//60Hz
Impulse width	1us	1us
Impulse voltage (+,-)	2kV	2kV
Applied period (Hours)	1.5Hrs Max.	1.5Hrs Max.

Impulse Test Condition

ELECTRICAL SPECIFICATIONS

Model No.	Clamp* Voltage V1.0 ± 10%	Peak Surge Current 8/20µs (A)	Peak Surge Voltage 1.2/50µs (V)	Response Time (ns)	Capacitance (PF) Max.)	Max. Line Voltage (Vrms)	Weight (g)	Operating Temp. Range (C)
RAV-401LDEZ	403	1000	12K	50	50	145	10	-20° to +70°
RAV-781LDEZ	783					300		

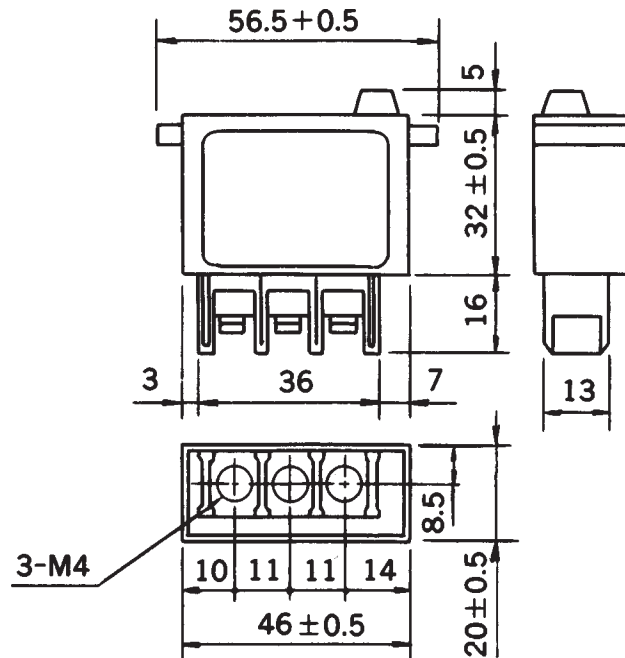
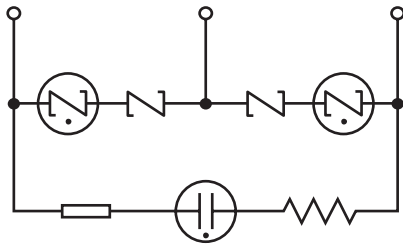
* Equivalent Varistor Voltage @ 1MA

Fax Back Document #1407

• RAV-QWZ

Designed specifically for use in single phase AC power line applications. The screw terminal connections allow for easy application interconnection. These models have specially treated discharge electrodes combined with RAVs for greatly enhanced noise immunity test and surge life.

Safety Agency : Standard	File No.
UL : UL-1449	E143446



ELECTRICAL SPECIFICATIONS

Model No.	Clamp* Voltage V1.0 ± 10%	Peak Surge Current 8/20µs (A)	Peak Surge Voltage 1.2/50µs (V)	Response Time (ns)	Capacitance (PF) Max.	Max. Line Voltage (Vrms)	Weight (g)	Operating Temp. Range (C)
RAV-401QWZ	403	2500	20K	50	100	145	65	-20° to +70°
RAV-781QWZ	783				50	300		

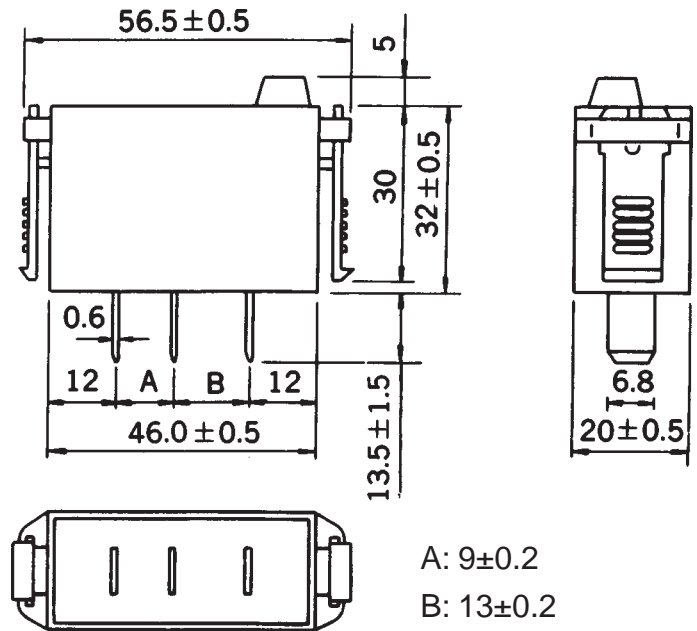
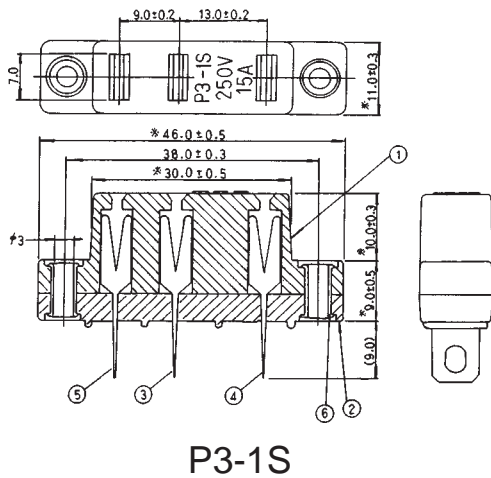
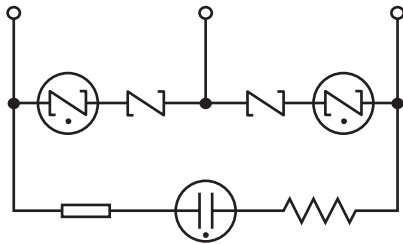
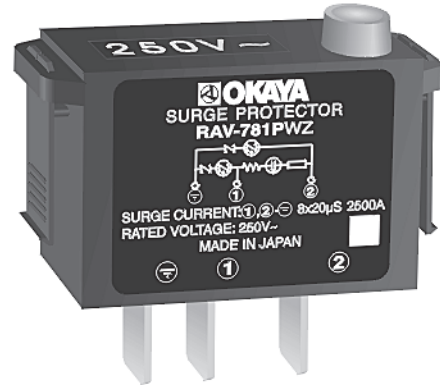
* Equivalent Varistor Voltage @ 1MA

Fax Back Document #1408

• RAV-PWZ

Designed specifically for use in single phase AC power line applications. The quick disconnect terminals, combined with the mating plug-in connector allows for easy application interconnection. These models have specially treated discharge electrodes combined with RAVs for greatly enhanced noise immunity test and surge life.

Safety Agency : Standard	File No.
UL : UL-1449	E143446



SURGE ABSORBERS

ELECTRICAL SPECIFICATIONS

Model No.	Clamp* Voltage V1.0 ± 10%	Peak Surge Current 8/20μs (A)	Peak Surge Voltage 1.2/50μs (V)	Response Time (ns)	Capacitance (PF) Max.)	Max. Line Voltage (Vrms)	Weight (g)	Operating Temp. Range (C)
RAV-401PWZ	403	2500	20K	50	100	145	56	-20° to + 70°
RAV-781PWZ	783				50	300		

* Equivalent Varistor Voltage @ 1MA

Fax Back Document #1404

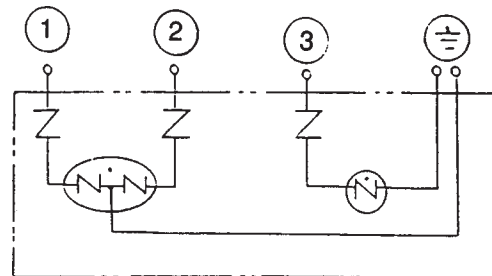
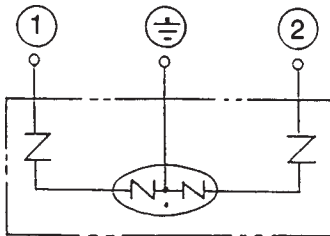
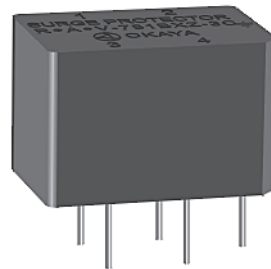
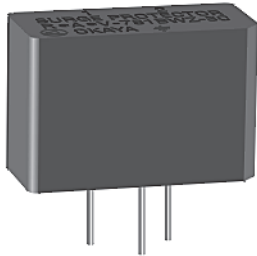
• **RAV-BWZ-3C:**

Designed specifically for use in AC power line applications. This model uses specially treated discharge electrodes for greatly enhanced noise immunity test and surge life making it optimum for the protection of single-phase power supply circuits.

Safety Agency : Standard		File No.
UL	: UL1449	E43446
CSA	: C22.2, No. 8 M1986	LR100413

• **RAV-BXZ-3C:**

This model is designed for use in three phase power circuit applications. Combining multiple RAVs with specially treated electrodes for greatly enhanced noise immunity test and surge life, this model is constructed in a unit-molded body.

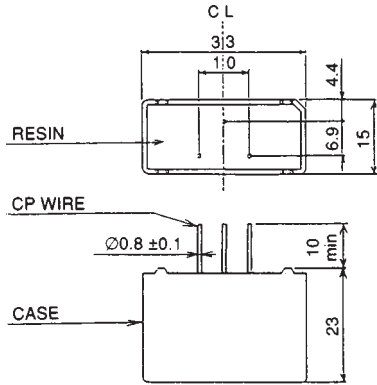


ELECTRICAL SPECIFICATIONS

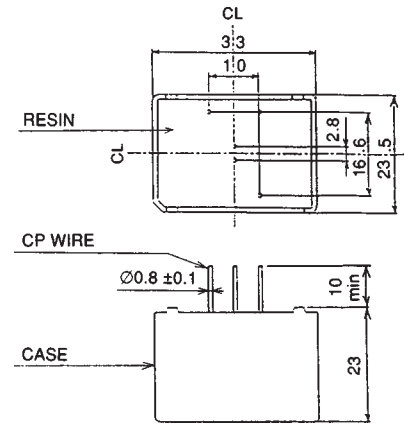
Model No.	Clamp* Voltage V1.0 ± 10%	Peak Surge Current 8/20µs (A)	Peak Surge Voltage 1.2/50µs (V)	Response Time (ns)	Capacitance (PF) Max.)	Max. Line Voltage (Vrms)	Weight (g)	Operating Temp. Range (C)
RAV-401BWZ-3C	403	2500	20K	50	100	145	20	-20° to + 70°
RAV-781BWZ-3C	783				50	300		
RAV-781BXZ-3C	783				30			

* Equivalent Varistor Voltage @ 1MA

• **BWZ-3C**



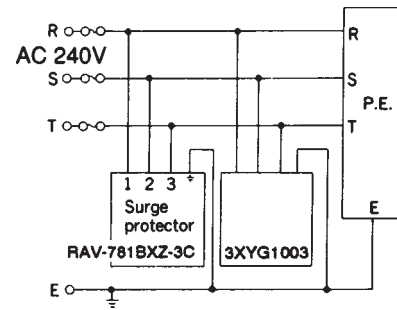
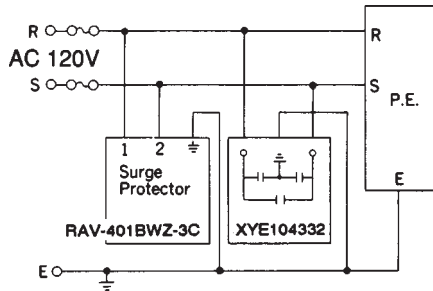
• **BXZ-3C**



• **Use of Surge Protectors:**

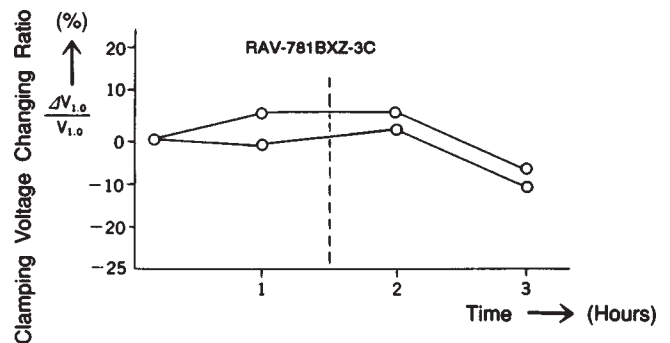
Okaya Surge protectors in combination with Okaya XYE series filter capacitors offer superb lightning surge suppression. Capacitor XYE-104332 will equalize excessive currents aiding the surge protector in absorbing the lightning surge. This parts combination is equally effective against severe noise.

Surge protectors can be connected to protect machines using 208/240VAC 3-phase power supplies. The combination of the 3XYG series of high pulse capacitors with the RAV-781BXZ-3C surge protector, is an effective countermeasure against excessive surge and noise.



• **Noise Margin Test:**

Noise margin testing usually requires the physical disconnection of lightning surge protection components. Such disconnection often is difficult, and time consuming. Okaya's RAV-BWZ-3C and BXZ-3C series allows noise margin testing without any such disconnection as they are designed to withstand the rigors of testing.



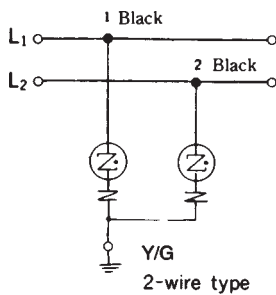
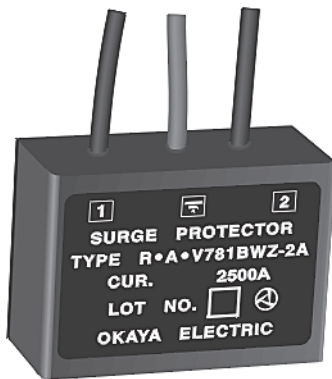
Model Number	RAV-401BWZ-3C	RAV-781BWZ-3C	RAV-781BXZ-3C
Power source	Single-phase 135VAC 50/60Hz	Single-phase 270VAC 50/60Hz	3-wire 270VAC 50/60Hz
Impulse width	1us	1us	1us
Impulse voltage (+,-)	2kV	2kV	2kV
Applied period (Hours)	1.5Hrs Max.	1.5Hrs Max.	1.5Hrs Max.

Impulse Test Condition

Fax Back Document #1404

• **RAV-BWZ-2A:**

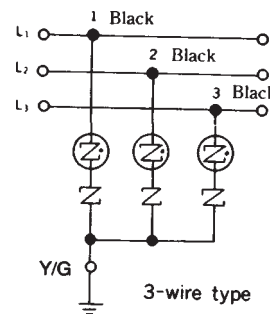
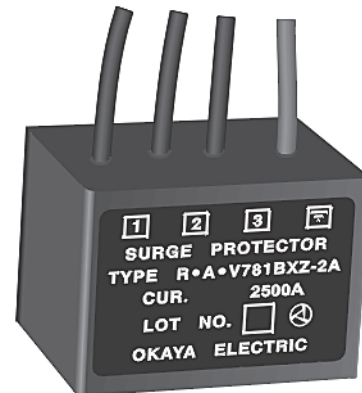
Designed specifically for use in AC power line applications. This model uses specially treated discharge electrodes for greatly enhanced noise immunity test and surge life making it optimum for the protection of single-phase power supply circuits.



Safety Agency : Standard	File No.
UL : UL1449	E143446
CSA : C22.2, No. 8, M1986	LR 105073

• **RAV-BXZ-2A:**

This model is designed for use in three phase power circuit applications. Combining multiple RAVs with specially treated electrodes for greatly enhanced noise immunity test and surge life, this model is constructed in a unit-molded body.

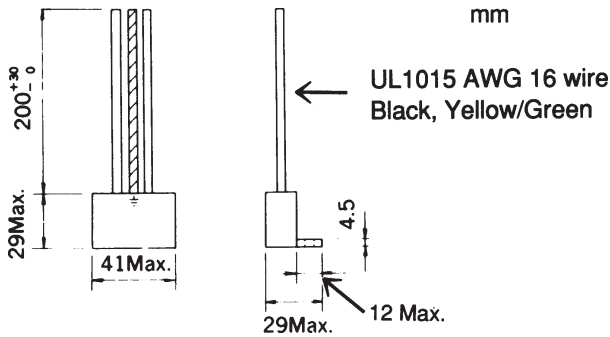


ELECTRICAL SPECIFICATIONS

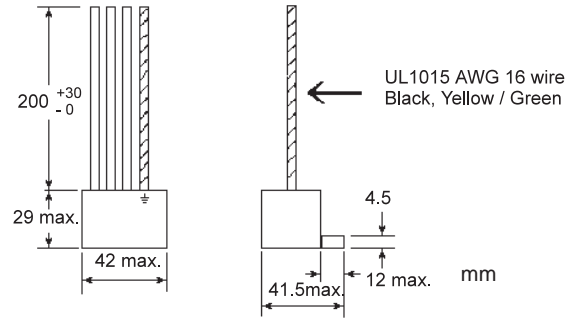
Model No.	Clamp* Voltage V1.0 ± 10%	Peak Surge Current 8/20µs (A)	Peak Surge Voltage 1.2/50µs (V)	Response Time (ns)	Capacitance (PF) Max.)	Max. Line Voltage (Vrms)	Weight (g)	Operating Temp. Range (C)
RAV-401BWZ-2A	403	2500	20K	50	100	145	60	-20° to + 70°
RAV-781BWZ-2A	783				50	300		
RAV-781BXZ-2A	783					300	100	

* Equivalent Varistor Voltage @ 1MA

• **BWZ-2A**



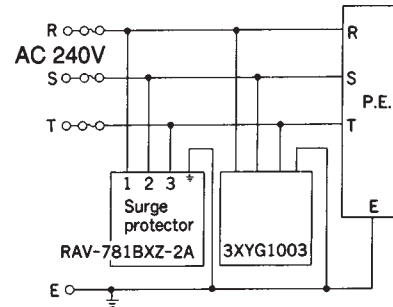
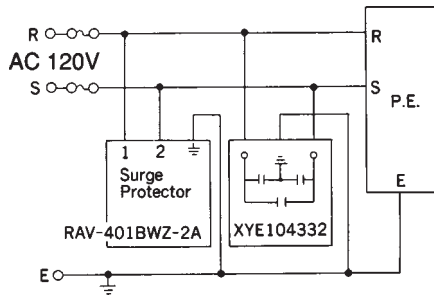
• **BXZ-2A**



• **Use of Surge Protectors:**

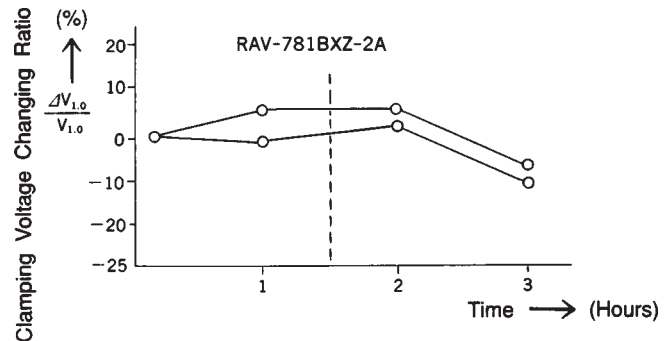
Okaya Surge protectors in combination with Okaya XYE series filter capacitors offer superb lightning surge suppression. Capacitor XYE-104332 will equalize excessive currents aiding the surge protector in absorbing the lightning surge. This parts combination is equally effective against severe noise.

Surge protectors can be connected to protect machines using 208/240VAC 3-phase power supplies. The combination of the 3XYG series of high pulse capacitors with the RAV-781BXZ-2A surge protector, is an effective countermeasure against excessive surge and noise.



• **Noise Margin Test:**

Noise margin testing usually requires the physical disconnection of lightning surge protection components. Such disconnection often is difficult, and time consuming. Okaya's RAV-BWZ-2A and BXZ-2A series allow noise margin testing without any such disconnection as they are designed to withstand the rigors of testing.



Model Number	RAV-401BWZ-2A	RAV-781BWZ-2A	RAV-781BXZ-2A
Power source	Single-phase 135VAC 50//60Hz	Single-phase 270VAC 50//60Hz	3-wire 270VAC 50/60Hz
Impulse width	1us	1us	1us
Impulse voltage (+,-)	2kV	2kV	2kV
Applied period (Hours)	1.5Hrs Max.	1.5Hrs Max.	1.5Hrs Max.

Impulse Condition

SURGE PROTECTORS



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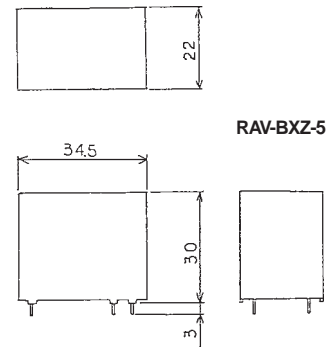
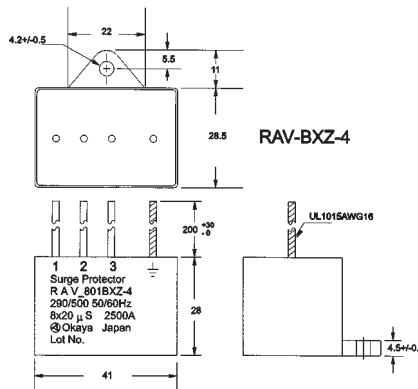
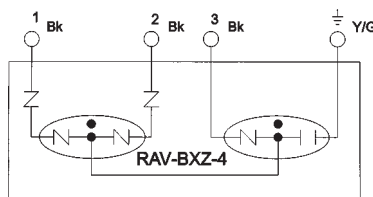
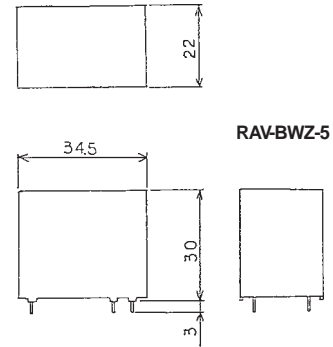
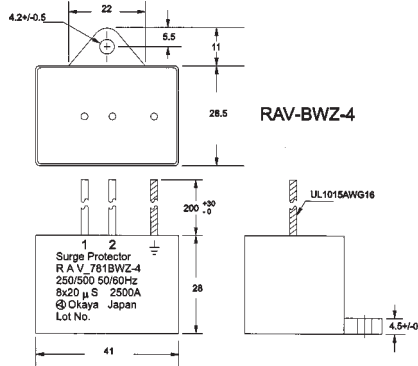
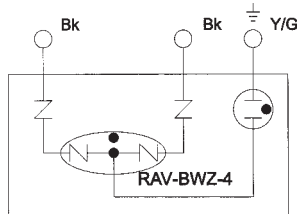
RAV-BWZ-4(5)
RAV-BXZ-4(5)

Safety Agency : Standard		File No.
TÜV	: EN60099-1	J9551051
UL	: UL1449	E143446

These models are specifically designed for use in AC Power Line Applications which may require European (CE) Mark.

They are designed for use in Single and Three-Phase applications for protection against "Common Mode" Noise Transient Surges.

Three-Phase applications include Delta and Wye connections to 500VAC.



ELECTRICAL SPECIFICATIONS

Model No.	Voltage Rating	Power Frequency Sparkover Voltage (Ua)	Nominal Discharge Current (Isn)	Max. Std. Lightning Impulse Sparkover Voltage (us)	Front of Wave Lightning Impulse Max. Impulse Sparkover Voltage (uas)	Max. Residual Voltage (ur)	Weight (g)	Operating Temp. Range (°C)
	L to Gnd L to L "Y" Config	L to Gnd	L to Gnd 8x20 Sec	L to Gnd 1.2x50 Sec	L to Gnd 10KV/ Sec	L to Gnd 8x20 Sec 2500A		
RAV-781BWZ-4 RAV-781BWZ-5	500V, 250V* 50/60Hz	AC700V ± 20% 50/60Hz	2500A	2KV	3KV	2KV	100gm	-40° to + 70°
RAV-781BXZ-4 RAV-781BXZ-5	3φAC 250V,* 430V 50/60Hz							
RAV-801BXZ-4 RAV-801BXZ-5	3φAC 290V,* 500V 50/60Hz	AC800V ± 20% 50/60Hz	2500A	2.32KV	3.48KV	2.32KV		

*=Delta, L-L & L-G

SURGE PROTECTORS

RAV-B Series

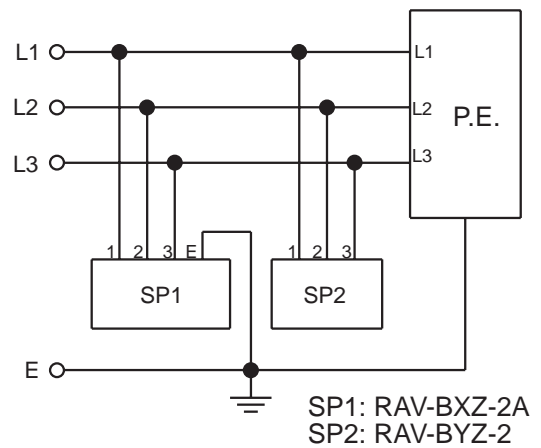
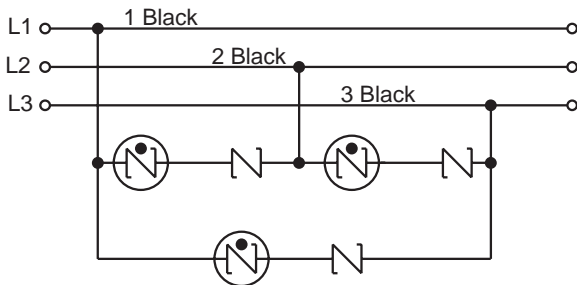
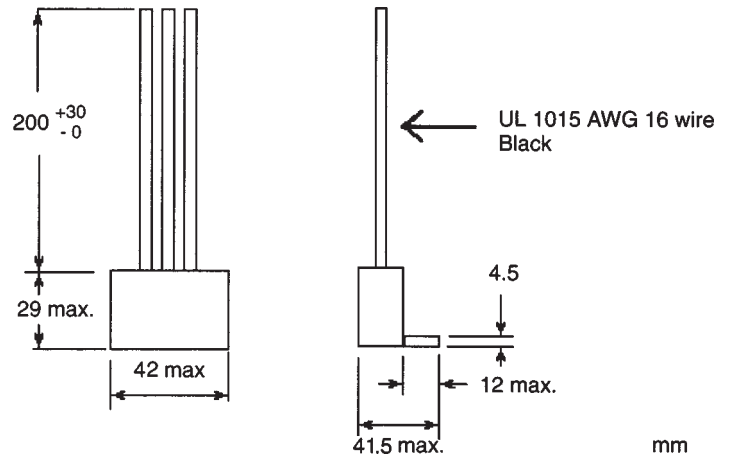
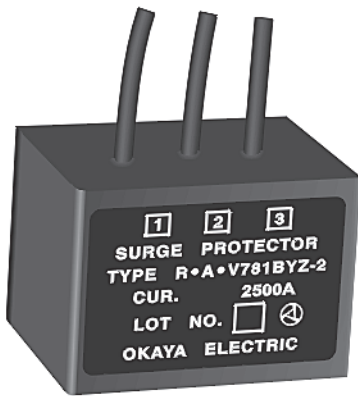
Fax Back Document #1414

• **RAV-BYZ-2**

This model is designed for use in three-phase power circuit applications. It is designed to protect against "Normal Mode" Noise Transient Surges.

When used in conjunction with the RAV-BXZ-2A, it will furnish complete protection of equipment, from both Normal and Common Mode transient voltage surges.

Safety Agency : Standard		File No.
UL	UL1449	E143446
CSA	C22.2 No. 0, 8	LR105073



ELECTRICAL SPECIFICATIONS

Model No.	**Clamp Voltage $V_{1.0}$ (V) $\pm 10\%$	Peak Surge Current	Peak Surge Voltage	Response Time	Cap.	Max Line Voltage	Weight	Operating Temp. Range
RAV-781BYZ-2	783	2500 Amp (8/20 μ sec)	20K V (1.2/50 μ sec)	50 nSec.	75pF	300 Vrms	100gm	-20° to +70°C
RAV-152BYZ-2A	1470			50 nSec.	35pF	500 Vrms		

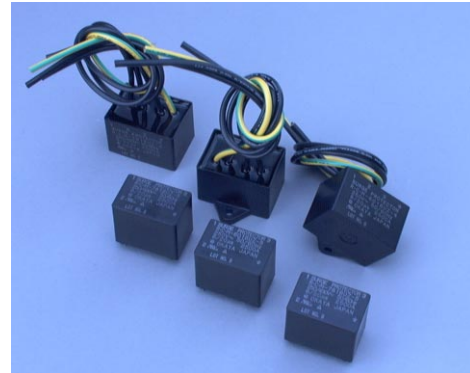
** Equivalent Varistor Voltage at 1mA. Surge Life Test (8/20 μ Sec) @ 1000Amp - 300 Times

RCM-BQZ-4 SERIES RCM-BUZ-4/5 SERIES

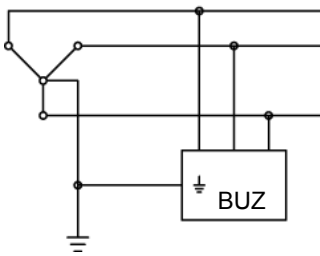
- Line to Line and Line to Ground combined protection.
- UL, CSA, CE safety approvals.
- Surge protection for both Single and 3 phase applications.
- Compact size.

Safety Agency: Standard		File No.
UL	: UL-1449	E143446
CSA*1	: C22.2, No.8	
TUV	: IEN60099-1/A:1999	J2150288

*1cUL

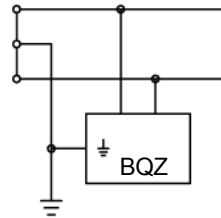


3-Phase, WYE



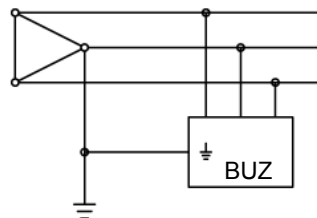
WYE: 1-Phase 430Vrms (L to L)
3-Phase 430Vrms (L to L)
3-Phase 500Vrms

Single Phase, WYE



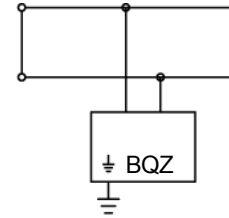
RCM-781BQZ-4
RCM-781BUZ-4
RCM-781BUZ-4

3-Phase Delta



Delta: 1-Phase 250Vrms
3-Phase 250Vrms
3-Phase 290Vrms

Single Phase Delta



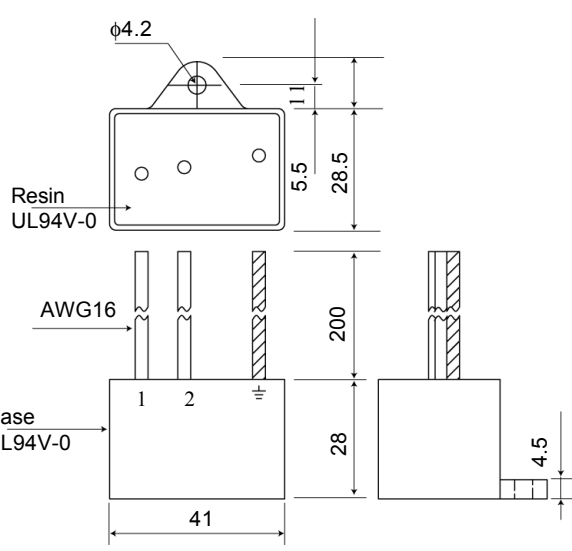
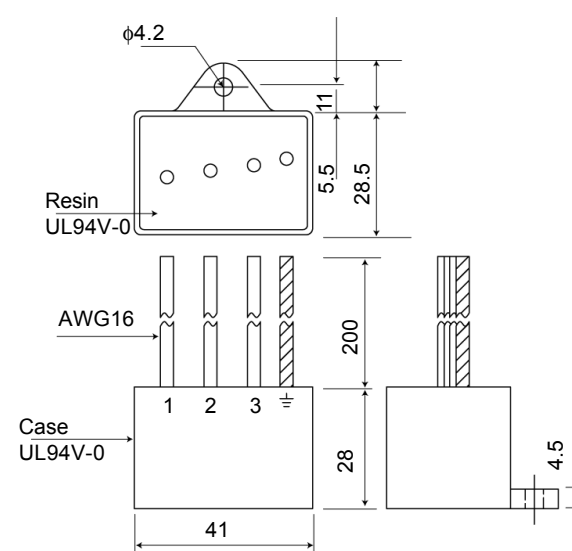
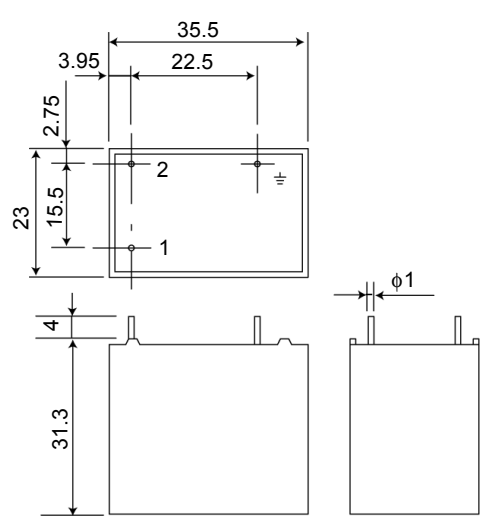
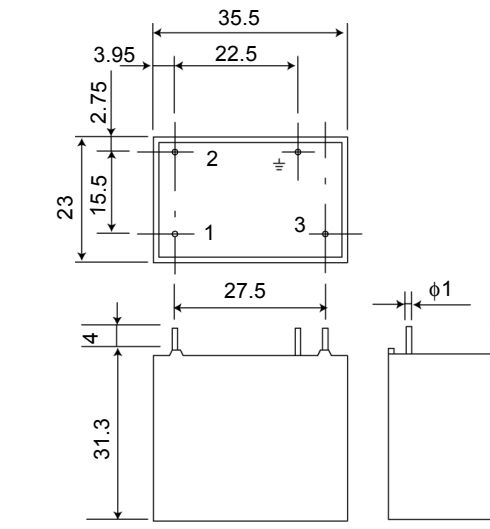
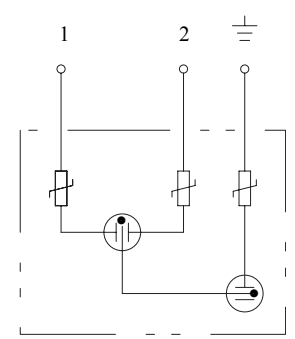
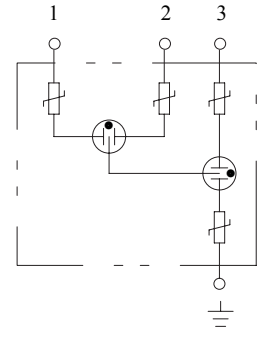
RCM-601BQZ-4
RCM-601BUZ-4
RCM-781BUZ-4

ELECTRICAL SPECIFICATIONS

Operating temp. range: -40 ~ +70C°

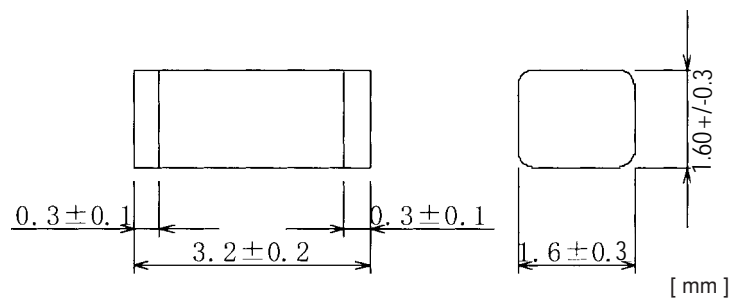
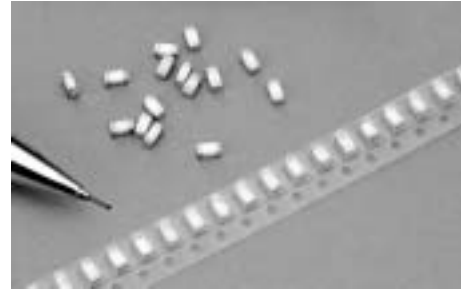
Model No.		Voltage Rating	Power frequency sparkover voltage (Ua)	Discharge current 8/20µs	Impulse sparkover voltage(µs) 1.2/50µs	Max. impulse sparkover Voltage (µs) 10KV/µs	Max. Residual Voltage (ur)	Surge current life 8/20 µs 500A	Max. peak surge current 8/20 µsec
RCM-601BQZ-4/5	1 Phase	250V	AC560V ±20%	2500A	2KV	3KV	2KV	300 times	5000A
RCM-601BUZ-4/5	3 Phase	250V							
RCM-781BQZ-4/5	1 Phase	430V	AC700V ±20%	2500A	2KV	3KV	2KV	300 times	5000A
RCM-781BUZ-4/5	3 Phase	250/ 430V							
RCM-801BUZ-4/5	3 Phase	290/ 500V	AC800V ±20%	2500A	2.32KV	3.48KV	2.32KV	300 times	5000A

This series has European approvals which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive

		BQZ (single phase) series	BUZ (3 phase) series
		Tolerance +1.0mm	
Outer Dimensions	Wire terminal type (-4)	 <p>Resin UL94V-0</p> <p>Case UL94V-0</p> <p>AWG16</p> <p>Dimensions: $\phi 4.2$, 5.5, 28.5, 11, 200, 28, 41, 4.5</p>	 <p>Resin UL94V-0</p> <p>Case UL94V-0</p> <p>AWG16</p> <p>Dimensions: $\phi 4.2$, 5.5, 28.5, 11, 200, 28, 41, 4.5</p>
	Solder lead type (-5)	 <p>Dimensions: 35.5, 22.5, 3.95, 2.75, 23, 15.5, 4, 31.3, $\phi 1$</p>	 <p>Dimensions: 35.5, 22.5, 3.95, 2.75, 23, 15.5, 27.5, 4, 31.3, $\phi 1$</p>
Circuit		 <p>Terminal 1: Phase 1</p> <p>Terminal 2: Phase 2</p> <p>Terminal 3: Neutral</p>	 <p>Terminal 1: Phase 1</p> <p>Terminal 2: Phase 2</p> <p>Terminal 3: Phase 3</p>

RHCA SERIES (3216)

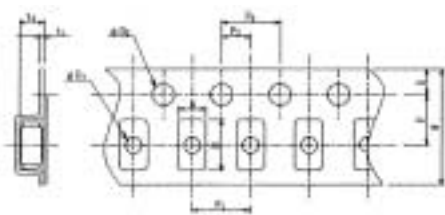
- Protection From Electrostatic Surge
- Surface Mounted Gas Arrester
- IEC-61000-4-2
- Micro-Gap Design
- Applications :
 - Antenna Protection,
 - Telecom, xBase T, Hub Protection
 - Security Systems
 - Data Acquisition
 - Audio Systems



Electrical Specifications

Model	Test	DC spark-over Voltage	Insulation Resistance	Electrostatic Capacitance	Surge Current Capacity	Electrostatic Surge Life IEC-61000-4-2
RHCA-201Q31	BA	200V	100MΩ Min. (DC100V)	0.3pF Max. (1MHz-1V)	8/20 μs 50A, 300Times 500A 5Times(+/-)	150pF-330 Ω 8kV 10000Times 500pF - 0 ohm 30kV 30 Times
	UA	(140~260)				
RHCA-301Q31	BA	300V				
	UA	(210~390)				
RHCA-401Q31	BA	400V				
	UA	(280~520)				

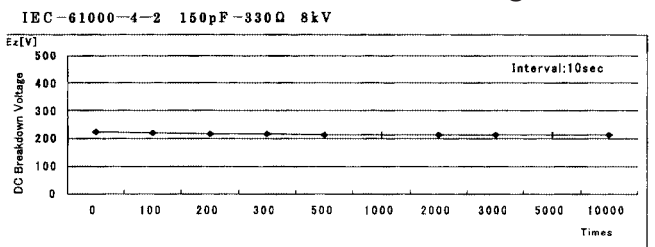
●Plastic Tape Dimensioning



A	B	W	F	E	P ₁	P ₂	P ₃
1.9±0.1	3.5±0.1	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1

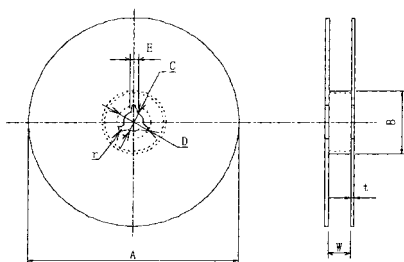
D ₀	D ₁	t ₁	t ₂
φ1.5 ^{+0.1}	φ1.1±0.1	0.25±0.05	1.7±0.1

Life Test vs DC Break down Voltage



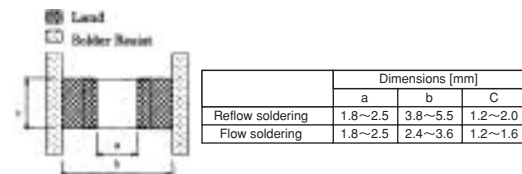
●Reel Dimensioning

Minimum Quantity : 2000



A	B	C	D	E	W	t	r
φ180 ^{+0.5}	φ60 ^{+0.5}	φ13.0±0.2	φ21±0.8	2.0±0.5	9.0 ^{+0.5}	1.6±0.5	1.0

●Recommended land pattern



SURGE PROTECTORS

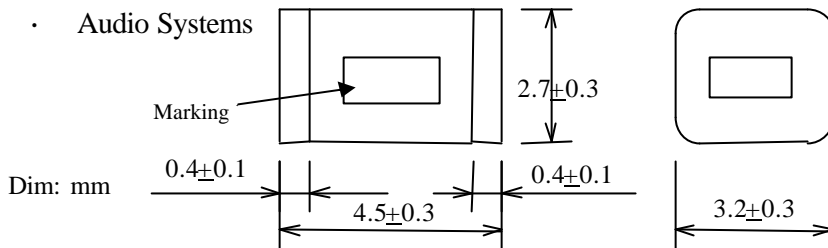
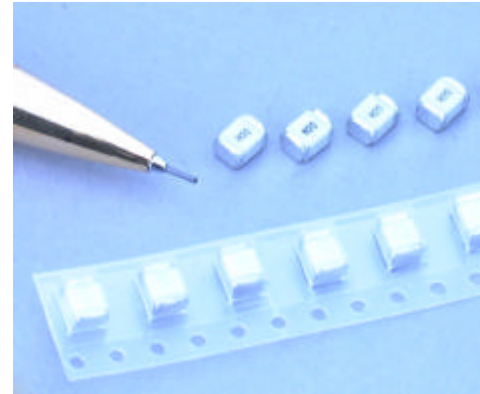
RHCA Series (4532)

- Surge current capacity 2000A 8/20 μ s
- Surface Mounted Gas Arrester
- Micro-Gap Design

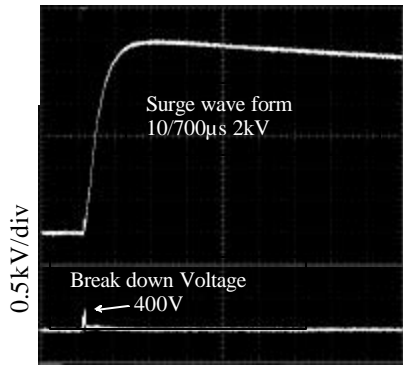
Agency	Standard	File:
UL	497B	E143446

Application:

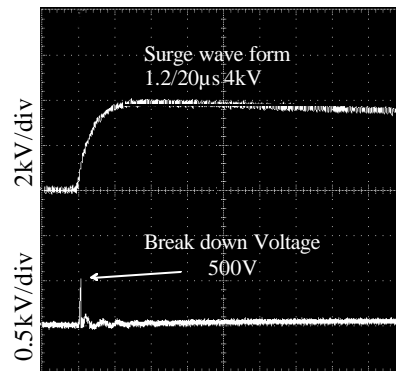
- CATV modem
- Telecom, xBase T, Hab Protection
- Security Systems
- Data Acquisition
- Audio Systems



Surge Absorption Characteristics at EN61000-4-5



10 μ sec/div



1 μ sec/div

Electrical Specifications

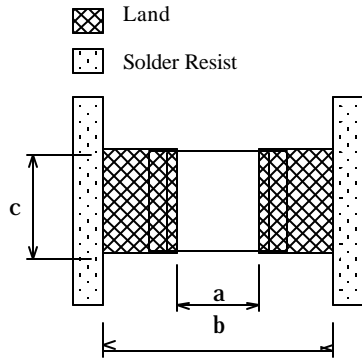
Test	DC Breakdown Voltage	Insulation resistance	Capacitance (1MHz-1V)	Impulse discharge current	Impulse Life test	Impulse Withstanding Voltage capacity
Model						
RHCA-201Q43U	200V (140~260)	100M Ω Min. (DC 100V)	0.6pF Max.	8/20 μ s 2000A	8/20 μ s 100A 300 Times	10/700 μ s 4kV Positive/Negative 5 Times
RHCA-301Q43U	300V (210~390)					
RHCA-351Q43U	350V (245~455)					
RHCA-401Q43U	400V (280~520)					

Part number systems

RHCA	201	Q	43	U	
Series	DC Breakdown Voltage 201:201 \times 10 ¹ V=200V	Tolerance	Size	Packing form	
		Q	43	U	B
		\pm 20%	4.5(L) \times 3.2(W)	Taping	Bulk

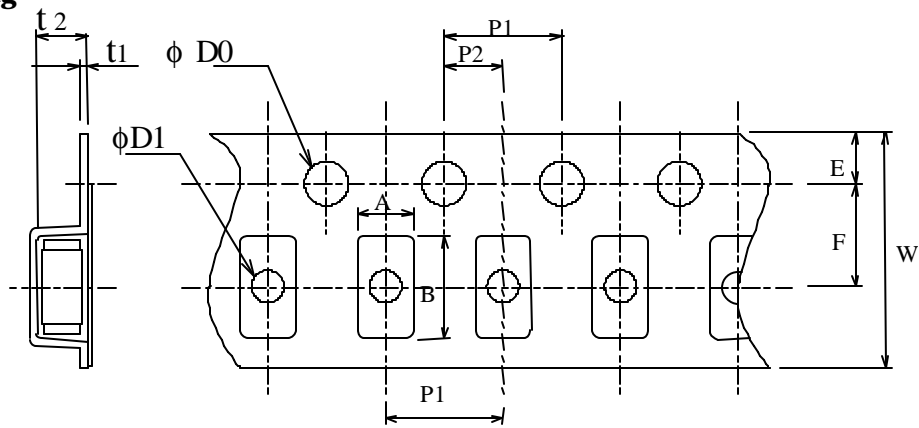
SURGE PROTECTORS

Recommended land Pattern



	Dimensions [mm]		
	a	b	c
Reflow soldering	2.7	6.5~8.5	3.4
Flow soldering	2.9	6.5~9.5	3.6

Plastic Tape Dimensioning



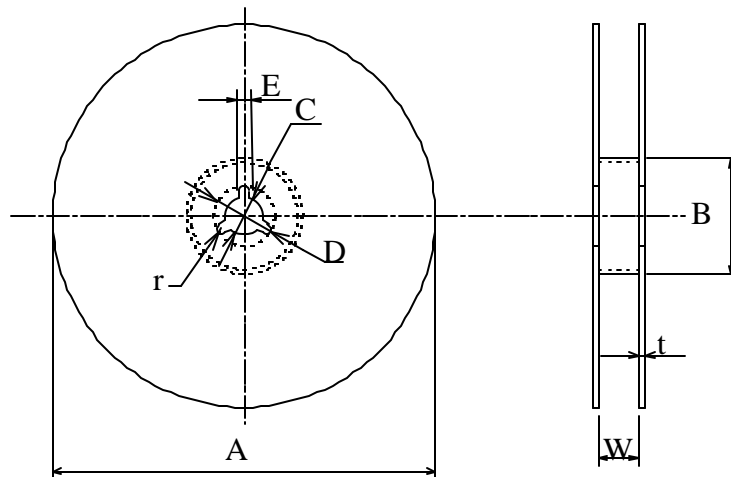
[mm]

A	B	W	F	E	P ₁	P ₂	P ₀
3.6± 0.2	4.9± 0.2	12.0± 0.3	5.5± 0.05	1.75± 0.1	8.0± 0.1	2.0± 0.05	4.0± 0.1

D ₀	D ₁	t ₁	t ₂
φ 1.5+0.1/-0	φ 1.65± 0.15	0.3± 0.1	3.0± 0.2

Reel Dimensioning

Minimum Quantity:3,000pcs.

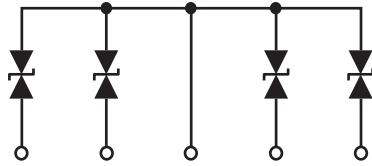


A	B	C	D	E	W	t	r
φ 330± 2	φ 80± 0.5	φ 13.0± 0.5	φ 21± 0.8	2.0± 0.5	13.5+1.0/-0.5	1.6± 0.5	1.0

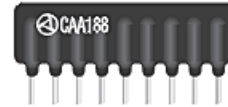
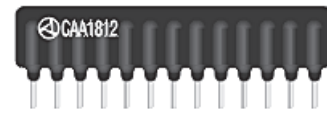
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• CAA

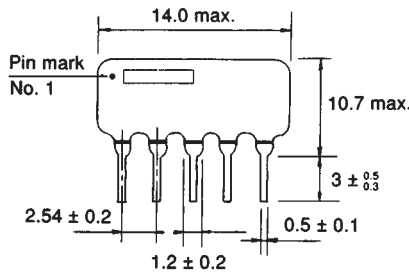
This array-type of silicon surge absorber was developed for using in signal line applications. The element's integration is improved, so space factor and process times are improved. You can choose 4 or 8 or 12 elements.



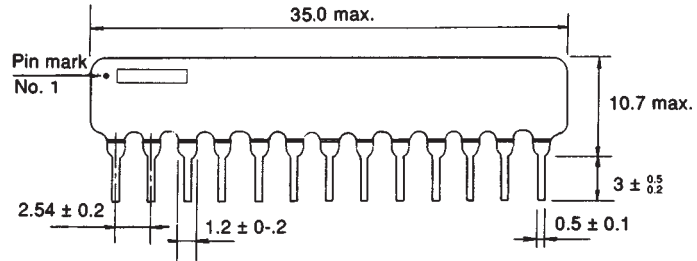
Center Common



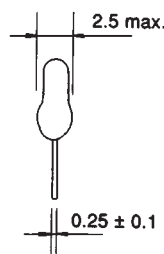
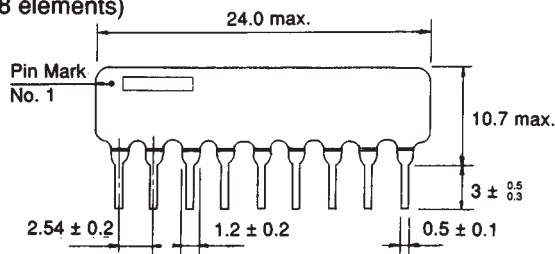
(4 elements)



(12 elements)



(8 elements)



ELECTRICAL SPECIFICATIONS

Maximum Allowable Power 4.2KW (8/20usec)

Model Name	Breakdown Voltage		Stand off Voltage		Maximum Rated Surge (8/20 μ s)	
	V _{BR} (V)	I _{TEST} (mA)	V _{SO} (V)	I _{SO} (μ A)	I _{SM} MAX. (A)	V _{CL} MAX. (V)
CAA06-O	6.8	1	5.50	500	284.0	14.8
CAA18-O	18.0		14.50		128.0	32.7
CAA22-O	22.0		17.80		105.0	40.0
CAA33-O	33.0		26.80		70.1	59.9
CAA68-O	68.0		55.10		34.1	123.0

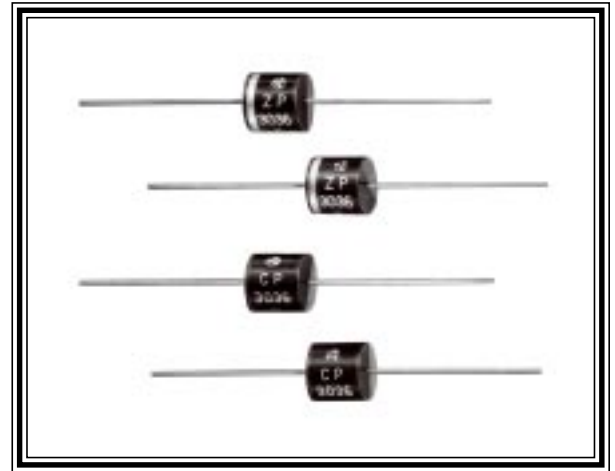
O = The number of Element 4, 8, 12

RSSA

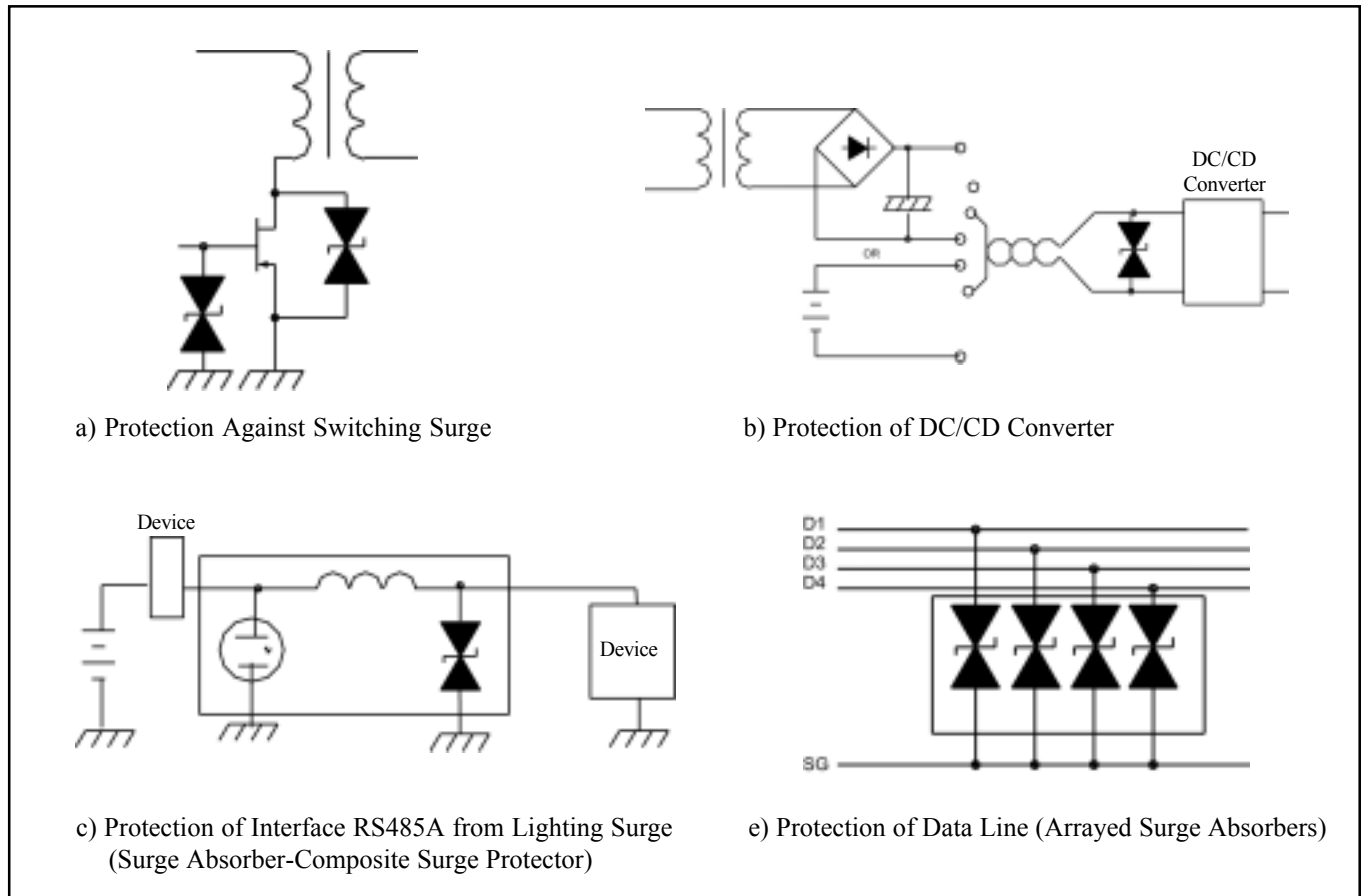
The silicon surge absorber is available in five series that support the countermeasure against a wide range of surges from low to high, including electrostatic discharges and lightning surges. The device may also be used as a constant voltage device where high voltage or high power is required.

■ Features

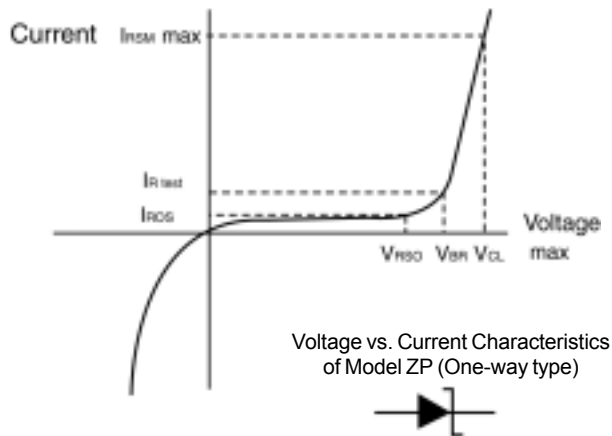
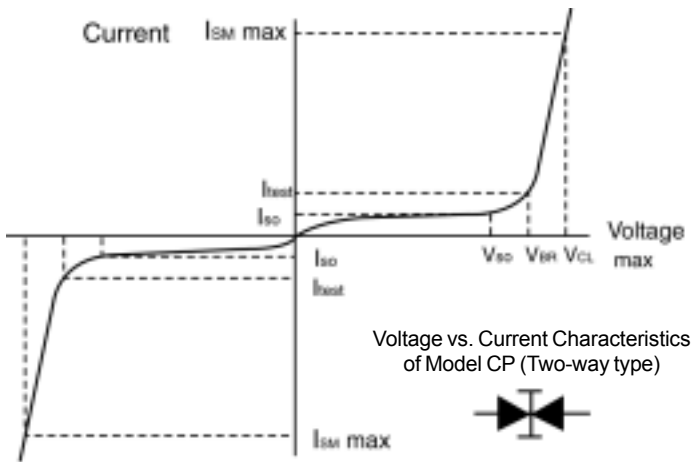
- Fast response to rapid surges (10^{-12} sec).
- Almost no performance degradation against repetitive surges.
- Very low internal resistance during operation.
- Very small leak current.
- Mesa chip design provides high invulnerability to impulse surges.



■ Applications

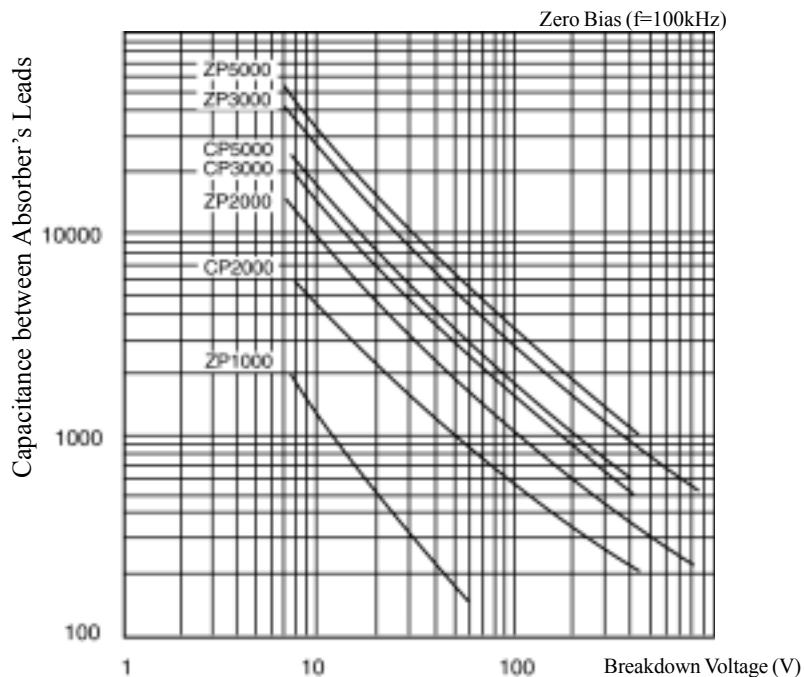


■ Electrical Characteristics

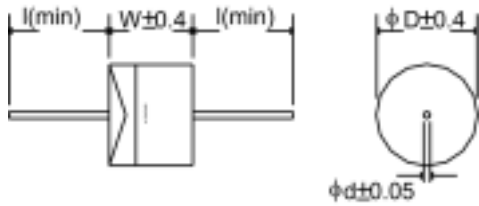


- Breakdown Voltage (V_{BR})
Voltage at which avalanche current may begin to flow, normally the voltage between the surge absorber's leads when 1mA of current is applied.
- Standoff Voltage ($V_{(R)SO}$)
A maximum voltage that can be applied to the surge absorber continuously.
- Reverse Leakage Current ($I_{(R)SO}$)
A maximum current flowing through the surge absorber when the standoff voltage is applied to the surge absorber.
- Peak Surge Current ($I_{(R)SM\ max.}$)
A maximum surge current that can flow through the surge absorber, but not repetitively. The waveform in the table is 8/20 μ sec.
- Peak Clamp Voltage ($V_{CL\ max.}$)
A maximum voltage that may be generated between the surge absorber's leads when the peak surge current is applied to the surge absorber.
- Maximum Allowable Power ($P_{(R)SM\ max.}$)
 $P_{(R)SM\ max.} = (V_{CL\ max.}) \times (I_{(R)SM\ max.})$

Typical Capacitance between Absorber's Leads vs. Breakdown Voltage



Physical Dimensions



Series	D	W	d	l
1000	2.8	5.0	0.6	20
2000	5.3	9.7	1.0	20
3000	8.5	8.6	1.0	20
5000	9.7	12.3	1.2	20

1000 Series Electrical Specifications

Operating Temp.: -40°C ~ +125°C
Power Dissipation: 1 Watt(6KW @8/20usec)

Model	Breakdown Voltage (V _{BR}) +10% @1mA	Standoff Voltage (V _(RSO))	Reverse Leakage Current (I _(RSO)) (μA)	Surge Waveform 8/20usec	
				Peak Pulse Voltage (V)	Peak Pulse Current (A)
□□1007	7.5	6.05	200	14.3	419.0
ZP1010	10	8.10	10	19.5	311.0
□□1012	12	9.72	5	22.7	267.0
ZP1016	16	12.90	5	28.4	213.0
□□1018	18	14.50	5	34.0	178.0
ZP1027	27	21.80	5	50.5	120.0
ZP1040	40	32.40	5	73.0	83.0
□□1050	50	40.50	5	88.0	68.9
ZP1060	60	48.60	5	114.0	52.6
ZP1075	75	60.70	5	142.0	42.2

□□ = ZP or CP Models available

2000 Series Electrical Specifications

Operating Temp.: -40°C ~ +125°C
Power Dissipation: 3 Watt(18KW @8/20usec)

Model	Breakdown Voltage (V _{BR}) +10% @1mA	Standoff Voltage (V _(RSO))	Reverse Leakage Current (I _(RSO)) (μA)	Surge Waveform 8/20usec	
				Peak Pulse Voltage (V)	Peak Pulse Current (A)
ZP2006	6.8 *	5.50	2000	13.4	1342.0
CP2007	7.5 *	6.05	1000	14.5	1241.0
□□2008	8.2 *	6.63	400	15.5	1161.0
□□2010	10	8.10	20	18.6	968.0
□□2012	12	9.72	5	21.7	829.0
□□2015	15	12.10	5	27.2	662.0
□□2018	18	14.50	5	32.5	554.0
□□2022	22	17.80	5	39.3	458.0
□□2027	27	21.80	5	48.3	373.0
□□2033	33	26.80	5	59.0	305.0
□□2039	39	31.60	5	69.7	258.0
□□2047	47	38.10	5	84.0	214.0
□□2056	56	45.50	5	100.0	180.0
□□2068	68	55.10	5	121.0	148.0
□□2082	82	66.40	5	146.0	123.0
□□2100	100	81.00	5	178.0	101.0
□□2120	120	97.00	5	212.0	85.0
□□2150	150	121.00	5	265.0	68.0
□□2180	180	146.00	5	317.0	57.0
□□2220	220	175.00	5	388.0	46.5
□□2250	250	202.00	5	442.0	40.7
□□2300	300	243.00	5	529.0	34.0
□□2350	350	284.00	5	618.0	29.1
□□2400	400	324.00	5	706.0	25.5
□□2440	440	356.00	5	776.0	23.2
ZP2500	500	405.00	5	884.0	20.3
ZP2600	600	486.00	5	1058.0	17.0
ZP2700	700	567.00	5	1236.0	14.5
ZP2800	800	648.00	5	1412.0	12.7
ZP2880	880	713.00	5	1552.0	11.7

□□ = ZP or CP models available

*Test current = 10ma

Silicon Surge Absorber ZP/CP Series



■3000 Series Electrical Specifications

Operating Temp.: -40°C ~ +125°C
Power Dissipation: 5Watt(34KW @8/20usec)

Model	Breakdown Voltage (V _{BR}) +10% @1mA	Standoff Voltage (V _(RSO))	Reverse Leakage Current (I _(RISO)) (μA)	Surge Waveform 8/20usec	
				Peak Pulse Voltage (V)	Peak Pulse Current (A)
ZP3006	6.8 *	5.50	5000	13.3	2556.0
CP3007	7.5 *	6.05	2000	14.7	2313.0
□□3008	8.2 *	6.63	2000	15.4	2208.0
□□3010	10	8.10	100	19.8	1717.0
□□3012	12	9.72	10	23.8	1429.0
□□3015	15	12.10	10	29.7	1145.0
□□3018	18	14.50	10	35.6	995.0
□□3022	22	17.80	10	43.6	780.0
□□3027	27	21.80	10	53.6	636.0
□□3033	33	26.80	10	63.5	521.0
□□3039	39	31.60	10	77.2	440.0
□□3047	47	38.10	10	93.1	365.0
□□3056	56	45.50	10	111.0	307.0
□□3068	68	55.10	10	135.0	252.0
□□3082	82	66.40	10	162.0	210.0
□□3100	100	81.00	10	198.0	172.0
□□3120	120	97.00	10	238.0	143.0
□□3150	150	121.00	10	297.0	114.0
□□3180	180	146.00	10	356.0	96.0
□□3220	220	175.00	10	436.0	80.0
□□3250	250	202.00	10	495.0	69.0
□□3300	300	243.00	10	594.0	57.2
□□3350	350	284.00	10	693.0	49.1
□□3400	400	324.00	10	792.0	42.4
□□3440	440	356.00	10	871.0	39.0
ZP3500	500	405.00	10	990.0	34.5
ZP3600	600	486.00	10	1188.0	28.5
ZP3700	700	567.00	10	1386.0	24.5
ZP3800	800	648.00	10	1584.0	21.2
ZP3880	880	713.00	10	1742.0	19.5

□□= ZP or CP models available

* Test current = 10ma

■4000 Series Electrical Specifications

Operating Temp.: -40°C ~ +125°C
Power Dissipation: 6Watt(44KW @8/20usec)

Model	Breakdown Voltage (V _{BR}) +10% @1mA	Standoff Voltage (V _(RSO))	Reverse Leakage Current (I _(RISO)) (μA)	Surge Waveform 8/20usec	
				Peak Pulse Voltage (V)	Peak Pulse Current (A)
ZP5006	6.8*	5.50	5000	13.6	3283.0
CP5007	7.5*	6.05	2000	15.1	2963.0
□□5008	8.2*	6.63	2000	15.9	2819.0
□□5010	10	8.10	100	18.5	2426.0
□□5012	12	9.72	10	22.1	2034.0
□□5015	15	12.10	10	27.6	1621.0
□□5018	18	14.50	10	35.1	1352.0
□□5022	22	17.80	10	40.5	1104.0
□□5027	27	21.80	10	49.7	901.0
□□5033	33	26.80	10	60.7	737.0
□□5039	39	31.60	10	71.9	622.0
□□5047	47	38.10	10	86.5	517.0
□□5056	56	45.50	10	103.0	434.0
□□5068	68	55.10	10	126.0	358.0
□□5082	82	66.40	10	150.0	298.0
□□5100	100	81.00	10	184.0	244.0
□□5120	120	97.00	10	221.0	202.0
□□5150	150	121.00	10	276.0	162.0
□□5180	180	146.00	10	331.0	135.0
□□5220	220	175.00	10	404.0	110.0
□□5250	250	202.00	10	460.0	97.1
□□5300	300	243.00	10	552.0	79.7
□□5350	350	284.00	10	644.0	68.3
□□5400	400	324.00	10	736.0	59.7
□□5440	440	356.00	10	809.0	54.3

□□= ZP or CP models available

* Test current = 10ma

OKAYA Electric America Inc. 503 Wall St., Valparaiso, IN 46383

Phone: 800-852-0122, 219-477-4488 Fax: 219-477-4856 <http://www.OKAYA.com>



RA-C6 Series

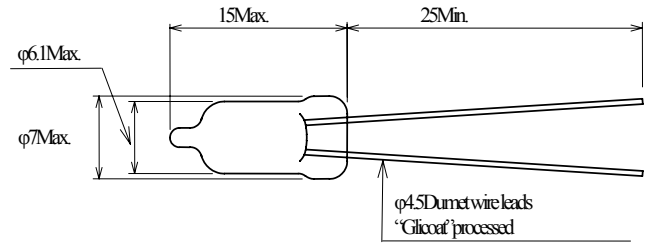
Featuring fast response time and large surge withstand capability of 2000A, the RA-C6 is designed for the protection of electronic components in electronic circuit from impulse type breakdown voltage.



Safety Agency : Standard	File No.
UL: UL497B	E139599
UL: UL1449	E143446
UL: UL1414	E47474
CSA: C22.2 No.1	

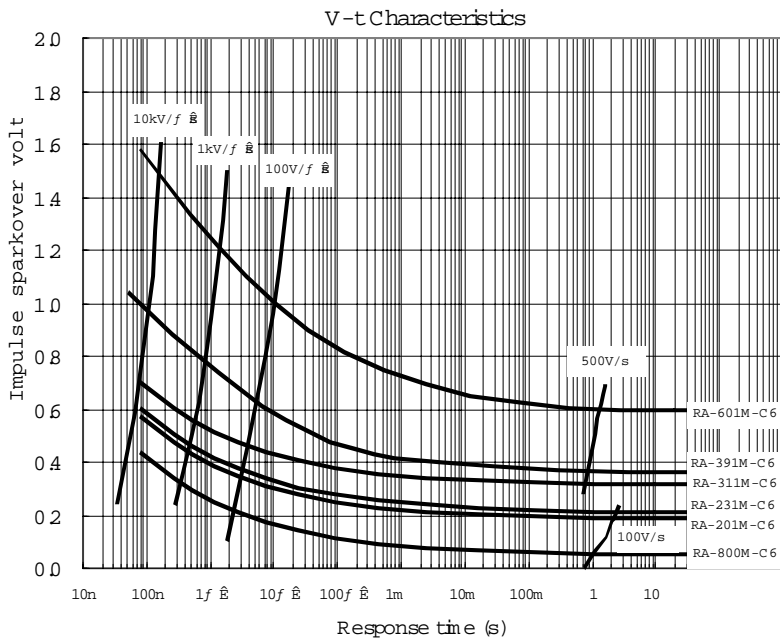
Application

- xDSL Modem, Splitter
- BS tuner, CRT, TV Monitor, VTR
- Telephone, Modem, Facsimile
- Car audio, Car navigation

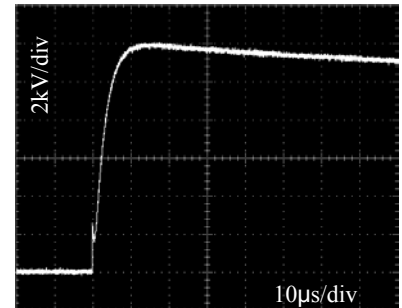


unit: mm

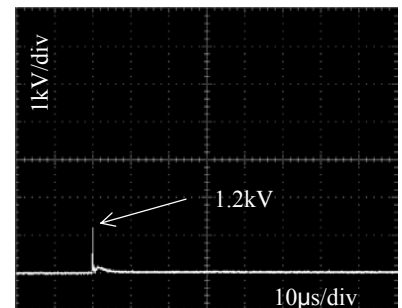
Safety Agency : Standard				Type	DC Spark-over Voltage (V)	Insulation resistance (MΩ)	Capacitance 1kHz-1.5V (pF)	Impulse discharge current 8/20μs (A)	Impulse Life test 8/20μs 100A (Times)	Voltage Withstanding Test
UL 497B	UL 1449	UL 1414	CSA C22.2 NO.1							
○	-	-	-	RA-800P/M-C6	80 (64~96)	1000Min. (DC50V)	1.0Max.	2000	300	-
○	-	-	-	RA-151P/M-C6	150 (120~180)	1000Min. (DC100V)				
○	-	-	-	RA-201P/M-C6	200 (160~240)					
○	-	-	-	RA-231P/M-C6	230 (184~276)					
○	○	-	-	RA-311P/M-C6	310 (248~372)					
○	○	-	-	RA-351P/M-C6	350 (280~420)					
○	○	-	-	RA-391P/M-C6	390 (312~468)					
○	○	-	-	RA-501P/M-C6	500 (400~600)	1000Min (DC500V)				
-	○	-	-	RA-601P/M-C6	600 (480~720)					
-	○	-	-	RA-102P/M-C6	1000(800~1200)					
-	○	-	-	RA-152P/M-C6	1500(1200~1800)					
-	○	○	○	RA-272M-C6	2700(2160~3240)					
-	○	○	○	RA-302M-C6	3000(2400~3600)					



10/700μs, 6kV Surge waveform

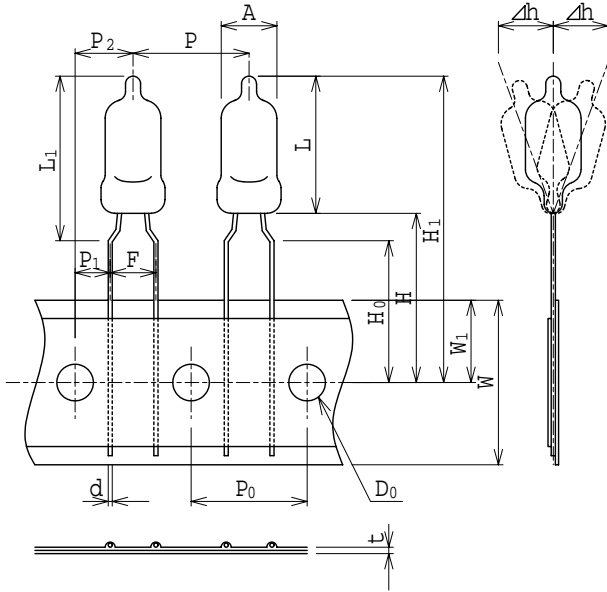


RA-391M-C6 Absorbed surge waveform



Taping type (RA-***M-C6-Y)

Outside dimension

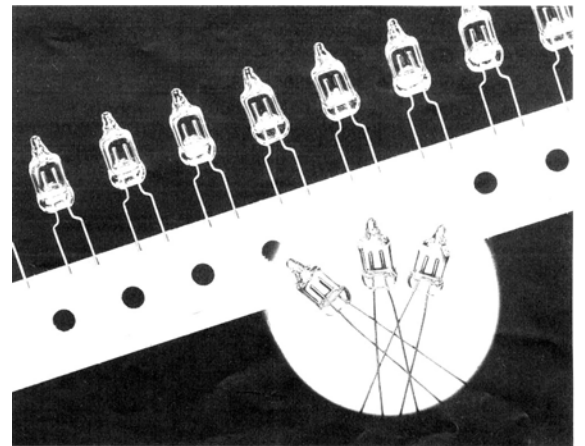
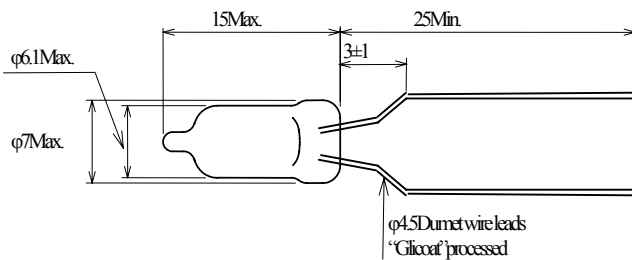


Description		Symbol	Dimension
RA	Height	L	15.0 Max.
	Lamp diameter	A	φ6.1Max.
	Lead diameter	d	φ0.45±0.05
Product height from board		L ₁	17.0 Max.
Lamp pitch		P	12.7±1.0
Hole pitch		P ₀	12.7±0.3 (Note)
Hole position		P ₁	3.85±0.7
		P ₂	6.35±1.3
Pitch between leads		F	5.0±
Declining		Δh	±2.0
Paper width		W	18.0±0.5
Hole position		W ₁	9.0±0.5
Lead chinch height		H ₀	16.0±0.5
Product height		H ₁	33.5 Max.
Lead length		H	18.5 Max.
Hole diameter		D ₀	φ4.0±0.2
Paper thickness		T	0.7±0.2

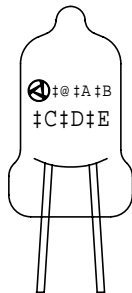
Note) Accumulative pitch error: 4 pitches -50.8±0.6mm
20 pitches 245±1.5mm

Forming Type(RA-***M-C6-F)

Outside dimension



See the following for specification of voltage markings



- ①②③----- DC Spark-over Voltage ①②×10^③
- ④----- Tolerance ±20% (symbol 0)
- ⑤----- The last digit calendar year Example 2002→2
- ⑥----- Month manufactured (see table below)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Symbol	A	B	D	E	F	G	H	J	K	L	M	N

Example)

Model-----RA-102M-C6

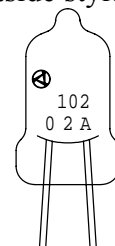
DC Spark-over Voltage---1000V

Tolerance-----±20%→M

Calendar-----2002→2

Month manufactured----January→A

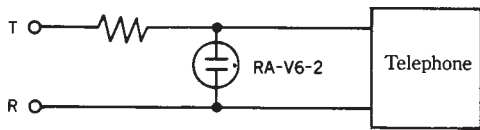
Outside style



• **RA-V6-2**

The RA-V6-2 series utilizes creeping corona discharge, thus demonstrating extremely fast response characteristics in dark ambient conditions without the use of radioactive isotopes. For example, a 1.2/50 μ s, 10kV surge voltage can be suppressed to about 1kV.

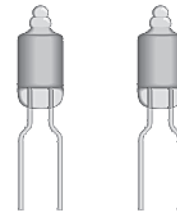
Applied as indirect lightning surge protection in telephone equipment, this model is used for parallel connection between T and R in telephone receivers. Also, by connecting this absorber within electronic circuits, network computers can be protected from destructive impulse current.



Safety Agency : Standard		File No.
UL	: UL 497B 1988	E139599
UL	: UL 1414	E47474

• **Features:**

1. Fast response time.
2. This Surge Absorber is bipolar. The device will fail open if the surge withstand capability is exceeded.
3. Inter-terminal capacity is extremely small, resulting in little influence on electronic circuits.
4. High insulation resistance (1X10⁹ ohms or more).
5. Repeatable - may be used up to 300 times at 500A (8/20 μ s).
6. Small size allows soldering together with resistors or other electronics components.
7. Product available taped for auto insertion. Add "Y" to model number (RA-201P-V6Y-2).

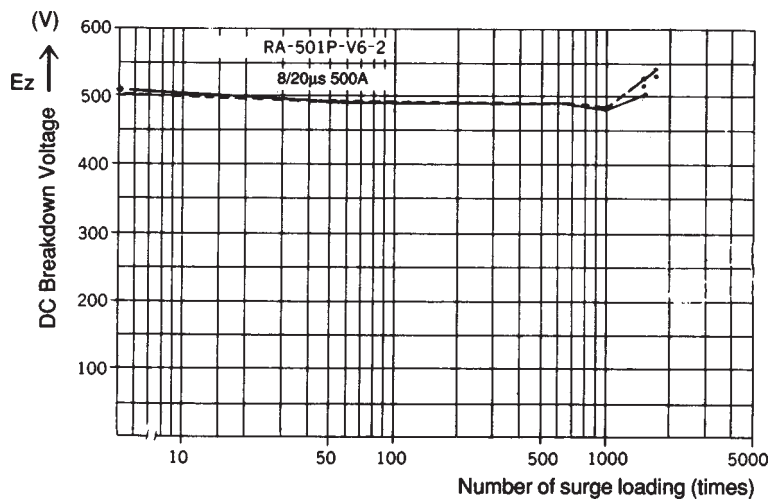
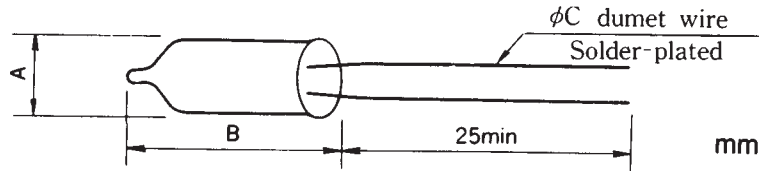


ELECTRICAL SPECIFICATIONS

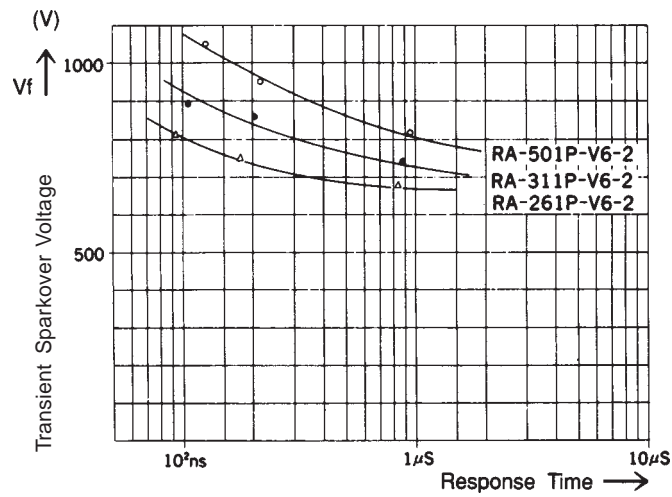
Model No.	D.C. Breakdown Voltage (when lighted) (V)	Peak Surge Current 8/20 μ s (A)	Capacitance (PF)	Dimensions (mm)			Operating Temp Range (C)
				A	B	C	
RA-201P-V6-2	200 \pm 15%	1500	2 Max.	6.5 Max.	14.0 Max.	0.45 \pm 0.05	-20° to + 70°
RA-231P-V6-2	230 \pm 15%						
RA-261P-V6-2	260 \pm 15%						
RA-301P-V6-2	300 \pm 15%						
RA-311P-V6-2	310 \pm 15%						
RA-351P-V6-2	350 \pm 15%						
RA-391P-V6-2	390 \pm 15%						
RA-501P-V6-2	500 \pm 15%						
RA-201M-V6-2	200 \pm 15%	1500	2 Max.	6.5 Max.	14.0 Max.	0.45 \pm 0.05	-20° to + 70°
RA-231M-V6-2	230 \pm 15%						
RA-261M-V6-2	260 \pm 15%						
RA-301M-V6-2	300 \pm 15%						
RA-311M-V6-2	310 \pm 15%						
RA-351M-V6-2	350 \pm 15%						
RA-391M-V6-2	390 \pm 15%						
RA-501M-V6-2	500 \pm 15%						

Series P - No marking on part

Series M - Coded marking on part



Impulse Circuit Endurance Characteristics



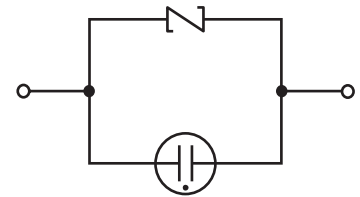
V - T Characteristics

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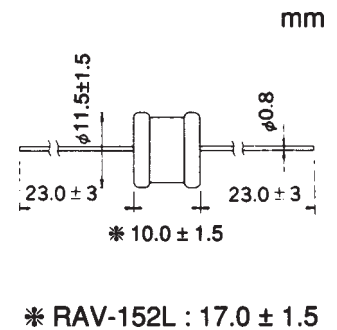
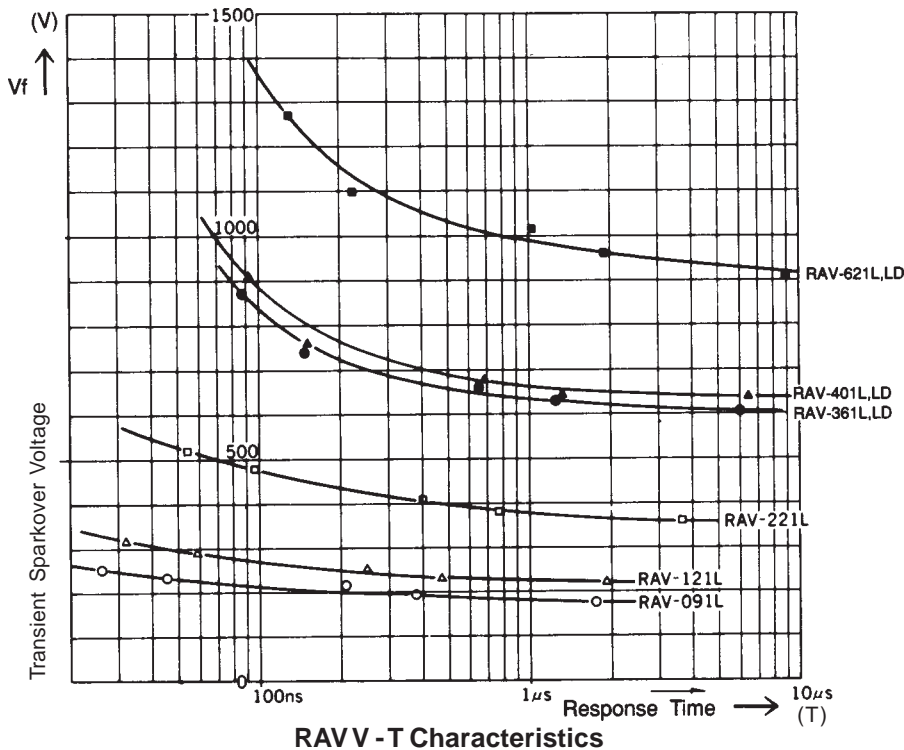
• RAV-L

RAV was developed to absorb high current surge such as indirect lightning. Specifically, the RAV applied to communication circuits will protect it. The RAV is suitable for use with equipment which requires high reliability protection from external surges.

1. Response time: 50ns max.
2. Life: Possible to absorb 1000A for 300 times repeatedly (Surge wave form: 8/20 μ s).



Equivalent Circuit Diagram



SURGE ABSORBERS

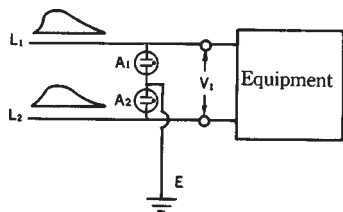
ELECTRICAL SPECIFICATIONS

Model No.	Clamp Voltage* V1.0 ±10%	Peak Surge Current 8/20 μ s (A)	Peak Surge Voltage 1.2/500 μ s (V)	Response Time (ns)	Capacitance (PF) Max.	Operating Temp Range (C)
RAV-091L	90	2400	20K	50	150	-20° to +70°
RAV-121L	120				130	
RAV-181L	180				100	
RAV-221L	220				90	
RAV-361L	360				30	
RAV-401L	400				30	
RAV-621L	620				40	
RAV-901L	900				30	
RAV-152L	1500				20	

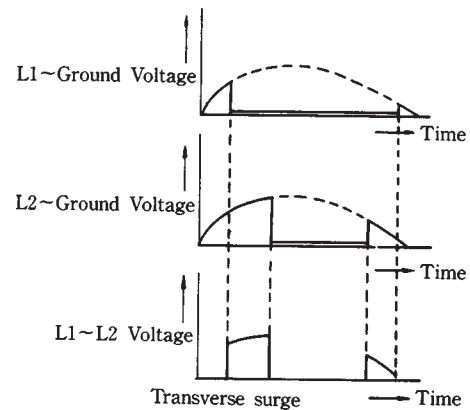
* Equivalent Varistor Voltage @ 1MA

Since the indirect lightning surges entering telecommunication lines have the same voltage and phase, the measures to be taken against the surge must involve placement of a surge absorber between the lines and ground.

For example, in the case of the two-line system shown in the accompanying illustration, the gas arresters A1, A2 are inserted in the lines L1-E and L2-E in order to protect the system, but in this kind of arrangement, there may be a difference in the response time of the elements.

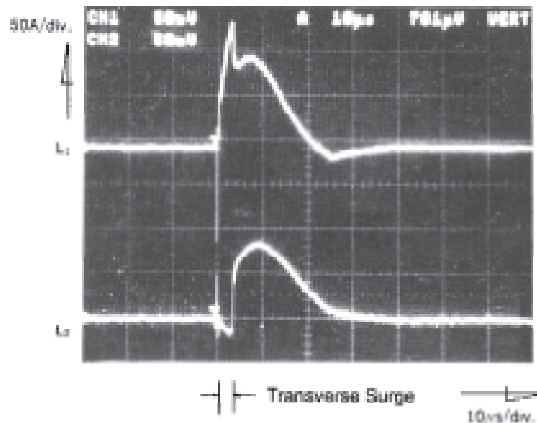


In general, indirect lightning surge is called “longitudinal surge”; in contrast, the surge caused by the difference in element operating time is called “transverse surge.” This condition is illustrated below. The important thing is to prevent the generation of this transverse surge.



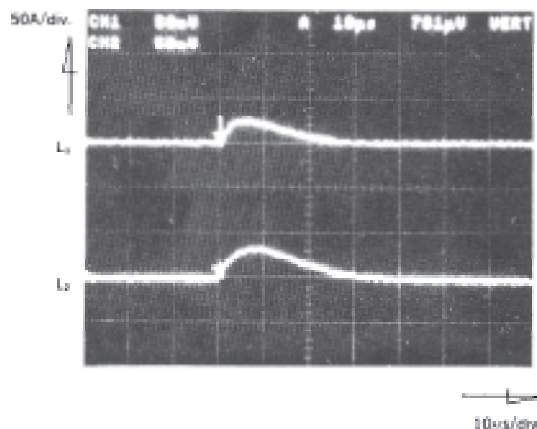
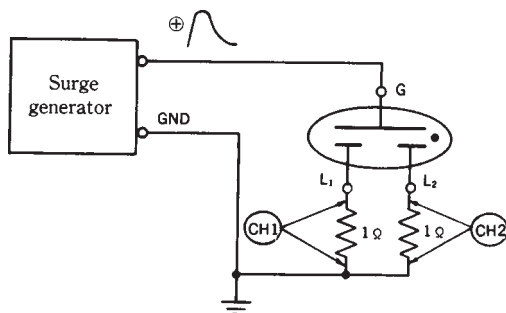
• Measurement of Transverse Surge:

A three-pole type of surge absorber is used here to protect a telecommunications line. A comparison can be made between the transverse surges in the gas arrester made by another manufacturer and in Okaya's RAV-361LD, thus allowing an evaluation of the performance of the respective products.



• Measurement Circuit

Measurements are made with the circuit shown below, and by observing the current waveform on an oscilloscope.



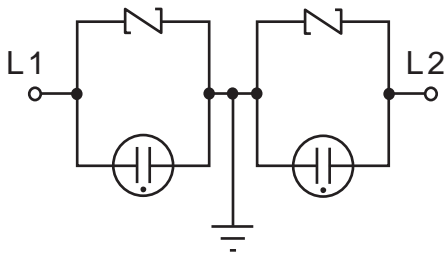
• Measurement Results

The gas arrester produced a transverse surge with a width of about 3-4 μ s, and the generation of that surge is facilitated in cases where the dv/dt is precipitous and voltage is not so great. This surge generation is a result of the V-T characteristics. In contrast, the RAV type resulted in virtually no transverse surge at all.

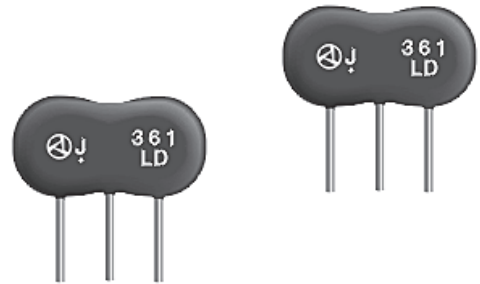
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• **RAV-LD (For protecting network lines)**

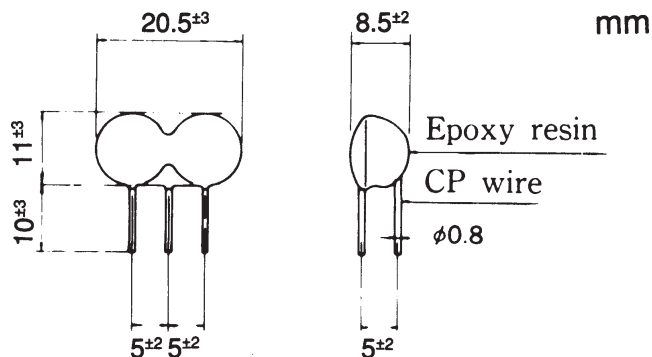
The RAV-LD series are designed as surge absorbers for protection of telecommunication lines from indirect lightning surges. They demonstrate extremely fast response time and positive surge absorption operation compared to gas arresters.



Equivalent Circuit Diagram



RAV-361LD



SURGE ABSORBERS

ELECTRICAL SPECIFICATIONS

Model No.	Clamp Voltage* V1.0 ± 10%	Peak Surge Current 8/20µs (A)	Peak Surge Voltage 1.2/50 µs (V)	Response Time (ns)	Capacitance (PF) Max.	Operating Temp Range (C)
RAV-221LD	220	2400	12K	50	90	-20° TO + 70°
RAV-361LD	360				30	
RAV-401LD	400				30	
RAV-621LD	620				40	

* Equivalent Varistor Voltage @ 1MA

SURGE ABSORBER

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The specifications contained in this catalog are subject to change without notice.

PART NUMBER	RATING	APPLICATION
RAV-L	90V - 1500V	SURGE PROTECTION OF NETWORK LINE
RAV-LD	360V - 620V	
RA-V6-2	200V - 500V	
CAA	6.8 - 68Vdc	TELECOM AND DATA TRANSMISSION PROTECTION
RSM-XRL	5 - 48V	DATA TRANSMISSION PROTECTION
RSP-TEL (-B)	Telephone	TELECOM PROTECTION
RSP-485	RS-485	DATA TRANSMISSION PROTECTION
RA-V7	2400V - 3600V	SURGE PROTECTION OF POWER LINE
RAV-401(782)QWZ	403V, 783V	
RAV-401(781)PWZ	403V, 783V	
RAV-401(781)BWZ-2A(3C)	403V, 783V	
RAV-781BXZ-2A(3C)	783V	SURGE PROTECTION OF 3-PHASE POWER LINE
RAV781BXZ-4	700V	
RAV-781(152)BYZ-2(A)	783V, 1470V	
RAV-401(781)LDEZ	403V, 783V	SURGE PROTECTION OF POWER LINE
RAM-LAS	125, 250VAC	
RAM-BWZ-(4)(5)	125 - 500VAC	SURGE PROTECTION OF 3-PHASE POWER LINE
RAM-BXZ-(4)(5)	250 - 300VAC	

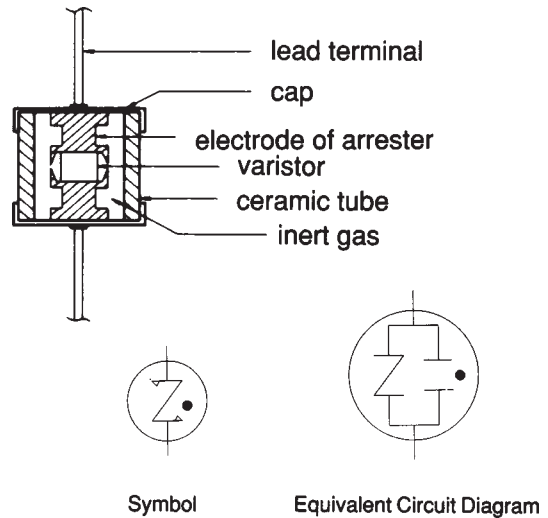
• SURGE

Power surges, both voltage and current, are occurring continually in today's power systems. Whether they occur naturally, such as from lightning and static electricity; or are man made, such as inductive surges from motor, transformers, solenoids, etc. power surges are a fact of life. These power surges have a very high voltage and current level as compared to electrical noise.

Recent developments in electronic designs have tended toward smaller and higher density packaging of circuitry. This results in a greater susceptibility to surges. Once attacked by a surge, electronic circuits can be destroyed in as short as 0.1 μ sec. The designer of electronic equipment must be aware of, and be able to deal with, power surges in product design.

OKAYA's RAV surge absorbers are designed to assist in dealing with the problem of power surges. The RAV series is a unique new approach which combines the features of two well known technologies. Combining the high speed capabilities of Metal Oxide Varistor (MOV) with the large power handling capability of Gas Arrester, OKAYA has developed a product which can clamp power surges faster than gas arrester alone and handle large power surges far beyond the capability of MOV.

• CONSTRUCTION



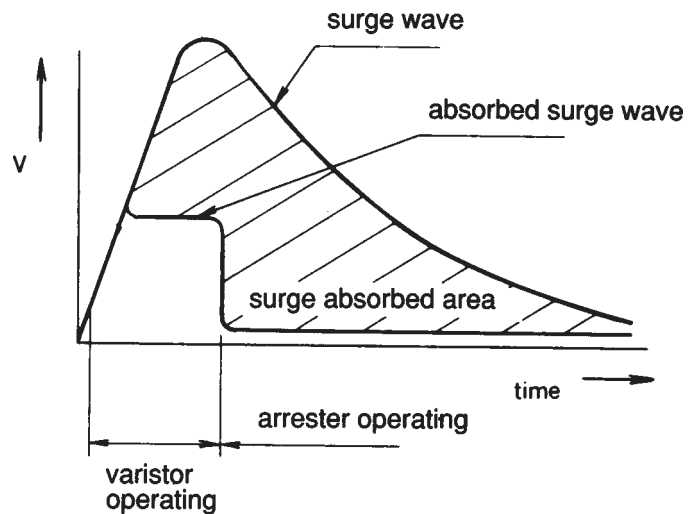
• FEATURES

The RAV Surge Absorber is applicable for the protection of many types of electrical equipment. The RAV has the following features:

- 1) Large capacity surge protection
- 2) Fast response time
- 3) Good endurance to repetitive lightning
- 4) High clipping performance
- 5) Low internal capacitance
- 6) No environmentally hazardous materials

• OPERATING PRINCIPAL

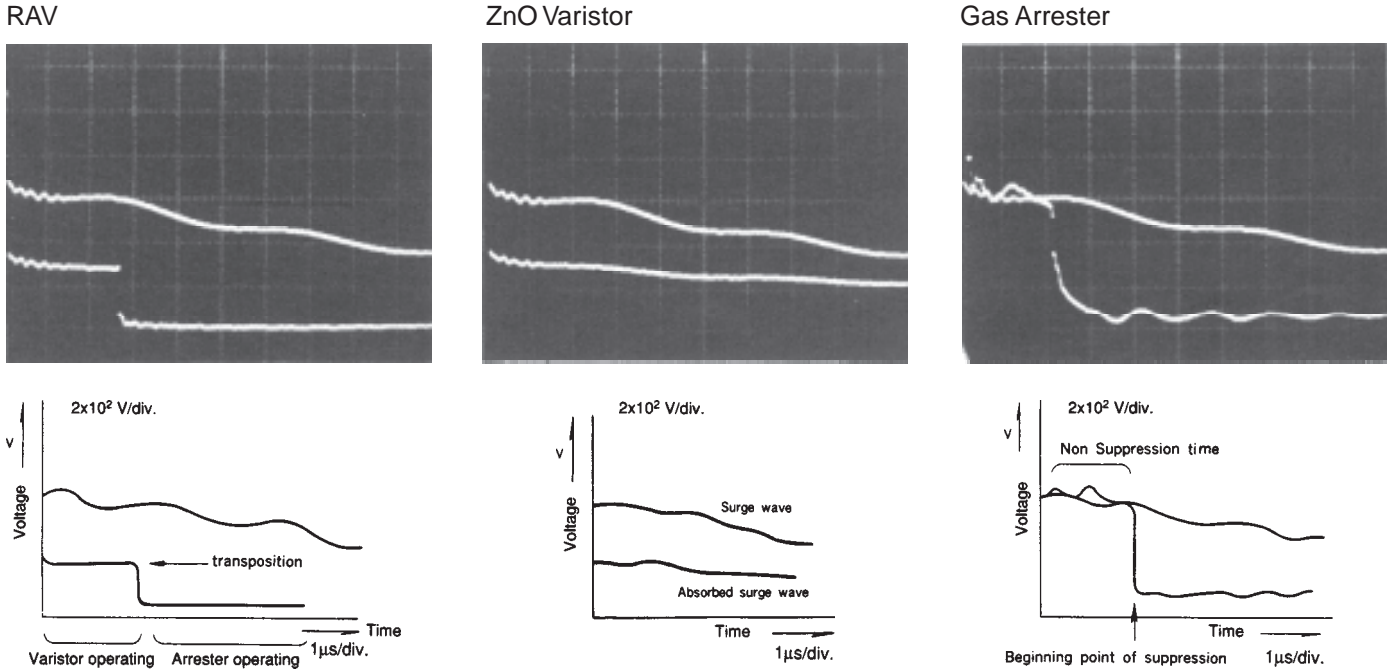
The RAV connected between lines will shunt the surge from one side of the line to the other. The high speed varistor quickly shunts the surge until the slower, but more powerful gas arrester takes over. This allows the gas arrester to handle the high energy portion of the surge and protect the MOV from damage. This interaction of the RAV assures safe handling of the power surge and long life stability to the MOV.



SURGE ABSORBER

• DYNAMIC CHARACTERISTICS

Fig. 1 Shows the dynamic characteristics of Varistor, Gas Arrester & RAV.



Lightning surges have precipitous dv/dt values and huge electrical charge. Surge absorbers must assimilate this surge. This limiting voltage capability varies depending upon the type of absorber. The voltage and current curves in Fig. 2 characterize varistors and gas arresters.

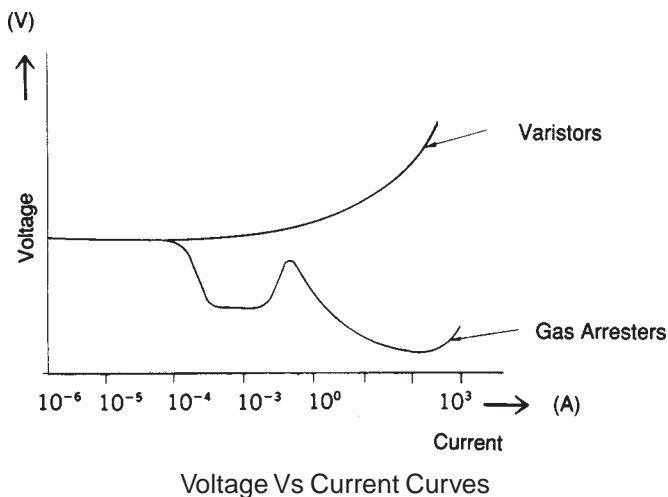


Figure 2

VARISTORS

Varistor voltage is specified by the manufacturer at low current (ie, 0.1-1.0 mA). The clamping voltage of the Varistor at higher current (ie, 1.0 Amp) can be several times higher and will increase as the current goes higher (See Fig. 2). Varistors have a very fast response time (ie, 50 nsec.) and will clamp at rated voltage for low currents or short periods of time. However, as a power surge increases in either current or duration, the Varistor clamping voltage can rise to unsafe levels, ultimately failing when its maximum energy level is exceeded. Although the Varistor may survive most power surges, each time it absorbs a power surge, damage occurs to the Varistor. Ultimately the MOV is rendered inoperative and unable to perform its suppression task.

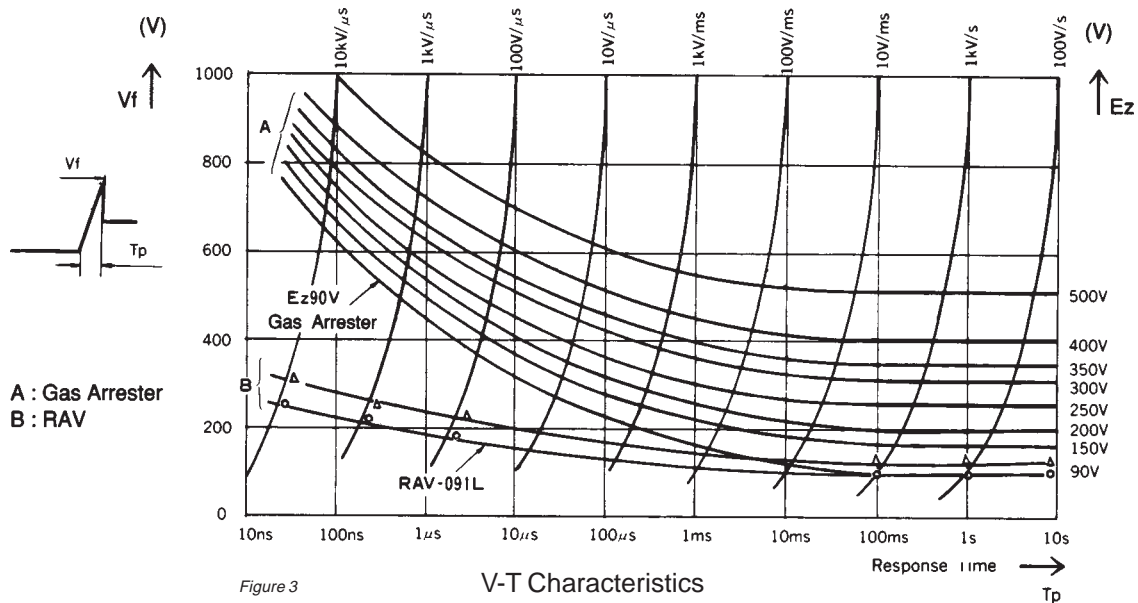
GAS ARRESTERS

The rated voltage of the Gas Arrester is defined as a DC breakdown Voltage (E_z). In contrast to the Varistor, as the surge current increases this voltage decreases. Therefore, once the Gas Arrester is triggered, the voltage level is maintained at a safe level, regardless of the increase in current or duration of the power surge. Typically the trigger response time is 1μsec.

• RAV CHARACTERISTICS

Power surges resulting from indirect lightning strikes occur with precipitous speed. The dv/dt of the rising waveform will exceed $100v/\mu\text{sec}$. As a result, a surge absorber without excellent response performance will be unable to protect equipment from damage. The element performance of gas arresters and other general surge absorbers is evaluated by means of the Voltage-Time characteristic curve, which expresses the relationship between the rise time of the voltage and the firing potential voltage of the device at the time of the surge rise. The accompanying graph shows an example of V-T characteristics.

The electrical characteristics of gas arresters are normally measured by the element performance, expressed in terms of the DC breakdown voltage. When such devices are used as surge absorbers, however, the more important value is the surge firing potential voltage (V_f : the voltage at which surge discharge begins). For example, even in the case of a gas arrester with DC breakdown voltage of 90V, the V_f value at $1kV/\mu\text{s}$ indicates a surge firing potential of about 500V (See Fig. 3). The surge cannot be discharged until the voltage rises to this value. This characteristic forms the chief failing of gas arresters. With the RAV surge absorber, however, the same 90V type permits the discharge operation to begin at a V_f (at $1kV/\mu\text{s}$), of about 210V. As a result, the discharge operation begins at a level 290V lower than the gas arrester.



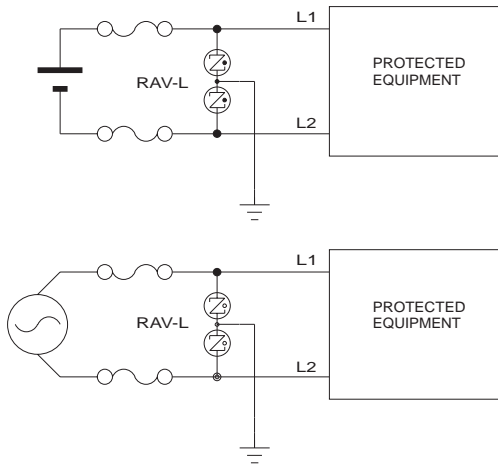
There are two standard tests which are used to classify surge absorbers. Each test uses a signal pulse which is imposed on the device under test (DUT). This pulse is described by two sets of numbers (1.2/50 μsec . and 8/20 μsec .). The first number in each set is the duration of the rise time of the signal imposed on the DUT. The second number is 1/2 of the duration of the fall time of the signal imposed on the DUT.

The 1.2/50 μsec . test is used to determine the peak surge voltage the DUT can withstand. The 8/20 μsec . test is used to determine the maximum discharge current the DUT can withstand. These wave forms are derived from IEEE-587, 1980 (ANSI-62.41). This standard defines the open circuit and short circuit current waveforms which can be expected to occur on AC power lines of 600 Volts (RMS) or less.

SURGE ABSORBER

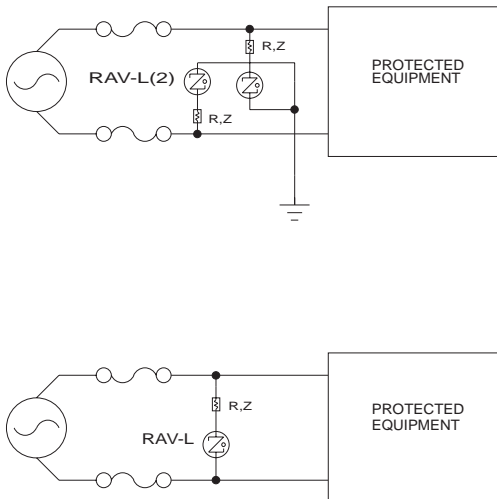
• BASIC CIRCUIT TO PROTECT EQUIPMENT

Input impedance is high



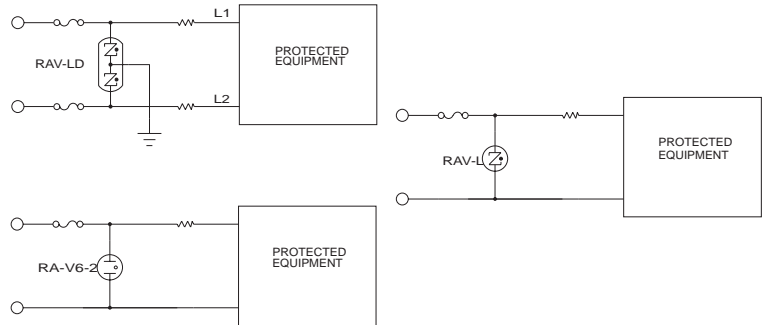
Input impedance is low

The resistors R or MOV Z control continuous flow discharge and low value ones should be selected so as not to reduce the capacity of the surge protection device.

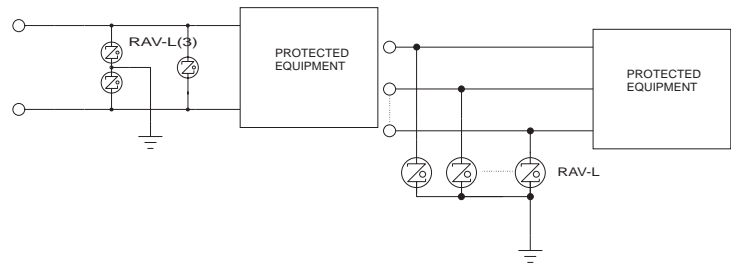


• APPLICATION

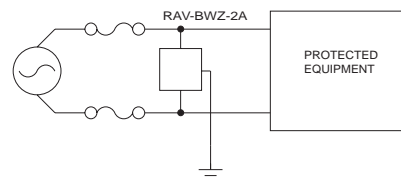
Protecting telephone lines



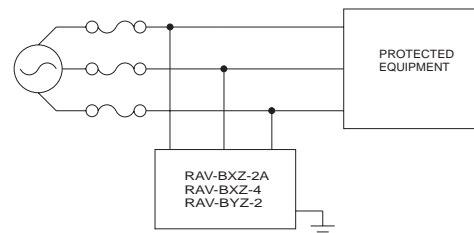
Protecting telecommunications and signal lines



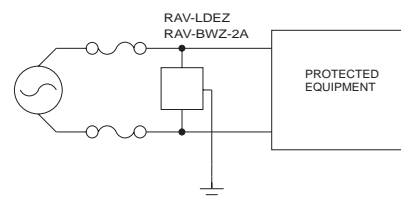
Single phase power supply



Three-phase inverter power supply



Protecting power supply for vending machine



Okaya's surge protection devices
Gas Discharge Tube
Arrester Series



www.okaya.com

www.okayaelec.co.jp

Okaya Electric America, Inc.





Sep.2003

Description



Okaya offers a variety of surge arresters built around its leading technologies, designed for use in protecting equipment from surges induced by lightning discharge and electrostatic discharge on communication lines and equipment.

The purpose of this document is to feature one of Okaya's surge arrester series -- Gas Discharge Tube Series. The application of gas discharging phenomena to the series has realized the surge arresters featuring high insulation resistance and extremely low capacitance, not affecting normal operation of protected equipment.

	Series	Envelope	Current Handling	Capacitance
	R28/R38	Ceramic	10,000A	1.5pF
	RA-V7	Glass	3,500A	1.0pF
	RA-C6	Glass	2,000A	1.0pF
	RHCA (SMD)	Ceramic	2,000A	0.6pF
	RCCA (SMD)	Ceramic	100A	0.3pF

Types of Surges

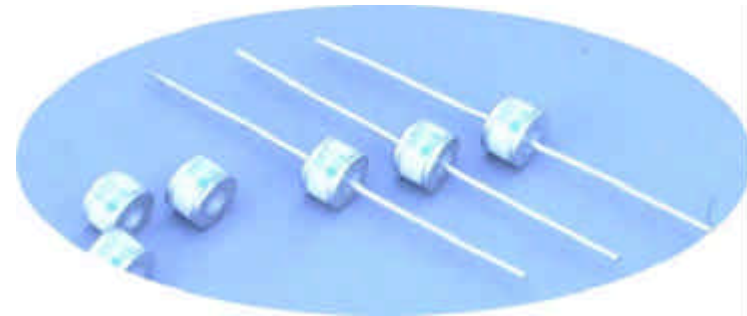


Surges are generated naturally and artificially. Lightning discharge and electrostatic discharge (ESD) generate surges naturally. Artificial surges are generated by the induction loads such as motors and relays when the devices are switched on and off, and by the electronic switches incorporating semiconductors, such as SCRs. The surges vary in amount of voltage, current, and energy. Proper use of protective devices is required to protect equipment against such surges.

The following table lists part of models available for Okaya's line of surge arresters including mov and silicon surge absorbers which are not explained in this document.

Type	Description	Typical Protective Devices	Okaya Product Series
Surges by lightning	a large amount of energy which contains high voltage and high current	Gas Discharge Tube Type Arresters Mov Silicon Surge Absorbers	R28,R38,RAV, RA-V7,RA-C6 RHCA,RSSA
Surges by ESD	a small amount of energy which contains high voltage and low current	Gas Discharge Tube Type Arresters Mov Silicon Surge Absorbers	RHCA,RCCA RA-C6,RSSA

Gas Discharge Tube R28/R38 Series



Features

- Fast response time to rapid surges
- Surge current capacity 10kA 8/20 μ s
- Large impulse current withstand capability
- Endures AC current
- Good insulation and low capacitance
- Various safety standards certified (IEC, ITU-T, Telcordia, GR1361, etc)

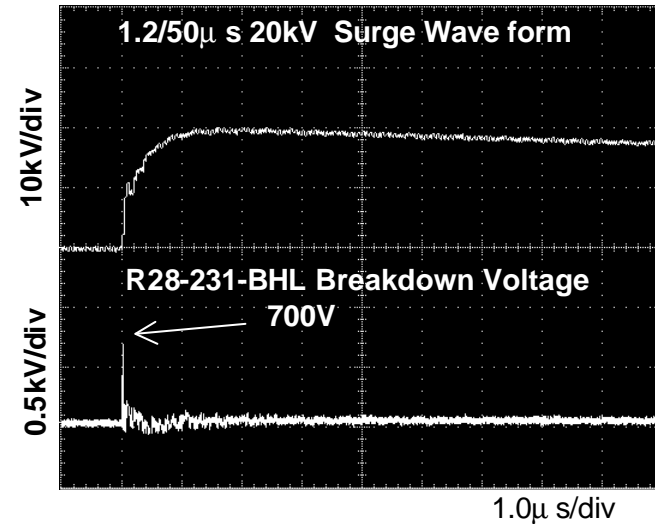
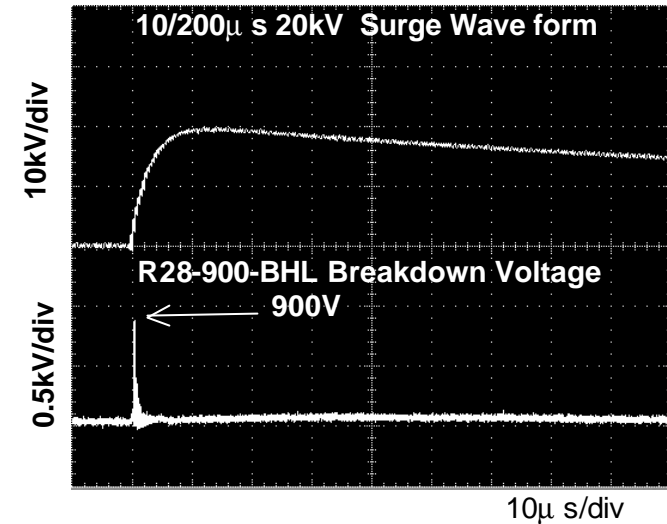


Gas Discharge Tube R28/R38 Series



APPLICATION

- Home telephone,
- Business telephone,
- PBX
- Wireless base station
- Optical transmission equipments
- CATV transmission equipments,
- Broadcasting equipments
- Fire alarm system,
- Home security systems



Gas Discharge Tube (R28 Series)



2-Electrode Arresters

Model	DC Breakdown Voltage 100V/s~500V/s	Impulse spark-over Voltage 100V/ μ s	Impulse discharge current 8/20 μ s	Alternating discharge current 50Hz/1sec.	Impulse life test 10/1000 μ s 100A	Insulation resistance	Capacitance
R28-900-BHL	90V \pm 20%	450V	10kA	10A (10Times)	300 Times	10 ⁴ M Ω Min.	1.5 pF Max.
R28-151-BHL	150V \pm 20%	500V					
R28-231-BHL	230V \pm 20%	600V					
R28-251-BHL	250V \pm 20%	600V					
R28-301-BHL	300V \pm 20%	650V					
R28-351-BHL	350V \pm 20%	750V					
R28-401-BHL	400V \pm 20%	800V					
R28-471-BHL	470V \pm 20%	900V					
R28-601-BHL	600V \pm 20%	1300V					

Gas Discharge Tube (R28 Series)



2-Electrode Arresters High-Voltage Types

Model	DC Breakdown Voltage 100V/s~500V/s	Voltage Withstanding Test	Impulse discharge current 8/20 μ s	Alternating discharge current 50Hz/1sec.	Impulse life test 10/1000 μ s 100A	Insulation resistance	Capacitance
R28-801-BHL	800V \pm 20%	-	10kA	10 A (10Times)	300Times	10 ⁴ M Ω Min.	1.5 pF Max
R28-102-BHL	1000V \pm 20%	-					
R28-152-BHL	1500V \pm 20%	-					
R28-242-BJL	2400V \pm 20%	AC1250V 3sec.					
R28-302-BKL	3000V \pm 20%	AC1500V 60sec.					
R28-362-BKL	3600V \pm 20%	AC1800V 3sec.					
R28-402-BKL	4000V \pm 20%	AC2000V 60sec.					
R28-452-BKL	4500V \pm 20%	AC2000 60sec.					

Gas Discharge Tube (R38 Series)



3-Electrode Arresters High-Voltage Types

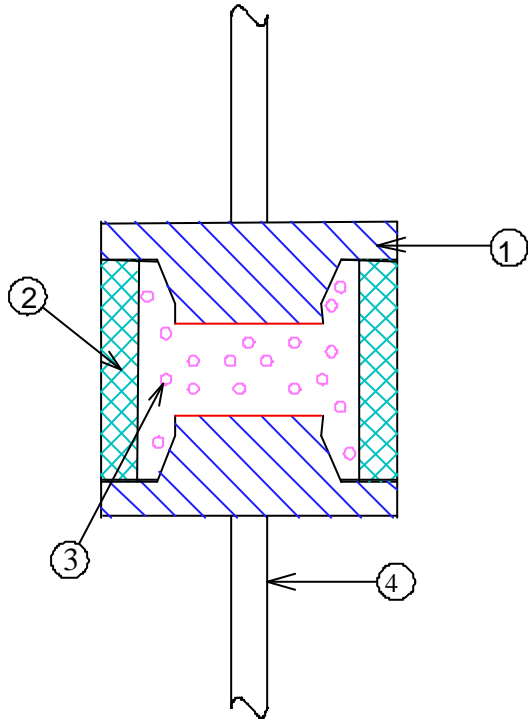
Model	DC Breakdown Voltage 100V/s~500V/s	Impulse discharge current 8/20 μ s	Alternating discharge current 50Hz/1sec.	Impulse life test 10/1000 μ s 100A	Insulation resistance	Capacitance
R38-900-BOL	90V \pm 20%	10kA	10 A (10Times)	300Times	10 ⁴ M Ω Min.	1.5 pF Max
R38-231-BOL	230V \pm 20%					
R38-261-BOL	260V \pm 20%					
R38-351-BOL	350V \pm 20%					
R38-421-BOL	420V \pm 20%					
R38-601-BOL	600V \pm 20%					
R28-801-BHL	800V \pm 20%					

Gas Discharge Tube (R28 Series)



Basic Construction

2-Electrode type



Lead Free

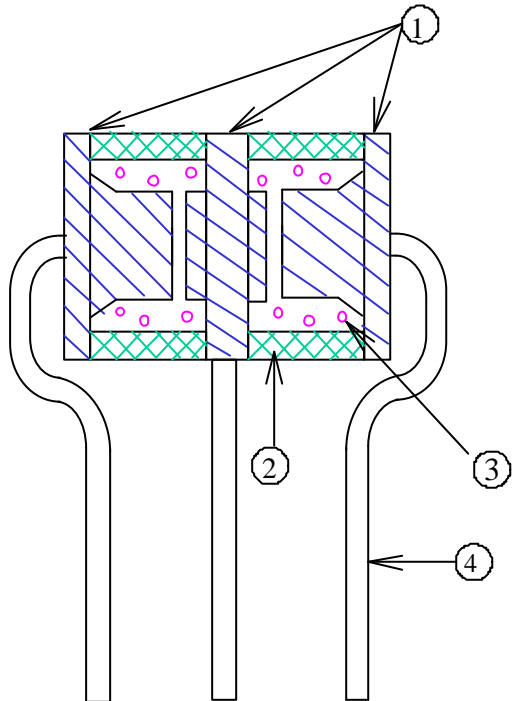
Sign	Reference	Material
1	Electrodes	Sn-plated
2	Envelope	Ceramic
3	Inner gas	Neon, Argon and those mixed gases
4	Lead wires	Copper covered steel wire Tin plating copper wire

Gas Discharge Tube (R38 Series)



Basic Construction

3-Electrode type



Lead Free

Sign	Reference	Material
1	Electrodes	Sn-plated
2	Envelope	Ceramic
3	Inner gas	Neon, Argon and those mixed gases
4	Lead wires	Copper covered steel wire Tin plating copper wire

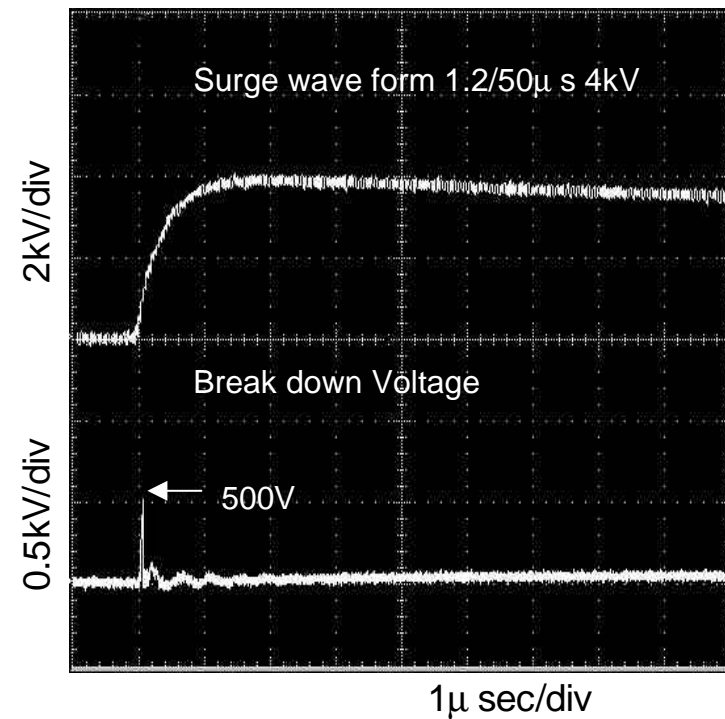


Features

- Surge current capacity 2000A 8/20 μ s
- Surface Mounted Gas Arrester
- Micro-Gap Design
- Capacitance:0.6pF Max

APPLICATION

- CATV modem
- Telecom, xBase T, Hab Protection
- Security Systems
- Data Acquisition
- Audio Systems

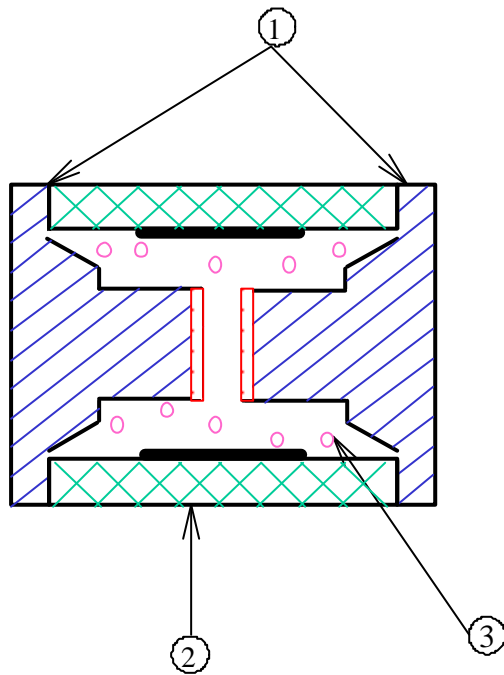


RHCA Series (4.5*3.2)



Model	DC Breakdown Voltage 100V/s~500V/s	Impulse discharge current 8/20 μ s	Impulse Withstanding Voltage capacity	Impulse life test	Insulation resistance Min.	Capacitance Max.
RHCA-301Q43U	200V (140~260)	2000A	10/700 μ s 3kV Positive/Negative 5 Times	8/20 μ s 100A 300 Times	100M Ω Min. (DC 100V)	0.6pF Max.
RHCA-301Q43U	300V (210~390)					
RHCA-351Q43U	350V (245~455)					
RHCA-401Q43U	400V (280~520)					

Basic Construction



Lead Free

Sign	Reference	Material
1	Electrodes	Sn-plated
2	Envelope	Ceramic
3	Inner gas	Neon, Argon and those mixed gases



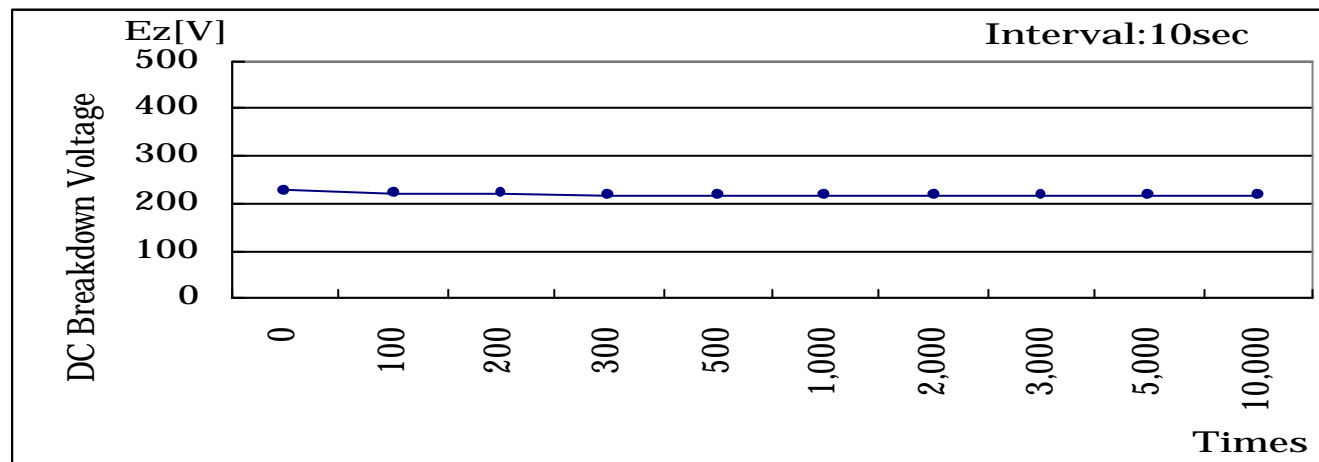
Features

- Surge current capacity 100A 8/20 μ s
- Protection From Electrostatic Surge
- Surface Mounted Gas Arrester
- Micro-Gap Design
- Capacitance:0.3pF Max

APPLICATION

- Antenna Protection
- Telecom, xBase T, Hab Protection
- Security Systems
- Data Acquisition
- Audio Systems

Life Test vs DC Breakdown Voltage
IEC-61000-4-2 150pF-330Ω-8kV

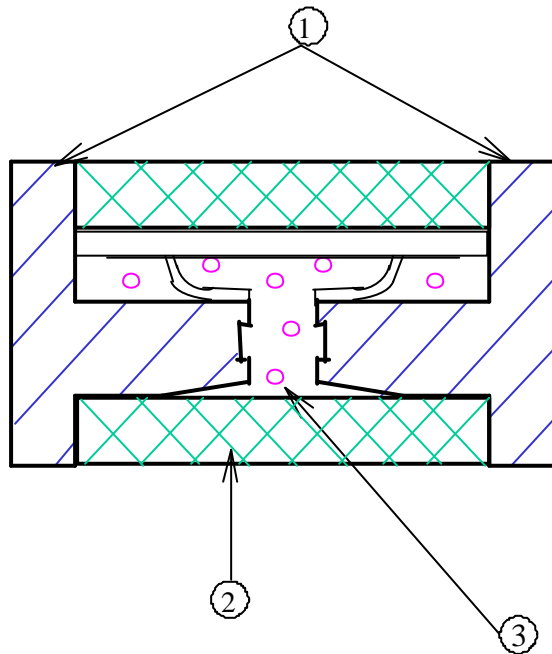


RCCA Series (3.2*1.6)



Model	DC Breakdown Voltage 100V/s~500V/s	Impulse discharge current 8/20μ s	Impulse life test	Insulation resistance	Capacitance Max.
RCCA-201Q31 ^{BA} _{UA}	200V (140~260)	100A	150pF-330Ω 8kV 10000 Times	100MΩ Min. (DC 100V)	0.3pF Max.
RCCA-301Q31 ^{BA} _{UA}	300V (210~390)				
RCCA-401Q31 ^{BA} _{UA}	400V (280~520)				

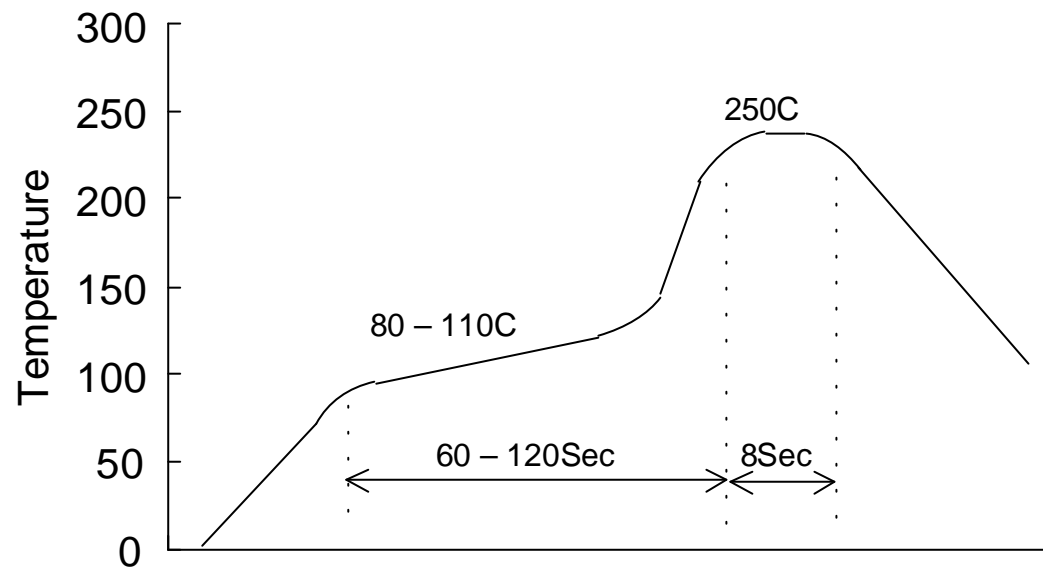
Basic Construction



Lead Free

Sign	Reference	Material
1	Electrodes	Sn-plated
2	Envelope	Ceramic
3	Inner gas	Neon, Argon and those mixed gases

Flow soldering profile

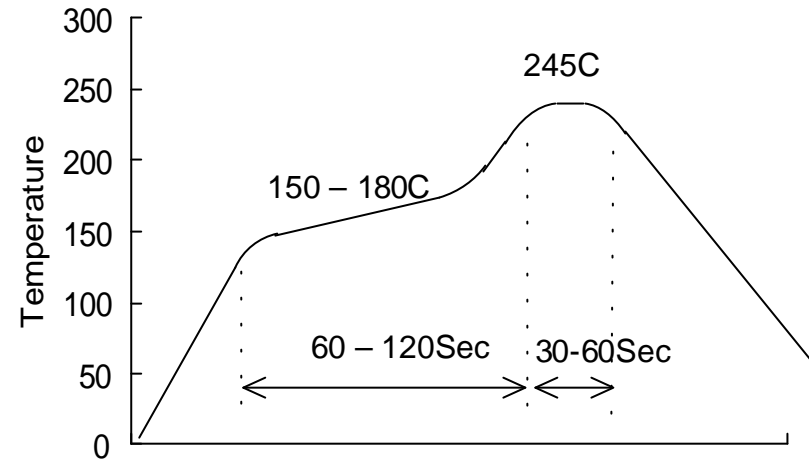


- Hand Soldering :350C - 5Sec

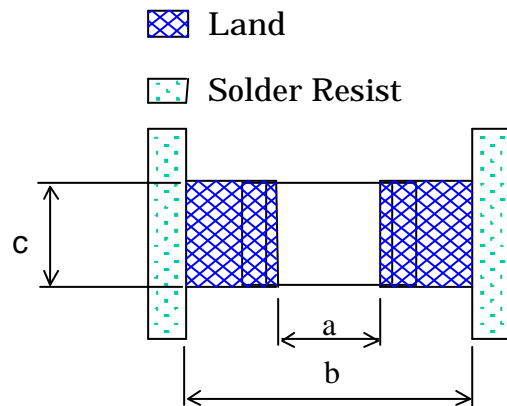
Soldering Profile RHCA,RCCA Series



Rflow soldering profile



- Recommended land Pattern



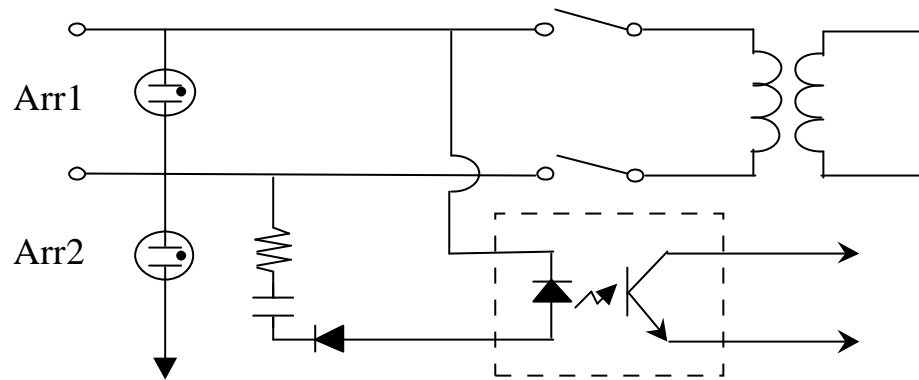
RHCA Type	Dimensions [mm]		
	a	b	c
Reflow soldering	2.7	6.5 to 8.5	3.4
Flow soldering	2.9	6.5-9.5	3.6

RCCA Type	Dimensions [mm]		
	a	b	c
Reflow soldering	1.8 to 2.5	3.8 to 5.5	1.2 to 2.0
Flow soldering	1.8 to 2.5	2.4 to 3.6	1.2 to 1.6

APPLICATION



- PBX, Modem, Facsimile



*Normal

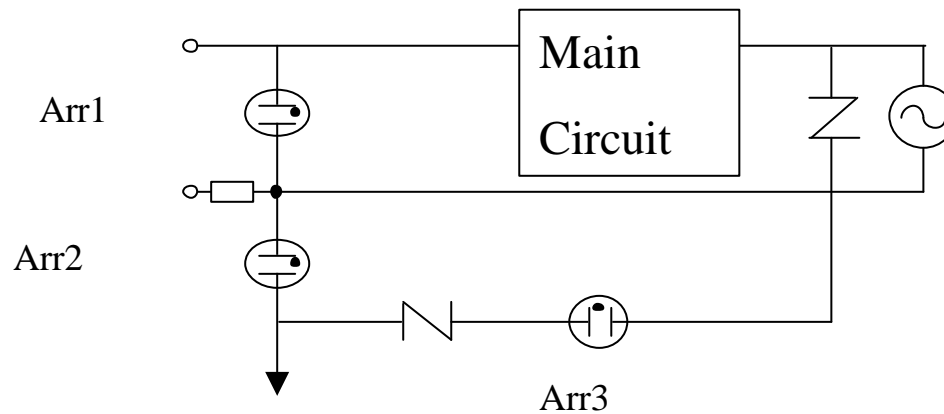
Arr1,2 : R28-351-BHL or R38-351-BOL,
RHCA-401Q43U

*AC Withstanding Voltage

Arr1: R28-351-BHL or RHCA-401Q43U

Arr2: R28-242-BJL or R28-302-BKL,
R28-362-BKL

- Modem, Facsimile, Telephone



Arr1,2 : R28-351-BHL or R38-351-BOL,
RHCA-401Q43U

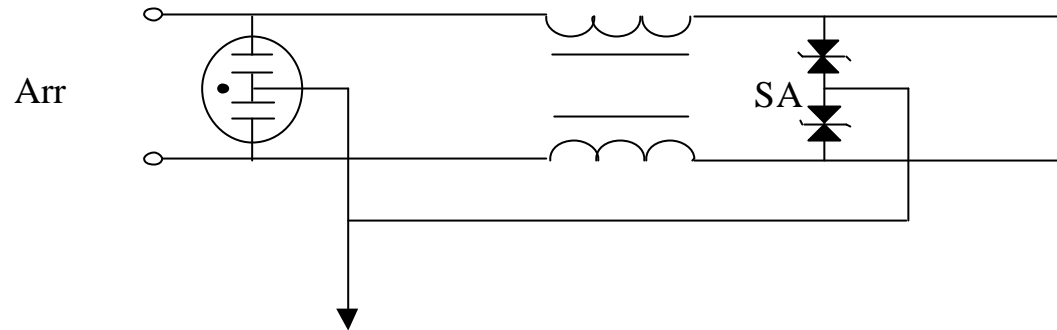
*AC Withstanding Voltage

Arr3: R28-242-BJL or R28-302-BKL,
R28-362-BKL

APPLICATION

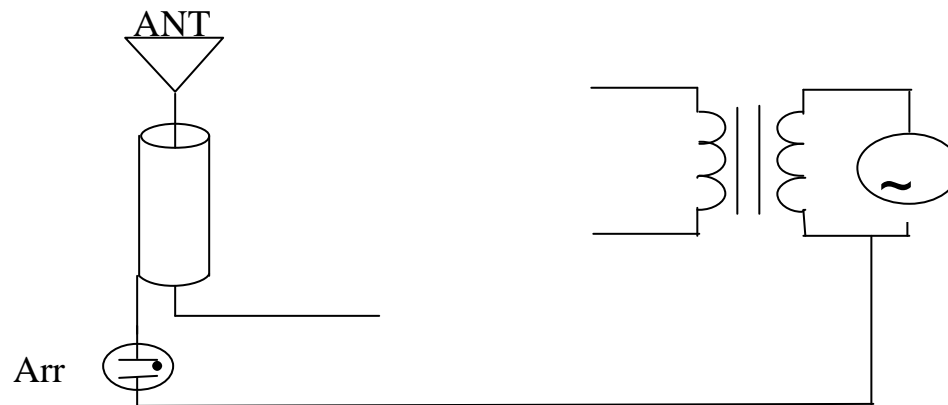


- Data Line, Sensor Line



Arr : R28-900-BHL or R38-900-BOL,
RHCA-201Q43U
SA : CP2007 or CP2022

- TV antenna

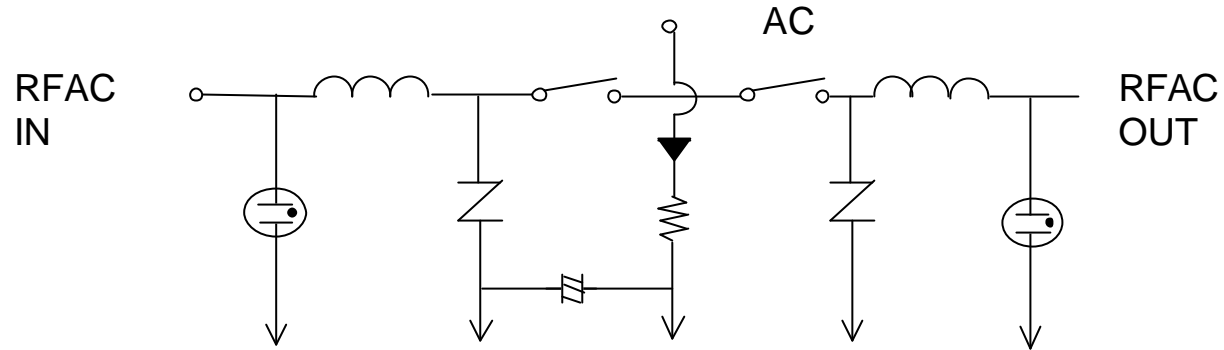


Arr : R28-242-BJL – R28-452-BKL

APPLICATION

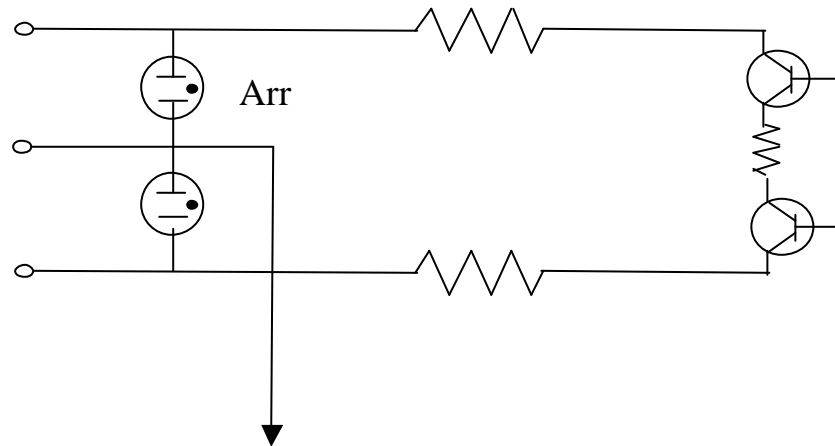


- CATV booster



Arr : R28-351-BHL

- Home Security System

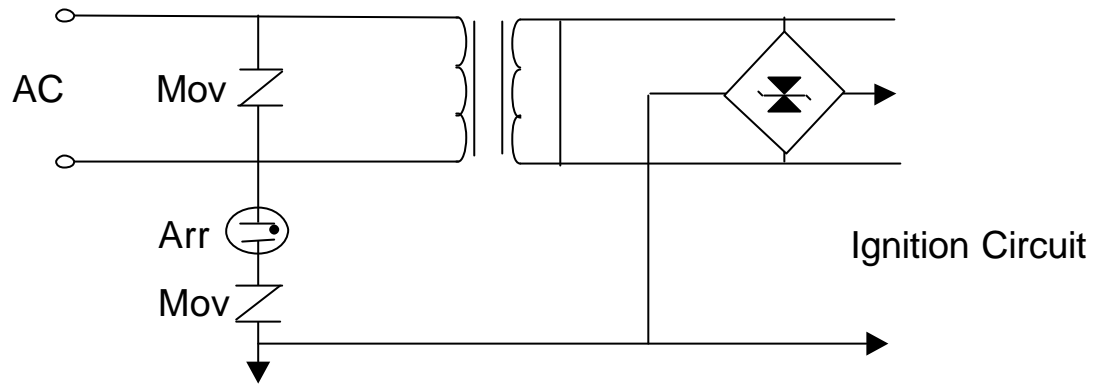


Arr :
INDOOR R28-900-BHL or
R38-900-BOL
OUT DOOR R28-351-BHL or
R38-351BOL

APPLICATION



- Water Heater Control Unit

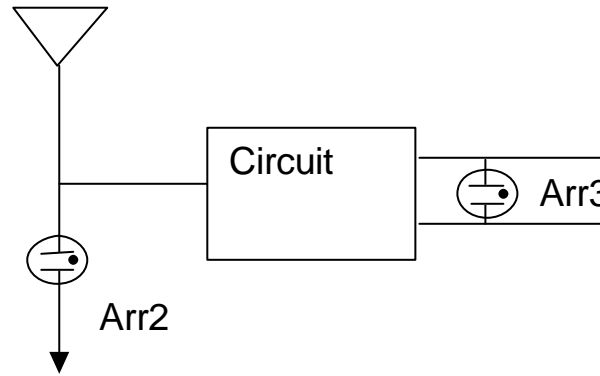
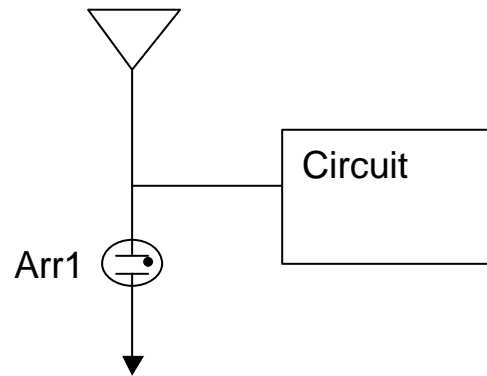


AC125V
Arr : R28-242-BJL
MOV : 270V

AC250V
Arr : R28-362-BKL
MOV : 470V

- Car Stereo,

- Wireless base station



Arr1 : RCCA-201Q31UA
Arr2 : RCCA-201Q31UA
Arr3 : R28-351-BHL or
RCCA-401Q43U

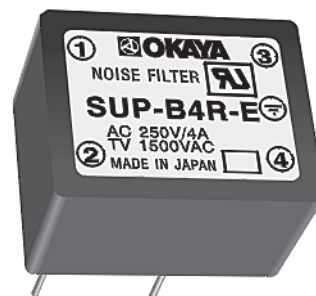
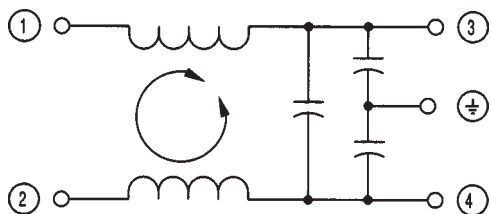
Fax Back Document #1301

SUP-B□R-E
SUP-C□G-E

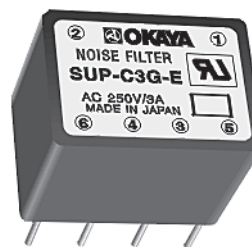
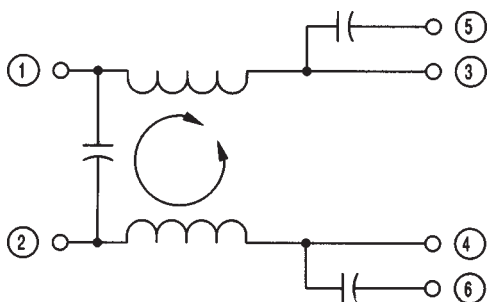
Safety Agency : Standard	File No.
UL : UL-1283	E78644

- P.C.B. mounting with wire leads
- High Attenuation in MF and HF bands
- Case material rated UL94-V0
- Compact size

SUP-B□R-E



SUP-C□G-E



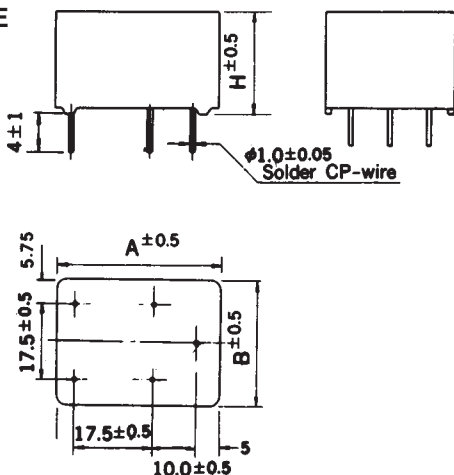
ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	SUP-B2R-E	2	Line to Line 1000 Vrms 50/60Hz 60sec	Line to Line 1000 M Ω min	1.0mA (at 250Vrms 60Hz)	1.0Vrms	20°C	-20 to +65
	SUP-B4R-E	4						
	SUP-B6R-E	6	Line to Ground 1500 Vrms 50/60Hz 60sec	Line to Ground 1000M Ω min (at 500VDC)		0.6Vrms	30°C	-20 to 55
	SUP-C3G-E	3						
	SUP-C6G-E	6						

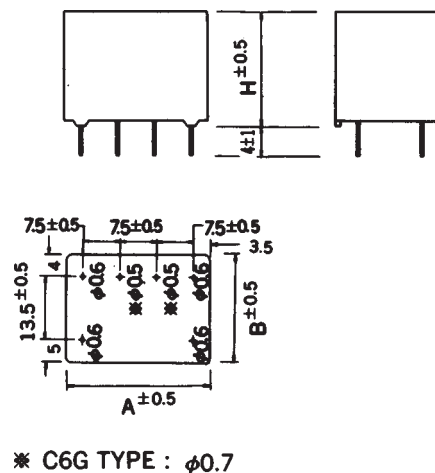
MECHANICAL DIMENSIONS

All Dimensions mm

SUP-B□R-E



SUP-C□G-E



DIMENSIONS

Model Number	Outside Dimension (mm)		
	A	B	H
SUP-B2R-E	37.0	29.0	23.0
SUP-B4R-E			
SUP-B6R-E			
SUP-C3G-E	29.5	22.0	23.5
SUP-C6G-E			

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

SUP-B□R-E

Part Number	Mode	Frequency - Megahertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-B2R-E	NORMAL, L-L	08	25	34	44	44	46	26	17	9
	COMMON, L-G	38	48	47	51	55	22	39	30	12
SUP-B4R-E	NORMAL, L-L	07	21	29	38	39	43	45	17	16
	COMMON, L-G	26	41	49	55	58	28	30	29	13
SUP-B6R-E	NORMAL, L-L	07	20	28	36	36	41	29	14	19
	COMMON, L-G	21	35	41	50	55	23	30	28	36

SUP-C□G-E

Part Number	Mode	Frequency - Megahertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-C3G-E	NORMAL, L-L	07	18	23	47	65	44	23	21	19
	COMMON, L-G	22	34	41	49	55	32	33	29	16
SUP-C6G-E	NORMAL, L-L	07	17	22	39	58	42	25	6	16
	COMMON, L-G	10	21	28	43	50	37	32	25	29

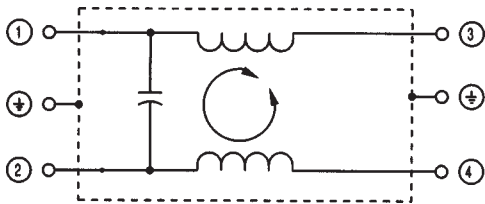
Fax Back Document #1302

SUP-J□G
SUP-J□G-E
SUP-J□G-E1

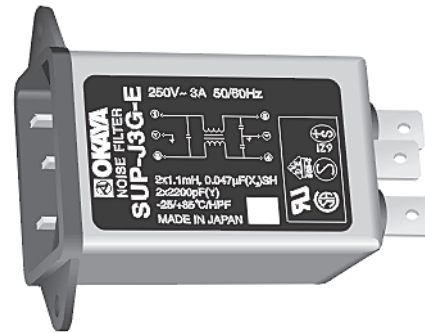
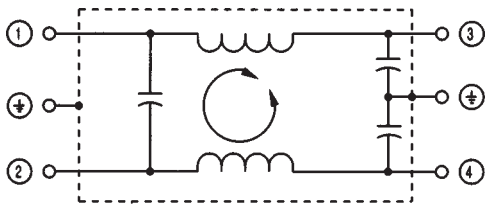
- Compact size
- IEC input connector
- UL544, Medical and Dental Equipment, rating
- Faston and Solder output terminals

Safety Agency	Standard	File No.
UL	: UL-1283	E78644
UL	: UL-544 *	E78644
CSA	: C22.2, No.8-M1986	LR60681
VDE	: VDE0565-3	10529-4730-1002
SEMKO	: IEC939	8946072, 9014077, 9016194
SEV	: IEC939	Nr.89.1 03047, Nr.91.1 112062

SUP-J□G



SUP-J□G-E



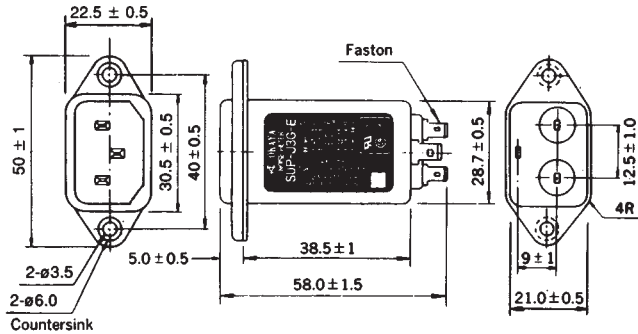
ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)		
	SUP-J3G-0* SUP-J3G-2*	3	Line to Line 1000 Vrms 50/60Hz 60sec	Line to Line 3000 MΩ min	10μA	0.6Vrms	20°C	-25 to 55		
	SUP-J3G-E SUP-J3G-E-2				0.5mA					
	SUP-J3G-E1-0* SUP-J3G-E1-2*	70μA								
	SUP-J6G-0* SUP-J6G-2*	6			10μA					
	SUP-J6G-E SUP-J6G-E-2				0.5mA					
	SUP-J6G-E1-0* SUP-J6G-E1-2*	70μA								
	SUP-J10G-0* SUP-J10G-2*	10			Line to Ground 2000 Vrms 50/60Hz 60sec				Line to Ground 6000MΩ min (at 500VDC)	10μA
	SUP-J10G-E SUP-J10G-E-2									0.5mA
SUP-J10G-E1-0* SUP-J10G-E1-2*	70μA									
SUP-J15G-0* SUP-J15G-2*	15		10μA							
SUP-J15G-E SUP-J15G-E-2		0.5mA								
SUP-J15G-E1-0* SUP-J15G-E1-2*		70μA								

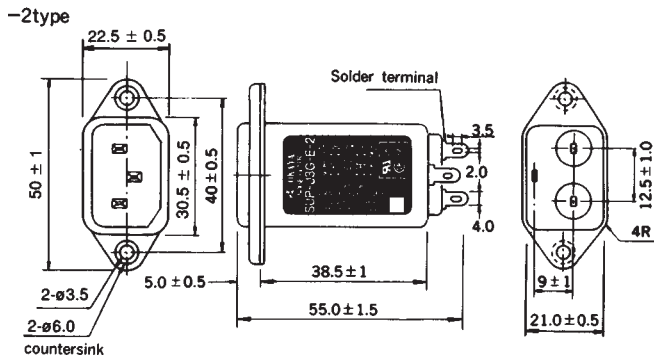
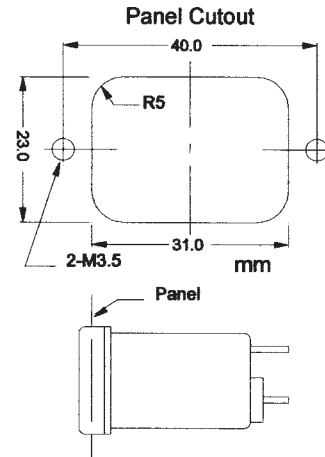
* These devices feature UL-544 (2601) recognition for medical & dental equipment applications.

MECHANICAL DIMENSIONS

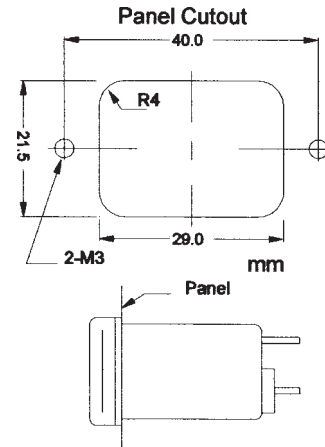
All Dimensions mm



SUP-J□G-0
SUP-J□G-E
SUP-J□G-E1-0



SUP-J□G-2
SUP-J□G-E-2
SUP-J□G-E1-2



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - Megahertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-J3G * SUP-J3G-E1	NORMAL, L-L	2	11	17	31	34	41	46	31	46
	COMMON, L-G	22	30	32	34	33	35	43	40	34
SUP-J6G * SUP-J6G-E1	NORMAL, L-L	2	12	17	27	31	41	45	53	49
	COMMON, L-G	18	22	24	29	34	40	46	54	37
SUP-J10G * SUP-J10G-E1	NORMAL, L-L	4	12	17	30	32	42	44	50	49
	COMMON, L-G	9	16	19	24	29	36	45	49	37
SUP-J10G-E SUP-J10G-E-2	NORMAL, L-L	4	12	17	27	37	47	40	40	46
	COMMON, L-G	8	16	20	35	47	59	44	39	32
SUP-J15G * SUP-J15G-E1	NORMAL, L-L	3	12	17	32	40	51	44	38	44
	COMMON, L-G	5	9	10	15	19	32	43	39	33
SUP-J15G-E SUP-J15G-E-2	NORMAL, L-L	4	12	17	28	33	48	35	37	45
	COMMON, L-G	4	10	14	28	48	55	44	37	33

* These devices have normal mode attenuation.
No "Y" capacitors are present for common mode.

Fax Back Document #1304

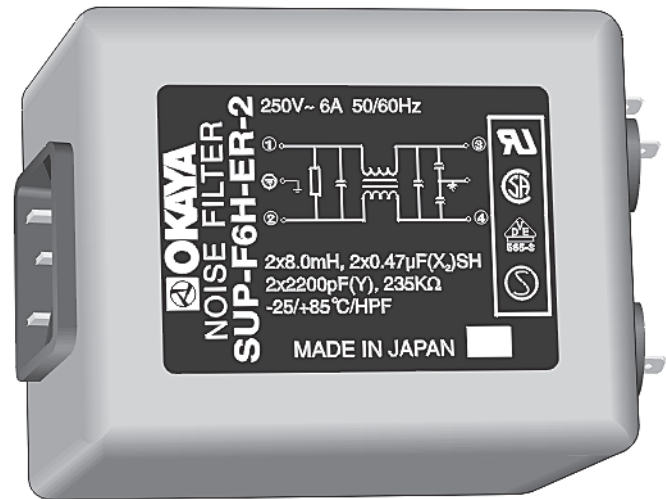
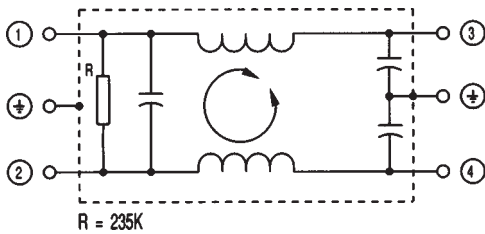
SUP-F□H-ER (Faston)

SUP-F□H-ER-2 (Solder)

- IEC input connector
- Bleeder Resistor for shock protection
- Normal and Common Mode Attenuation
- Chassis Sealable

Safety Agency	Standard	File No.
UL	: UL-1283	E78644
CSA	: C22.2, No.8-M1986	LR60681
VDE	: VDE0565-3	10529-4730-1002
SEMKO	: SS443 2901	8815052

SUP-F□H

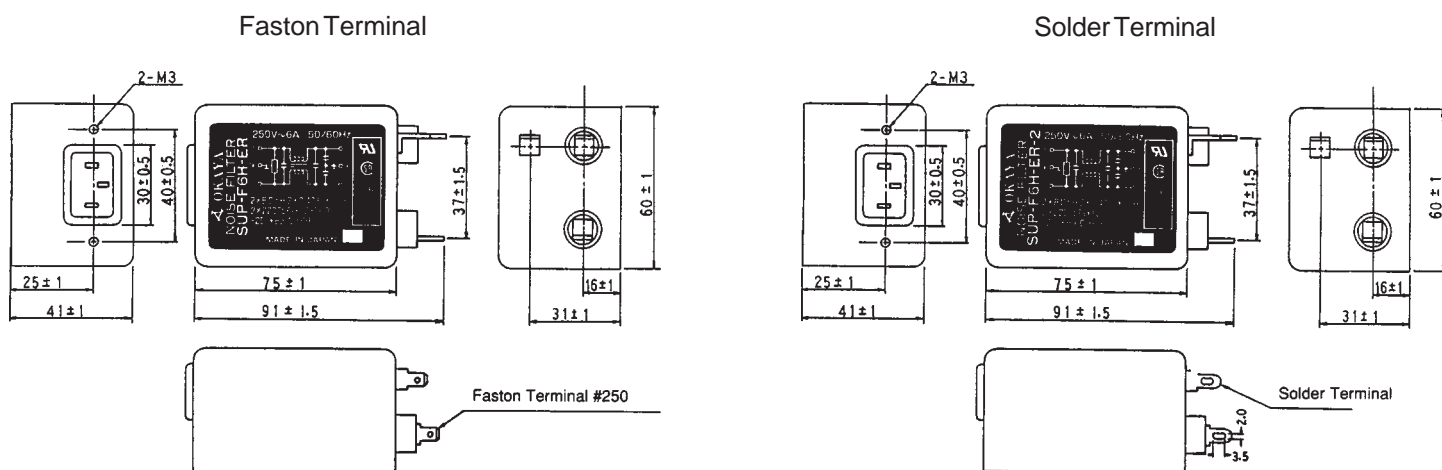


ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)					
	SUP-F3H-ER	3	Line to Line 1000Vrms 50/60Hz 60sec Line to Ground 2000Vrms 50/60Hz 60sec	Line to Ground 6000M Ω min (at 500VDC)	0.5mA (at 250Vrms 60Hz)	1.0Vrms	30°C	-25 to 55					
	SUP-F3H-ER-2												
	SUP-F6H-ER	6											
	SUP-F6H-ER-2												
	SUP-F10H-ER	10											
	SUP-F10H-ER-2												
	SUP-F15H-ER-2	15	Line to Line 1000Vrms 50/60Hz 60sec Line to Ground 2000Vrms 50/60Hz 60sec	Line to Ground 6000M Ω min (at 500VDC)	0.5mA (at 250Vrms 60Hz)	1.0Vrms	30°C	-25 to 55					
	SUP-F15H-ER-2												
	SUP-F15H-ER-2	15					Line to Line 1000Vrms 50/60Hz 60sec Line to Ground 2000Vrms 50/60Hz 60sec		Line to Ground 6000M Ω min (at 500VDC)	0.5mA (at 250Vrms 60Hz)	1.0Vrms	35°C	-25 to 50
	SUP-F15H-ER-2												

MECHANICAL DIMENSIONS

All Dimensions mm



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-F3H-ER	NORMAL, L-L	50	81	94	69	50	55	65	23	30
SUP-F3H-ER-2	NORMAL, L-G	46	43	41	40	41	44	46	21	28
SUP-F6H-ER	NORMAL, L-L	42	61	91	77	64	47	43	44	45
SUP-F6H-ER-2	NORMAL, L-G	37	40	41	40	39	42	40	43	35
SUP-F10H-ER	NORMAL, L-L	27	66	88	92	93	65	44	33	36
SUP-F10H-ER-2	NORMAL, L-G	26	31	35	42	43	52	46	32	25
SUP-F15H-ER	NORMAL, L-L	22	61	81	78	85	69	42	43	31
SUP-F15H-ER-2	NORMAL, L-G	24	39	40	39	40	41	45	40	23

Fax Back Document #1316

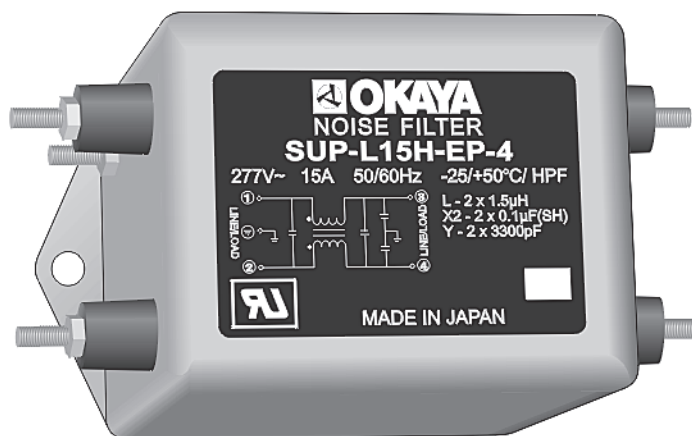
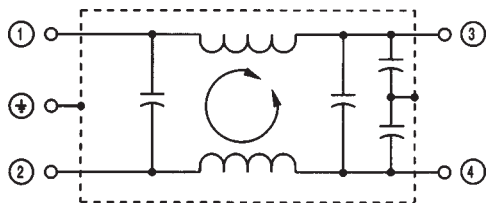
SUP-L□H-EP-4 Series

- High performance magnetic core material
- 20dB attenuation of 1000V, 800μsec pulse
- 277VAC for HVAC, Ballast and Lighting applications

Safety Agency : Standard	File No.
UL : UL-1283	E78644



SUP-L□H-EP-4

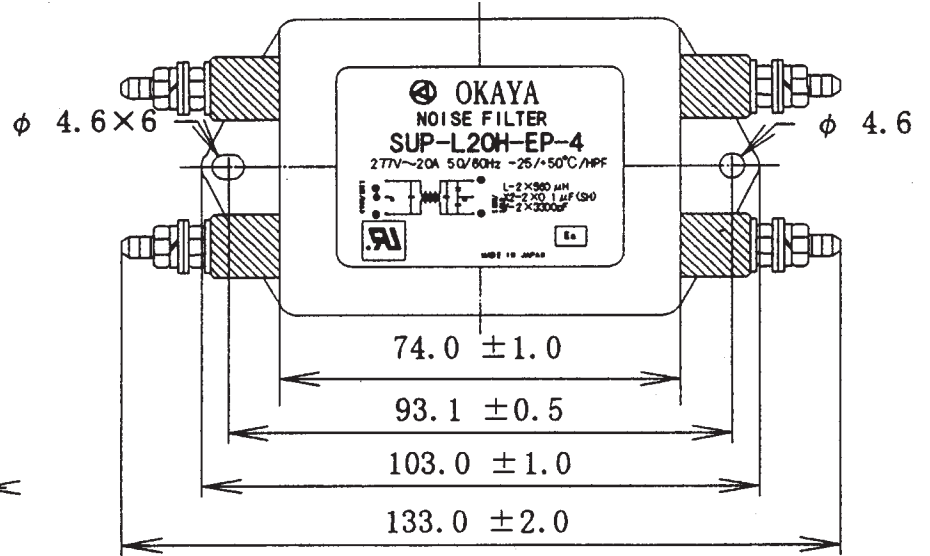
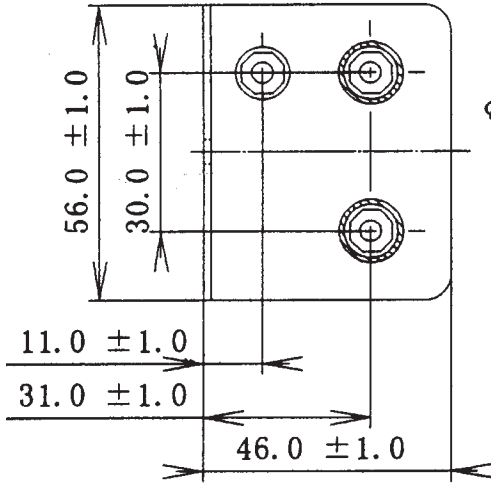


ELECTRICAL SPECIFICATIONS

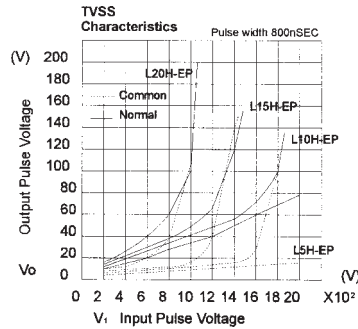
Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)	
UL	SUP-L5H-EP-4	5	Line to Line 1550Vrms 50/60Hz 60sec	Line to Line 3000MΩ min	0.6 mA (at 250Vrms 60Hz)	1.0Vrms	30°C	-25 to 55	
	SUP-L10H-EP-4	10					35°C	-25 to 50	
	SUP-L15H-EP-4	15	Line to Ground 2240Vrms 50/60Hz 60sec	Line to Ground 6000MΩ min					
	SUP-L20H-EP-4	20		(at 500VDC)					

MECHANICAL DIMENSIONS

Mechanical Drawings



TVSS characteristics



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-L5H-ER-4	NORMAL, L-L	05	44	64	79	67	55	57	36	24
	COMMON, L-G	32	44	49	55	59	49	52	50	19
SUP-L10H-ER-4	NORMAL, L-L	04	38	58	86	72	50	45	49	23
	COMMON, L-G	26	42	45	46	48	46	55	41	30
SUP-L15H-ER-4	NORMAL, L-L	07	32	54	81	71	63	49	31	21
	COMMON, L-G	22	41	43	42	45	47	45	44	21
SUP-L20H-ER-4	NORMAL, L-L	11	25	45	73	68	65	45	27	27
	COMMON, L-G	15	32	40	44	48	49	52	48	23

Fax Back Document #1305

SUP-E□H
SUP-E□H-0
SUP-E□H-2

- High performance magnetics for pulse absorption
- 20dB attenuation of 1000V, 800nsec. pulse
- UL544 (2601) Medical & Dental Equipment, rating
- Available in Vinyl lead, Screw, Faston and Solder terminals

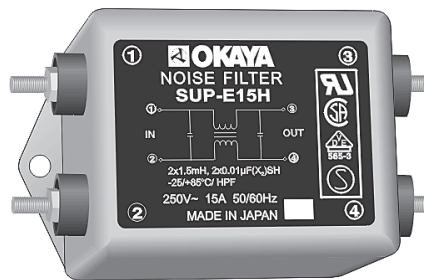
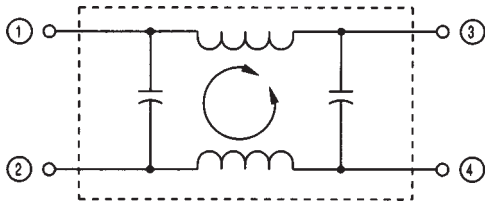
Safety Agency	Standard	File No.
UL	: UL-1283	E78644
UL	: UL-544 *	E78644
CSA	: C22.2, No.8-M1986	LR60681
VDE	: VDE0565-3	10529-4730-1001, 1003
SEMKO	: SEN432901	8415187
TUV	: VDE0565-3	R85074



(1, 2, 3A)



SUP-E□H



(5, 10, 15, 20A)



ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	SUP-E1H	1	Line to Line 1000Vrms 50/60Hz 60sec	Line to Line 3000MΩ min	10μA (at 250Vrms 60Hz)	1.0Vrms	30°C	-25 to 55
	SUP-E2H	2						
	SUP-E3H	3						
	SUP-E5H SUP-E5H-0 SUP-E5H-2	5	Line to Ground 1500Vrms 50/60Hz 60sec	Line to Ground 6000MΩ min (at 500VDC)	10μA (at 250Vrms 60Hz)	1.0Vrms	35°C	-25 to 50
	SUP-E10H SUP-E10H-0 SUP-E10H-2	10						
	SUP-E15H SUP-E15H-0 SUP-E15H-2	15						
	SUP-E20H SUP-E20H-0 SUP-E20H-2	20						

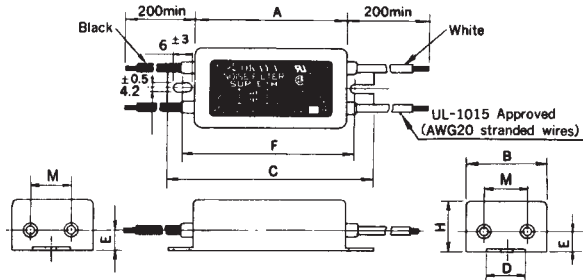
* These devices feature UL-544 (2601) recognition for medical & dental equipment applications.

MECHANICAL DIMENSIONS

All Dimensions mm

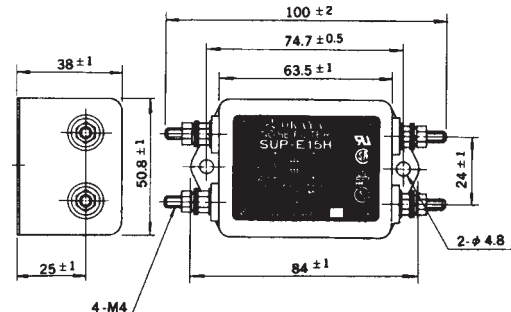
SUP-E□H

Wire Leads



SUP-EH
(1, 2, 3A)

Screw Terminal

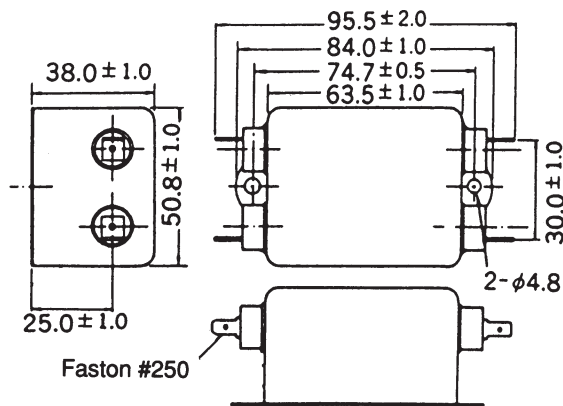
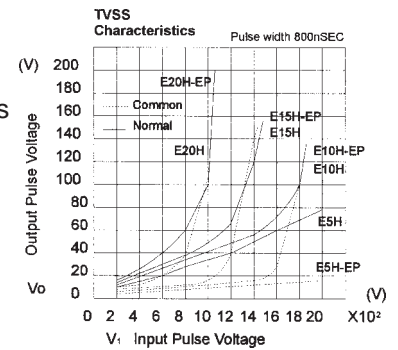


SUP-EH
(5, 10, 15, 20A)

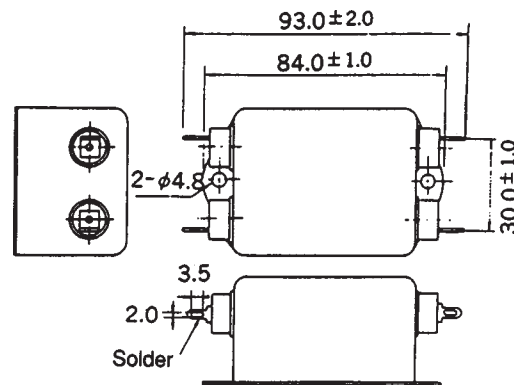
DIMENSIONS

Model Number	A ±1	B ±1	C ±1	D ±0.5	E ±1	F ±1	H ±0.5	M ±1
SUP-E1H	60	30	80	15	7.0	70	25	20
SUP-E2H	60	30	80	15	7.0	70	25	20
SUP-E3H	60	40	80	20	7.0	70	25	25

TVSS characteristics



SUP-EH-0
(5, 10, 15, 20A)



SUP-EH-2
(5, 10, 15, 20A)

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-E1H	NORMAL, L-L	14	49	66	89	90	69	53	36	29
SUP-E2H	NORMAL, L-L	14	49	66	89	89	69	53	36	29
SUP-E3H	NORMAL, L-L	09	45	64	85	88	71	55	34	17
SUP-E5H	NORMAL, L-L	05	44	64	79	67	55	57	36	24
SUP-E10H	NORMAL, L-L	04	38	58	86	72	50	45	49	23
SUP-E15H	NORMAL, L-L	07	32	54	81	71	63	49	31	21
SUP-E20H	NORMAL, L-L	11	25	45	73	68	65	45	27	27

Fax Back Document #1305

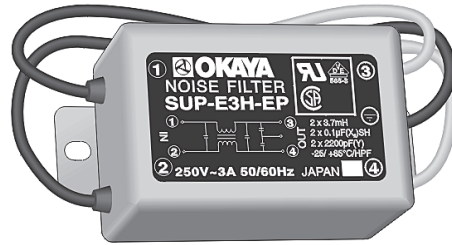
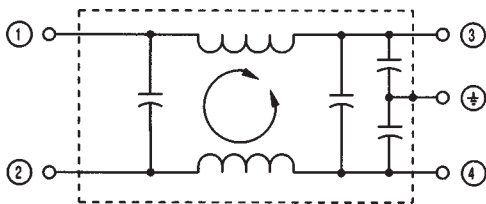
SUP-E□H-EP

- 20dB attenuation of 1000V, 800nsec. pulse
- Common & Normal Mode Attenuation
- High performance magnetic core material
- Available in Vinyl leads and Screw terminals

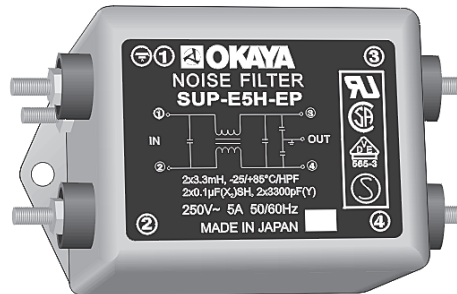
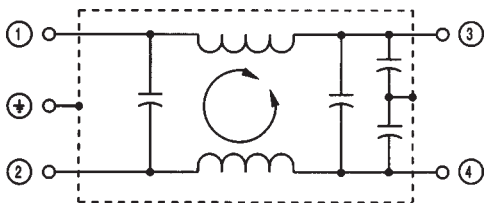
Safety Agency	Standard	File No.
UL	: UL-1283	E78644
CSA	: C22.2, No.8-M1986	LR60681
VDE	: VDE0565-3	10529-4730-1001,1003
SEMKO	: SEN 432901	8415187
TUV	: VDE 0565-3	R85074



SUP-E□H-EP (1, 2, 3AMP)



SUP-E□H-EP (5, 10, 15, 20AMP)



(5, 10, 15, 20A)

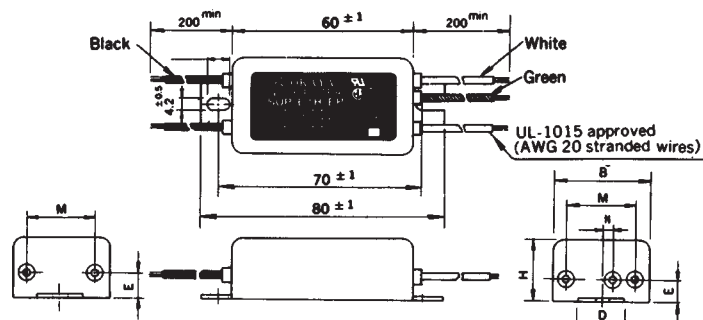
ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)				
	SUP-E1H-EP	1	Line to Line 1000Vrms 50/60Hz 60sec	Line to Line 3000MΩ min	0.5 mA (at 250Vrms 60Hz)	1.0Vrms	30°C	-25 to 55				
	SUP-E2H-EP	2										
	SUP-E3H-EP	3										
	SUP-E5H-EP	5					Line to Ground 1500Vrms 50/60Hz 60sec	Line to Ground 6000MΩ min (at 500VDC)	0.5 mA (at 250Vrms 60Hz)	1.0Vrms	35°C	-25 to 50
	SUP-E10H-EP	10										
	SUP-E15H-EP	15										
	SUP-E20H-EP	20										

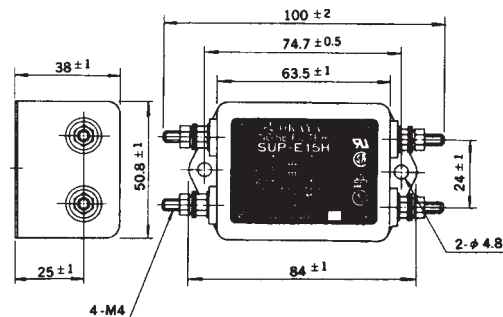
MECHANICAL DIMENSIONS

All Dimensions mm

SUP-E□H-EP

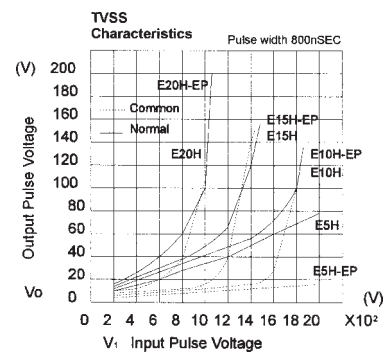


Screw Terminal



DIMENSIONS

Model Number	B ± 1	D ± 0.5	E ± 1	H ± 0.5	M ± 1	N ± 1
SUP-E1H-EP	30	15	7.0	25	20	3
SUP-E2H-EP	30	15	7.0	25	20	3
SUP-E3H-EP	40	20	7.0	25	25	4



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - Megahertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-E1H-EP	NORMAL, L-L	14	49	66	89	90	69	53	36	29
	COMMON, L-G	36	49	48	44	44	50	66	44	31
SUP-E2H-EP	NORMAL, L-L	14	49	66	89	89	69	53	36	29
	COMMON, L-G	36	49	48	44	44	50	66	44	31
SUP-E3H-EP	NORMAL, L-L	09	45	64	85	88	71	55	34	17
	COMMON, L-G	35	47	45	42	43	53	66	43	18
SUP-E5H-EP	NORMAL, L-L	05	44	64	79	67	55	57	36	24
	COMMON, L-G	32	44	49	55	59	49	52	50	19
SUP-E10H-EP	NORMAL, L-L	04	38	58	86	72	50	45	49	23
	COMMON, L-G	26	42	45	46	48	46	55	41	30
SUP-E15H-EP	NORMAL, L-L	07	32	54	81	71	63	49	31	21
	COMMON, L-G	22	41	43	42	45	47	45	44	21
SUP-E20H-EP	NORMAL, L-L	11	25	45	73	68	65	45	27	27
	COMMON, L-G	15	32	40	44	48	49	52	48	23

Fax Back Document #1307

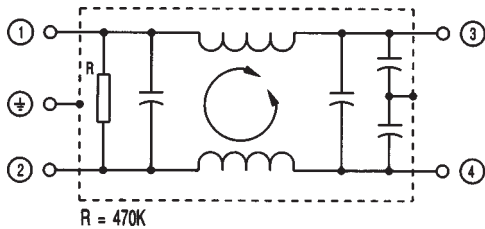
- SUP-G□H-EPR** (Faston)
- SUP-G□H-EPR-2** (Solder)
- SUP-G□H-EPR-4** (Screw)

- 20dB attenuation of 2000V, 800nsec. pulses
- Amorphous Alloy core material
- Bleed Resistor for shock protection
- Three Terminal Styles

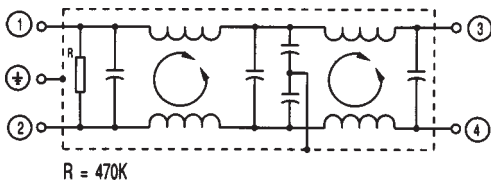
Safety Agency : Standard	File No.
UL : UL-1283	E78644
CSA : C22.2, No. 8-M1986	LR60681, LR60611
VDE : VDE0565-3	10529-4730-1001,1003
SEMKO : SEN432901	8707213



SUP-G□H-EPR (5 AND 10 AMP)



SUP-G□H-EPR (15 AND 20 AMP)

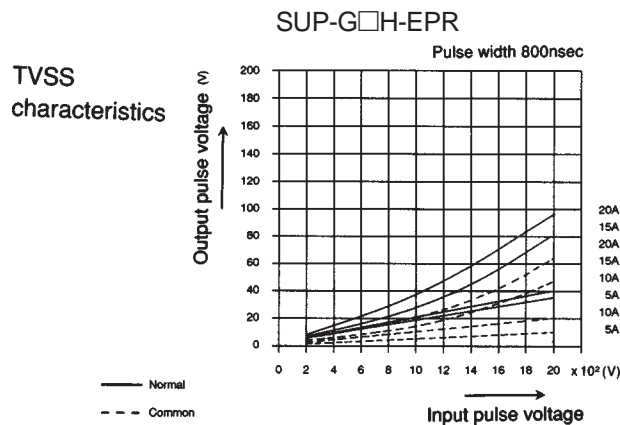
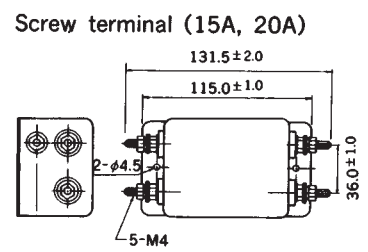
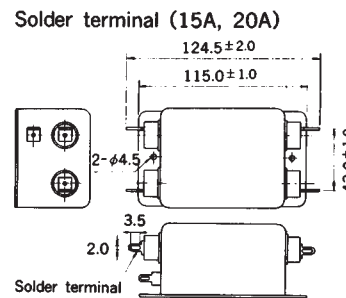
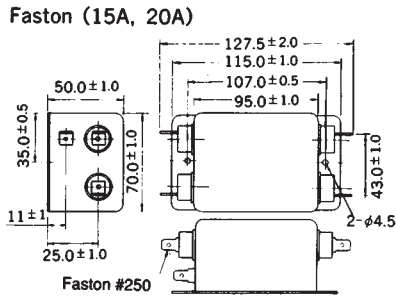
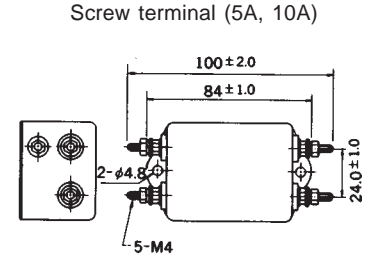
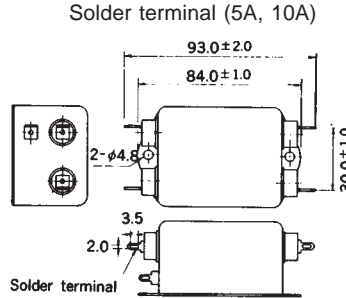
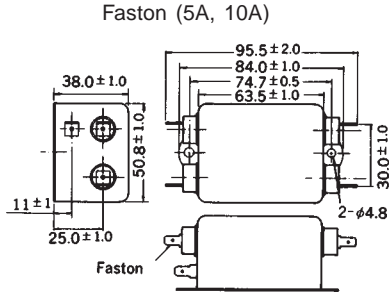


ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)			
	SUP-G5H-EPR	5	Line to Line 1000Vrms 50/60Hz 60sec	Line to Ground 6000MΩ min (at 500VDC)	0.6 mA (at 250Vrms 60Hz)	1.0Vrms	30°C	-25 to 55			
	SUP-G5H-EPR-2										
	SUP-G5H-EPR-4										
		SUP-G10H-EPR					10		Line to Ground 2000Vrms 50/60Hz 60sec	35°C	-25 to 50
		SUP-G10H-EPR-2									
		SUP-G10H-EPR-4									
		SUP-G15H-EPR					15				
		SUP-G15H-EPR-2									
SUP-G15H-EPR-4											
	SUP-G20H-EPR	20									
	SUP-G20H-EPR-2										
	SUP-G20H-EPR-4										

MECHANICAL DIMENSIONS

All Dimensions mm



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

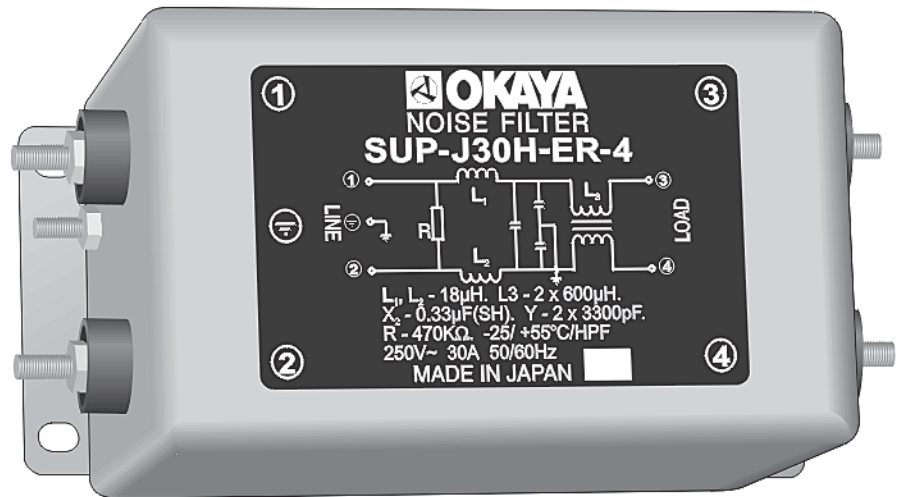
Part Number	Mode	Frequency - Megahertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-G5H-EPR	NORMAL, L-L	20	57	73	65	60	56	52	38	23
SUP-G5H-EPR-2	COMMON, L-G	32	45	53	64	67	50	55	59	18
SUP-G5H-EPR-4		30	42	50	55	56	49	68	35	26
SUP-G10H-EPR	NORMAL, L-L	14	54	71	67	61	51	55	47	27
SUP-G10H-EPR-2	COMMON, L-G	30	42	50	55	56	49	68	35	26
SUP-G10H-EPR-4		25	54	67	75	69	60	62	42	18
SUP-G15H-EPR	NORMAL, L-L	11	61	91	71	63	62	66	23	22
SUP-G15H-EPR-2	COMMON, L-G	25	54	67	75	69	60	62	42	18
SUP-G15H-EPR-4		22	45	59	78	74	62	66	52	27
SUP-G20H-EPR	NORMAL, L-L	11	51	85	70	64	61	66	39	28
SUP-G20H-EPR-2	COMMON, L-G	22	45	59	78	74	62	66	52	27
SUP-G20H-EPR-4		22	45	59	78	74	62	66	52	27

Fax Back Document #1310

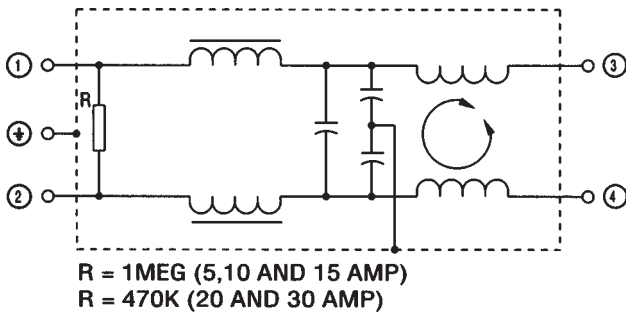
SUP-J□H-ER

- Rated 5-30 Ampere at 250VAC
- Common and Normal mode attenuation to 300 MHz
- Bleed Resistor for shock protection

Safety Agency	Standard	File No.
UL	: UL-1283 (250VAC)	E78644
CSA	: C22.2, No.8-M1986	LR60681
VDE	: VDE0565-3	10529-4730-1001



SUP-J□H-ER

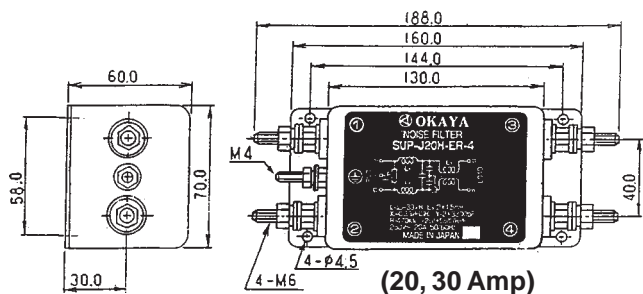
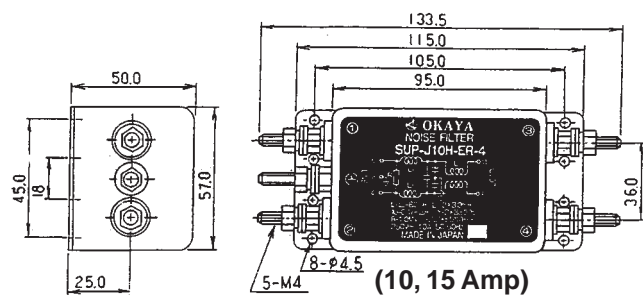
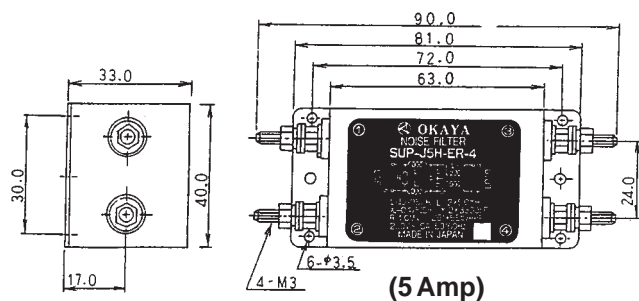


ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
 	SUP-J5H-ER-4	5	Line to Line 1000Vrms 50/60Hz 60sec	Line to Ground 6000MΩ min (at 500VDC)	1.0mA (at 250Vrms 60Hz)	1.5Vrms	30°C	-25 to 55
	SUP-J10H-ER-4	10						
	SUP-J15H-ER-4	15	Line to Ground 2000Vrms 50/60Hz 60sec					
	SUP-J20H-ER-4	20						
	SUP-J30H-ER-4	30						

MECHANICAL DIMENSIONS

All Dimensions mm



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

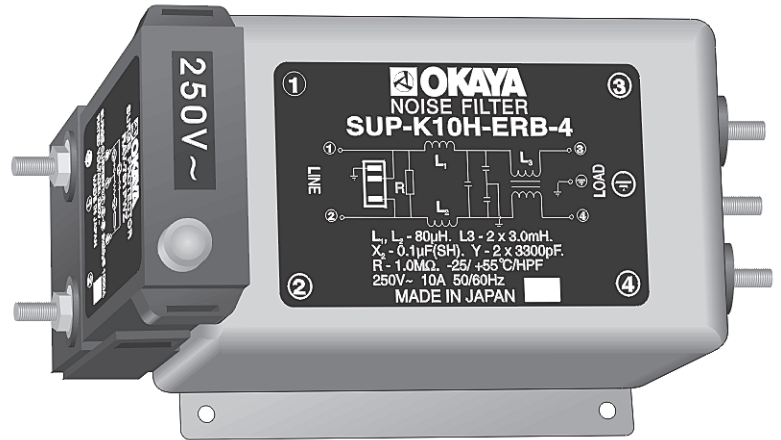
Part Number	Mode	Frequency - Megahertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUPJ5H-ER-4	NORMAL, L-L	18	41	57	75	73	42	49	59	67
	COMMON, L-G	34	47	53	49	50	38	45	36	24
SUPJ10H-ER-4	NORMAL, L-L	16	39	53	66	63	39	38	27	23
	COMMON, L-G	29	43	53	59	56	24	27	24	19
SUPJ15H-ER-4	NORMAL, L-L	10	30	45	65	65	54	42	26	24
	COMMON, L-G	22	33	43	60	59	33	40	28	23
SUP-J20H-ER-4	NORMAL, L-L	21	45	71	65	63	33	24	23	24
	COMMON, L-G	25	36	40	56	52	24	30	27	18
SUP-J30H-ER-4	NORMAL, L-L	16	37	55	54	58	44	30	17	35
	COMMON, L-G	18	29	35	57	54	30	32	26	32

Fax Back Document #1311

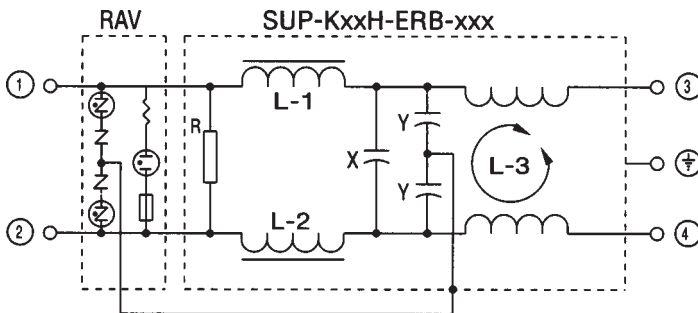
SUP-K□H-ERB

- EMI/RFI Filter with Transient Voltage Protection
- Common and Normal Mode Attenuation to 300 MHz
- 125VAC and 250VAC Models
- TVS Protection Monitoring Indicator
- TVS Protector is replaceable

Safety Agency	Standard	File No.
UL	: UL-1283 (250VAC)	E78644
	: UL-1449	E143446



SUP-K□H-ERB-4P



R = 1MEG (10 AND 15 AMP)
R = 470K (20 AND 30 AMP)

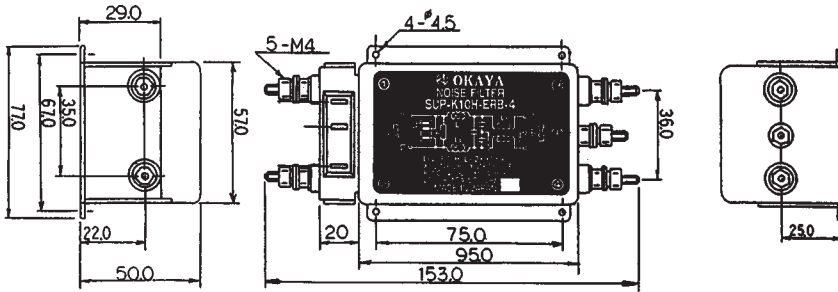


ELECTRICAL SPECIFICATIONS

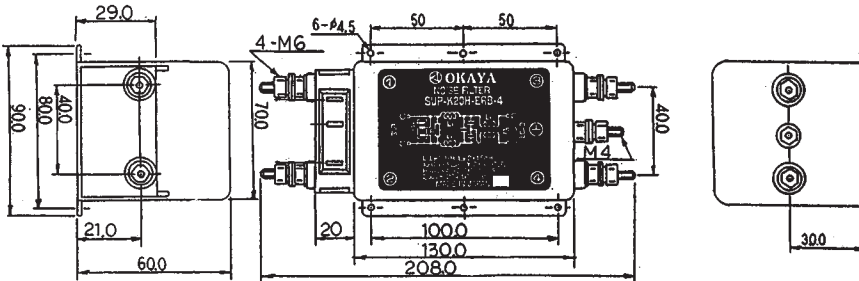
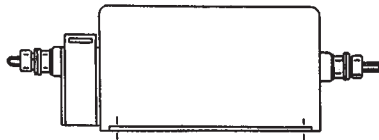
Safety Standard	Model number	Rated voltage (VAC)	Rated current (A)	Maximum discharge voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
UL	SUP-K10H-ERB-4P1	125	10	1.2/50μS 12KV	Line to Ground 100MΩ min (at 100VDC)	0.5mA (at 125Vrms 60Hz)	1.5Vrms	30°C	-25 to 55
	SUP-K15H-ERB-4P1		15						
	SUP-K20H-ERB-4P1		20						
	SUP-K30H-ERB-4P1		30						
	SUP-K10H-ERB-4P2	250	10			1.0mA (at 250Vrms 60Hz)			
	SUP-K15H-ERB-4P2		15						
	SUP-K20H-ERB-4P2		20						
	SUP-K30H-ERB-4P2		30						

MECHANICAL DIMENSIONS

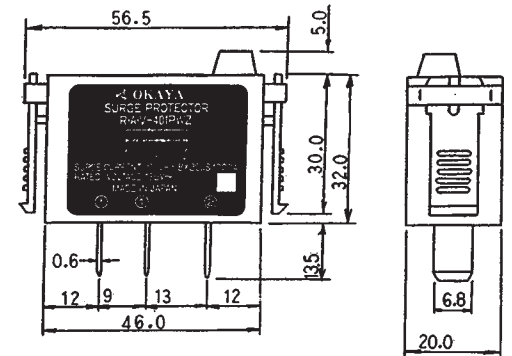
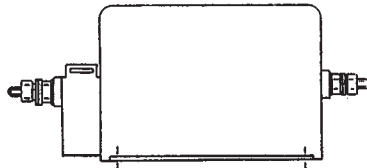
All Dimensions mm



SUP-K10/15H



SUP-K20/30H



RAV-401/781 PWZ



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

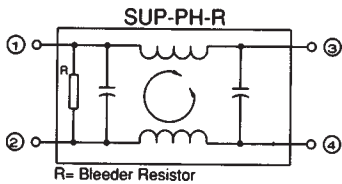
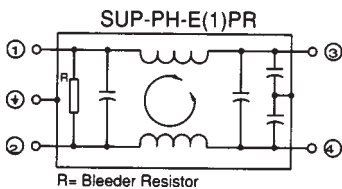
Part Number	Mode	Frequency - Megahertz								
		0.15	0.5	1.0	5.0	10	30	50	100	300
SUP-K10H-ER-4	NORMAL, L-L	16	39	53	66	63	39	38	27	23
	COMMON, L-G	29	43	53	59	56	24	27	24	19
SUP-K15H-ER-4	NORMAL, L-L	10	30	45	65	65	54	42	26	24
	COMMON, L-G	22	33	43	60	59	33	40	28	23
SUP-K20H-ER-4	NORMAL, L-L	21	45	71	65	63	33	24	23	24
	COMMON, L-G	25	36	40	56	52	24	30	27	18
SUP-K30H-ER-4	NORMAL, L-L	16	37	55	54	58	44	30	17	35
	COMMON, L-G	18	29	35	57	54	30	32	26	32

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- SUP-P□H-EPR-0** (Faston)
- SUP-P□H-EPR-2** (Solder)
- SUP-P□H-EPR-4** (Screw)

Safety Agency : Standard	File No.
UL : UL-1283	E78644
UL : UL-544*	E78644
CSA : C22.2, No. 8-M1986	LR60681
TUV : VDE 0565-3	R9250051

- EMI/RFI Noise Filter for Low Band Width Applications
- High μ Core Material
- 20-30dB Attenuation at 10KHz
- 30 Models Designed for Medical Applications
- Available in Faston, Solder and Screw Terminal Styles



ELECTRICAL SPECIFICATIONS

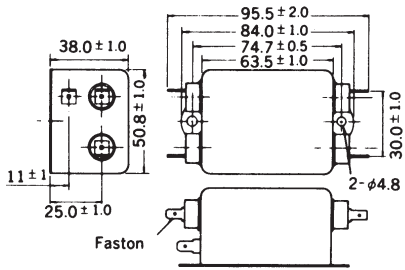
Safety Standard	Model No.	Rated current (A)	Test voltage	Insulation resistance	Leakage current (at 250Vrms 60Hz)	Voltage drop (max.)	Temperature rise (max.)	Operating temp. range (C)
 	* SUP-P5H-R-0(2,4)	5	Line to Line 1000Vrms 50/60Hz 60sec	Line to Ground 6000MΩ min. (at 500VDC)	10μA	1.0Vrms	35°C	-25° to +50°
	SUP-P5H-EPR-0(2,4)				0.6mA			
	* SUP-P5H-E1PR-0(2,4)	8			70μA			
	* SUP-P8H-R-0(2,4)				10μA			
	SUP-P8H-EPR-0(2,4)	0.6mA						
	* SUP-P8H-E1PR-0(2,4)	10			70μA			
	* SUP-P10H-R-0(2,4)				10μA			
	SUP-P10H-EPR-0(2,4)	0.6mA						
	* SUP-P10H-E1PR-0(2,4)	15			70μA			
	* SUP-P15H-R-0(2,4)				10μA			
	SUP-P15H-EPR-0(2,4)	0.6mA						
	* SUP-P15H-E1PR-0(2,4)	20			70μA			
	* SUP-P20H-R-0(2,4)				10μA			
	SUP-P20H-EPR-0(2,4)	0.6mA						
	* SUP-P20H-E1PR-0(2,4)	30			70μA			
* SUP-P30H-R-4	10μA							
SUP-P30H-EPR-4	0.6mA							
* SUP-P30H-E1PR-4	70μA							

* These devices feature UL-544 (2601) recognition for medical & dental equipment applications.

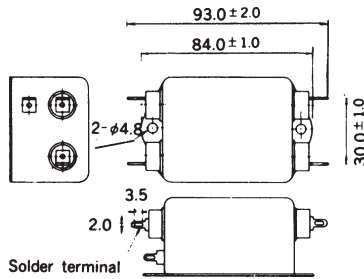
MECHANICAL DIMENSIONS

All Dimensions mm

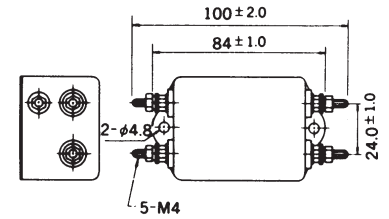
Faston (5, 10, 15, 20A)



Solder (5, 10, 15, 20A)



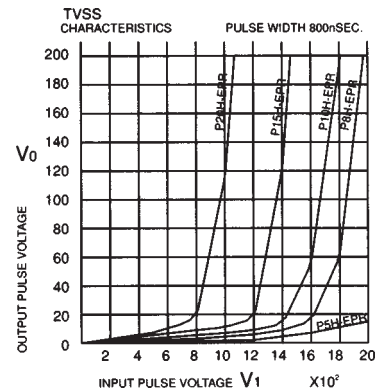
Screw (5, 10, 15, 20, 30A)



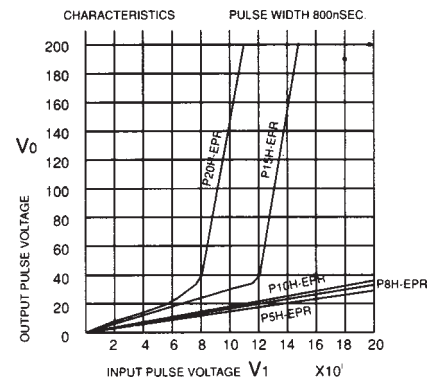
STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz							
		0.01	0.05	0.1	0.5	1.0	5.0	10	30
SUP-P5H-R	NORMAL, L-L	2	8	9	59	78	88	69	39
SUP-P5H-EPR	NORMAL, L-L	1	8	9	58	74	94	72	51
	COMMON, L-G	31	42	43	54	56	59	61	51
SUP-P5H-E1PR	NORMAL, L-L	1	8	7	55	72	70	68	38
	COMMON, L-G	31	40	43	50	49	41	39	36
SUP-P8H-R	NORMAL, L-L	1	9	9	52	67	72	67	60
SUP-P8H-EPR	NORMAL, L-L	1	9	8	51	66	63	58	60
	COMMON, L-G	30	41	42	47	50	52	53	42
SUP-P8H-E1PR	NORMAL, L-L	1	9	9	50	67	61	55	60
	COMMON, L-G	30	39	42	46	48	41	40	48
SUP-P10H-R	NORMAL, L-L	2	9	11	50	70	80	77	45
SUP-P10H-EPR	NORMAL, L-L	1	9	11	54	69	76	70	51
	COMMON, L-G	28	36	39	48	47	49	50	48
SUP-P10H-E1PR	NORMAL, L-L	1	9	11	48	67	74	73	48
	COMMON, L-G	28	37	39	42	46	39	37	41
SUP-P15H-R	NORMAL, L-L	1	7	11	38	57	85	80	48
SUP-P15H-EPR	NORMAL, L-L	1	7	11	37	56	85	78	56
	COMMON, L-G	25	33	35	43	47	49	51	48
SUP-P15H-E1PR	NORMAL, L-L	1	7	11	38	59	75	70	59
	COMMON, L-G	20	31	34	39	39	32	29	30
SUP-P20H-R	NORMAL, L-L	1	7	12	30	52	78	79	54
SUP-P20H-EPR	NORMAL, L-L	1	7	12	30	51	78	80	65
	COMMON, L-G	16	25	28	37	40	53	55	50
SUP-P20H-E1PR	NORMAL, L-L	1	7	12	11	49	71	61	64
	COMMON, L-G	16	25	27	29	34	37	36	38
SUP-P30H-R	NORMAL, L-L	1	8	12	20	37	64	52	51
SUP-P30H-EPR	NORMAL, L-L	1	7	13	19	35	65	54	56
	COMMON, L-G	7	15	16	23	28	46	53	48

NORMAL MODE



COMMON MODE



SUP-ET□-ER-0

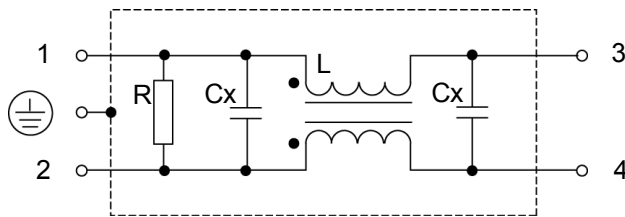
- Wiring with Fasten terminal.
- High attenuation by using a ferrite Core with broad frequency characteristic.
- Wide rating up (5, 8, 10, 15, 20Ampere)
- Inclusion of bleeder resistance for electric shock protection.

Safety Agency: Standard	File No.
UL : UL-1283	E78644
CSA*1 : C22.2, No.8-M1986	E78644
SEMKO : EN133200	SE/0142-2

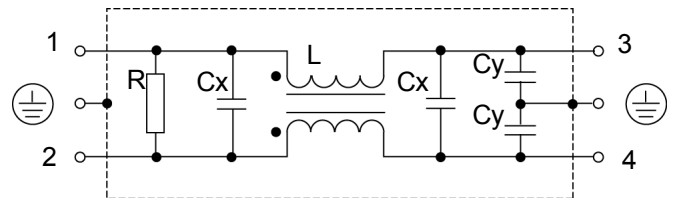
*1 cUL



Circuit diagram (5 ~ 20A)



SUP-ETX-R-0



SUP-ETX-ER-0

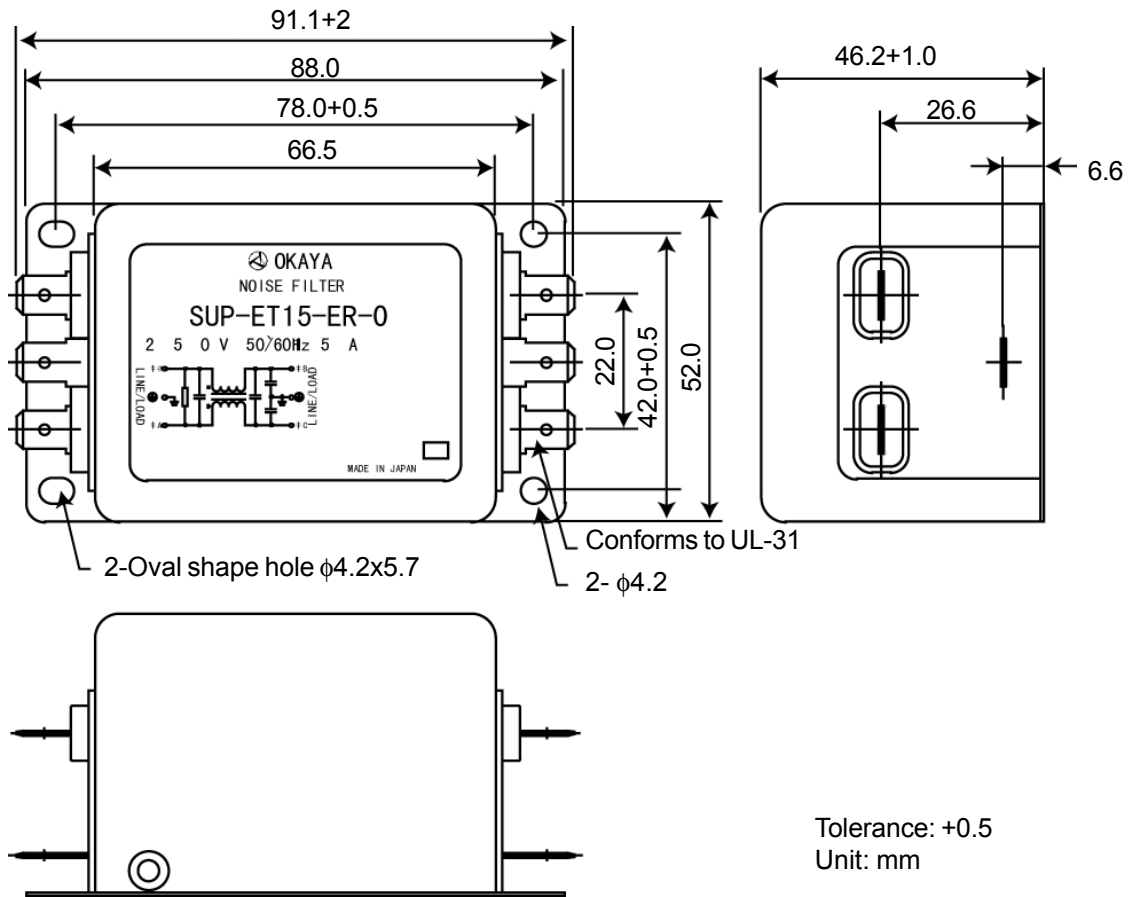
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -25°C ~ +55°C

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.) (250Vrms 60Hz)	Voltage drop (max.)	Temperature rise (max.)
UL	SUP-ET5-R-0	5	Line to Ground 1500Vrms 50/60Hz 60sec	Line to Ground 100MΩmin (at 500VDC)	10μA	1.0Vrms	45°C
	SUP-ET5-ER-0				0.6mA		
CSA	SUP-ET8-ER-0	8			10μA		
	SUP-ET8-ER-0				0.6mA		
CE*2	SUP-ET10-R-0	10			10μA		
	SUP-ET10-ER-0				0.6mA		
CE*2	SUP-ET15-R-0	15			10μA		
	SUP-ET15-ER-0				0.6mA		
CE*2	SUP-ET20-R-0	20			10μA		
	SUP-ET20-ER-0				0.6mA		

*2Our products have European approval which assists in obtaining the CE Marking in accordance with the EC Low Voltage Directive

MECHANICAL DIMENSIONS



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50 Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10	30
SUP-ET5-(E)R-0	Normal L-L	61	83	78	65	60	53
SUP-ET5-ER-0	Common L-G	48	48	46	45	45	47
SUP-ET8-(E)R-0	Normal L-L	53	77	77	65	60	50
SUP-ET8-ER-0	Common L-G	42	48	47	46	47	42
SUP-ET10-(E)R-0	Normal L-L	52	80	78	65	58	50
SUP-ET10-ER-0	Common L-G	39	48	45	45	44	45
SUP-ET15-(E)R-0	Normal L-L	48	81	81	78	73	76
SUP-ET15-ER-0	Common L-G	33	43	45	47	48	46
SUP-ET20-(E)R-0	Normal L-L	37	76	79	62	58	52
SUP-ET20-ER-0	Common L-G	25	35	39	48	52	52

SUP-EP□-ER-6

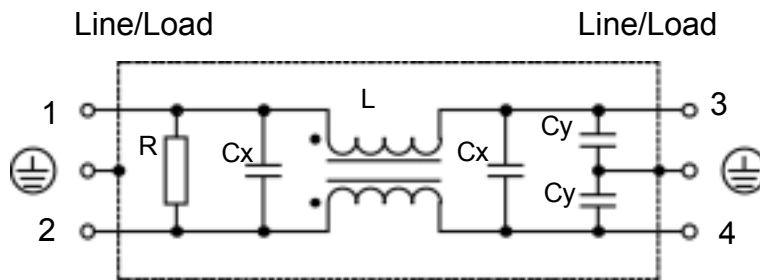
- Uses easy-wiring terminal block.
- General purpose model made with ferrite core.
- Bleeder resistor for protecting against electric shock.
- Thyristor-applied systems, fax machines, game machines, variety of control systems.

Safety Agency: Standard		File No.
UL	: UL-1283	E78644
CSA*1	: C22.2, No.8-M1986	E78644
TUV	: EN133200	NR2-50006831

*1 cUL






Circuit diagram



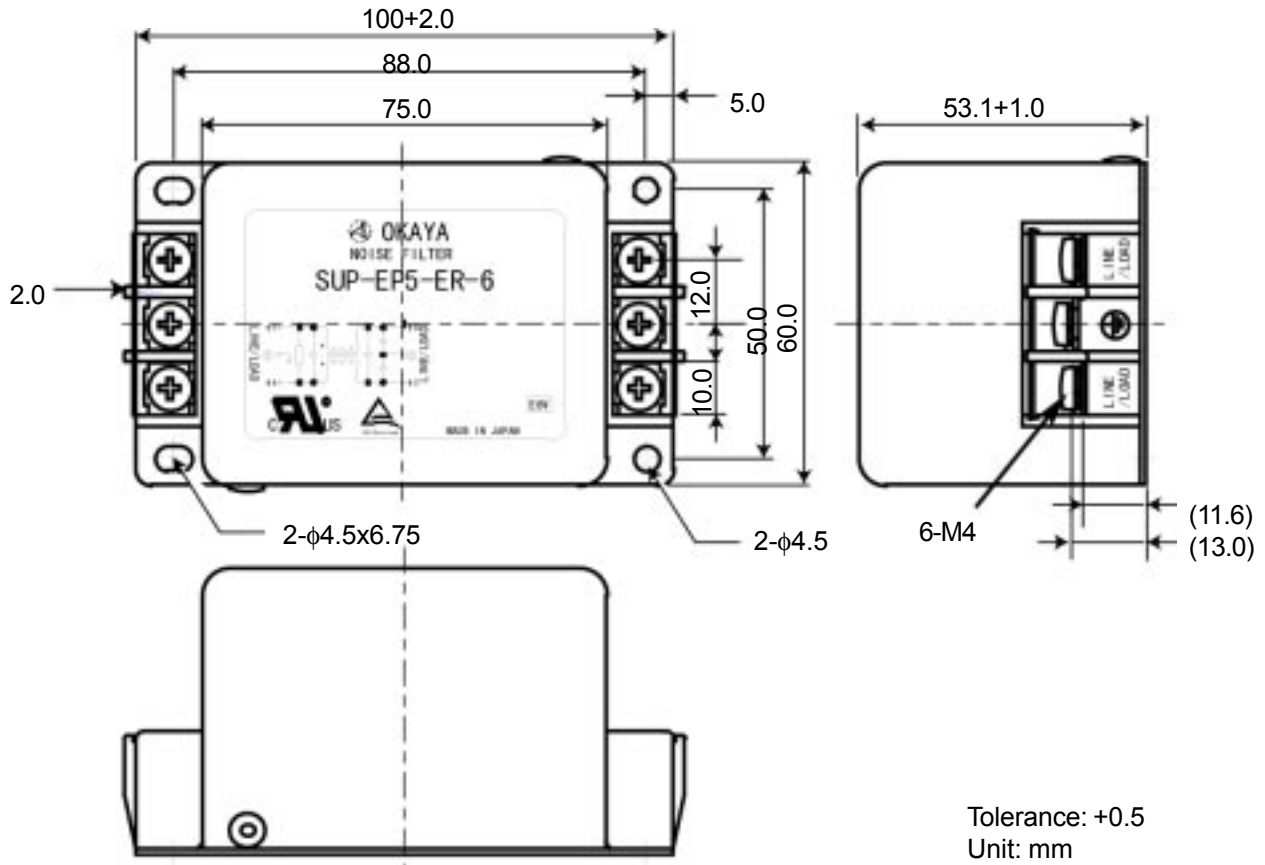
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -25°C ~ +55°C

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)
   *2	SUP-EP5-ER-6	5	Line to Ground 2500Vrms 50/60Hz 60sec	Line to Ground 100MΩmin (at 500VDC)	1mA (at 250Vrms 60Hz)	1.0Vrms	45°C
	SUP-EP10-ER-6	10					
	SUP-EP15-ER-6	15					
	SUP-EP20-ER-6	20					
	SUP-EP30-ER-6	30					

*2Our products have European approval which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive

MECHANICAL DIMENSIONS



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10	30
SUP-EP5-ER-6	Normal L-L	52	78	81	73	67	68
	Common L-G	38	48	52	58	59	65
SUP-EP10-ER-6	Normal L-L	48	76	81	73	67	68
	Common L-G	35	46	48	53	57	40
SUP-EP15-ER-6	Normal L-L	42	72	80	74	68	70
	Common L-G	28	38	43	52	57	48
SUP-EP20-ER-6	Normal L-L	34	68	79	75	69	69
	Common L-G	22	32	38	48	53	53
SUP-EP30-ER-6	Normal L-L	25	55	73	79	72	70
	Common L-G	11	21	26	38	43	46

SUP-EQ□-ER-6

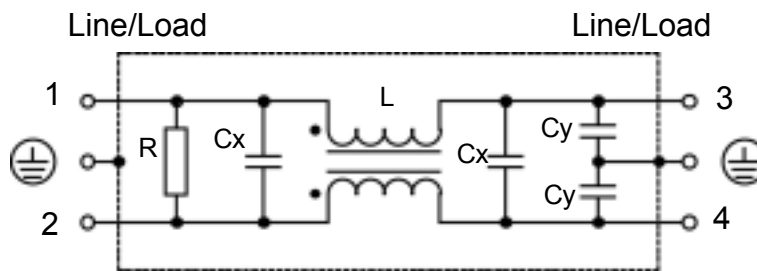
- Uses easy wiring terminal block.
- Super high μ core material ensures high attenuation.
- Bleeder resistor for protecting against electric shock.
- Information processing systems (specially for export to Europe, office appliances, various control systems).

Safety Agency: Standard		File No.
UL	: UL-1283	E78644
CSA*1	: C22.2, No.8-M1986	E78644
TUV	: EN133200	R2-50006839

*1 cUL






Circuit diagram



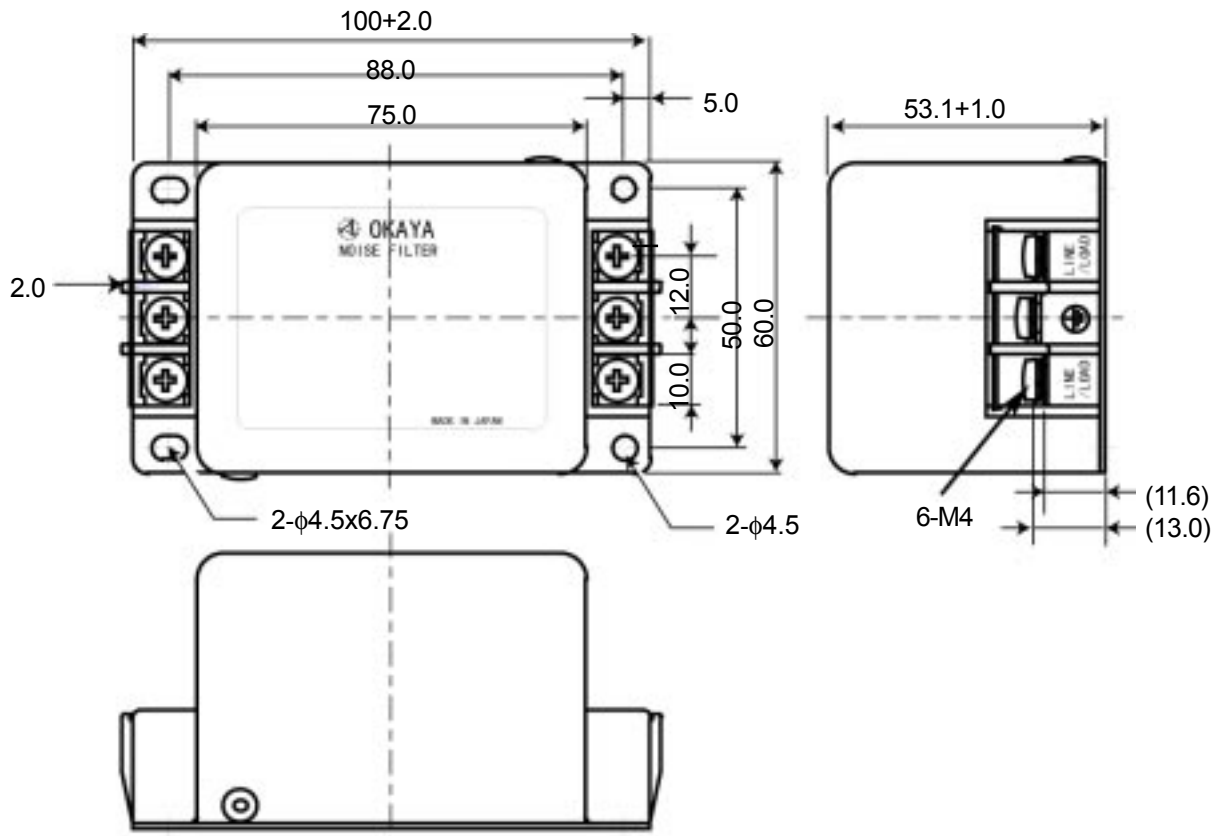
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -25°C ~ +55°C

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)
   *2	SUP-EQ5-ER-6	5	Line to Ground 2500Vrms 50/60Hz 60sec	Line to Ground 100M Ω min (at 500VDC)	1mA (at 250Vrms 60Hz)	1.0Vrms	45°C
	SUP-EQ10-ER-6	10					
	SUP-EQ15-ER-6	15					
	SUP-EQ20-ER-6	20					
	SUP-EQ30-ER-6	30					

*2 Our products have European approval which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive

MECHANICAL DIMENSIONS



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10	30
SUP-EQ5-ER-6	Normal L-L	52	78	83	73	67	70
	Common L-G	47	53	58	60	62	58
SUP-EQ10-ER-6	Normal L-L	48	75	81	73	67	69
	Common L-G	43	49	53	55	58	38
SUP-EQ15-ER-6	Normal L-L	42	73	80	74	68	70
	Common L-G	38	43	50	56	58	48
SUP-EQ20-ER-6	Normal L-L	31	65	78	76	68	71
	Common L-G	31	37	42	56	59	52
SUP-EQ30-ER-6	Normal L-L	25	55	73	78	71	69
	Common L-G	19	25	31	47	55	58

SUP-EK□-ER-6

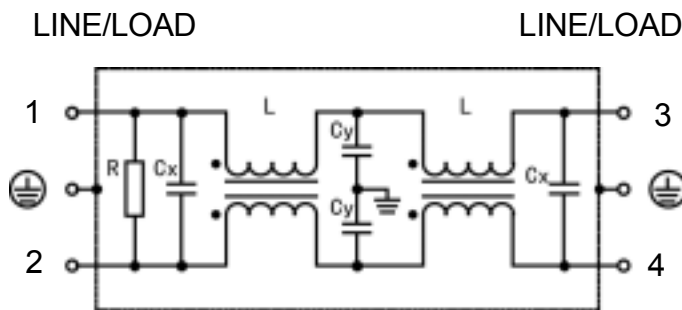
- Uses easy wiring terminal block.
- The two-stage ferrite core allows high attenuation over a broad band range.
- Bleeder resistor for protecting against electric shock.
- Information processing systems (specially for export to Europe, office appliances, various control systems and others).

Safety Agency: Standard		File No.
UL	: UL-1283	E78644
CSA*1	: C22.2, No.8-M1986	E78644
TUV	: EN133200	R2-50006837

*1 cUL






Circuit diagram



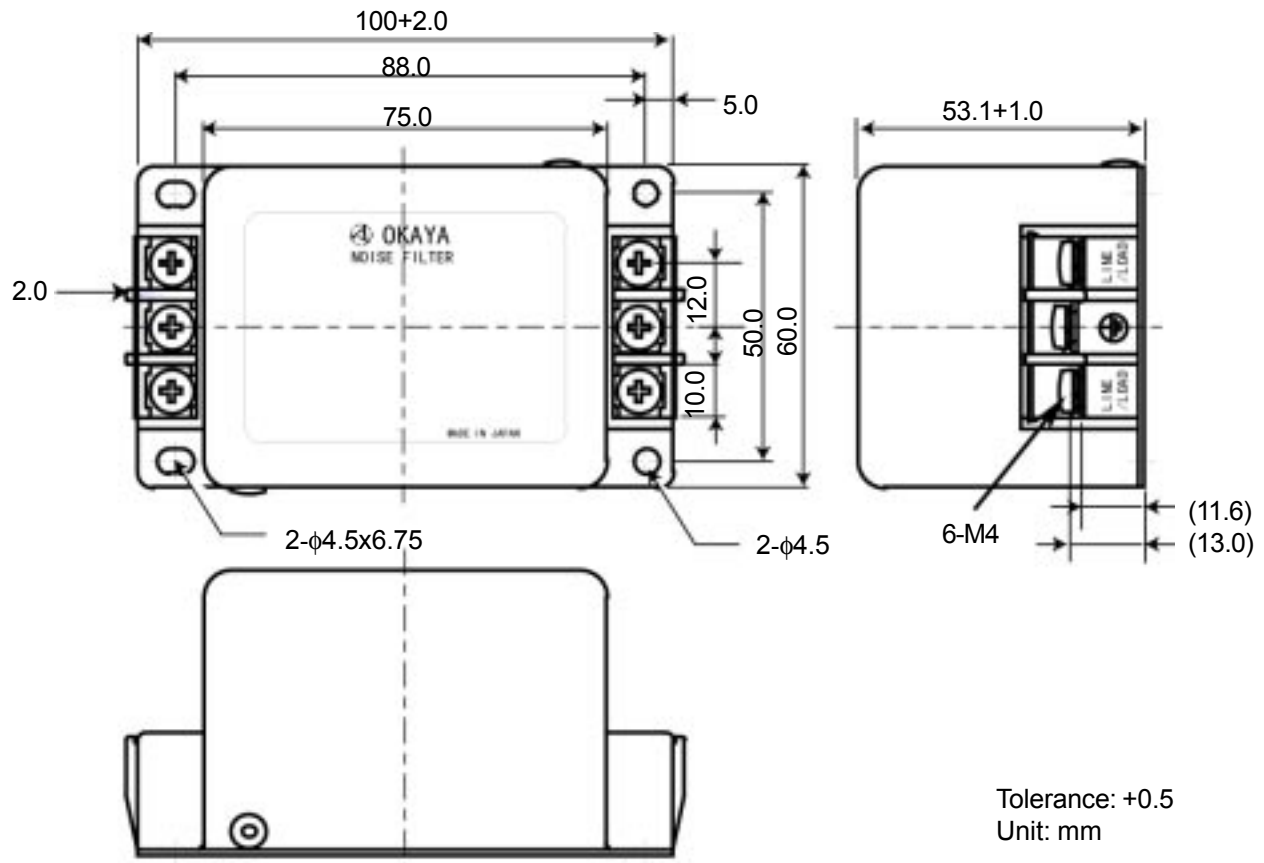
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -25°C ~ +55°C

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)
  	SUP-EK5-ER-6	5	Line to Ground 2500Vrms 50/60Hz 60sec	Line to Ground 100MΩmin (at 500VDC)	1mA (at 250Vrms 60Hz)	1.0Vrms	45°C
	SUP-EK10-ER-6	10					
	SUP-EK15-ER-6	15					
	SUP-EK20-ER-6	20					
	SUP-EK30-ER-6	30					

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MECHANICAL DIMENSIONS



STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

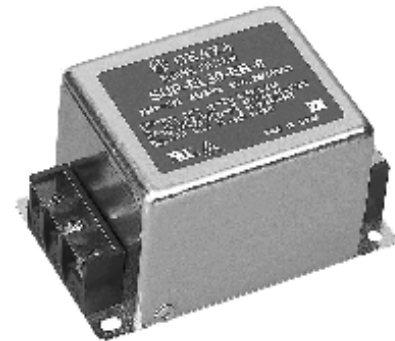
Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10	30
SUP-EK5-ER-6	Normal L-L	39	77	83	80	74	63
	Common L-G	68	90	88	71	67	20
SUP-EK10-ER-6	Normal L-L	35	75	85	82	75	67
	Common L-G	61	87	79	63	58	35
SUP-EK15-ER-6	Normal L-L	25	68	87	85	74	67
	Common L-G	45	80	76	56	51	48
SUP-EK20-ER-6	Normal L-L	10	62	88	74	85	66
	Common L-G	36	62	68	65	60	48
SUP-EK30-ER-6	Normal L-L	22	44	79	46	60	59
	Common L-G	8	33	39	51	56	50

SUP-EL□-ER-6

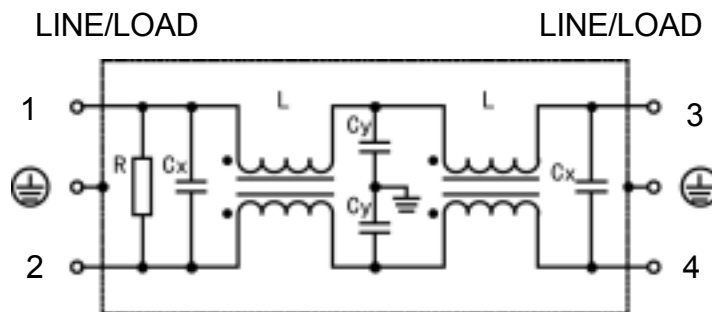
- Uses easy wiring terminal block.
- The two-stage super high μ core allows high attenuation over a broad band range.
- The construction of two-staged super high μ core circuit realizes high attenuation over high band.
- Bleeder resistor for protecting against electric shock.
- Information processing systems (specially for export to Europe, office appliances, various control systems).

Safety Agency: Standard		File No.
UL	: UL-1283	E78644
CSA*1	: C22.2, No.8-M1986	E78644
TUV	: EN133200	R2-50006835

*1 cUL



Circuit diagram



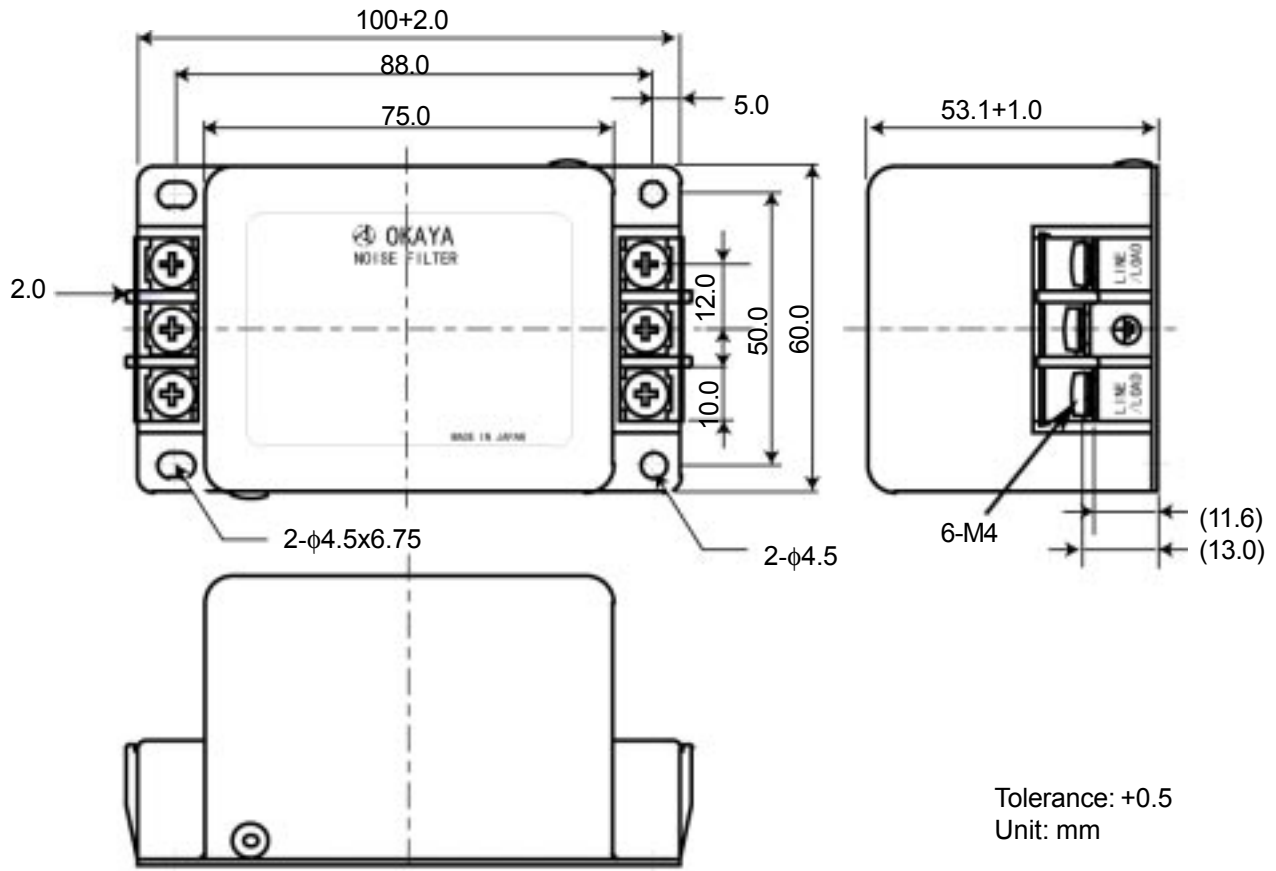
ELECTRICAL SPECIFICATIONS

Operating Temp. range: -25°C ~ +55°C

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)
 	SUP-EL5-ER-6	5	Line to Ground 2500Vrms 50/60Hz 60sec	Line to Ground 100M Ω min (at 500VDC)	1mA (at 250Vrms 60Hz)	1.0Vrms	45°C
	SUP-EL10-ER-6	10					
	SUP-EL15-ER-6	15					
	SUP-EL20-ER-6	20					
	SUP-EL30-ER-6	30					

*2Our products have European approval which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive

MECHANICAL DIMENSIONS

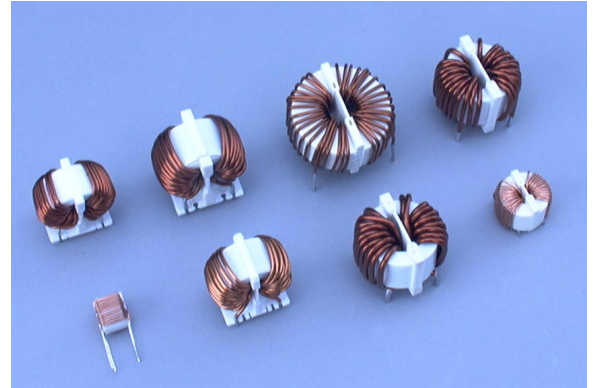


STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10	30
SUP-EL5-ER-6	Normal L-L	38	80	88	85	80	69
	Common L-G	87	83	77	63	58	30
SUP-EL10-ER-6	Normal L-L	36	75	88	85	81	66
	Common L-G	80	84	77	63	58	34
SUP-EL15-ER-6	Normal L-L	23	67	90	88	84	73
	Common L-G	63	84	82	64	58	46
SUP-EL20-ER-6	Normal L-L	10	60	89	80	75	67
	Common L-G	52	74	84	61	56	47
SUP-EL30-ER-6	Normal L-L	22	42	77	50	68	58
	Common L-G	27	42	51	70	58	45

RCV/ RCH SERIES

- High performance Ferrite core material.
- Broad current capacity from 3 to 30 Ampere.
- Counter measure for EMI/RFI suppression of conducted noise in power sources or signal lines.



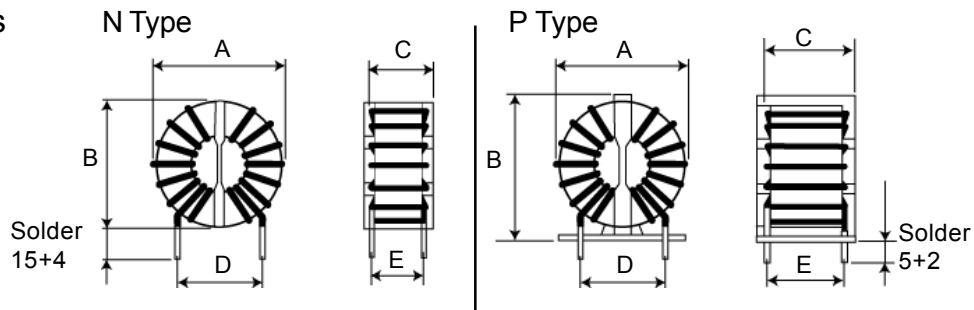
ELECTRICAL SPECIFICATIONS

Model number	Rated current (A)	Inductance Min. (mH)	Insulation resistance (mΩ)
RCV103-10N	3	1.0	70
RCV105-10N	5		2.0
RCV105-20N			
RCV110-10N RCV110-10P	10	1.0	25
RCV115-07N RCV115-07P	15	0.7	9
RCV115-16N RCV115-16P		1.6	15
RCV120-12N RCV120-12P	20	1.2	14
RCV125-07N RCV125-07P	25	0.7	7
RCV130-06N	30	0.6	5
RCH203-10N	3	1.0	70
RCH205-10N	5		2.0
RCH205-20N			
RCH210-10N	10	1.0	25
RCH215-07N	15	0.7	10
RCH215-16N		1.6	15
RCH220-12N	20	1.2	14
RCH225-07N	25	0.7	7
RCH230-06N	30	0.5	5

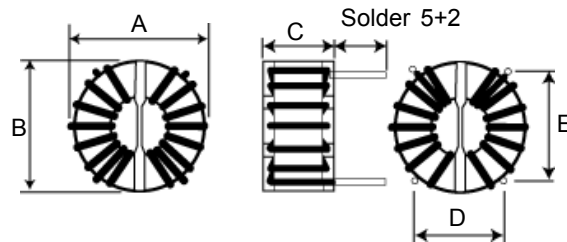


MECHANICAL DIMENSIONS

RCV Series



RCH Series



Model number	ϕ	A. max.	B. max	C. Max.	D.	E.
RCV103-10N	0.6	17.0	17.0	15.0	7	0.6
RCV105-10N	0.8	23.5	23.5	19.0	10	0.8
RCV105-20N						
RCV110-10N RCV110-10P	1.3	34.0	34.0 35.0	23.0	20 18	1.3
RCV115-07N RCV115-07P	1.5		34.0 35.0		27.0	
RCV115-16N RCV115-16P	1.7	37.0	37.0 38.0	27.0		23 20
RCV120-12N RCV120-12P	2.0	39.0	39.0 40.0		29.0	23 20
RCV125-07N RCV125-07P	3.2	41.0	41.0 42.0	30.0		23 12
RCV130-06N			65.0		65.0	40.0
RCH203-10N	0.6	17.0	17.0	15.0	11	0.6
RCH205-10N	0.8	23.5	23.5	19.0	12	0.8
RCH205-20N						
RCH210-10N	1.3	34.0	34.0	23	21	1.3
RCH215-07N	1.5					1.5
RCH215-16N	1.7	37.0	37.0	27.0	23	1.7
RCH220-12N	2.0	39.0	39.0	29.0		2.0
RCH225-07N	2.3	41.0	41.0	30.0		2.3
RCH230-06N	3.2	65.0	65.0	40.0	18	3.2

NOISE FILTERS

Fax Back Document #1300

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Model Number	Rated Current									Feature	Terminal	Characteristics Application	Safety Standards																	
	1	2	3	4	5	6	1	1	2				3	UL	CSA	VDE	TUV	SEMKO	SEV	EI										
SUP-B□R-E		●		●		●					Plastic case	CP-wire solder-plated	Direct installation to PCB	E78644																
SUP-C□G-E			●			●																								
SUP-E□H-EP	●	●	●								Metal case	Vinyl insulated cable	1,000V Pulse absorption		E78644			10529-4730-1003												
SUP-E□H-EP					●		●	●	●			Screw terminals							10529-4730-1001	R85074	8415187									
SUP-G□H-EPR					●		●	●	●			Faston	2,000V Pulse absorption Bleeder resistor			E78644			10529-4730-1001		8707213									
SUP-G□H-EPR-2					●		●	●	●			Solder terminals																		
SUP-G□H-EPR-4					●		●	●	●		Screw terminals																			
SUP-E□H **	●	●	●								Metal case	Vinyl insulated cable	Low leakage				E78644 **	LR60681			10529-4730-1003									
SUP-E□H					●		●	●				Screw terminals												8415187						
SUP-E□H-0 **	●	●	●		●		●	●	●			Faston																		
SUP-E□H-2 **	●	●	●		●		●	●	●			Solder											R85074							
SUP-J□G-E(1) **			●			●	●	●			Inlet socket	Faston Solder terminals	Compact type	E78644 **					LR60681			10529-4730-1002		8946082 9014077	Nr.91.1 12062	139047				
SUP-J□G-E(1)-2			●			●	●	●																						
SUP-F□H-ER-2			●			●	●																		8815052					
SUP-J□H-ER-4					●		●	●	●		Metal case	Screw terminals	High Current		E78644	LR60681						10529-4730-1001								
SUP-K□H-ERB-4P							●	●	●				Surge							Surge Absorber and Filter										
SUP-L□H-ERB-2					●		●	●	●		277VAC																			
SUP-P□H **					●		●	●	●		Metal case	Faston Solder Screw	TVSS				E78644	LR60681					R9250051							
3SUP-H□H *					●		●	●	●			3-Phase	Screw terminals							3-Phase	E78644	LR60681				R9251182 T9250187				
3SUP-C□H *					●		●	●	●																Pending	Pending				
3SUP-D□H *					●		●	●	●																				J9650389	
4SUP-T□H *									●														Pending	Pending						

* 35 Amp, 50 Amp, 75 Amp, 100 Amp, & 170 Amp Versions Also Available

** UL544 Medical & Dental Equipment Rating Available

• INTRODUCTION

Recent years have witnessed tremendous advances in electronics. In the field of personal computers, word processors and other computer related equipment, legal restrictions regarding safety and noise generation have grown more strict with each passing year. In most cases, electronic devices exported must now conform to the noise regulations of the target country in order for them to be given market approval.

The following is an introductory description of the ways in which noise is generated and the various noise regulations currently enforced throughout the world.

• NOISE GENERATION AND TRANSMISSION

The noise generated by electronic devices consists of two kinds. Radiated noise is transmitted directly into the air from an electronic device, taking the form of an electric wave that interferes with other electronic devices. In contrast Conductive noise interferes with other components and devices by being transmitted along power lines and the wiring of electronic circuits. These two kinds of noise can be briefly explained in the context of an electronic device by means of the following diagram (Figure 1).

A) Electronic device

1. Conductive noise from electric power line.
2. Conductive noise along the signal lines connecting electronic devices.
3. Radiated noise transmitted from an electronic device which interferes with another device.
4. Radiated noise picked up and generated by the power line which acts as an antenna.
5. Radiated noise picked up and generated by the signal lines which act as an antenna.
6. Noise produced from a source within the electronic device.
7. Noise entering from the ground line.

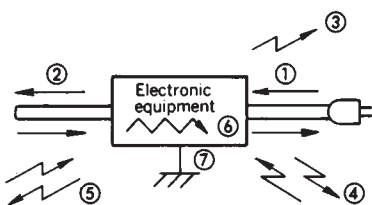


Fig. 1

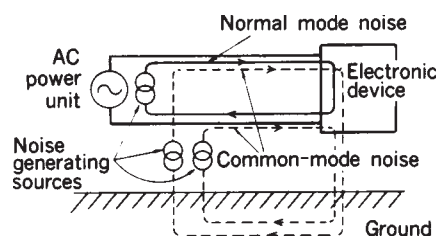


Fig. 2

As shown in Figure 2, conductive noise can also be divided into two types, normal mode noise involving symmetrical noise components oscillating between lines (L1-L2) and common mode noise involving asymmetrical noise components transmitted between a line and ground (L1-E, L2-E).

• OPERATING PRINCIPLES OF NOISE FILTERS

A key counter measure taken against noise is the use of noise filters. The operating principles of these devices are described in the following:

Viewed from the perspective of the circuit network, the noise filter is a kind of low range or low pass filter. It is designed to pass only frequencies lower than the cut off frequency of the filter, while attenuating or blocking all ranges higher than the cut off frequency.

As shown in Figure 3, the filter operates according to a principle whereby inductance connected directly in series with the line has virtually no effect on the noise current at low frequencies, but at high frequencies it demonstrates a high interruptive effect with respect to the noise current.

Also, a capacitor connected in parallel with the line is used as a side path to return high frequency back to the power line. The result is that normal mode noise passes through the capacitor and is shunted back to the other line. In the case of common mode noise, the result is that the noise passes through the midpoint of the two capacitors to ground.

The use of special materials such as amorphous alloys and toroidal cores gives the Okaya noise filters excellent insertion loss characteristics and high voltage pulse attenuation capability.

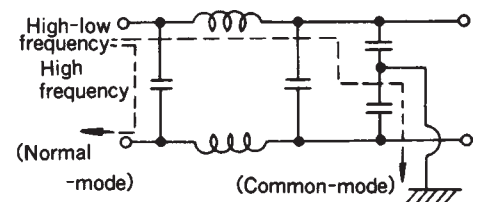


Fig. 3

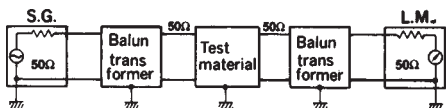
NOISE FILTERS

• EVALUATION METHODS OF NOISE FILTER CHARACTERISTICS

1. Static Characteristics

With a measuring impedance of 50 ohms, the amount of attenuation (insertion loss) is determined by using a level meter to measure the voltage before and after insertion of a noise filter into the test circuit. Using this method, both normal mode and common mode attenuation can be measured.

Measuring Circuit

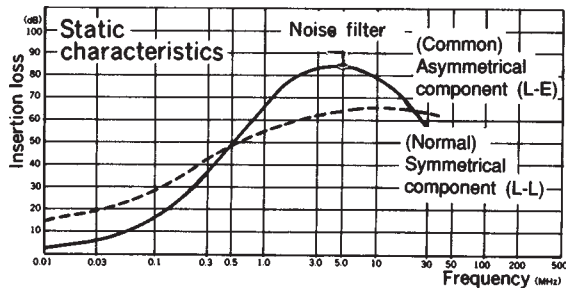


$$\text{Attenuation} = 20 \log_{10} (V_2/V_1) \text{ [dB]}$$

V_1 ...Level when test material is inserted

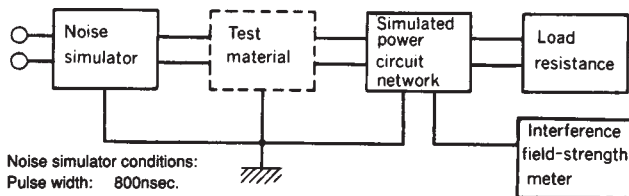
V_2 ...Level when test material is not inserted

Test material: Noise filter.



2. Dynamic Characteristics

In order to achieve measurement results as near as possible to actual application conditions, the following method is used: With a noise simulator as the noise generating source, a rated current is allowed to flow through the test device and a simulated power circuit network. The amount of normal mode and common mode attenuation is measured.



Noise simulator conditions:

Pulse width: 800nsec.

Frequency: 60Hz

Polarity: (+)

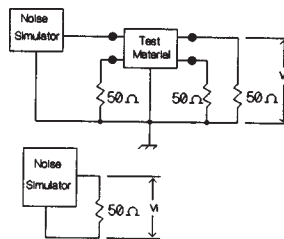
Test Material: Noise filter

3. Pulse Attenuation Characteristics

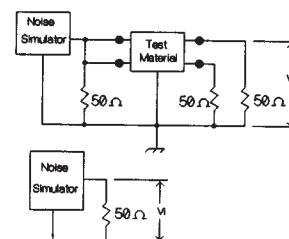
The following method is used to measure the noise margin for the external noise in an electronic device: a noise simulator is connected and the input/output voltages are measured. The formula noted below is then used to calculate the amount of attenuation in the form of the pulse absorption effect produced. In general, the noise condition used to test malfunctions is a high voltage pulse of 50nsec. to 1μsec at 1kV to 2kV in amplitude.

$$\text{Attenuation} = 20 \log_{10} (V_0/V_1) \text{ [dB]}$$

Normal Mode



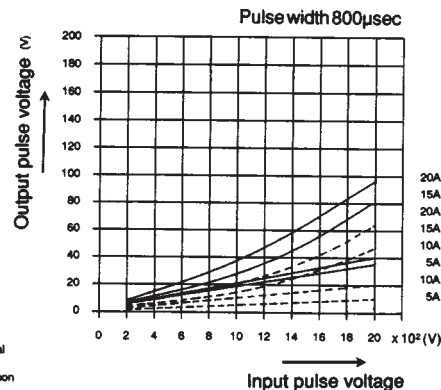
Common Mode



$$\text{Attenuation} = 20 \log_{10} (V_0/V_1) \text{ [dB]}$$

SUP-G□H-EPR-4

TVSS characteristics



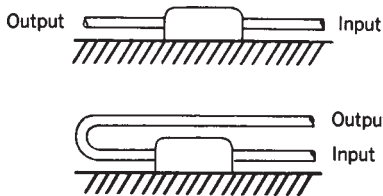
• APPLICATION PRECAUTIONS

The following points should be kept in mind with regard to the installation of noise filters.

1. When mounting on the noise producing side, they should be mounted as close as possible to the source of the noise with noise electrical or mechanical contact between the input and output side of the filter.

(Example) When the input/output lines are bundled together or arranged parallel with each other, high frequency noise components induced on the input side, results in the production of noise current on the output side.

Separation of input/output lines (good example)



Bundling or parallel arrangement of input/output lines (poor example)

2. When the device is directly installed on the equipment exposed to interference, it is important to mount the noise filter as close as possible to the machines power unit or input wiring. If a power line is allowed to enter the case of the equipment without passing through the noise filter, noise current can be radiated throughout the inside of the equipment enclosure, affecting the internal electronics.

3. Precautions should be taken to insure that the ground line for the noise filter has a lower impedance than that of the noise current. If this is not done, the noise prevention effect will be lost. Also, ground lines should be as short as possible. The use of long ground lines will result in substantial reduction of the noise prevention effects (particularly in the high frequency ranges above several MHz.).

4. Whenever possible, the outer case of the noise filter should be mounted directly to the outer case of the electronic equipment. When this is not possible, a short grounding line should be used to link the outer case of the filter and the equipment.

• INTERNATIONAL ELECTROMAGNETIC INTERFERENCE (EMI) REGULATIONS

In recent years the diffusion of personal computers, facsimiles and other data processing equipment has made safety measures and noise prevention measures for such devices a pressing concern. When selling electronic equipment domestically or exporting, the EMI (Electromagnetic Interference) standards for the target country must be satisfied or the product will not be approved for marketing in those countries. The following is a summary of the EMI regulations.

1. FCC Regulations for Computers and Related Electronic Equipment. In October 1979, the FCC (USA) included within its part 15 regulations a new sub-part J for the control of computer equipment. The values established by the FCC computer regulations divide equipment into Classes A and B.

Class A: Computer equipment meant for commercial use, namely such things as office computers and business machines.

Class B: Computer equipment meant for consumer home use, including such things as personal computers and television games.

2. VDE (Germany) Regulations: Standard VDE-0565 along with Standard IEC-939 are the Standards for Power Line Filters. VDE-0871 specifies conducted emissions limits for computing devices.

Class A: Special operating license required.

Class B: For general approval, no operation license required.

3. IEC (International Electrotechnical Commission) Worldwide standards body: IEC 1000/EN61000 became the EMI standard in the European Community (CE) in 1995, and as a result has become the defacto Worldwide standard.

IEC1000-4-2: ESD (Electrostatic Discharge) has very fast times with high voltage (15KV) and low energy (<10Amp).

IEC1000-4-4: EFT (Electrical Fast Transient) are a burst of very fast noise pulses (5 nanosecond) several kV in amplitude.

IEC1000-4-5: SURGE is high energy (kV/kA) short duration (μ second) pulses which can be caused by lightning, switching power loads or large inductive loads.

4. Other standards bodies in the USA include ANSI, IEEE, SAE, EIA, ASTM, FDA, and NFPA.

OKAYA DOES SPECIAL FILTER DESIGN

ASK ABOUT A NOISE SUPPRESSION FILTER TO MEET YOUR EXACT NEEDS



ASK ABOUT THE OKAYA AC POWER LINE NOISE FILTER DESIGN KIT

- **TRANSIENT VOLTAGE SURGE SUPPRESSION**



Transient Voltage Surge Suppression (TVSS) has become an important part of Power Line Protection. In the past, accessories which furnished some TVSS protection were available as add-on or after market protection devices. Many of these accessories were very marginal protection against TVSS. With the changes to International Safety Agency Regulations, better TVSS protection and TVSS protection incorporated directly into equipment is becoming a major consideration in new equipment design.

Okaya's dedication to the continual improvement of product has given rise to a new feature in many of the AC Noise Suppression Filters featured in this catalog. This new feature is Transient Voltage Surge Suppression (TVSS). Okaya has incorporated TVSS capability into many of its Filters Series. This Suppression takes several different forms and capabilities.

The SUP-EH and SUP-EH-EP Series feature toroid coils with high performance magnetic media. This feature combined with high voltage pulse capacitors gives these two series a 20dB attenuation of 1000V, 800nsec. pulses.

The SUP-GH Series incorporate into the inductance a toroid coil which is manufactured from amorphous alloys. This special core material combined with high voltage pulse capacitors gives this series a 20dB attenuation of 2000v, 800nsec. pulses.

The SUP-KH Series incorporates a plug-in TVSS device. This TVSS device RAV-PWZ comes in either 135VAC (RAV-401 -PWZ) or 270VAC (RAV-781-PWZ) versions. This TVSS device features a line monitor indicator to assure proper protection and the ability to suppress 12KV (1.2 x 50µsec) and 1000A (8/20µsec) pulses. These features combine to give reliable TVSS protection to an already high performance EMI/RFI Filter Series.

The RAV-PH Series Feature a high mu Core material which when combined with high voltage pulse capacitors, allows this series to attenuate both common and normal transient voltage surges of 2000volt, 800 µsec. EMI/RFI attenuation curves begin at 10KHz. Some models are UL544(2601) recognized.

The ability to supply complete power line protection, from EMI/RFI noise attenuation to Transient Voltage Surge Suppression is what continues to make Okaya a leader in new innovation design to meet industry needs.

Our staff of technical personnel is always ready to work with the customer to furnish the exact product needs.

Okaya's ability to incorporate multiple features in our AC Power Line Filters is just one example of our commitment.

Fax Back Document #1319

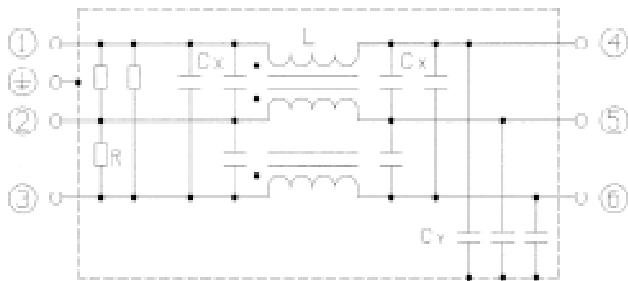
3SUP-A□H-ER-4

- Three Phase (3 φ) Filter Delta “Δ”
- Rated 10 to 250 Ampere at 250VAC
- Normal and Common mode attenuation
- Low forward voltage drop
- Low leakage current

Safety Agency : Standard		File No.
UL	: UL-1283	E78644
TUV	: EN133200	R9750235



3SUP-A□H-ER-4



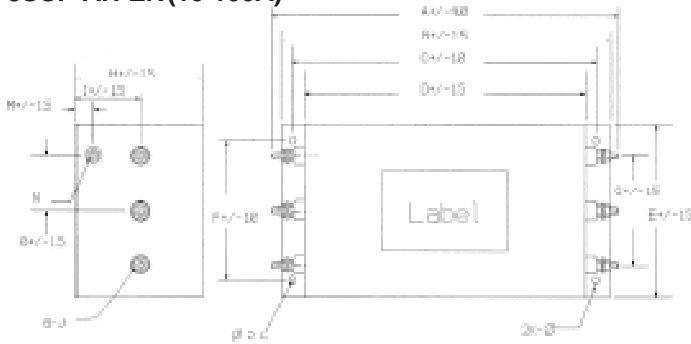
ELECTRICAL SPECIFICATIONS

Safety Standard	Model Number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	3SUP-A10H-ER-4	10	2000Vrms 50/60Hz 60 sec	Line to Ground 6000MΩ min (at 500VDC)	1mA (at 250 Vrms 60Hz)	1.0Vrms	35°C	-25 to +50
	3SUP-A20H-ER-4	20						
	3SUP-A30H-ER-4	30						
	3SUP-A50H-ER-4	50						
	3SUP-A75H-ER-4	75						
	3SUP-A100H-ER-4	100						
	3SUP-A150H-ER-4	150						
	3SUP-A200H-ER-4	200						
	3SUP-A250H-ER-4	250			1.5mA (at 250 Vrms 60Hz)			

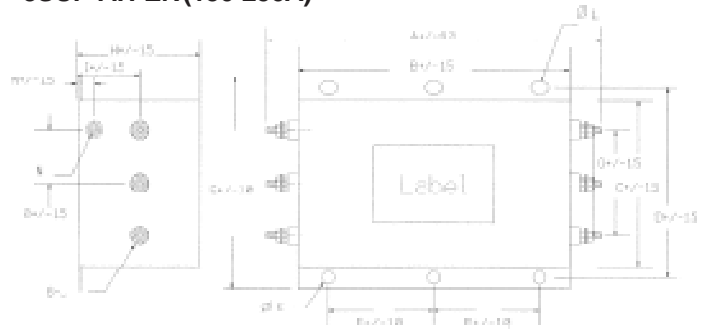
MECHANICAL DIMENSIONS

All Dimensions mm

3SUP-AH-ER(10-100A)



3SUP-AH-ER(150-250A)



DIMENSIONS

Model Number	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3SUP-A10H-ER-4	188	160	145	130	110	95	70	55	25	M5	4.5	4.5x7	10	M4	17.5
3SUP-A20H-ER-4	228	200	185	170				60	30						
3SUP-A30H-ER-4										M6					20
3SUP-A50H-ER-4	272	240	220	200	140	110	70	80	40	M8	6.5	6.5x8	15	M6	30
3SUP-A75H-ER-4	312	280	260	240	180	150									
3SUP-A100H-ER-4	342	300	280	260				100	50	M10	6.5	6.5x8	20	M6	30
3SUP-A150H-ER-4	360	280	200	220	240	120	110								
3SUP-A200H-ER-4	380									M12			30		
3SUP-A250H-ER-4	400	300	210	230	250		150	90							

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10.0	30.0
3SUP-A10H-ER-4	NORMAL, L-L	47	69	72	58	54	44
	COMMON, L-G	44	38	36	36	47	42
3SUP-A20H-ER-4	NORMAL, L-L	51	70	71	56	50	63
	COMMON, L-G	34	38	39	39	42	43
3SUP-A30H-ER-4	NORMAL, L-L	41	73	74	56	50	50
	COMMON, L-G	28	33	36	36	41	48
3SUP-A50H-ER-4	NORMAL, L-L	43	73	73	53	50	43
	COMMON, L-G	29	34	35	36	45	40
3SUP-A75H-ER-4	NORMAL, L-L	46	73	68	50	47	38
	COMMON, L-G	26	31	36	38	49	40
3SUP-A100H-ER-4	NORMAL, L-L	35	64	58	40	37	36
	COMMON, L-G	18	23	30	40	41	40
3SUP-A150H-ER-4	NORMAL, L-L	39	68	64	46	43	47
	COMMON, L-G	11	17	23	41	67	48
3SUP-A200H-ER-4	NORMAL, L-L	28	69	60	43	40	45
	COMMON, L-G	13	25	31	48	51	37
3SUP-A250H-ER-4	NORMAL, L-L	46	60	50	36	32	29
	COMMON, L-G	12	22	30	43	39	22

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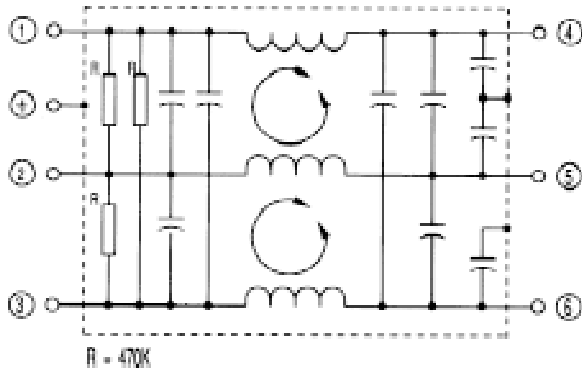
3SUP-H□H-ER

- Three Phase (3 ϕ) Filter
- Rated 5-100 Ampere at 250VAC
- Normal and Common mode attenuation
- Bleed Resistor for shock protection

Safety Agency : Standard		File No.
UL	: UL-1283	E78644
CSA	: C22.2, No. 8-M1986	LR60681
TUV	: VDE0565-3	R9251182, J9651128



3SUP-H□H-ER

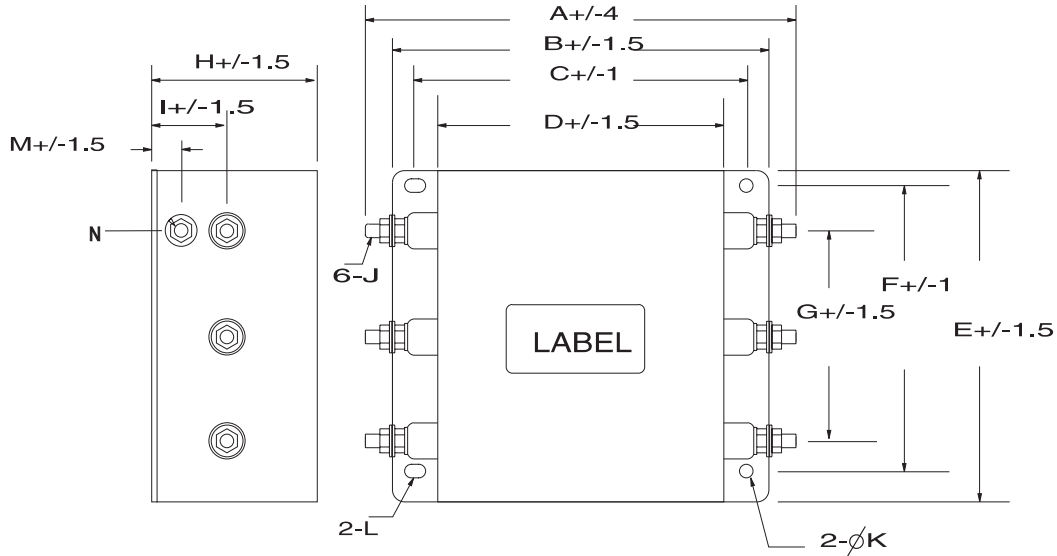


ELECTRICAL SPECIFICATIONS

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp. range (°C)
	3SUP-H5H-ER-4	5	Line to Line 1000Vrms 50/60Hz 60sec	Line to Ground 6000M Ω min (at 500VDC)	1.0mA (at 250Vrms 50/60Hz)	1.0Vrms	30°C	-25 to 50
	3SUP-H10H-ER-4	10						
	3SUP-H20H-ER-4	20						
	3SUP-H30H-ER-4	30	Line to Ground 2000Vrms 50/60Hz 60sec					
	3SUP-H50H-ER-4	50						
	3SUP-H75H-ER-4	75						
	3SUP-H100H-ER-4	100						

MECHANICAL DIMENSIONS

All Dimensions mm



DIMENSIONS

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3SUP-H5H-ER-4	128	125	110	95	110	95	70	55	25	M 4	ø4.5	4.5 X 7.0	10	M4
3SUP-H10H-ER-4	188	160	145	130	110	95	70	55	25	M 5	ø4.5	4.5 X 7.0	10	M4
3SUP-H20H-ER-4	228	200	185	170	110	95	70	60	30	M 5	ø4.5	4.5 X 7.0	10	M4
3SUP-H30H-ER-4	228	200	185	170	110	95	70	60	30	M 6	ø4.5	4.5 X 7.0	10	M4
3SUP-H50H-ER-4	272	240	220	200	140	110	80	80	40	M 6	ø6.5	6.5 X 8.0	15	M4
3SUP-H75H-ER-4	312	280	260	240	180	150	120	80	40	M 8	ø6.5	6.5 X 8.0	15	M6
3SUP-H100H-ER-4	342	300	280	260	180	150	120	100	50	M10	ø6.5	6.5 X 8.0	15	M6

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - Megahertz									
		0.15	0.5	1.0	5.0	10	30	50	100	300	
3SUP-H5H-ER-4	NORMAL, L-L	52	81	70	56	52	52	47	26	28	
	COMMON, L-G	45	38	36	36	40	45	28	36	39	
3SUP-H10H-ER-4	NORMAL, L-L	45	85	95	74	75	55	55	40	21	
	COMMON, L-G	38	43	41	42	43	38	38	43	30	
3SUP-H20H-ER-4	NORMAL, L-L	46	88	102	89	61	57	22	23	33	
	COMMON, L-G	46	34	32	32	35	41	32	18	34	
3SUP-H30H-ER-4	NORMAL, L-L	31	75	93	68	62	61	50	38	32	
	COMMON, L-G	21	40	43	45	48	40	40	46	29	
3SUP-H50H-ER-4	NORMAL, L-L	31	74	87	67	61	65	28	29	29	
	COMMON, L-G	19	32	35	42	48	35	19	18	31	
3SUP-H75H-ER-4	NORMAL, L-L	22	75	85	66	58	53	30	33	26	
	COMMON, L-G	19	20	23	41	48	23	25	23	23	
3SUP-H100H-ER-4	NORMAL, L-L	25	74	77	53	48	48	29	36	22	
	COMMON, L-G	12	28	31	36	43	29	30	28	19	

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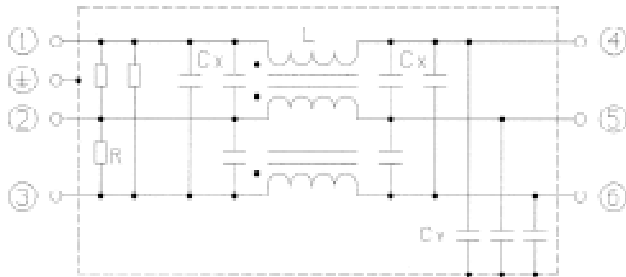
3SUP-W□H-ER-4

- Three Phase (3 φ) Filter Delta “Δ”
- Rated 10 to 250 Ampere at 250VAC
- Normal and Common mode attenuation
- Low forward voltage drop
- Low leakage current

Safety Agency : Standard		File No.
UL	: UL-1283	E78644
TUV	: EN133200	9750507



3SUP-W□H-ER-4



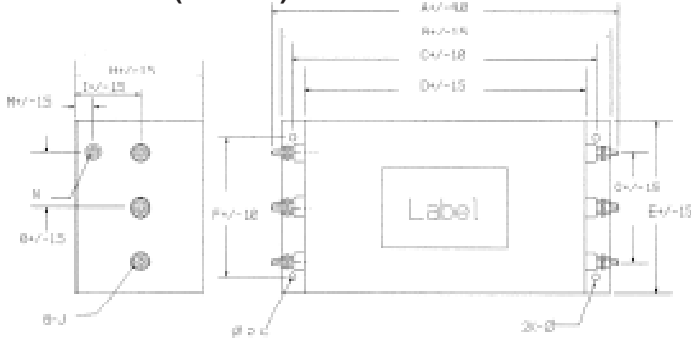
ELECTRICAL SPECIFICATIONS

Safety Standard	Model Number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	3SUP-W10H-ER-4	10	2500Vrms 50/60Hz 60 sec	Line to Ground 6000MΩ min (at 500VDC)	1mA (at 250 Vrms 60Hz)	1.0Vrms	35°C	-25 to +50
	3SUP-W20H-ER-4	20						
	3SUP-W30H-ER-4	30						
	3SUP-W50H-ER-4	50						
	3SUP-W75H-ER-4	75						
	3SUP-W100H-ER-4	100						
	3SUP-W150H-ER-4	150	2000Vrms 50/60Hz 60 sec		1.5mA (at 250 Vrms 60Hz)	35°C		
	3SUP-W200H-ER-4	200						
	3SUP-W250H-ER-4	250						

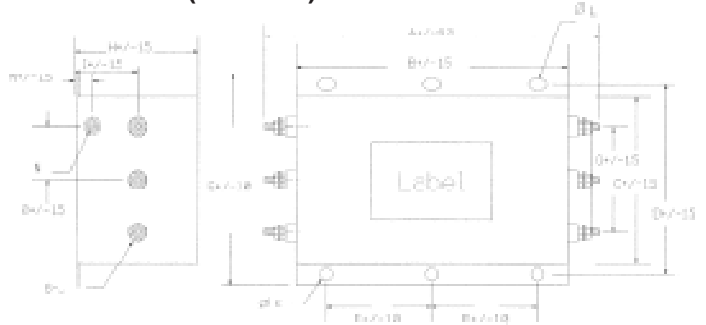
MECHANICAL DIMENSIONS

All Dimensions mm

3SUP-WH-ER (10-150A)



3SUP-WH-ER (200-250A)



DIMENSIONS

Model Number	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
3SUP-W10H-ER-4	133	125	110	95	110	95	70	55	25	M4	4.5	4.5x7	10	M4	17.5		
3SUP-W20H-ER-4	178	160	145	130						M5							
3SUP-W30H-ER-4										M6						5.5	5.5x8
3SUP-W50H-ER-4	208	190	170	150	90	60	60	30	M6	6.5	6.5x8	15	M6	17.5			
3SUP-W75H-ER-4	270	240	220	200	140	110	70	80	40						M8		
3SUP-W100H-ER-4	280														M10	20	
3SUP-W150H-ER-4	342	300	280	260	180	150	120	100	50	M10	6.5	6.5x8	15	M6	30		
3SUP-W200H-ER-4	380	280	200	220	240	120										110	20
3SUP-W250H-ER-4	400	300	210	230	250	120										150	90

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10.0	30.0
3SUP-W10H-ER-4	NORMAL, L-L	63	78	74	61	57	54
	COMMON, L-G	29	41	38	38	42	41
3SUP-W20H-ER-4	NORMAL, L-L	49	82	87	72	84	57
	COMMON, L-G	21	39	41	43	47	51
3SUP-W30H-ER-4	NORMAL, L-L	33	83	87	72	84	57
	COMMON, L-G	16	39	41	43	47	51
3SUP-W50H-ER-4	NORMAL, L-L	24	68	83	55	51	47
	COMMON, L-G	7	28	35	43	54	42
3SUP-W75H-ER-4	NORMAL, L-L	52	84	82	62	59	46
	COMMON, L-G	18	37	36	44	59	34
3SUP-W100H-ER-4	NORMAL, L-L	47	82	80	67	61	53
	COMMON, L-G	13	32	34	44	52	42
3SUP-W150H-ER-4	NORMAL, L-L	49	70	58	44	47	41
	COMMON, L-G	5	25	26	39	34	25
3SUP-W200H-ER-4	NORMAL, L-L	45	72	59	45	42	36
	COMMON, L-G	6	28	30	40	43	25
3SUP-W250H-ER-4	NORMAL, L-L	36	58	48	35	31	43
	COMMON, L-G	2	20	23	42	34	20

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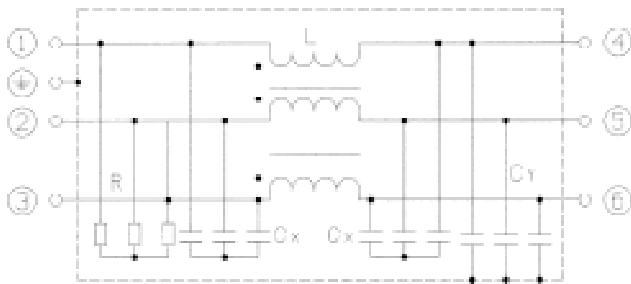
3SUP-HE□-ER-6

- Three Phase (3 φ) Filter Delta “Δ”
- Rated 75 tAmpere at 480VAC
- Screw Terminal Block Interconnect
- Low forward voltage drop

Safety Agency : Standard		File No.
UL	: UL-1283	E78644
TUV	: EN133200	9851262

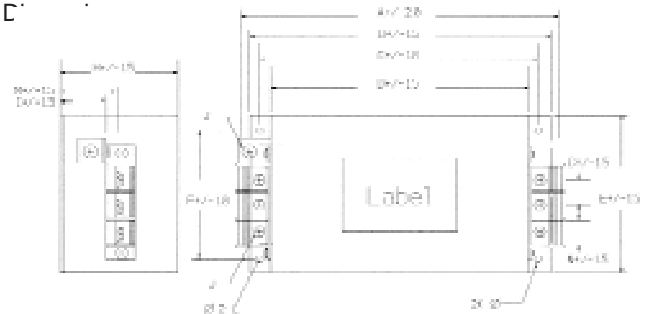


3SUP-HE□-ER-6



MECHANICAL DIMENSIONS

All in mm



DIMENSIONS

Model Number	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3SUP-HE50-ER-6	196	190	170	150	120	105	18	80	-	M6	5.5	5.5x7	-	13

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10.0	30.0
3SUP-HE50-ER-6	NORMAL, L-L	20	66	86	57	58	49
	COMMON, L-G	12	42	43	53	52	32

ELECTRICAL SPECIFICATIONS

Safety Standard	Model Number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	3SUP-HE50-ER-6	50	2000Vrms 50/60Hz 60 sec	Line to Ground 6000MΩ min (at 500VDC)	5.0mA (at 460 Vrms 60Hz)	1.0Vrms	35°C	-25 to +50

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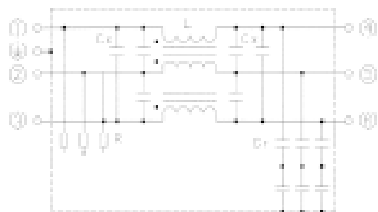
3SUP-HB□-ER-6

Safety Agency : Standard		File No.
UL	: UL-1283	E78644
TUV	: EN133200	R9750235

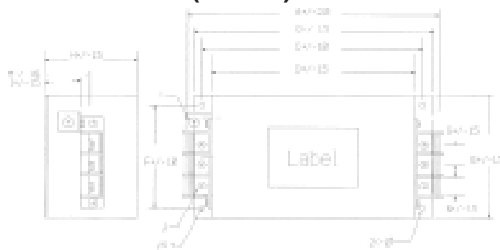
- Three Phase (3 φ) Filter Delta “Δ”
- Rated 20 to 100 Ampere at 500VAC
- Screw Terminal Block Interconnect
- Low forward voltage drop

MECHANICAL DIMENSIONS All Dimensions mm

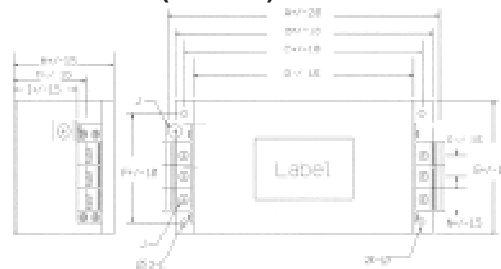
3SUP-HB□-ER-6



SUP-HB-ER (20-50A)



SUP-HB-ER (75-100A)



DIMENSIONS

Model Number	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3SUP-HB20-ER-6	176	160	145	130	120	100	18.0	70.0	-	M4	4.5	4.7x7	-	13.0
3SUP-HB30-ER-6						105								
3SUP-HB50-ER-6	216	190	170	150	140	110	23.0	80.0	17.5	M6	6.5	6.5x8	49.0	18.0
3SUP-HB75-ER-6	266	240	220	200		110			40.0				52.5	
3SUP-HB100-ER-6														

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10.0	30.0
3SUP-HB20-ER-6	NORMAL, L-L	41	78	72	66	60	65
	COMMON, L-G	20	37	32	34	39	33
3SUP-HB30-ER-6	NORMAL, L-L	28	72	84	63	62	50
	COMMON, L-G	20	36	37	40	45	40
3SUP-HB50-ER-6	NORMAL, L-L	30	76	73	55	52	38
	COMMON, L-G	15	32	32	39	57	26
3SUP-HB75-ER-6	NORMAL, L-L	31	74	78	61	59	49
	COMMON, L-G	16	33	32	40	50	25
3SUP-HB100-ER-6	NORMAL, L-L	25	73	80	58	50	52
	COMMON, L-G	10	25	26	36	45	38

ELECTRICAL SPECIFICATIONS

Safety Standard	Model Number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	3SUP-HB20-ER-4	20	2000Vrms 50/60Hz 60 sec	Line to Ground 6000MΩ min (at 500VDC)	1.5mA (at 500 Vrms 60Hz)	1.0Vrms	35°C	-25 to +50
	3SUP-HB30-ER-4	30						
	3SUP-HB50-ER-4	50						
	3SUP-HB75-ER-4	75						
	3SUP-HB100-ER-4	100						

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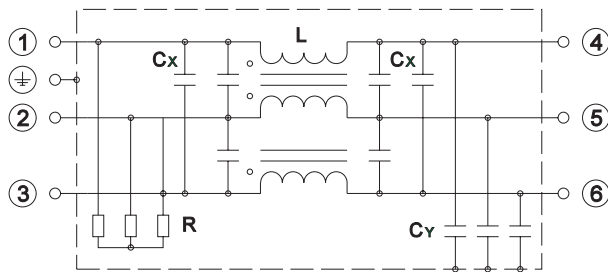
3SUP-C□H-ER

- Three Phase (3 ϕ) Filter “ Δ ”
- Rated 5-250 Ampere at 500VAC
- Normal and Common mode attenuation

Safety Agency : Standard		File No.
TUV	: IEC 939-1 : 1988	J9650384
UL	: UL-1283	Pending



3SUP-C□H-E



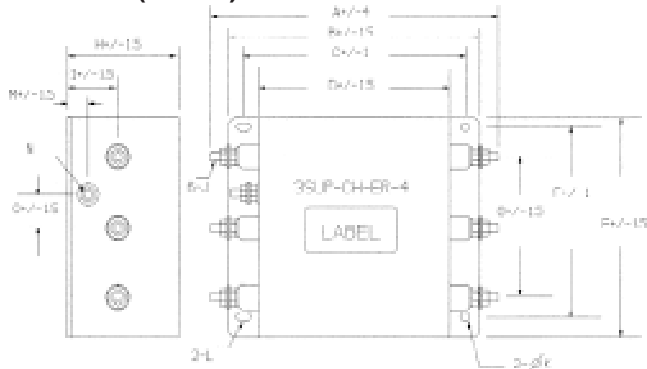
ELECTRICAL SPECIFICATIONS

Safety Standard	Model Number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	3SUP-C5H-ER-4	5	2000Vrms 50/60Hz 60 sec	Line to Ground 3000M Ω min (at 500VDC)	3mA (at 500 Vrms 60Hz)	1.0Vrms	35°C	-25 to +50
	3SUP-C10H-ER-4	10						
	3SUP-C20H-ER-4	20						
	3SUP-C30H-ER-4	30						
	3SUP-C50H-ER-4	50						
	3SUP-C75H-ER-4	75						
	3SUP-C100H-ER-4	100						
	3SUP-C150H-ER-4	150						
	3SUP-C200H-ER-4	200						
	3SUP-C250H-ER-4	250						
				Line to Ground 6000M Ω min (at 500VDC)				

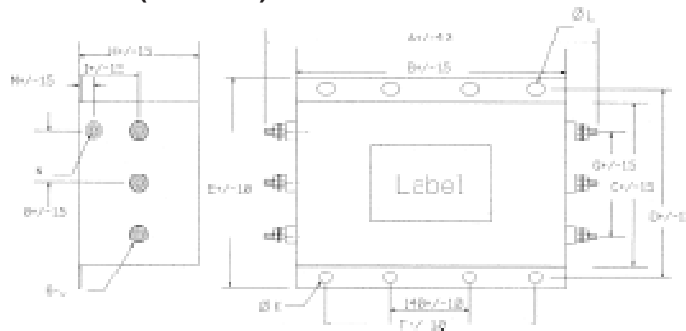
MECHANICAL DIMENSIONS

All Dimensions mm

SUP-CH-E(5-100A)



SUP-CH-E(150-250A)



DIMENSIONS

Model Number	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3SUP-C5H-E-4	165	125	145	95	110	95	70	55	25	M4	ø4.5	4.5 X 7	10	M4	17.5
3SUP-C10H-E-4	195	160	145	130	110	95	70	55	25	M5	ø4.5	4.5 X 7	10	M4	17.5
3SUP-C20H-E-4	235	200	185	170	110	95	70	60	30	M5	ø4.5	4.5 X 7	10	M4	17.5
3SUP-C30H-E-4	245	200	185	170	110	95	70	60	30	M6	ø4.5	4.5 X 7	10	M4	17.5
3SUP-C50H-E-4	272	240	220	200	140	110	80	80	40	M6	ø6.5	6.5 X 8	15	M4	20
3SUP-C75H-E-4	342	280	260	240	180	150	120	80	40	M8	ø6.5	6.5 X 8	15	M6	30
3SUP-C100H-E-4	362	300	280	260	180	150	120	100	50	M10	ø6.5	6.5 X 8	15	M6	30
3SUP-C150H-E-4	380	280	200	220	240	240	120	130	70	M10	ø6.5	6.5 X 8	30	M6	30
3SUP-C200H-E-4	400	300	210	230	250	240	120	150	90	M12	ø6.5	6.5 X 8	30	M6	30
3SUP-C250H-E-4	460	360	230	250	270	280	130	180	100	M12	ø6.5	6.5 X 8	35	M8	30.5

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10.0	30.0
3SUP-C5H-ER-4	NORMAL, L-L	52	74	71	57	49	53
	COMMON, L-G	45	35	34	35	36	43
3SUP-C10H-ER-4	NORMAL, L-L	42	80	79	64	58	62
	COMMON, L-G	35	44	41	41	42	40
3SUP-C20H-ER-4	NORMAL, L-L	46	80	80	71	59	76
	COMMON, L-G	44	30	28	28	28	41
3SUP-C30H-ER-4	NORMAL, L-L	32	71	80	64	55	68
	COMMON, L-G	22	36	38	41	43	40
3SUP-C50H-ER-4	NORMAL, L-L	24	71	80	64	55	56
	COMMON, L-G	18	32	32	38	40	39
3SUP-C75H-ER-4	NORMAL, L-L	25	71	80	61	51	63
	COMMON, L-G	16	31	32	40	45	40
3SUP-C100H-ER-4	NORMAL, L-L	22	72	78	57	46	58
	COMMON, L-G	12	28	31	38	46	42
3SUP-C150H-ER-4	NORMAL, L-L	20	69	62	44	42	36
	COMMON, L-G	9	27	30	44	40	24
3SUP-C200H-ER-4	NORMAL, L-L	14	71	60	44	42	22
	COMMON, L-G	7	28	29	50	33	17
3SUP-C250H-ER-4	NORMAL, L-L	24	64	65	45	45	33
	COMMON, L-G	3	23	26	40	40	22

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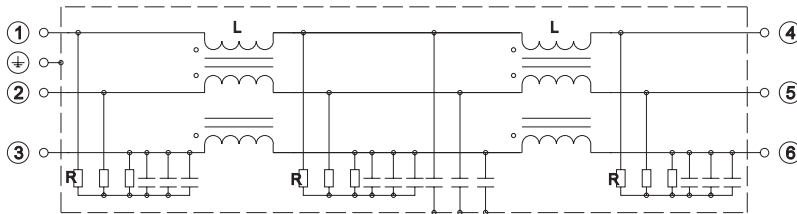
3SUP-D□H-ER-4

Safety Agency : Standard	File No.
TUV : IEC 939-1, 2 : 1988	J9650389

- Three Phase (3 ϕ) Filter “ Δ ”
- Rated 75-200 Ampere at 500VAC
- Normal and Common mode attenuation



3SUP-D□H-ER-4



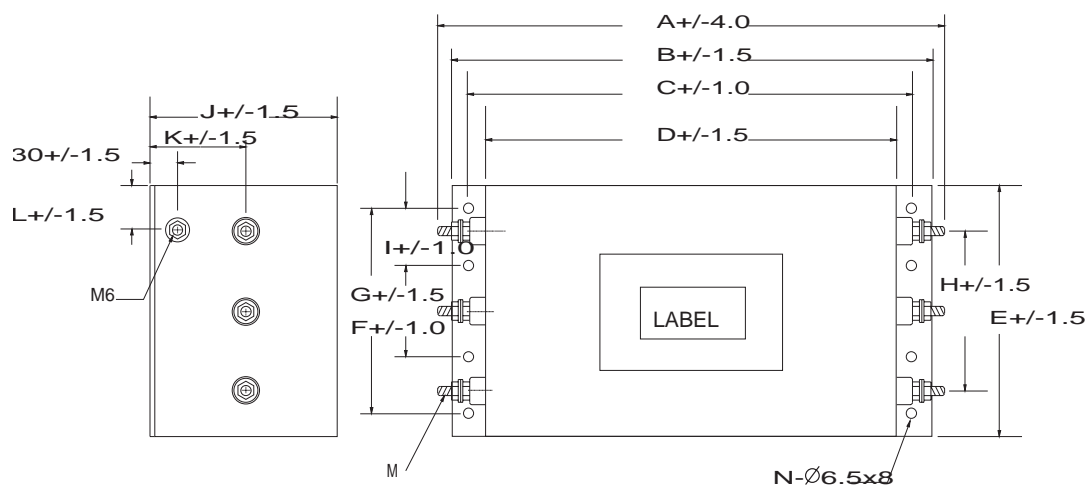
ELECTRICAL SPECIFICATIONS

Safety Standard	Model Number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp range (°C)
	3SUP-D75H-ER-4	75	2000Vrms 50/60Hz 60 sec	Line to Ground 6000M Ω min (at 500VDC)	6mA (at 500 Vrms 60Hz)	1.5Vrms	45°C	-25 to +55
	3SUP-D150H-ER-4	150						
	3SUP-D200H-ER-4	200						



MECHANICAL DIMENSIONS

All Dimensions mm



DIMENSIONS

Model Number	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3SUP-D75H-ER-4	412	370	350	330	210	170	60	120	55	155	70	45	M8	4
3SUP-D150H-ER-4	471	410	390	370	250	290	75	150	67.5	210	105	50	M10	4
3SUP-D200H-ER-4	546	485	465	445	300	260	130	160	130	255	125	70	M12	5

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz							
		0.01	0.05	0.1	0.5	1.0	5.0	10.0	30.0
3SUP-D75H-ER-4	NORMAL, L-L	18	23	67	72	77	89	86	38
	COMMON, L-G	18	45	56	78	75	73	50	20
3SUP-D150H-ER-4	NORMAL, L-L	18	22	51	82	80	79	81	41
	COMMON, L-G	12	32	45	66	64	49	28	4
3SUP-D200H-ER-4	NORMAL, L-L	18	21	40	63	58	49	49	69
	COMMON, L-G	12	24	36	62	55	50	49	31

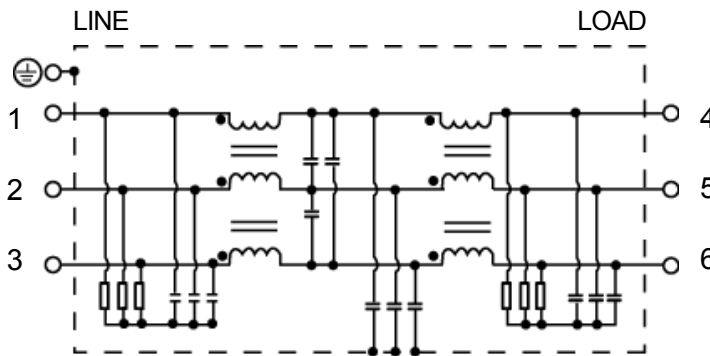
3SUP-HL-ER-6

- 3-Phase 3 wire, High Attenuation Characteristics.
- Designed for Class A and B.
- Conforms to CE marking.
- Application: Inverter primary power,
Servo-control machine tool

Safety Agency: Standard		File No.
UL	: UL-1283	E78644
TUV	: EN133200	R9950704



CIRCUIT DIAGRAM



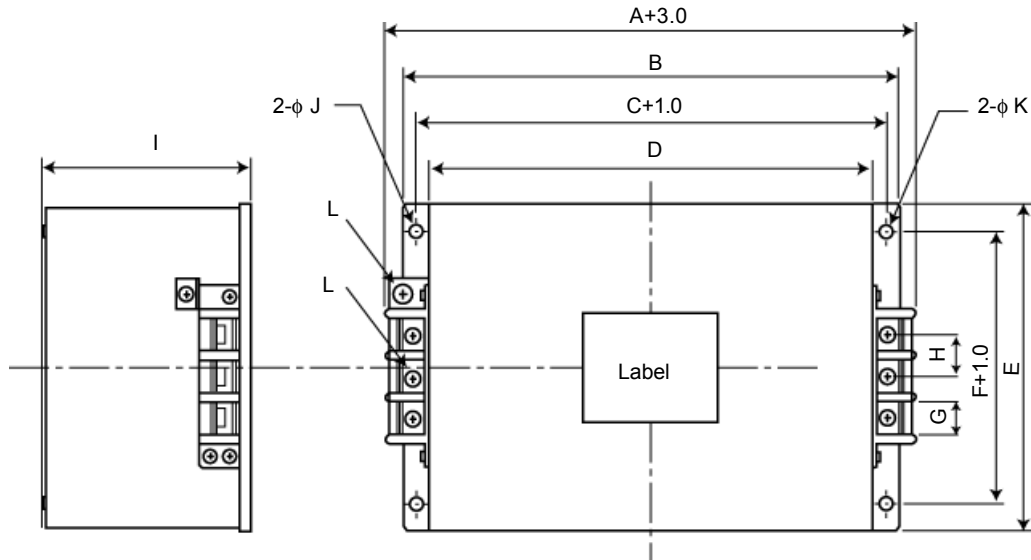
ELECTRICAL SPECIFICATIONS

Operating temp. range: -25 ~ +50C°

Safety Standard	Model number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)
	3SUP-HL30-ER-6	30	Line to Ground 2000Vrms 50/60Hz 60sec	Line to Ground 6000M Ωmin (at 500VDC)	8.0mA (at 500Vrms 60Hz)	1.5Vrms	35°C
	3SUP-HL50-ER-6	50					
	3SUP-HL75-ER-6	75					
	3SUP-HL100-ER-6	100					
	3SUP-HL150-ER-6	150					
	3SUP-HL200-ER-6	200					

This series has European approvals which assists in obtaining the **CE Marking** in accordance with the EC Low Voltage Directive

MECHANICAL DIMENSIONS



Model	A	B	C	D	E	F	G	H	I	J	K	L
3SUP-HL30-ER-6	246	230	215	200	100	85	13	18	140	5.5x7	5.5	M4
3SUP-HL50-ER-6	286	270	255	240	120	90						
3SUP-HL75-ER-6	396	370	350	330	170	140	18	23	155	6.5x8	6.5	M6
3SUP-HL100-ER-6												
3SUP-HL150-ER-6	484	440	420	400	200	170	25	30	200			M8
3SUP-HL200-ER-6												

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10	30
3SUP-HL30-ER-6	Normal L-L	72	65	60	48	45	48
	Common L-G	64	53	50	35	30	51
3SUP-HL50-ER-6	Normal L-L	82	78	76	63	30	43
	Common L-G	65	65	58	50	49	35
3SUP-HL75-ER-6	Normal L-L	82	85	88	83	76	51
	Common L-G	62	76	74	68	48	39
3SUP-HL100-ER-6	Normal L-L	81	86	86	78	74	60
	Common L-G	54	77	81	69	60	55
3SUP-HL150-ER-6	Normal L-L	74	85	85	72	67	42
	Common L-G	55	75	68	62	42	32
3SUP-HL200-ER-6	Normal L-L	73	81	74	62	59	55
	Common L-G	45	62	73	67	45	38

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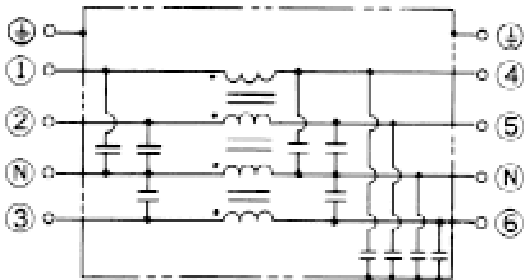
4SUP-T□H-E-4S

- Three Phase (3 φ) Filter “Δ”
- Rated 35 to 170 Ampere at 250VAC
- Common mode attenuation
- Low forward voltage drop
- Low leakage current

Safety Agency : Standard	File No.
UL : UL-1283	Pending
CSA : C22.2, No. 8-M1986	Pending
TUV : VDE0565-3	Pending



4SUP-T□H-E

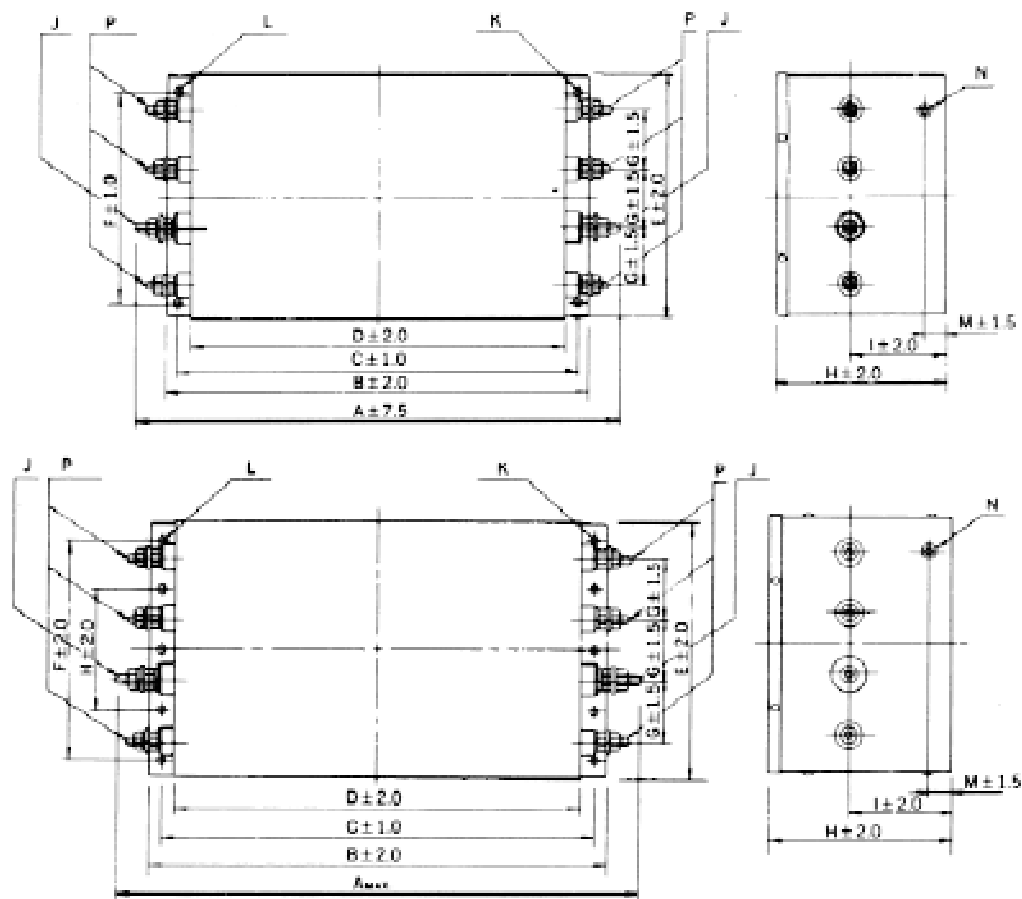


ELECTRICAL SPECIFICATIONS

Safety Standard	Model Number	Rated current (A)	Test voltage	Insulation resistance	Leakage current (max.)	Voltage drop (max.)	Temperature rise (max.)	Operating temp. range (C)
	4SUP-T35H-E-4S	35	2000Vrms 50/60Hz 60 sec	500MΩ min (at 500 VDC)	1mA (at 250Vrms 60Hz)	1.0Vrms	45°C	-20° to +40°
	4SUP-T50H-E-4S	50						
	4SUP-T70H-E-4S	70						
	4SUP-T100H-E-4S	100						
	4SUP-T170H-E-4S	170						

MECHANICAL DIMENSIONS

All Dimensions mm



DIMENSIONS

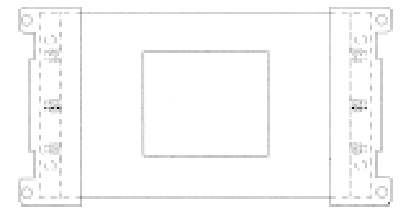
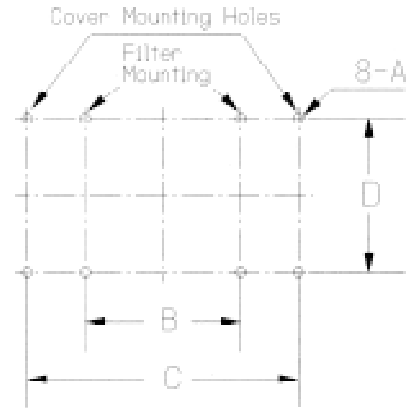
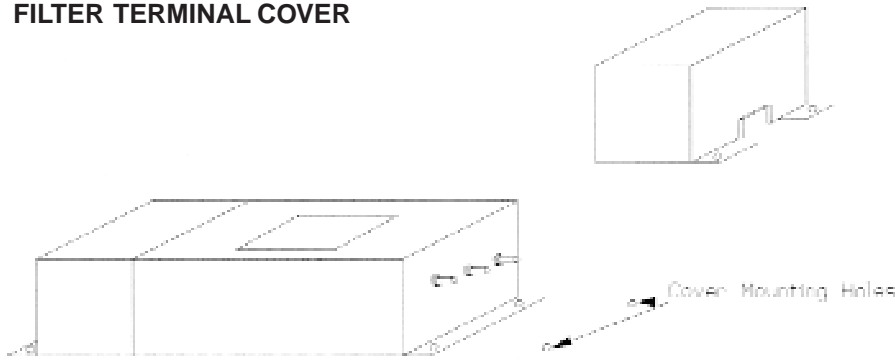
Model Number	A	B	C	D	E	F	G	H	I	J	K	L	Mø	N	P	Q	
4SUP-T35H-E-4S	255	230	215	200	140	110	30	80	40	M6	Ø6.5	6.5 x 8	15	M4	M5		
4SUP-T50H-E-4S	340	300	280	260	200	170	45	100	50	M10			20	M6	M10		
4SUP-T70H-E-4S									150	M12						100	
4SUP-T100H-E-4S	445	370	350	330	210	180	50	120	190	M14			25			M12	120
4SUP-T170H-E-4S	515	440	420	400	280	240	60	120	190	M14							

STATIC CHARACTERISTICS - INSERTION LOSSES (dB) - 50Ω

Part Number	Mode	Frequency - MegaHertz					
		0.15	0.5	1.0	5.0	10	30
4SUP-T35H-E-4S	COMMON, L-G	31	44	41	44	46	53
4SUP-T50H-E-4S	COMMON, L-G	31	42	39	43	45	51
4SUP-T70H-E-4S	COMMON, L-G	29	43	42	47	50	52
4SUP-T100H-E-4S	COMMON, L-G	26	37	36	46	68	43
4SUP-T170H-E-4S	COMMON, L-G	18	27	26	40	46	32

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• **FILTER TERMINAL COVER**



Filter Model	Terminal Cover	A	B	C	D
3SUP-H5H-ER-4	TC-H5H	M4	110	170	95
3SUP-H10H-ER-4	TC-H10H		145	230	
3SUP-H20H-ER-4	TC-H30H		185	270	
3SUP-H30H-ER-4					
3SUP-H50H-ER-4	TC-H50H	M6	220	318	110
3SUP-H75H-ER-4	TC-H75H		260	362	150
3SUP-H100H-ER-4	TC-H100H		280	402	
3SUP-A10H-ER-4	TC-H10H	M4	145	230	95
3SUP-A20H-ER-4	TC-H30H		185	270	
3SUP-A30H-ER-4					
3SUP-A50H-ER-4	TC-H50H	M6	220	318	110
3SUP-A75H-ER-4	TC-H75H		260	362	150
3SUP-A100H-ER-4	TC-H100H		280	402	
3SUP-A150H-ER-4	TC-W200H		240	350	220
3SUP-A200H-ER-4					
3SUP-A250H-ER-4	TC-H200H		240	370	230
3SUP-C5H-ER-4	TC-H5H	M4	110	185	95
3SUP-C10H-ER-4	TC-H10H		145	237	
3SUP-C20H-ER-4	TC-H30H		185	277	
3SUP-C30H-ER-4				287	
3SUP-C50H-ER-4	TC-H50H	M6	220	318	110
3SUP-C75H-ER-4	TC-H75H		260	392	150
3SUP-C100H-ER-4	TC-H100H		280	422	
3SUP-C150H-ER-4	TC-H150H		240	350	220
3SUP-C200H-ER-4	TC-H200H			370	230
3SUP-C250H-ER-4	TC-H250H			280	430
3SUP-D75H-ER-4	TC-D75H		M6	350	480
3SUP-D150H-ER-4	TC-D150H	390		568	210
3SUP-D200H-ER-4	TC-D200H	465		643	260
3SUP-W10H-ER-4	TC-H5H	M4	110	175	95
3SUP-W20H-ER-4	TC-H10H		145	220	
3SUP-W30H-ER-4					
3SUP-W50H-ER-4	TC-H30H	M6	170	250	90
3SUP-W75H-ER-4	TC-H50H		220	316	110
3SUP-W100H-ER-4				322	
3SUP-W150H-ER-4	TC-H100H		280	402	150
3SUP-W250H-ER-4	TC-H200H		240	370	230

NOISE FILTERS

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The specifications contained in this catalog are subject to change without notice.

Model Number	Rated Current									Feature	Terminal	Characteristics Application	Safety Standards																	
	1	2	3	4	5	6	1	1	2				3	UL	CSA	VDE	TUV	SEMKO	SEV	EI										
SUP-B□R-E		●		●		●					Plastic case	CP-wire solder-plated	Direct installation to PCB	E78644																
SUP-C□G-E			●			●																								
SUP-E□H-EP	●	●	●								Metal case	Vinyl insulated cable	1,000V Pulse absorption		E78644			10529-4730-1003												
SUP-E□H-EP					●		●	●	●			Screw terminals								10529-4730-1001	R85074	8415187								
SUP-G□H-EPR					●		●	●	●			Faston	2,000V Pulse absorption Bleeder resistor			E78644			10529-4730-1001		8707213									
SUP-G□H-EPR-2					●		●	●	●			Solder terminals																		
SUP-G□H-EPR-4					●		●	●	●		Screw terminals																			
SUP-E□H **	●	●	●								Metal case	Vinyl insulated cable	Low leakage				E78644 **	LR60681			10529-4730-1003									
SUP-E□H					●		●	●				Screw terminals													8415187					
SUP-E□H-0 **	●	●	●		●		●	●	●			Faston																		
SUP-E□H-2 **	●	●	●		●		●	●	●			Solder											R85074							
SUP-J□G-E(1) **			●			●	●	●			Inlet socket	Faston Solder terminals	Compact type	E78644 **					LR60681			10529-4730-1002		8946082 9014077	Nr.91.1 12062	139047				
SUP-J□G-E(1)-2			●			●	●	●																						
SUP-F□H-ER-2			●			●	●																			8815052				
SUP-J□H-ER-4					●		●	●	●		Metal case	Screw terminals	High Current		E78644	LR60681						10529-4730-1001								
SUP-K□H-ERB-4P							●	●	●				Surge							Surge Absorber and Filter										
SUP-L□H-ERB-2					●		●	●	●		277VAC																			
SUP-P□H **					●		●	●	●		Metal case	Faston Solder Screw	TVSS				E78644	LR60681					R9250051							
3SUP-H□H *					●		●	●	●			3-Phase	Screw terminals							3-Phase	E78644	LR60681				R9251182 T9250187				
3SUP-C□H *					●		●	●	●																Pending	Pending				
3SUP-D□H *					●		●	●	●																				J9650389	
4SUP-T□H *									●														Pending	Pending						

* 35 Amp, 50 Amp, 75 Amp, 100 Amp, & 170 Amp Versions Also Available

** UL544 Medical & Dental Equipment Rating Available

• INTRODUCTION

Recent years have witnessed tremendous advances in electronics. In the field of personal computers, word processors and other computer related equipment, legal restrictions regarding safety and noise generation have grown more strict with each passing year. In most cases, electronic devices exported must now conform to the noise regulations of the target country in order for them to be given market approval.

The following is an introductory description of the ways in which noise is generated and the various noise regulations currently enforced throughout the world.

• NOISE GENERATION AND TRANSMISSION

The noise generated by electronic devices consists of two kinds. Radiated noise is transmitted directly into the air from an electronic device, taking the form of an electric wave that interferes with other electronic devices. In contrast Conductive noise interferes with other components and devices by being transmitted along power lines and the wiring of electronic circuits. These two kinds of noise can be briefly explained in the context of an electronic device by means of the following diagram (Figure 1).

A) Electronic device

1. Conductive noise from electric power line.
2. Conductive noise along the signal lines connecting electronic devices.
3. Radiated noise transmitted from an electronic device which interferes with another device.
4. Radiated noise picked up and generated by the power line which acts as an antenna.
5. Radiated noise picked up and generated by the signal lines which act as an antenna.
6. Noise produced from a source within the electronic device.
7. Noise entering from the ground line.

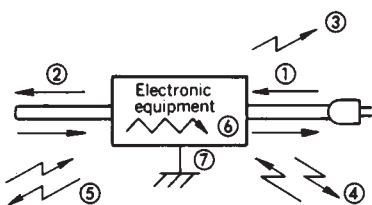


Fig. 1

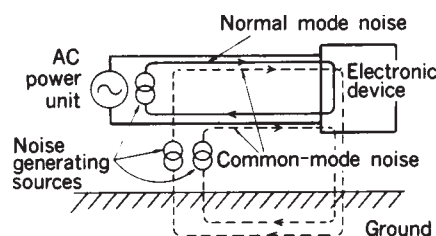


Fig. 2

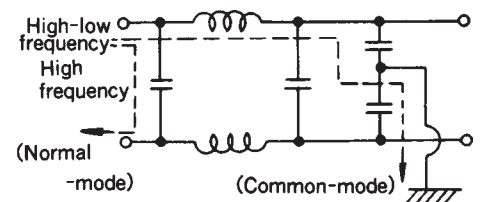


Fig. 3

As shown in Figure 2, conductive noise can also be divided into two types, normal mode noise involving symmetrical noise components oscillating between lines (L1-L2) and common mode noise involving asymmetrical noise components transmitted between a line and ground (L1-E, L2-E).

• OPERATING PRINCIPLES OF NOISE FILTERS

A key counter measure taken against noise is the use of noise filters. The operating principles of these devices are described in the following:

Viewed from the perspective of the circuit network, the noise filter is a kind of low range or low pass filter. It is designed to pass only frequencies lower than the cut off frequency of the filter, while attenuating or blocking all ranges higher than the cut off frequency.

As shown in Figure 3, the filter operates according to a principle whereby inductance connected directly in series with the line has virtually no affect on the noise current at low frequencies, but at high frequencies it demonstrates a high interruptive effect with respect to the noise current.

Also, a capacitor connected in parallel with the line is used as a side path to return high frequency back to the power line. The result is that normal mode noise passes through the capacitor and is shunted back to the other line. In the case of common mode noise, the result is that the noise passes through the midpoint of the two capacitors to ground.

The use of special materials such as amorphous alloys and toroidal cores gives the Okaya noise filters excellent insertion loss characteristics and high voltage pulse attenuation capability.

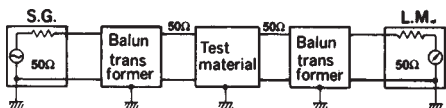
NOISE FILTERS

• EVALUATION METHODS OF NOISE FILTER CHARACTERISTICS

1. Static Characteristics

With a measuring impedance of 50 ohms, the amount of attenuation (insertion loss) is determined by using a level meter to measure the voltage before and after insertion of a noise filter into the test circuit. Using this method, both normal mode and common mode attenuation can be measured.

Measuring Circuit

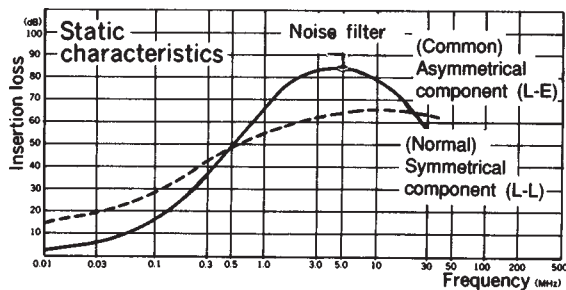


$$\text{Attenuation} = 20 \log_{10} (V_2/V_1) \text{ [dB]}$$

V_1 ...Level when test material is inserted

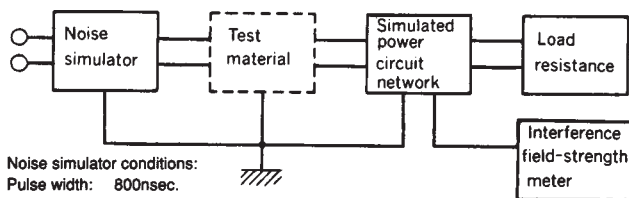
V_2 ...Level when test material is not inserted

Test material: Noise filter.



2. Dynamic Characteristics

In order to achieve measurement results as near as possible to actual application conditions, the following method is used: With a noise simulator as the noise generating source, a rated current is allowed to flow through the test device and a simulated power circuit network. The amount of normal mode and common mode attenuation is measured.



Noise simulator conditions:

Pulse width: 800nsec.

Frequency: 60Hz

Polarity: (+)

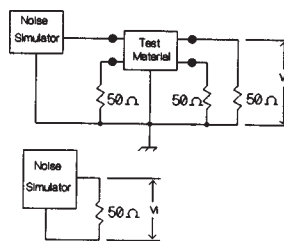
Test Material: Noise filter

3. Pulse Attenuation Characteristics

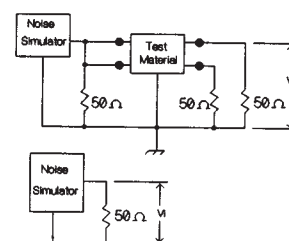
The following method is used to measure the noise margin for the external noise in an electronic device: a noise simulator is connected and the input/output voltages are measured. The formula noted below is then used to calculate the amount of attenuation in the form of the pulse absorption effect produced. In general, the noise condition used to test malfunctions is a high voltage pulse of 50nsec. to 1μsec at 1kV to 2kV in amplitude.

$$\text{Attenuation} = 20 \log_{10} (V_0/V_1) \text{ [dB]}$$

Normal Mode

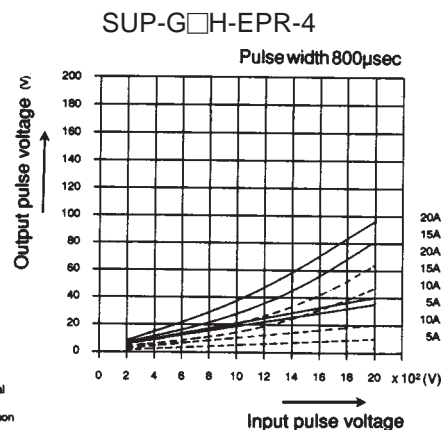


Common Mode



$$\text{Attenuation} = 20 \log_{10} (V_0/V_1) \text{ [dB]}$$

TVSS characteristics



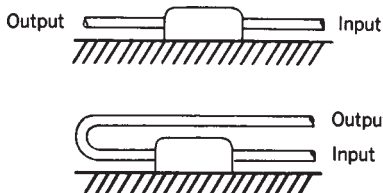
• APPLICATION PRECAUTIONS

The following points should be kept in mind with regard to the installation of noise filters.

1. When mounting on the noise producing side, they should be mounted as close as possible to the source of the noise with noise electrical or mechanical contact between the input and output side of the filter.

(Example) When the input/output lines are bundled together or arranged parallel with each other, high frequency noise components induced on the input side, results in the production of noise current on the output side.

Separation of input/output lines (good example)



Bundling or parallel arrangement of input/output lines (poor example)

2. When the device is directly installed on the equipment exposed to interference, it is important to mount the noise filter as close as possible to the machines power unit or input wiring. If a power line is allowed to enter the case of the equipment without passing through the noise filter, noise current can be radiated throughout the inside of the equipment enclosure, affecting the internal electronics.

3. Precautions should be taken to insure that the ground line for the noise filter has a lower impedance than that of the noise current. If this is not done, the noise prevention effect will be lost. Also, ground lines should be as short as possible. The use of long ground lines will result in substantial reduction of the noise prevention effects (particularly in the high frequency ranges above several MHz.).

4. Whenever possible, the outer case of the noise filter should be mounted directly to the outer case of the electronic equipment. When this is not possible, a short grounding line should be used to link the outer case of the filter and the equipment.

• INTERNATIONAL ELECTROMAGNETIC INTERFERENCE (EMI) REGULATIONS

In recent years the diffusion of personal computers, facsimiles and other data processing equipment has made safety measures and noise prevention measures for such devices a pressing concern. When selling electronic equipment domestically or exporting, the EMI (Electromagnetic Interference) standards for the target country must be satisfied or the product will not be approved for marketing in those countries. The following is a summary of the EMI regulations.

1. FCC Regulations for Computers and Related Electronic Equipment. In October 1979, the FCC (USA) included within its part 15 regulations a new sub-part J for the control of computer equipment. The values established by the FCC computer regulations divide equipment into Classes A and B.

Class A: Computer equipment meant for commercial use, namely such things as office computers and business machines.

Class B: Computer equipment meant for consumer home use, including such things as personal computers and television games.

2. VDE (Germany) Regulations: Standard VDE-0565 along with Standard IEC-939 are the Standards for Power Line Filters. VDE-0871 specifies conducted emissions limits for computing devices.

Class A: Special operating license required.

Class B: For general approval, no operation license required.

3. IEC (International Electrotechnical Commission) Worldwide standards body: IEC 1000/EN61000 became the EMI standard in the European Community (CE) in 1995, and as a result has become the defacto Worldwide standard.

IEC1000-4-2: ESD (Electrostatic Discharge) has very fast times with high voltage (15KV) and low energy (<10Amp).

IEC1000-4-4: EFT (Electrical Fast Transient) are a burst of very fast noise pulses (5 nanosecond) several kV in amplitude.

IEC1000-4-5: SURGE is high energy (kV/kA) short duration (μ second) pulses which can be caused by lightning, switching power loads or large inductive loads.

4. Other standards bodies in the USA include ANSI, IEEE, SAE, EIA, ASTM, FDA, and NFPA.

OKAYA DOES SPECIAL FILTER DESIGN

ASK ABOUT A NOISE SUPPRESSION FILTER TO MEET YOUR EXACT NEEDS



ASK ABOUT THE OKAYA AC POWER LINE NOISE FILTER DESIGN KIT

- **TRANSIENT VOLTAGE SURGE SUPPRESSION**



Transient Voltage Surge Suppression (TVSS) has become an important part of Power Line Protection. In the past, accessories which furnished some TVSS protection were available as add-on or after market protection devices. Many of these accessories were very marginal protection against TVSS. With the changes to International Safety Agency Regulations, better TVSS protection and TVSS protection incorporated directly into equipment is becoming a major consideration in new equipment design.

Okaya's dedication to the continual improvement of product has given rise to a new feature in many of the AC Noise Suppression Filters featured in this catalog. This new feature is Transient Voltage Surge Suppression (TVSS). Okaya has incorporated TVSS capability into many of its Filters Series. This Suppression takes several different forms and capabilities.

The SUP-EH and SUP-EH-EP Series feature toroid coils with high performance magnetic media. This feature combined with high voltage pulse capacitors gives these two series a 20dB attenuation of 1000V, 800nsec. pulses.

The SUP-GH Series incorporate into the inductance a toroid coil which is manufactured from amorphous alloys. This special core material combined with high voltage pulse capacitors gives this series a 20dB attenuation of 2000v, 800nsec. pulses.

The SUP-KH Series incorporates a plug-in TVSS device. This TVSS device RAV-PWZ comes in either 135VAC (RAV-401 -PWZ) or 270VAC (RAV-781-PWZ) versions. This TVSS device features a line monitor indicator to assure proper protection and the ability to suppress 12KV (1.2 x 50µsec) and 1000A (8/20µsec) pulses. These features combine to give reliable TVSS protection to an already high performance EMI/RFI Filter Series.

The RAV-PH Series Feature a high mu Core material which when combined with high voltage pulse capacitors, allows this series to attenuate both common and normal transient voltage surges of 2000volt, 800 µsec. EMI/RFI attenuation curves begin at 10KHz. Some models are UL544(2601) recognized.

The ability to supply complete power line protection, from EMI/RFI noise attenuation to Transient Voltage Surge Suppression is what continues to make Okaya a leader in new innovation design to meet industry needs.

Our staff of technical personnel is always ready to work with the customer to furnish the exact product needs.

Okaya's ability to incorporate multiple features in our AC Power Line Filters is just one example of our commitment.

SWITCHING SPARK GAP

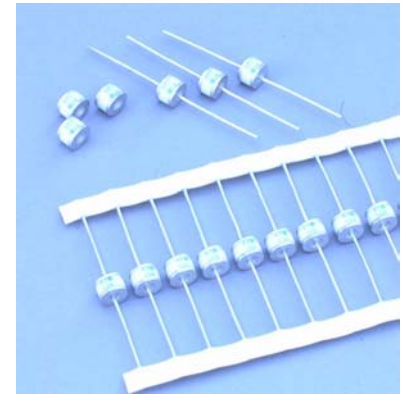
RSG Series

Application

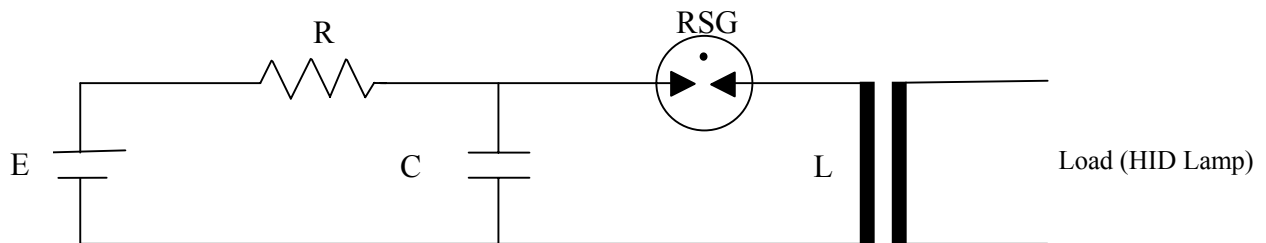
- LCD Projectors, Rear Projections
- Ballasts for HID headlamp systems for automobiles
- Exposure systems, UV Cleaning Systems

Feature

- DC breakdown voltage is stabilized even in a dark place.
- This series is possible to use under higher voltage and heavier current than semiconductor switch method.
- Long life.
- It is possible to harden by using the resin of epoxy.
- Corresponding to 8000V



Basic Circuit

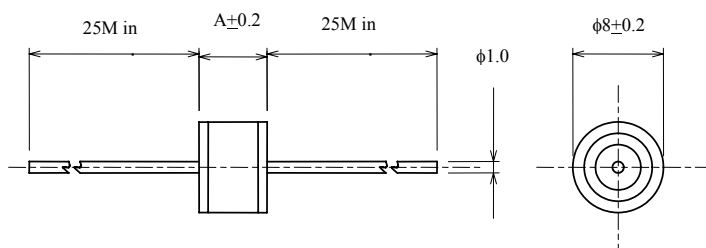


Electrical Specifications

Test / Model	DC Break down voltage (V)	Insulation resistance (MΩ)	Capacitance Max. (pF)	Number of switching Min. (Times)	Peak current (A)	Switching frequency Max. (Hz)	Operation and storage temperature (C)
RSG-401-BJL	400±15%	1000	2.0	2×10 ⁵	500	200	-40~+100
RSG-601-BJL	600±15%	1000	2.0	2×10 ⁵	500	200	-40~+100
RSG-801-BJL	800±15%	1000	2.0	2×10 ⁵	500	200	-40~+100 *
RSG-102-BJL	1000±15%	1000	2.0	2×10 ⁵	500	200	-40~+100
RSG-302-BKL	3000+20/-15%	1000	2.0	2x10 ⁵	500	200	-40~+100
RSG-502-BKL	5000±20%	1000	2.0	10 ⁵	500	200	-40~+100
RSG-802-BQL	8000±20%	1000	2.0	10 ⁵	500	200	-40~+100

* for automobile: -40~+150C

Dim:mm

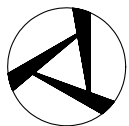


Model	A
RSG-***-BJL	6.05
RSG-***-BKL	7.50
RSG-***-BQL	11.90

Spec No.	SS-020
Data	Oct 30, 2003
Version	First

SPECIFICATION

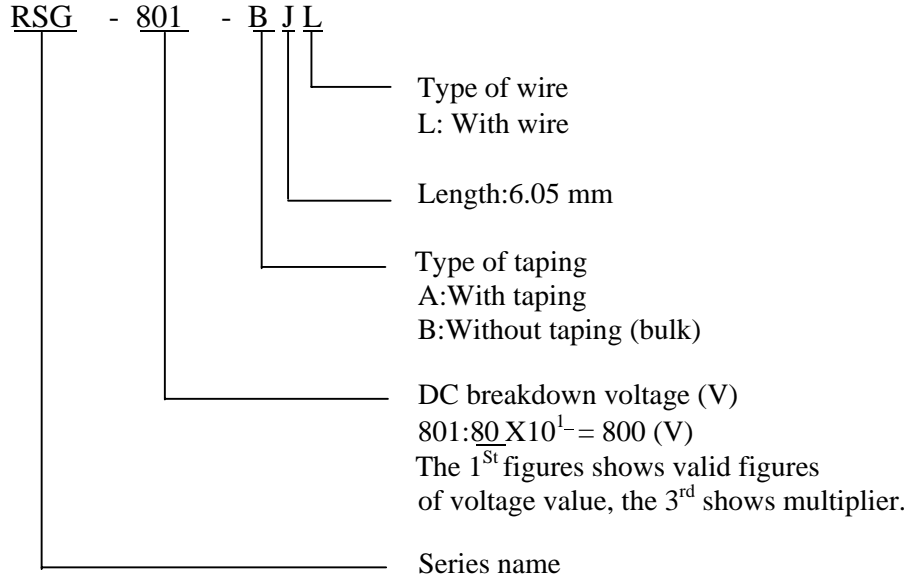
Product name :Rodan Spark Gap
Type : RSG-801-BJL



Spec No.	SS-020
Data	Oct 30, 2003
Version	First

1. Scope This specification covers Rodan Spark Gap RSG-801-BJL.

2. Type designation



3. Appearance Structure

- 3-1 Dimension Refer to drawing 4R-4198-Y79
- 3-2 Display and contents Marking must not be disappeared easily, and it has to be identified.

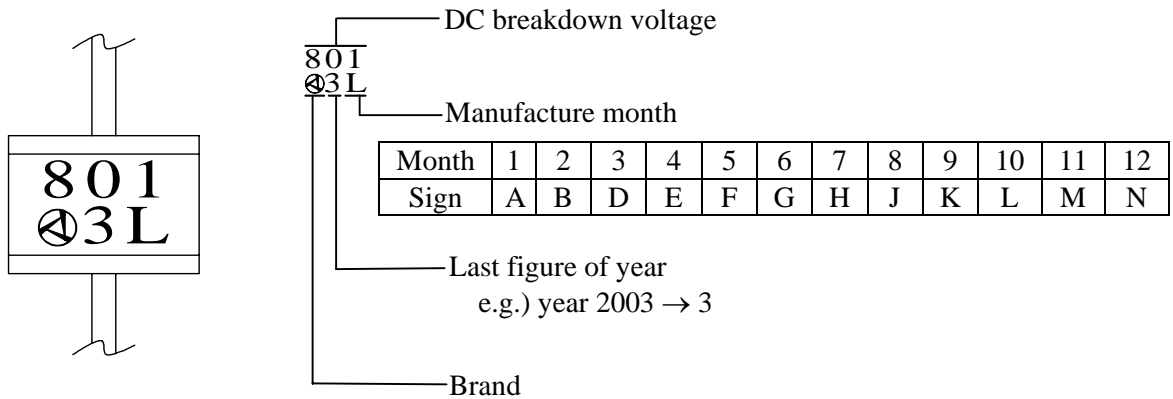


Fig.1 Example of marking

- 3-3 Materials Ceramic, Electrode, Lead wire etc
- 3-4 Plating treatment Tinning
- 3-5 Filler gas Ar, mixed gas (This product doesn't use radioisotope.)



Spec No.	SS-020	P: 3/5
Data	Oct 30, 2003	
Version	First	

4. Electrical characteristics

No.	Item	Mark	Test condition	Standard values	
1	DC breakdown voltage	Ez	Switching times	1 s Max	800 V \pm 15 %
			Ambient temperature	Room temperature	
			Test circuit 		
2	Insulation resistance	IR	DC100 V	1000 MΩ Min	
3	Electrostatic capacitance	C	1.0 kHz	2.0 pF Max	
4	Life test	-	Switching frequency	30Hz	Initial breakdown voltage 1000 V Max Following breakdown voltage 800 V \pm 15 % Insulation resistance 100 MΩ Min (DC100 V)
			Switching times	2.5 s ON / 57.5 s OFF	
			Ambient temperature	Room temperature	
			Test circuit <p style="text-align: center;">*R is adjusted</p> <p>Minimum number of switching is 2×10^5 times, according to the above condition.</p>		

*1 The above-mentioned electric characteristics are regulations of during darkness.

*2 This product may discharge less than 680 V that is lower limit of specification. This case is known as early ignition. Early ignition incidence is specified as maximum of 3 % by above test condition of section1 and section4.



Spec No.	SS-020
Data	Oct 30, 2003
Version	First

5. Switching frequency

Maximum switching frequency : 200 Hz

6. Operating condition

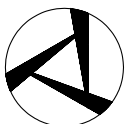
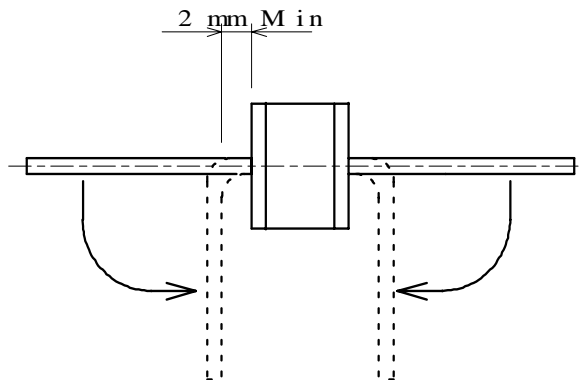
Operating temperature: -40C to +100C

7. Storage condition

Storage temperature: -40C to +100C

8. About forming

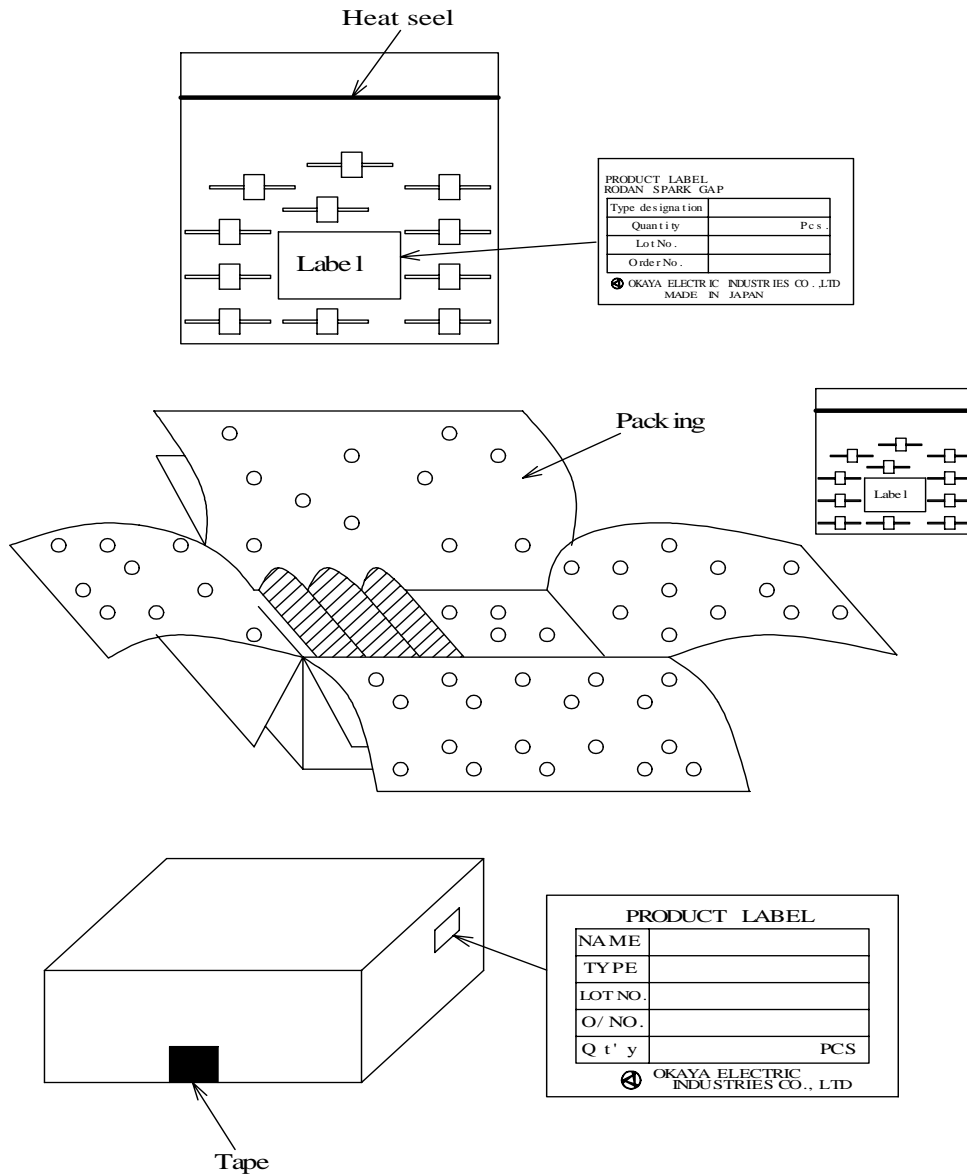
As regards forming of spark gap, please take distance more than 2mm from main body when you bend lead wire.
When performing a forming, please hold only lead wire and be careful not to give a stress on main body.

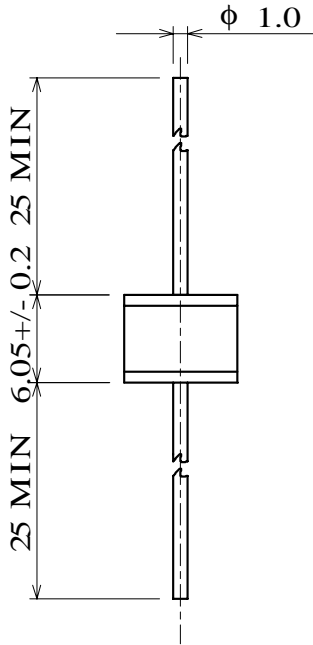
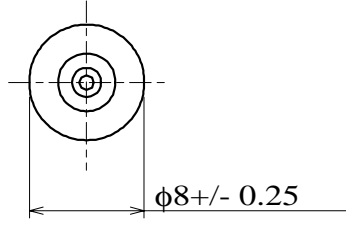


Spec No.	SS-020
Data	Oct 30, 2003
Version	First

9. Packing

Put 50 pcs. of RSG series and 1pc. of product label in a vinyl bag of specified size, seal the bag with a heatseal, put bags of quantity required a box, pack and stick product label on the box.





Weight: approx.2 g

Ver.	Rev . data	His tory of rev .	Date	Scale	Product name	
			2003 .5 .27	2 :1	Rodan spark gap	
					Type name	
					Outline dimension (Φ8 .0 X 6 .05 L)	
					Drawing No .	
OKAYA ELECTRIC AMERICA, INC.					4 R - 4198 - Y79	4

Spec No.	SS-021
Data	Oct 30, 2003
Version	First

SPECIFICATION

Product name :Rodan Spark Gap

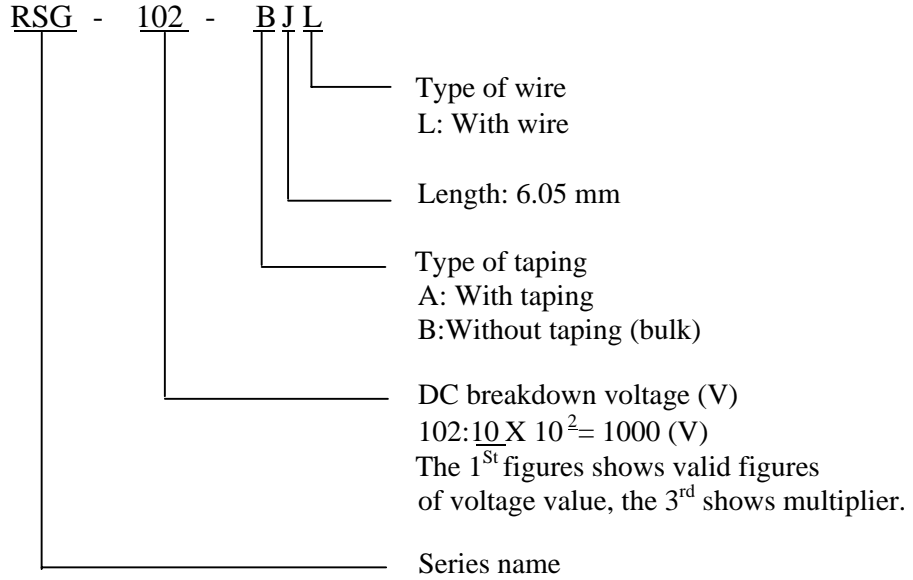
Type :RSG-102-BJL



Spec No.	SS-021
Data	Oct 30, 2003
Version	First

1. Scope This specification covers Rodan Spark Gap RSG-102-BJL.

2. Type designation



3. Appearance Structure

3-1 Dimension Refer to drawing 4R-4198-Y79

3-2 Display and contents Marking must not be disappeared easily, and it has to be identified.

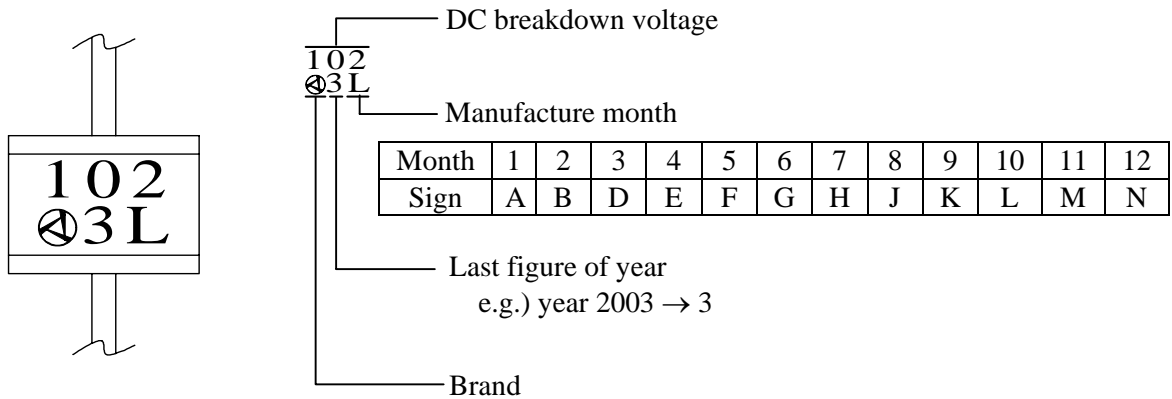


Fig.1 Example of marking

3-3 Materials Ceramic, Electrode, Lead wire etc

3-4 Plating treatment Tinning

3-5 Filler gas Ar, mixed gas (This product doesn't use radioisotope.)

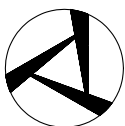


Spec No.	SS-021
Data	Oct 30, 2003
Version	First

4. Electrical characteristics

No.	Item	Mark	Test condition	Standard values
1	DC breakdown voltage	Ez	Switching times	1 s Max
			Ambient temperature	Room temperature
			Test circuit 	
				1000 V ±15 %
2	Insulation resistance	IR	DC100 V	1000 MΩ Min
3	Electrostatic capacitance	C	1.0 kHz	2.0 pF Max
4	Life test	-	Switching frequency	30Hz
			Switching times	2.5 s ON / 57.5 s OFF
			Ambient temperature	Room temperature
			Test circuit 	
				Initial breakdown voltage 1390 V Max Following breakdown voltage 1000 V ±15 % Insulation resistance 100 MΩ Min (DC100 V)
				Minimum number of switching is 2×10^5 times, according to the above condition.

*1 The above-mentioned electric characteristics are regulations of during darkness.
 *2 This product may discharge less than 850 V that is lower limit of specification. This case is known as early ignition. Early ignition incidence is specified as maximum of 3 % by above test condition of section1 and section4.



Spec No.	SS-021
Data	Oct 30, 2003
Version	First

5. Switching frequency

Maximum switching frequency : 200 Hz

6. Operating condition

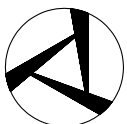
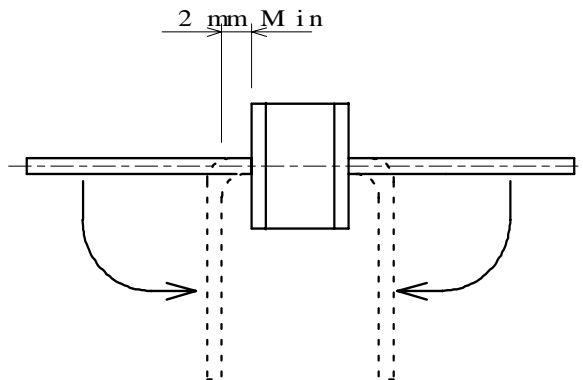
Operating temperature: -40C to +100C

7. Storage condition

Storage temperature: -40C to +100C

8. About forming

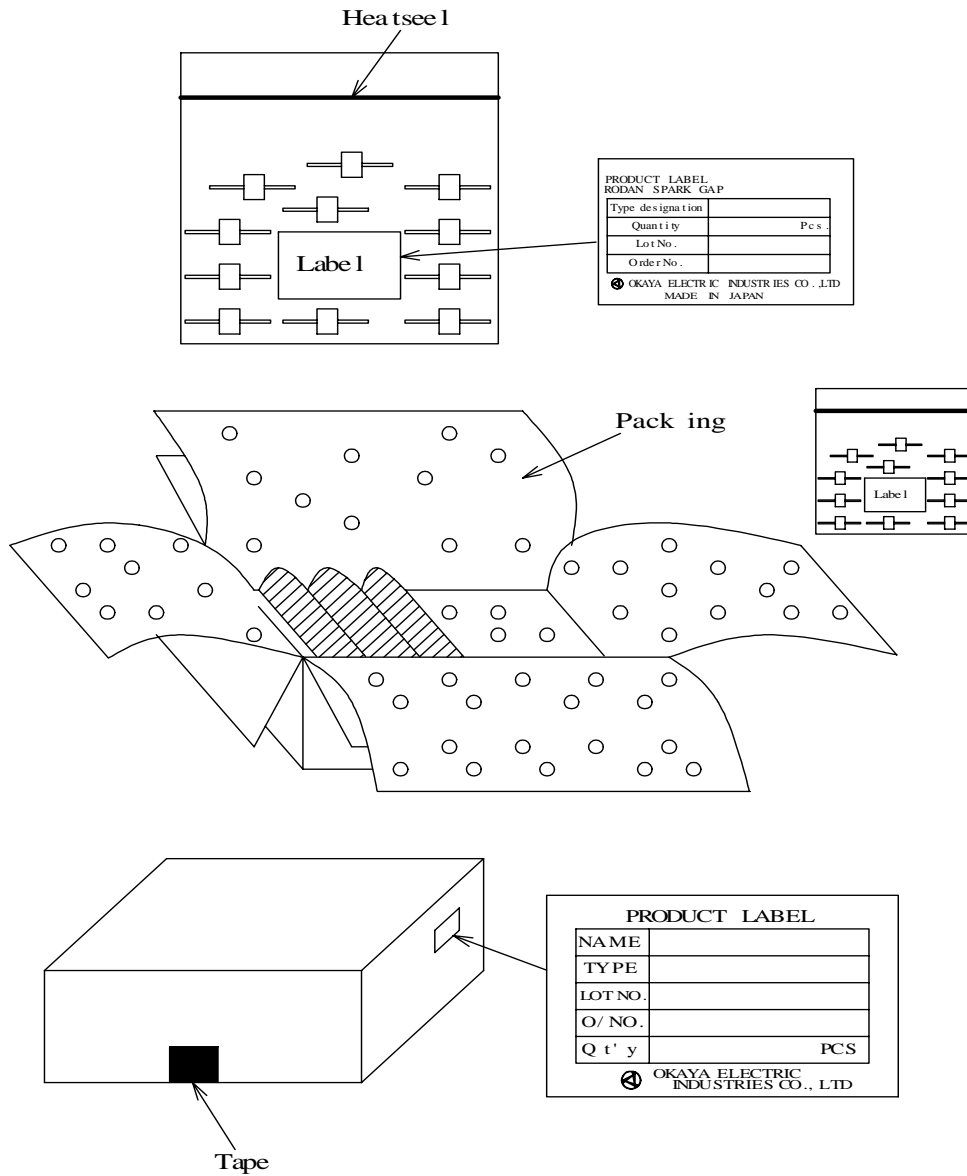
As regards forming of spark gap, please take distance more than 2mm from main body when you bend lead wire.
When performing a forming, please hold only lead wire and be careful not to give a stress on main body.

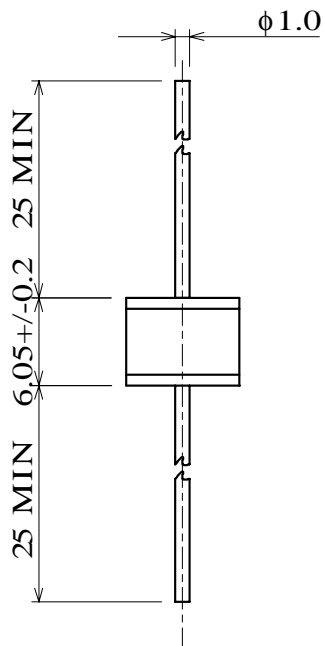
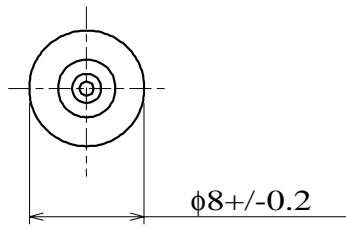


Spec No.	SS-021
Data	Oct 30, 2003
Version	First

9. Packing

Put 50 pcs. of RSG series and 1pc. of product label in a vinyl bag of specified size, seal the bag with a heatseal, put bags of quantity required a box, pack and stick product label on the box.





Weight: approx. 2 g

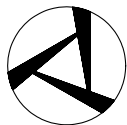
Ver.	Rev. data	History of rev.	Date	Scale	Product name	
			2003.5.27	2:1	Rodan spark gap	
					Type name	
					Outline dimension ($\Phi 8.0 \times 6.05 \text{ L}$)	
					Drawing No.	
OKAYA ELECTRIC AMERICA, INC.					4 R- 4198- Y79	4

Spec No.	SS-022	P: 1/5
Data	Oct 30, 2003	
Version	First	

SPECIFICATION

Product name : Rodan Spark Gap

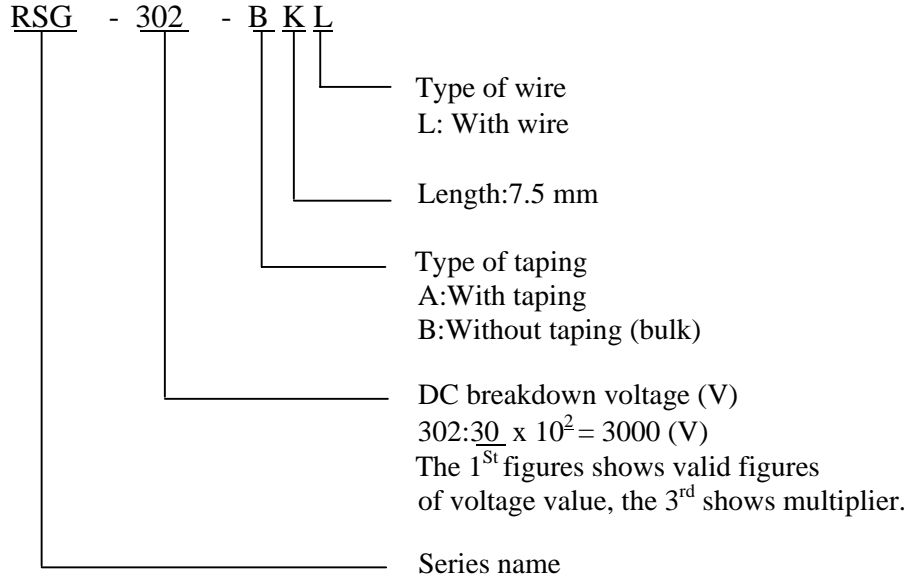
Type : RSG-302-BKL



Spec No.	SS-022
Data	Oct 30, 2003
Version	First

1. Scope This specification covers Rodan Spark Gap RSG-302-BKL.

2. Type designation



3. Appearance Structure

3-1 Dimension Refer to drawing 4R-4198-Y85

3-2 Display and contents Marking must not be disappeared easily, and it has to be identified.

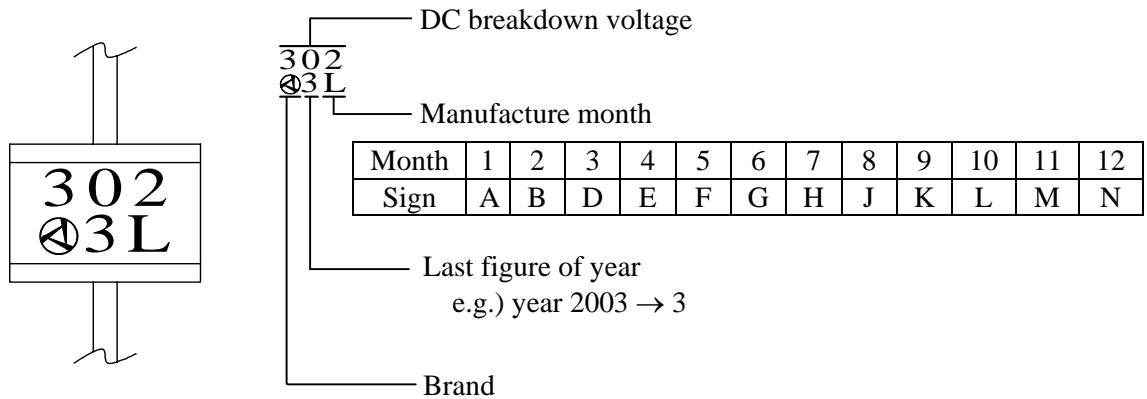
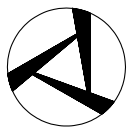


Fig.1 Example of marking

3-3 Materials Ceramic, Electrode, Lead wire etc

3-4 Plating treatment Tinning

3-5 Filler gas Ar, mixed gas (This product doesn't use radioisotope.)



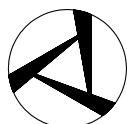
Spec No.	SS-022	P: 3/5
Data	Oct 30, 2003	
Version	First	

4. Electrical characteristics

No.	Item	Mark	Test condition	Standard values	
1	DC breakdown voltage	Ez	Peak current	100 A Max	3000 V ⁺²⁰ ₋₁₅ %
			Switching frequency	100 Hz Max	
			Switching times	1 s Max	
			Ambient temperature	Room temperature	
			Test circuit		
2	Insulation resistance	IR	DC100 V	1000 MΩ Min	
3	Electrostatic capacitance	C	1.0 kHz	2.0 pF Max	
4	Life test	-	Peak current	500 A Max	Initial breakdown voltage 3900 V Max
			Switching frequency	50 Hz	
			Switching times	2 s ON / 3 s OFF	
			Ambient temperature	Room temperature	
			Test circuit		
Minimum number of switching is 2×10^5 times, according to the above condition.				Following breakdown Voltage 3000 V \pm 20%	
				Insulation resistance 100 MΩ Min (DC100 V)	

*1 The above-mentioned electric characteristics are regulations of during darkness.

*2 This product may discharge less than 2550 V that is lower limit of specification. This case is known as early ignition. Early ignition incidence is specified as maximum of 3 % by above test condition of section1 and section4



OKAYA ELECTRIC AMERICA, INC.

Spec No.	SS-022
Data	Oct 30, 2003
Version	First

5. Switching frequency

Maximum switching frequency : 200 Hz

6. Operating condition

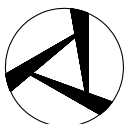
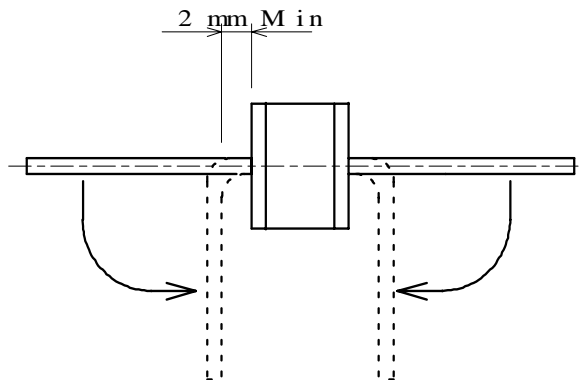
Operating temperature: -40C to +100C

7. Storage condition

Storage temperature : -40C to +100C

8. About forming

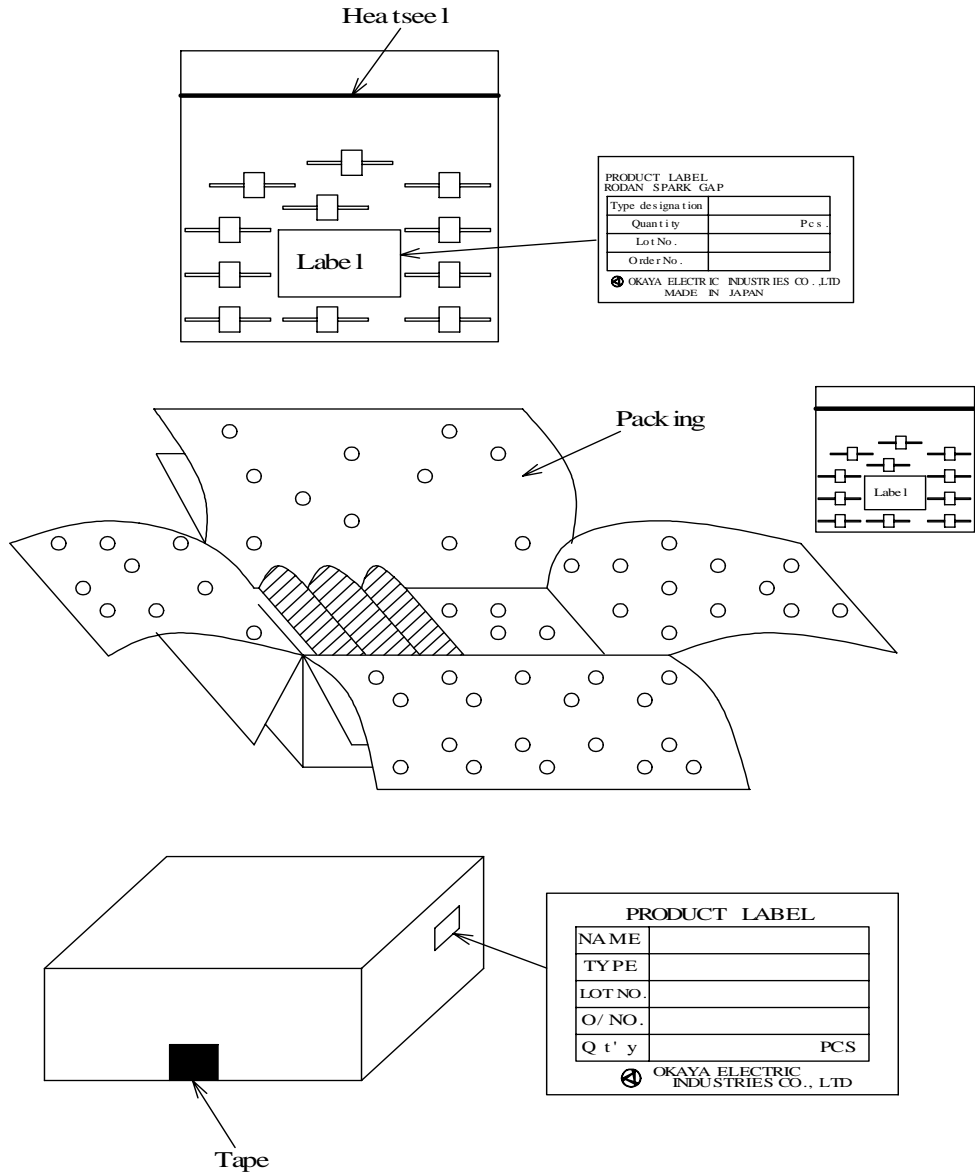
As regards forming of spark gap, please take distance more than 2mm from main body when you bend lead wire.
When performing a forming, please hold only lead wire and be careful not to give a stress on main body.

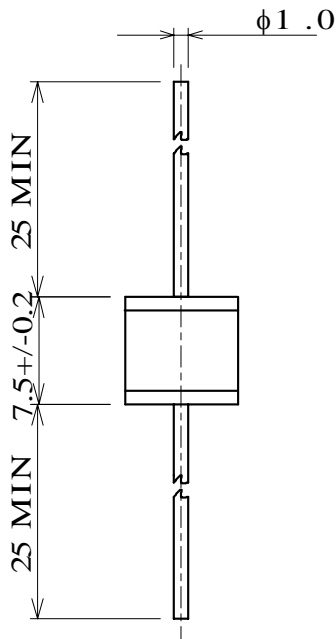
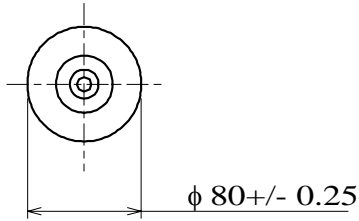


Spec No.	SS-022
Data	Oct 30, 2003
Version	First

9. Packing

Put 50 pcs. of RSG series and 1pc. of product label in a vinyl bag of specified size, seal the bag with a heatseal, put bags of quantity required a box, pack and stick product label on the box.





Weight : approx . 2g

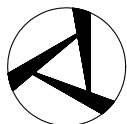
Ver.	Rev . data	History of rev .	Date	Scale	Product name	
			2003 .8 .29	2 :1	Rodan spark gap	
					Type name	
					Outline dimension (Φ 8.0 X 7 .5L)	
					Drawing No .	
OKAYA ELECTRIC AMERICA, INC.					4 R - 4198 - Y85	4

Spec No.	SS-023
Data	Oct 30, 2003
Version	First

SPECIFICATION

Product name : Rodan Spark Gap

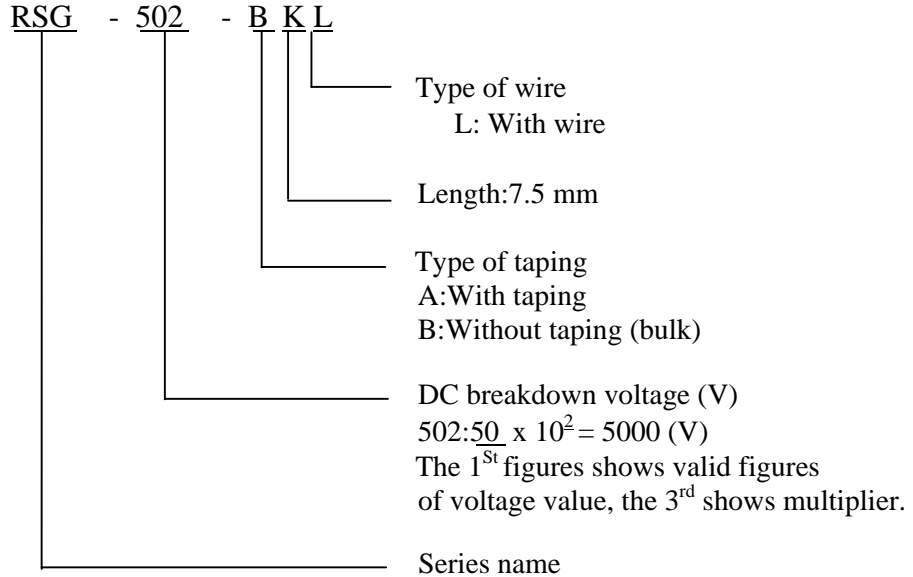
Type : RSG-502-BKL



Spec No.	SS-023
Data	Oct 30, 2003
Version	First

1. Scope This specification covers Rodan Spark Gap RSG-502-BKL.

2. Type designation



3. Appearance Structure

3-1 Dimension Refer to drawing 4R-4198-Y85

3-2 Display and contents Marking must not be disappeared easily, and it has to be identified.

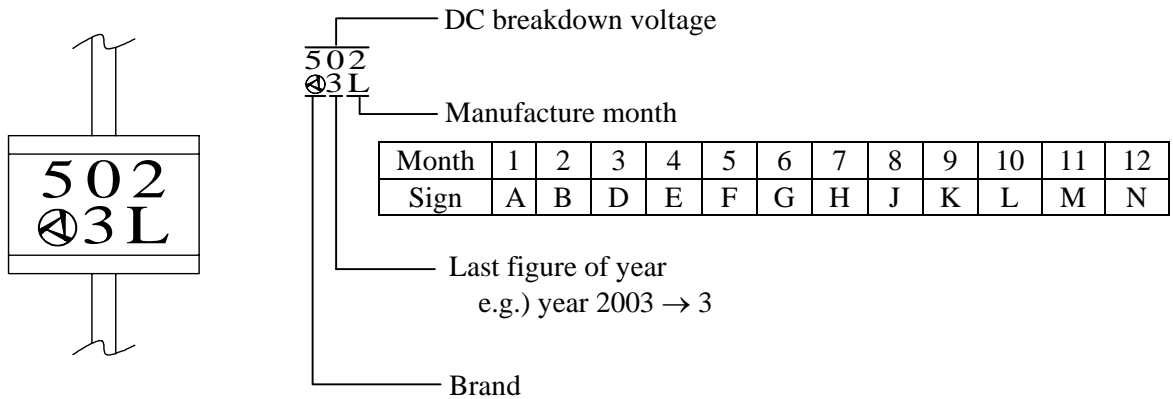
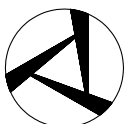


Fig.1 Example of marking

3-3 Materials Ceramic, Electrode, Lead wire etc

3-4 Plating treatment Tinning

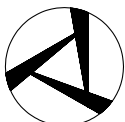
3-5 Filler gas Ar, mixed gas (This product doesn't use radioisotope.)



Spec No.	SS-023	P: 3/5
Data	Oct 30, 2003	
Version	First	

4. Electrical characteristics

No.	Item	Mark	Test condition	Standard values
1	DC breakdown voltage	Ez	1 MΩ , 500 V/s	5000 V ±20 %
2	Insulation resistance	IR	DC100 V	1000 MΩ Min
3	Electrostatic capacitance	C	1.0 kHz	2.0 pF Max
4	Life test	-	Switching times	1 s ON / 10 s OFF
			Ambient temperature	Room temperature
			Test circuit 	DC breakdown Voltage 5000 V ⁺²⁰ / ₋₂₅ % Insulation resistance 100 MΩ Min (DC100 V)
			Minimum number of switching is 10 ⁵ times, according to the above condition.	



Spec No.	SS-023
Data	Oct 30, 2003
Version	First

5. Switching frequency

Maximum switching frequency : 200 Hz

6. Operating condition

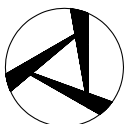
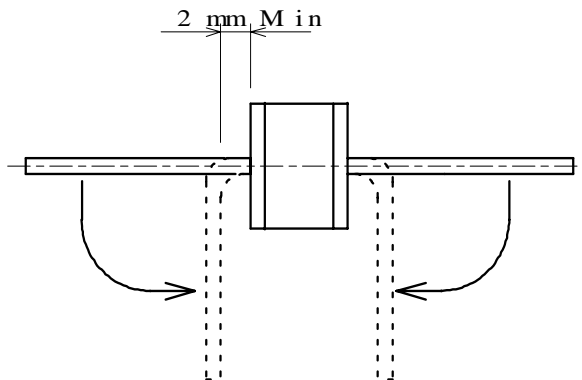
Operating temperature: -40C to +100C

7. Storage condition

Storage temperature: -40C to +100C

8. About forming

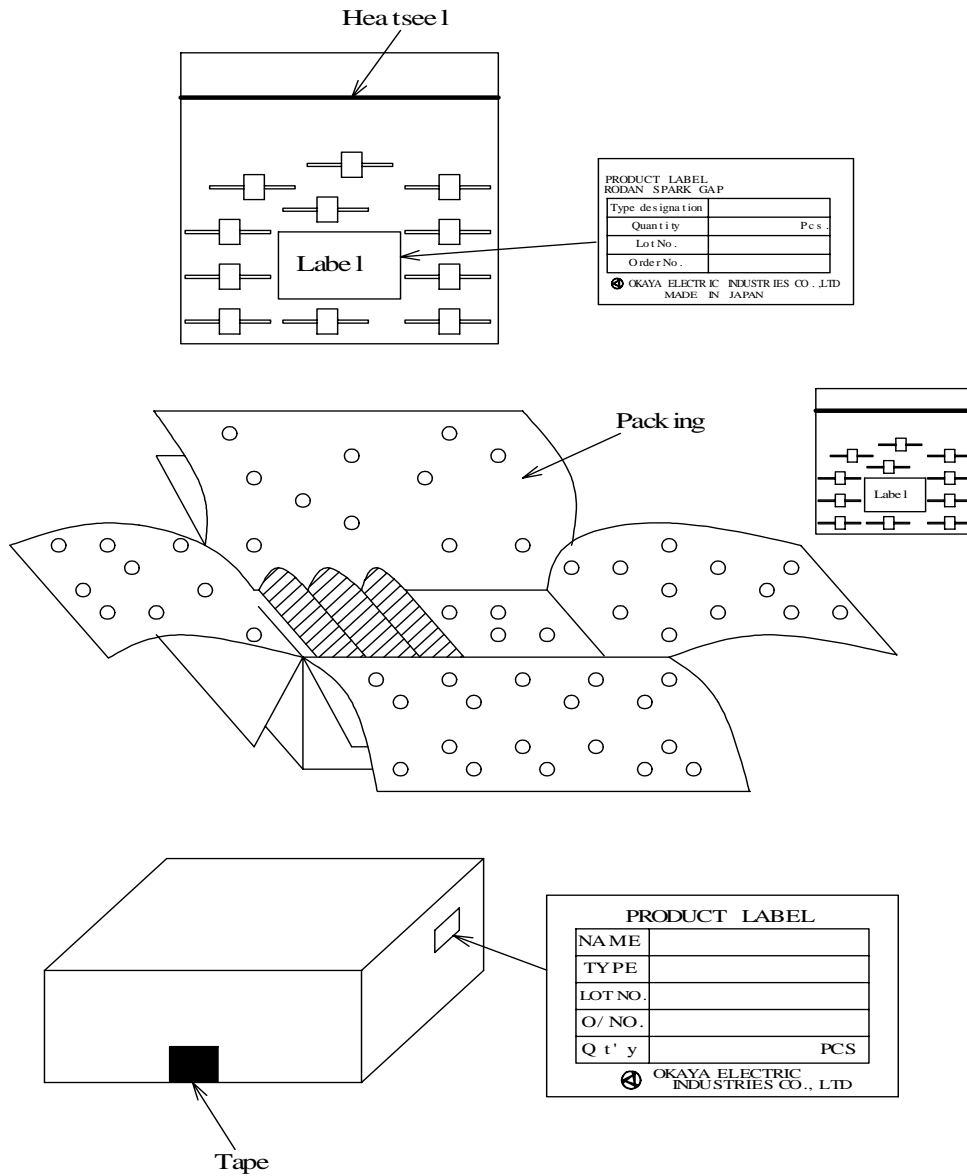
As regards forming of spark gap, please take distance more than 2mm from main body when you bend lead wire.
When performing a forming, please hold only lead wire and be careful not to give a stress on main body.

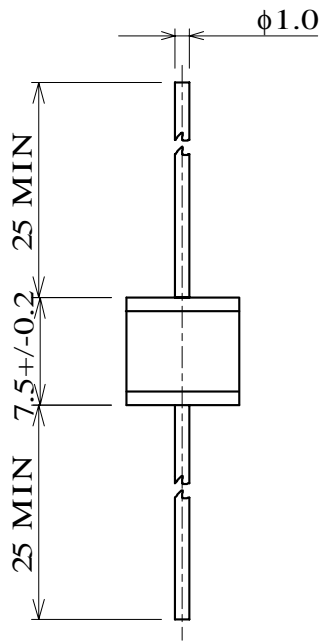
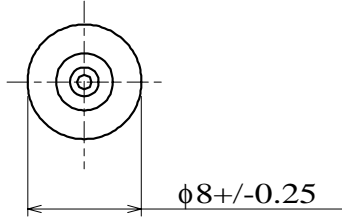


Spec No.	SS-023
Data	Oct 30, 2003
Version	First

9. Packing

Put 50 pcs. of RSG series and 1pc. of product label in a vinyl bag of specified size, seal the bag with a heatseal, put bags of quantity required a box, pack and stick product label on the box.





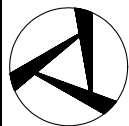
Weight: approx. 2g

Ver.	Rev. data	History of rev.	Date	Scale	Product name	
			2003.8.29	2:1	Rodan spark gap	
					Type name	
					Outline dimension (Φ8.0 X 7.5L)	
					Drawing No.	
OKAYA ELECTRIC AMERICA, INC.					4R-4198-Y85	4

Spec No.	SS-024
Data	Oct 30, 2003
Version	First

SPECIFICATION

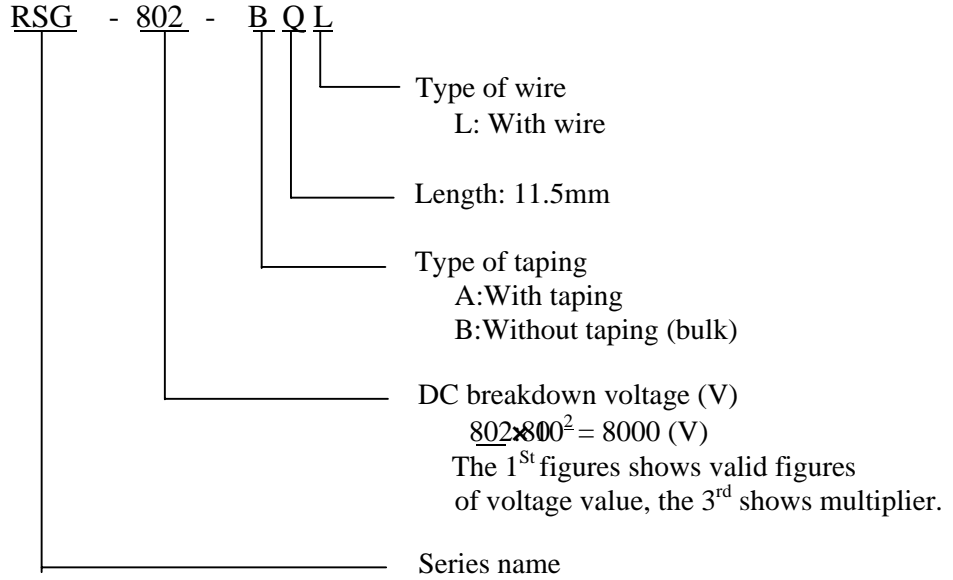
Product name Rodan Spark Gap
Type RSG-802-BQL



Spec No.	SS-024
Data	Oct 30, 2003
Version	First

1. Scope This specification covers Rodan Spark Gap RSG-802-BQL.

2. Type designation



3. Appearance Structure

3-1 Dimension Refer to drawing 4R-4198-Y89

3-2 Display and contents Marking must not be disappeared easily, and it has to be identified.

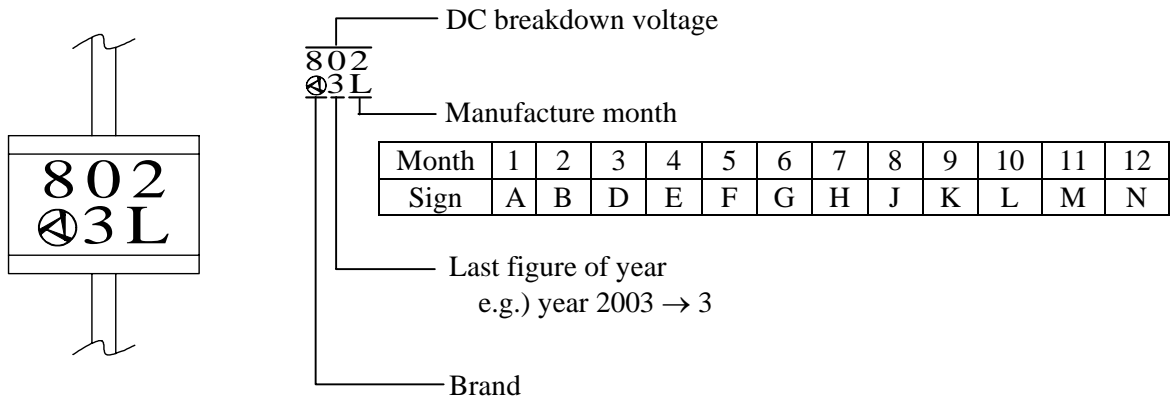
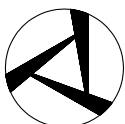


Fig.1 Example of marking

3-3 Materials Ceramic, Electrode, Lead wire etc

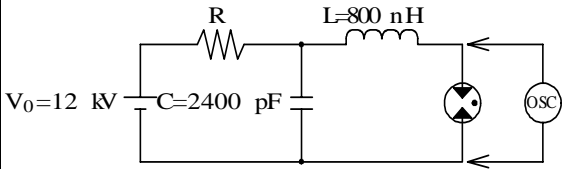
3-4 Plating treatment Tinning

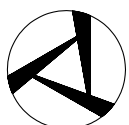
3-5 Filler gas Ar, mixed gas This product doesn't use radioisotope.



Spec No.	SS-024	P:3/5
Data	Oct 30, 2003	
Version	First	

4. Electrical characteristics

No.	Item	Mark	Test condition		Standard values
1	DC breakdown voltage	Ez	1 MΩ , 500 V/s		8000 V ±20 %
2	Insulation resistance	IR	DC100 V		1000 MΩ Min
3	Electrostatic capacitance	C	1.0 kHz		2.0 pF Max
4	Life test	-	Switching frequency	100 Hz	DC breakdown Voltage 8000 V ⁺²⁰ ₋₂₅ %
			Switching times	5 s ON / 55 s OFF	
			Ambient temperature	Room temperature	
			Test circuit		 <p style="text-align: center;">* R is adjusted</p>
Minimum number of switching is 10 ⁵ times, according to the above condition.					



Spec No.	SS-024
Data	Oct 30, 2003
Version	First

5. Switching frequency

Maximum switching frequency : 200 Hz

6. Operating condition

Operating temperature : -40 to +100

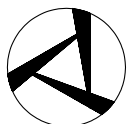
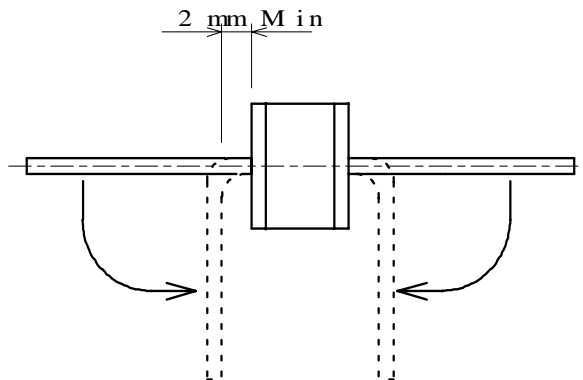
7. Storage condition

Storage temperature : -40 to +100

8. About forming

As regards forming of spark gap, please take distance more than 2mm from main body when you bend lead wire.

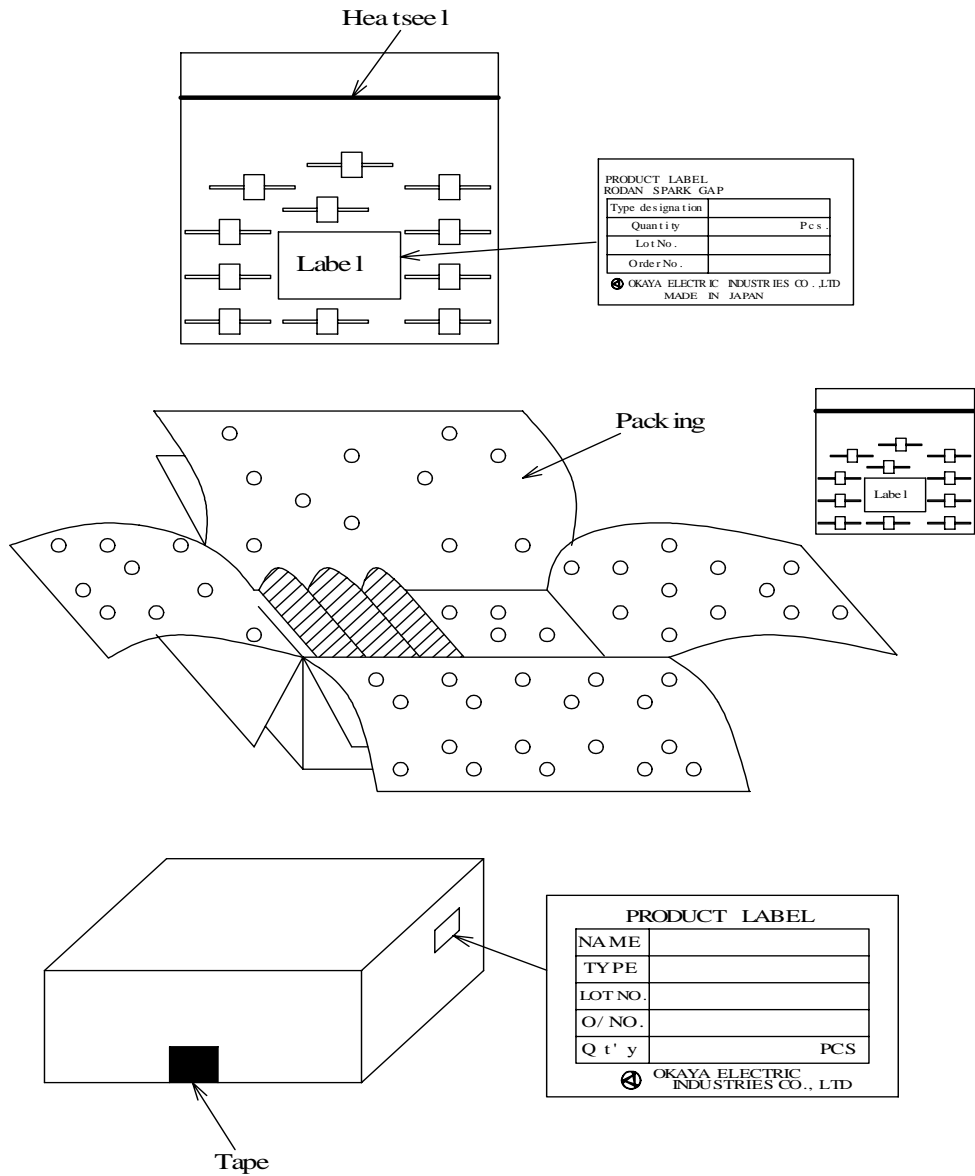
When performing a forming, please hold only lead wire and be careful not to give a stress on main body.

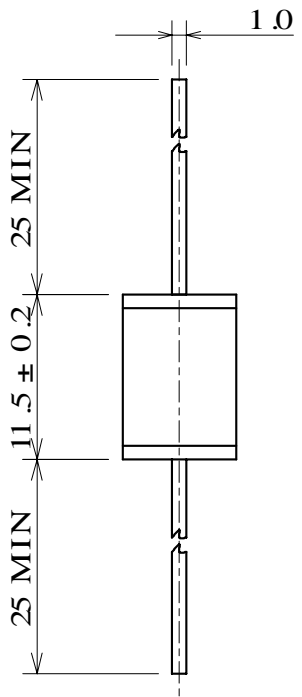
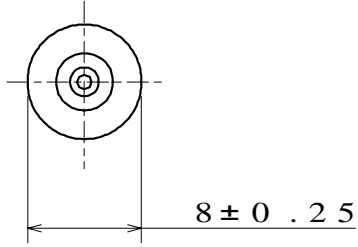


Spec No.	SS-024
Data	Oct 30, 2003
Version	First

9. Packing

Put 50 pcs. of RSG series and 1pc. of product label in a vinyl bag of specified size, seal the bag with a heatseal, put bags of quantity required a box, pack and stick product label on the box.



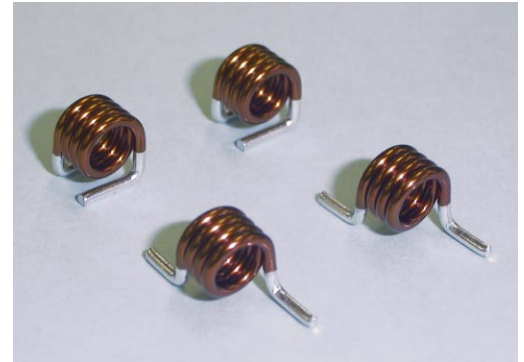


Weight: approx. 2.5 g

Ver.	Rev. data	History of rev.	Date	Scale	Product name	
			2003.10.30	2:1	Rodan spark gap	
					Type name	
					Outline dimension (8.0X 11.5 L)	
					Drawing No.	
OKAYA ELECTRIC AMERICA, INC.					4R-4198-Y89	4

WA SERIES

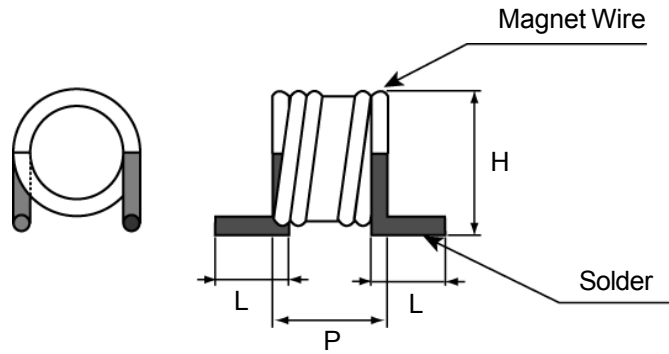
- Supporting large current allows the device to be used in high-power, high frequency circuit.
- The electrode's positioning structure can offer surface mounting type (L type) and manual soldering type (A type).
- Low direct current resistance
- Supports re-flow soldering
- High frequency circuits for mobile communications system.
- High frequency circuits for a variety of high-power amplifiers.



ELECTRICAL SPECIFICATIONS

Operating Temp. range: -40°C ~ +105°C

Series	Model number	Inductance (nH) 200MHz ±10%	Self resonance frequency (MHz) Min.	Rated current (A)	Direct current resistance DC(mΩ) Max.
X=	WA0502x20NKB	20	1900	5	3.0
	WA0504x68NKB	68	700	5	5.5
	WA0506xR15KB	150	300	5	8.0
	WA0802x18NKB	18	1900	10	1.5
	WA0804x51NKB	51	900	10	2.5
	WA0806xR11KB	110	400	10	3.5
A Series	WA1002x16NKB	16	1500	10	1.0
	WA1004x51NKB	51	500	10	1.5
	WA1006x75NKB	75	700	10	2.5
	WA1202x15NKB	15	1600	20	0.5
	WA1204x47NKB	47	500	15	1.5
L Series	WA1206x68NKB	68	700	15	2.0
	WA1402x15NKB	15	2200	20	0.5
	WA1404x43NKB	43	500	20	1.0
	WA1406x68NKB	62	600	20	1.5

MECHANICAL DIMENSIONS
A Series

L Series


Model number	A Series				L Series			
	ϕ	L	H	P	ϕ	L	H	P
WA0502x20NKB	0.5	5.00	5.70	1.60	0.5	5.10	5.70	1.70
WA0504x68NKB				2.70				2.80
WA0506xR15KB				3.80				4.00
WA0802x18NKB	0.8		6.65	2.60	0.8	5.75	6.65	2.65
WA0804x51NKB				4.30				4.40
WA0806xR11KB				6.10				6.15
WA1002x16NKB	1.0		7.30	3.20	1.0	6.20	7.30	3.30
WA1004x51NKB				5.30				5.50
WA1006x75NKB				7.50				7.70
WA1202x15NKB	1.2		7.80	3.80	1.2	6.60	7.80	4.20
WA1204x47NKB				6.30				7.65
WA1206x68NKB				8.90				9.80
WA1402x15NKB	1.4		8.30	4.40	1.4	7.00	8.30	4.35
WA1404x43NKB				7.30				7.25
WA1406x68NKB				10.30				10.15

Date of issue

SPECIFICATIONS

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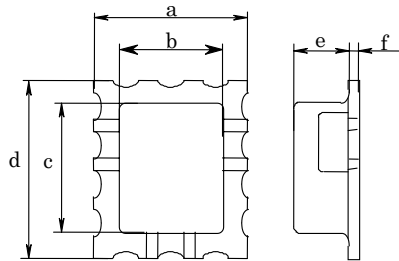
1

1. ARTICLE BIAS T

2. TYPE S100AR

2. DIMENSIONS

Appearance (Unit : mm)



Type No.	a	b	c	d	e	f
S100AR	10 \pm 0.2	8 \pm 0.3	13 \pm 0.3	15 \pm 0.2	3.5 \pm 0.2	0.5 \pm 0.15

4. RATING

Type No.	Max. DC Voltage	Max. DC Current	Range of frequency	Rise Time	Operating temperature
S100AR	16V	100mA	50kHz~10G Hz	40ps	0~85C

Insertion Loss Characteristics

Type No.	Range of frequency	Transmission	Reflective
S100AR	40MHz~10GHz	3dB Max.	10dB Min.
	50KHz~40MHz	3dB Max.	

5. Performance

No	Application Item	Performance	Test Method
1	Temperature cycle	No remarkable abnormality To satisfy the insertion loss characteristics	Min. Temp. at 0C for 30 min., Max. Temp. at +85C for 30 min. and leave alone at ambient temp. for 2~5 min. All above as 1 cycle and it shall be repeated for 100 cycles. Leave alone for 1~2hr after test.

OKAYA ELECTRIC AMERICA, INC.
 503 Wall ST. Valparaiso IN 46383
 Phone: 800-852-0122 Fax: 800-852-0106

Date of issue

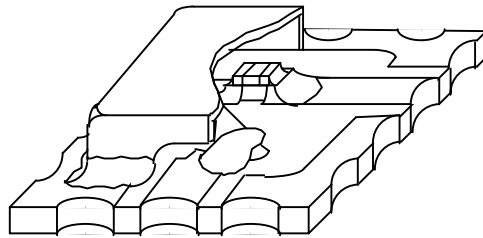
SPECIFICATIONS

Aug. 28, 2002

2

No	Application Item	Performance	Test Method
2	Moisture resistance	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $60 \pm 2C$ Relative humidity $85 \pm 3\%$ for 500 hours. The samples shall be leave alone for 24 ± 2 hours
3	High temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $85 \pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
4	Low-temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $0 \pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
5	Vibration	No remarkable abnormality To satisfy the insertion loss characteristics.	Frequency of 10Hz, 55Hz, 10Hz. Amplitude of 2mmP-P with X, Y, Z directions for 2H per direction.

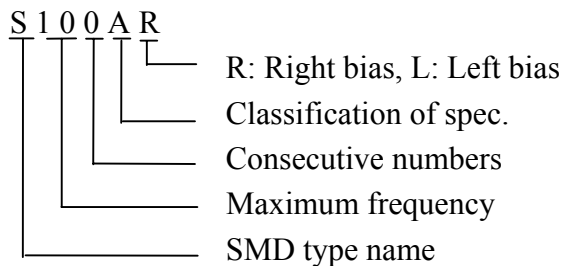
6. STRUCTURE DRAWING



Remarks:

The above materials are subjected to change into specifications and other related standards in the range which guarantees the regular contents. The materials are also described as existing chemical materials, complied with ' Inspection and manufacturing control of chemical materials of law'.

7. ORDERING INFORMATION



OKAYA ELECTRIC AMERICA, INC.
 503 Wall ST. Valparaiso IN 46383
 Phone: 800-852-0122 Fax: 800-852-0106

Date of issue

SPECIFICATIONS

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3

8. LOT SYMBOL

8.1 The basic form of display.

Below lot symbol will be expressed as in a cycle of eight years if there is especially no specification.

M \ Y	1	2	3	4	5	6	7	8	9	10	11	12
2002	A	B	C	D	E	F	G	H	I	J	K	L
2003	┌	N	O	P	Q	R	S	T	U	V	┘	X
2004	Y	Z	a	b	d	e	f	▪	h	i	▪	n
2005	u	▪	▪	▪	y	2	3	4	5	6	7	9
2006	▪ A	▪ B	▪ C	▪ D	▪ E	▪ F	▪ G	▪ H	▪ I	▪ J	▪ K	▪ L
2007	▪ ┌	▪ N	▪ O	▪ P	▪ Q	▪ R	▪ S	▪ T	▪ U	▪ V	▪ ┘	▪ X
2008	▪ Y	▪ Z	▪ a	▪ b	▪ d	▪ e	▪ f	▪ ▪	▪ h	▪ i	▪ ▪	▪ n
2009	▪ u	▪ ▪	▪ ▪	▪ ▪	▪ y	▪ 2	▪ 3	▪ 4	▪ 5	▪ 6	▪ 7	▪ 9

Remarks: *shall be added in a cycle of four years, and it shall cycles of eight years.

9. ADVANCE NOTICE OF CHANGE

In order to change specification, material, a manufacturing process, a management system, etc. of this product, recognition shall be obtained in advance.

Date of issue

SPECIFICATIONS

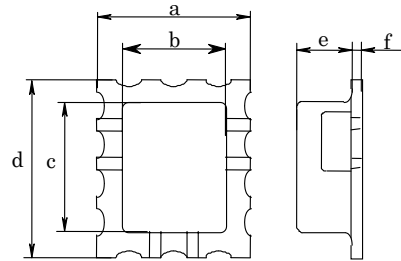
Aug. 28, 2002

1. ARTICLE BIAS T

2. TYPE S100BR

3. DIMENSIONS

Appearance (Unit : mm)



Type No.	a	b	c	d	e	f
S100BR	9 \pm 0.2	7 \pm 0.3	8 \pm 0.3	10 \pm 0.2	3 \pm 0.2	0.5 \pm 0.15

4. RATING

Type No.	Max.DC Voltage	Max.DC Current	Range of frequency	Rise Time	Operating temperature
S100BR	16V	100mA	50kHz~10G Hz	40ps	0~85C

Insertion Loss Characteristics

Type No.	Range of frequency	Transmission	Reflective
S100BR	40MHz~10GHz	3dB Max.	10dB Min.
	1MHz~40MHz	3dB Max.	

As for 1MHz or less, the coil is mount outside

5. Performance

No	Application Item	Performance	Test Method
1	Temperature cycle	No remarkable abnormality To satisfy the insertion loss characteristics	Min. Temp. at 0C for 30 min., Max. Temp. at +85C for 30 min. and leave alone at ambient temp. for 2-5 min. All above as 1 cycle and it shall be repeated for 100 cycles. Leave alone for 1-2hr after the test.

OKAYA ELECTRIC AMERICA, INC.

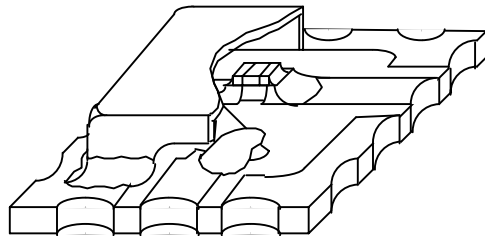
503 Wall ST. Valparaiso IN 46383

Phone: 800-852-0122 Fax: 800-852-0106

Date of issue	SPECIFICATIONS	
Aug. 28, 2002		

No	Application Item	Performance	Test Method
2	Moisture resistance	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $60 \pm 2^\circ\text{C}$ Relative humidity $85 \pm 3\%$ for 500 hours. The samples shall be leave alone for 24 ± 2 hours
3	High temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $85 \pm 2^\circ\text{C}$ for 500 hours. The samples shall be leave alone for 1~2hours
4	Low-temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $0 \pm 2^\circ\text{C}$ for 500 hours. The samples shall be leave alone for 1~2hours
5	Vibration	No remarkable abnormality To satisfy the insertion loss characteristics.	Frequency of 10Hz, 55Hz, 10Hz. Amplitude of 2mmP-P with X, Y, Z directions for 2H per direction.

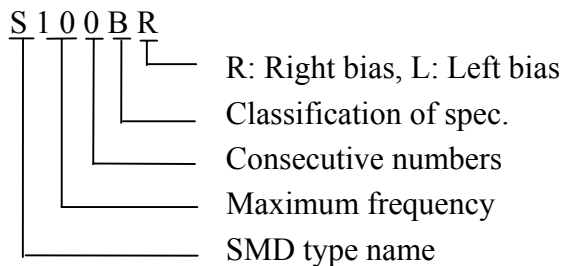
6. STRUCTURE DRAWING



Remarks:

The above materials are subjected to change into specifications and other related standards in the range which guarantees the regular contents. The materials are also described as existing chemical materials, complied with ' Inspection and manufacturing control of chemical materials of law'.

7. ORDERING INFORMATION



OKAYA ELECTRIC AMERICA, INC.
503 Wall ST. Valparaiso IN 46383
Phone: 800-852-0122 Fax: 800-852-0106

Date of issue	SPECIFICATIONS	
Aug. 28, 2002		

8. LOT SYMBOL

8.1 The basic form of display.

Below lot symbol will be expressed as in a cycle of eight years if there is especially no specification.

M \ Y	1	2	3	4	5	6	7	8	9	10	11	12
2002	A	B	C	D	E	F	G	H	I	J	K	L
2003	┌	N	O	P	Q	R	S	T	U	V	┘	X
2004	Y	Z	a	b	d	e	f	▪	h	i	▪	n
2005	u	▪	▪	▪	y	2	3	4	5	6	7	9
2006	▪ A	▪ B	▪ C	▪ D	▪ E	▪ F	▪ G	▪ H	▪ I	▪ J	▪ K	▪ L
2007	▪ ┌	▪ N	▪ O	▪ P	▪ Q	▪ R	▪ S	▪ T	▪ U	▪ V	▪ ┘	▪ X
2008	▪ Y	▪ Z	▪ a	▪ b	▪ d	▪ e	▪ f	▪ ▪	▪ h	▪ i	▪ ▪	▪ n
2009	▪ u	▪ ▪	▪ ▪	▪ ▪	▪ y	▪ 2	▪ 3	▪ 4	▪ 5	▪ 6	▪ 7	▪ 9

Remarks: *shall be added in a cycle of four years, and it shall cycles of eight years.

9. ADVANCE NOTICE OF CHANGE

In order to change specification, material, a manufacturing process, a management system , etc. of this product, recognition shall be obtained in advance.

Date of issue

SPECIFICATIONS

Aug. 28, 2002

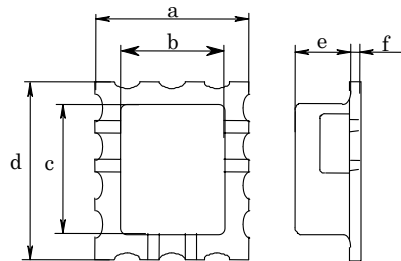
1

1. ARTICLE BIAS T

2. TYPE S200AR

2. DIMENSIONS

Appearance (Unit : mm)



Type No.	a	b	c	d	e	f
S200AR	10 \pm 0.2	8 \pm 0.3	13 \pm 0.3	15 \pm 0.2	3.5 \pm 0.2	0.5 \pm 0.15

4. RATING

Type No.	Max.DC Voltage	Max.DC Current	Range of frequency	Rise Time	Operating temperature
S200AR	16V	100mA	50kHz~20G Hz	20ps	0~85C

Insertion Loss Characteristics

Type No.	Range of frequency	Transmission	Reflective
S200AR	40MHz~20GHz	3dB Max.	10dB Min.
	50KHz~40MHz	3dB Max.	

5. Performance

No	Application Item	Performance	Test Method
1	Temperature cycle	No remarkable abnormality To satisfy the insertion loss characteristics	Min. Temp. at 0C for 30 min., Max. Temp. at +85C for 30 min. and leave alone at ambient temp. for 2-5 min. All above as 1 cycle and it shall be repeated for 100 cycles. Leave alone for 1-2hr after test.

OKAYA ELECTRIC AMERICA, INC.
 503 Wall ST. Valparaiso IN 46383
 Phone: 800-852-0122 Fax: 800-852-0106

Date of issue

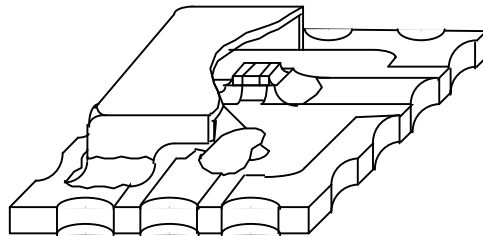
SPECIFICATIONS

Aug. 28, 2002

2

No	Application Item	Performance	Test Method
2	Moisture resistance	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $60\pm 2^{\circ}\text{C}$ Relative humidity $85\pm 3\%$ for 500 hours. The samples shall be leave alone for 24 ± 2 hours
3	High temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $85\pm 2^{\circ}\text{C}$ for 500 hours. The samples shall be leave alone for 1~2hours
4	Low-temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $0\pm 2^{\circ}\text{C}$ for 500 hours. The samples shall be leave alone for 1~2hours
5	Vibration	No remarkable abnormality To satisfy the insertion loss characteristics.	Frequency of 10Hz, 55Hz, 10Hz. Amplitude of 2mmP-P with X, Y, Z directions for 2H per direction.

6. STRUCTURE DRAWING

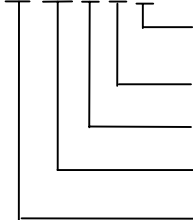


Remarks:

The above materials are subjected to change into specifications and other related standards in the range which guarantees the regular contents. The materials are also described as existing chemical materials, complied with ' Inspection and manufacturing control of chemical materials of law'.

7. ORDERING INFORMATION

S 2 0 0 A R



R: Right bias, L: Left bias

Classification of spec.

Consecutive numbers

Maximum frequency

SMD type name

OKAYA ELECTRIC AMERICA, INC.

503 Wall ST. Valparaiso IN 46383

Phone: 800-852-0122 Fax: 800-852-0106

Date of issue

SPECIFICATIONS

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8. LOT SYMBOL

8.1 The basic form of display.

Below lot symbol will be expressed as in a cycle of eight years if there is especially no specification.

M \ Y	1	2	3	4	5	6	7	8	9	10	11	12
2002	A	B	C	D	E	F	G	H	I	J	K	L
2003	┌	N	O	P	Q	R	S	T	U	V	└	X
2004	Y	Z	a	b	d	e	f	▪	h	i	▪	n
2005	u	▪	▪	▪	y	2	3	4	5	6	7	9
2006	▪ A	▪ B	▪ C	▪ D	▪ E	▪ F	▪ G	▪ H	▪ I	▪ J	▪ K	▪ L
2007	▪┌	▪ N	▪ O	▪ P	▪ Q	▪ R	▪ S	▪ T	▪ U	▪ V	▪└	▪ X
2008	▪ Y	▪ Z	▪ a	▪ b	▪ d	▪ e	▪ f	▪▪	▪ h	▪ i	▪▪	▪ n
2009	▪ u	▪▪	▪▪	▪▪	▪ y	▪ 2	▪ 3	▪ 4	▪ 5	▪ 6	▪ 7	▪ 9

Remarks: *shall be added in a cycle of four years, and it shall cycles of eight years.

9. ADVANCE NOTICE OF CHANGE

In order to change specification, material, a manufacturing process, a management system , etc. of this product, recognition shall be obtained in advance.

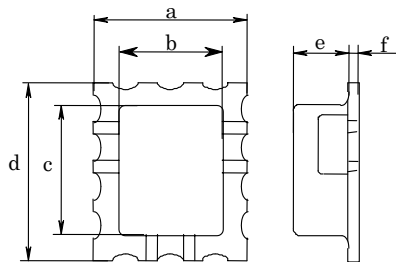
Date of issue	SPECIFICATIONS	
Aug. 28, 2002		1

1. ARTICLE BIAS T

2. TYPE S200BR

2. DIMENSIONS

Appearance (Unit : mm)



Type No.	a	b	c	d	e	f
S200BR	9 \pm 0.2	7 \pm 0.3	8 \pm 0.3	10 \pm 0.2	3 \pm 0.2	0.4 \pm 0.15

4. RATING

Type No.	Max.DC Voltage	Max.DC Current	Range of frequency	Rise Time	Operating temperature
S200BR	16V	100mA	50kHz~20G Hz	20ps	0~85C

Insertion Loss Characteristics

Type No.	Range of frequency	Transmission	Reflective
S200BR	40MHz~20GHz	3dB Max.	10dB Min.
	1MHz~40MHz	3dB Max.	

As for 1MHz or less, the coil is mount outside

5. Performance

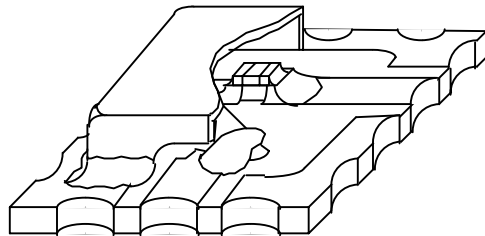
No	Application Item	Performance	Test Method
1	Temperature cycle	No remarkable abnormality To satisfy the insertion loss characteristics	Min. Temp. at 0C for 30 min., Max. Temp. at +85C for 30 min. and leave alone at ambient temp. for 2-5 min. All above as 1 cycle and it shall be repeated for 100 cycles. Leave alone for 1-2hr after test.

OKAYA ELECTRIC AMERICA, INC.
503 Wall ST. Valparaiso IN 46383
Phone: 800-852-0122 Fax: 800-852-0106

Date of issue	SPECIFICATIONS	
Aug. 28, 2002		2

No	Application Item	Performance	Test Method
2	Moisture resistance	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $60\pm 2C$ Relative humidity $85\pm 3\%$ for 500 hours. The samples shall be leave alone for 24 ± 2 hours
3	High temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $85\pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
4	Low-temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $0\pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
5	Vibration	No remarkable abnormality To satisfy the insertion loss characteristics.	Frequency of 10Hz,55Hz,10Hz. Amplitude of 2mmP-P with X,Y,Z directions for 2H per direction.

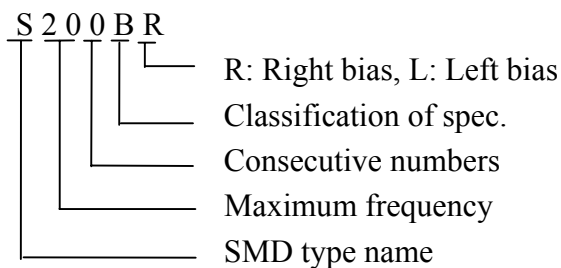
6. STRUCTURE DRAWING



Remarks:

The above materials are subjected to change into specifications and other related standards in the range which guarantees the regular contents. The materials are also described as existing chemical materials, complied with ‘ Inspection and manufacturing control of chemical materials of law’.

7. ORDERING INFORMATION



OKAYA ELECTRIC AMERICA, INC.
 503 Wall ST. Valparaiso IN 46383
 Phone: 800-852-0122 Fax: 800-852-0106

Date of issue	SPECIFICATIONS	
Aug. 28, 2002		3

8. LOT SYMBOL

8.1 The basic form of display.

Below lot symbol will be expressed as in a cycle of eight years if there is especially no specification.

M \ Y	1	2	3	4	5	6	7	8	9	10	11	12
2002	A	B	C	D	E	F	G	H	I	J	K	L
2003	┆	N	O	P	Q	R	S	T	U	V	┆	X
2004	Y	Z	a	b	d	e	f	▪	h	i	▪	n
2005	u	▪	▪	▪	y	2	3	4	5	6	7	9
2006	▪ A	▪ B	▪ C	▪ D	▪ E	▪ F	▪ G	▪ H	▪ I	▪ J	▪ K	▪ L
2007	▪┆	▪ N	▪ O	▪ P	▪ Q	▪ R	▪ S	▪ T	▪ U	▪ V	▪┆	▪ X
2008	▪ Y	▪ Z	▪ a	▪ b	▪ d	▪ e	▪ f	▪▪	▪ h	▪ i	▪▪	▪ n
2009	▪ u	▪▪	▪▪	▪▪	▪ y	▪ 2	▪ 3	▪ 4	▪ 5	▪ 6	▪ 7	▪ 9

Remarks: *shall be added in a cycle of four years, and it shall cycles of eight years.

9. ADVANCE NOTICE OF CHANGE

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Date of issue

SPECIFICATIONS

Aug. 28, 2002

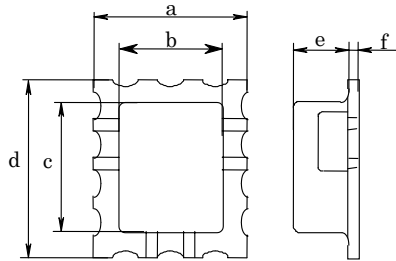
1

1. ARTICLE BIAS T

2. TYPE S400AR

2. DIMENSIONS

Appearance (Unit : mm)



Type No.	a	b	c	d	e	f
S400AR	10 \pm 0.2	8 \pm 0.3	13 \pm 0.3	15 \pm 0.2	3.5 \pm 0.2	0.4 \pm 0.15

4. RATING

Type No.	Max.DC Voltage	Max.DC Current	Range of frequency	Rise Time	Operating temperature
S400AR	16V	100mA	50kHz~40GHz	8ps	0~85C

Insertion Loss Characteristics

Type No.	Range of frequency	Transmission	Reflective
S400AR	40MHz~40GHz	3dB Max.	10dB Min.
	50KHz~40MHz	3dB Max.	

5. Performance

No	Application Item	Performance	Test Method
1	Temperature cycle	No remarkable abnormality To satisfy the insertion loss characteristics	Min. Temp. at 0C for 30 min., Max. Temp. at +85C for 30 min. and leave alone at ambient temp. for 2-5 min. All above as 1 cycle and it shall be repeated for 100 cycles. Leave alone for 1-2hr after test.

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Date of issue

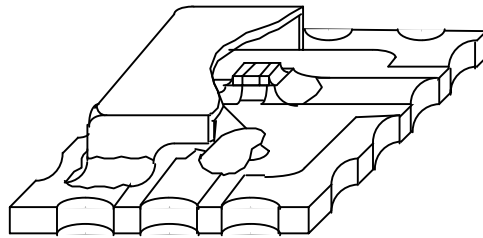
SPECIFICATIONS

Aug. 28, 2002

2

No	Application Item	Performance	Test Method
2	Moisture resistance	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $60\pm 2C$ Relative humidity $85\pm 3\%$ for 500 hours. The samples shall be leave alone for 24 ± 2 hours
3	High temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $85\pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
4	Low-temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $0\pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
5	Vibration	No remarkable abnormality To satisfy the insertion loss characteristics.	Frequency of 10Hz,55Hz,10Hz. Amplitude of 2mmP-P with X,Y,Z directions for 2H per direction.

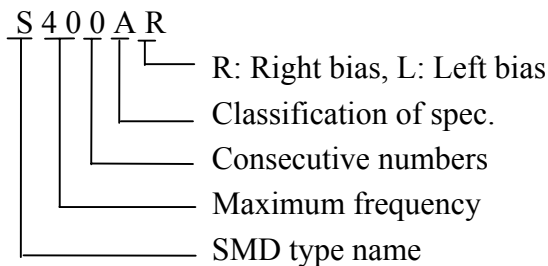
6. STRUCTURE DRAWING



Remarks:

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7.ORDERING INFORMATION



OKAYA ELECTRIC AMERICA, INC.
 503 Wall ST. Valparaiso IN 46383
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Date of issue	SPECIFICATIONS	
Aug. 28, 2002		3

8. LOT SYMBOL

8.1 The basic form of display.

Below lot symbol will be expressed as in a cycle of eight years if there is especially no specification.

M \ Y	1	2	3	4	5	6	7	8	9	10	11	12
2002	A	B	C	D	E	F	G	H	I	J	K	L
2003	┆	N	O	P	Q	R	S	T	U	V	┆	X
2004	Y	Z	a	b	d	e	f	▪	h	i	▪	n
2005	u	▪	▪	▪	y	2	3	4	5	6	7	9
2006	▪ A	▪ B	▪ C	▪ D	▪ E	▪ F	▪ G	▪ H	▪ I	▪ J	▪ K	▪ L
2007	▪┆	▪ N	▪ O	▪ P	▪ Q	▪ R	▪ S	▪ T	▪ U	▪ V	▪┆	▪ X
2008	▪ Y	▪ Z	▪ a	▪ b	▪ d	▪ e	▪ f	▪▪	▪ h	▪ i	▪▪	▪ n
2009	▪ u	▪▪	▪▪	▪▪	▪ y	▪ 2	▪ 3	▪ 4	▪ 5	▪ 6	▪ 7	▪ 9

Remarks: *shall be added in a cycle of four years, and it shall cycles of eight years.

9. ADVANCE NOTICE OF CHANGE

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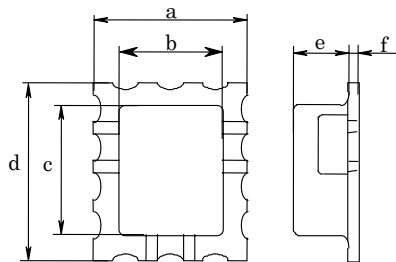
Date of issue	SPECIFICATIONS	
Aug. 28, 2002		1

1. ARTICLE BIAS T

2. TYPE S400BR

2. DIMENSIONS

Appearance (Unit : mm)



Type No.	a	b	c	d	e	f
S400BR	9±0.2	7±0.3	8±0.3	10±0.2	3±0.2	0.4±0.15

4. RATING

Type No.	Max.DC Voltage	Max.DC Current	Range of frequency	Rise Time	Operating temperature
S400BR	16V	100mA	50kHz~40G Hz	8ps	0~85C

Insertion Loss Characteristics

Type No.	Range of frequency	Transmission	Reflective
S400BR	40MHz~40GHz	3dB Max.	10dB Min.
	1MHz~40MHz	3dB Max.	

As for 1MHz or less, the coil is mount outside

5. Performance

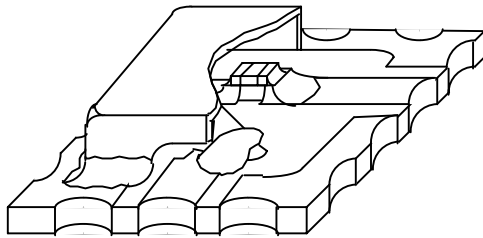
No	Application Item	Performance	Test Method
1	Temperature cycle	No remarkable abnormality To satisfy the insertion loss characteristics	Min. Temp. at 0C for 30 min., Max. Temp. at +85C for 30 min. and leave alone at ambient temp. for 2-5 min. All above as 1 cycle and it shall be repeated for 100 cycles. Leave alone for 1-2hr after test.

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Date of issue	SPECIFICATIONS	
Aug. 28, 2002		2

No	Application Item	Performance	Test Method
2	Moisture resistance	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $60\pm 2C$ Relative humidity $85\pm 3\%$ for 500 hours. The samples shall be leave alone for 24 ± 2 hours
3	High temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $85\pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
4	Low-temperature neglect	No remarkable abnormality To satisfy the insertion loss characteristics.	Test Temp. at $0\pm 2C$ for 500 hours. The samples shall be leave alone for 1~2hours
5	Vibration	No remarkable abnormality To satisfy the insertion loss characteristics.	Frequency of 10Hz,55Hz,10Hz. Amplitude of 2mmP-P with X,Y,Z directions for 2H per direction.

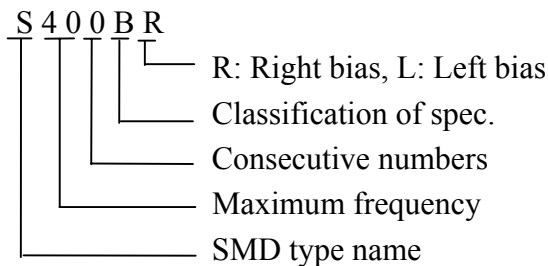
6. STRUCTURE DRAWING



Remarks:

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7.ORDERING INFORMATION



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Date of issue	SPECIFICATIONS	
Aug. 28, 2002		3

8. LOT SYMBOL

8.1 The basic form of display.

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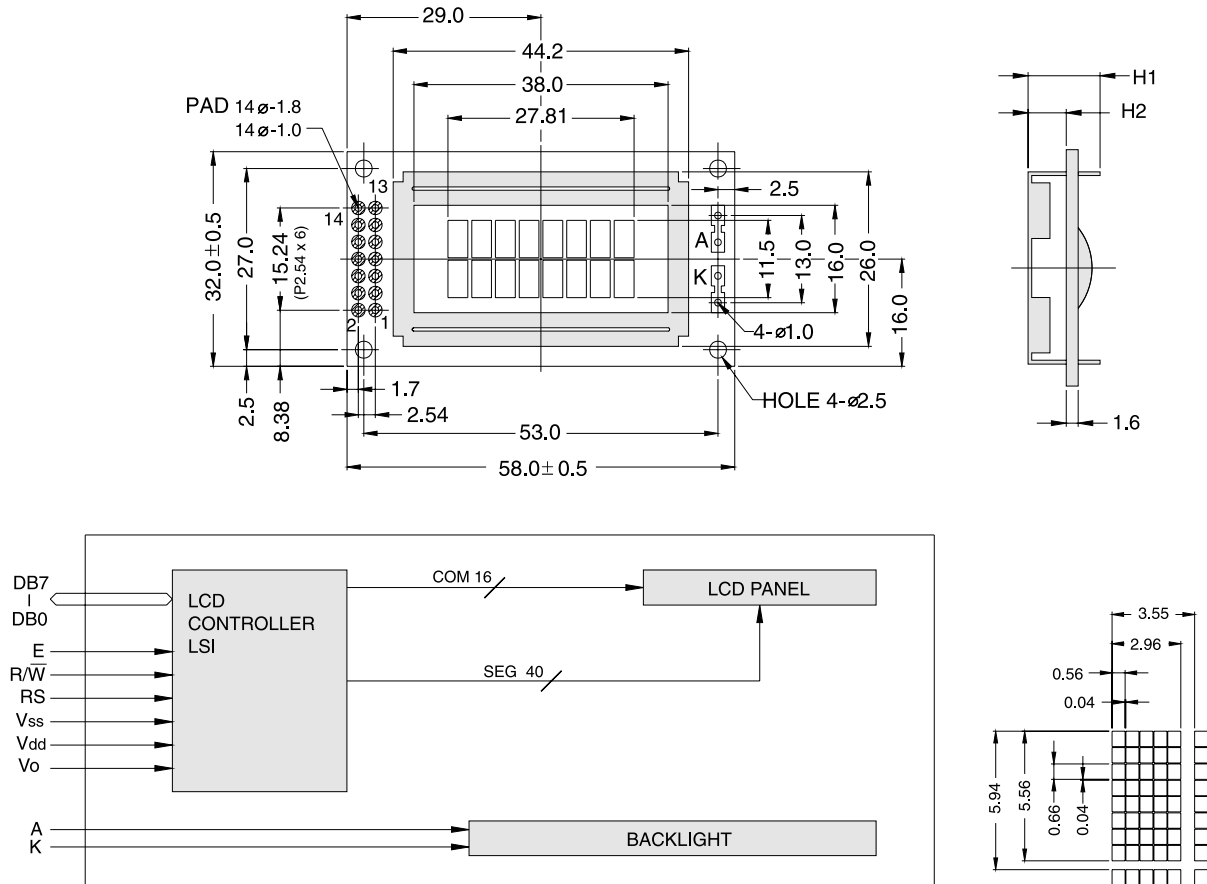
M \ Y	1	2	3	4	5	6	7	8	9	10	11	12
2002	A	B	C	D	E	F	G	H	I	J	K	L
2003	┌	N	O	P	Q	R	S	T	U	V	└	X
2004	Y	Z	a	b	d	e	f	▪	h	i	▪	n
2005	u	▪	▪	▪	y	2	3	4	5	6	7	9
2006	▪ A	▪ B	▪ C	▪ D	▪ E	▪ F	▪ G	▪ H	▪ I	▪ J	▪ K	▪ L
2007	▪┌	▪ N	▪ O	▪ P	▪ Q	▪ R	▪ S	▪ T	▪ U	▪ V	▪└	▪ X
2008	▪ Y	▪ Z	▪ a	▪ b	▪ d	▪ e	▪ f	▪▪	▪ h	▪ i	▪▪	▪ n
2009	▪ u	▪▪	▪▪	▪▪	▪ y	▪ 2	▪ 3	▪ 4	▪ 5	▪ 6	▪ 7	▪ 9

Remarks: *shall be added in a cycle of four years, and it shall cycles of eight years.

9. ADVANCE NOTICE OF CHANGE

In order to change specification, material, a manufacturing process, a management system, etc. of this product, recognition shall be obtained in advance.

OUTLINE DIMENSION & BLOCK DIAGRAM



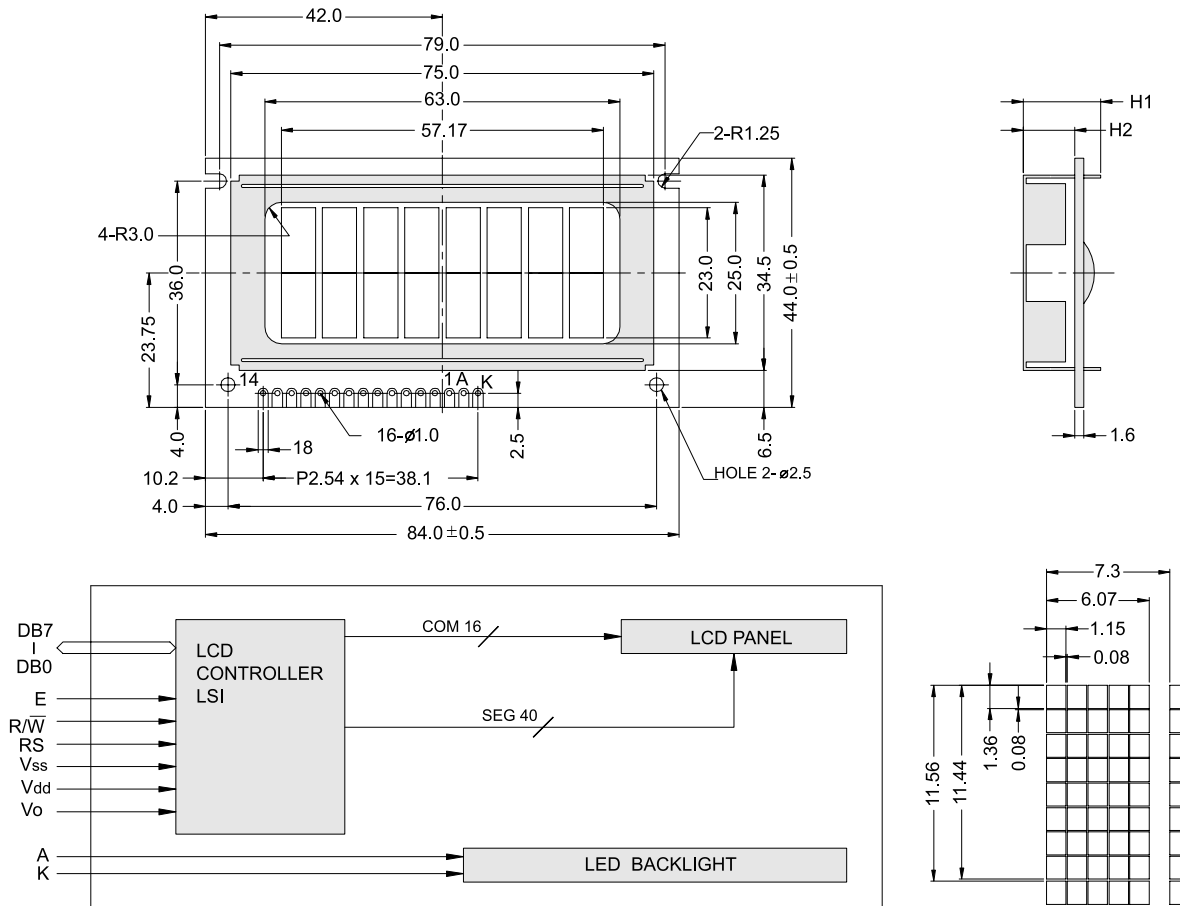
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	58.0 x 32.0	Module	H2 / H1
View Area	38.0 x 16.0	W/O B/L	5.2 / 9.8
Dot Size	0.56 x 0.66	EL B/L	5.2 / 9.8
Dot Pitch	0.60 x 0.70	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.4	-	4.6	-	5.2	-	V
		25°C	4.1	6.1	4.3	6.4	4.8	6.7	V
		50°C	3.8	-	4	-	4.6	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	110	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



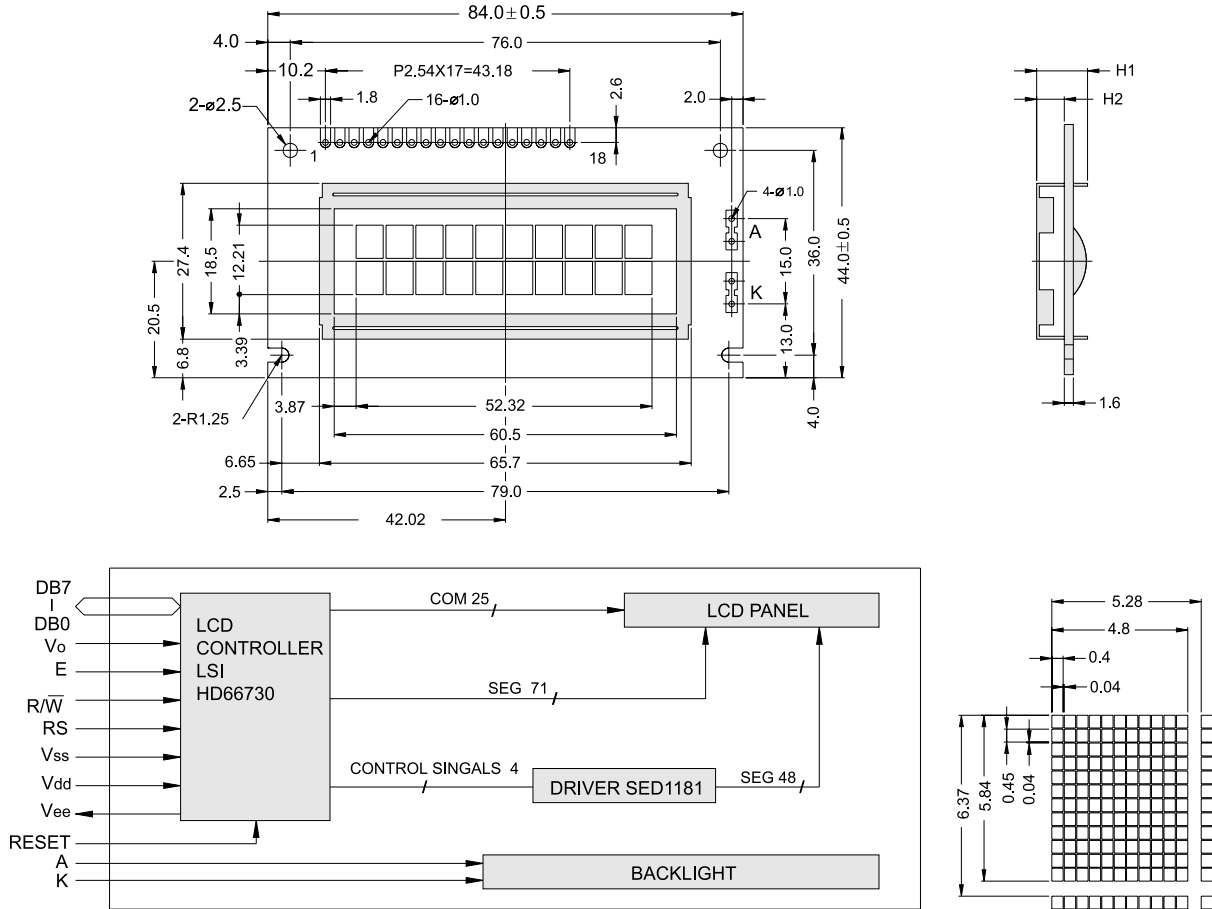
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	84.0 x 44.0	Module	H2 / H1
View Area	63.0 x 25.0	W / O B/L	- / -
Dot Size	1.15 x 1.36	EL B/L	- / -
Dot Pitch	1.23 x 1.44	LED B/L	9.1 / 13.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	4.3	-	4.6	-	5.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	4.4	4.5	4.7	4.7	5	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	3.9	-	4.2	-	4.5	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	60	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



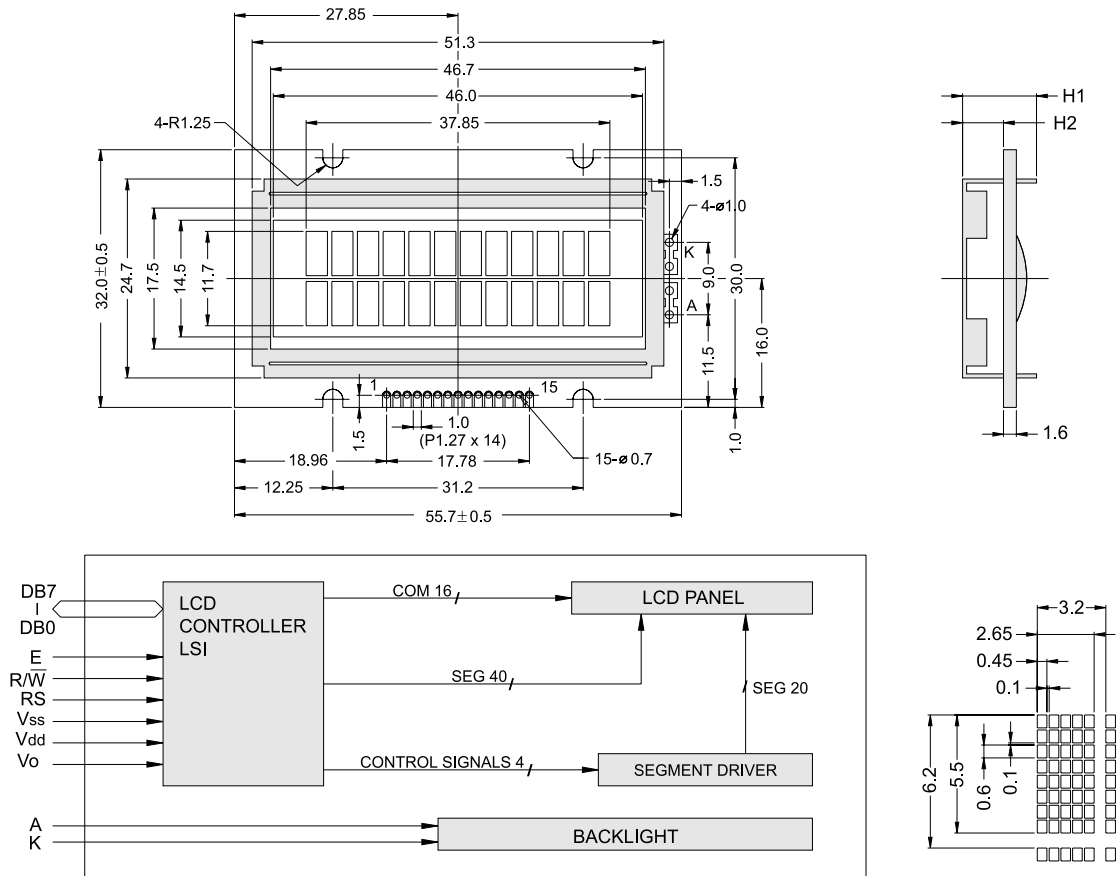
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	84.0 x 44.0	Module	H2 / H1
View Area	60.5 x 18.5	W / O B/L	4.9 / 8.9
Dot Size	0.44 x 0.45	EL B/L	4.9 / 8.9
Dot Pitch	0.44 x 0.49	LED B/L	8.9 / 13.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	Vee	Negative voltage
16	RESET	Reset signal
17	A	Power supply for LED B/L (+)
18	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	17	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-25°C	-	8.6	-	9.1	-	V	
		0°C	6.1	-	6.4	-	6.7	-	V
		25°C	5.6	7.7	5.9	8.1	6.2	8.5	V
		50°C	5.1	-	5.4	-	5.7	-	V
		70°C	-	7.2	-	7.6	-	8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



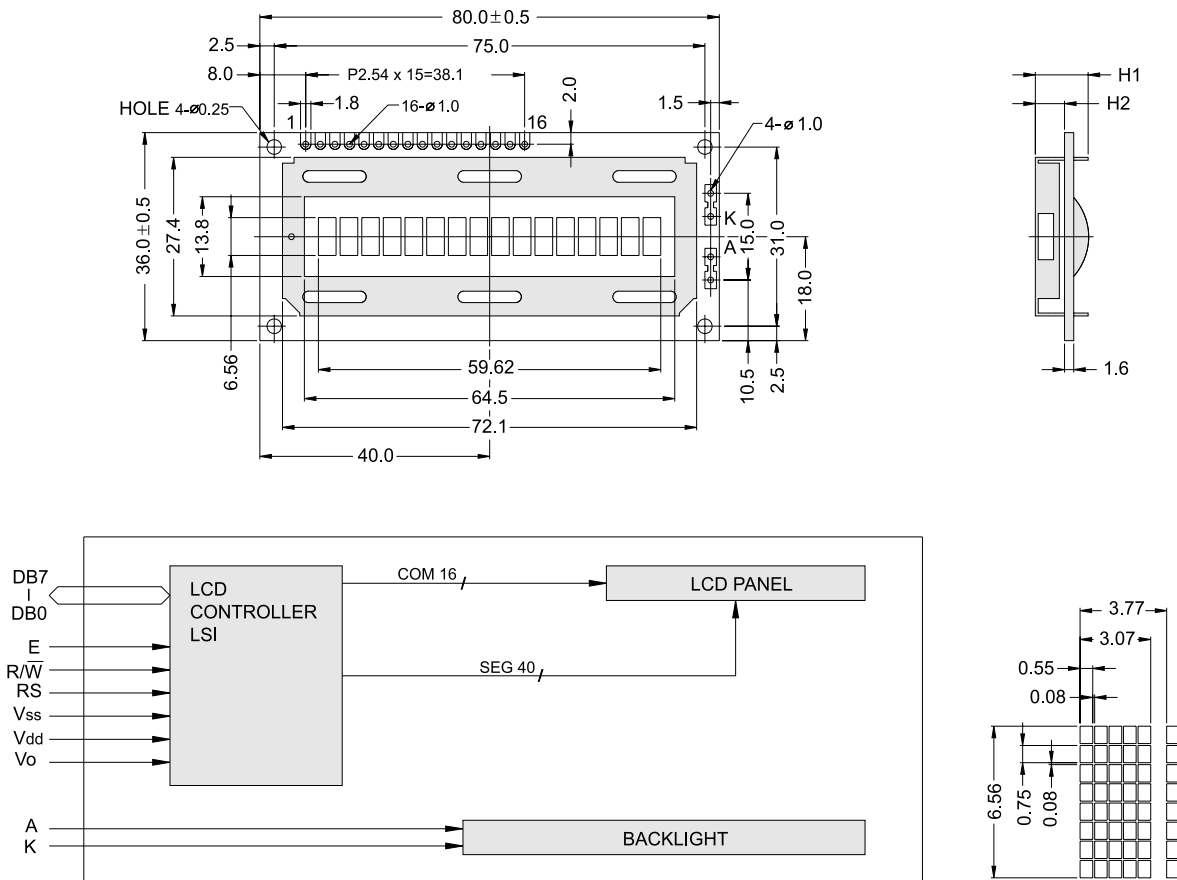
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	55.7 x 32.0	Module	H2 / H1
View Area	46.7 x 17.5	W / O B/L	5.1 / 9.2
Dot Size	0.45 x 0.60	EL B/L	5.1 / 9.2
Dot Pitch	0.55 x 0.70	LED B/L	8.7 / 12.8

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss/K	Power supply(GND) / LED B/L(-)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vs	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.6	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
70°C	-	5.7	-	6	-	6.3	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	80	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



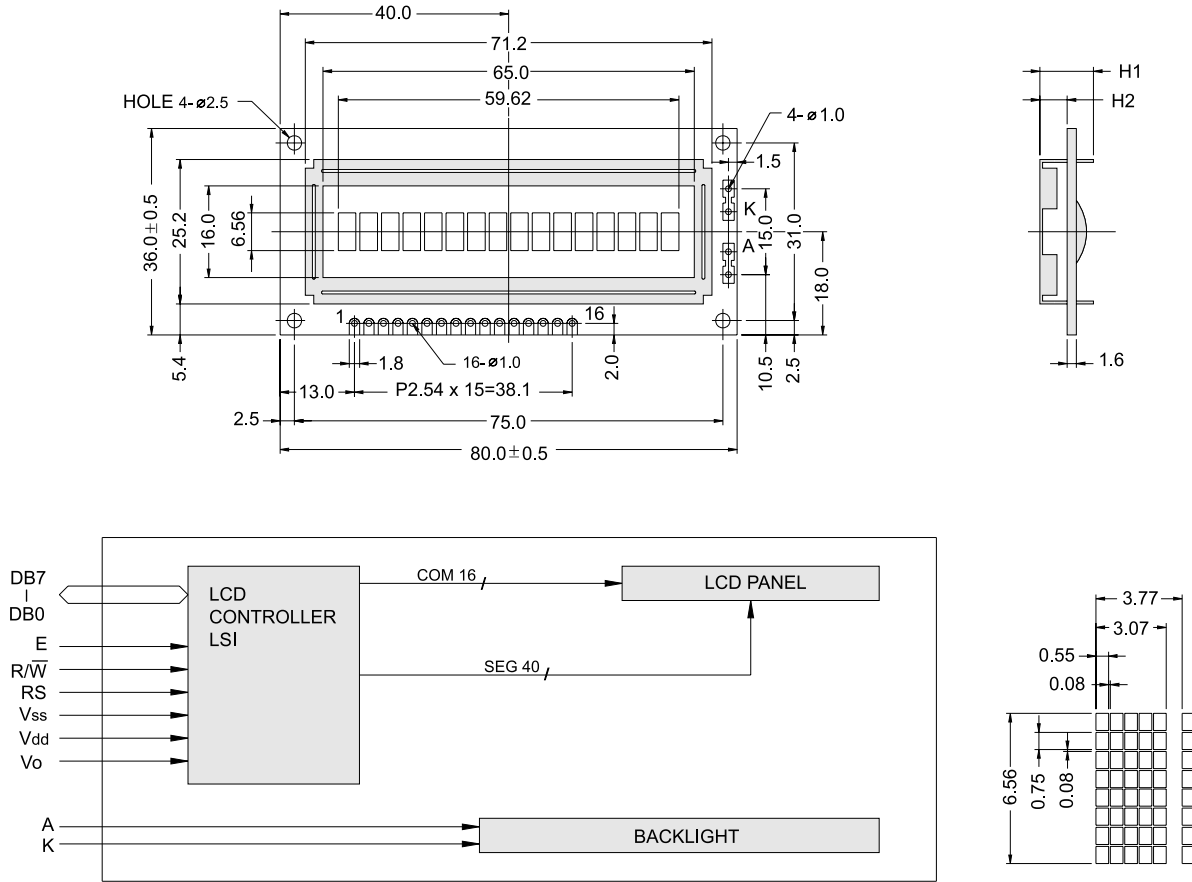
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	64.5 x 13.8	W / O B/L	5.1 / 9.2
Dot Size	0.55 x 0.75	EL B/L	5.1 / 9.2
Dot Pitch	0.63 x 0.83	LED B/L	9.4 / 14.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	5.2	-	5.4	-	5.7	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	4.2	4.5	4.5	4.7	4.9	V
		50°C	3.8	-	4.1	-	4.4	-	V
70°C	-	3.9	-	4.0	-	4.5	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



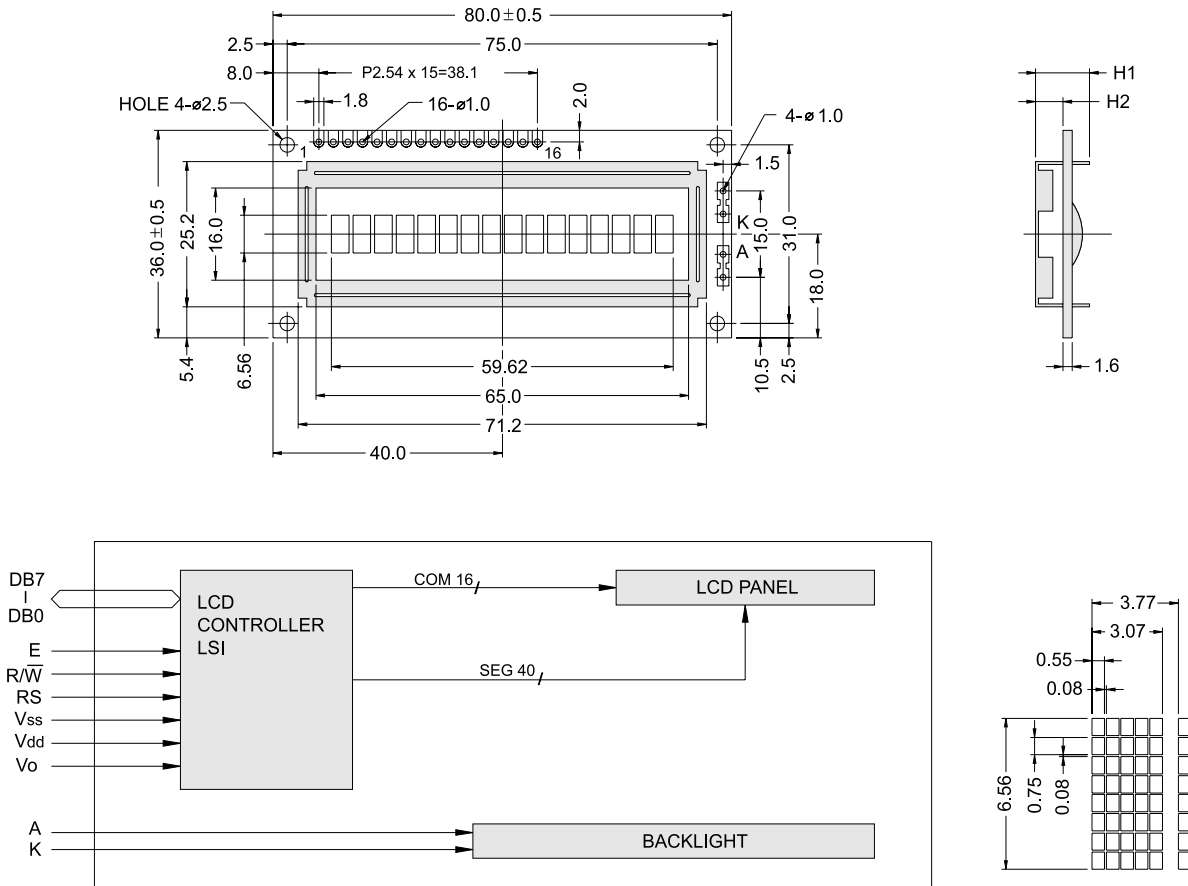
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	65.0 x 16.0	W / O B/L	4.8 / 9.4
Dot Size	0.55 x 0.75	EL B/L	4.8 / 9.4
Dot Pitch	0.63 x 0.83	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



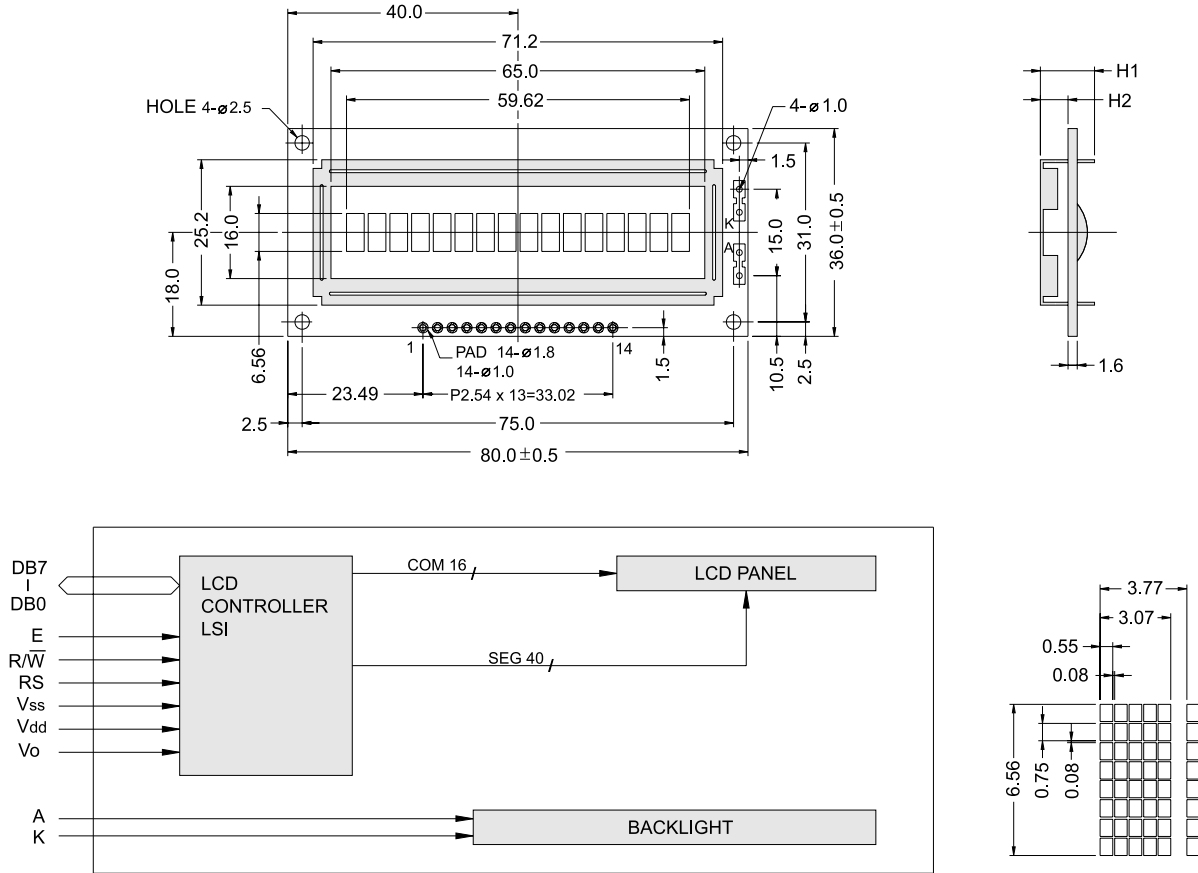
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MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	65.0 x 16.0	W / O B/L	4.8 / 9.4
Dot Size	0.55 x 0.75	EL B/L	4.8 / 9.4
Dot Pitch	0.63 x 0.83	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	—	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	—	5.2	—	5.4	—	5.7	V
		0°C	4.5	—	4.8	—	5.1	—	V
		25°C	4.1	4.3	4.4	4.5	4.7	4.9	V
		50°C	3.8	—	4.1	—	4.4	—	V
		70°C	—	3.9	—	4.1	—	4.5	V
LCM current consumption (No B/L)	Idd	Vdd=5V	—	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	—	40	—	mA			
	LED/array	VB/L=4.2V	—	120	—	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



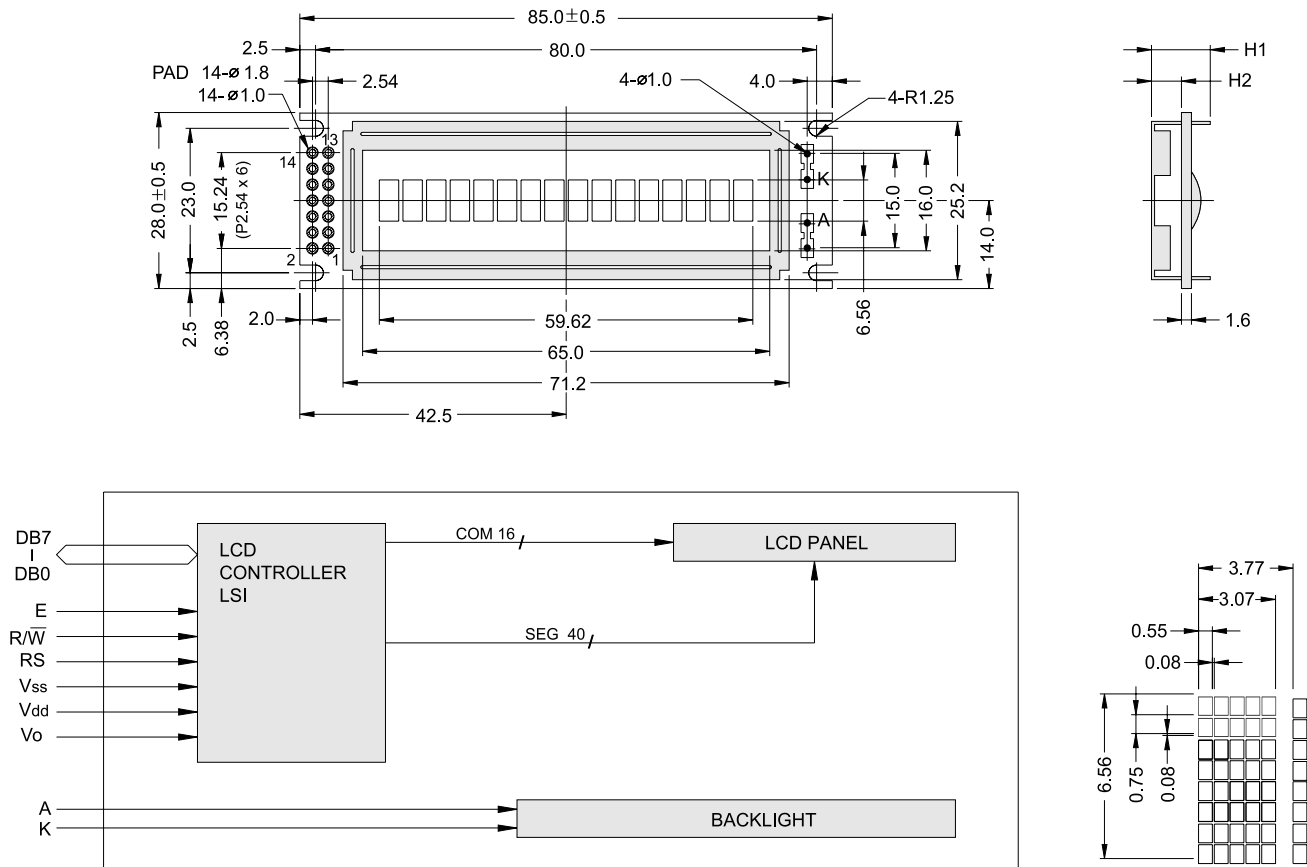
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	65.0 x 16.0	W / O B/L	4.8 / 9.4
Dot Size	0.55 x 0.77	EL B/L	4.8 / 9.4
Dot Pitch	0.63 x 0.83	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	5.2	-	5.4	-	5.7	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	4.3	4.5	4.5	4.7	5.3	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	3.9	-	4.1	-	4.5	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



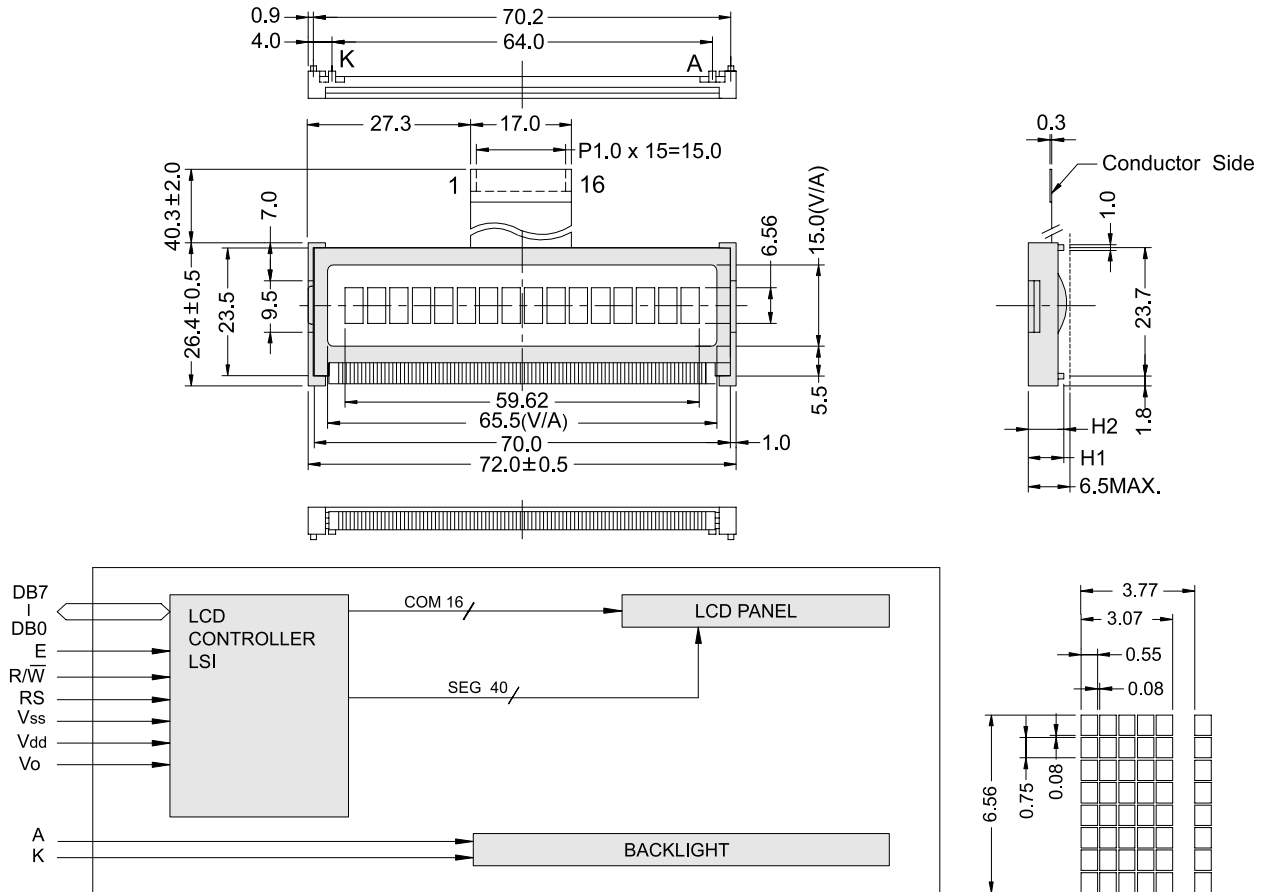
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	85.0 x 28.0	Module	H2 / H1
View Area	65.0 x 16.0	W/O B/L	4.8 / 9.4
Dot Size	0.55 x 0.75	EL B/L	4.8 / 9.4
Dot Pitch	0.63 x 0.83	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	5.2	-	5.4	-	5.6	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	4.2	4.4	4.4	4.7	4.8	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	3.8	-	4.0	-	4.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



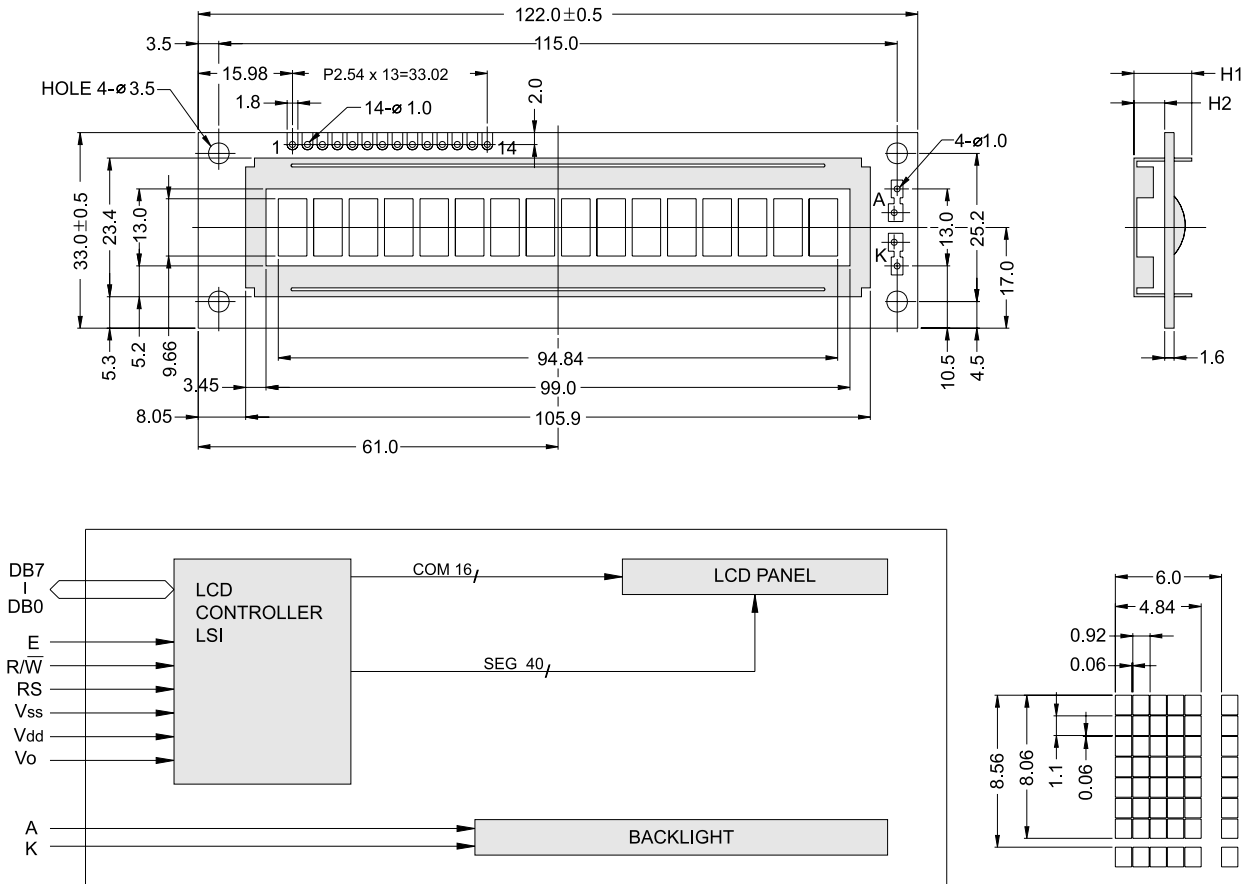
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	72.5 x 26.4	Module	H2 / H1
View Area	65.5 x 15.0	W / O B/L	- / 2.6
Dot Size	0.55 x 0.75	EL B/L	- / -
Dot Pitch	0.63 x 0.83	LED B/L	5.0 / 6.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A/NC	Power supply for LED B/L (+)
16	K/NC	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	4.5	-	5.7	-	5.8	V
		0°C	4.8	-	4.8	-	4.8	-	V
		25°C	4.3	4.4	4.5	5.1	4.3	5.3	V
		50°C	3.7	-	4.8	-	3.9	-	V
		70°C	-	4.1	-	4.6	-	4.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



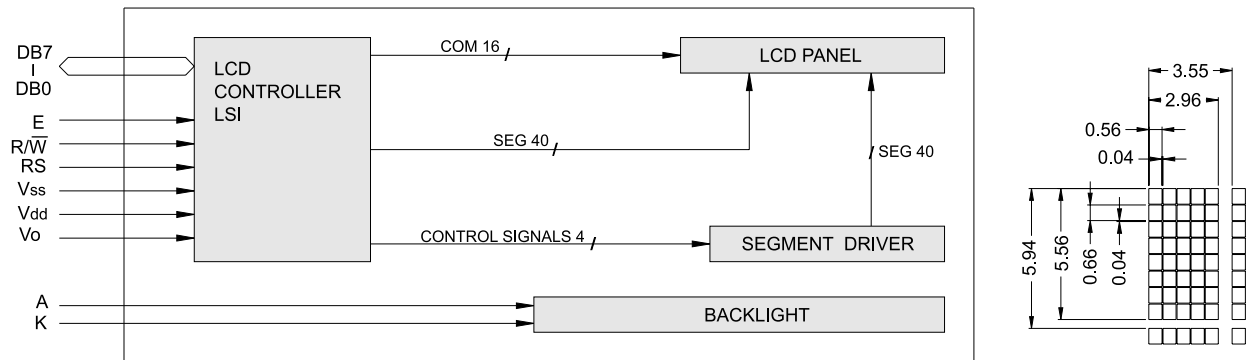
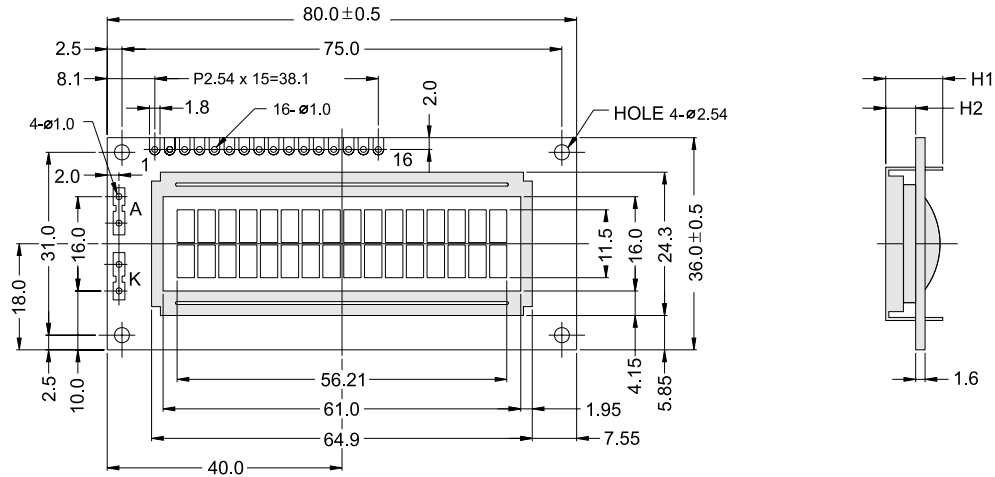
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	122.0 x 33.0	Module	H2 / H1
View Area	99.0 x 13.0	W / O B/L	5.2 / 9.8
Dot Size	0.92 x 1.10	EL B/L	5.2 / 9.8
Dot Pitch	0.98 x 1.16	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.6	-	4.9	-	5.2	-	V
		25°C	4.2	6.1	4.4	6.4	4.8	6.7	V
		50°C	3.9	-	4.2	-	4.5	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	190	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



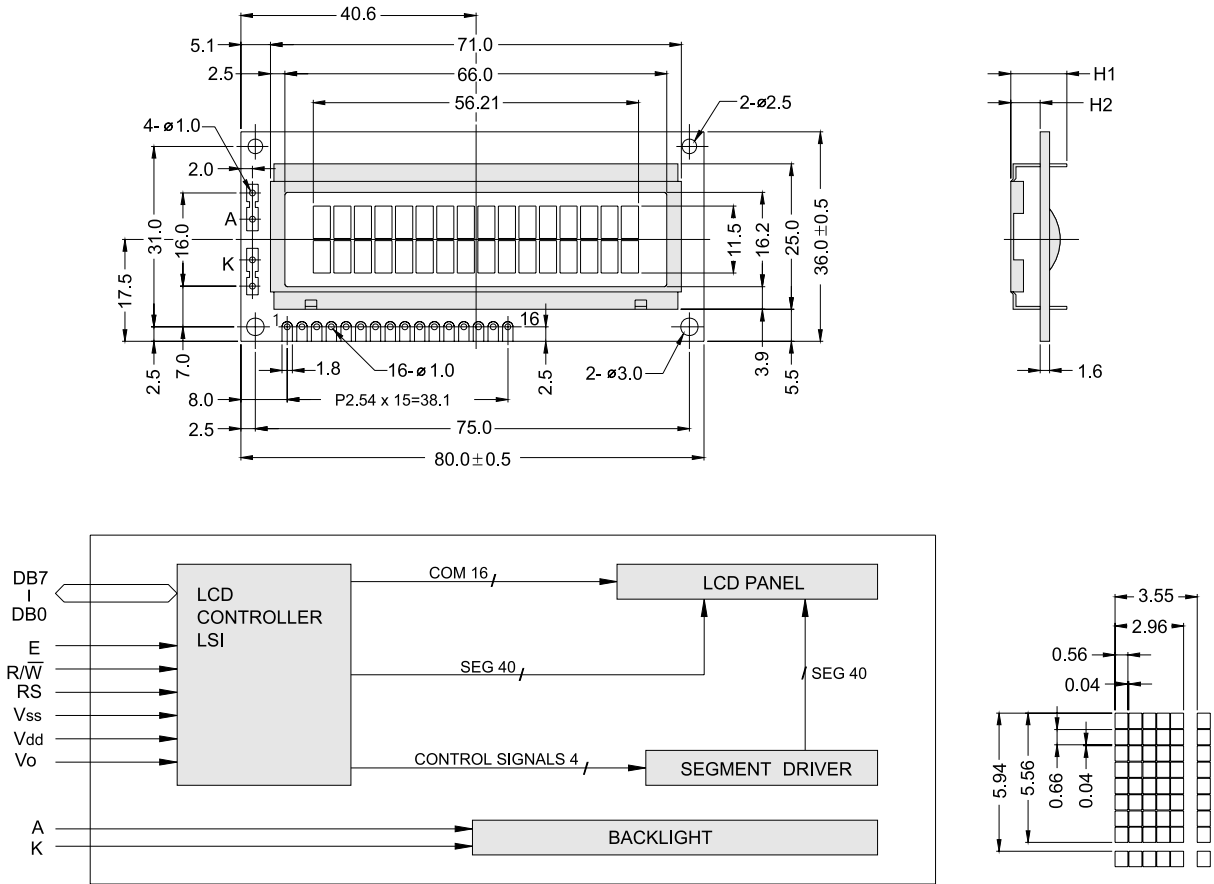
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	61.0 x 16.0	W / O B/L	5.1 / 9.7
Dot Size	0.56 x 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.60 x 0.70	LED B/L	9.1 / 13.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	4.7	-	5	-	5.3	V
		0°C	4.6	-	4.9	-	5.2	-	V
		25°C	4.2	4.7	4.5	5	4.8	5.3	V
		50°C	3.9	-	4.2	-	4.5	-	V
		70°C	-	4.5	-	4.8	-	5.1	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	20	-	mA			
	LED/array	VB/L=4.2V	-	90	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



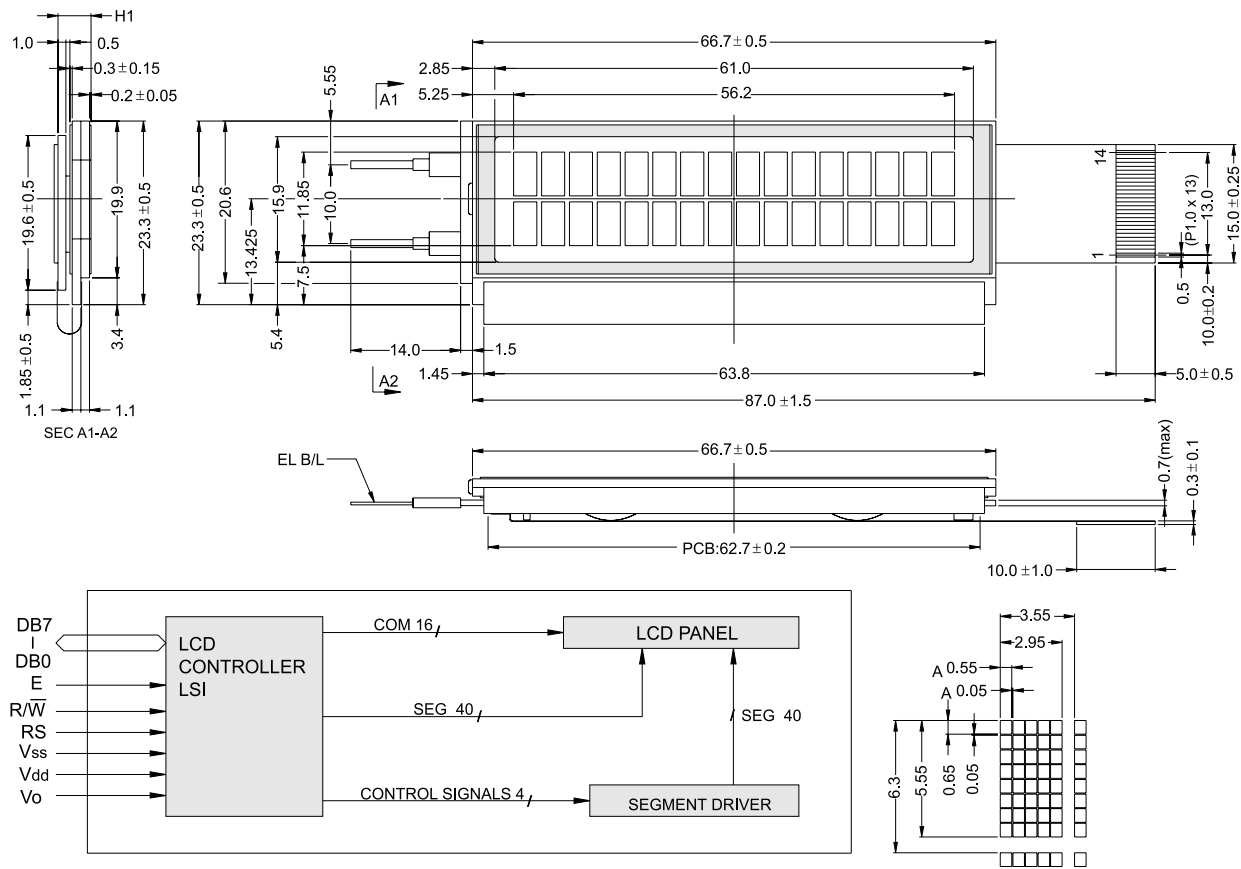
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	66.0 x 16.2	W / O B/L	5.1 / 9.7
Dot Size	0.56 x 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.60 x 0.70	LED B/L	9.4 / 14.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.1	6.4	4.7	6.7	V
		50°C	3.8	-	3.8	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



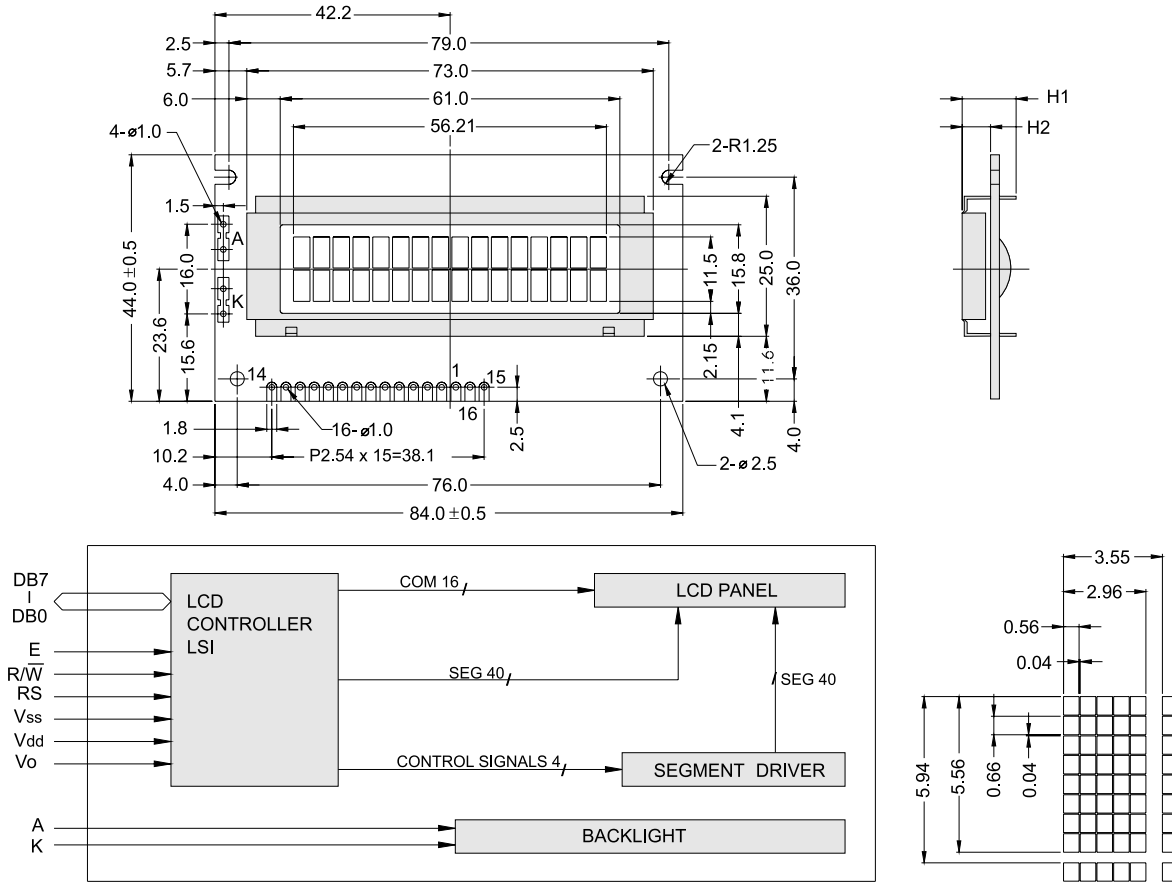
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	66.7 x 23.3	Module	H2 / H1
View Area	61.0 x 15.9	W/O B/L	- / 4.2
Dot Size	0.55 x 0.65	EL B/L	- / 4.6
Dot Pitch	0.60 x 0.70	LED B/L	-

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	5	-	5.3	-	V	
		0°C	4.4	-	4.7	-	5	-	V
		25°C	3.9	4.8	4.2	5.1	4.5	5.4	V
		50°C	3.7	-	4	-	4.3	-	V
		70°C	-	4.8	-	4.9	-	5.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



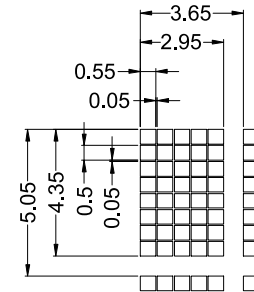
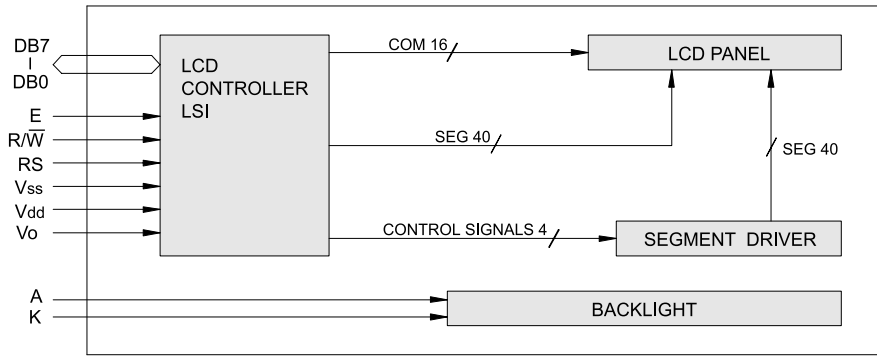
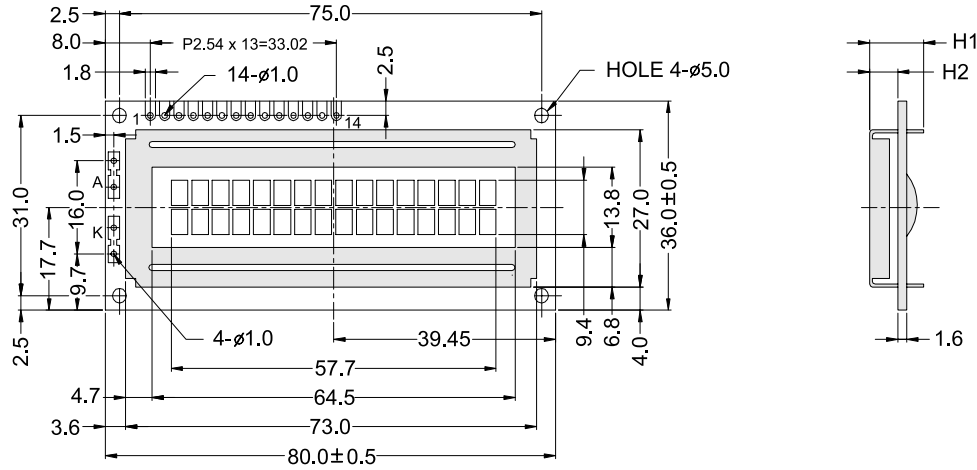
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	84.0 x 44.0	Module	H2 / H1
View Area	61.0 x 15.8	W / O B/L	5.1 / 9.7
Dot Size	0.56 x 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.60 x 0.70	LED B/L	9.4 / 14.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	5.1	-	5.3	-	V
		25°C	4.1	6.1	4.7	6.4	4.9	6.7	V
		50°C	3.8	-	4.4	-	4.6	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



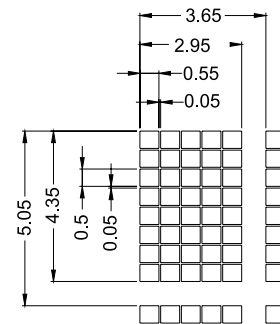
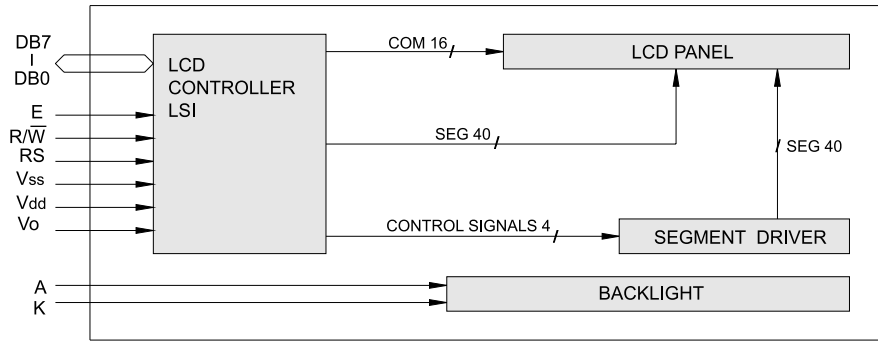
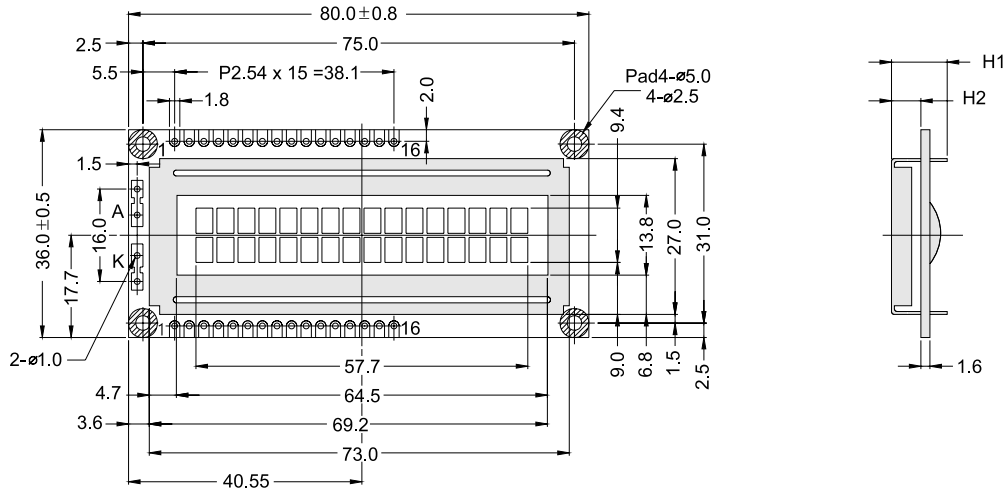
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	64.0 x 13.8	W / O B/L	5.0 / 9.6
Dot Size	0.55 x 0.50	EL B/L	5.0 / 9.6
Dot Pitch	0.60 x 0.55	LED B/L	9.0 / 13.6

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION

Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	64.5 x 13.8	W / O B/L	5.0 / 9.6
Dot Size	0.55 x 0.50	EL B/L	5.0 / 9.6
Dot Pitch	0.60 x 0.55	LED B/L	9.0 / 13.6

PIN ASSIGNMENT

Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

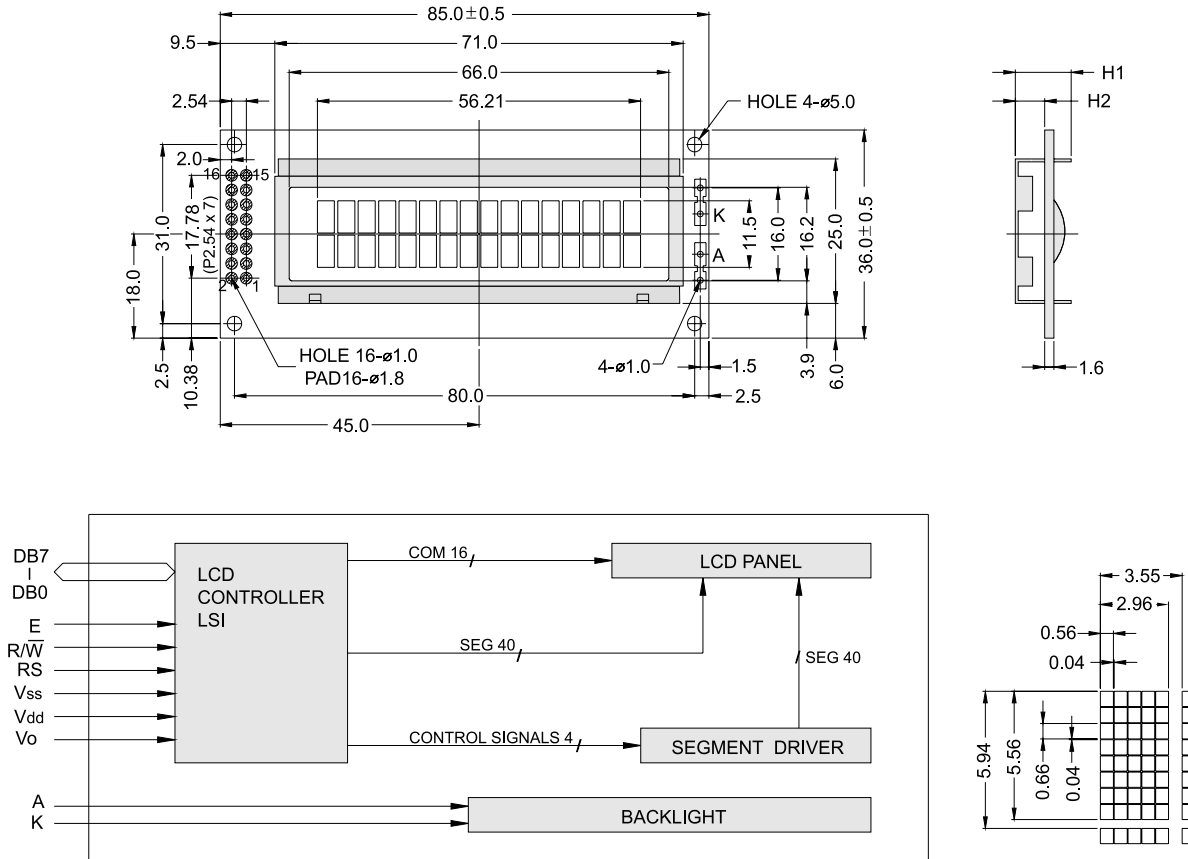
ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



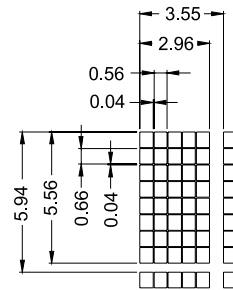
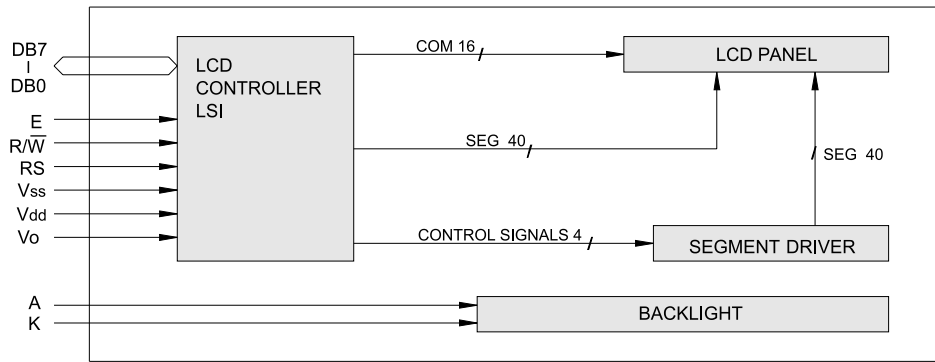
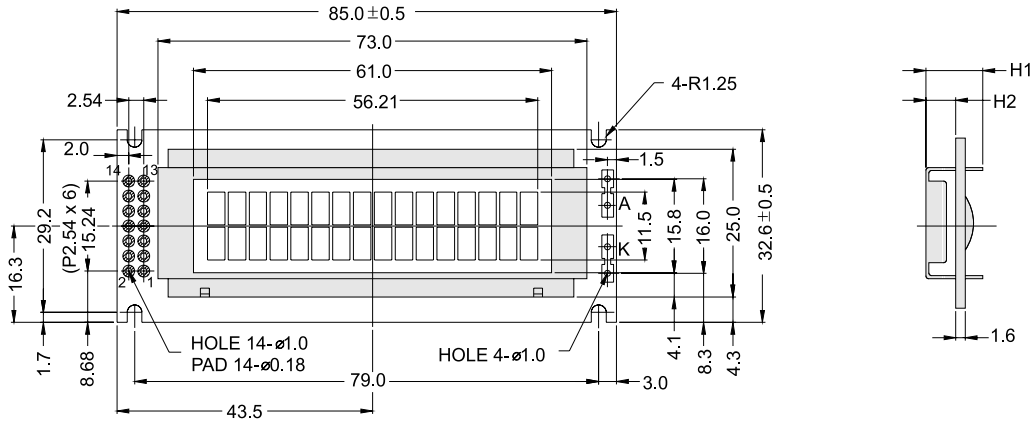
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	85.0 x 36.0	Module	H2 / H1
View Area	66.0 x 16.2	W / O B/L	5.1 / 9.7
Dot Size	0.56 x 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.60 x 0.70	LED B/L	9.4 / 14.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	4.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	5.3	-	5.1	-	V
		25°C	4.1	6.1	4.9	6.4	4.7	6.7	V
		50°C	3.8	-	4.6	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



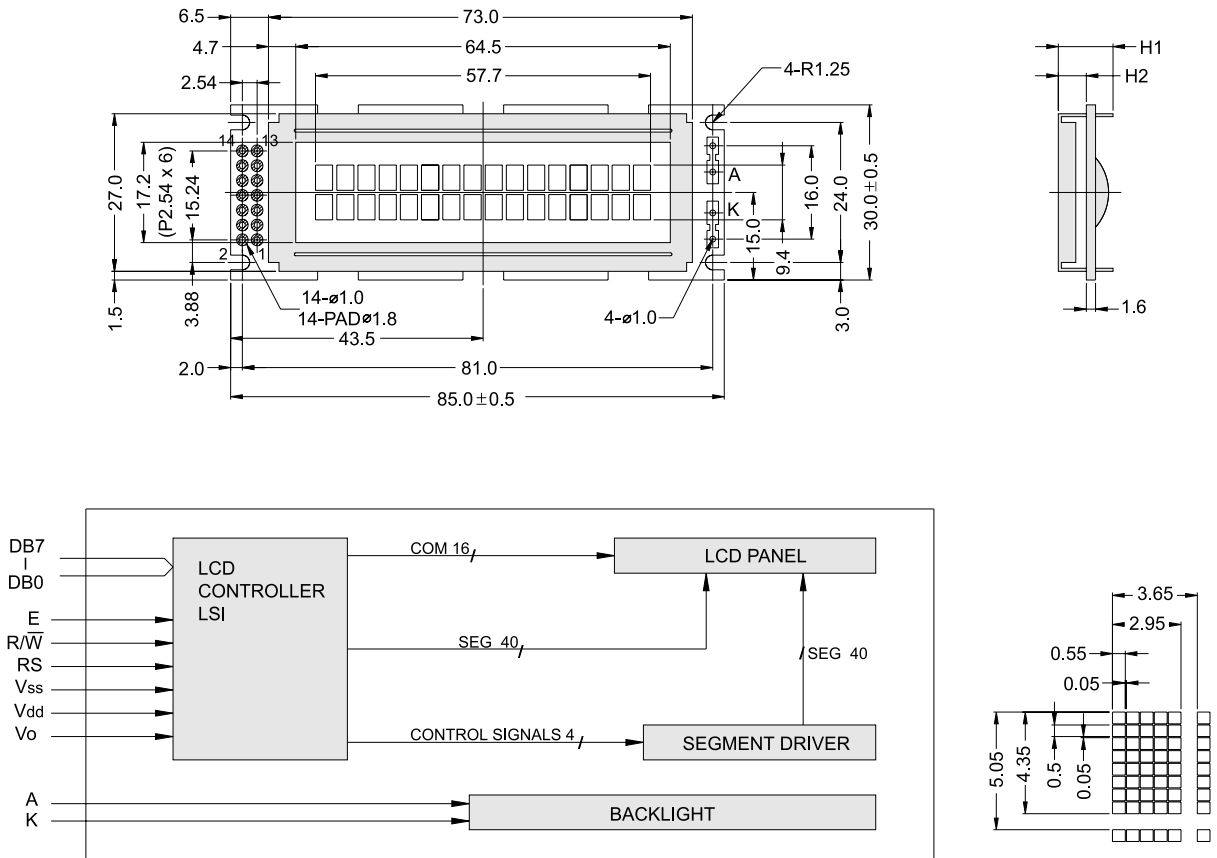
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	85.0 x 32.6	Module	H2 / H1
View Area	61.0 x 15.8	W/O B/L	5.1 / 9.7
Dot Size	0.56 x 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.60 x 0.70	LED B/L	9.4 / 14.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	4.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	5.1	-	5.3	-	V
		25°C	4.1	6.1	4.7	6.4	4.9	6.7	V
		50°C	3.8	-	4.5	-	4.6	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



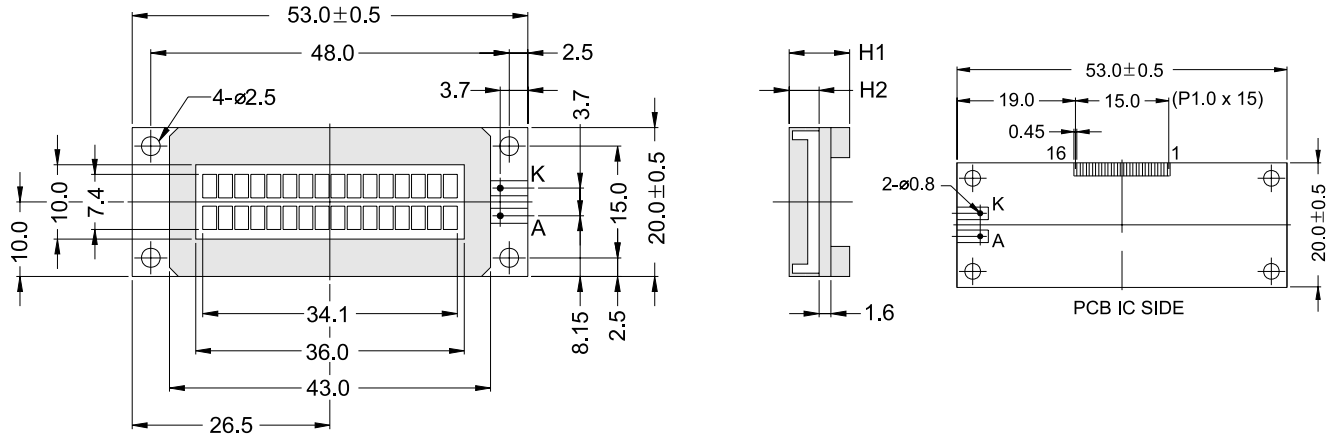
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	85.0 x 30.0	Module	H2 / H1
View Area	64.5 x 17.2	W / O B/L	4.8 / 9.4
Dot Size	0.55 x 0.50	EL B/L	4.8 / 9.4
Dot Pitch	0.60 x 0.55	LED B/L	9.0 / 13.1

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	4.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	110	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



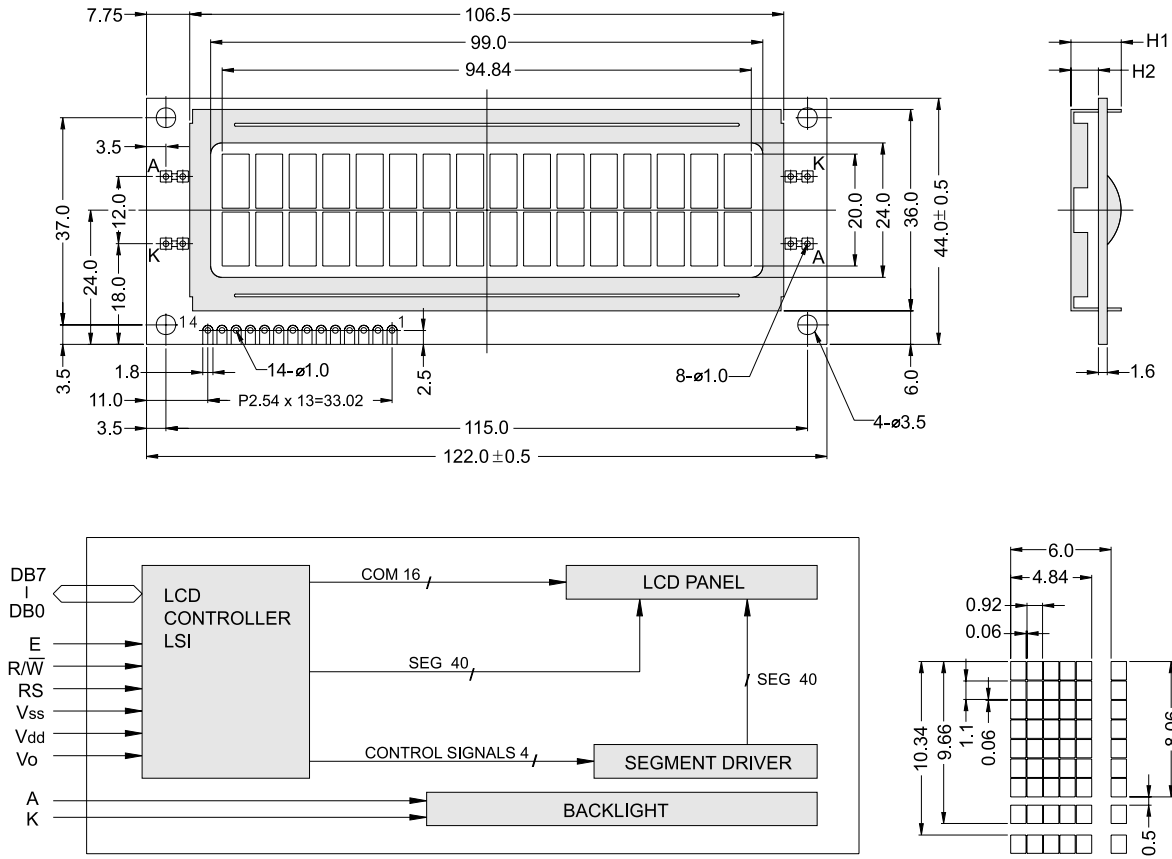
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	53.0 x 20.0	Module	H2 / H1
View Area	36.0 x 10.0	W/O B/L	4.0 / 8.1
Dot Size	0.33 x 0.35	EL B/L	- / -
Dot Pitch	0.38 x 0.40	LED B/L	4.0 / 8.1

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING											
Item	Symbol	Condition	Min.	Max.	Units						
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V						
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V						
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V						
ELECTRICAL CHARACTERISTICS											
Item	Symbol	Condition	Min.	Typical	Max.	Units					
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V					
		LCD operation voltage	Top	N	W	N	W	N	W	V	
			-20°C	-	7.1	-	7.5	-	7.9	V	
		LCD operation voltage	Vop	0°C	4.8	-	5.1	-	5.4	-	V
				25°C	4.4	6.1	4.7	6.4	5	6.7	V
				50°C	3.9	-	4.2	-	4.5	-	V
LCD operation voltage	Vop	70°C	-	5.7	-	6	-	6.3	V		
		LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	20	-	mA					
	LED/array	VB/L=4.2V	-	-	-	mA					

OUTLINE DIMENSION & BLOCK DIAGRAM



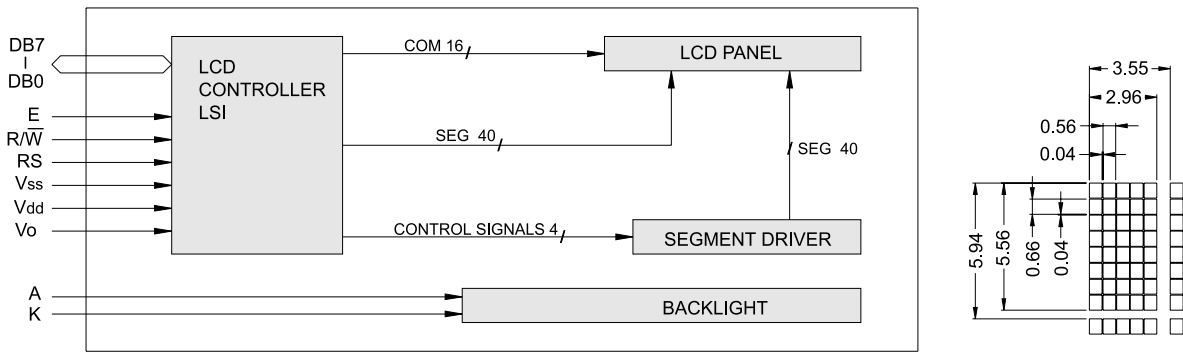
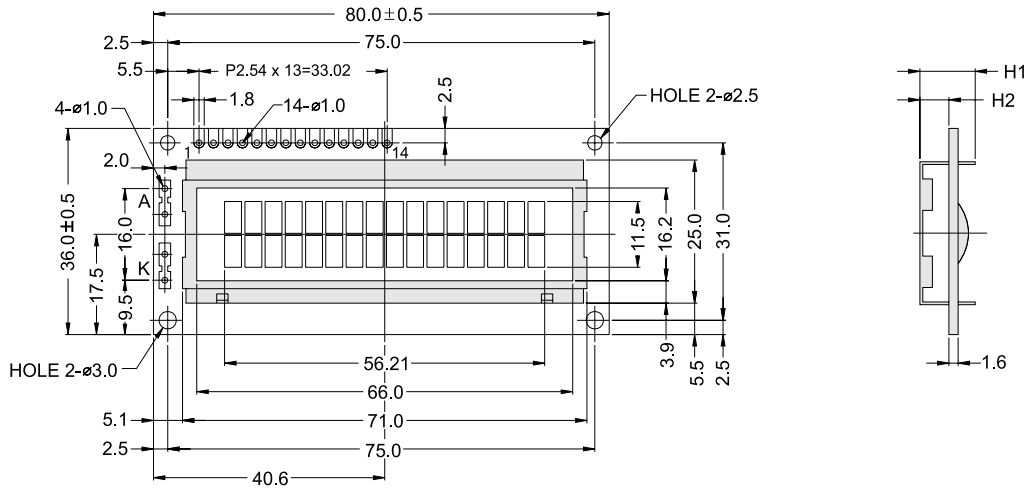
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	122.0 x 44.0	Module	H2 / H1
View Area	99.0 x 24.0	W / O B/L	4.9 / 9.0
Dot Size	0.92 x 1.10	EL B/L	4.9 / 9.0
Dot Pitch	0.98 x 1.16	LED B/L	9.4 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.5	-	4.7	-	V
		25°C	4.1	6.1	4.3	6.4	4.5	6.7	V
		50°C	4	-	4.2	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	300	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



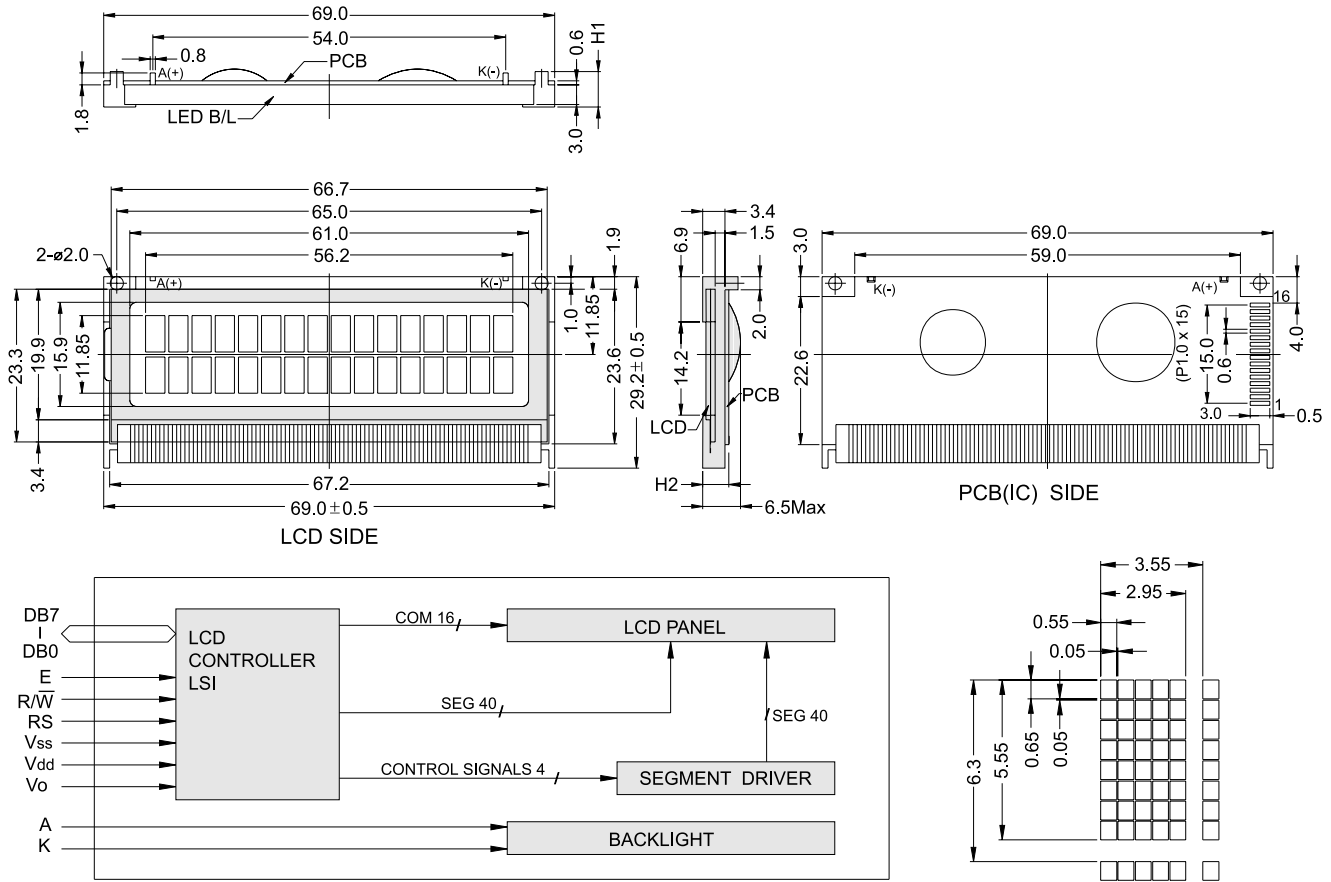
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	66.0 x 16.2	W / O B/L	5.1 / 9.7
Dot Size	0.56 x 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.66 x 0.70	LED B/L	9.4 / 14.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



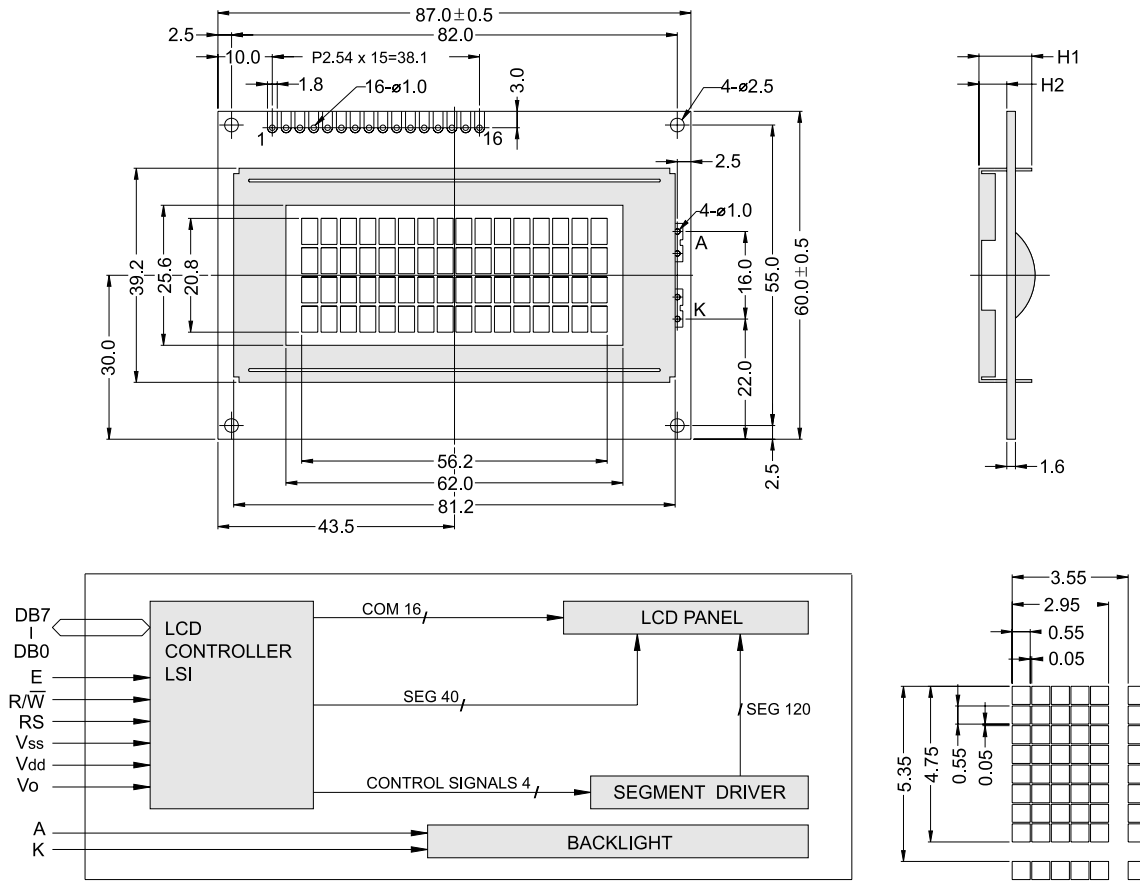
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	69.0 x 29.2	Module	H2 / H1
View Area	61.0 x 15.9	W/O B/L	-
Dot Size	0.55 x 0.65	EL B/L	-
Dot Pitch	0.60 x 0.70	LED B/L	4.0 / 5.4

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V			
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V			
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V			
ELECTRICAL CHARACTERISTICS								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V		
		LCD operation voltage	Vop	Top	N	W	N	W
-20°C	-	5		-	5.3	-	5.6	V
0°C	4.4	-		4.7	-	5	-	V
25°C	3.9	4.8		4.2	5.1	4.8	5.4	V
50°C	3.7	-		4	-	4.5	-	V
70°C	-	4.6		-	4.9	-	5.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA		
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA		
	LED/array	VB/L=4.2V	-	-	-	mA		

OUTLINE DIMENSION & BLOCK DIAGRAM



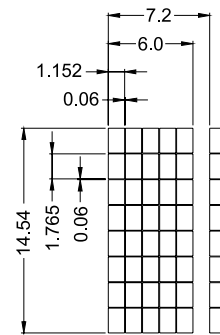
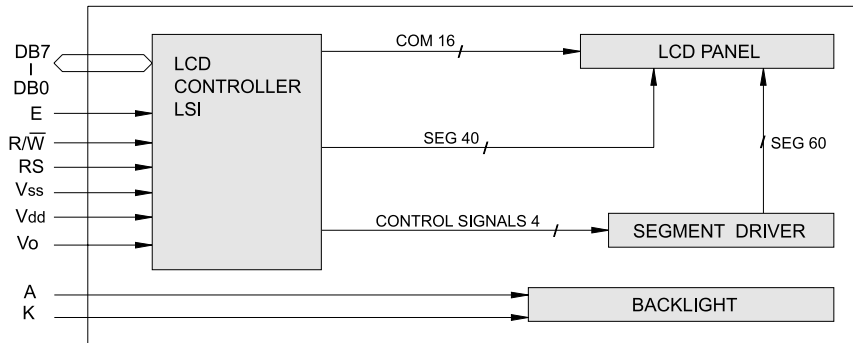
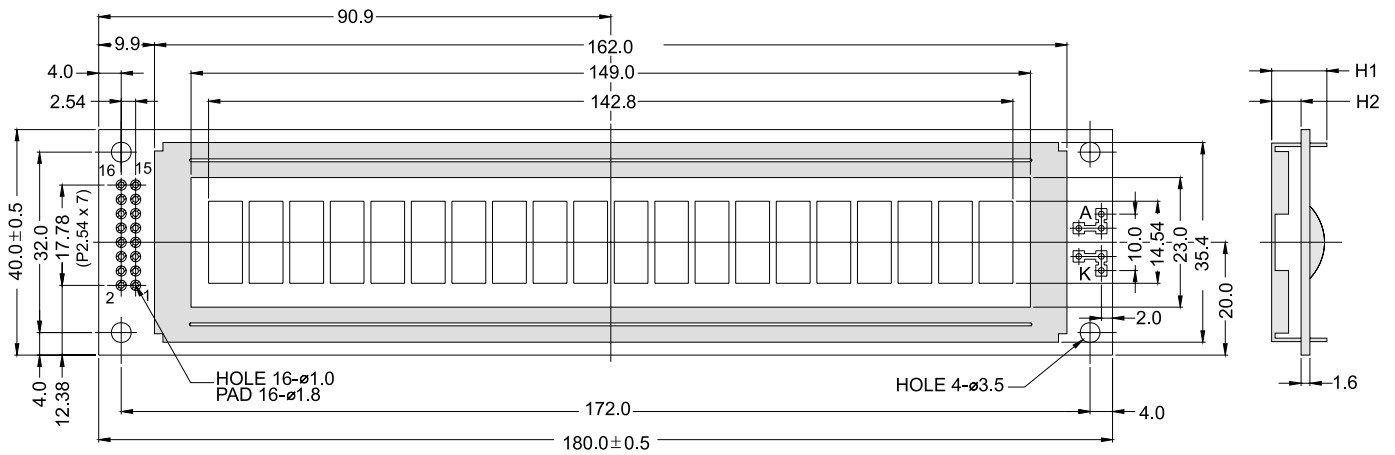
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	87.0 x 60.0	Module	H2 / H1
View Area	62.0 x 25.6	W / O B/L	5.1 / 9.7
Dot Size	0.55 x 0.55	EL B/L	5.1 / 9.7
Dot Pitch	0.60 x 0.60	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.3	-	4.6	-	4.9	-	V
		25°C	3.9	6.1	4.2	6.4	4.5	6.7	V
		50°C	3.6	-	3.9	-	4.2	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	220	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



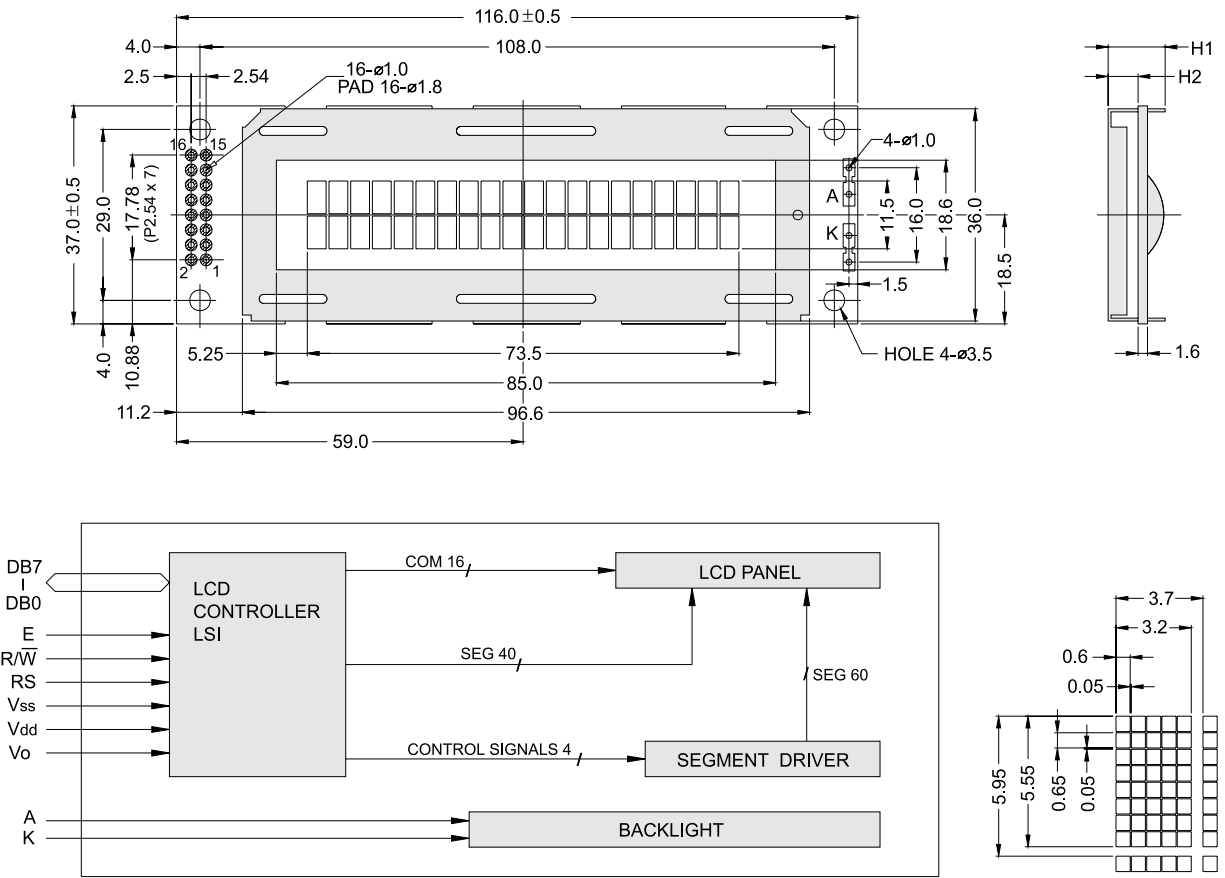
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	180.0 x 40.0	Module	H2 / H1
View Area	149.0 x 23.0	W / O B/L	5.2 / 9.8
Dot Size	1.152 x 1.765	EL B/L	5.2 / 9.8
Dot Pitch	1.212 x 1.825	LED B/L	10.7 / 15.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.3	-	4.6	-	4.9	-	V
		25°C	3.9	6.1	4.2	6.4	4.5	6.7	V
		50°C	3.6	-	3.9	-	4.2	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	360	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



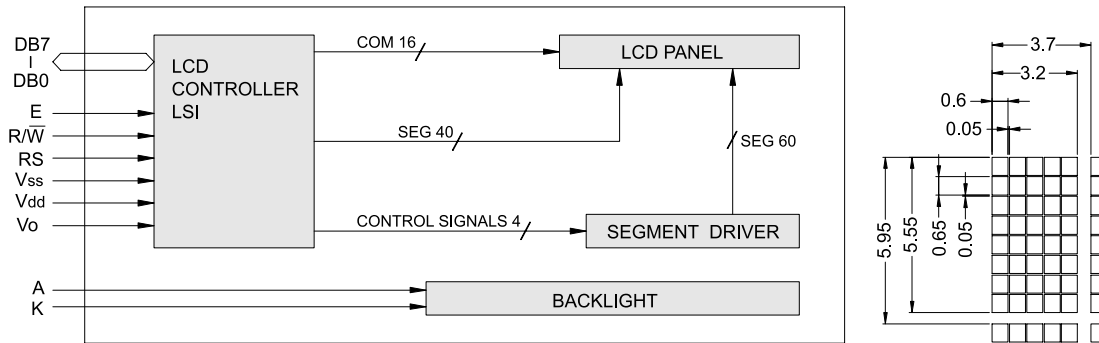
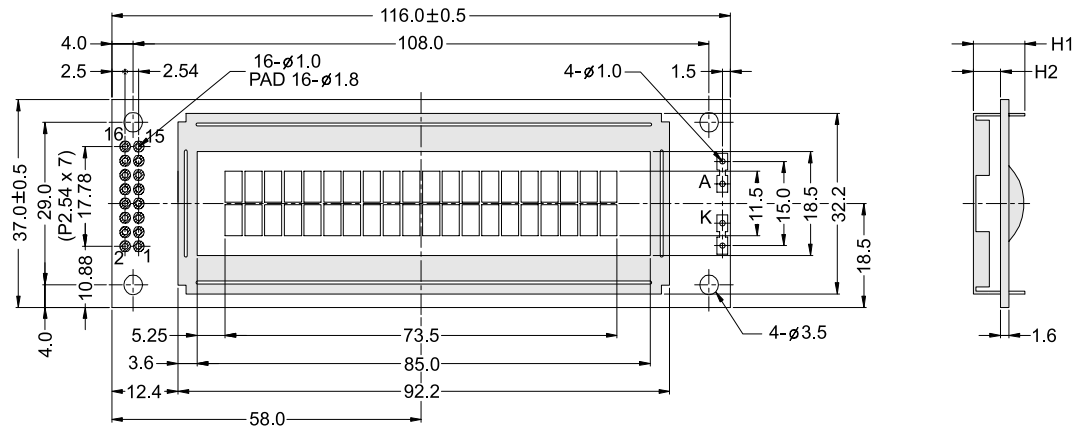
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	116.0 x 37.0	Module	H2 / H1
View Area	85.0 x 18.5	W / O B/L	5.1 / 9.7
Dot Size	0.60 x 0.65	EL B/L	5.1 / 9.7
Dot Pitch	0.65 x 0.70	LED B/L	9.4 / 14.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.3	-	4.7	-	4.9	-	V
		25°C	4.2	6.1	4.4	6.4	4.3	6.7	V
		50°C	3.7	-	3.8	-	3.9	-	V
70°C	-	5.7	-	6	-	6.3	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	210	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



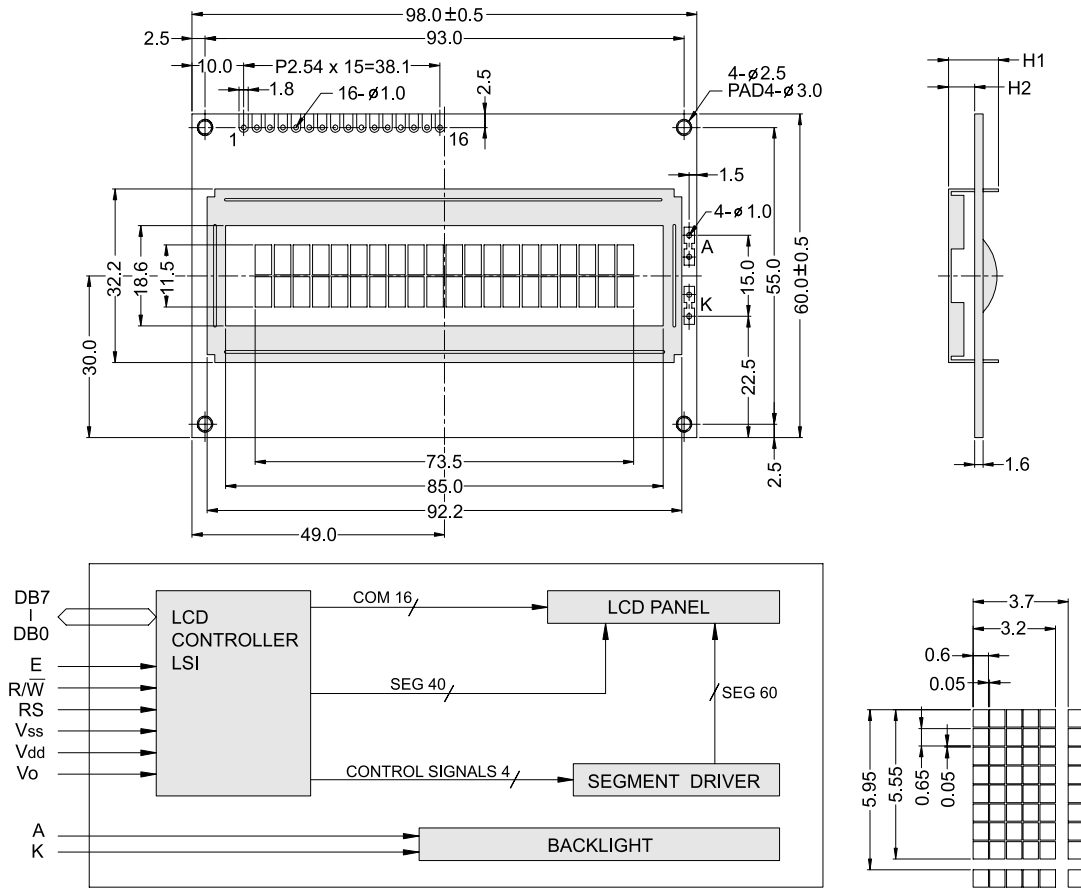
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	116.0 x 37.0	Module	H2 / H1
View Area	85.0 x 18.5	W / O B/L	5.1 / 9.7
Dot Size	0.60 x 0.65	EL B/L	5.1 / 9.7
Dot Pitch	0.65 x 0.70	LED B/L	8.7 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.3	-	4.7	-	5.0	-	V
		25°C	3.7	6.1	4.1	6.4	4.4	6.7	V
		50°C	3.3	-	3.6	-	4.0	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	210	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



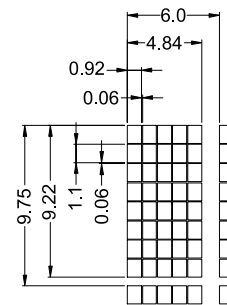
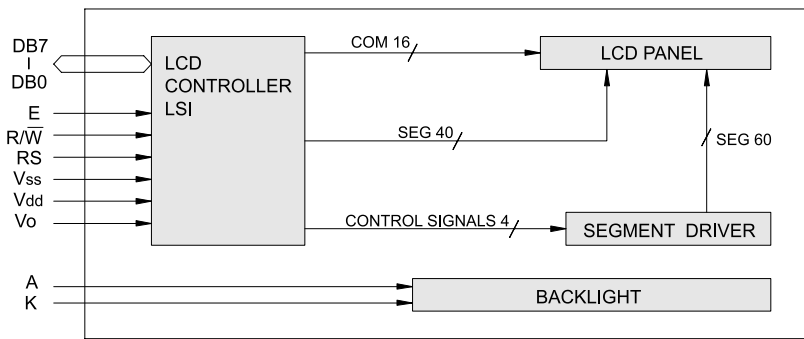
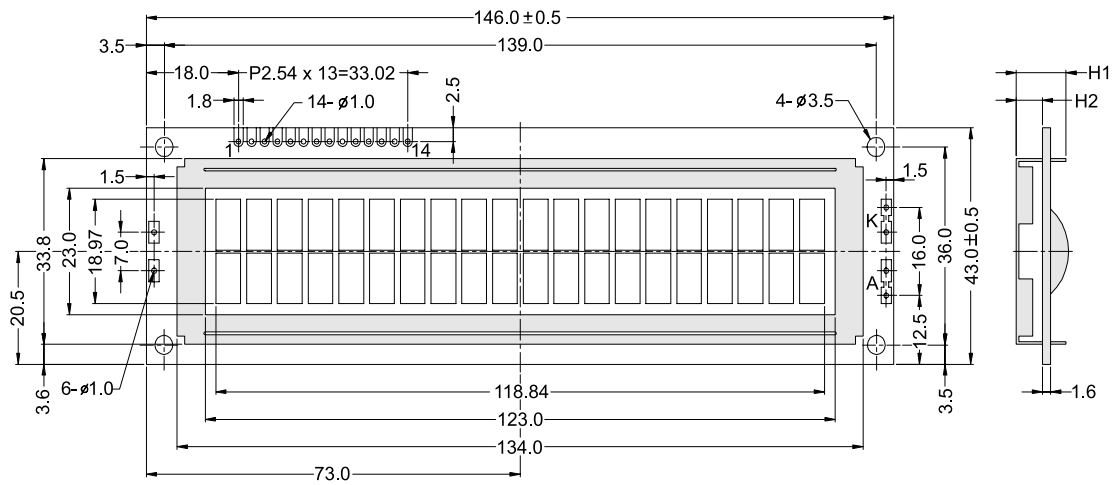
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	98.0 x 60.0	Module	H2 / H1
View Area	85.0 x 18.6	W / O B/L	5.1 / 9.7
Dot Size	0.60 x 0.65	EL B/L	-
Dot Pitch	0.65 x 0.70	LED B/L	8.7 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	210	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



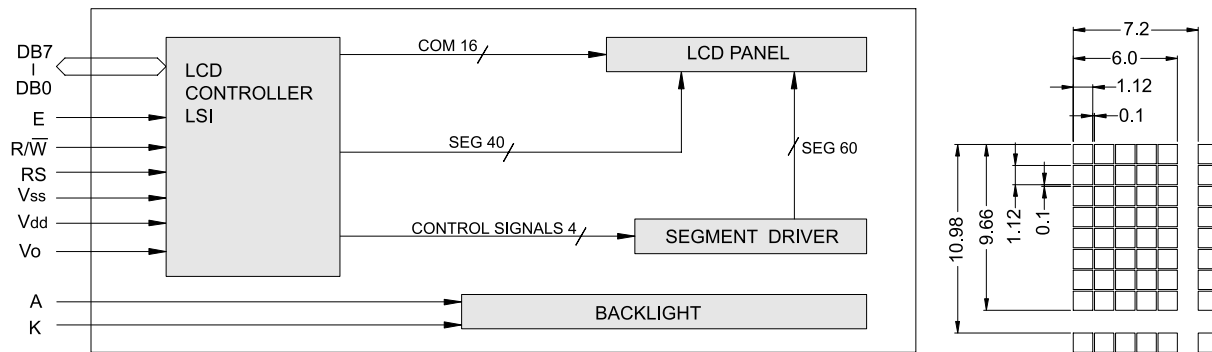
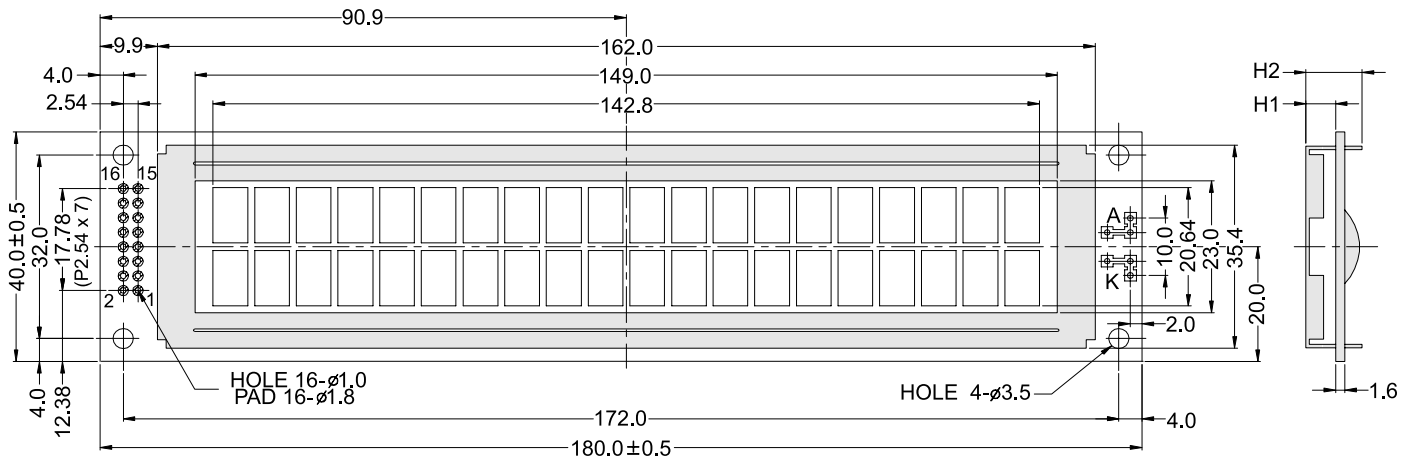
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	146.0 x 43.0	Module	H2 / H1
View Area	123.0 x 23.0	W / O B/L	5.1 / 9.7
Dot Size	0.92 x 1.10	EL B/L	5.1 / 9.7
Dot Pitch	0.98 x 1.16	LED B/L	9.1 / 13.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.6	-	4.9	-	5.2	-	V
		25°C	4.2	6.1	4.5	6.4	4.8	6.7	V
		50°C	3.9	-	4.2	-	4.5	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	270	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified $\pm 0.3\text{mm}$

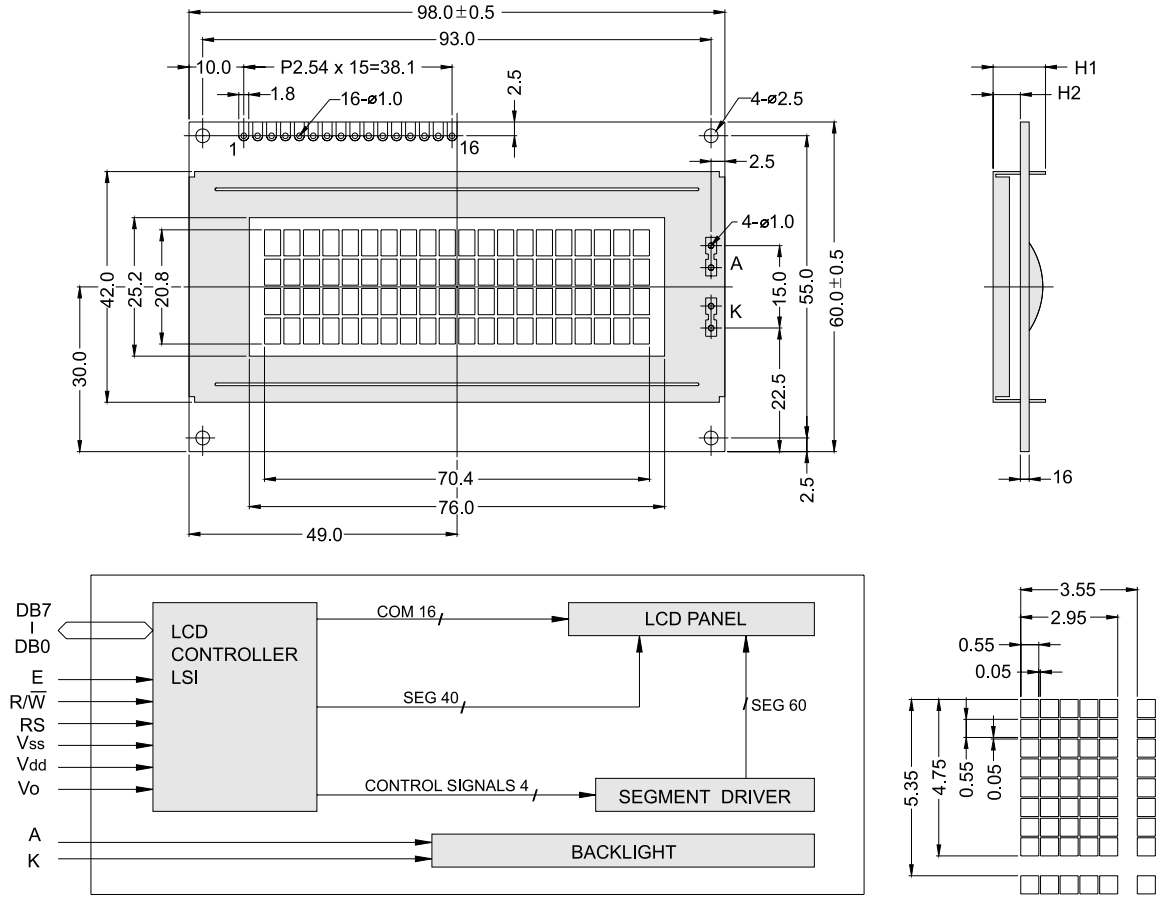
MECHANICAL SPECIFICATION			
Overall Size	180.0 x 40.0	Module	H2 / H1
View Area	149.0 x 23.0	W / O B/L	5.2 / 9.8
Dot Size	1.12 x 1.12	EL B/L	5.2 / 9.8
Dot Pitch	1.22 x 1.22	LED B/L	10.7 / 15.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A/Vee	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING					
Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V

ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	5	-	5.3	-	5.6	V
		0°C	4.3	-	4.6	-	4.9	-	V
		25°C	3.9	4.8	5.2	5.1	4.5	5.4	V
		50°C	3.7	-	4.0	-	4.3	-	V
		70°C	-	4.3	-	4.8	-	5.1	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	360	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



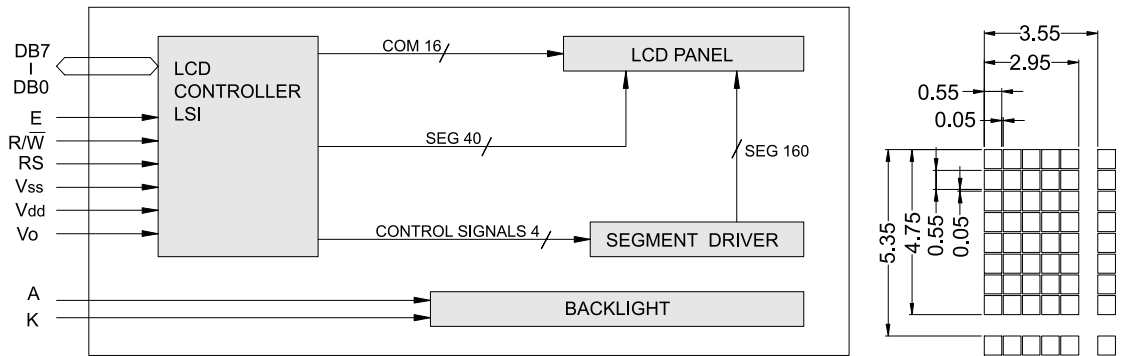
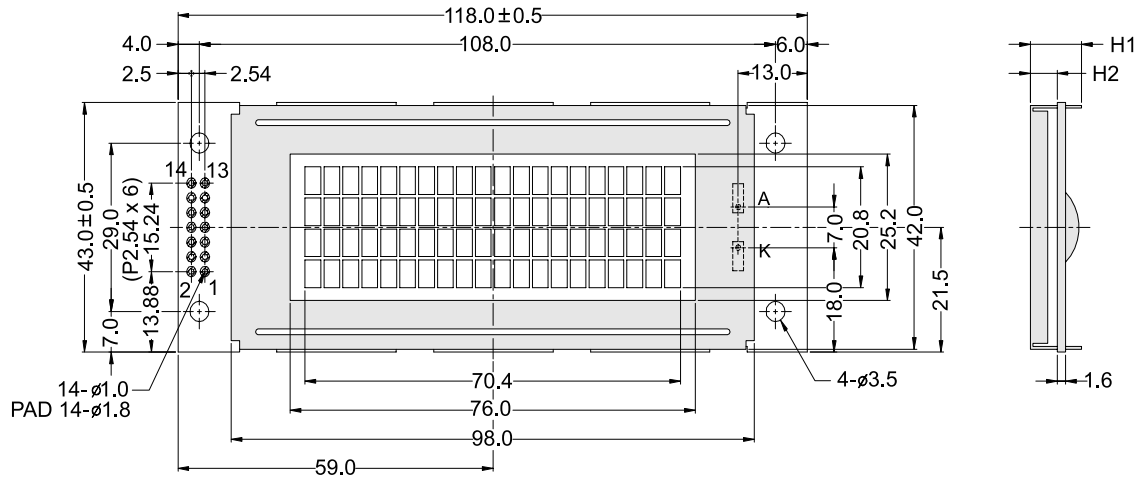
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	98.0 x 60.0	Module	H2 / H1
View Area	76.0 x 25.2	W / O B/L	5.0 / 9.6
Dot Size	0.55 x 0.55	EL B/L	5.0 / 9.6
Dot Pitch	0.60 x 0.60	LED B/L	8.7 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	5.1	-	5.4	-	6.1	-	V
		25°C	5	6.1	5.3	6.4	5.8	6.7	V
		50°C	4.4	-	4.7	-	5.5	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	260	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



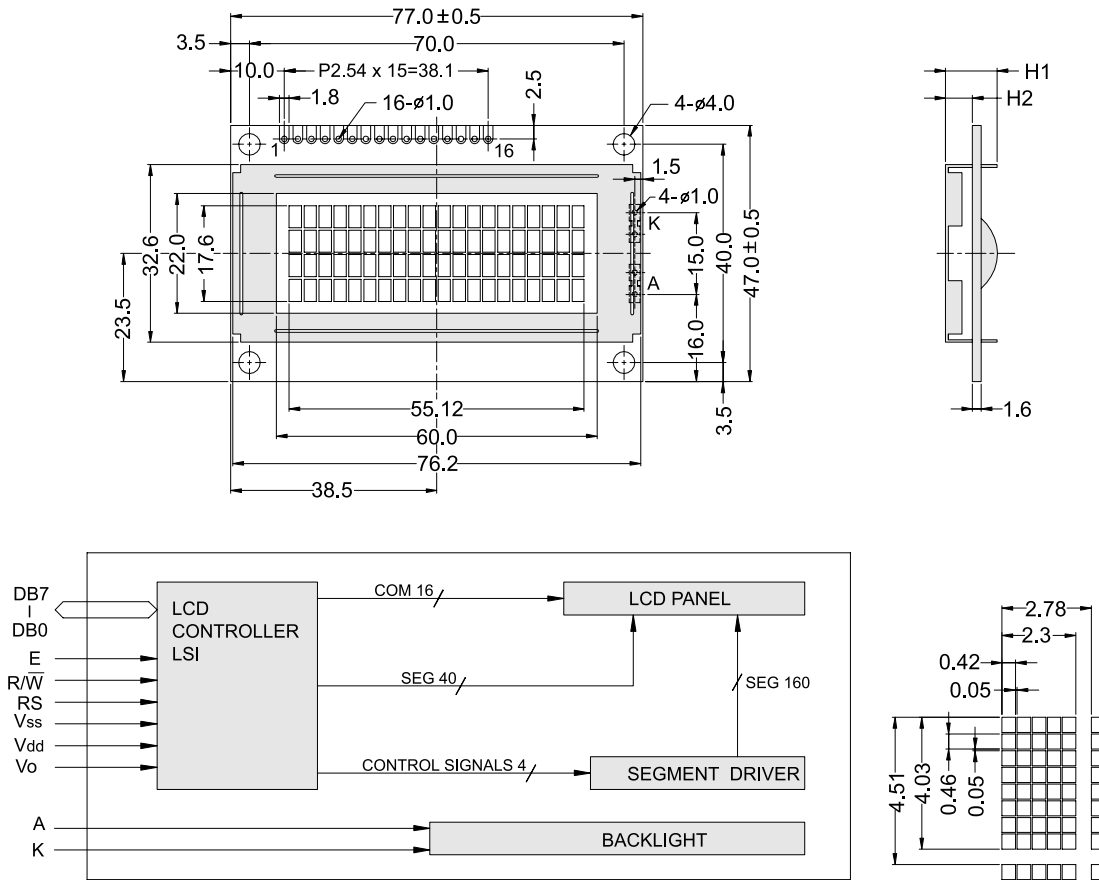
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	118.0 x 43.0	Module	H2 / H1
View Area	76.0 x 25.2	W / O B/L	5.0 / 9.6
Dot Size	0.55 x 0.55	EL B/L	5.0 / 9.6
Dot Pitch	0.60 x 0.60	LED B/L	8.7 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	5.3	-	5.3	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	5.3	-	5.7	-	6.1	-	V
		25°C	5	6.1	5.4	6.4	5.8	6.7	V
		50°C	4.7	-	5.1	-	5.5	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	260	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



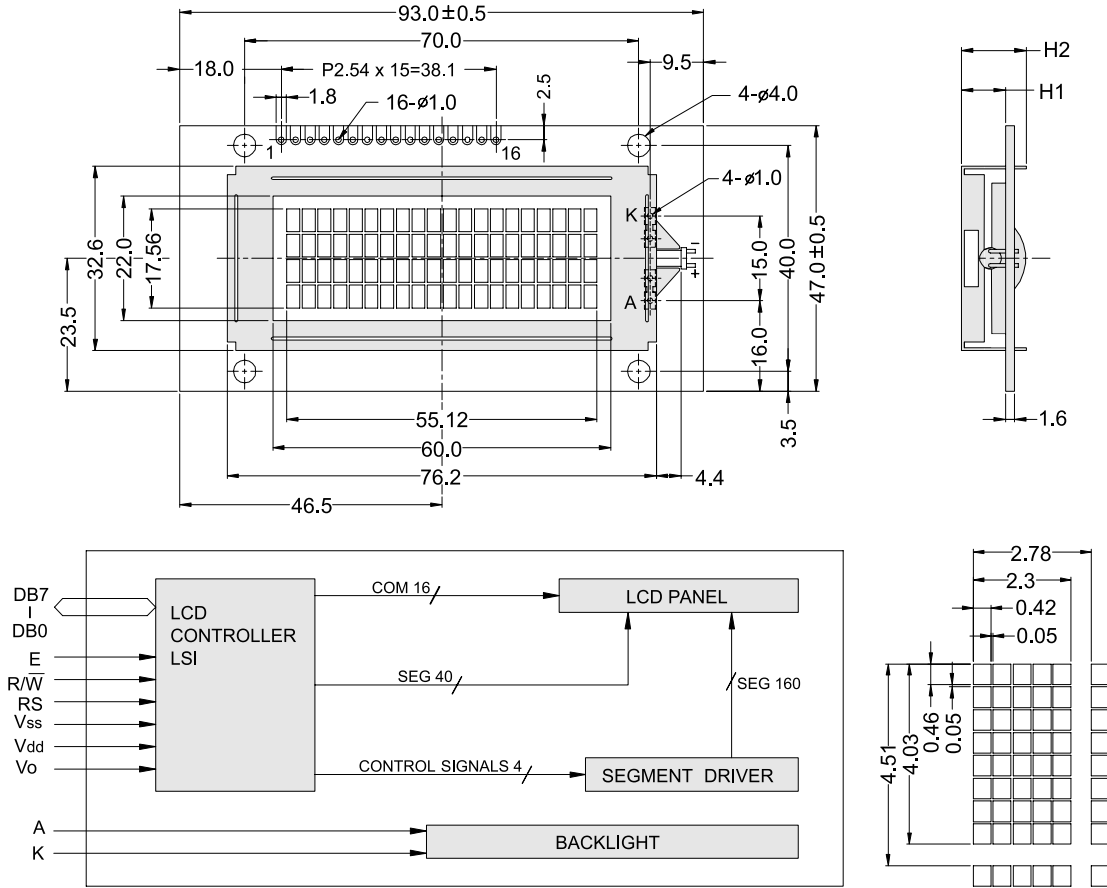
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	77.0 x 47.0	Module	H2 / H1
View Area	60.0 x 22.2	W / O B/L	5.0 / 9.6
Dot Size	0.42 x 0.46	EL B/L	5.0 / 9.6
Dot Pitch	0.47 x 0.51	LED B/L	9.6 / 14.2

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.4	-	7.8	-	8.2	V
		0°C	4.9	-	5.2	-	5.5	-	V
		25°C	4.5	6.4	4.8	6.7	5.1	7	V
		50°C	4.1	-	4.4	-	4.7	-	V
		70°C	-	6	-	6.3	-	6.6	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	150	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



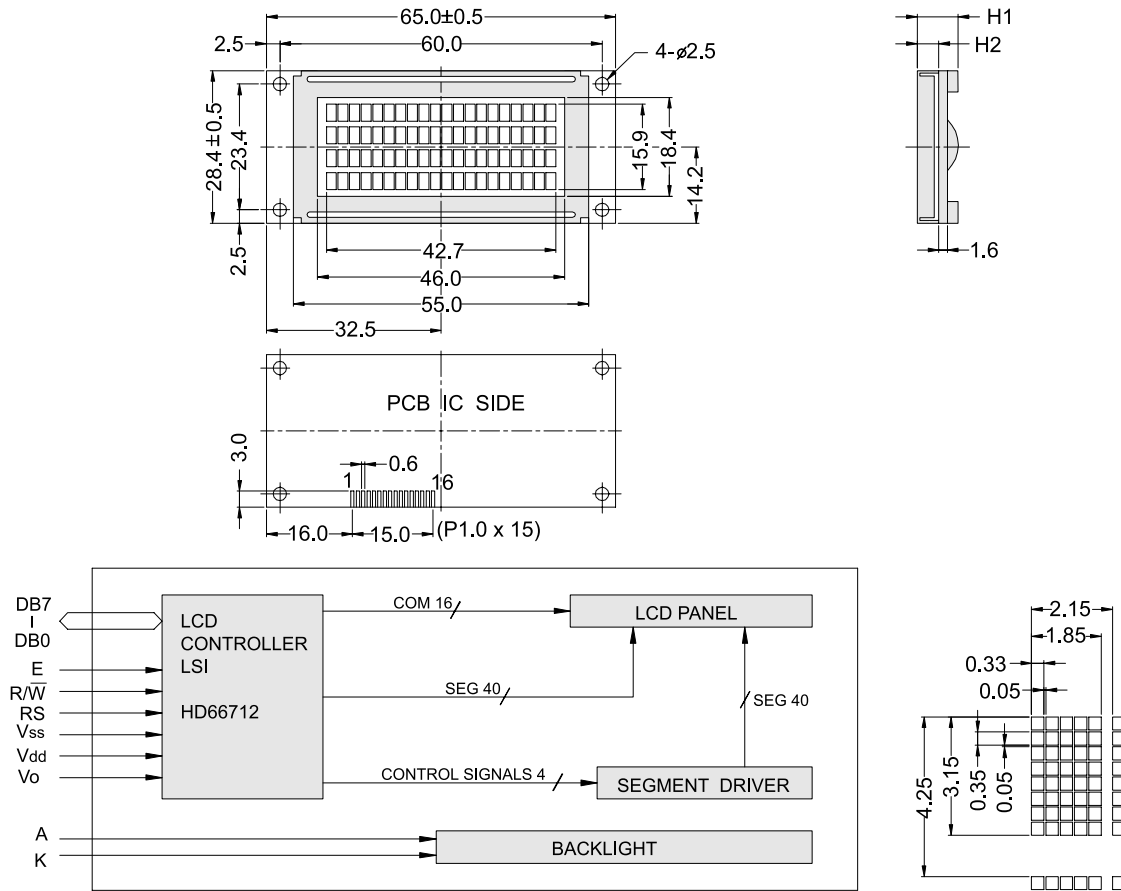
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	93.0 x 47.0	Module	H2 / H1
View Area	60.0 x 22.0	W/O B/L	5.0 / 9.6
Dot Size	0.42 x 0.46	EL B/L	5.0 / 9.6
Dot Pitch	0.47 x 0.51	LED B/L	7.8 / 11.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.4	-	7.8	-	8.2	V
		0°C	4.9	-	5.2	-	5.5	-	V
		25°C	4.5	6.4	4.8	6.7	5.1	7	V
		50°C	4.1	-	4.4	-	4.7	-	V
		70°C	-	6	-	6.3	-	6.6	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=3.3V	-	10	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



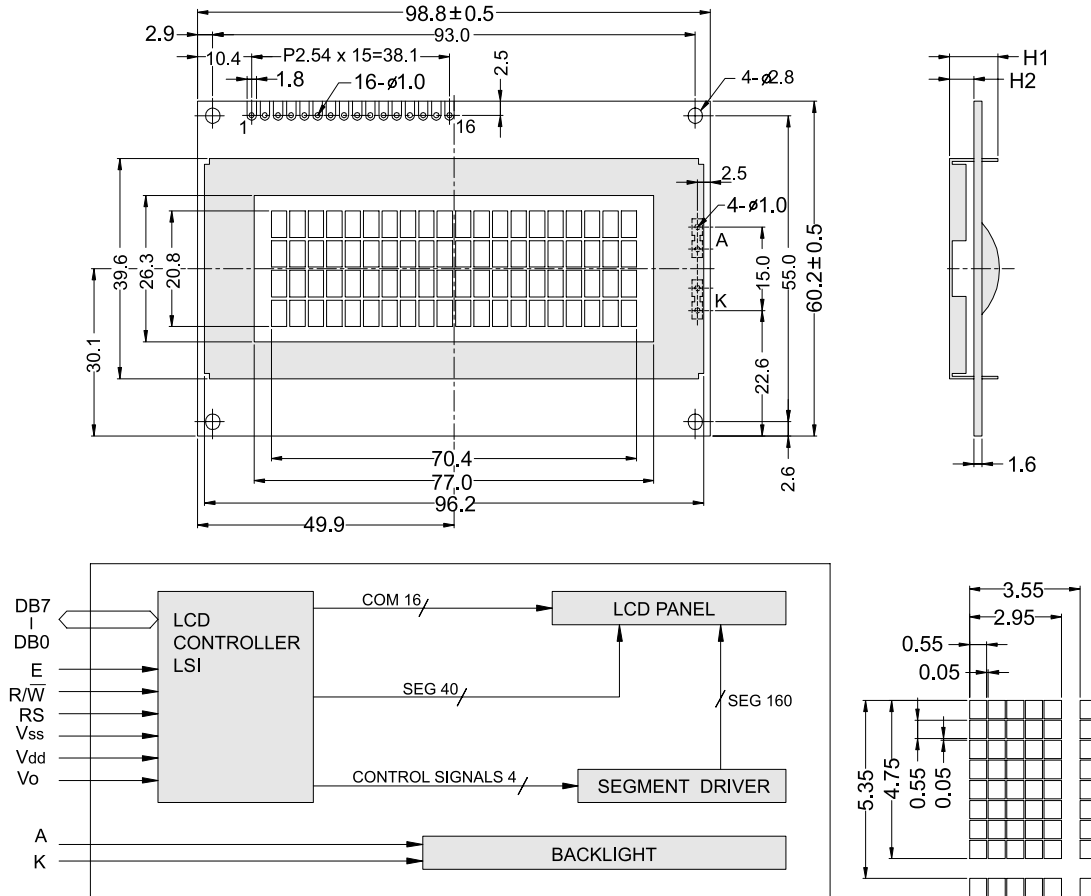
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	65.0 x 28.4	Module	H2 / H1
View Area	46.0 x 18.4	W/O B/L	4.0 / 7.6
Dot Size	0.33 x 0.35	EL B/L	- / -
Dot Pitch	0.38 x 0.40	LED B/L	4.0 / 7.6

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.4	-	7.8	-	8.2	V
		0°C	4.9	-	5.2	-	5.5	-	V
		25°C	4.5	6.4	4.8	6.7	5.1	7	V
		50°C	4.1	-	4.4	-	4.7	-	V
		70°C	-	6	-	6.3	-	6.6	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



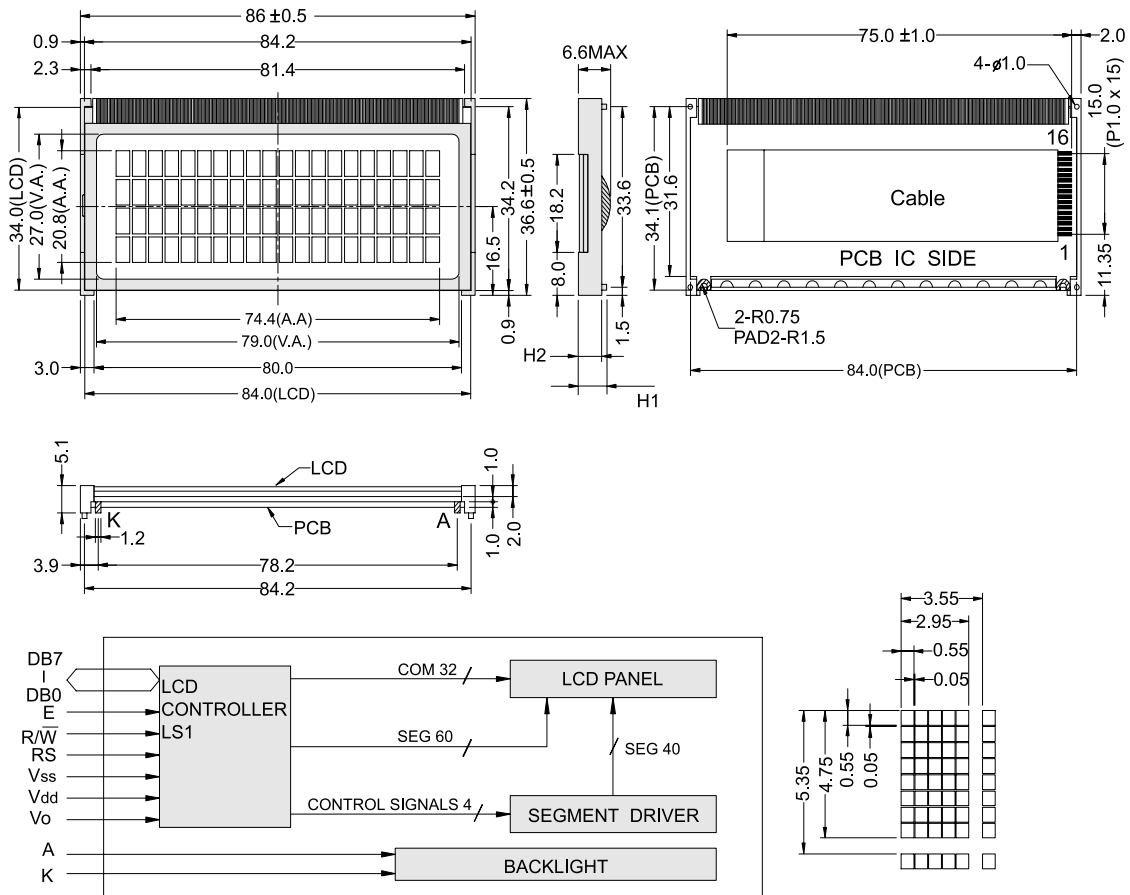
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	98.8 x 60.2	Module	H2 / H1
View Area	77.0 x 26.3	W / O B/L	4.7 / 9.3
Dot Size	0.55 x 0.55	EL B/L	- / -
Dot Pitch	0.60 x 0.60	LED B/L	8.7 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vss	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.3	-	4.6	-	4.9	-	V
		25°C	3.9	6.1	4.2	6.4	4.5	6.7	V
		50°C	3.6	-	3.9	-	4.2	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	V			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	260	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



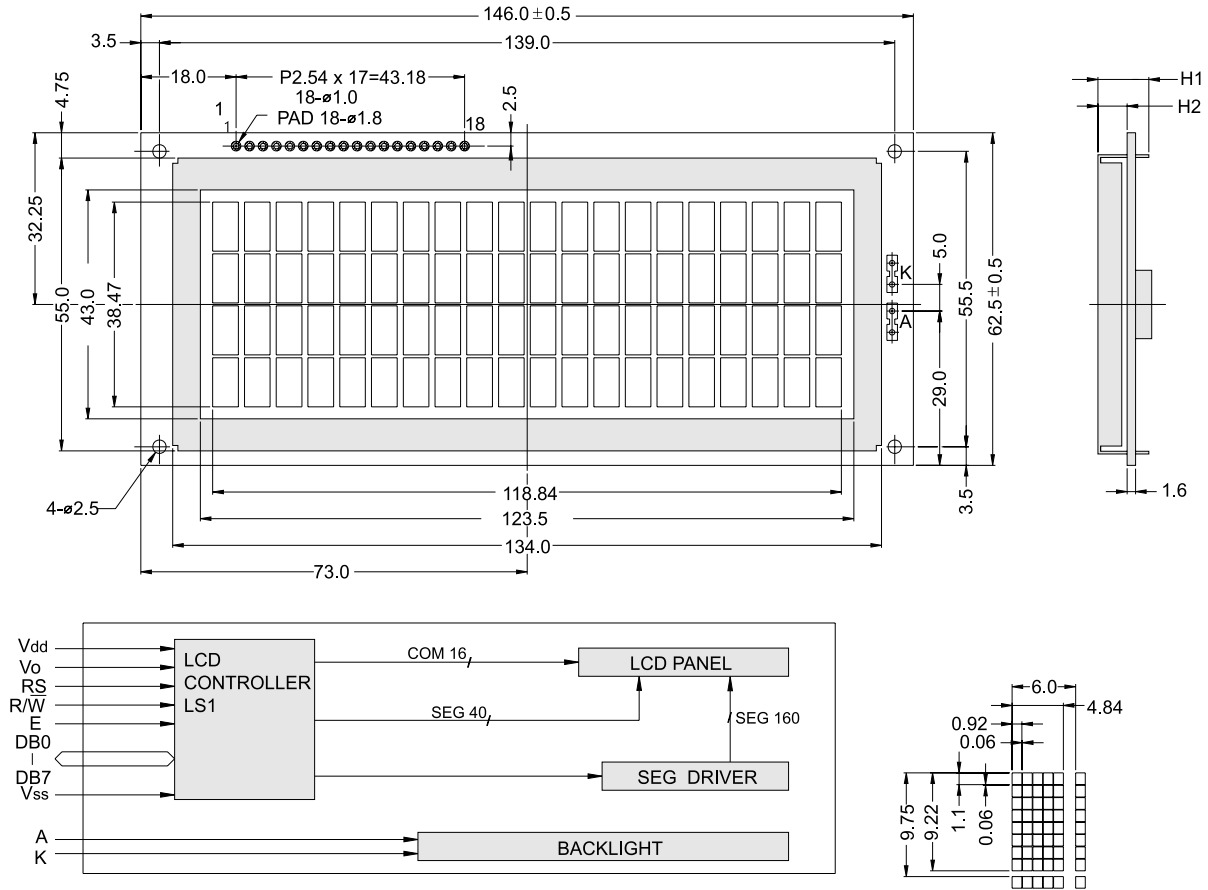
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	86.0 x 36.6	Module	H2 / H1
View Area	79.0 x 27.0	W / O B/L	- / -
Dot Size	0.55 x 0.55	EL B/L	- / -
Dot Pitch	0.60 x 0.60	LED B/L	5.1 / 6.1

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	6.5	-	6.8	-	7.1	V
		0°C	4.3	-	4.6	-	4.9	-	V
		25°C	3.9	6.5	4.2	6.7	4.5	6.8	V
		50°C	3.6	-	3.9	-	4.2	-	V
		70°C	-	6.3	-	6.5	-	6.6	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	60	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



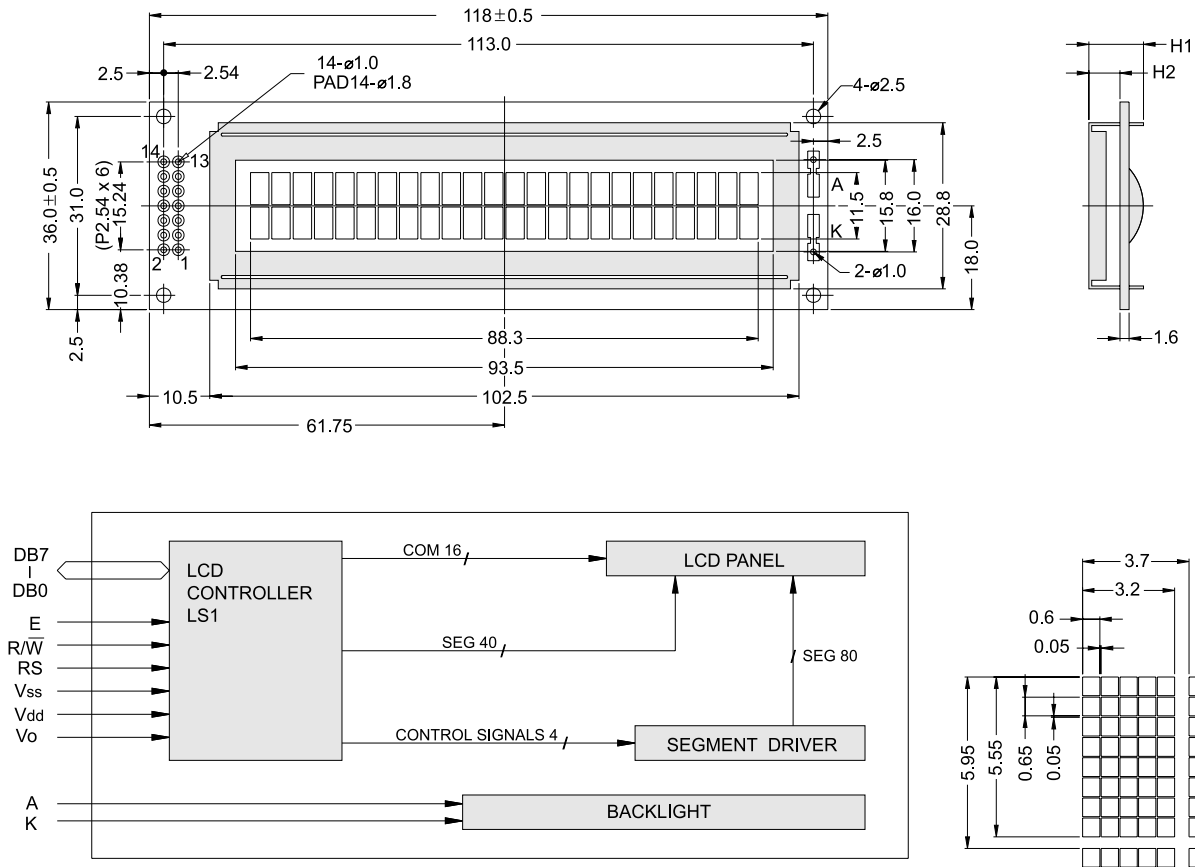
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	146.0 x 62.5	Module	H2 / H1
View Area	123.5 x 43.0	W / O B / L	5.5 / 9.6
Dot Size	0.92 x 1.10	EL B / L	5.5 / 9.6
Dot Pitch	0.98 x 1.16	LED B / L	9.0 / 13.1

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)
17	NC/Vee	Negative voltage
18	NC	No connection

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	770	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



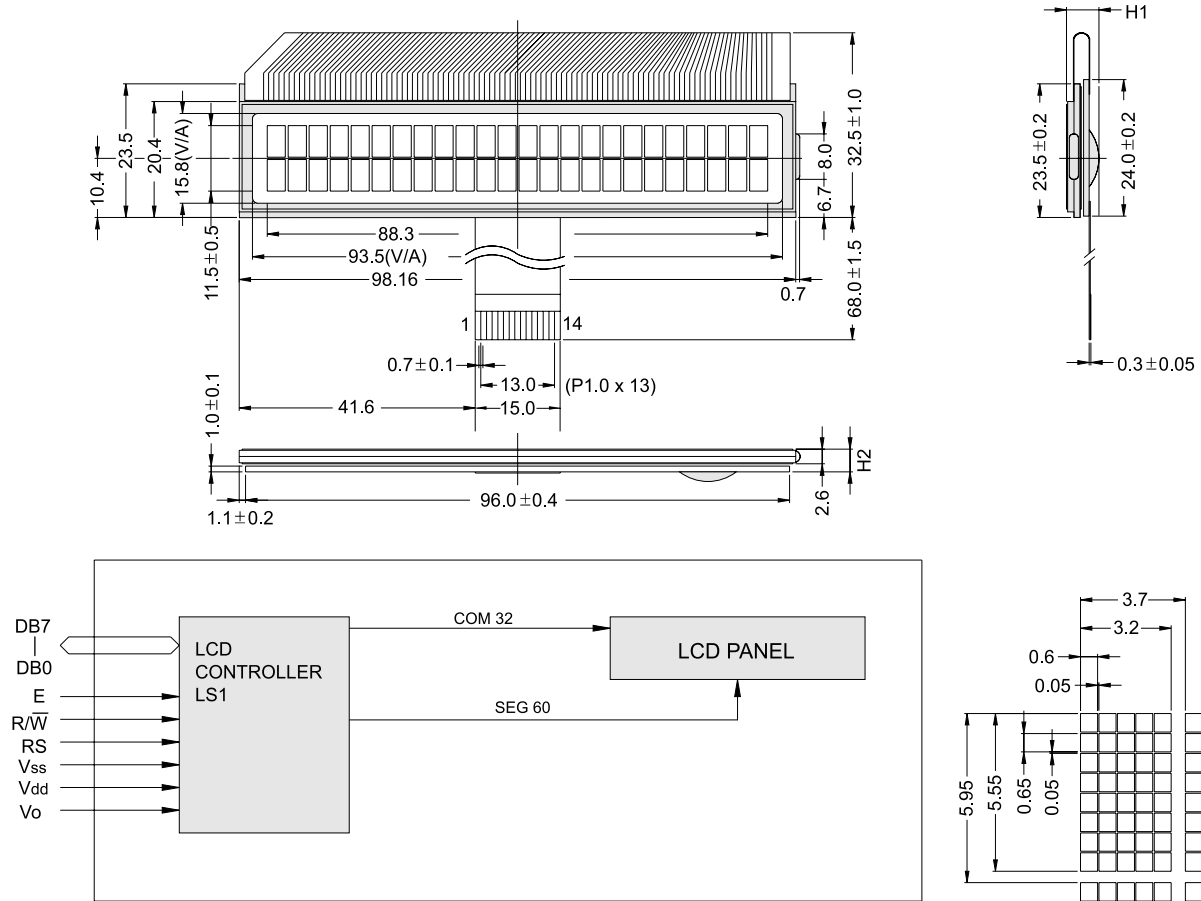
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	118.0 x 36.0	Module	H2 / H1
View Area	93.5 x 16.0	W/O B/L	5.4 / 9.5
Dot Size	0.60 x 0.65	EL B/L	5.4 / 9.5
Dot Pitch	0.65 x 0.70	LED B/L	8.7 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	4.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	15	-	mA			
	LED/array	VB/L=4.2V	-	150	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



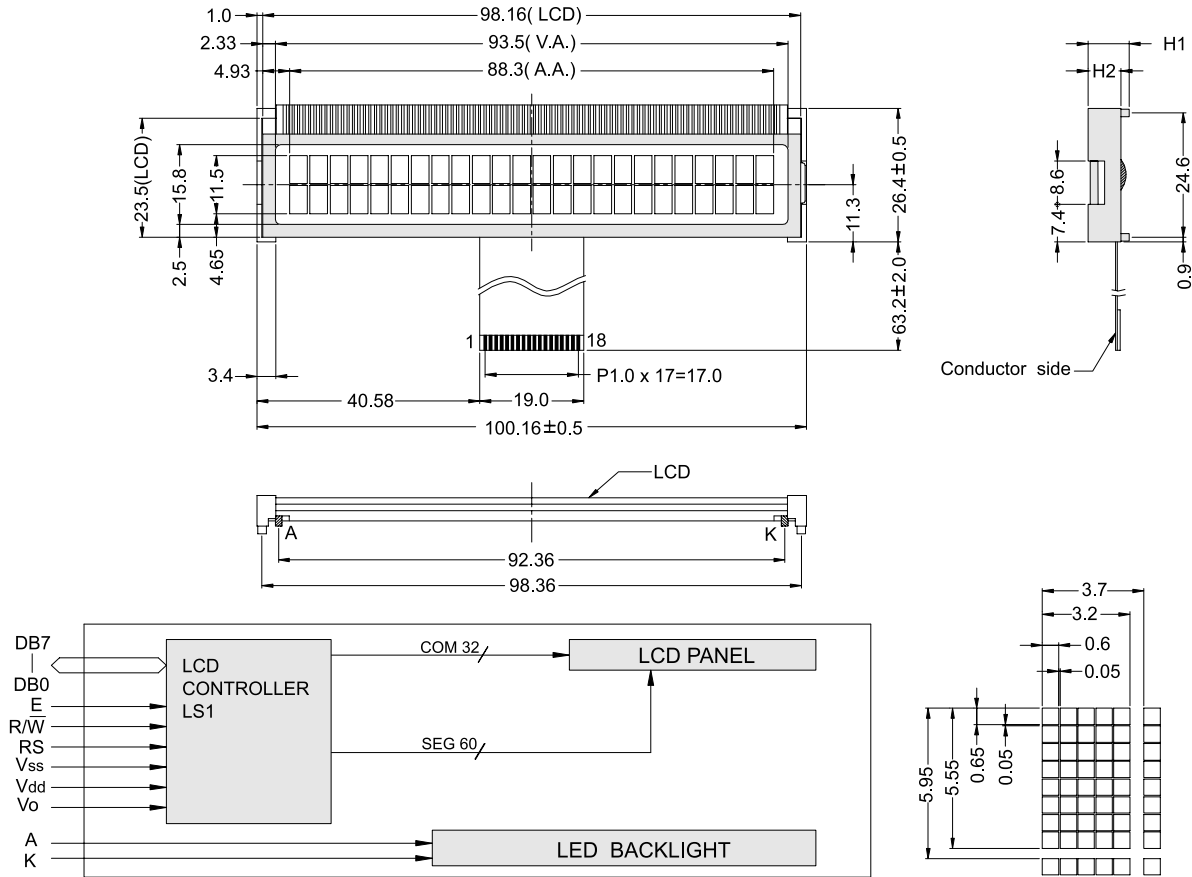
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	98.16 x 32.50	Module	H2 / H1
View Area	93.5 x 15.8	W / O B/L	4.1 / 5.5
Dot Size	0.60 x 0.65	EL B/L	-
Dot Pitch	0.65 x 0.70	LED B/L	-

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	9	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.2	-	8.3	-	7.3	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	7.7	4.4	7.9	4.7	6.9	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	6.7	-	6.9	-	6.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



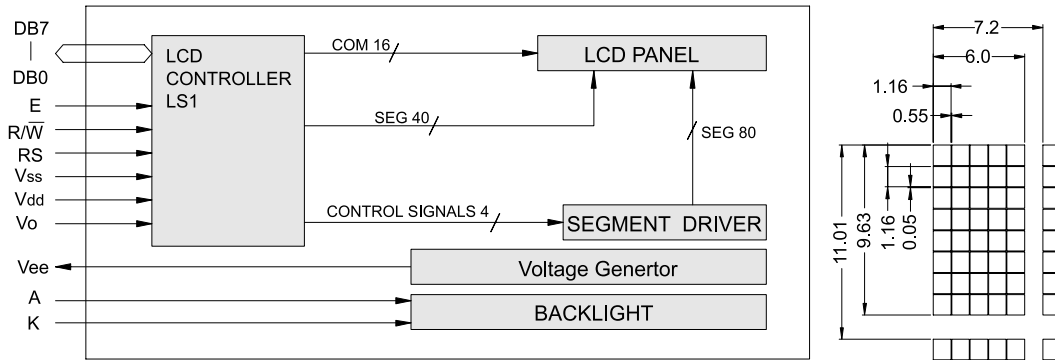
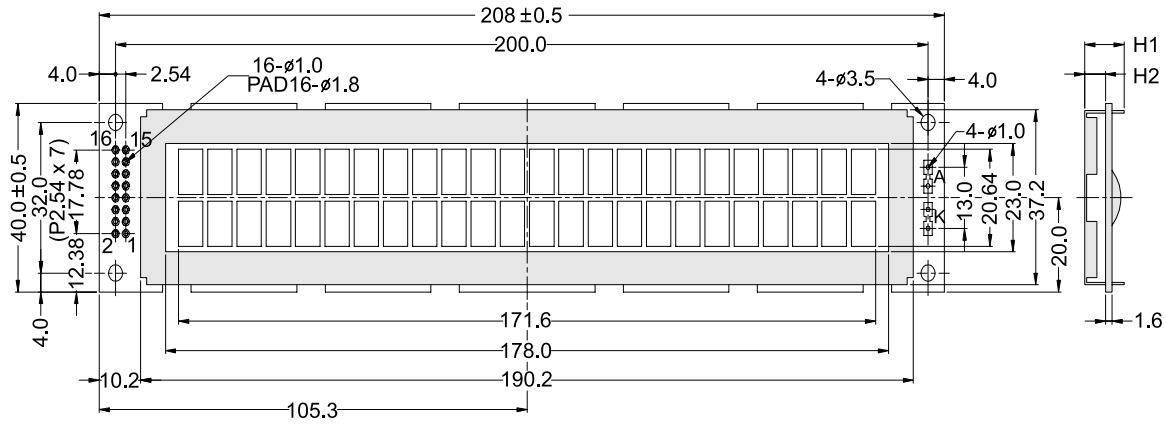
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	100.16 x 26.4	Module	H1 / H2
View Area	93.5 x 15.8	W / O B/L	- / -
Dot Size	0.60 x 0.65	EL B/L	- / -
Dot Pitch	0.65 x 0.70	LED B/L	6.0 / 7.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)
17	SCL	Serial clock input
18	SDA	Serial data input

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	9	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.2	-	8.4	-	7.3	V
		0°C	4.5	-	4.8	-	7.4	-	V
		25°C	4.1	7.7	4.4	7.9	7.0	6.9	V
		50°C	3.8	-	4.1	-	6.5	-	V
		70°C	-	6.7	-	6.9	-	6.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	60	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



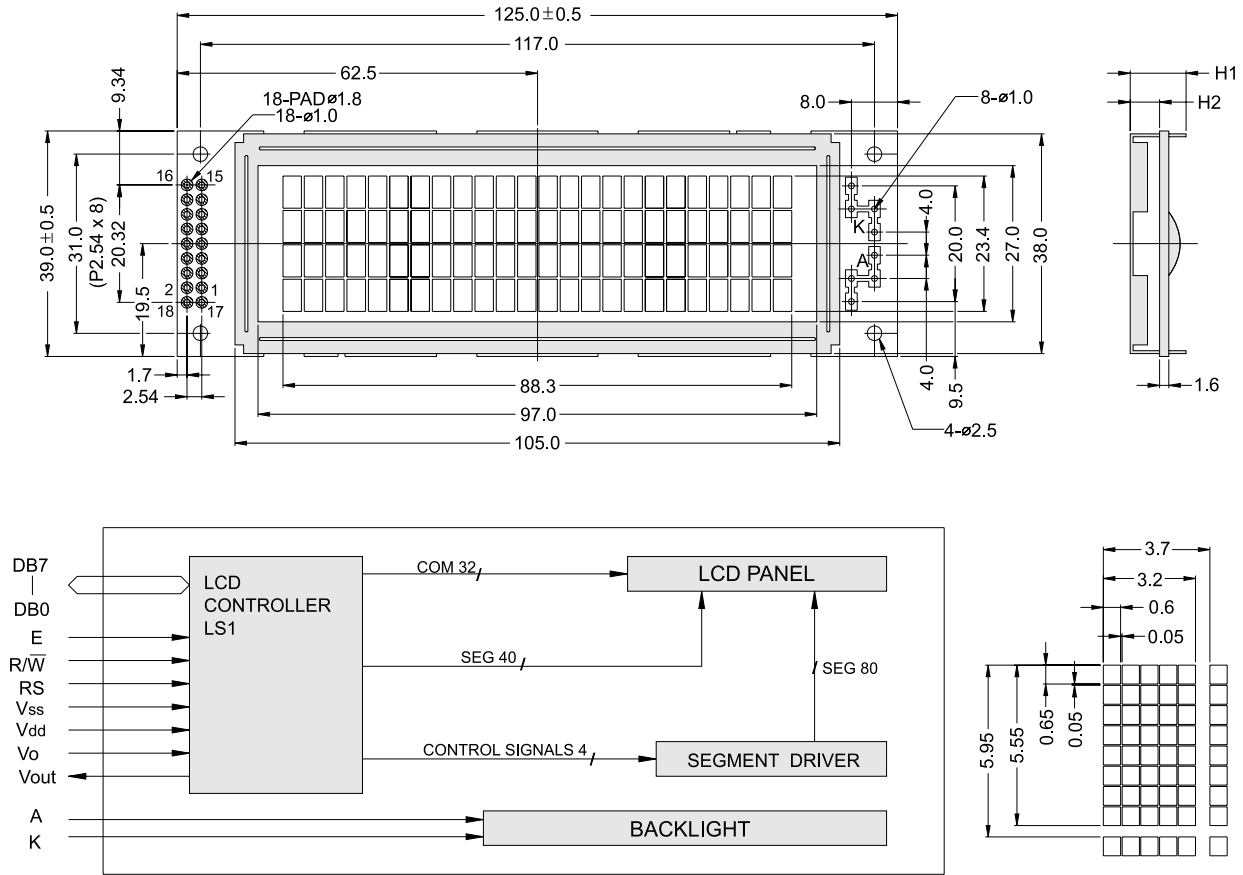
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	208.0 x 40.0	Module	H2 / H1
View Area	188.0 x 23.0	W/O B/L	5.1 / 9.7
Dot Size	1.16 x 1.16	EL B/L	5.1 / 9.7
Dot Pitch	1.21 x 1.21	LED B/L	9.2 / 13.8

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	7.9	V	
		0°C	4.3	-	4.6	-	4.9	V	
		25°C	3.9	6.1	4.2	6.4	4.5	6.7	V
		50°C	3.6	-	3.9	-	4.2	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	380	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



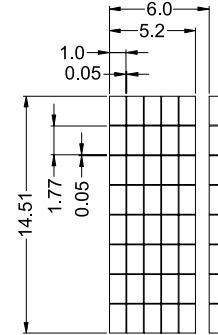
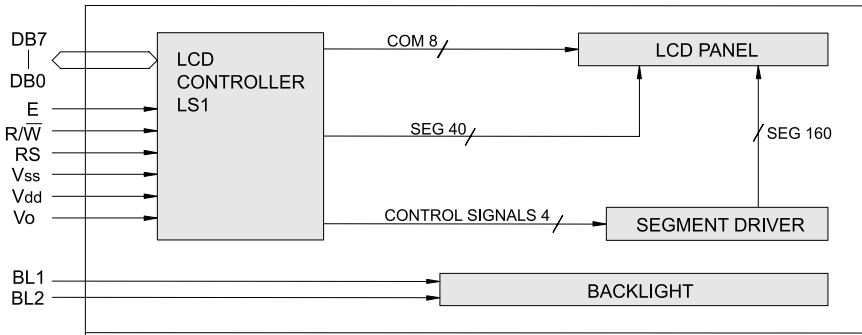
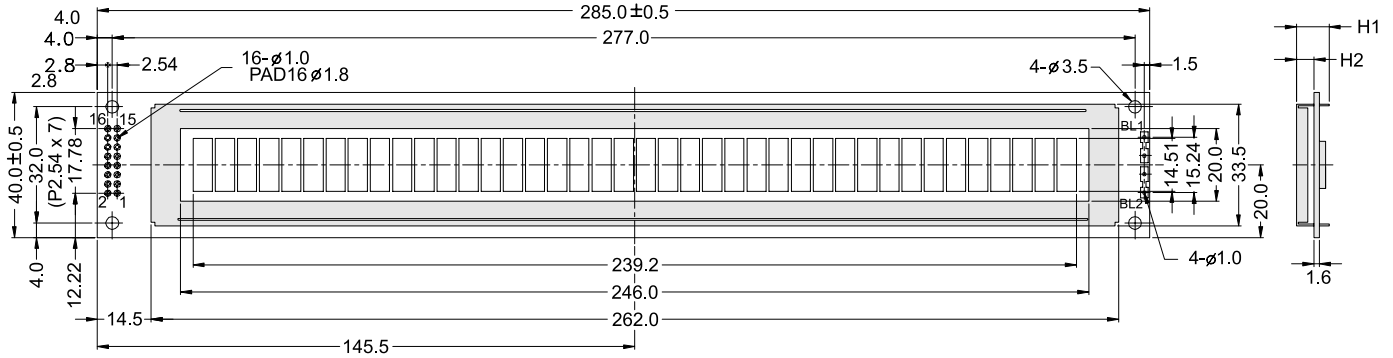
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	125.0 x 39.0	Module	H2 / H1
View Area	97.0 x 27.0	W / O B/L	5.1 / 9.7
Dot Size	0.60 x 0.65	EL B/L	- / -
Dot Pitch	0.65 x 0.70	LED B/L	9.1 / 13.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	Vout	Negative voltage output
16	RESET	Reset signal
17	A	Power supply for LED B/L (+)
18	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	5.9	-	6.7	-	6.9	V
		0°C	6.7	-	7.1	-	7.4	-	V
		25°C	6.3	5.9	6.7	6.5	7.0	6.7	V
		50°C	5.8	-	6.2	-	6.5	-	V
		70°C	-	5.5	-	5.9	-	6.1	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	320	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



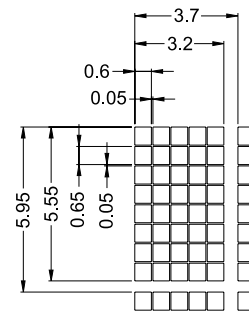
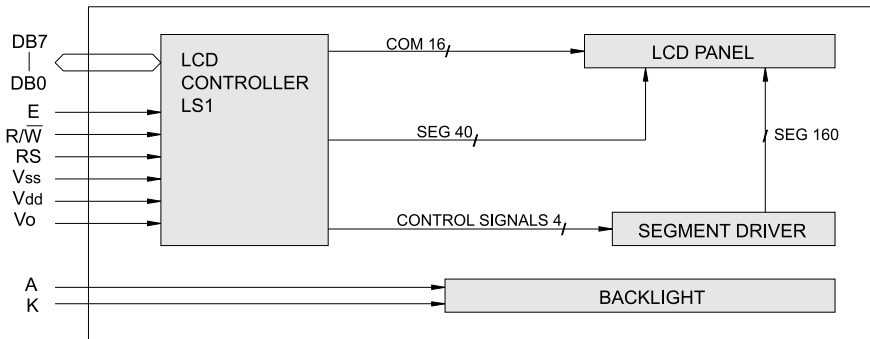
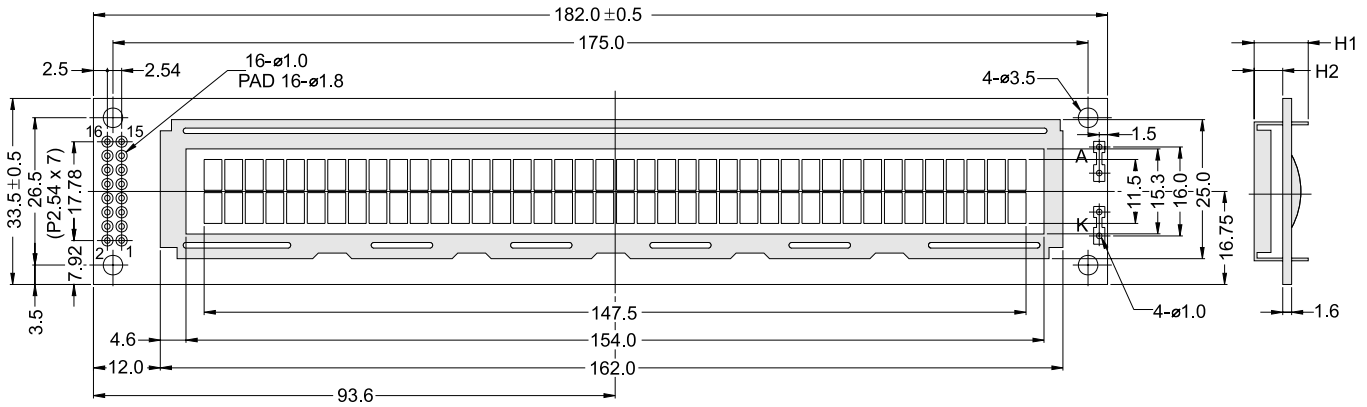
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	285.0 x 40.0	Module	H2 / H1
View Area	246.0 x 20.0	W/O B/L	4.7 / 8.8
Dot Size	1.00 x 1.77	EL B/L	4.7 / 8.8
Dot Pitch	1.05 x 1.82	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)
	BL1	Power supply for EL B/L
	BL2	Power supply for EL B/L

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION

Overall Size	182.0 x 33.5	Module	H2 / H1
View Area	154.0 x 15.3	W / O / B / L	5.1 / 9.7
Dot Size	0.60 x 0.65	EL B / L	5.1 / 9.7
Dot Pitch	0.65 x 0.70	LED B / L	9.4 / 14.0

PIN ASSIGNMENT

Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

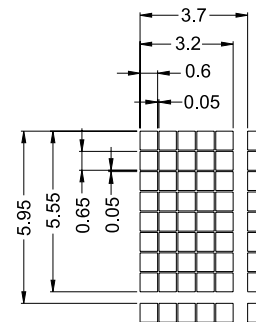
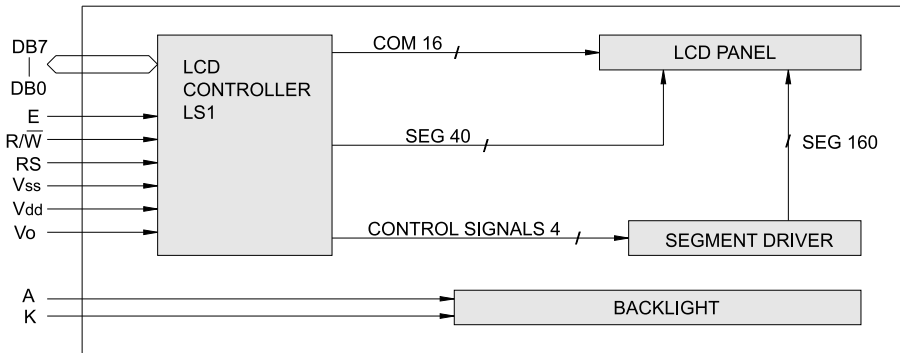
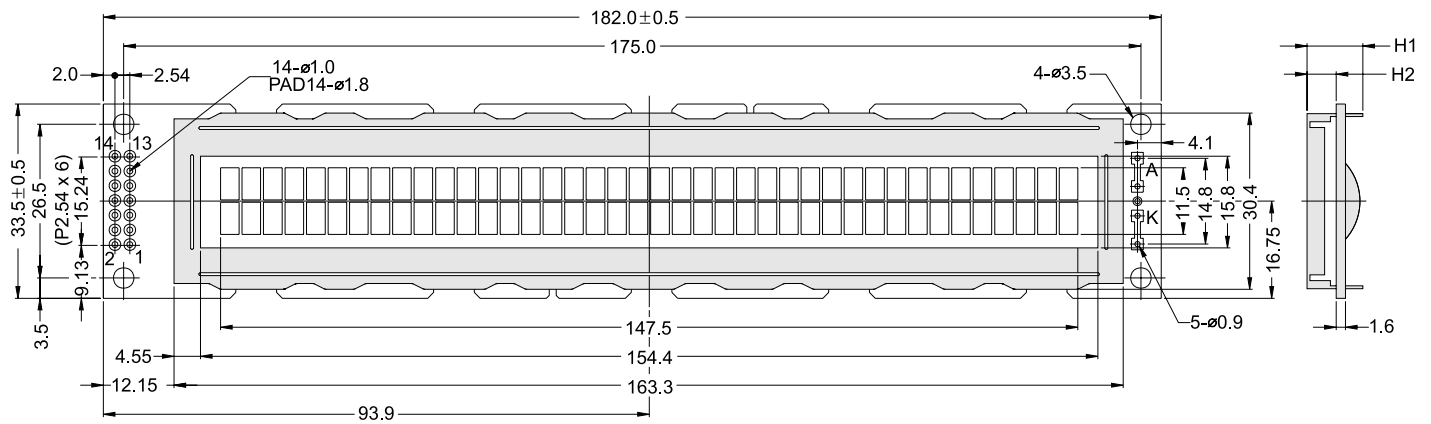
ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	5.2	-	6.4	-	7.5	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	5.3	4.4	5.9	4.7	6.9	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	4.6	-	5.2	-	6.5	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	280	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified $\pm 0.3\text{mm}$

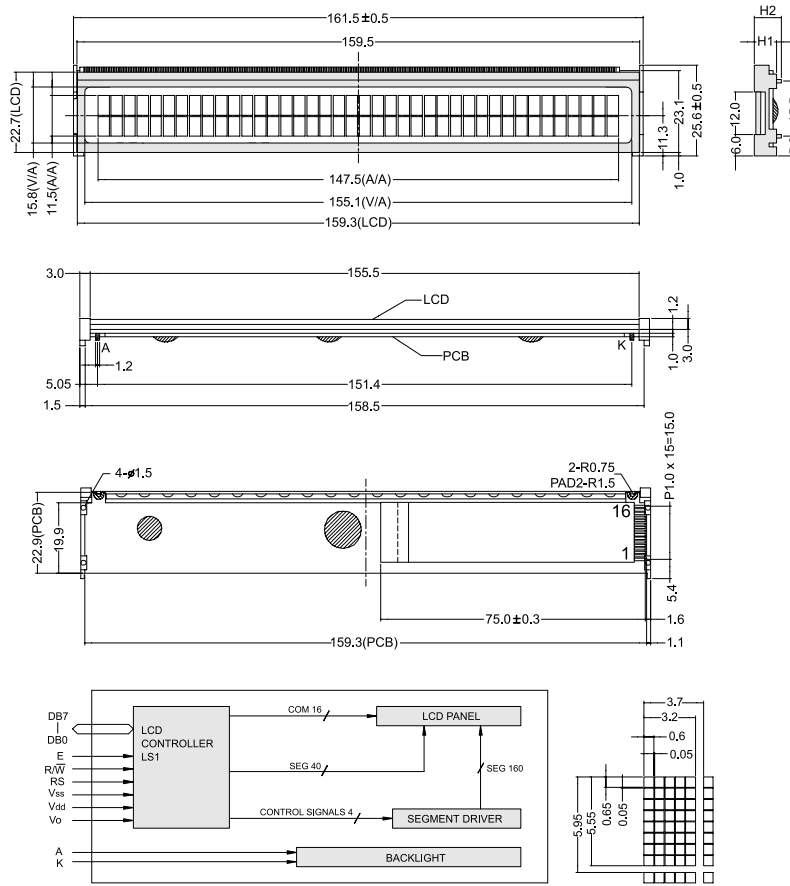
MECHANICAL SPECIFICATION			
Overall Size	182.0 x 33.5	Module	H2 / H1
View Area	154.0 x 15.80	W / O B/L	5.0 / 9.6
Dot Size	0.60 x 0.65	EL B/L	- / -
Dot Pitch	0.65 x 0.70	LED B/L	10.5 / 15.1

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
	A	Power supply for LED B/L (+)
	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING					
Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V

ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	280	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



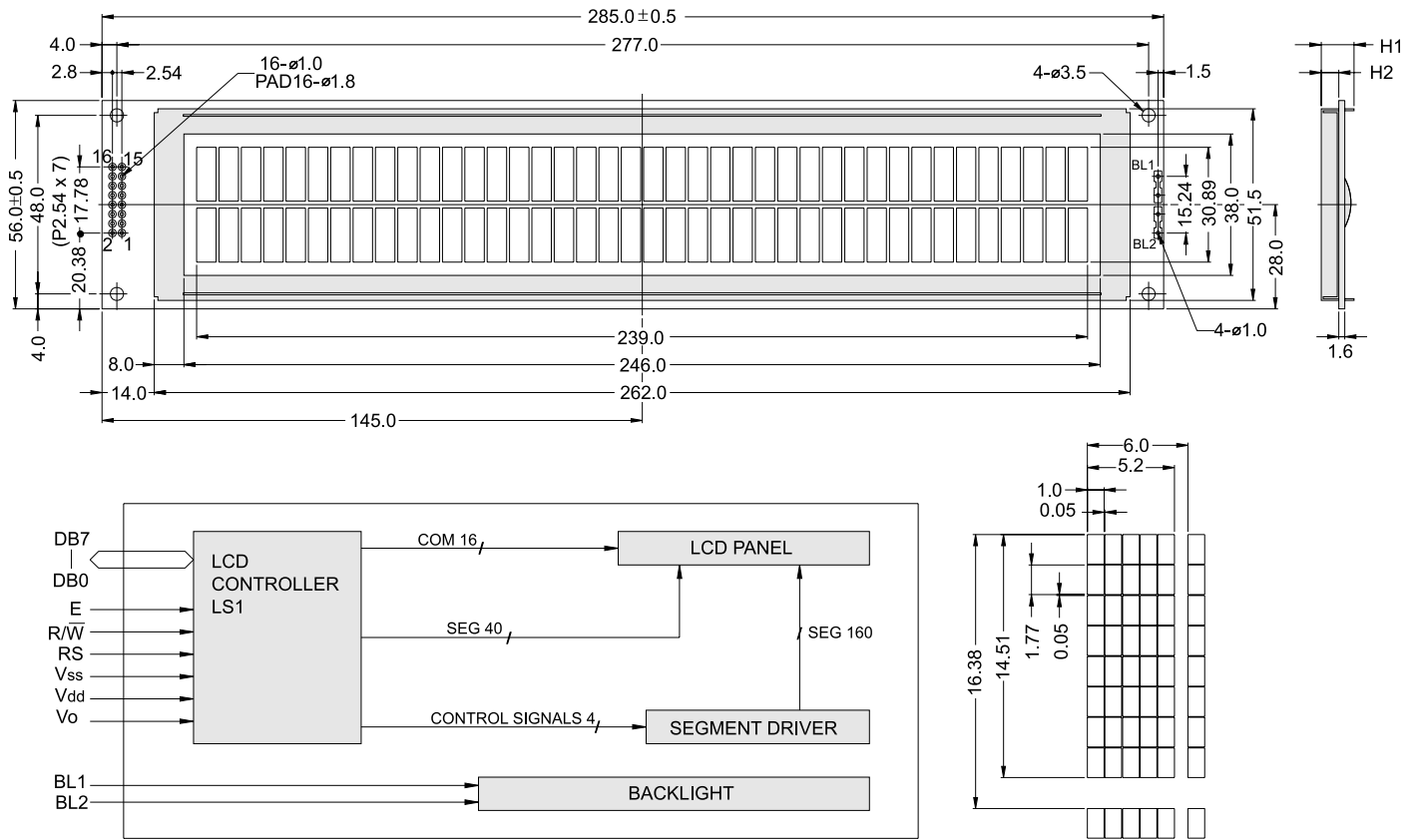
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	167.5 x 25.6	Module	H2 / H1
View Area	155.1 x 15.8	W / O B/L	- / -
Dot Size	0.60 x 0.65	EL B/L	- / -
Dot Pitch	0.65 x 0.70	LED B/L	6.2 / 7.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
	A	Power supply for LED B/L (+)
	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	100	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



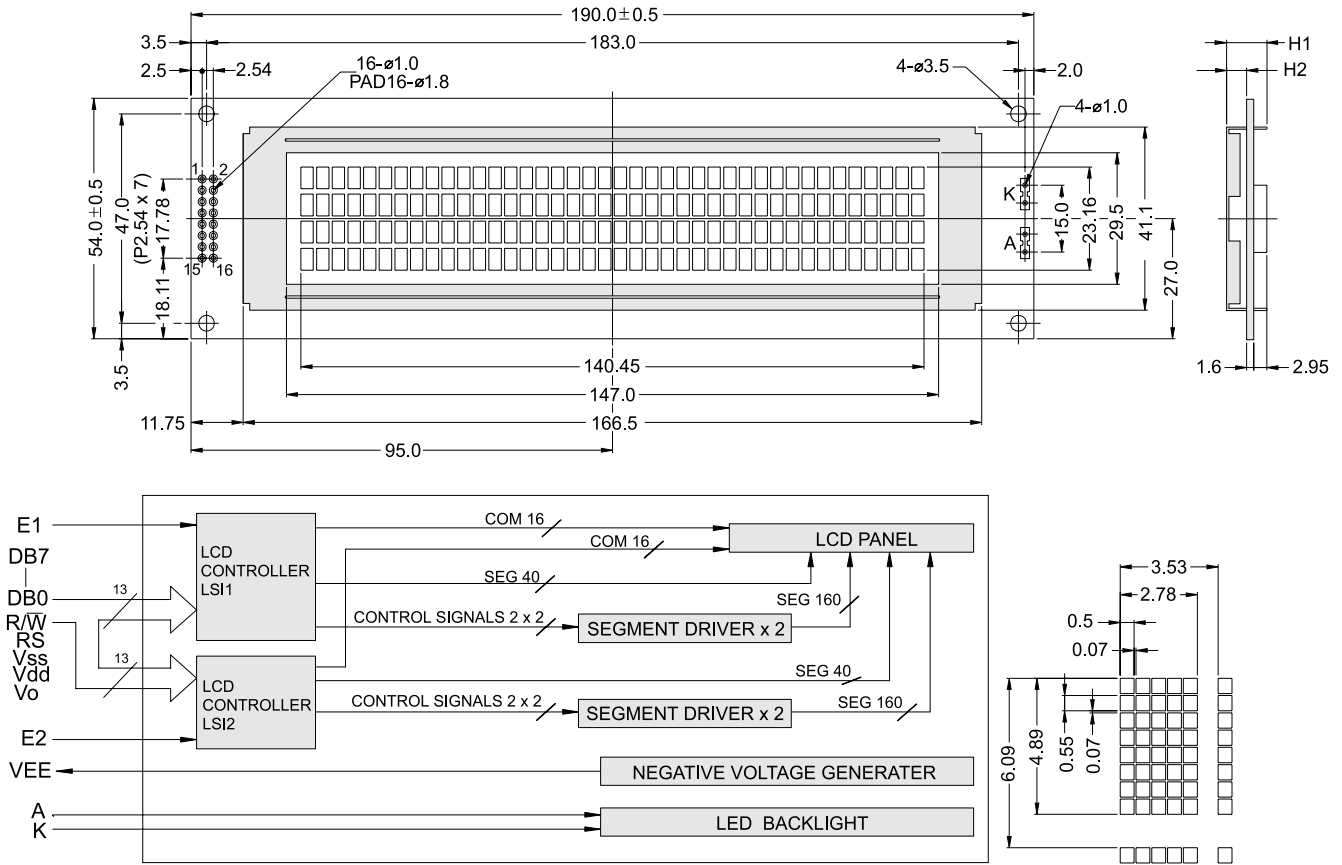
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	285.0 x 56.0	Module	H2 / H1
View Area	246.0 x 38.0	W / O B/L	4.7 / 8.8
Dot Size	1.00 x 1.77	EL B/L	4.7 / 8.8
Dot Pitch	1.05 x 1.82	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)
	BL1	Power supply for EL B/L
	BL2	Power supply for EL B/L

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.5	-	4.8	-	5.1	-	V
		25°C	4.1	6.1	4.4	6.4	4.7	6.7	V
		50°C	3.8	-	4.1	-	4.4	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	4	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



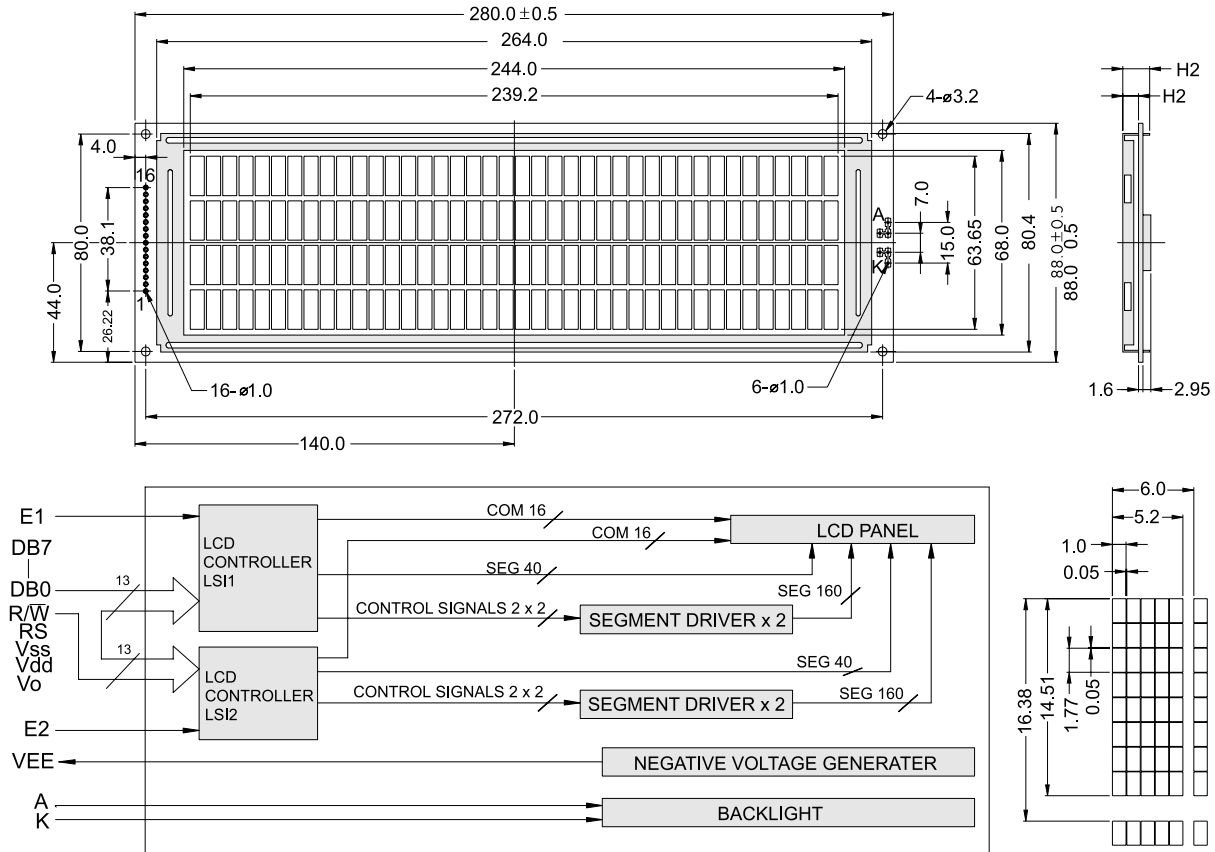
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	190.0 x 54.0	Module	H2 / H1
View Area	147.0 x 29.50	W/O B/L	4.5 / 9.1
Dot Size	0.50 x 0.55	EL B/L	4.5 / 9.1
Dot Pitch	0.57 x 0.62	LED B/L	9.0 / 13.6

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	DB7	Data bus line
2	DB6	Data bus line
3	DB5	Data bus line
4	DB4	Data bus line
5	DB3	Data bus line
6	DB2	Data bus line
7	DB1	Data bus line
8	DB0	Data bus line
9	E1	Enable 1
10	R/W	Data read / write
11	RS	Register select signal
12	Vo	Contrast Adjust
13	Vss	Power supply(GND)
14	Vdd	Power supply(+)
15	E2	Enable 2
16	Vee	Negative voltage
17	A	Power supply for LED B/L (+)
18	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.5	-	7.9	V
		0°C	4.8	-	4.8	-	4.9	-	V
		25°C	4.5	6.1	4.6	6.4	4.7	6.7	V
		50°C	4.4	-	4.5	-	4.6	-	V
		70°C	-	5.7	-	6	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	4	7	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	220	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



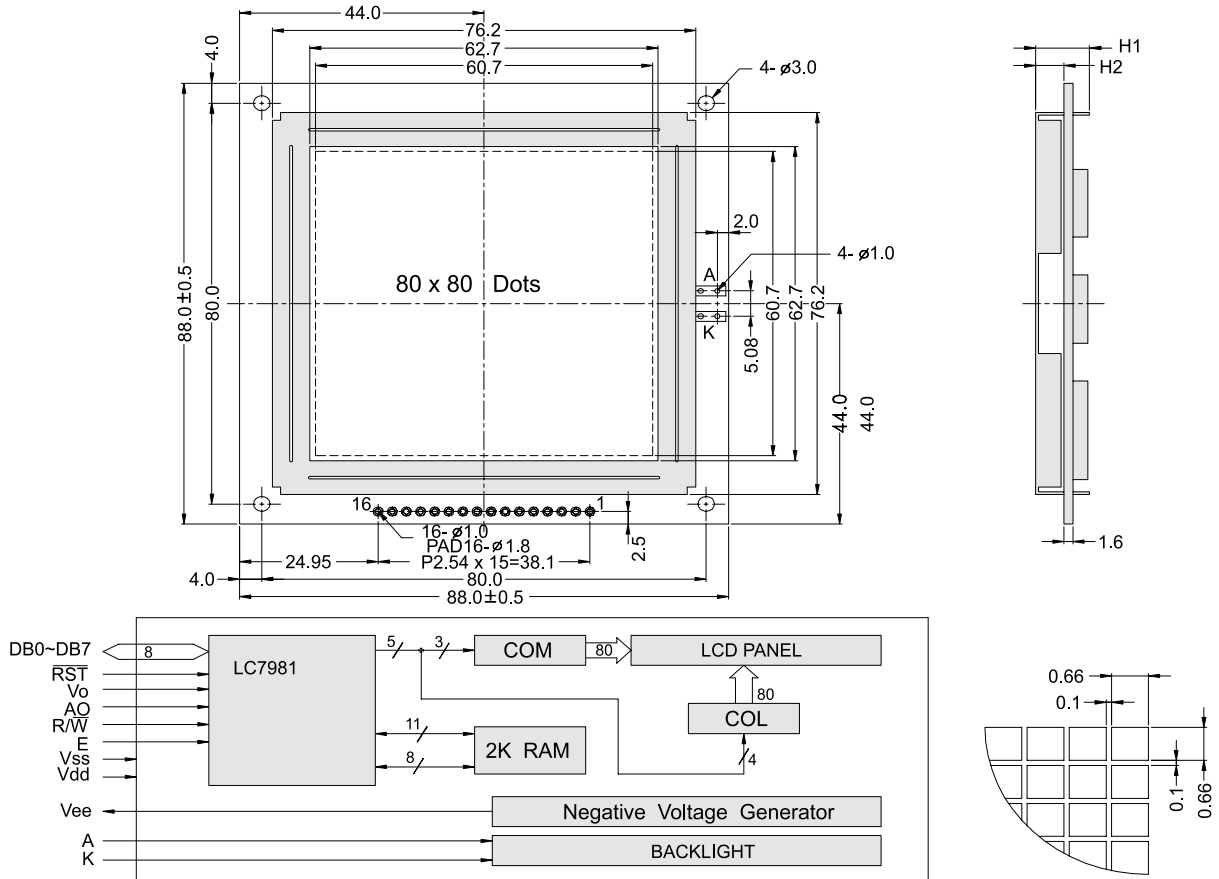
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	280.0 x 88.0	Module	H2 / H1
View Area	244.0 x 68.0	W / O B/L	5.3 / 9.9
Dot Size	1.00 x 1.77	EL B/L	5.3 / 9.9
Dot Pitch	1.05 x 1.82	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read / write
6	E1	Enable 1
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	E2	Enable 2
16	NC/Vee	NC or Negative voltage

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	4.3	-	4.6	-	4.9	V
		0°C	4.3	-	4.6	-	4.9	-	V
		25°C	3.9	4.4	4.2	4.7	4.5	5.0	V
		50°C	3.6	-	3.9	-	4.2	-	V
70°C	-	3.9	-	4.2	-	4.5	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	4	7	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



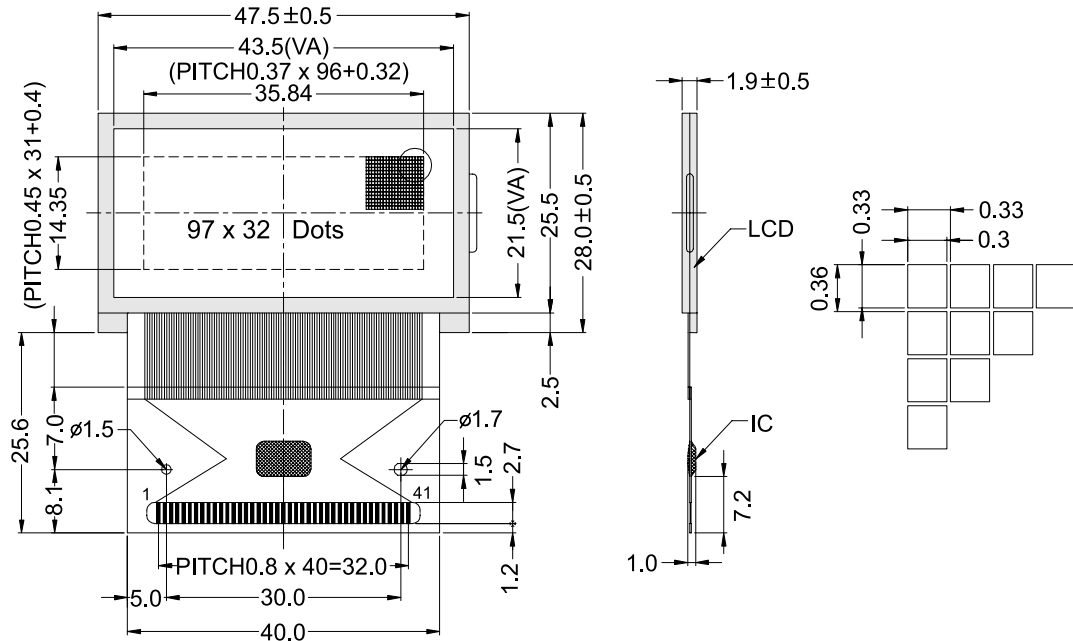
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	88.0 x 88.0	Module	H2 / H1
View Area	62.7 x 62.7	W/O B/L	5.1 / 9.7
Dot Size	0.66 x 0.66	EL B/L	5.1 / 9.7
Dot Pitch	0.76 x 0.76	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	Ao	Command / data select
5	R/W	Data read / write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	Vee	Negative voltage
16	RST	Reset

ABSOLUTE MAXIMUM RATING								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V			
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V			
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V			
ELECTRICAL CHARACTERISTICS								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V		
LCD operation voltage	Vop	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	9.7	9.3	10.2	9.8	10.4	V
		25°C	8.9	8	9.4	8.4	9.9	V
		40°C	8.6	-	9.1	-	9.6	V
		70°C	-	7.5	-	7.9	-	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.8	4	mA		
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA		
	LED/array	VB/L=4.2V	-	-	-	mA		

OUTLINE DIMENSION & BLOCK DIAGRAM



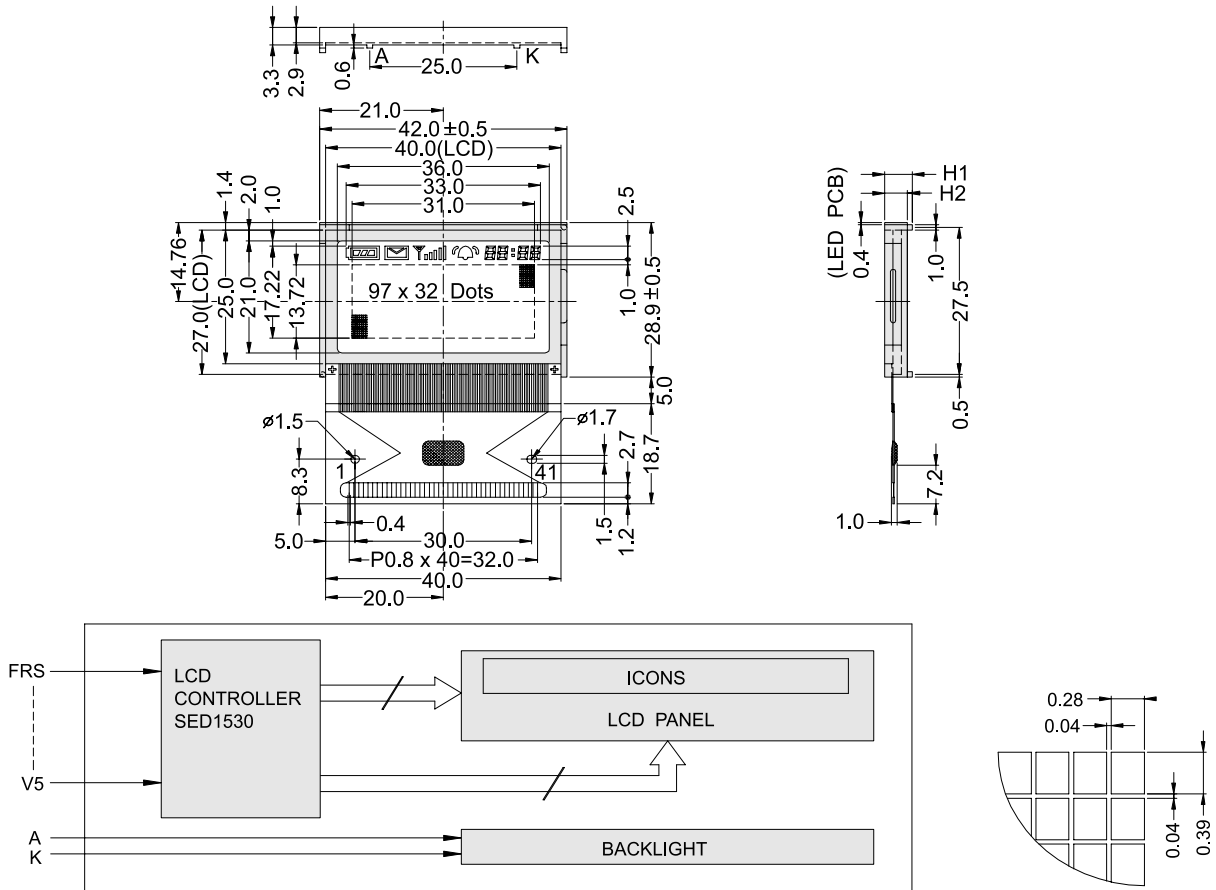
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	47.5 x 28.0	Module	H2 / H1
View Area	43.5 x 21.5	W / O B/L	1.9
Dot Size	0.32 x 0.40	EL B/L	- / -
Dot Pitch	0.37 x 0.45	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
2	FRS	Static driver output
3	FR	LCD AC signal
4	Dyo	Command driver signal output
5	CL	Display clock I/O
6	DOF	LCD blanking control I/O
7	VS1	lternal power supply
8	MS	Master / slave mode select
9	RST	Reset
10	P/S	Serial / Parallel data select
11-12	CS1,CS2	Chip select
13	C86	Microprocessor interface select
14	Ao	Cortori / display data flag
15/16	WR/RD	Data write /read
17/26	Vdd,Vss	Power supply
18~25	D0-D7	Data bus line
27	Vout	DC voltage output
28~32	CAP1~CAP3	Capacitor connection
34	VR	Voltage adjust
36~40	V1-V5	Bias for LCD driver supply voltage

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	18.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	6	-	6.4	-	6.8	V
		0°C	5.3	-	5.6	-	5.9	-	V
		25°C	5.1	5.8	5.4	6.2	5.7	6.6	V
		50°C	4.4	-	4.7	-	5	-	V
		70°C	-	5.6	-	5.9	-	6.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	0.5	1	mA			
Backlight current consumption	LED/edge	VB/L=2.1V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



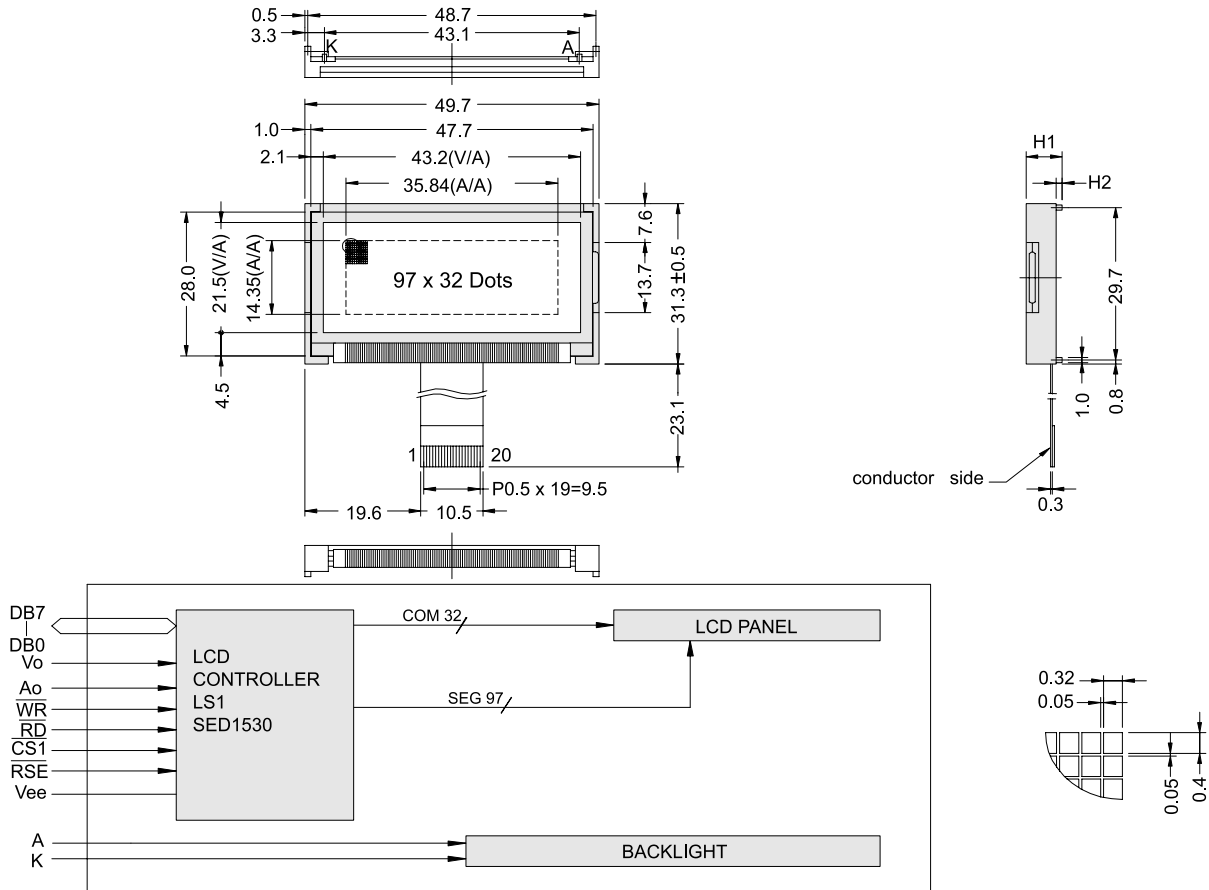
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	42.0 x 28.9	Module	H2 / H1
View Area	36.0 x 21.0	W / O B/L	- / -
Dot Size	0.28 x 0.39	EL B/L	- / -
Dot Pitch	0.32 x 0.43	LED B/L	3.9 / 4.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	N.C	NO Connection
2	FRS	Static driver output
3	FR	LCD Ac signal I/O
4	Dyo	Common driver signal output
5	CL	DOF
6	DOF	LCD blanking control I/O
7	VS1	Internal power supply
8	M/S	Master/slave mode select
9	RST	Reset
10	P/S	Serial/Parallel data select
11~12	CS1,CS2	Chip select
13	C86	Microprocessor interface select
14	A0	Control/display data flag
15	WR	Write enable input
16	RD	Databus output enable
17/26	Vdd/Vss	Power supply
18~25	D0-D7	Data bus line
27	Vout	DC voltage output
28~32	CAP1~CAP3	Capacitor connection
36~40	V1~V5	Bias for LCD driver supply voltage
34	VR	Voltage adjust

ABSOLUTE MAXIMUM RATING							
Item	Symbol	Condition	Min.	Max.	Units		
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V		
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	18.0	V		
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V		
ELECTRICAL CHARACTERISTICS							
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V	
LCD operation voltage	Vop	Top	N	W	N	W	V
		-20°C	-	-	-	-	V
		0°C	-	-	-	-	V
		25°C	-	-	6.5	-	V
		50°C	-	-	-	-	V
		70°C	-	-	-	-	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	0.5	1	mA	
Backlight current consumption	LED/edge	VB/L=4.2V	-	40	-	mA	
	LED/array	VB/L=4.2V	-	-	-	mA	

OUTLINE DIMENSION & BLOCK DIAGRAM



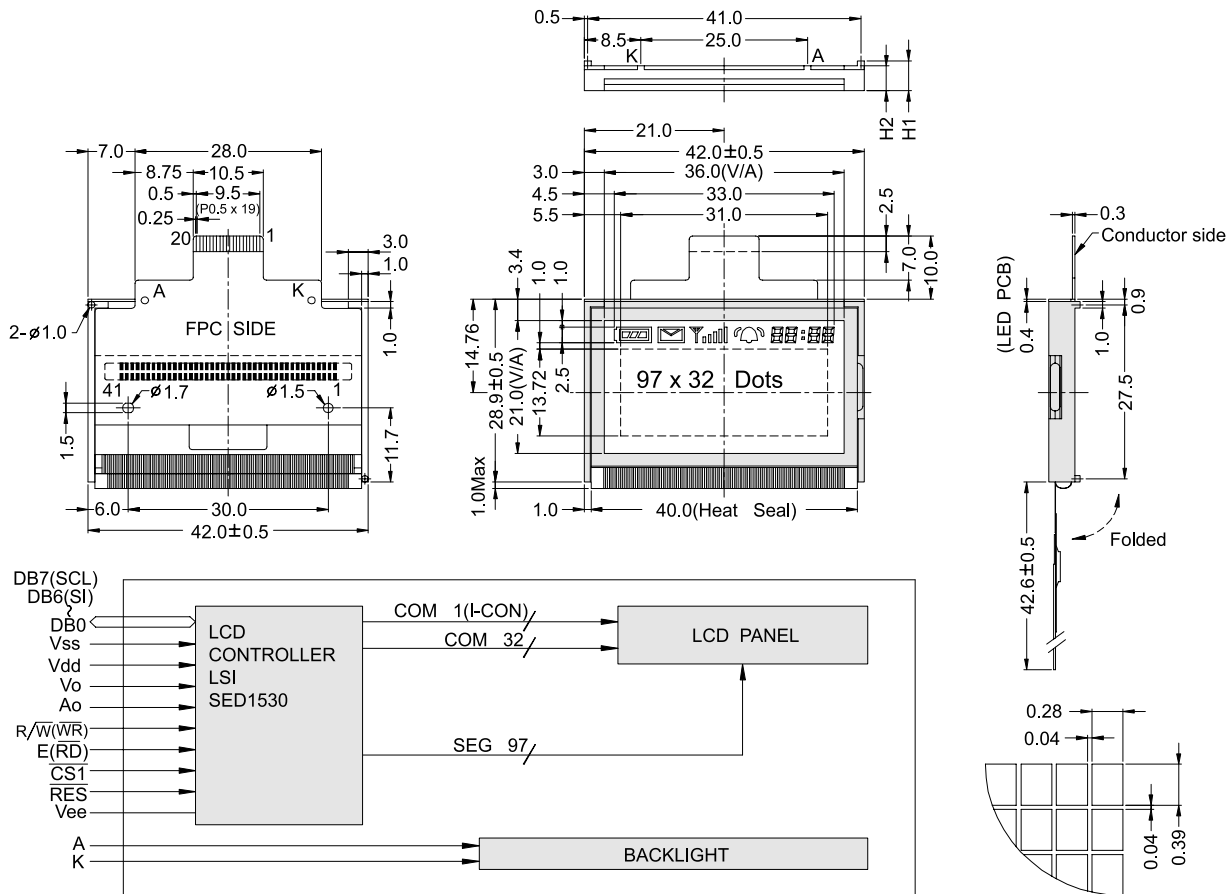
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	49.7 x 31.3	Module	H2 / H1
View Area	43.5 x 21.5	W / O B/L	- / -
Dot Size	0.32 x 0.40	EL B/L	- / -
Dot Pitch	0.37 x 0.45	LED B/L	5.1 / 6.1

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	A0	Command / Data select
5	WR	Data write
6	RD	Data read
7-14	DB0-DB7	Data bus line
15	CS1	Chip select driver 1
16	RST	Reset
17	Vee	DC / DC booster output
18	NC	No connection
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	18.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	6	-	6.4	-	6.8	V
		0°C	5.3	-	5.6	-	5.9	-	V
		25°C	5.1	5.8	5.4	6.2	5.7	6.6	V
		50°C	4.4	-	4.7	-	5	-	V
		70°C	-	5.6	-	5.9	-	6.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	0.5	1	mA			
Backlight current consumption	LED/edge	VB/L=2.1V	-	80	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



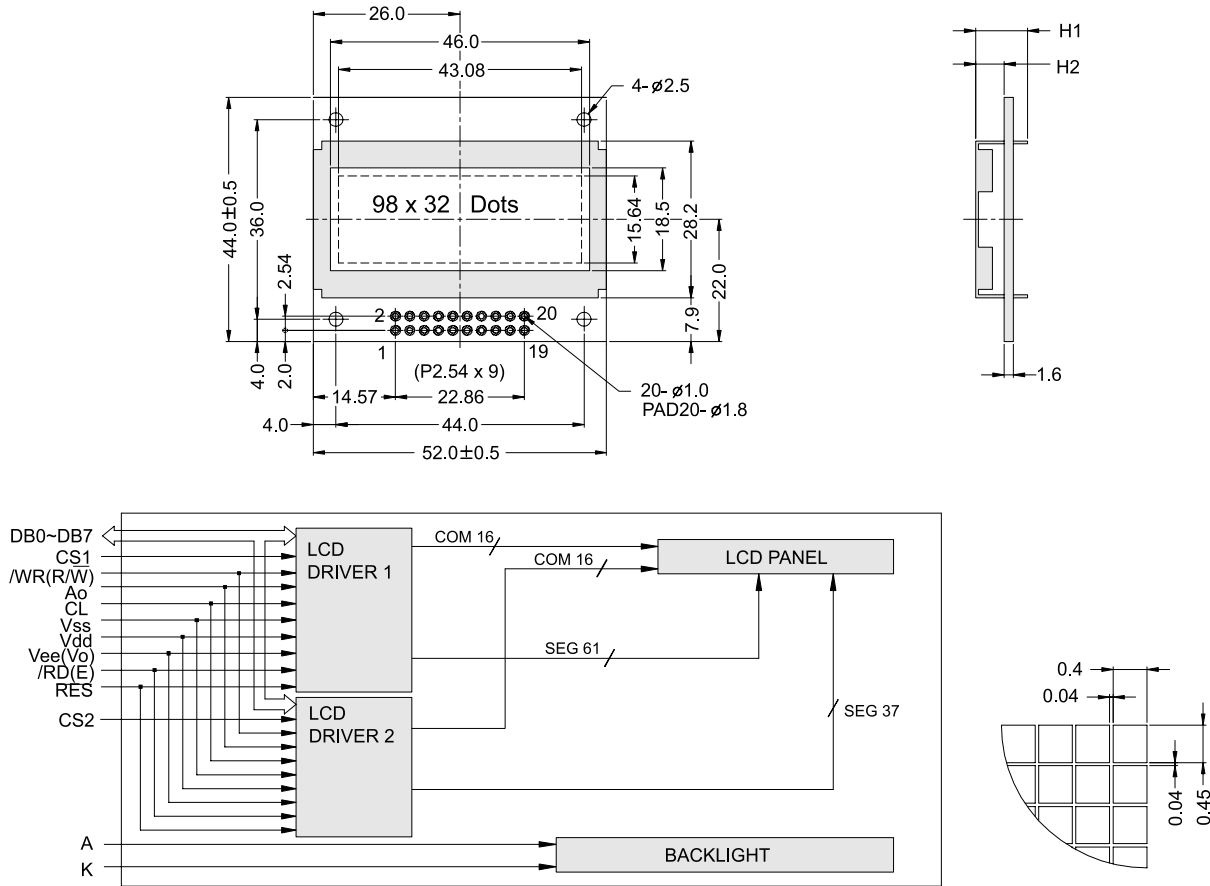
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MECHANICAL SPECIFICATION			
Overall Size	42.0 x 39.9	Module	H2 / H1
View Area	36.0 x 21.0	W / O B/L	- / -
Dot Size	0.28 x 0.39	EL B/L	- / -
Dot Pitch	0.32 x 0.43	LED B/L	3.9 / 4.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	A0	Command / data input
5	WR	Data write / (R/W)
6	RD	Data read / (E)
7-14	DB0-DB7	Data bus line
15	CS1	Chip select
16	RES	Reset
17	Vee	Negative voltage
18	NC	No Connection
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING							
Item	Symbol	Condition	Min.	Max.	Units		
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V		
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	18.0	V		
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V		
ELECTRICAL CHARACTERISTICS							
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V	
LCD operation voltage	Vop	Top	N	W	N	W	V
		-20°C	-	-	-	-	V
		0°C	-	-	-	-	V
		25°C	-	-	6.5	-	V
		50°C	-	-	-	-	V
70°C	-	-	-	-	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	0.5	1	mA	
Backlight current consumption	LED/edge	VB/L=2.1V	-	40	-	mA	
	LED/array	VB/L=4.2V	-	-	-	mA	

OUTLINE DIMENSION & BLOCK DIAGRAM



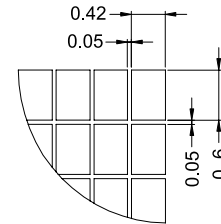
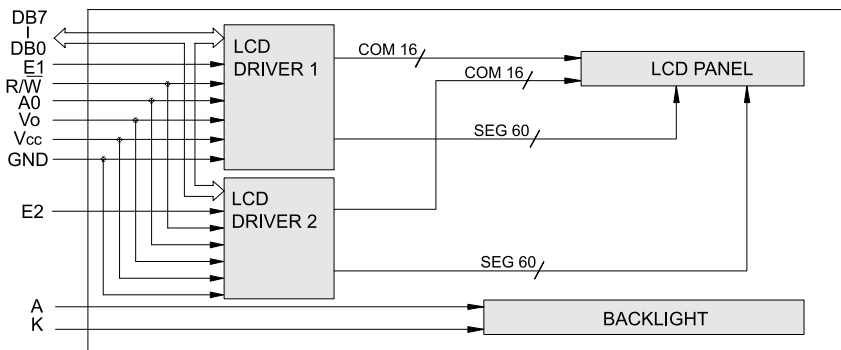
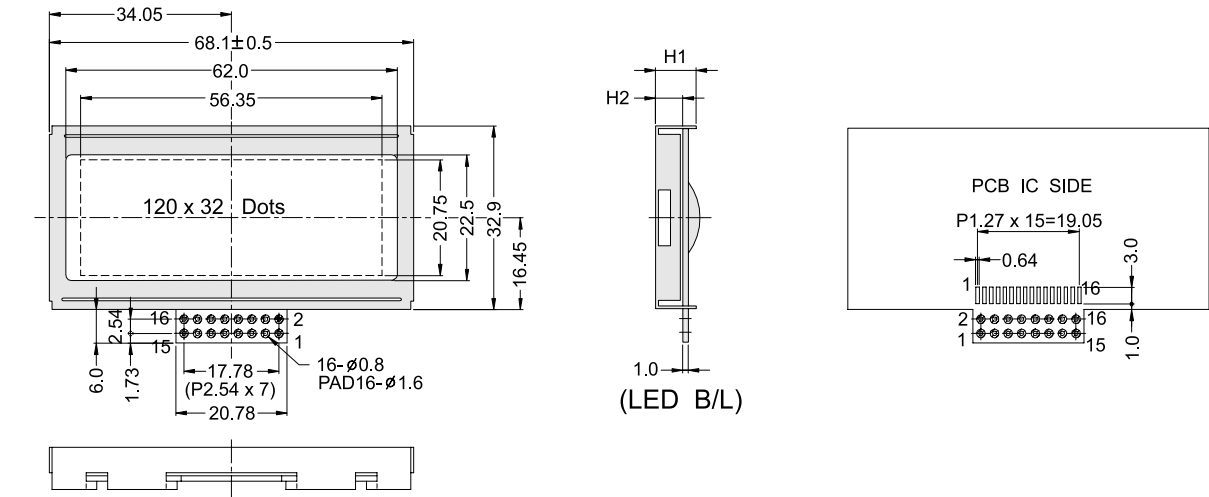
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	52.0 x 44.0	Module	H2 / H1
View Area	46.0 x 18.5	W / O B/L	5.1 / 9.20
Dot Size	0.40 x 0.45	EL B/L	- / -
Dot Pitch	0.44 x 0.459	LED B/L	8.9 / 13.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vee(Vo)	Contrast Adjust
4	A0	Command / Data select
5	CS1	Chip select driver 1
6	CS2	Chip select driver 2
7	CL	External clock input
8	E	Enable signal
9	R/W	Data read /write
10-17	DB0-DB7	Data bus line
18	RES	Reset
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	6.1	-	6.4	-	6.7	V
		0°C	-	-	-	-	-	-	V
		25°C	-	6	-	6.3	-	6.6	V
		50°C	-	-	-	-	-	-	V
		70°C	-	5.8	-	6.1	-	6.4	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.0	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



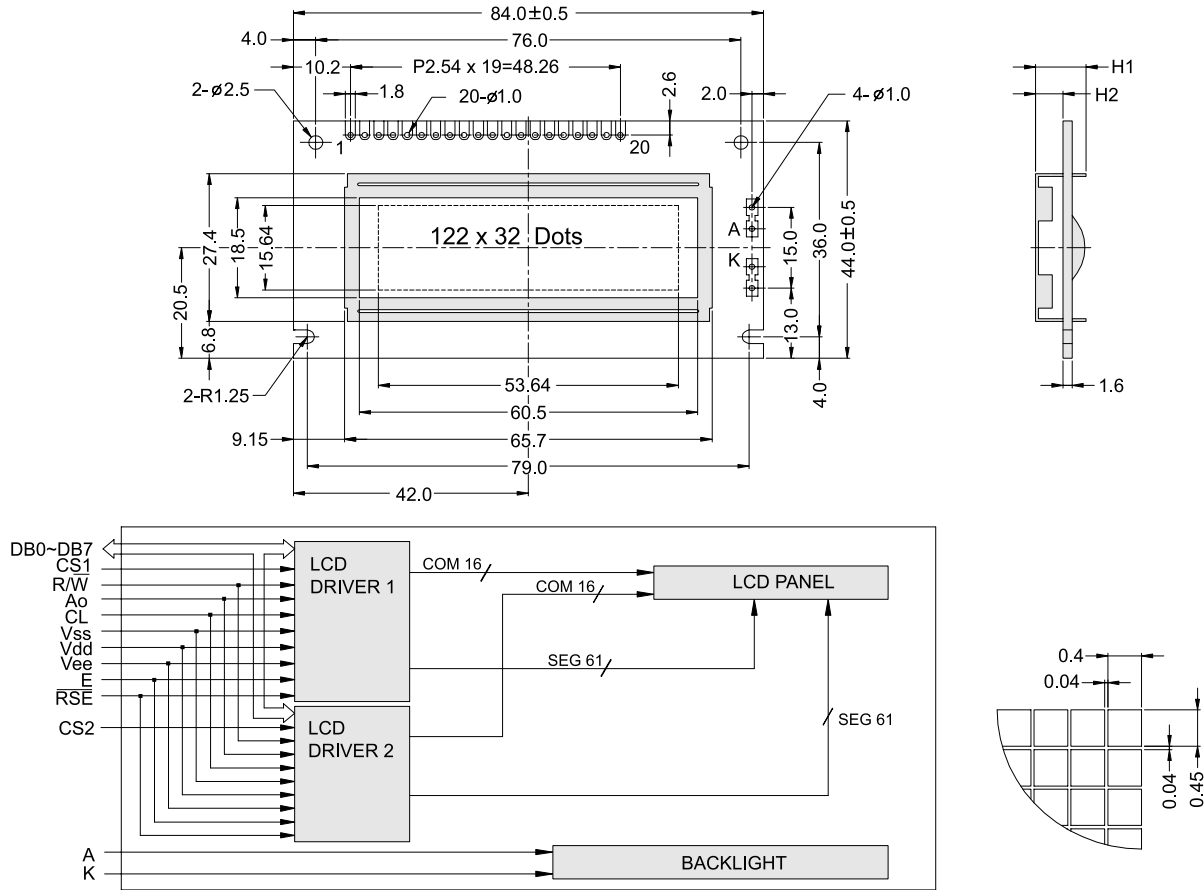
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	68.1 x 32.9	Module	H2 / H1
View Area	62.0 x 22.5	W / O B/L	3.7 / 6.2
Dot Size	0.42 x 0.60	EL B/L	5.1 / 7.6
Dot Pitch	0.47 x 0.65	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	GND	Power supply (GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	A0	Command data input
5	R/W	Data read / write
6	E1	Enable driver 1
7	E2	Enable driver 2
8	NC	No connection
9~16	DB0~DB7	Data bus line

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	5.6	-	6	-	6.3	V
		0°C	5.3	-	5.7	-	6.1	-	V
		25°C	5.0	5.6	5.4	5.9	5.8	6.2	V
		50°C	4.7	-	5.1	-	5.5	-	V
70°C	-	5.3	-	5.6	-	5.9	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.0	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	100	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



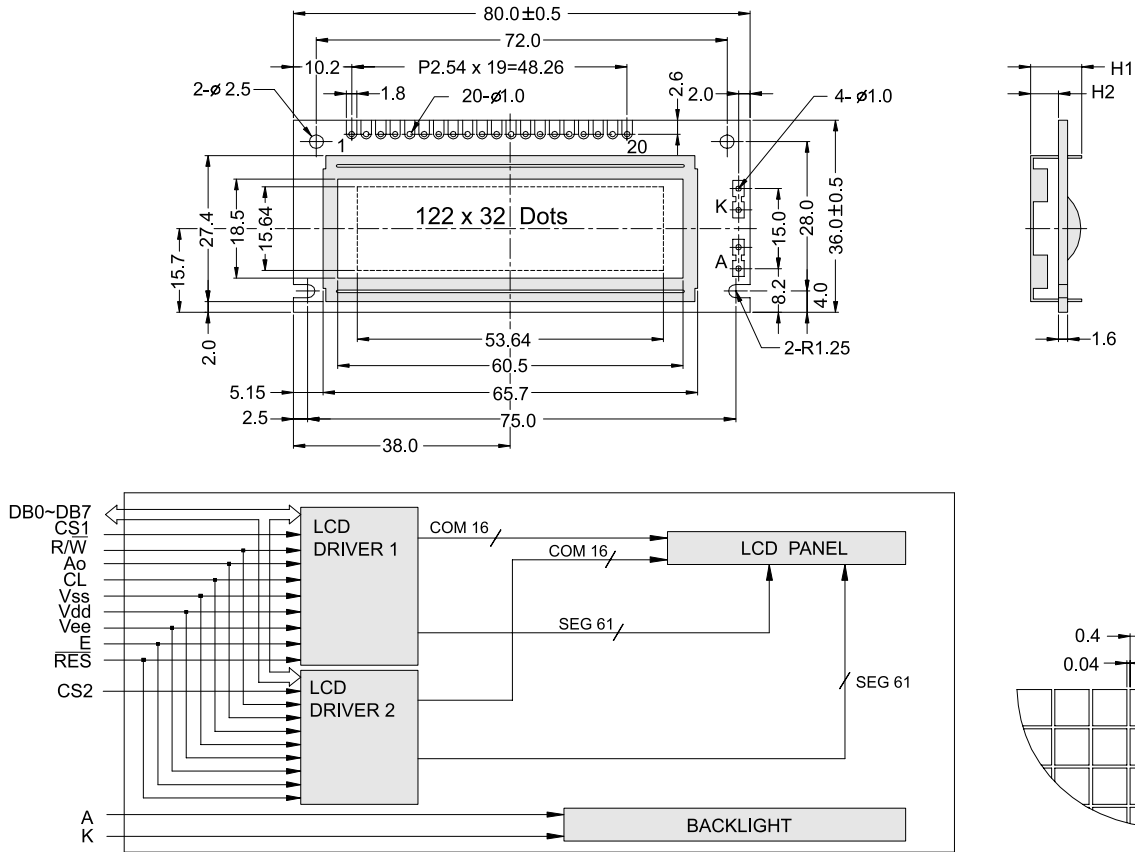
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	84.0 x 44.0	Module	H2 / H1
View Area	60.5 x 18.5	W/O B/L	4.9 / 9.0
Dot Size	0.40 x 0.45	EL B/L	4.9 / 9.0
Dot Pitch	0.44 x 0.49	LED B/L	8.9 / 13.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	A0	Command / data input
5	CS1	Chip select driver 1
6	CS2	Chip select driver 2
7	CL	External clock input
8	E	Enable signal
9	R/W	Data read / write
10-17	DB0-DB7	Data bus line
18	RES	Reset
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.6	-	9.1	-	9.6	V
		0°C	6.1	-	6.4	-	6.7	-	V
		25°C	5.6	7.7	5.9	8.1	6.2	8.5	V
		40°C	5.1	-	5.4	-	5.7	-	V
		70°C	-	7.2	-	7.6	-	8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.0	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



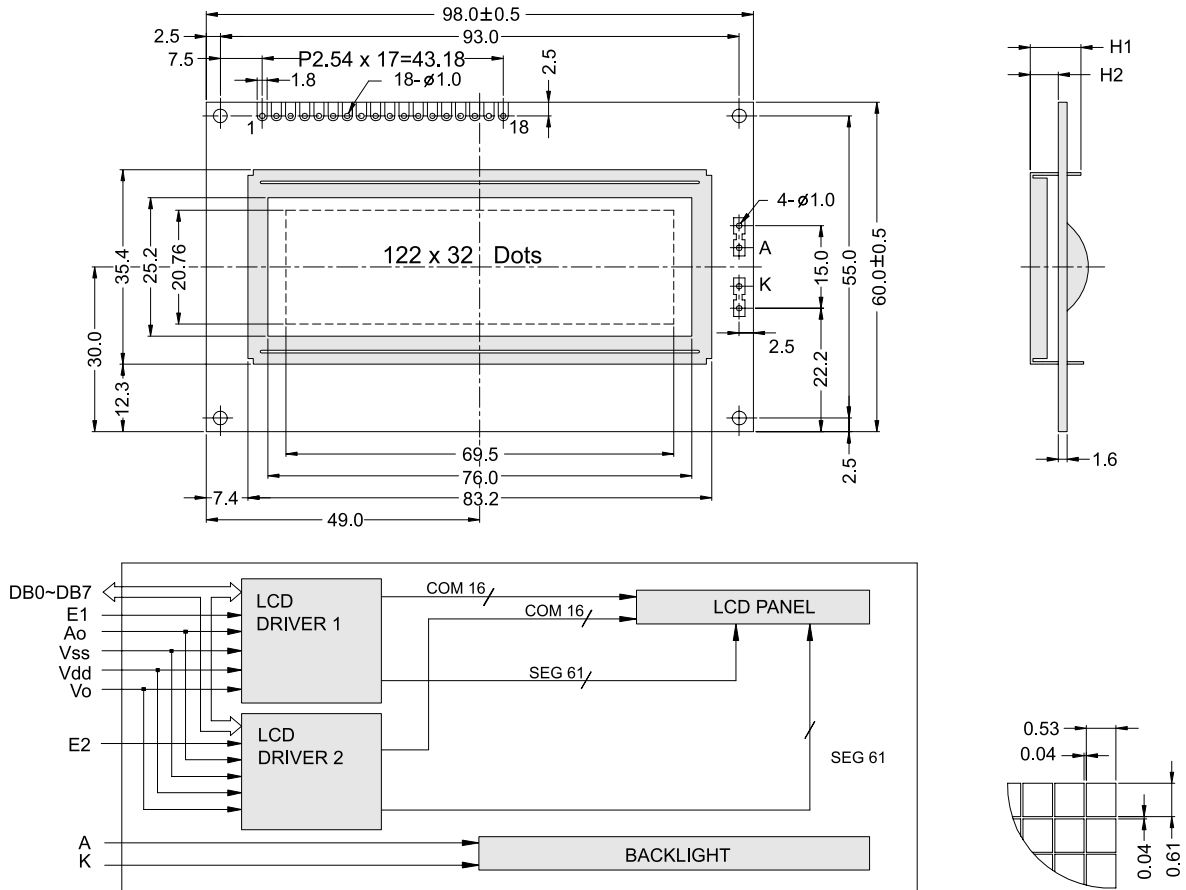
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	80.0 x 36.0	Module	H2 / H1
View Area	60.5 x 18.5	W / O B/L	4.9 / 9.0
Dot Size	0.40 x 0.45	EL B/L	4.9 / 9.0
Dot Pitch	0.44 x 0.49	LED B/L	8.9 / 13.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	A0	Command / data input
5	CS1	Chip select driver 1
6	CS2	Chip select driver 2
7	CL	External clock input
8	E	Enable signal
9	R/W	Data read / write
10-17	DB0-DB7	Data bus line
18	RES	Reset
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.6	-	9.1	-	9.6	V
		0°C	6.1	-	6.4	-	6.7	-	V
		25°C	5.6	7.7	5.9	8.1	6.2	8.5	V
		50°C	5.1	-	5.4	-	5.7	-	V
		70°C	-	7.2	-	7.6	-	8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.0	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



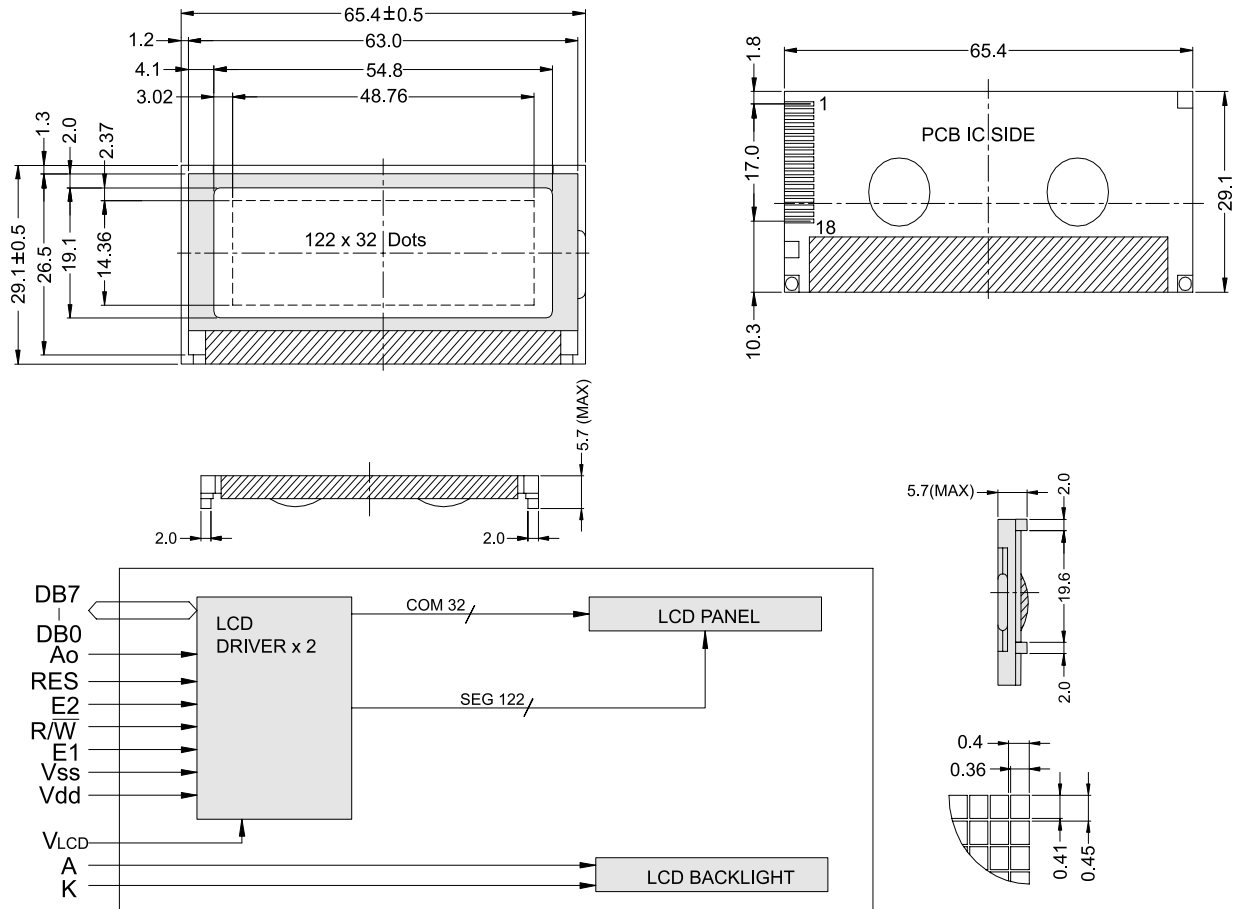
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	98.0 x 60.0	Module	H2 / H1
View Area	76.0 x 25.2	W / O B/L	5.0 / 9.1
Dot Size	0.53 x 0.61	EL B/L	- / -
Dot Pitch	0.57 x 0.65	LED B/L	9.4 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	Ao	Command / data select
5	E1	Enable driver 1
6	E2	Enable driver 2
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)
17	N.C	No connection
18	N.C(R/W)	No connection (R/W)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.2	-	7.4	-	6.9	V
		0°C	4.9	-	5.1	-	4.6	-	V
		25°C	4.5	6.2	4.7	6.4	4.2	5.9	V
		50°C	3.5	-	3.7	-	3.3	-	V
70°C	-	5.6	-	5.8	-	5.4	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.0	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	260	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



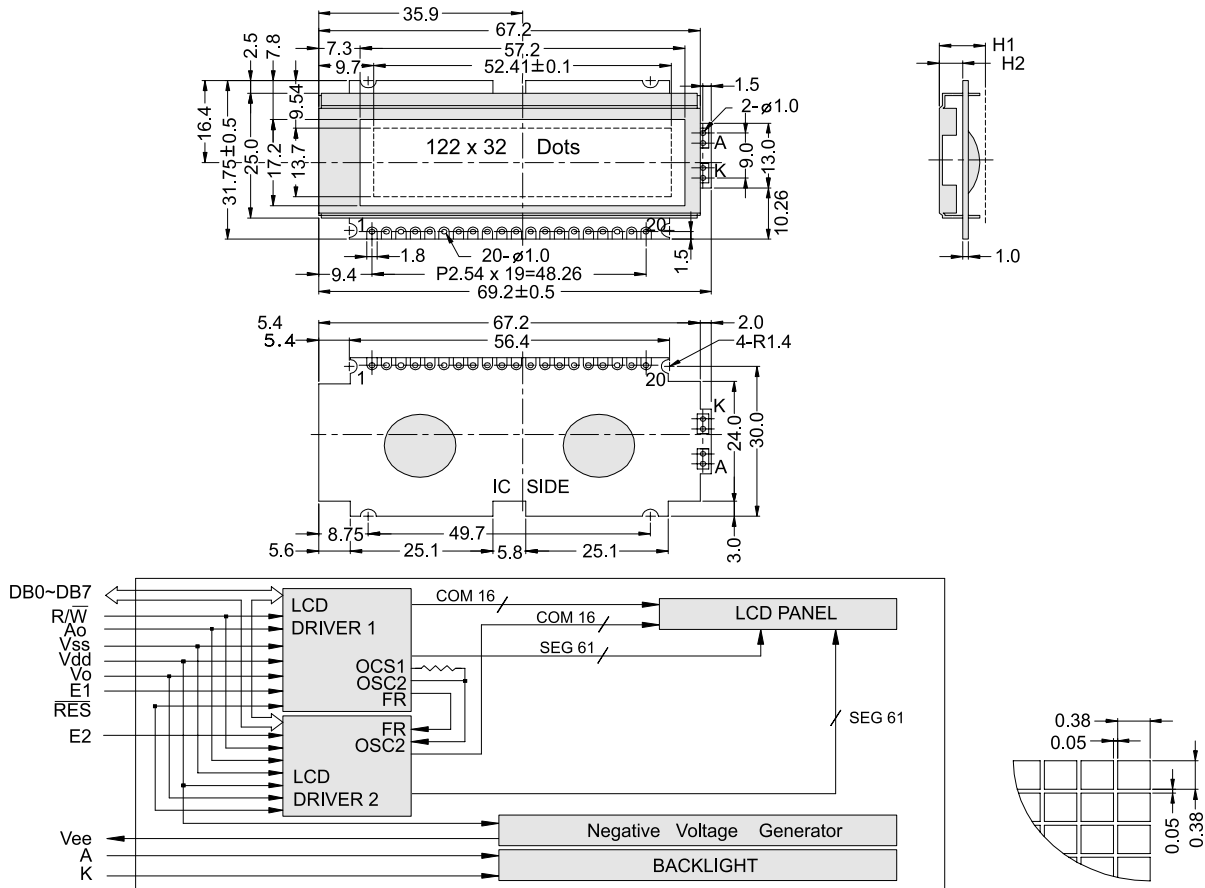
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	65.4 x 29.1	Module	H2 / H1
View Area	54.8 x 19.1	W / O B/L	- / 1.8
Dot Size	0.36 x 0.41	EL B/L	-
Dot Pitch	0.40 x 0.45	LED B/L	- / 5.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vdd	Power supply(+)
2	Vss	Power supply(GND)
3	VLCD	Contrast Adjust
4	RES	Reset
5	E1	Enable driver 1
6	E2	Enable driver 2
7	R/W	Data read / write
8	Ao	Command / Data select
9	DB0	Data bus line
10	DB1	Data bus line
11	DB2	Data bus line
12	DB3	Data bus line
13	DB4	Data bus line
14	DB5	Data bus line
15	DB6	Data bus line
16	DB7	Data bus line
17	N.C(A)	NC(Power supply (+) to B/L)
18	N.C(K)	NC(Power supply (-) to B/L)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.4	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	7.1	-	7.3	-	7.5	V
		0°C	6.7	-	6.9	-	7.1	-	V
		25°C	6.3	6.4	6.5	6.6	6.7	7.3	V
		50°C	6.1	-	6.3	-	6.5	-	V
		70°C	-	5.4	-	5.6	-	7.1	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.0	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	100	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



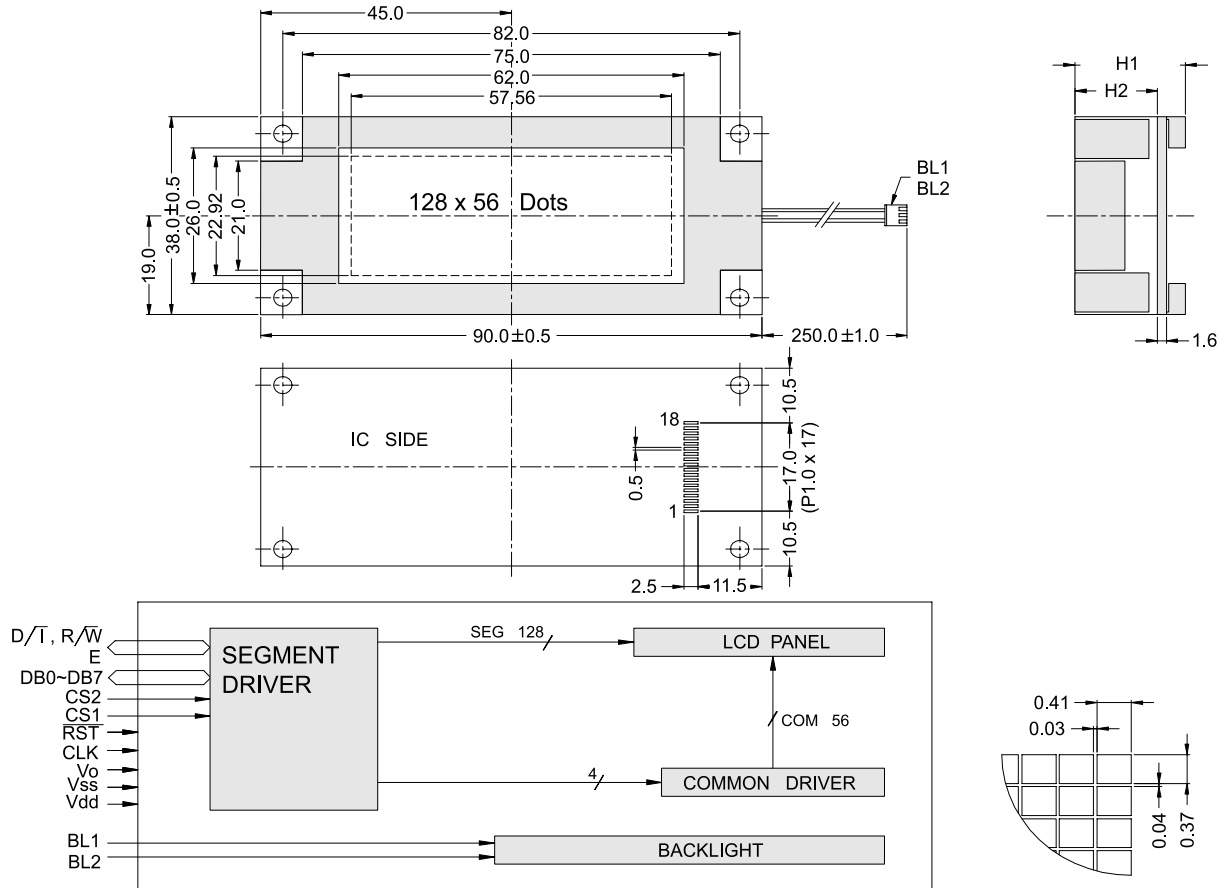
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	69.2 x 31.75	Module	H2 / H1
View Area	57.2 x 17.2	W / O B/L	4.1 / 8.0
Dot Size	0.38 x 0.38	EL B/L	4.1 / 8.0
Dot Pitch	0.43 x 0.43	LED B/L	7.0 / 11.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	Vee	Poewr supply for LCD
5	Ao	L: Instruction / H: Data
6	E1	Enable driver 1
7	E2	Enable driver 2
8	DB0	Data bit 0
9	DB1	Data bit 1
10	NC/Vdd	NC or anode voltage
11	NC/Vss	NC or cathode voltage
12-17	DB2-DB7	Data bit 2 ~ bit 7
18	NC/RW	NC or data read/write
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	6.1	-	6.5	-	6.9	V
		0°C	5.0	-	5.3	-	5.6	-	V
		25°C	4.8	4.6	5.0	5.0	5.3	5.4	V
		50°C	4.5	-	4.8	-	5.2	-	V
		70°C	-	4.1	-	4.4	-	4.7	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	180	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	90.0 x 38.0	Module	H2 / H1
View Area	62.0 x 26.0	W / O B/L	- / -
Dot Size	0.41 x 0.37	EL B/L	- / -
Dot Pitch	0.45 x 0.41	LED B/L	14.8 / 19.8

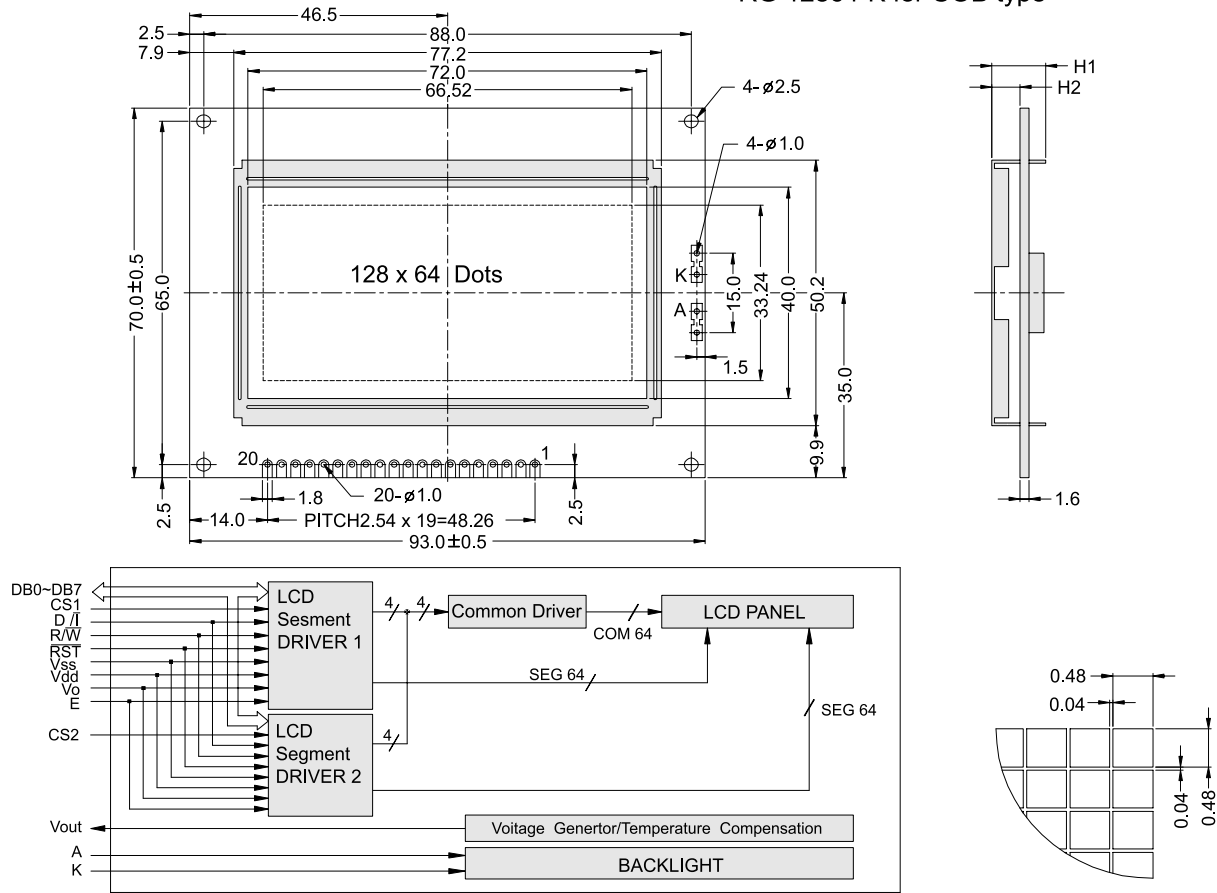
PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	D/I	Command / Data select
5	R/W	Data read / write
6	E	Chip enable
7-14	DB0-DB7	Data bus line
15	CS1	Chip select driver 1
16	CS2	Chip select driver 2
17	RST	Reset
18	CLK	External clock

ABSOLUTE MAXIMUM RATING							
Item	Symbol	Condition	Min.	Max.	Units		
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V		
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	19.0	V		
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V		
ELECTRICAL CHARACTERISTICS							
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V	
LCD operation voltage	Vop	Top	N	W	N	W	V
		-20°C	-	-	-	-	V
		0°C	-	-	-	-	V
		25°C	-	-	9.2	-	V
		50°C	-	-	-	-	V
		70°C	-	-	-	-	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	3	mA	
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA	
	LED/array	VB/L=4.2V	-	-	-	mA	

OUTLINE DIMENSION & BLOCK DIAGRAM

*RG 12864-A for SMT type

*RG 12864-K for COB type



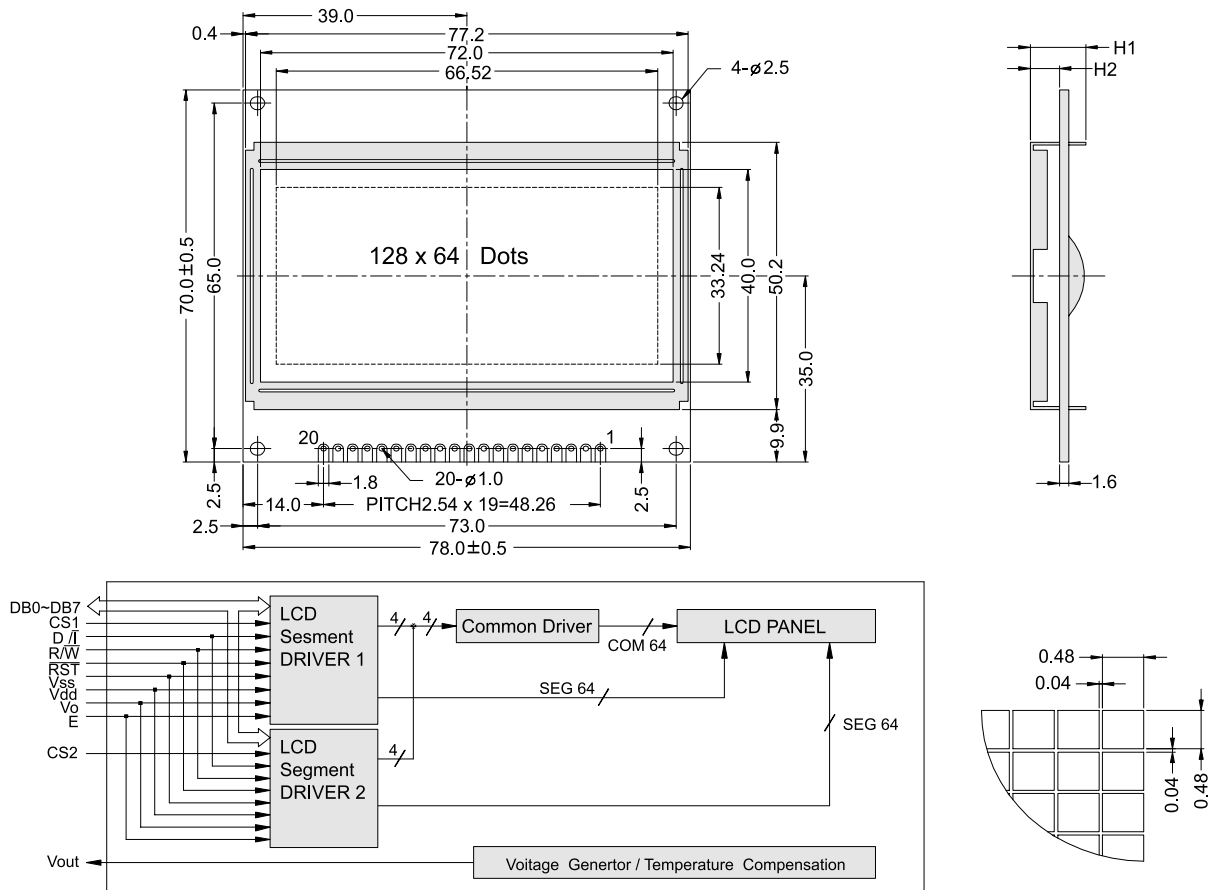
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	93.0 x 70.0	Module	H2 / H1
View Area	72.0 x 40.0	W/O B/L	5.1 / 9.7
Dot Size	0.48 x 0.48	EL B/L	5.1 / 9.7
Dot Pitch	0.52 x 0.52	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	D/I	Command / data input
5	R/W	Data read / write
6	E	Enable signal
7-14	DB0~DB7	Data bus line
15	CS1	Chip selection driver 1
16	CS2	Chip selection driver 2
17	RST	Reset
18	Vout	Negative voutage output
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	19.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	—	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	—	14.3	—	14.7	—	15.1	V
		0°C	9.7	—	10.2	—	10.7	—	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	—	9.1	9.6	—	—	V
70°C	—	12	—	12.4	—	12.8	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	—	2.5	5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	—	—	—	mA			
	LED/array	VB/L=4.2V	—	400	—	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



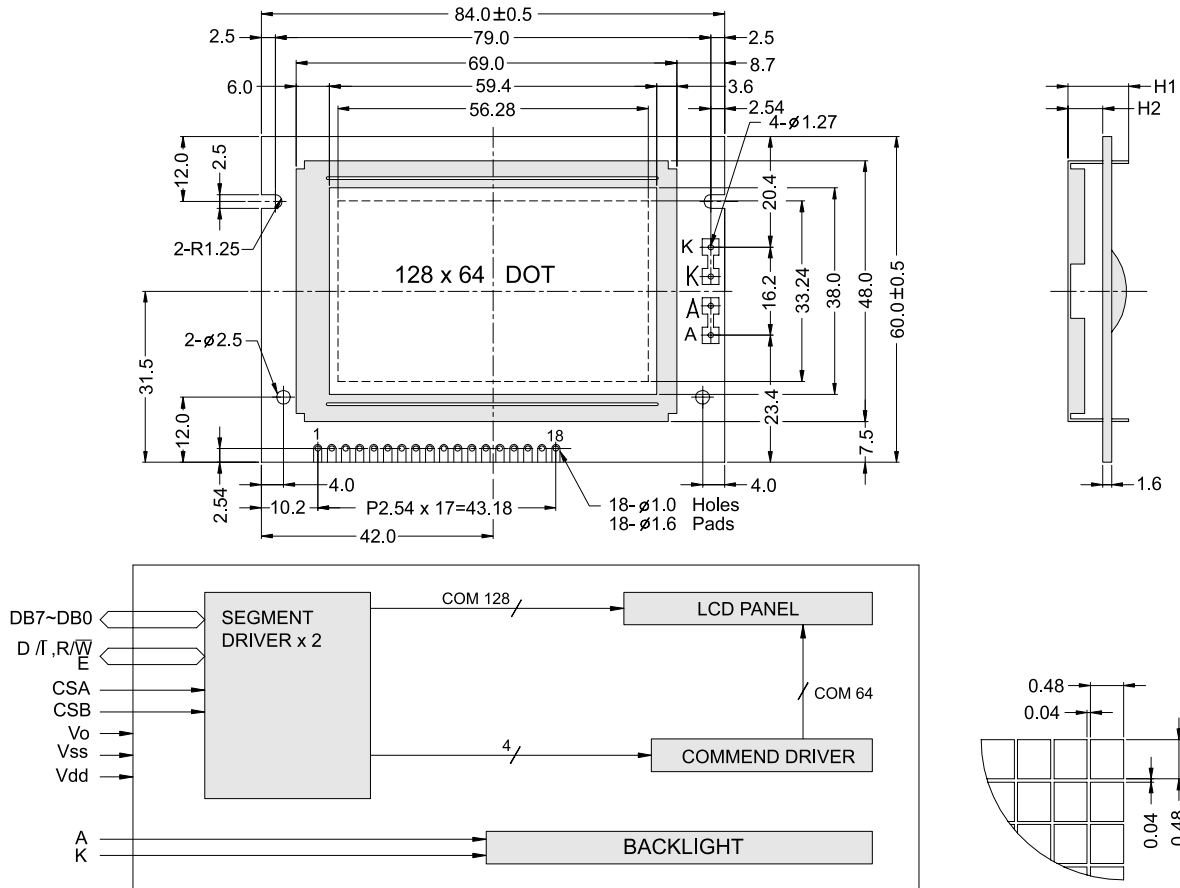
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	78.0 x 70.0	Module	H2 / H1
View Area	72.0 x 40.0	W / O B/L	5.1 / 9.7
Dot Size	0.48 x 0.48	EL B/L	- / -
Dot Pitch	0.52 x 0.52	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	D/I	Command / data input
5	R/W	Data read / write
6	E	Enable signal
7-14	DB0~DB7	Data bus line
15	CS1	Chip selection driver 1
16	CS2	Chip selection driver 2
17	RST	Reset
18	Vout	Negative voutage output
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	19.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	14.3	-	14.7	-	15.1	V
		0°C	9.7	-	10.2	-	10.7	-	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	-	9.1	-	9.6	-	V
		70°C	-	12	-	12.4	-	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	300	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



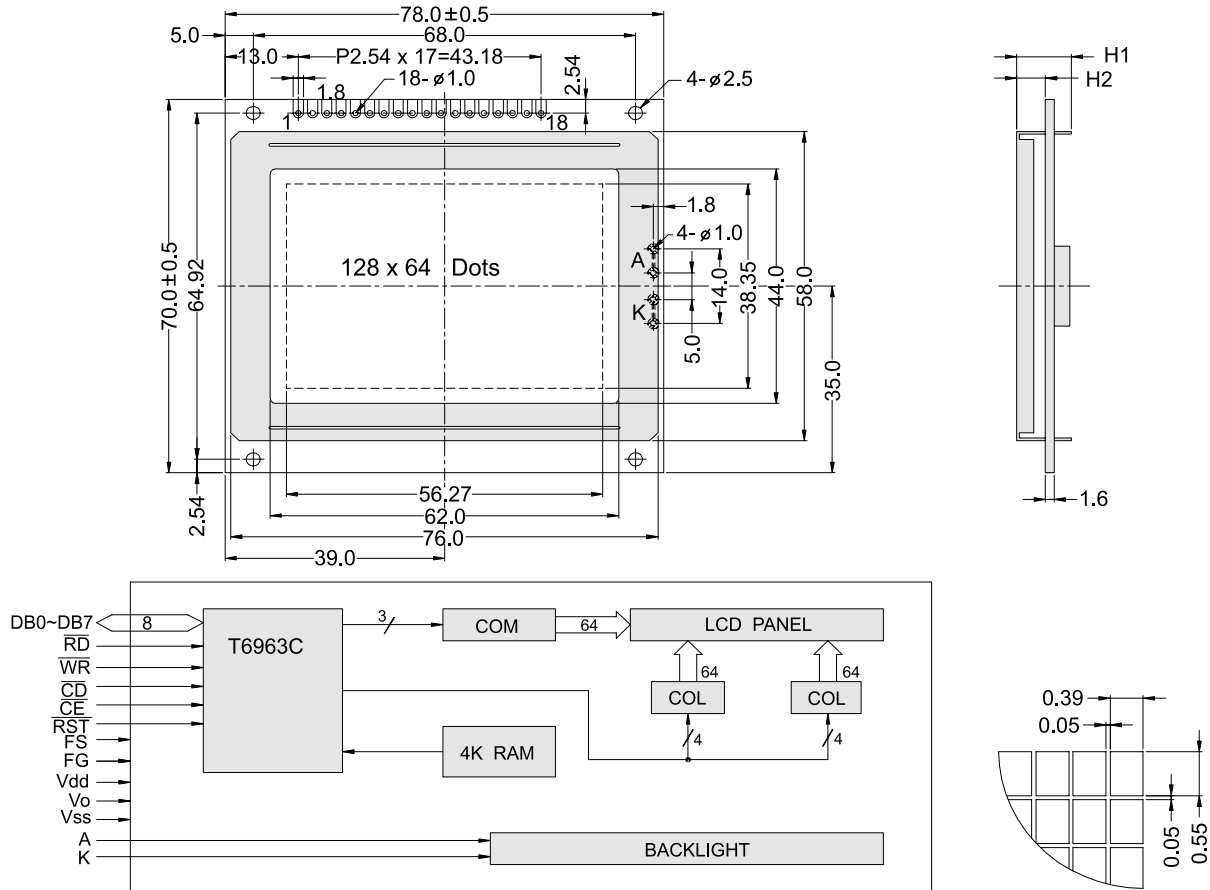
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	84.0 x 60.0	Module	H2 / H1
View Area	59.4 x 38.0	W/O B/L	3.6 / 8.2
Dot Size	0.40 x 0.48	EL B/L	3.6 / 8.2
Dot Pitch	0.44 x 0.52	LED B/L	6.3 / 11.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1-8	DB0-DB7	Data bus line
9	E	Enable signal
10	R/W	Data read / write
11	D/I	Command /Data select
12	Vo	Contrast Adjust
13	Vdd	Power supply(+)
14	Vss	Power supply(GND)
15	K	Power supply for LED B/L(-)
16	A	Power supply for LED B/L(+)
17	CSA	Chip selection driver 1
18	CSB	Chip selection driver 2

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	19.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	14.3	-	14.7	-	15.1	V
		0°C	9.5	-	10	-	10.6	-	V
		25°C	8.8	13.2	9.3	13.6	9.8	14	V
		50°C	8.5	-	9	-	9.5	-	V
		70°C	-	12	-	12.4	-	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.5	3	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	100	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



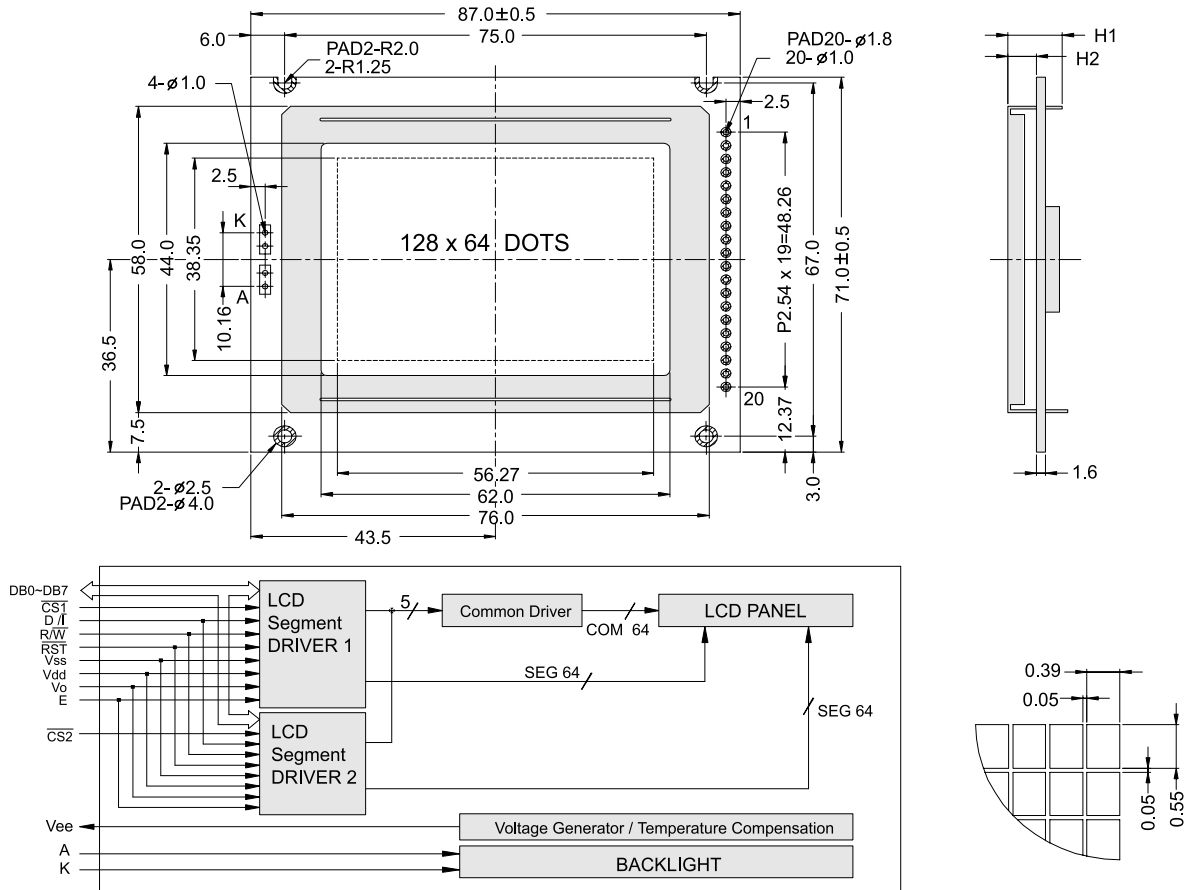
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	78.0 x 70.0	Module	H2 / H1
View Area	62.0 x 44.0	W / O B/L	5.1 / 9.7
Dot Size	0.39 x 0.55	EL B/L	5.1 / 5.7
Dot Pitch	0.44 x 0.60	LED B/L	9.2 / 13.8

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FG	Frame ground
2	Vss	Power supply(GND)
3	Vdd	Power supply(+)
4	Vo	Contrast Adjust
5	WR	Data write
6	RD	Data read
7	CE	Chip enable
8	CD	Command / data select
9	RST	Reset
10-17	DB0-DB7	Data bus line
18	FS	Font select

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.6	-	9	-	9.5	V
		0°C	8.5	-	8.9	-	9.3	-	V
		25°C	8	8.6	8.4	9	8.8	9.5	V
		50°C	7.6	-	8	-	8.4	-	V
		70°C	-	8	-	8.4	-	7.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	6.5	-	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	350	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



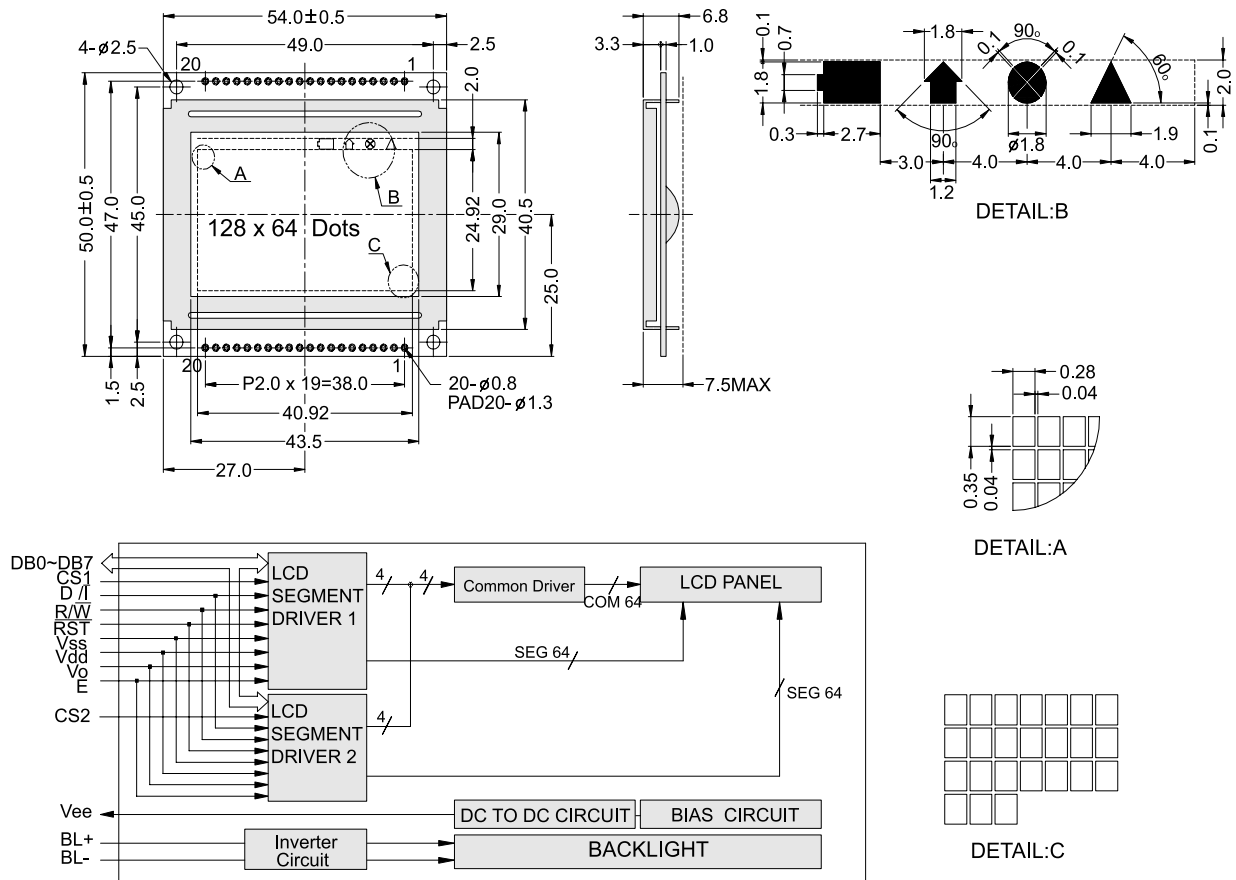
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	87.0 x 71.0	Module	H2 / H1
View Area	62.0 x 44.0	W/O B/L	5.1 / 9.7
Dot Size	0.39 x 0.55	EL B/L	5.1 / 9.7
Dot Pitch	0.44 x 0.60	LED B/L	9.2 / 13.8

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	D/I	Command / data select
5	R/W	Data read / write
6	E	Chip enable signal
7-14	DB0-DB7	Data bus line
15	CS1	Chip select driver 1
17	RST	Reset
18	Vee	Negative voltage output
16	CS2	Chip select driver 1
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vss	25°C	-0.3	19.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.6	-	9	-	9.5	V
		0°C	8.6	-	8.9	-	9.2	-	V
		25°C	8.1	8.6	8.4	9	8.7	9.5	V
		50°C	7.7	-	8	-	8.3	-	V
		70°C	-	8.0	-	8.4	-	7.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	390	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



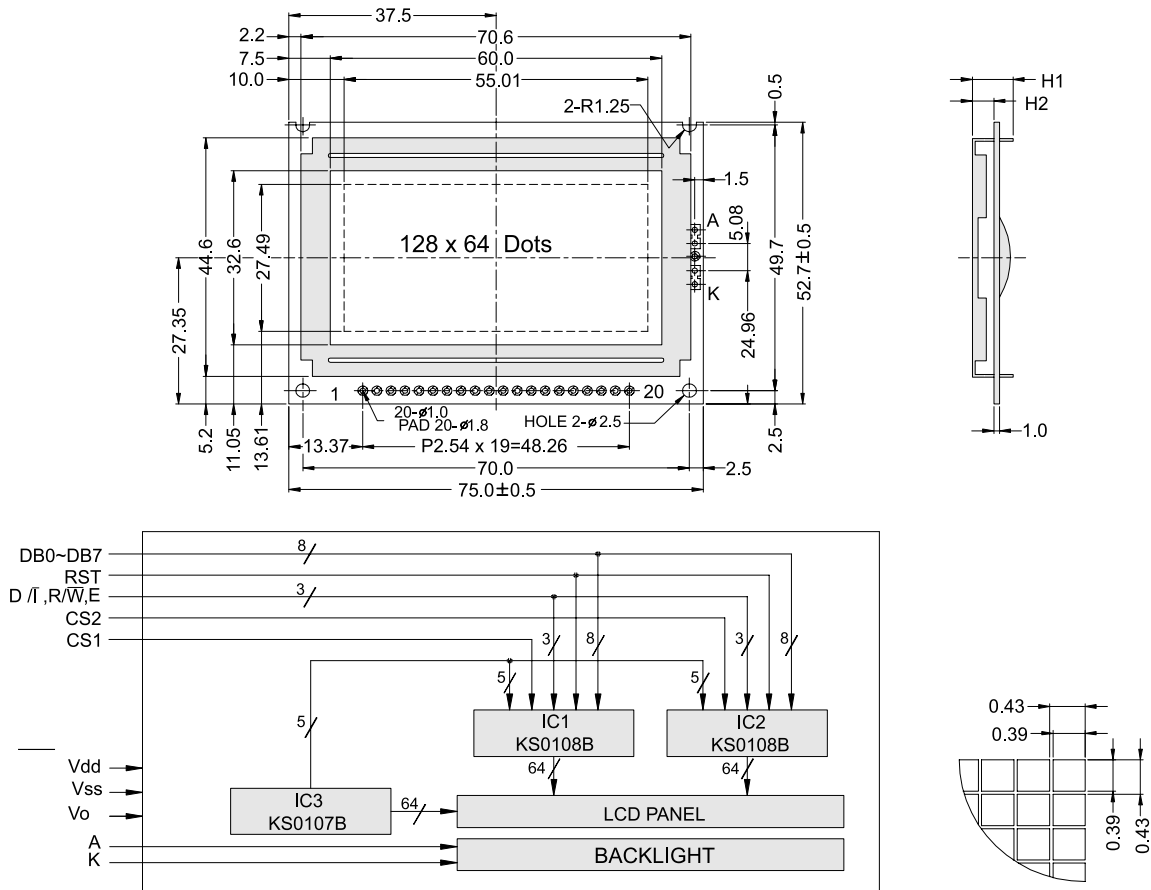
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	54.0 x 50.0	Module	H2 / H1
View Area	43.5 x 29.0	W / O B/L	3.3 / 6.8
Dot Size	0.28 x 0.35	EL B/L	3.3 / 6.8
Dot Pitch	0.32 x 0.39	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	D/I	Command / data select
5	R/W	Data read / write
6	E	Chip enable signal
7-14	DB0-DB7	Data bus line
15	CS1	Chip select driver 1
16	CS2	Chip select driver 2
17	RST	Reset
18	Vee	Negative voltage output
19	BL+	Enable (on/off) for EL B/L
20	BL-	No connection

ABSOLUTE MAXIMUM RATING							
Item	Symbol	Condition	Min.	Max.	Units		
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V		
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	19.0	V		
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V		
ELECTRICAL CHARACTERISTICS							
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V	
LCD operation voltage	Vop	Top	N	W	N	W	V
		-20°C	-	-	-	-	V
		0°C	-	-	-	-	V
		25°C	-	-	8.5	-	V
		50°C	-	-	-	-	V
		70°C	-	-	-	-	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	5	mA	
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA	
	LED/array	VB/L=4.2V	-	-	-	mA	

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	75.0 x 52.7	Module	H2 / H1
View Area	60.0 x 32.6	W / O B / L	3.9 / 7.4
Dot Size	0.39 x 0.39	EL B / L	3.9 / 7.4
Dot Pitch	0.43 x 0.43	LED B / L	5.4 / 8.4

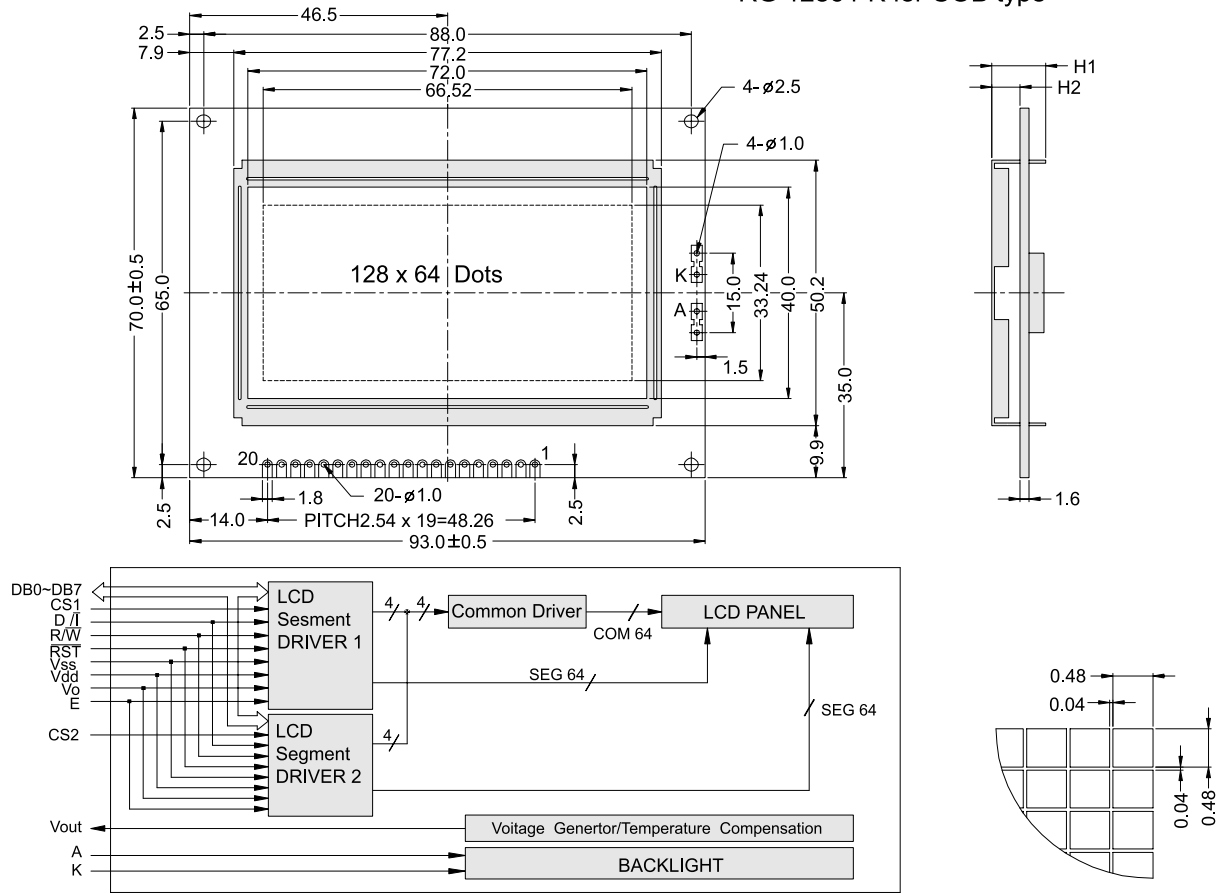
PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vdd	Power supply(+)
2	Vss	Power supply(GND)
3	Vo	Contrast Adjust
4-11	DB0-DB7	Data bus line
12	CS1	Chip select driver 1
13	CS2	Chip select driver 2
14	RST	Reset
15	R/W	Data read / write
16	D / I	Command / data select
17	E	Chip enable signal
18	Vss	Power supply (GND)
19	A	Power supply for LED B/L(+)
20	K	Power supply for LED B/L(-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	19.0	V				
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.3	-	9	-	9.7	V
		0°C	8.2	-	8.9	-	9.6	-	V
		25°C	7.7	8.3	8.4	9	9.1	9.7	V
		50°C	7.3	-	8.0	-	8.7	-	V
		70°C	-	7.7	-	8.4	-	9.1	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	100	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM

*RG 12864-A for SMT type

*RG 12864-K for COB type



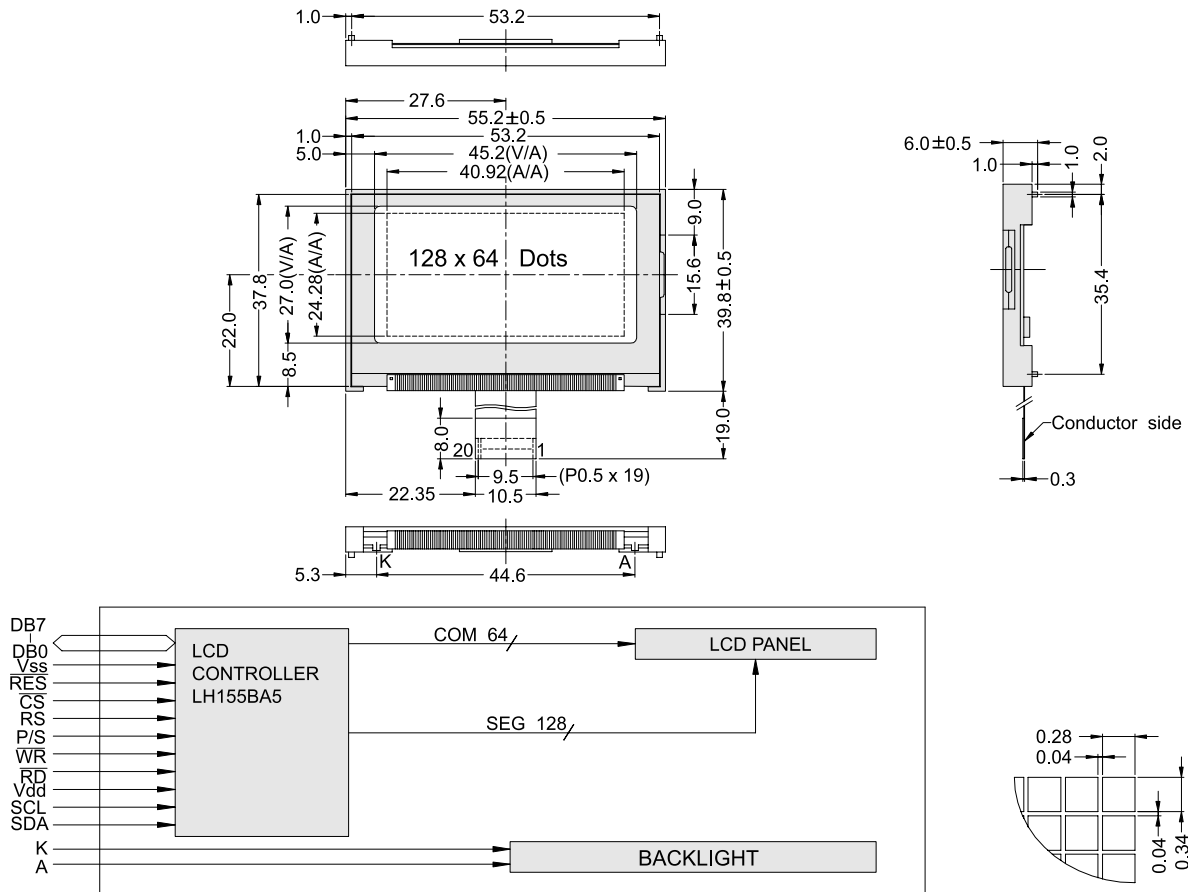
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	93.0 x 70.0	Module	H2 / H1
View Area	72.0 x 40.0	W/O B/L	5.1 / 9.7
Dot Size	0.48 x 0.48	EL B/L	5.1 / 9.7
Dot Pitch	0.52 x 0.52	LED B/L	8.9 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	D/I	Command / data input
5	R/W	Data read / write
6	E	Enable signal
7-14	DB0~DB7	Data bus line
15	CS1	Chip selection driver 1
16	CS2	Chip selection driver 2
17	RST	Reset
18	Vout	Negative voutage output
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	19.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	—	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	—	14.3	—	14.7	—	15.1	V
		0°C	9.7	—	10.2	—	10.7	—	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	—	9.1	9.6	—	—	V
70°C	—	12	—	12.4	—	12.8	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	—	2.5	5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	—	—	—	mA			
	LED/array	VB/L=4.2V	—	400	—	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



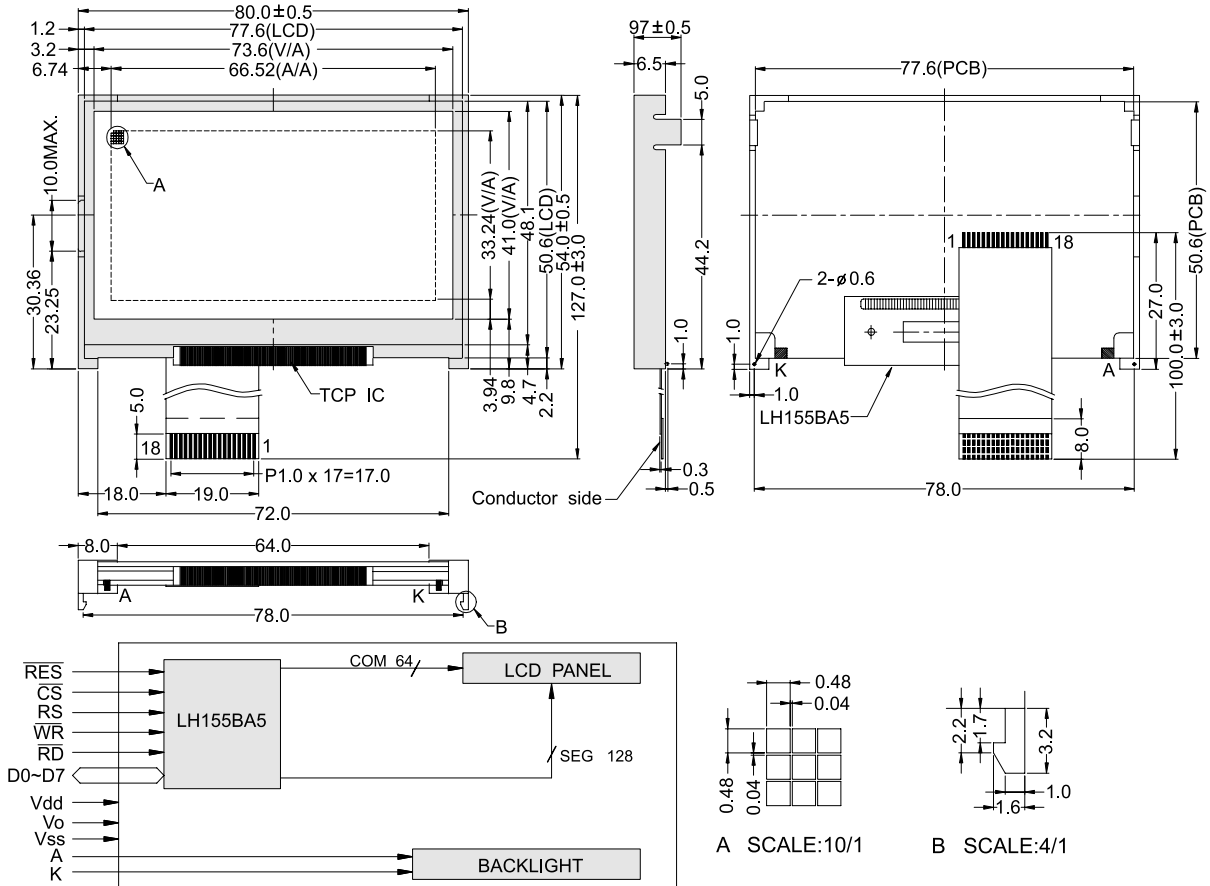
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	55.2 x 39.8	Module	H2 / H1
View Area	45.2 x 27.0	W / O B/L	5.0 / 6.0
Dot Size	0.28 x 0.34	EL B/L	- / -
Dot Pitch	0.23 x 0.38	LED B/L	5.0 / 6.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	RES	Reset
3	CS	Chip select signal
4	RS	Identify data sent by MPU at D0 to D7
5	P/S	Switch between parallel & serial interface
6	WR	Write data signal
7	RD	Read data signal
8-15	DB0-DB7	Data bus line
16	Vdd	Power supply(+)
17	SCL	Serial data input pin
18	SDA	Serial data transfer clock pin
19	A	Power supply for LED B/L(+)
20	K	Power supply for LED B/L(-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	6.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	15.0	V				
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	1.8	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	8.6	-	9.0	-	V	
		0°C	8.6	-	8.9	-	9.2	-	V
		25°C	8.1	8.6	8.4	9.0	8.7	9.5	V
		50°C	7.7	-	8.0	-	8.3	-	V
		70°C	-	8.0	-	8.4	-	8.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1	3	mA			
Backlight current consumption	LED/edge	VB/L=2.1V	-	40	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



MECHANICAL SPECIFICATION

Overall Size	80.0 x 54.0	Module	H2 / H1
View Area	73.6 x 41.0	W / O B/L	5.2 / 8.2
Dot Size	0.48 x 0.48	EL B/L	- / -
Dot Pitch	0.52 x 0.52	LED B/L	5.2 / 8.2

PIN ASSIGNMENT

Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	RES	Reset
5	CS	Chip select
6	RS	Command / data select
7	WR	Data write
8	RD	Data read
9~16	DB0-DB7	Data bus line
17	A	Power supply for LED B/L (+)
18	K	Power supply for LED B/L (-)

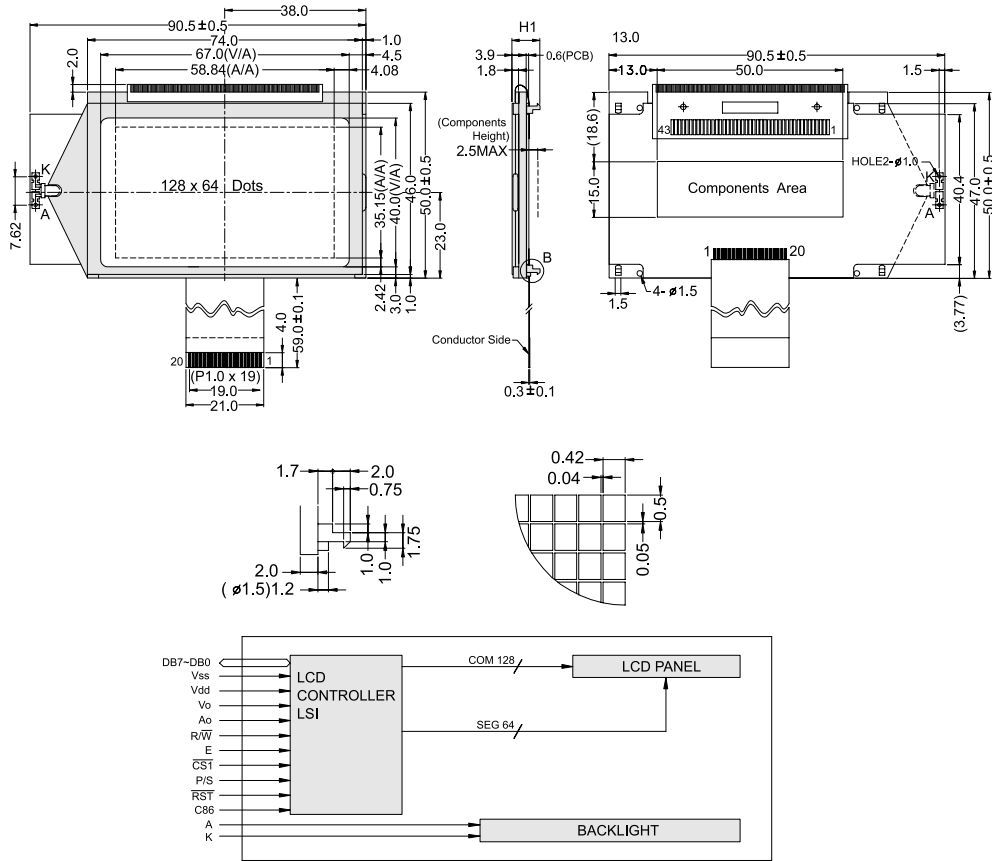
ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	Vdd-Vss	25°C	-0.3	6.0	V
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	15.0	V
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	1.8	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	11.4	-	11.6	-	10.6	V
		0°C	-	-	-	-	-	-	V
		25°C	-	10.3	-	10.5	-	9.6	V
		50°C	-	-	-	-	-	-	V
		70°C	-	9.0	-	8.2	-	8.6	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	80	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



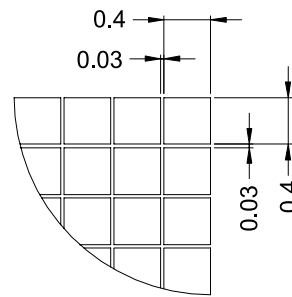
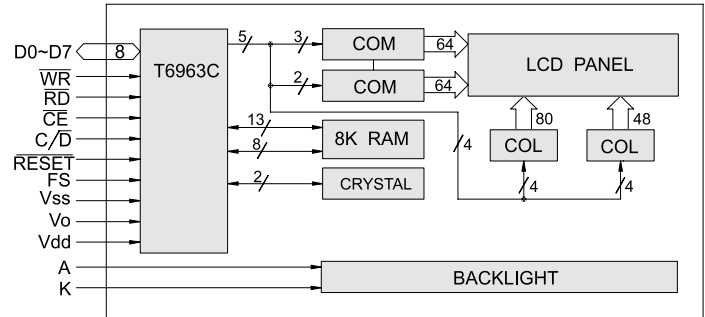
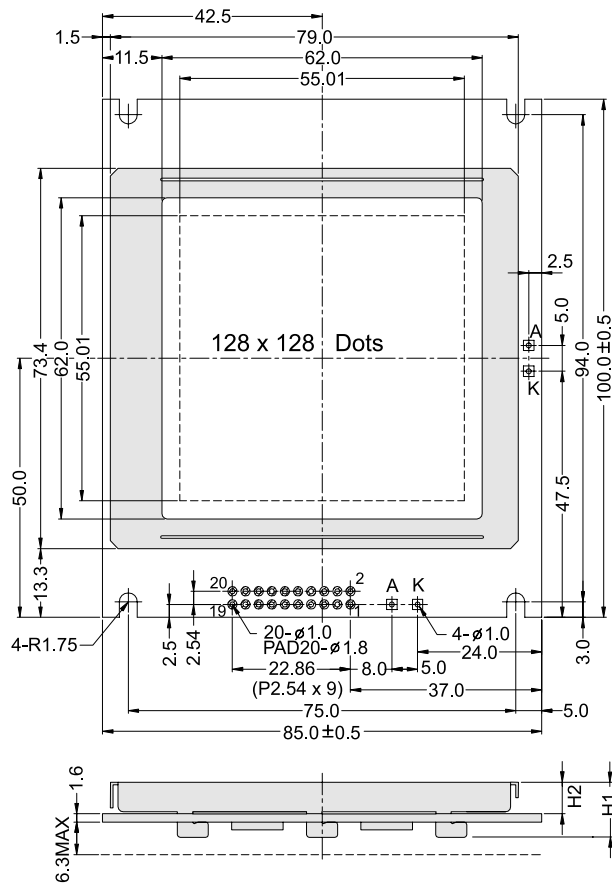
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	90.5 x 50.0	Module	H2 / H1
View Area	67.0 x 40.0	W / O B/L	- / 7.5
Dot Size	0.42 x 0.5	EL B/L	- / -
Dot Pitch	0.46 x 0.55	LED B/L	- / 7.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	A0	Command / data input
5	R/W	Data read / write signal(/RW)
6	E	Enable signal
7-14	DB0-DB7	Data bus line
15	P/S	Parallel / serial interface select
16	CS1	Chip select
17	RST	Reset
18	C86	8080 / 6800 select
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	18.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	1.8	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	9.9	-	10.2	-	10.4	V
		0°C	-	-	-	-	-	-	V
		25°C	-	8.4	-	9.0	-	9.4	V
		50°C	-	-	-	-	-	-	V
		70°C	-	7.8	-	8.0	-	8.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1.0	2.5	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	-	20	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



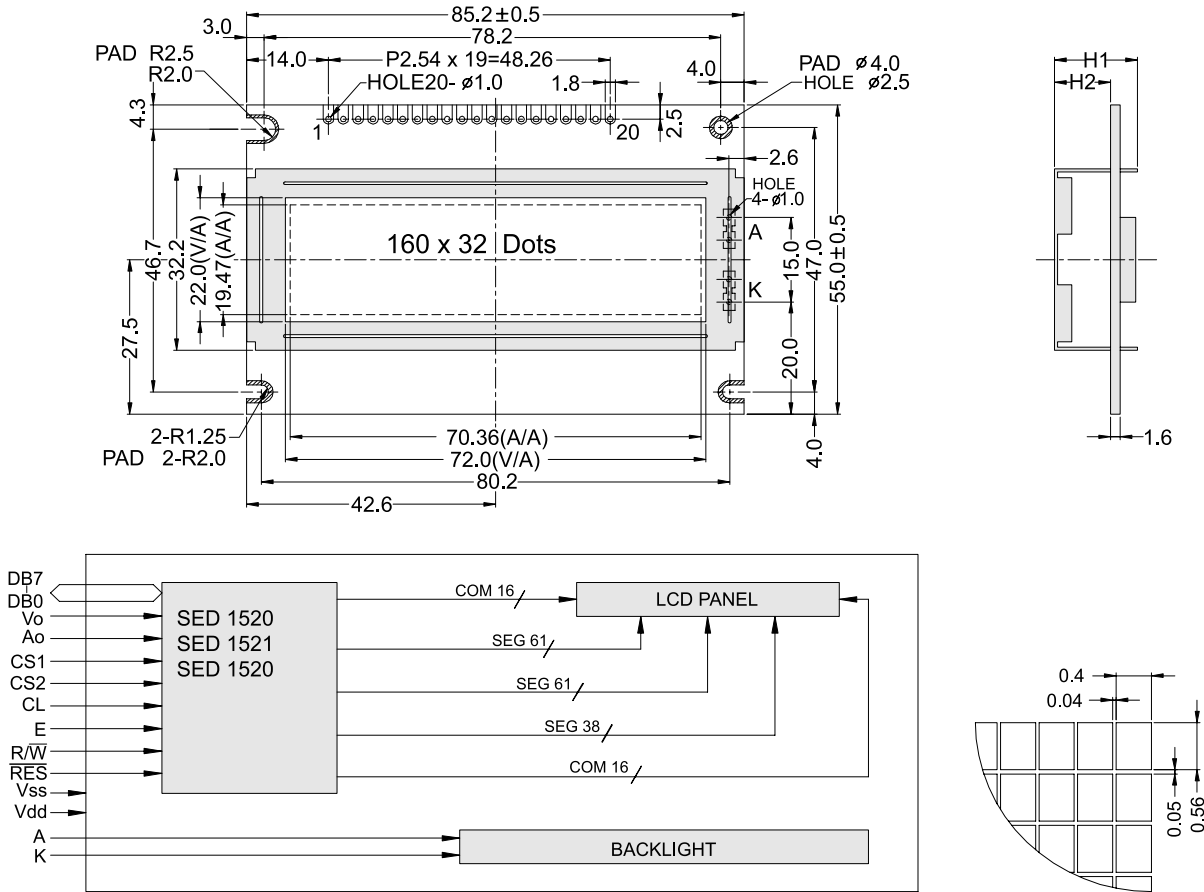
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	85.0 x 100.0	Module	H2 / H1
View Area	62.0 x 62.0	W / O B/L	6.1 / 14.0
Dot Size	0.40 x 0.40	EL B/L	6.1 / 14.0
Dot Pitch	0.43 x 0.43	LED B/L	9.2 / 17.1

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FGND	Frame ground
2	Vss	Power supply(GND)
3	Vdd	Power supply(+)
4	Vo	Contrast Adjust
5	WR	Data write
6	RD	Data read
7	CE	Chip enable
8	C/D	Command / data select
9	NC	No connection
10	RESET	Reset
11-18	DB0-DB7	Data bus line
19	FS	Font selection
20	NC	No connection

ABSOLUTE MAXIMUM RATING								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V			
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V			
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V			
ELECTRICAL CHARACTERISTICS								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V		
LCD operation voltage	Vop	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	18.1	-	19	-	20	V
		25°C	17.5	-	18.4	-	19.3	V
		50°C	16.5	-	17.4	-	18.3	V
		70°C	-	-	-	-	-	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	8.0	-	mA		
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA		
	LED/array	VB/L=4.2V	-	450	-	mA		

OUTLINE DIMENSION & BLOCK DIAGRAM



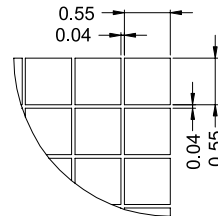
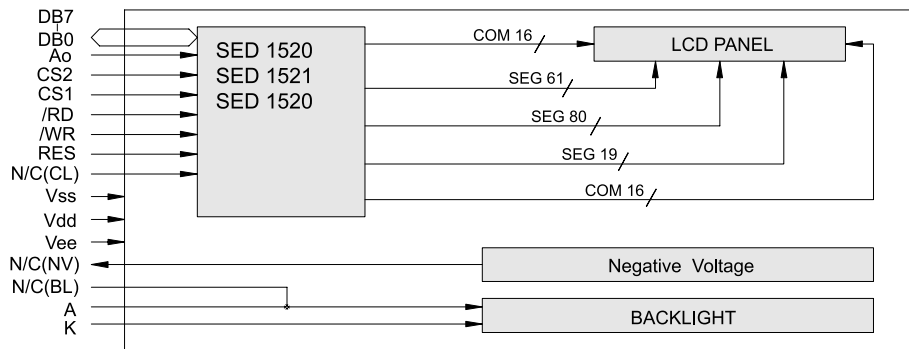
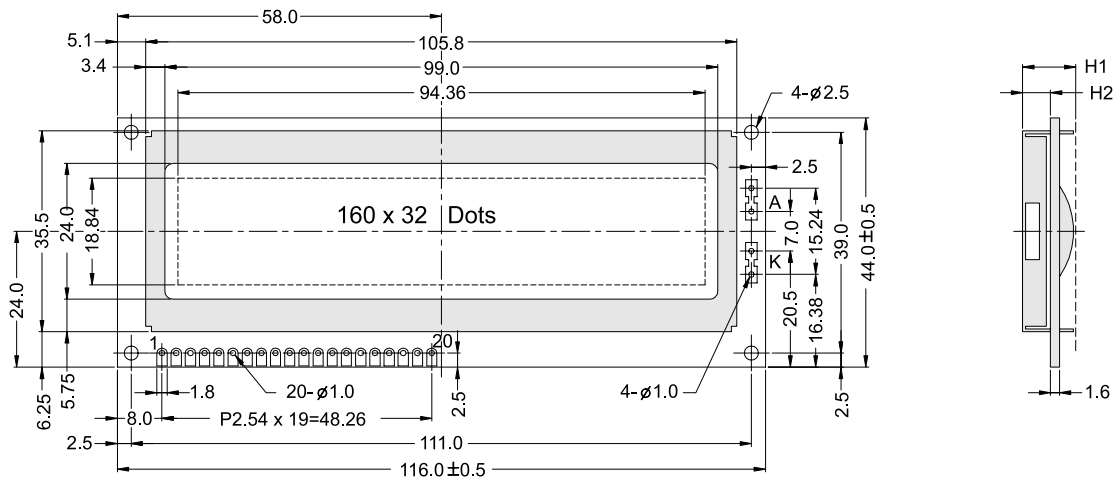
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	85.2 x 55.0	Module	H2 / H1
View Area	72.0 x 22.0	W / O B/L	9.6 / 14.5
Dot Size	0.40 x 0.56	EL B/L	- / -
Dot Pitch	0.44 x 0.61	LED B/L	9.6 / 14.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast adjust
4	Ao	Command / Data select
5	CS1	Chip select driver 1
6	CS2	Chip select driver 2
7	CL	External clock input
8	E	Enable signal
9	R/W	Data read / write
10-17	DB0-DB7	Data bus line
18	RES	Reset
19	A	Power supply for LED B/L(+)
20	K	Power supply for LED B/L(-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	6.1	-	6.4	-	6.7	V
		0°C	-	-	-	-	-	V	
		25°C	-	6.0	-	6.3	-	6.6	V
		50°C	-	-	-	-	-	V	
		70°C	-	5.8	-	6.1	-	6.4	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	180	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



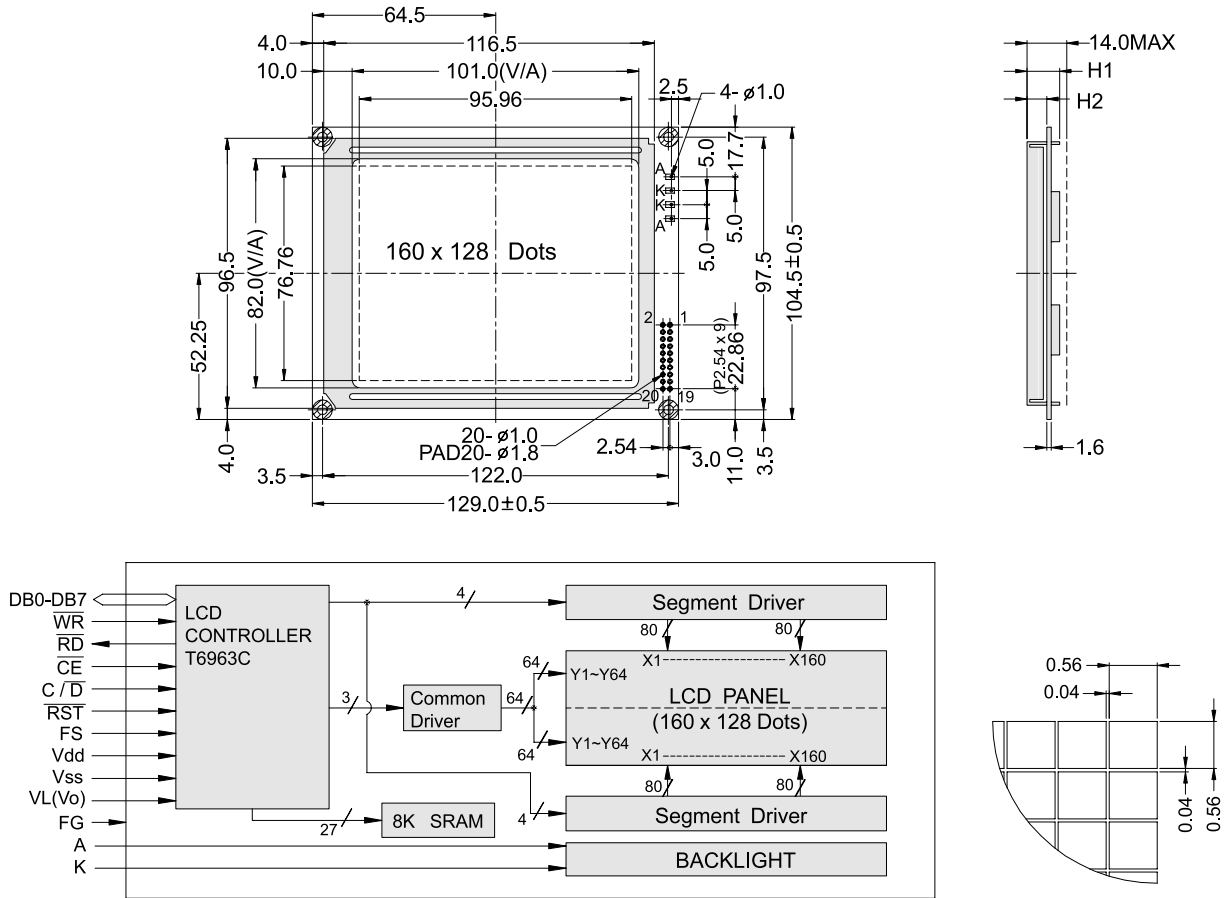
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	116.0 x 44.0	Module	H2 / H1
View Area	99.0 x 24.0	W / O B/L	5.0 / 9.5
Dot Size	0.55 x 0.55	EL B/L	5.0 / 9.5
Dot Pitch	0.59 x 0.59	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Ao	Command / data select
2	CS2	Chip select driver 2
3	CS1	Chip select driver 1
4	RD	Data read
5	WR	Data write
6	Vdd	Power supply(+)
7	Vss	Power supply(GND)
8-15	DB0-DB7	Data bus line
16	RES	Reset
17	Vee	Contrast adjust
18	N.C	No Connection
19	N.C	No Connection
20	N.C	No Connection

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	8.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	16.5	V				
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	2.7	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	6.4	-	6.8	-	7.4	V
		0°C	-	-	-	-	-	-	V
		25°C	-	5.8	-	6.2	-	6.8	V
		50°C	-	-	-	-	-	-	V
		70°C	-	5.3	-	5.7	-	6.3	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	1	2.5	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



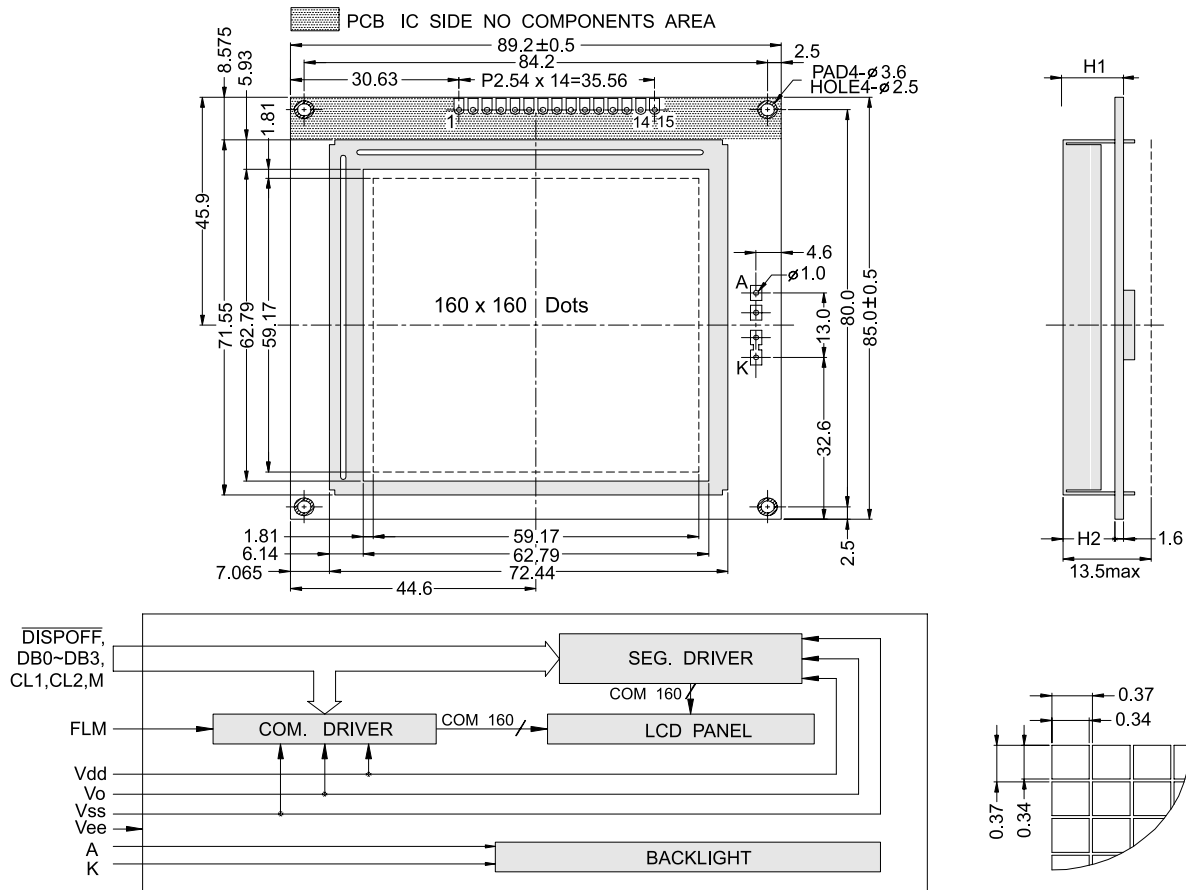
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	129.0 x 104.5	Module	H2 / H1
View Area	101.0 x 82.0	W / O B/L	7.0 / 14.0
Dot Size	0.56 x 0.56	EL B/L	7.0 / 14.0
Dot Pitch	0.60 x 0.60	LED B/L	- / -

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FGND	Frame ground
2	Vss	Power supply(GND)
3	Vdd	Power supply(+)
4	VL(Vo)	Contrast Adjust
5	WR	Data write
6	RD	Data read
7	CE	Chip enable
8	C/D	Command / data select
9	NC	No connection
10	RST	Reset
11-18	DB0-DB7	Data bus line
19	FS	Font selection
20	NC	No connection

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	28.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	9.9	-	10.4	-	10.9	V
		0°C	11	-	11.6	-	12.2	-	V
		25°C	10.3	9.8	10.9	10.3	11.5	10.8	V
		50°C	9.6	-	10.2	-	10.8	-	V
		70°C	-	9.6	-	10.4	-	10.6	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	3	6	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	500	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



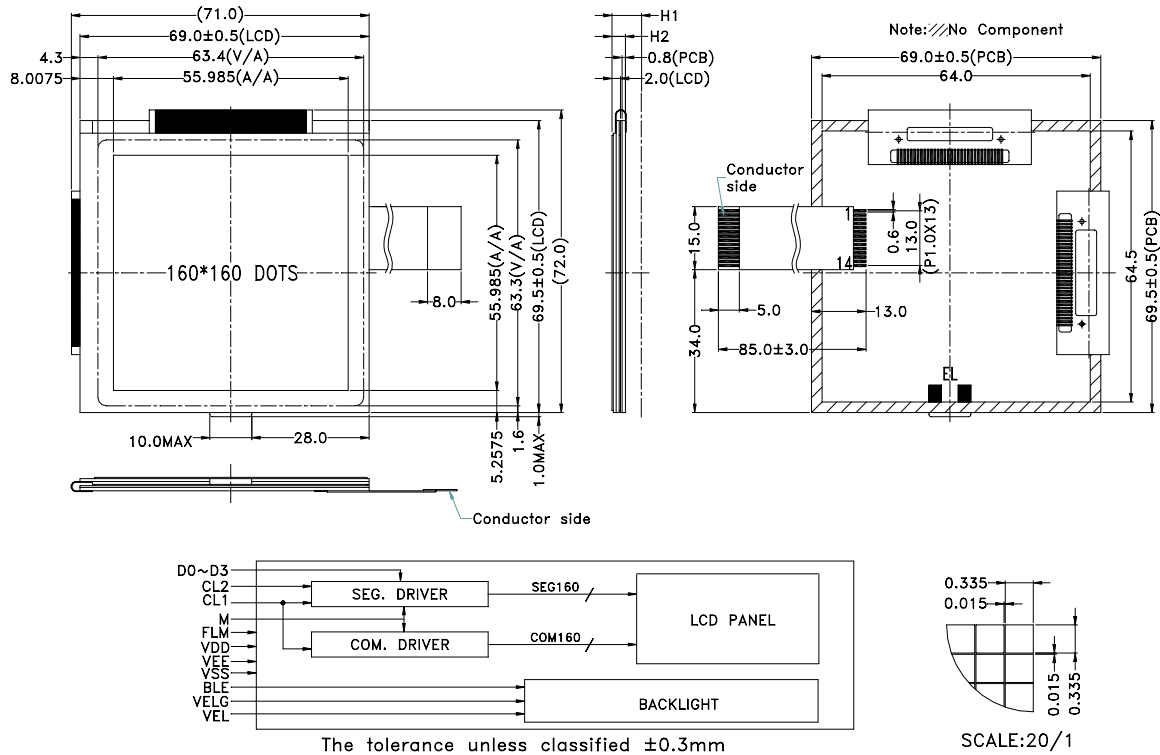
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	89.2 x 85.0	Module	H2 / H1
View Area	62.79 x 62.79	W / O B/L	- / -
Dot Size	0.34 x 0.34	EL B/L	- / -
Dot Pitch	0.37 x 0.37	LED B/L	9.4 / 13.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply (GND)
2	M	Alternation control signal
3	FLM	Shift direction select
4	CL1	Display data input clock
5	CL2	Display data input clock
6	DB3	Data bus line
7	DB2	Data bus line
8	DB1	Data bus line
9	DB0	Data bus line
10	Vee	Negative voltage Input
11	Vdd	Power supply (+)
12	Vo	Contrast Adjust
13	DISPOFF	Data bus line
14	A	Power supply for LED B/L (-)
15	K	Power supply for LED B/L (+)

ABSOLUTE MAXIMUM RATING							
Item	Symbol	Condition	Min.	Max.	Units		
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V		
LCD driving supply voltage	Vdd-Vee	25°C	0	30.0	V		
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V		
ELECTRICAL CHARACTERISTICS							
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V	
LCD operation voltage	Vop	Top	N	W	N	W	V
		-20°C	-	-	-	-	V
		0°C	-	-	-	-	V
		25°C	-	-	18.3	-	V
		50°C	-	-	-	-	V
70°C	-	-	-	-	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	3	5	mA	
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA	
	LED/array	VB/L=4.2V	-	500	-	mA	

.....**OUTLINE DIMENSION & BLOCK DIAGRAM**



MECHANICAL SPECIFICATION			
Overall Size	69.0 x 69.5 mm	Module	H2 / H1
View Area	63.4 x 63.3 mm	W/O B/L	2.9 / 5.0
Dot Size	0.335 x 0.335 mm	EL B/L	3.2 / 7.0
Dot Pitch	0.35 x 0.35 mm	LED B/L	- / -

PIN ASSIGNMENT		
Pin No.	Symbol	Function
1	CL2(SCP)	Data shift pulse
2	CL1(LP)	Data latch pulse
3	FLM	Scan start-up signal
4	M	Frame reverse signal(Alternate signal)
5	D0	Data display
6	D1	Data display
7	D2	Data display
8	D3	Data display
9	V _{EE}	Power supply voltage for LCD(+V)
10	V _{DD}	Power supply voltage for logic
11	V _{SS}	Ground
12	BLE	EL enable/disable
13	VELG	Power supply for EL(-)
14	VEL	Power supply for EL(+)

ABSOLUTE MAXIMUM RATING						
Item	Symbol	Condition	Min.	Max.	Units	
Supply for logic voltage	V _{DD} -V _{SS}	25°C	-0.3	7.0	V	
LCD driving supply voltage	V _{DD} -V _{EE}	25°C	-0.3	30.0	V	
Input Voltage	V _{IN}	25°C	-0.3	V _{DD} +0.3	V	

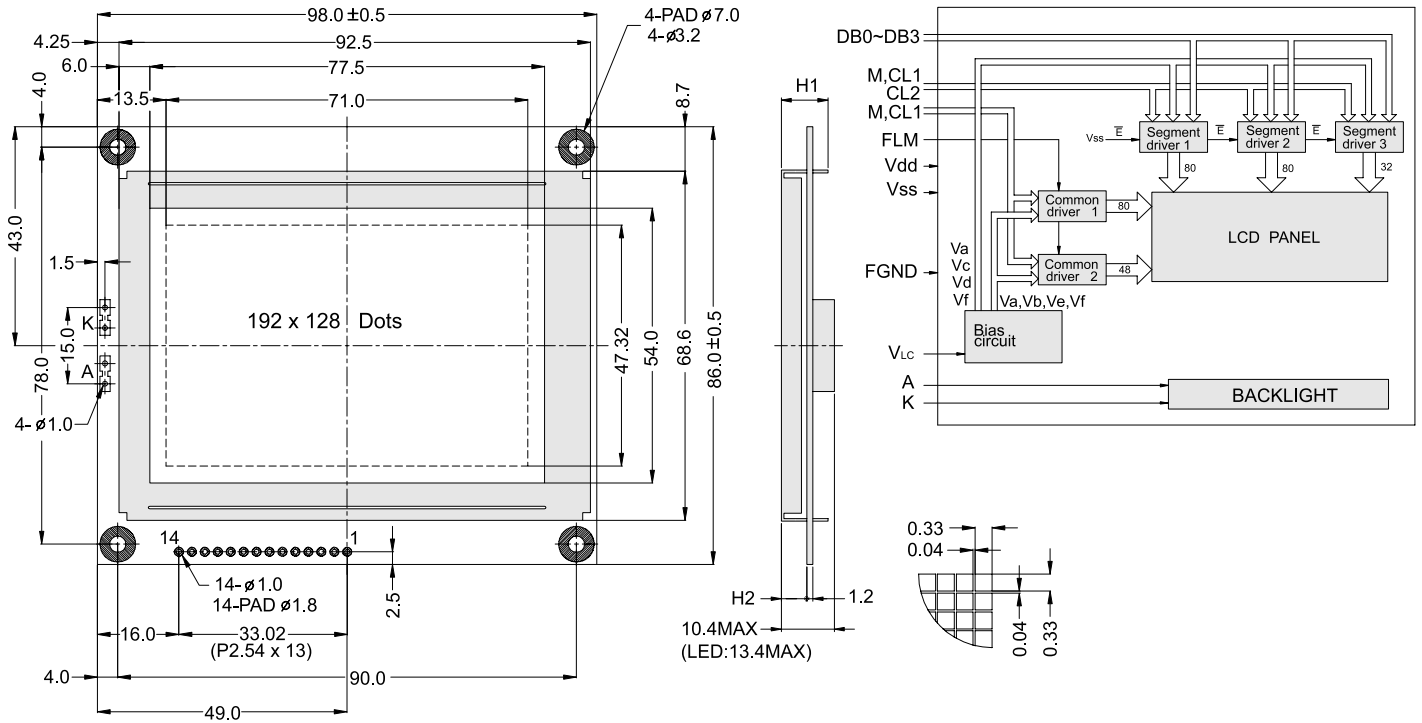
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	V _{DD} -V _{SS}	25°C	2.7	-	5.5	V			
LCD operation voltage	V _{OP}	T _{OP}	N	W	N	W	V		
		-20°C	-	-	20.6	-	-	V	
		0°C	-	19.4	-	19.6	-	20.2	V
		25°C	-	18.4	-	19.0	-	19.6	V
		50°C	-	17.6	-	18.1	-	18.6	V
		70°C	-	-	17.5	-	-	V	
LCM current consumption (No B/L)	I _{DD}	V _{DD} =5V	-	0.3	-	mA			
	I _{EE}	V _{DD} =5V	-	4.0	-	mA			
Backlight current consumption	EL	V _{OP} =5V	-	40.0	-	mA			

REMARK

LCD option: STN, FSTN

Backlight Option: EL backlight feature, other specs not available on catalog is under request.

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified $\pm 0.3\text{mm}$

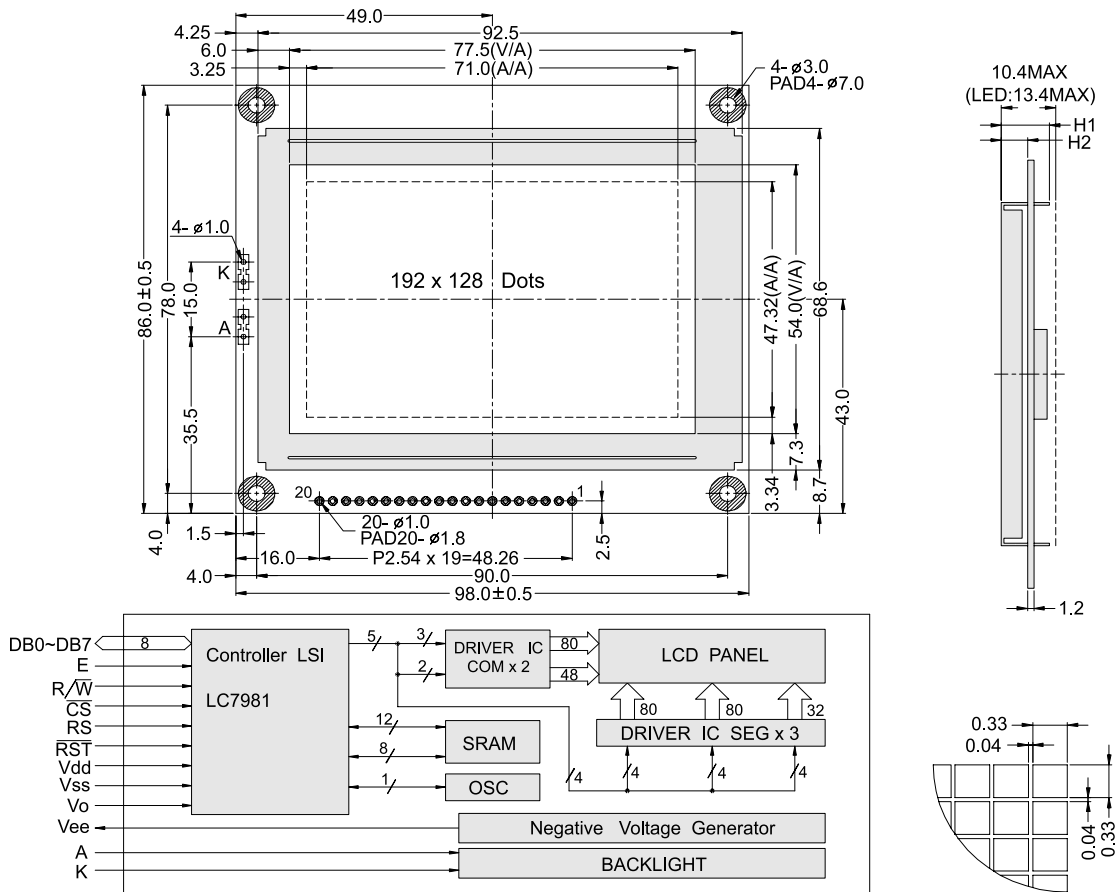
MECHANICAL SPECIFICATION			
Overall Size	98.0 x 86.0	Module	H2 / H1
View Area	75.0 x 54.0	W / O B/L	5.0 / 9.2
Dot Size	0.33 x 0.33	EL B/L	5.0 / 9.2
Dot Pitch	0.37 x 0.37	LED B/L	8.0 / 12.2

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1,2	D3,D2	Data line
3	FLM	Shift direction select
4	M	Alternation control signal
5	CL1	Display data input colock
6	CL2	Display data input colock
7,8	D1,D0	Data line
9	Vdd	Power supply(+)
10	Vss	Power supply(GND)
11	Vlc	Contrast adjust
12	FGND	Frame adjust
13	K	Power supply for LED B/L (+)
14	A	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING						
Item	Symbol	Condition	Min.	Max.	Units	
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V	
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V	
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V	

ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-25°C	-	19.5	-	20.6	-	21.7	V
		0°C	19.4	-	20.4	-	21.4	-	V
		25°C	18.0	17.0	18.9	17.9	19.8	18.8	V
		50°C	16.1	-	16.9	-	17.7	-	V
		70°C	-	15.4	-	16.3	-	17.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	-	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	85	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



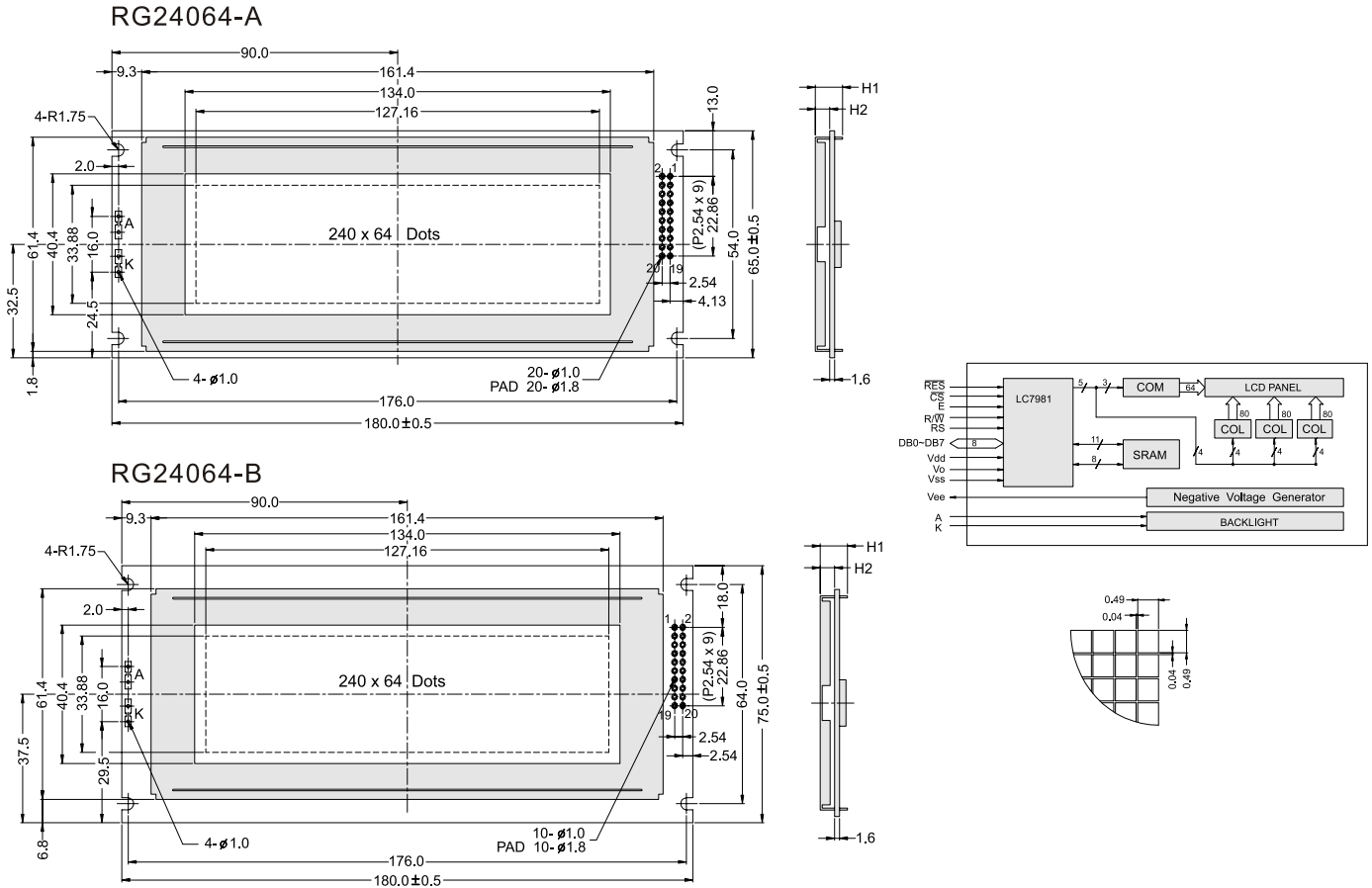
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	98.0 x 86.0	Module	H2 / H1
View Area	77.5 x 54.0	W / O B/L	5.0 / 9.2
Dot Size	0.33 x 0.33	EL B/L	5.0 / 9.2
Dot Pitch	0.37 x 0.37	LED B/L	8.0 / 12.2

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply (GND)
2	Vdd	Power supply (+)
3	Vo	Contrast adjust
4	RS	Common / Data select
5	R/W	data read / write
6	E	enable signal
7	DB0	Data bus line
8	DB1	Data bus line
9	DB2	Data bus line
10	DB3	Data bus line
11	DB4	Data bus line
12	DB5	Data bus line
13	DB6	Data bus line
14	DB7	Data bus line
15	CS	Chip select
16	RST	Reset
17	Vee	Negative voltage output
18	N/C	No connection
19	A	Power supply for LED B/L (+)
20	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	30.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.75	-	5.25	V			
LCD operation voltage	Vop	Top	N	W	N	W	N	W	V
		-20°C	-	19.5	-	20.6	-	21.7	V
		0°C	19.4	-	20.4	-	21.4	-	V
		25°C	18.0	17.0	18.9	17.9	19.8	18.8	V
		50°C	16.1	-	16.9	-	17.7	-	V
		70°C	-	15.4	-	16.3	-	17.2	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	20	25	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	85	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



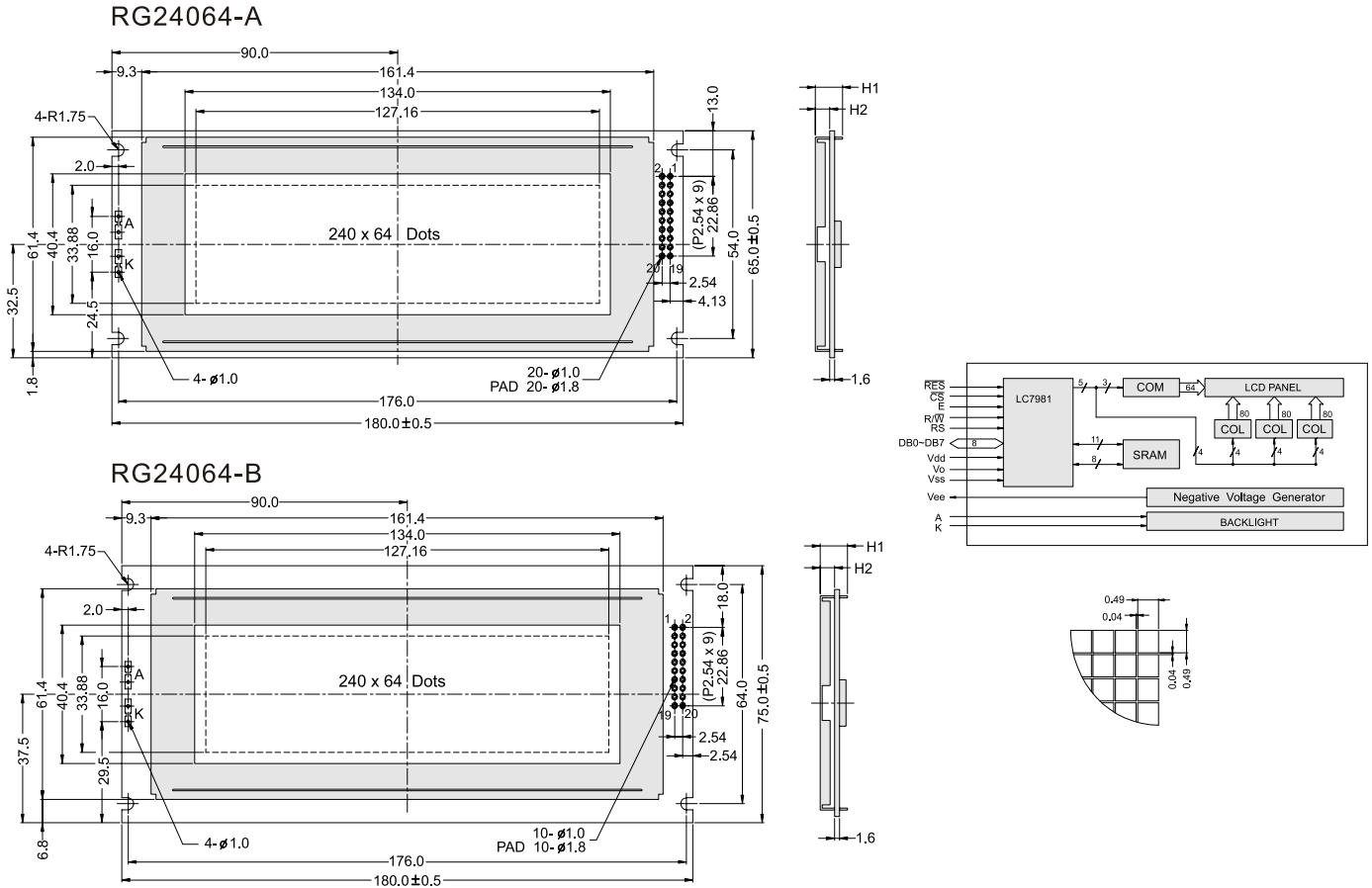
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	180.0 x 65.0	Module	H2 / H1
View Area	134.0 x 40.4	W/O B/L	4.5 / 8.6
Dot Size	0.49 x 0.49	EL B/L	4.5 / 8.6
Dot Pitch	0.53 x 0.53	LED / CCFL B/L	9.2 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast adjust
4	RS	Command / data select
5	R/W	Data read / write
6	E	Enable signal
7-14	DB0-DB7	Data bus line
15	CS	Chip select
16	RST	Reset
17	Vee	Negative voltage output
18	NC	No Connection
19	A	Power supply for LED B/L(+)
20	K	Power supply for LED B/L(-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V				
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.75	-	5.25	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-25°C	-	14.3	-	14.7	-	15.1	V
		0°C	9.7	-	10.2	-	10.7	-	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	-	9.1	-	9.6	-	V
		70°C	-	12	-	12.4	-	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	42	-	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	-	80	-	mA			
	LED/array	VB/L=4.2V	-	650	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



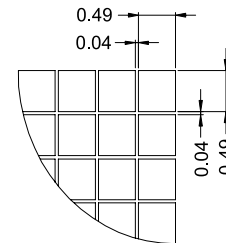
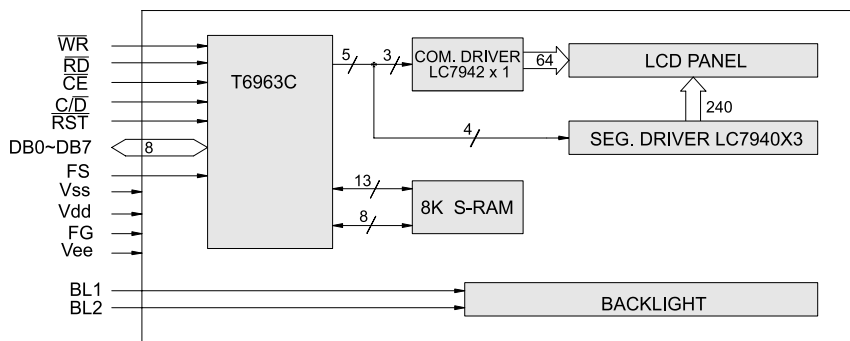
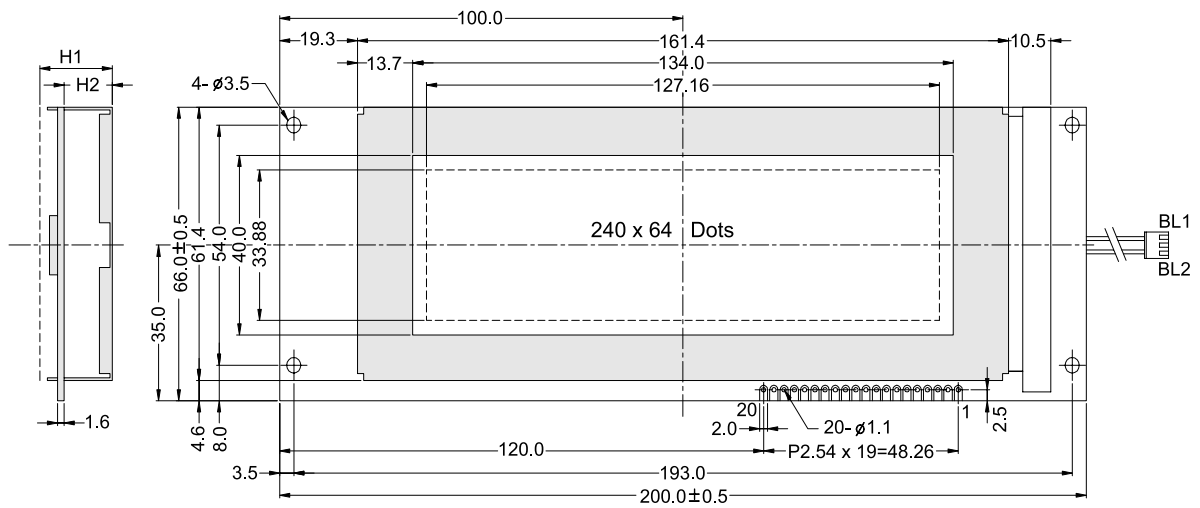
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	180.0 x 65.0	Module	H2 / H1
View Area	134.0 x 40.4	W/O B/L	4.5 / 8.6
Dot Size	0.49 x 0.49	EL B/L	4.5 / 8.6
Dot Pitch	0.53 x 0.53	LED / CCFL B/L	9.2 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast adjust
4	RS	Command / data select
5	R/W	Data read / write
6	E	Enable signal
7-14	DB0-DB7	Data bus line
15	CS	Chip select
16	RST	Reset
17	Vee	Negative voltage output
18	NC	No Connection
19	A	Power supply for LED B/L(+)
20	K	Power supply for LED B/L(-)

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V				
Input voltage	Vin	25°C	-0.3	Vdd-0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.75	-	5.25	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-25°C	-	14.3	-	14.7	-	15.1	V
		0°C	9.7	-	10.2	-	10.7	-	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	-	9.1	-	9.6	-	V
		70°C	-	12	-	12.4	-	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	42	-	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	-	80	-	mA			
	LED/array	VB/L=4.2V	-	650	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



The tolerance unless classified $\pm 0.3\text{mm}$

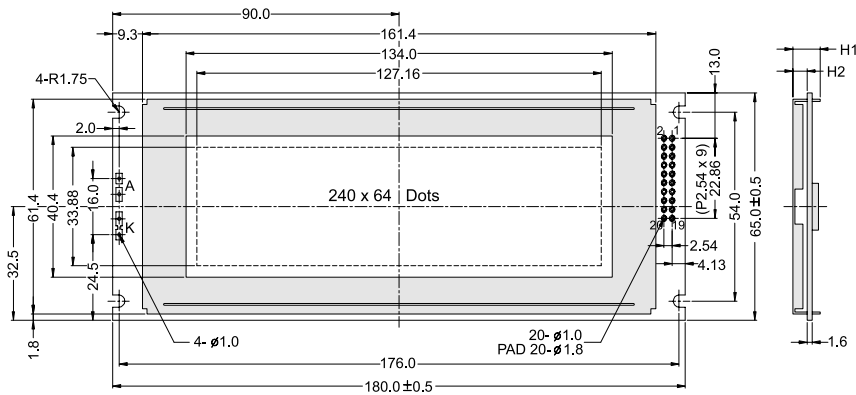
MECHANICAL SPECIFICATION			
Overall Size	200.0 x 66.0	Module	H2 / H1
View Area	134.0 x 40.4	W / O B/L	- / -
Dot Size	0.49 x 0.49	EL B/L	- / -
Dot Pitch	0.53 x 0.53	CCFL B/L	16.0 / 23.0

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FG	Frame ground
2	Vss	Power supply(GND)
3	Vdd	Power supply(+)
4	Vee	Negative voltage input
5	WR	Data write
6	RD	Data read
7	CE	Chip enable
8	C/D	Command / data select
10	RST	Reaet
11-18	DB0-DB7	Data bus line
19	FS	Font select
9/20	NC	No Connection

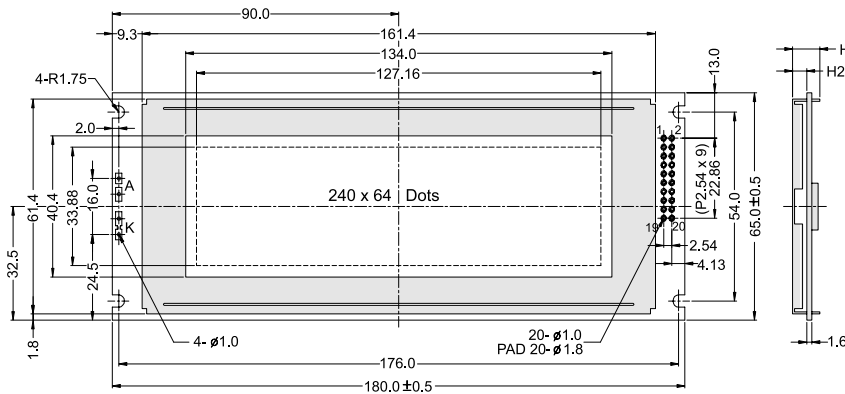
ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-10°C	-	14.3	-	15.7	-	15.1	V
		0°C	-	-	-	-	-	-	V
		25°C	-	13.2	-	13.7	-	14.0	V
		50°C	-	-	-	-	-	-	V
		60°C	-	12.0	-	11.4	-	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	10	-	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA			
	LED/array	VB/L=4.2V	-	-	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM

RG 24064-E



PG 24064-F



The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION

Overall Size	180.0 x 65.0	Module	H2 / H1
View Area	134.0 x 40.4	W / O B/L	4.5 / 8.6
Dot Size	0.49 x 0.49	EL B/L	4.5 / 8.6
Dot Pitch	0.53 x 0.53	LED / CCFL B/L	9.2 / 13.3

PIN ASSIGNMENT

Pin no.	Symbol	Function
1	FG	Frame ground
2	Vss	Power supply(GND)
3	Vdd	Power supply(+)
4	Vo	Contrast Adjust
5	WR	Data write
6	RD	Data read
7	CE	Chip enable
8	C/D	Command / data select
9	Vee	Negative output
10	RST	Reset
11-18	DB0-DB7	Data bus line
19	FS	Font selection
20	NC	No connection

ABSOLUTE MAXIMUM RATING

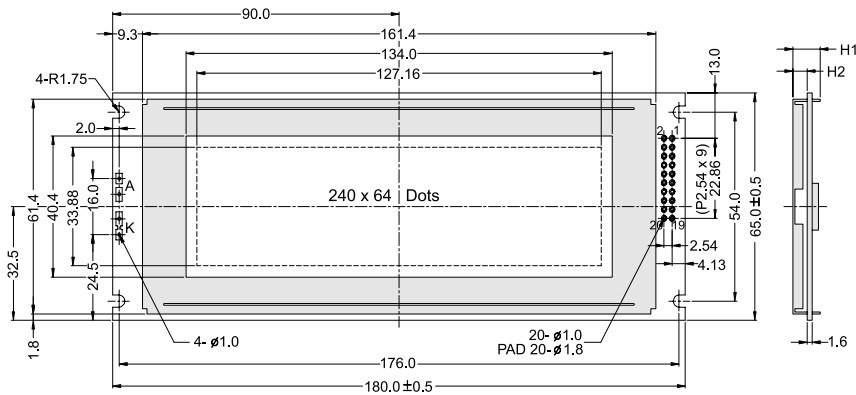
Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V

ELECTRICAL CHARACTERISTICS

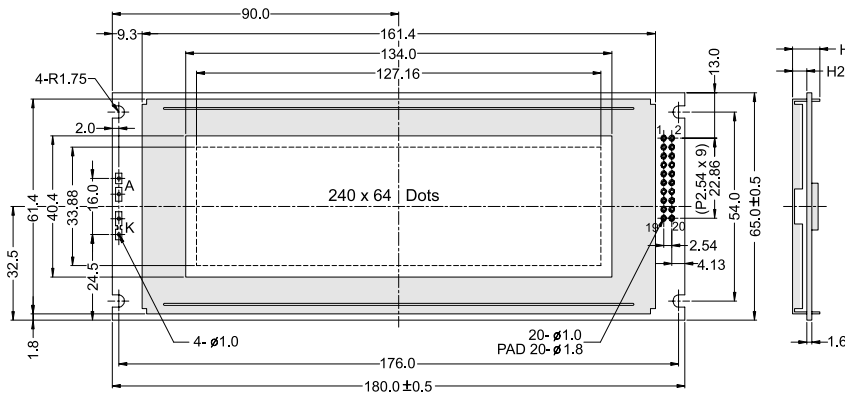
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	—	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	—	14.3	—	14.7	—	15.1	V
		0°C	9.7	—	10.2	—	10.7	—	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	—	9.1	—	9.6	—	V
		70°C	—	12	—	12.4	—	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	—	10	—	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	—	80	—	mA			
	LED/array	VB/L=4.2V	—	650	—	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM

RG 24064-E



PG 24064-F



The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION

		MECHANICAL SPECIFICATION	
Overall Size	180.0 x 65.0	Module	H2 / H1
View Area	134.0 x 40.4	W / O B/L	4.5 / 8.6
Dot Size	0.49 x 0.49	EL B/L	4.5 / 8.6
Dot Pitch	0.53 x 0.53	LED / CCFL B/L	9.2 / 13.3

PIN ASSIGNMENT

Pin no.	Symbol	Function
1	FG	Frame ground
2	Vss	Power supply(GND)
3	Vdd	Power supply(+)
4	Vo	Contrast Adjust
5	WR	Data write
6	RD	Data read
7	CE	Chip enable
8	C/D	Command / data select
9	Vee	Negative output
10	RST	Reset
11-18	DB0-DB7	Data bus line
19	FS	Font selection
20	NC	No connection

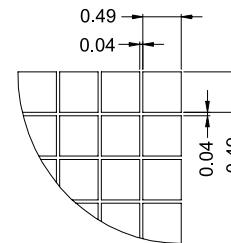
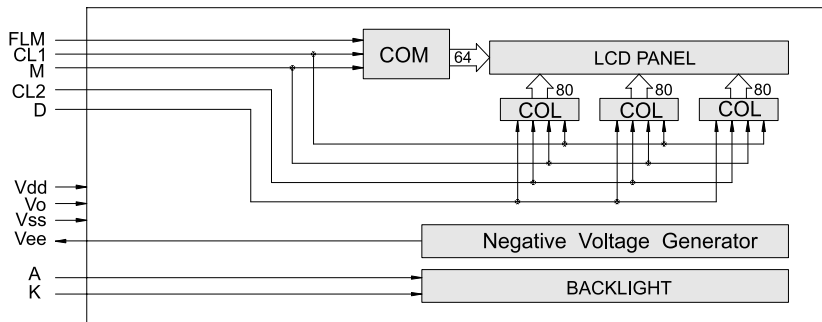
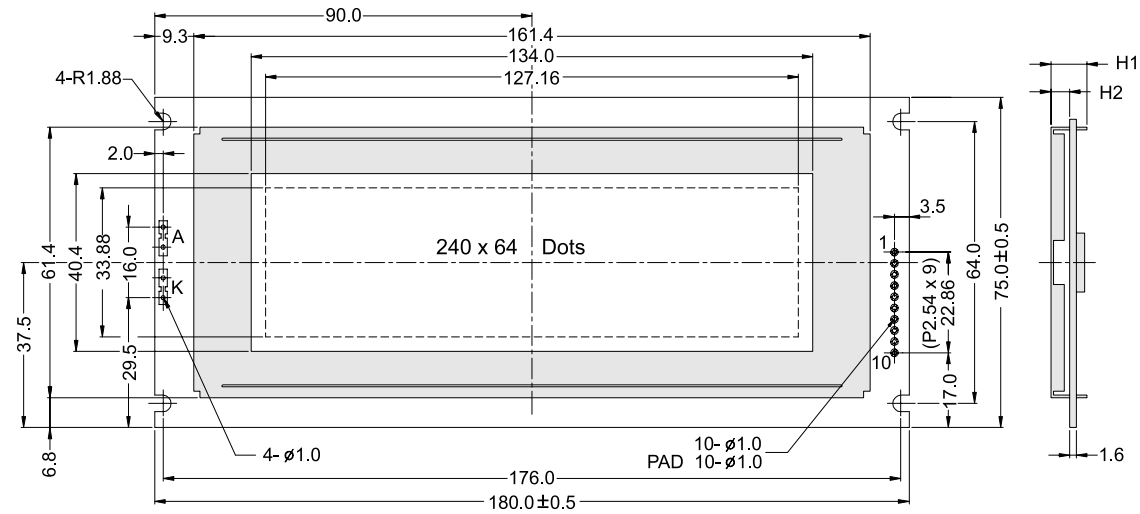
ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	—	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	—	14.3	—	14.7	—	15.1	V
		0°C	9.7	—	10.2	—	10.7	—	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	—	9.1	—	9.6	—	V
		70°C	—	12	—	12.4	—	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	—	10	—	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	—	80	—	mA			
	LED/array	VB/L=4.2V	—	650	—	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



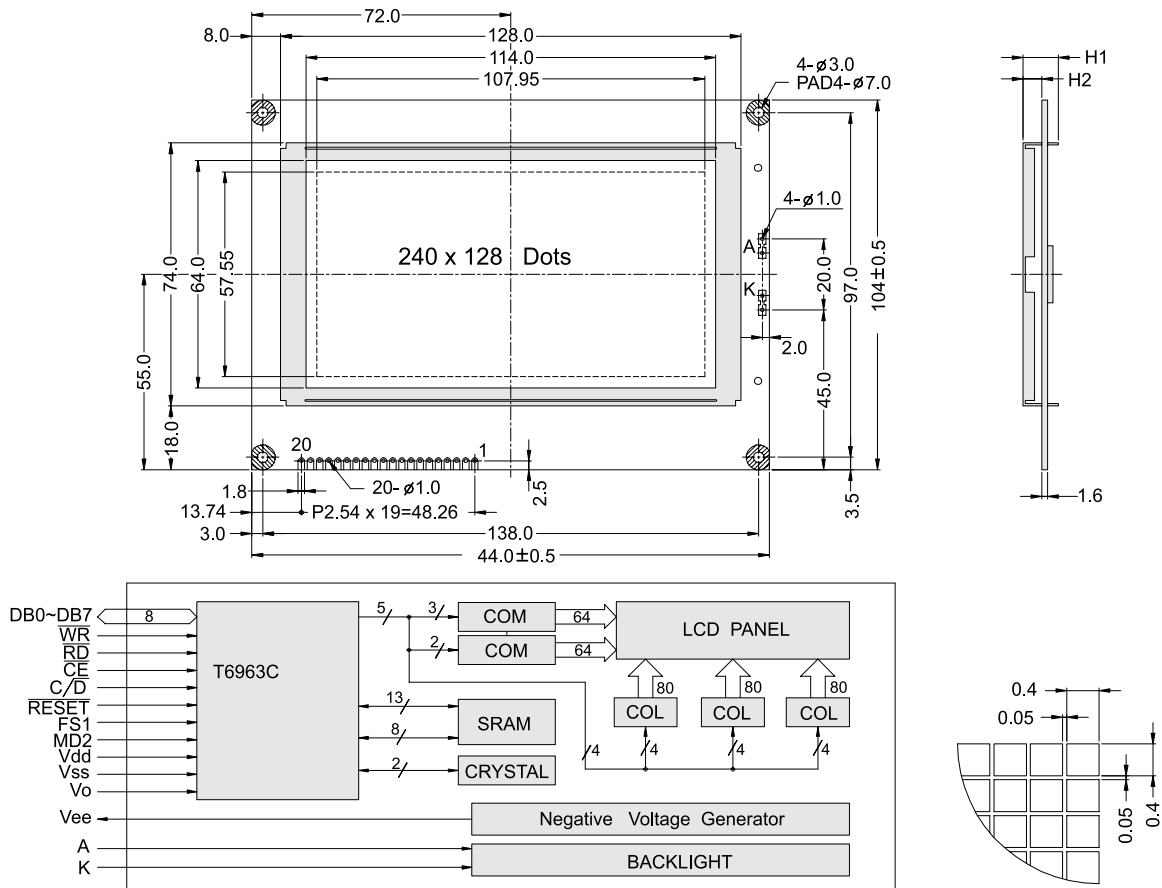
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	180.0 x 75.0	Module	H2 / H1
View Area	134.0 x 40.4	W / O B/L	4.5 / 8.6
Dot Size	0.49 x 0.49	EL B/L	4.5 / 8.6
Dot Pitch	0.53 x 0.53	LED CCFL B/L	9.2 / 13.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	D	Serial data input
2	FLM	Shift direction select
3	M	Alternation control signal
4	CL1	Display data input clock
5	CL2	Display data input clock
6	NC	No connection
7	Vdd	Power supply(+)
8	Vss	Power supply(GND)
9	Vee	Negative voltage output
10	Vo	Contrast Adjust

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	14.3	-	14.7	-	15.1	V
		0°C	9.7	-	10.2	-	10.7	-	V
		25°C	8.9	13.2	9.4	13.6	9.9	14	V
		50°C	8.6	-	9.1	-	9.6	-	V
		70°C	-	12	-	12.4	-	12.8	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	2.5	-	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	-	80	-	mA			
	LED/array	VB/L=4.2V	-	650	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



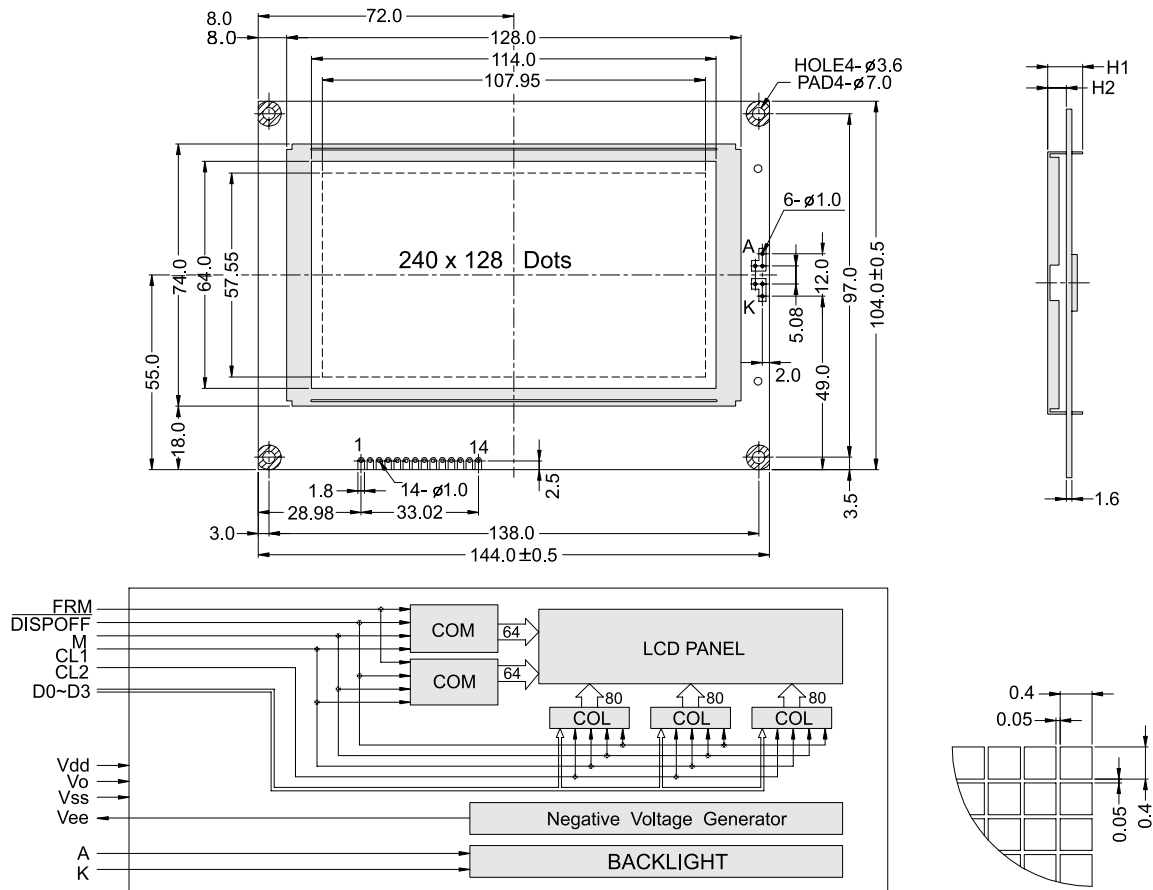
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	144.0 x 104.0	Module	H2 / H1
View Area	114.0 x 64.0	W / O B/L	5.2 / 9.8
Dot Size	0.40 x 0.40	EL B/L	5.2 / 9.8
Dot Pitch	0.45 x 0.45	LED / CCFL B/L	9.2 / 13.8

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	Vo	Contrast Adjust
4	C/D	Command / data select
5	RD	Data read
6	WR	Data write
7-14	DB0-DB7	Data bus line
15	CE	Chip enable
16	RST	Reset
17	Vee	Negative output
18	MD2	Select number of columns
19	FS1	Font selection
20	NC	No connection

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	—	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	—	18.8	—	19.8	—	20.8	V
		0°C	12.5	—	13.1	—	13.7	—	V
		25°C	11.7	17.2	12.3	18.1	12.9	19.1	V
		50°C	10.9	—	11.4	—	11.9	—	V
		70°C	—	16.1	—	16.9	—	17.7	V
LCM current consumption (No B/L)	Idd	Vdd=5V	—	35	50	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	—	120	—	mA			
	LED/array	VB/L=4.2V	—	900	—	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



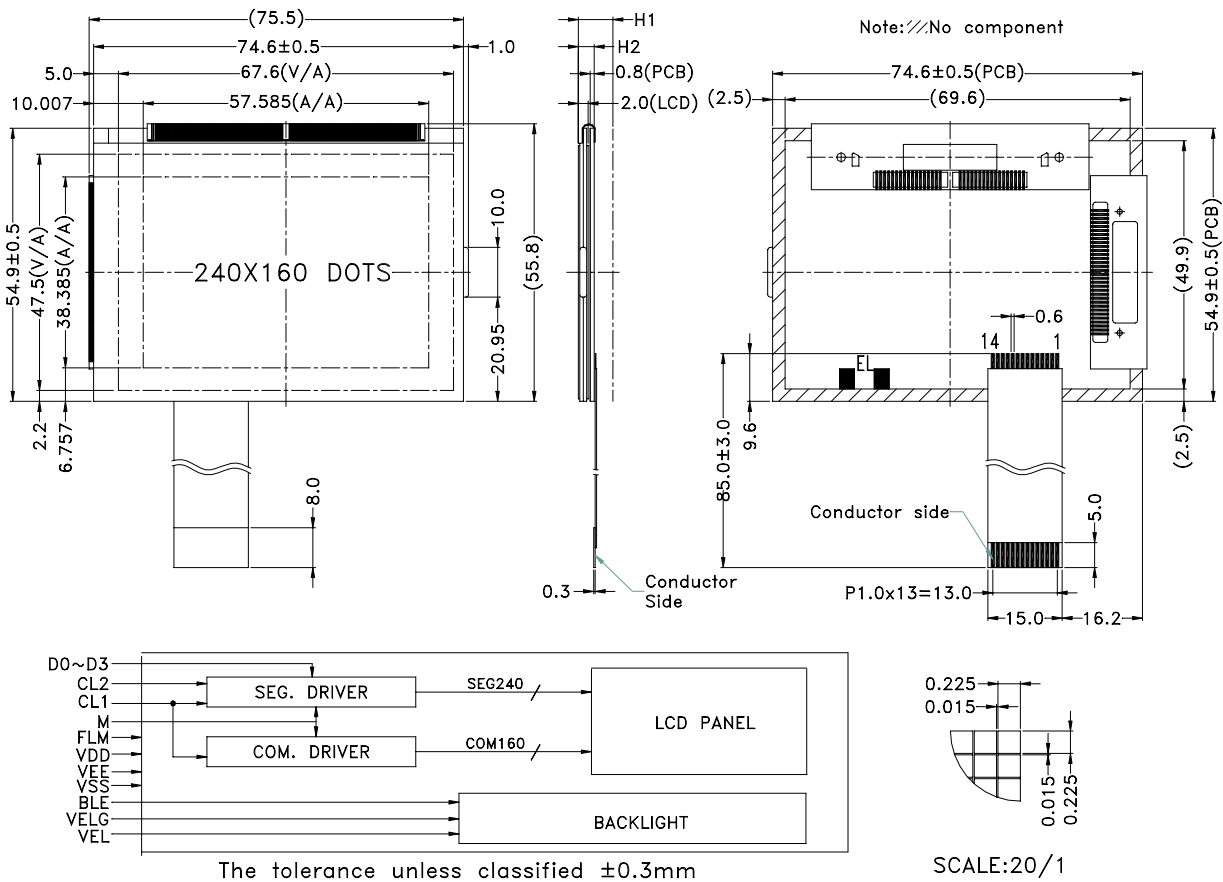
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	144.0 x 104.0	Module	H2 / H1
View Area	114.0 x 64.0	W/O B/L	5.2 / 9.8
Dot Size	0.40 x 0.40	EL B/L	5.2 / 9.8
Dot Pitch	0.45 x 0.45	LED / CCFL B/L	9.2 / 13.8

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vo	Contrast Adjust
2	Vee	Negative voltage output
3	DB0	Data bus line
4	DB1	Data bus line
5	DB2	Data bus line
6	DB3	Data bus line
7	M	Alternation control signal
8	Vss	Power supply(GND)
9	Vdd	Power supply(+)
10	CL2	Dispaly data input colock
11	CL1	Dispaly data input colock
12	FRM	Shift direction select
13	DISPOFF	Column output control
14	FG	Frame ground

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	22.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	18.8	-	19.8	-	20.8	V
		0°C	12.5	-	13.1	-	13.7	-	V
		25°C	11.7	17.2	12.3	18.1	12.9	19.1	V
		50°C	10.9	-	11.4	-	11.9	-	V
		70°C	-	16.1	-	16.9	-	17.7	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	7	-	mA			
Backlight current consumption	LED/edge	VB/L=3.5V	-	120	-	mA			
	LED/array	VB/L=4.2V	-	900	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



MECHNICAL SPECIFICATION

Overall Size	74.6 x 54.9 mm	Module	H2 / H1
View Area	67.6 x 47.5 mm	W/O B/L	2.9 / 5.0
Dot Size	0.225 x 0.225 mm	EL B/L	3.2 / 7.0
Dot Pitch	0.24 x 0.24 mm	LED B/L	- / -

PIN ASSIGNMENT

Pin No.	Symbol	Function
1	CL2(SCP)	Data shift pulse
2	CL1(LP)	Data latch pulse
3	FLM	Scan start-up signal
4	M	Frame reverse signal(Alternate signal)
5	D0	Data display
6	D1	Data display
7	D2	Data display
8	D3	Data display
9	VEE	Power supply voltage for LCD(+V)
10	VDD	Power supply voltage for logic
11	VSS	Ground
12	BLE	EL enable/disable
13	VELG	Power supply for EL(-)
14	VEL	Power supply for EL(+)

ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	$V_{DD}-V_{SS}$	25°C	-0.3	7.0	V
LCD driving supply voltage	$V_{DD}-V_{EE}$	25°C	-0.3	30.0	V
Input Voltage	V_{IN}	25°C	-0.3	$V_{DD}+0.3$	V

ELECTRICAL CHARACTERISTICS

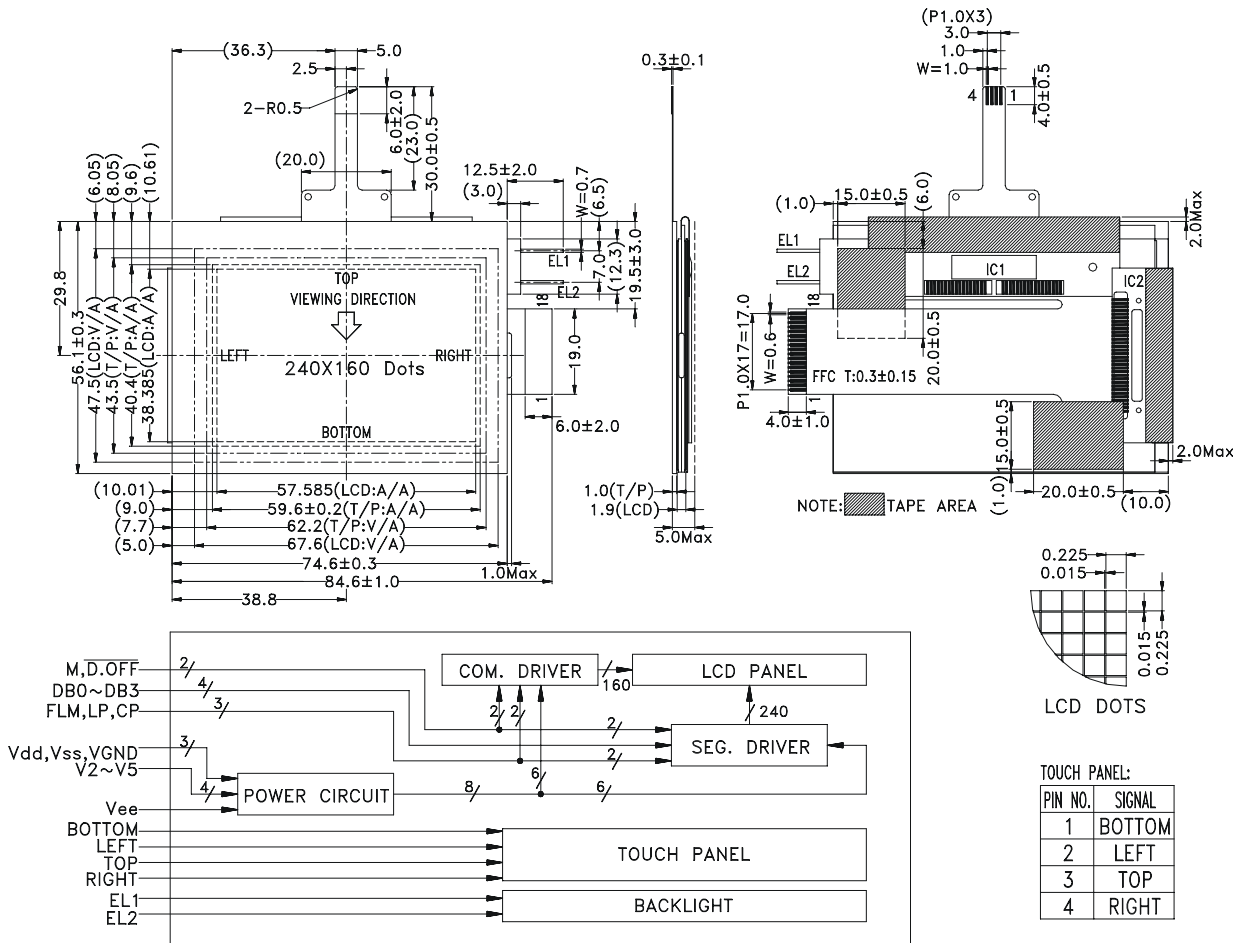
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	$V_{DD}-V_{SS}$	25°C	4.5	5.0	5.5	V	
LCD operation voltage	V_{OP}	T_{OP}	N	W	N	W	V
		-20°C	-	-	21.5	-	V
		0°C	-	20.1	20.7	-	V
		25°C	-	19.6	19.6	20.2	V
		50°C	-	18.6	18.7	19.3	V
		70°C	-	-	17.7	-	V
LCM current consumption (No B/L)	I_{DD}	$V_{DD}=5V$	-	0.3	-	mA	
	I_{EE}	$V_{DD}=5V$	-	3.0	-	mA	
Backlight current consumption	EL	$V_{OP}=5V$	-	40.0	-	mA	

REMARK

LCD option: STN, FSTN

Backlight Option: EL backlight feature, other specs not available on catalog is under request.

OUTLINE DIMENSION & BLOCK DIAGRAM



MECHANICAL SPECIFICATION

Overall Size	74.6 x 54.9 mm	Module	H2 / H1
View Area	67.6 x 47.5 mm	W/O B/L	2.9 / 5.0
Dot Size	0.225 x 0.225 mm	EL B/L	3.2 / 7.0
Dot Pitch	0.24 x 0.24 mm	LED B/L	- / -

PIN ASSIGNMENT

Pin No.	Symbol	Function
1	V5	Bias voltage for non-select com.driver
2	V2	Bias voltage for non-select com.driver
3	VEE	Power supply voltage for LCD(+V)
4	VDD	Power supply voltage for logic
5	FRAME	Scan start-up signal
6	VGND	Ground
7	LOAD	Data latch pulse
8	VSS	Ground
9	DF	Frame reverse signal(Alternate signal)
10	/D.OFF	H: Display on L: Display off
11	CP	Data shift pulse
12	V4	Bias voltage for none-select(seg.driver)
13	V3	Bias voltage for none-select(seg.driver)
14-17	DB3-DB0	Data bus
18	NC	None connection

ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	V _{DD} -V _{SS}	25°C	-0.3	7.0	V
LCD driving supply voltage	V _{DD} -V _{EE}	25°C	-0.3	30.0	V
Input Voltage	V _{IN}	25°C	-0.3	V _{DD} +0.3	V

ELECTRICAL CHARACTERISTICS

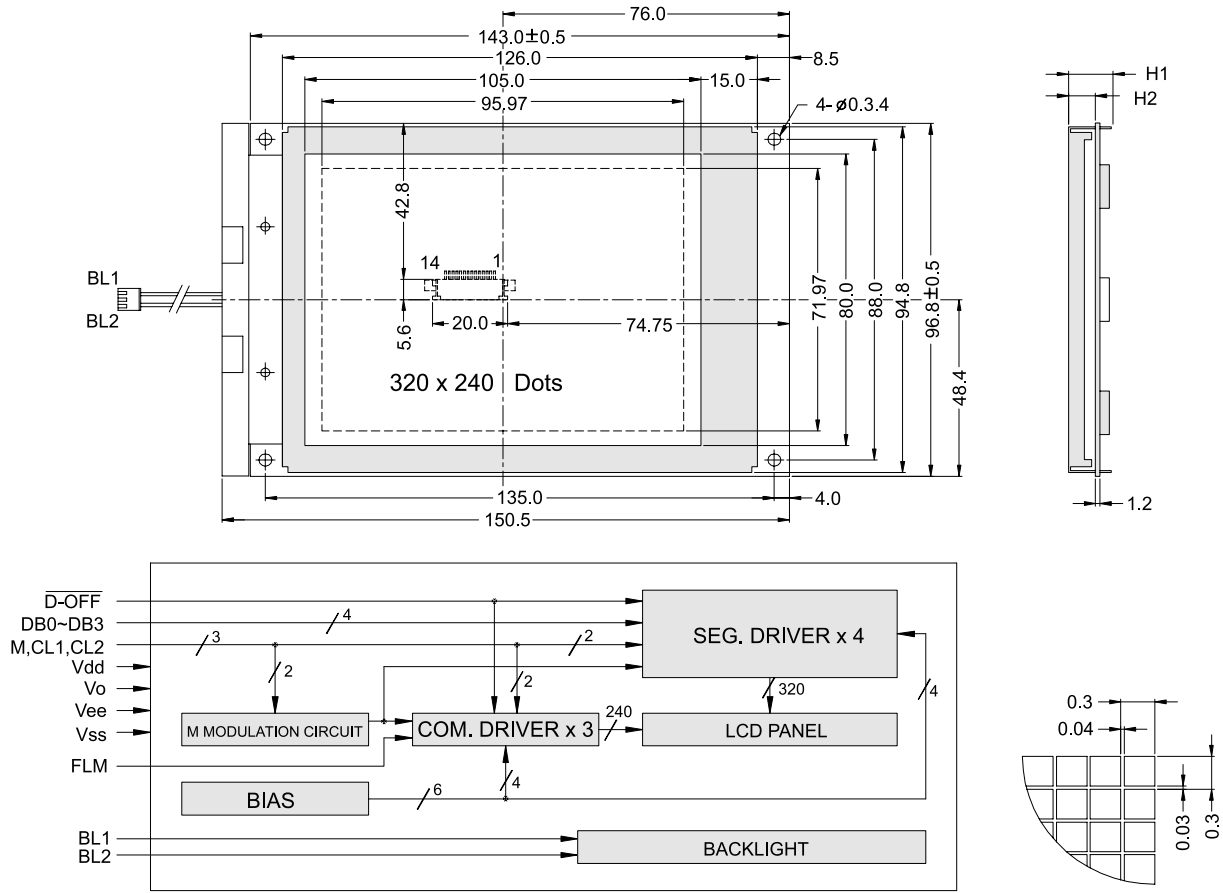
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	V _{DD} -V _{SS}	25°C	2.7	5.0	5.5	V			
LCD operation voltage	V _{OP}	T _{OP}	N	W	N	W	V		
		-20°C	-	20.2	-	20.5	-	20.8	V
		0°C	-	-	-	-	-	-	V
		25°C	-	18.2	-	18.5	-	18.8	V
		50°C	-	-	-	-	-	-	V
		70°C	-	16.2	-	16.5	-	16.8	V
LCM current consumption (No B/L)	I _{DD}	V _{DD} =5V	-	0.3	-	mA			
	I _{EE}	V _{DD} =5V	-	3.0	-	mA			
Backlight current consumption	EL	V _{OP} =5V	-	40.0	--	mA			

REMARK

LCD option: STN, FSTN

Backlight Option: EL backlight feature, other specs not available on catalog is under request.

OUTLINE DIMENSION & BLOCK DIAGRAM



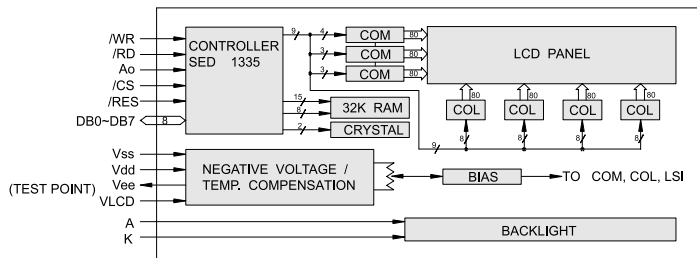
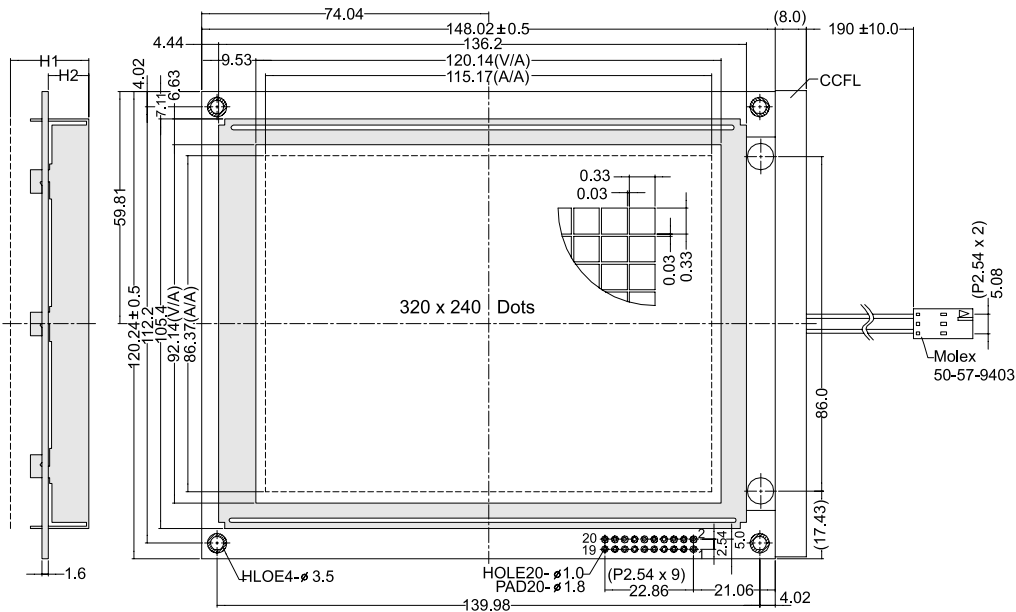
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	143.0 x 96.8	Module	H2 / H1
View Area	105.0 x 80.0	W / O B/L	5.9 / 10.1
Dot Size	0.27 x 0.27	EL B/L	5.9 / 10.1
Dot Pitch	0.30 x 0.30	LED / CCFL B/L	8.0 / 11.7

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FLM	Shift direction select
2	M	Synchronous signal input
3	CL1	Display data input clock
4	CL2	Display data input clock
5	D-OFF	Column output control
6-9	DB0-DB3	Data bus line
10	Vdd	Power supply(+)
11	Vss	Power supply(GND)
12	Vee	Negative voltage input
13	Vo	Contrast Adjust
14	FG	Frame ground

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	0	35.0	V				
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V			
LCD operation voltage	Vop	Top	N	W	N	W	V		
		-20°C	-	26.9	-	28.4	-	29.9	V
		0°C	25.5	-	27	-	28.5	-	V
		25°C	23.5	24.4	25	25.9	26.5	27.4	V
		50°C	21	-	22.5	-	24	-	V
		70°C	-	22	-	23.5	-	25	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	7	-	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	180	-	mA			
	LED/white	VB/L=3.5V	-	120	-	mA			

OUTLINE DIMENSION & BLOCK DIAGRAM



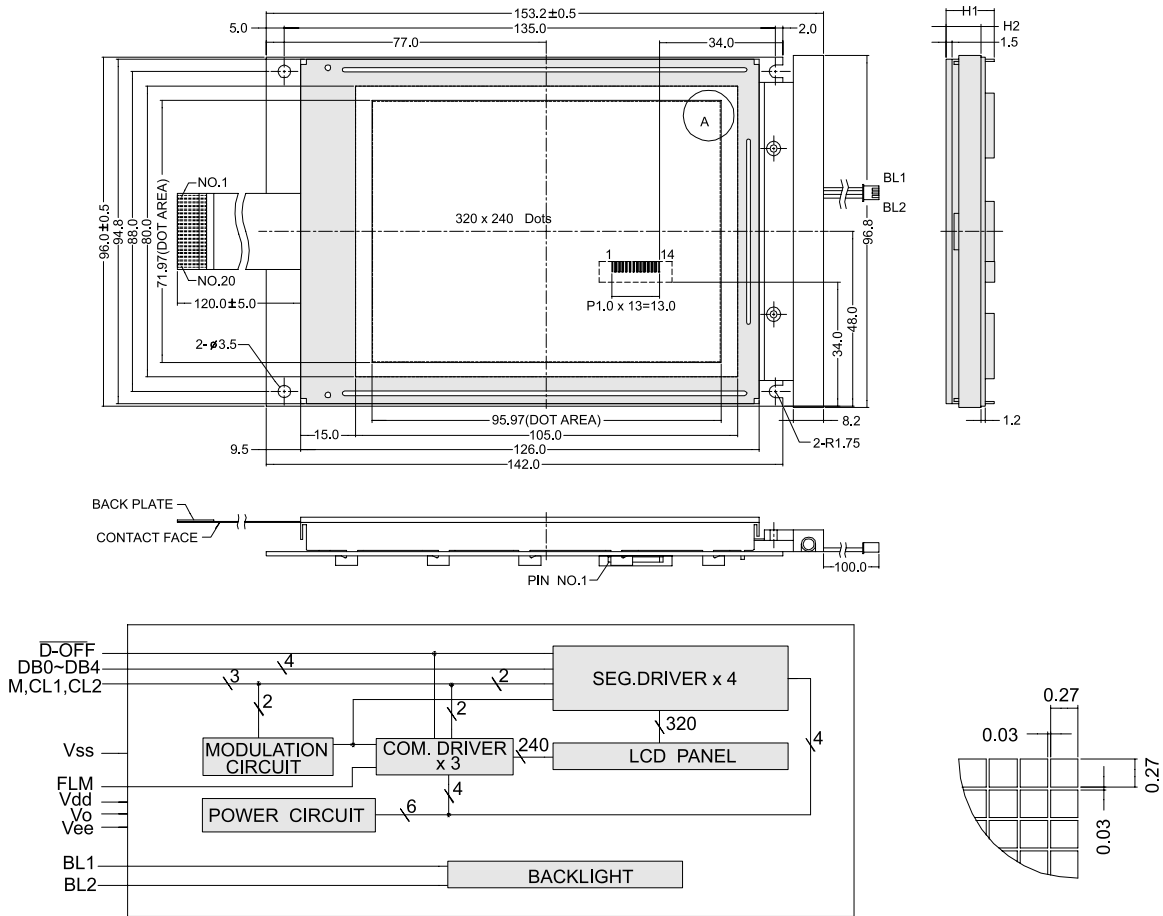
The tolerance unless classified ± 0.3mm

MECHANICAL SPECIFICATION			
Overall Size	148.02 x 120.24	Module	H2 / H1
View Area	120.14 x 92.14	W / O B/L	- / -
Dot Size	0.33 x 0.33	EL B/L	- / -
Dot Pitch	0.36 x 0.36	LED CCFL B/L	10.5 / 20.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	Vss	Power supply(GND)
2	Vdd	Power supply(+)
3	VLCD	Contrast Adjust
4	RD	Data Read
5	WR	Data Write
6	Ao	Command / Data select
7~14	DB0~DB7	Data bus line
15	CS	Chip select
16	RST	Reset
17	Vee	Negative voltage input
18	FG	Frame Ground
19/20	NC	No Connection

ABSOLUTE MAXIMUM RATING								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V			
LCD driving supply voltage	Vdd-Vee	25°C	0	35.0	V			
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V			
ELECTRICAL CHARACTERISTICS								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V		
LCD operation voltage	Vop	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	-	-	26.4	-	-	V
		25°C	-	-	24.8	-	-	V
		50°C	-	-	24.2	-	-	V
		70°C	-	-	-	-	-	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	50	-	mA		
Backlight current consumption	LED/edge	VB/L=4.2V	-	200	-	mA		
	LED/white	VB/L=3.5V	-	160	-	mA		

OUTLINE DIMENSION & BLOCK DIAGRAM



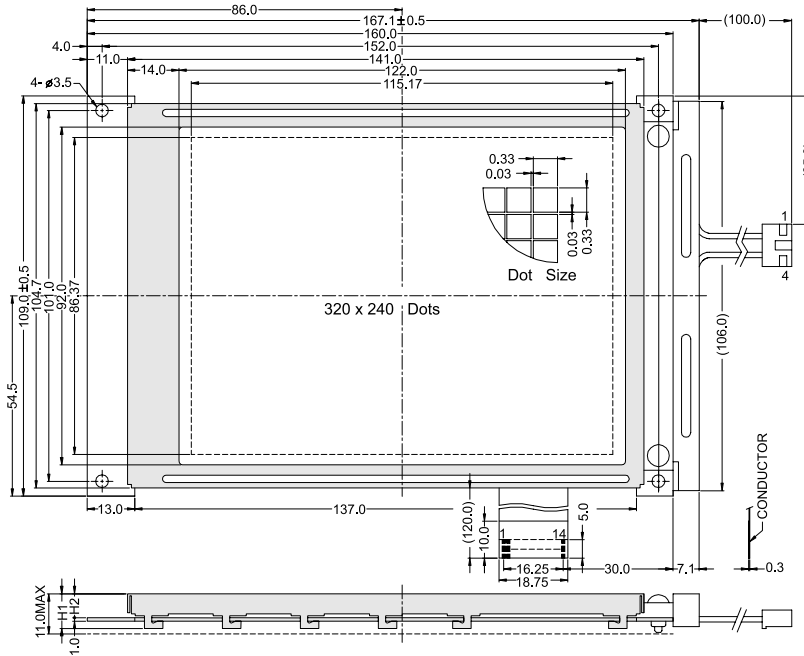
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	153.2 x 96.0	Module	H2 / H1
View Area	105.0 x 80.0	W/O B/L	- / -
Dot Size	0.27 x 0.27	EL B/L	- / -
Dot Pitch	0.30 x 0.30	LED / CCFL B/L	10.5 / 20.3

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FLM	Shift direction select
2	M	Synchronous signal input
3	CL1	Display data input clock
4	CL2	Display data input clock
5	D-OFF	Column output control
6	DB0	Data bus line
7	DB1	Data bus line
8	DB2	Data bus line
9	DB3	Data bus line
10	Vdd	Power supply(+)
11	Vss	Power supply(GND)
12	Vee	Negative voltage input
13	Vo	Contrast Adjust
14	FG	Frame ground

ABSOLUTE MAXIMUM RATING											
Item	Symbol	Condition	Min.	Max.	Units						
Supply for logic voltage	Vdd-Vss	25°C	-0.3	+7.0	V						
LCD driving supply voltage	Vdd-Vee	25°C	0	+35.0	V						
Input Voltage	Vin	25°C	-0.3	Vdd-0.3	V						
ELECTRICAL CHARACTERISTICS											
Item	Symbol	Condition	Min.	Typical	Max.	Units					
Power Supply Voltage	Vdd-Vss	25°C	4.5	-	5.5	V					
		LCD operation voltage	Top	N	W	N	W	N	W	V	
			-20°C	-	26.9	-	28.4	-	29.9	V	
		LCD operation voltage	Vop	0°C	25.5	-	27	-	28.5	-	V
				25°C	23.5	24.4	25	25.9	28.5	27.4	V
				50°C	21	-	22.5	-	24	-	V
LCD operation voltage	Vop	70°C	-	22	-	23.5	-	25	V		
		LCM current consumption (No B/L)	Idd	Vdd=5V	-	4	7	mA			
Backlight current consumption	LED/edge	VB/L=4.2V	-	180	-	mA					
	LED/white	VB/L=3.5V	-	120	-	mA					

OUTLINE DIMENSION & BLOCK DIAGRAM



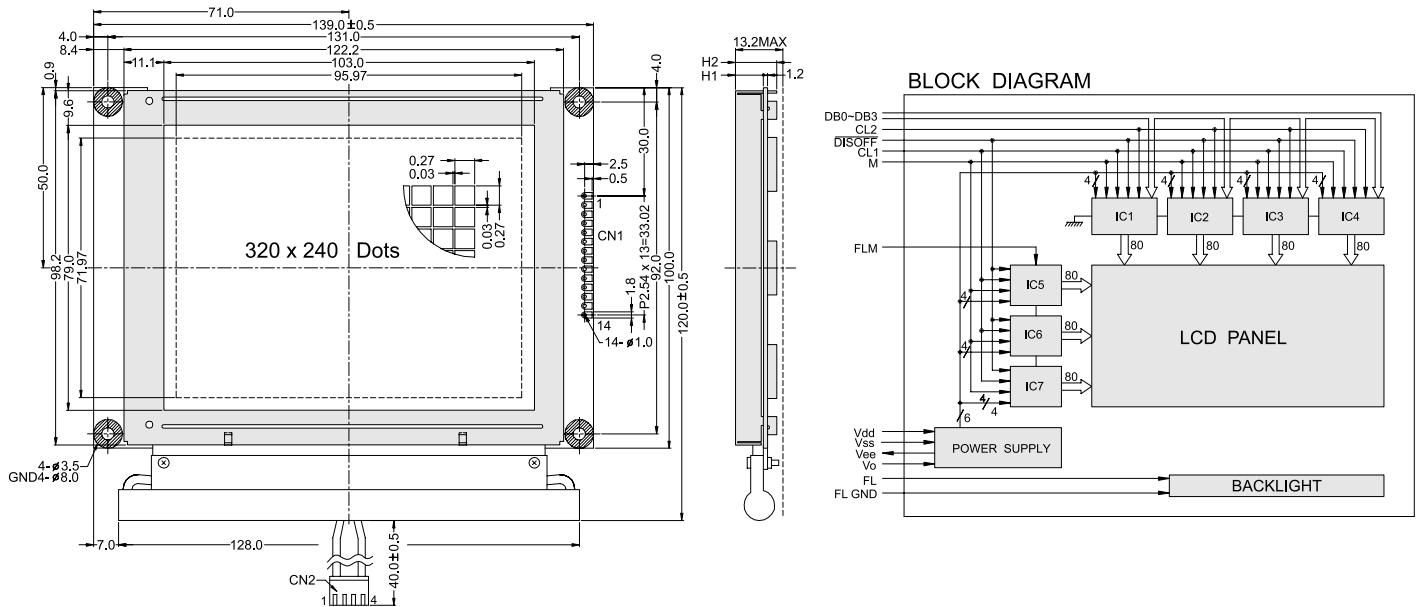
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	167.1 x 109.0	Module	H2 / H1
View Area	122.0 x 92.0	W / O B/L	- / -
Dot Size	0.33 x 0.33	EL B/L	- / -
Dot Pitch	0.36 x 0.36	CCFL B/L	6.9 / 9.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	DB0	Data bus line
2	DB1	Data bus line
3	DB2	Data bus line
4	DB3	Data bus line
5	D-OFF	Column output control
6	FLM	Shift direction select
7	N.C	No connection
8	CL1	Clock signal input
9	CL2	Clock signal input
10	Vdd	Power supply (+)
11	Vss	Power supply (GND)
12	Vee	N.V. input
13	Vo	Contrast adjust
14	FGND	Frame ground

ABSOLUTE MAXIMUM RATING										
Item	Symbol	Condition	Min.	Max.	Units					
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V					
LCD driving supply voltage	Vdd-Vee	25°C	0	35.0	V					
Input Voltage	Vin	25°C	-0.3	Vdd-0.3	V					
ELECTRICAL CHARACTERISTICS										
Item	Symbol	Condition	Min.	Typical	Max.	Units				
Power Supply Voltage	Vdd-Vss	25°C	4.5	-	5.5	V				
		LCD operation voltage	Top	N	W	N	W	N	W	V
			-20°C	-	-	-	31.1	-	-	V
		0°C	-	-	-	-	-	-	V	
		25°C	-	-	-	24.5	-	-	V	
		50°C	-	-	-	-	-	-	V	
70°C	-	-	-	20.5	-	-	V			
LCM current consumption (No B/L)	Idd	Vdd=5V	-	3.5	7	mA				
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA				
	LED/array	VB/L=4.2V	-	-	-	mA				

OUTLINE DIMENSION & BLOCK DIAGRAM



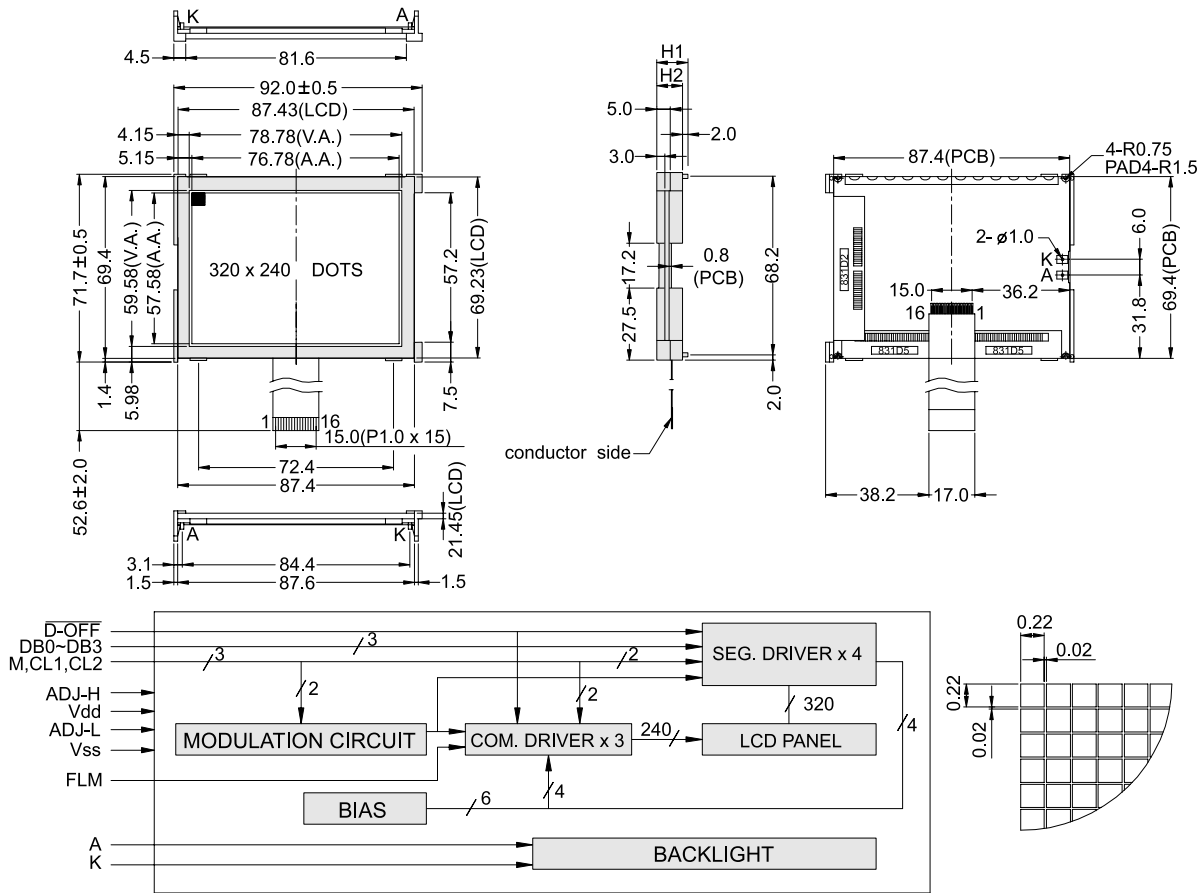
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	139.0 x 120.0	Module	H2 / H1
View Area	103.0 x 79.0	W / O B/L	- / -
Dot Size	0.27 x 0.27	EL B/L	- / -
Dot Pitch	0.30 x 0.30	CCFL B/L	7.8 / 11.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FLM	Shift direction select
2	CL1	Colck signal input
3	CL2	Colck signal input
4	M	Command / Data select
5	Vo	Contrast adjust
6	Vdd	Power supply (+)
7	Vss	Power supply (GND)
8	Vee	Negative voltage output
9	DB0	Data bus line
10	DB1	Data bus line
11	DB2	Data bus line
12	DB3	Data bus line
13	DISPOFF	Clumn output control
14	N.C.	No connection

ABSOLUTE MAXIMUM RATING								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V			
LCD driving supply voltage	Vdd-Vee	25°C	0	35.0	V			
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V			
ELECTRICAL CHARACTERISTICS								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	4.5	-	5.5	V		
LCD operation voltage	Vop	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	-	-	30	-	31.2	V
		25°C	22.8	-	24	-	25.2	V
		50°C	18.8	-	20	-	-	V
70°C	-	-	-	-	-	V		
LCM current consumption (No B/L)	Idd	Vdd=5V	-	3.5	7	mA		
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA		
	LED/array	VB/L=4.2V	-	-	-	mA		

OUTLINE DIMENSION & BLOCK DIAGRAM



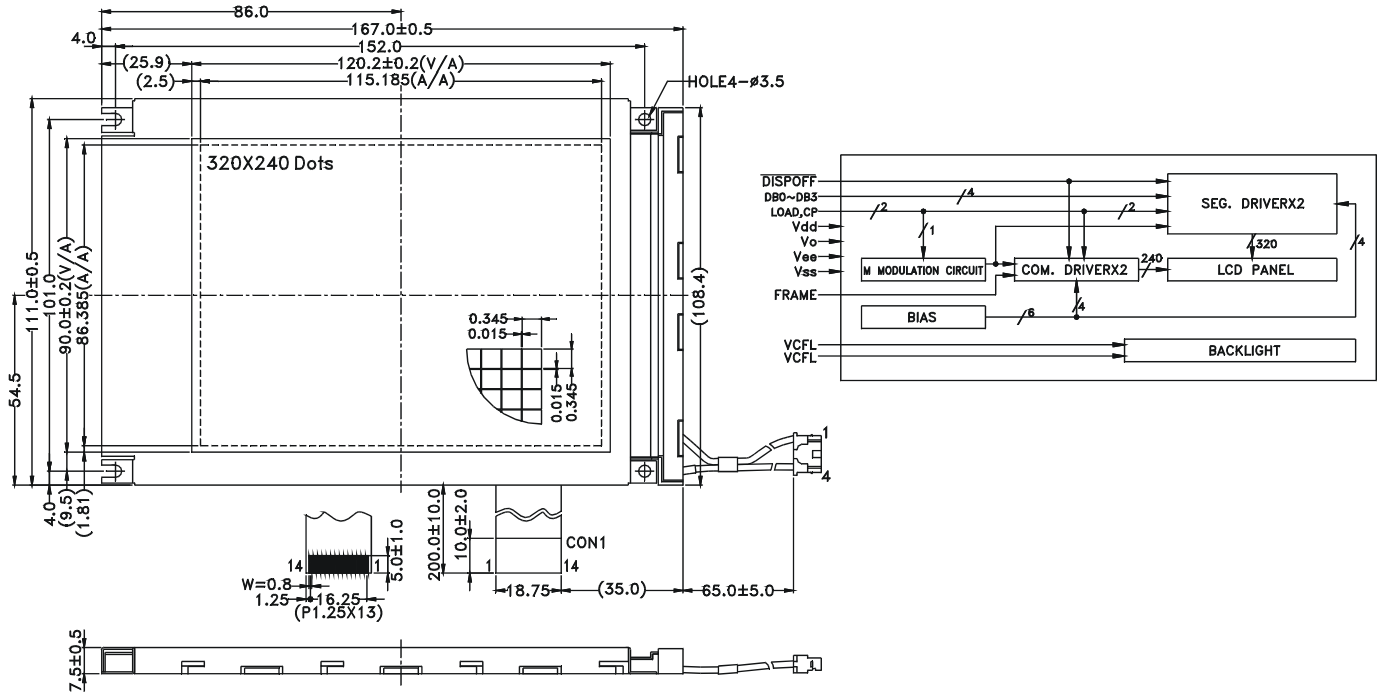
The tolerance unless classified $\pm 0.3\text{mm}$

MECHANICAL SPECIFICATION			
Overall Size	92.0 x 71.7	Module	H2 / H1
View Area	78.78 x 59.58	W / O B/L	- / -
Dot Size	0.22 x 0.22	EL B/L	2.7 / 4.9
Dot Pitch	0.24 x 0.24	LED B/L	9.5 / 11.5

PIN ASSIGNMENT		
Pin no.	Symbol	Function
1	FLM	Shift direction select
2	M	Alternation Control signal
3	CL1	Display data input clock
4	CL2	Display data input clock
5	D-OFF	Display enable
6	DB0	Data bus line
7	DB1	Data bus line
8	DB2	Data bus line
9	DB3	Data bus line
10	Vdd	Power supply(+5V)
11	Vss	Power supply(GND)
12	Adj-H	Contrast adjust (1)
13	Adj-L	Contrast adjust (2)
14	NC/EL-EN	No connection / EL-enable
15	A	Power supply for LED B/L (+)
16	K	Power supply for LED B/L (-)

ABSOLUTE MAXIMUM RATING											
Item	Symbol	Condition	Min.	Max.	Units						
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V						
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	45.0	V						
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V						
ELECTRICAL CHARACTERISTICS											
Item	Symbol	Condition	Min.	Typical	Max.	Units					
Power supply voltage	Vdd-Vss	25°C	2.5	-	5.5	V					
		LCD operation voltage	Vop	Top	N	W	N	W	V		
				-20°C	-	-	-	-	V		
				0°C	-	22.9	-	23.6	-	24.3	V
				25°C	-	22	-	22.7	-	23.3	V
				50°C	-	21.1	-	21.7	-	22.4	V
70°C	-	-	-	-	-	V					
LCM current consumption (No B/L)	Idd	Vdd=5V	-	13	-	mA					
Backlight current consumption	LED/edge	VB/L=4.2V	-	70	-	mA					
	LED/array	VB/L=4.2V	-	-	-	mA					

OUTLINE DIMENSION & BLOCK DIAGRAM



MECHANICAL SPECIFICATION			
Overall Size	167.0 x 111.0 mm	Module	H2 / H1
View Area	120.2 x 90.0 mm	W/O B/L	- / -
Dot Size	0.345 x 0.345 mm	EL B/L	- / -
Dot Pitch	0.360 x 0.360 mm	CCFL B/L	- / 7.5 mm

PIN ASSIGNMENT		
Pin No.	Symbol	Function
1	DB0	Data input
2	DB1	Data input
3	DB2	Data input
4	DB3	Data input
5	/DISPOFF	Driver on(H)/off(L) enable
6	FRAME	First line mark
7	NC	No connection
8	LOAD	Input data latch signal
9	CP	Data input shift signal
10	V _{DD}	Logic power supply
11	V _{SS}	Ground
12	V _{EE}	Negative voltage
13	V _O	Contrast adjust
14	V _{SS}	Ground

ABSOLUTE MAXIMUM RATING									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	V _{DD} -V _{SS}	25°C	4.75	5.25	V				
LCD driving supply voltage	V _{DD} -V _{EE}	25°C	22.0	23.4	V				
Input Voltage	V _{IN}	25°C	-0.4	V _{DD} +0.3	V				
ELECTRICAL CHARACTERISTICS									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	V _{DD} -V _{SS}	25°C	2.7	5.0	5.5	V			
LCD operation voltage (V _{DD} =5v)	V _{OP}	T _{OP}	N	W	N	W	V		
		-20°C	-	23.5	-	24.0	-	24.5	V
		0°C	-	-	-	-	-	-	V
		25°C	-	22.5	-	23.0	-	23.5	V
		50°C	-	-	-	-	-	-	V
		70°C	-	20.5	-	21.0	-	21.5	V
LCM current consumption (No B/L)	I _{DD}	V _{DD} =5V	-	1.0	2.0	mA			
	I _{EE}	V _{DD} =5V	-	4.0	10.0	mA			
Backlight current consumption	White LED	B/L=3.3V	-	160	--	mA			

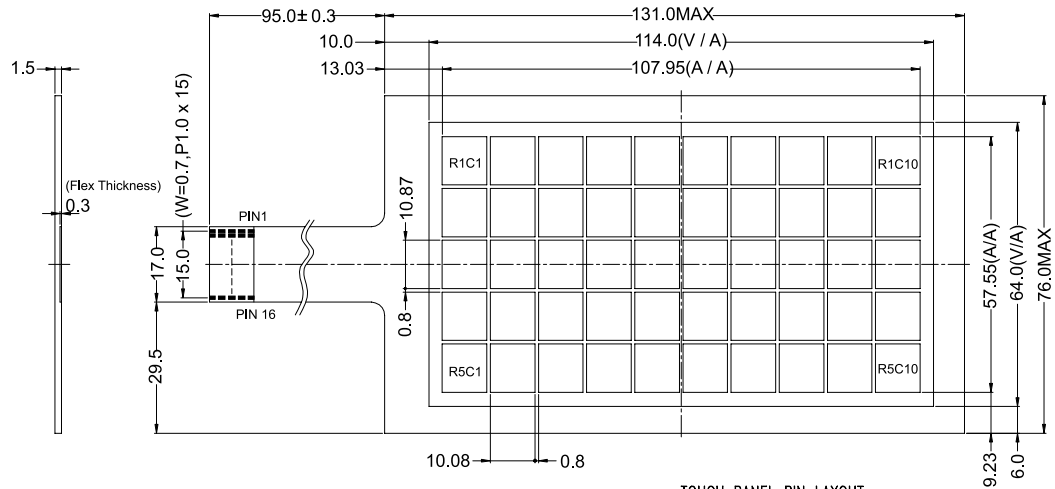
REMARK

LCD option: STN, FSTN

Backlight Option: CCFL, white LED backlight

OUTLINE DIMENSION & BLOCK DIAGRAM

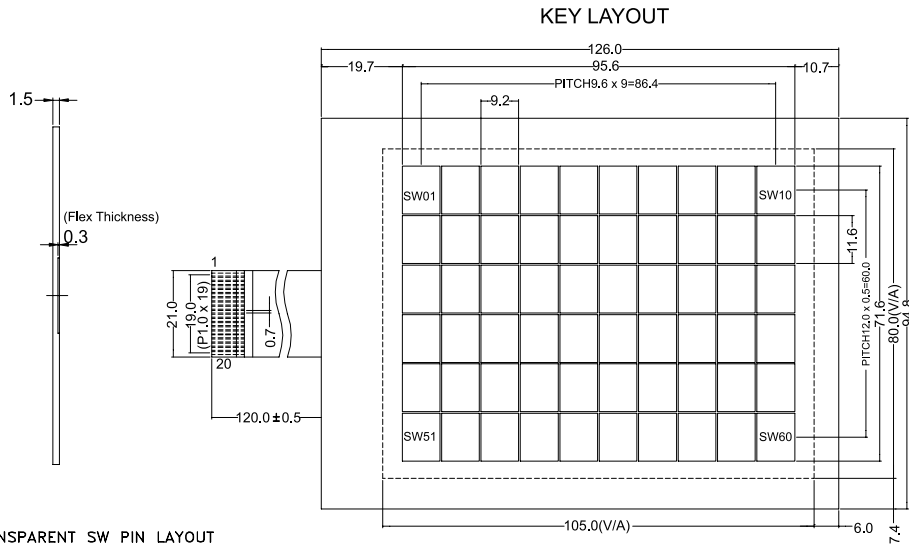
◆ For RG 240128-A/B



TOUCH PANEL PIN LAYOUT

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	COL5	9	ROW4
2	COL4	10	ROW5
3	COL3	11	COL6
4	COL2	12	COL7
5	COL1	13	COL8
6	ROW1	14	COL9
7	ROW2	15	COL10
8	ROW3	12	DUMMY

◆ For RG 320240-C/E



KEY LAYOUT

TRANSPARENT SW PIN LAYOUT

NO.	SYMBOL	NO.	SYMBOL
1	DUMMY	11	R4
2	DUMMY	12	R5
3	C10	13	R6
4	C9	14	C1
5	C8	15	C2
6	C7	16	C3
7	C6	17	C4
8	R1	18	C5
9	R2	19	DUMMY
10	R3	20	DUMMY

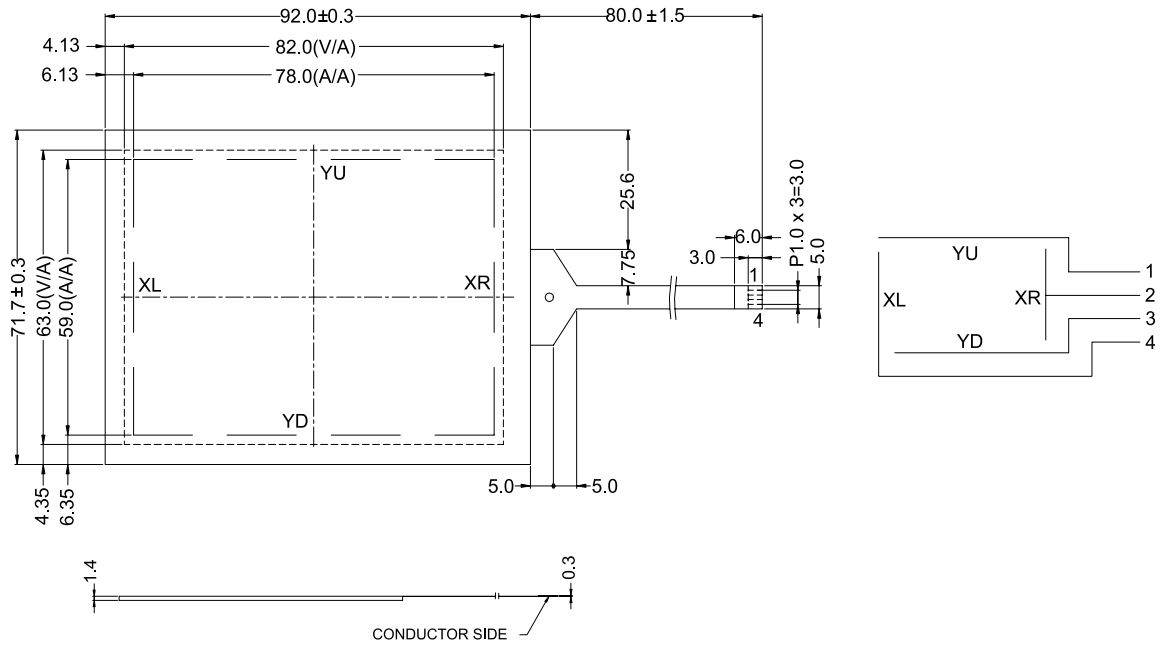
KEY MATRIX

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
R1	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW08	SW09	SW10
R2	SW11	SW12	SW13	SW14	SW15	SW16	SW17	SW18	SW19	SW20
R3	SW21	SW22	SW23	SW24	SW25	SW26	SW27	SW28	SW29	SW30
R4	SW31	SW32	SW33	SW34	SW35	SW36	SW37	SW38	SW39	SW40
R5	SW41	SW42	SW43	SW44	SW45	SW46	SW47	SW48	SW49	SW50
R6	SW51	SW52	SW53	SW54	SW55	SW56	SW57	SW58	SW59	SW60

The tolerance unless classified $\pm 0.2\text{mm}$

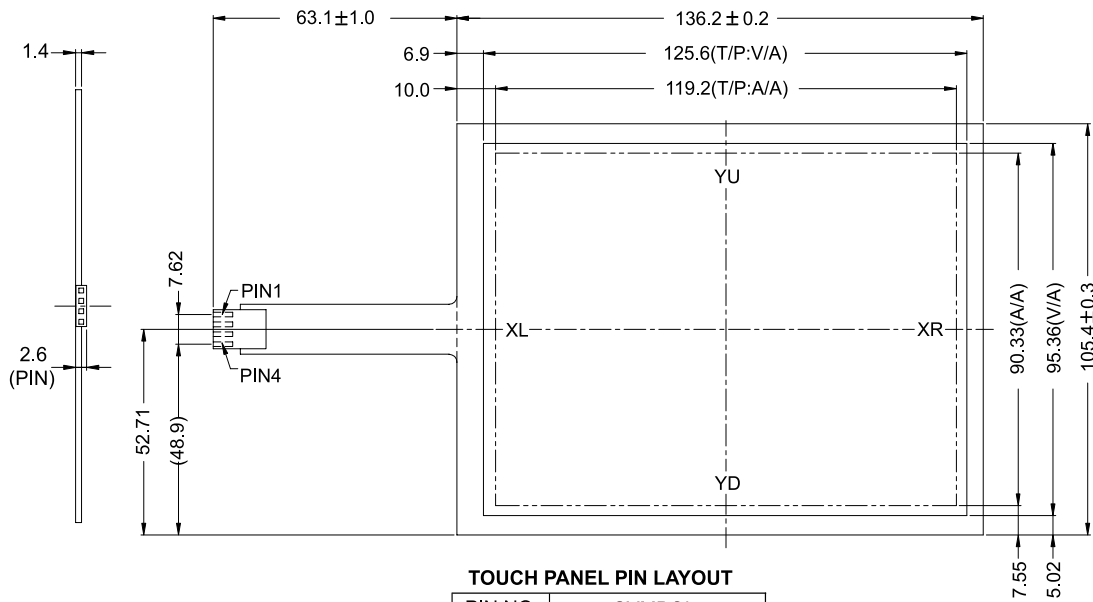
OUTLINE DIMENSION & BLOCK DIAGRAM

◆ For RG 320240-H



The tolerance unless classified $\pm 0.2\text{mm}$

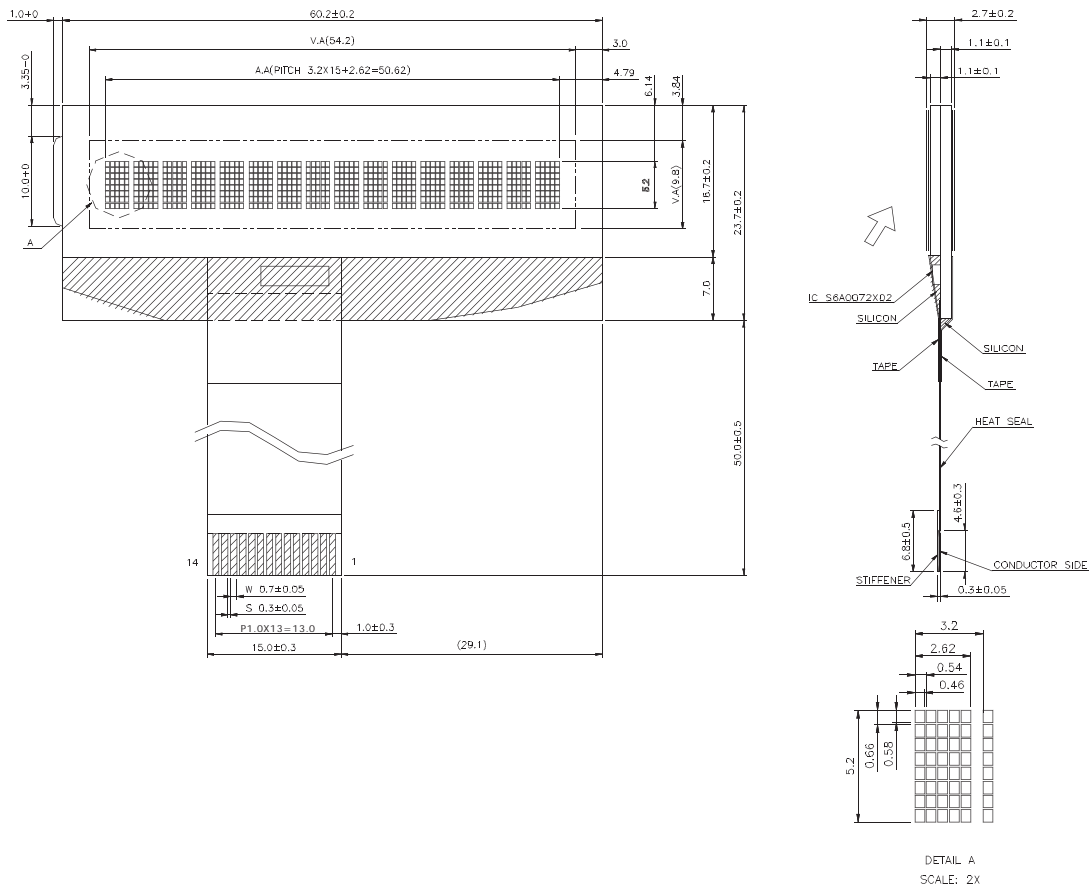
◆ For RG 320240-D



TOUCH PANEL PIN LAYOUT

PIN NO.	SYMBOL
1	YU
2	YD
3	XL
4	XR

The tolerance unless classified $\pm 0.2\text{mm}$

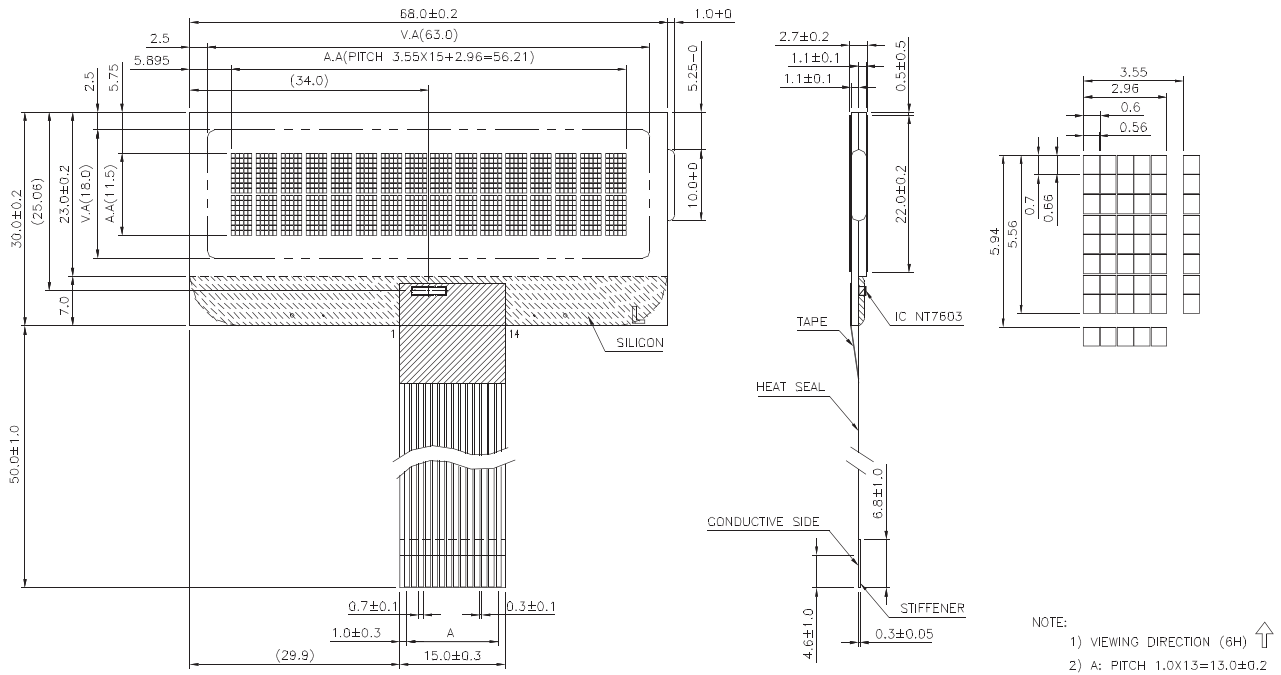


Features:

- Duty ration: 1/16
- LCD option: TN
- Backlight option: None (-/2.7)
- Controller IC: S6A0072X

Pin Assignment		
1	VSS	Ground
2	Vdd	Power supply (+)
3	Vo	Contrast Adjust
4	RS	Register select signal
5	R/W	Data read/ write
6	E	Enable signal
7	DB0	Data bus
8	DB1	Data bus
9	DB2	Data bus
10	DB3	Data bus
11	DB4	Data bus
12	DB5	Data bus
13	DB6	Data bus
14	DB7	Data bus

Absolute Maximum Rating							
Item	Symbol	Condition	Min.	Max.	Units		
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7	V		
LCD driving supply voltage	Vdd-Vee	25°C	-0.3	13	V		
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V		
Electrical Characteristics							
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	Vdd-Vss	25°C	2.7	-	4.5	V	
LCD operation voltage	Vop	Top	N	W	N	W	V
		-20°C	-	-	-	-	V
		0°C	-	-	-	-	V
		25°C	-	-	3.7	-	V
		50°C	-	-	-	-	V
70°C	-	-	-	-	V		
LCM current consumption (No B/L)	Idd	Vdd=5.0V	-	1.2	-	mA	
Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA	
	LED/array	VB/L=4.2V	-	-	-	mA	



Features:

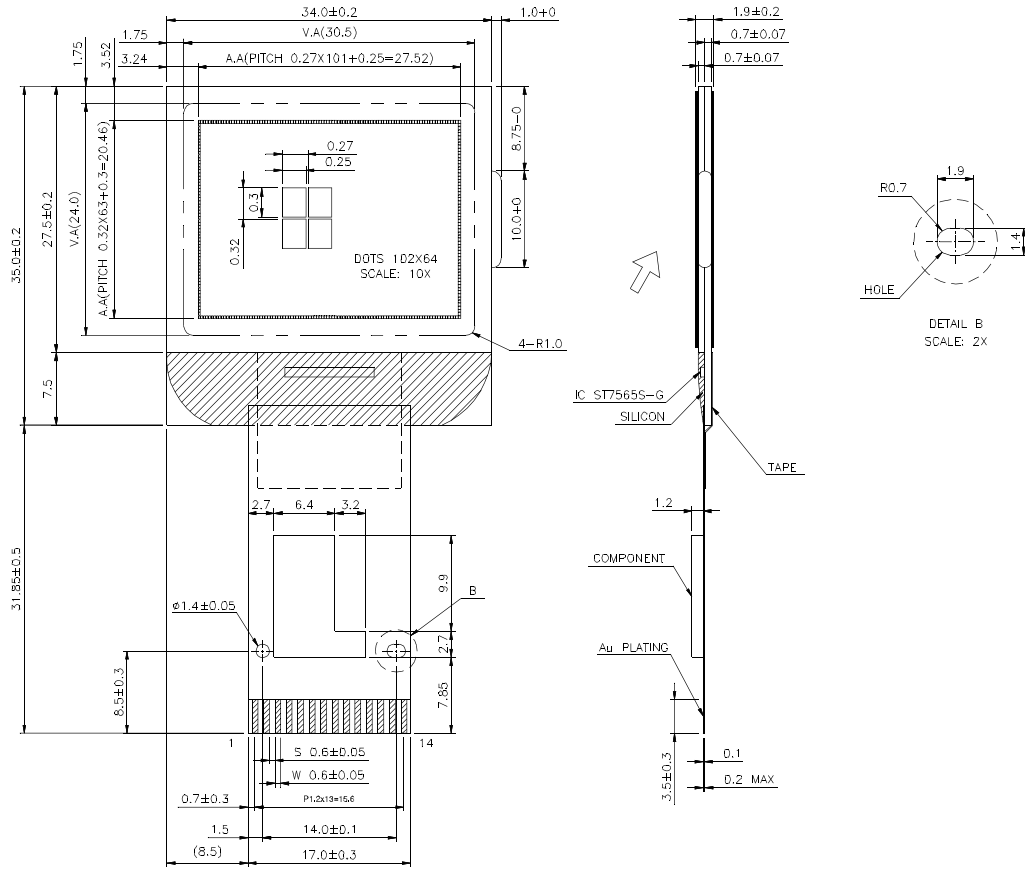
- Duty ratio: 1/16
- LCD option: TN, STN
- Backlight option(H2/H1mm): none(-/2.8)
- Controller IC: NT7603

Address code:

Display position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Address line 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Address line 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

Pin Assignment		
Pin no.	Symbol	Function
1	VSS	Power supply (GNP)
2	VO	Contrast Adjustment
3	VDD	Power supply (+)
4	RS	Register select signal
5	R/W	Read/write selection
6	E	Enable signal
7	DB0	Data bus
8	DB1	Data bus
9	DB2	Data bus
10	DB3	Data bus
11	DB4	Data bus
12	DB5	Data bus
13	DB6	Data bus
14	DB7	Data bus

Absolute Maximum Rating								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	VDD-VSS	25°C	-0.3	7.0	V			
LCD driving supply voltage	VDD-VEE	25°C	3.0	VDD	V			
Input Voltage	VIN	25°C	-0.3	+0.3	V			
Electrical Characteristics								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	VDD-VSS	25°C	4.75	5.0	5.25	V		
LCD operation voltage	VOP	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	-	-	-	-	V	
		25°C	-	4.3	-	4.5	-	V
		50°C	-	-	-	-	-	V
LCM current consumption (No B/L)	I _{dd}	V _{dd} =5V	-	0.5	1.5	mA		
	Backlight current consumption	LED/edge	VB/L=4.2V	-	-	-	mA	
LED/array		VB/L=4.2V	-	-	-	mA		



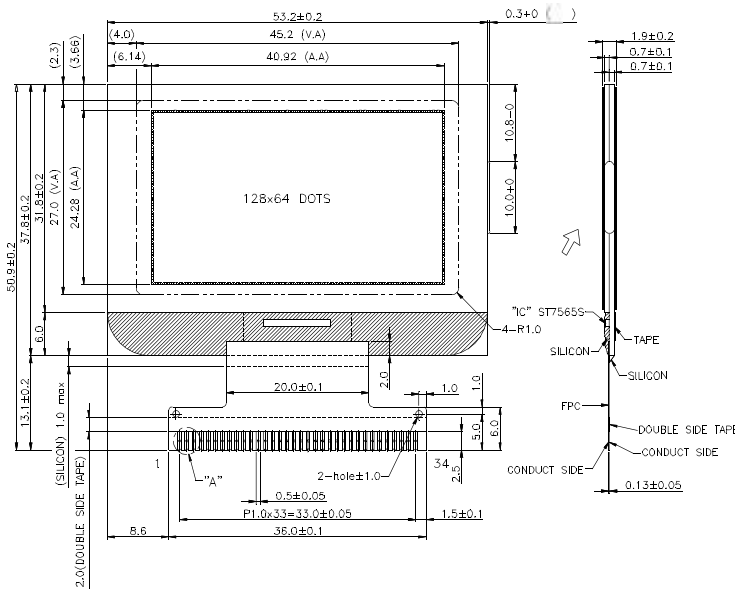
Features:

- Resolution: 102S*64C Dots
- Duty ratio: 1/65
- LCD Option: FSTN
- Backlight option (H2/H1): None(-/1.9)
- Controller IC: ST7565S
- Serial interface
- Built-in components

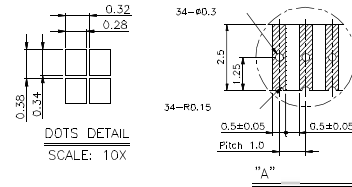
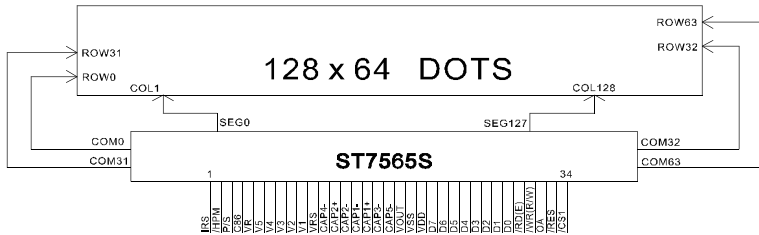
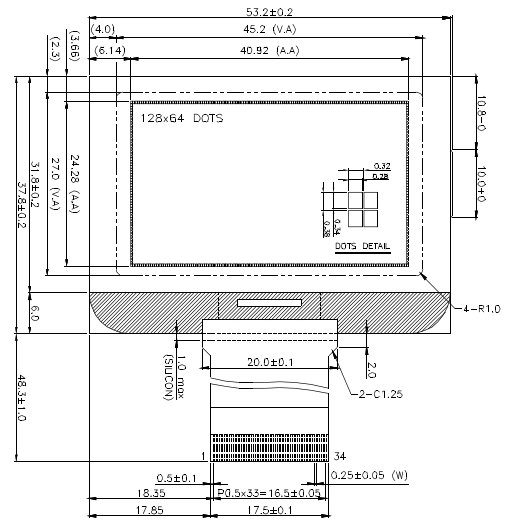
Pin Assignment		
Pin No.	Symbol	Function
1	NC	No connection
2	NC	No connection
3	VDD	Power supply (+)
4	VSS	Ground
5	SID	D7 serial data input
6	SOLE	D6 serial clock input
7	RS	Display/ control data select
8	RESETB	Reset pin
9	CS1B	Chip select signal
10	VSS	Ground
11	VSS	Ground
12	VSS	Ground
13	NC	No connection
14	NC	No connection

Absolute Maximum Rating								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	VDD-VSS	25°C	-0.3	5.0	V			
LCD driving supply voltage	VDD-VEE	25°C	-4.0	-13	V			
Input Voltage	VIN	25°C	-0.3	Vdd+0.3	V			
Electrical Characteristics								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	VDD-VSS	25°C	-	3.0	-	V		
LCD operation voltage	VOP	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	-	-	-	-	V	
		25°C	-	9.8	-	10.0	10.2	V
		50°C	-	-	-	-	-	V
		70°C	-	-	-	-	V	
LCM current consumption (No B/L)	Idd	Vdd=3.0V	-	0.5	1.3	mA		

RE12864-001



RE12864-001-C1



Features:

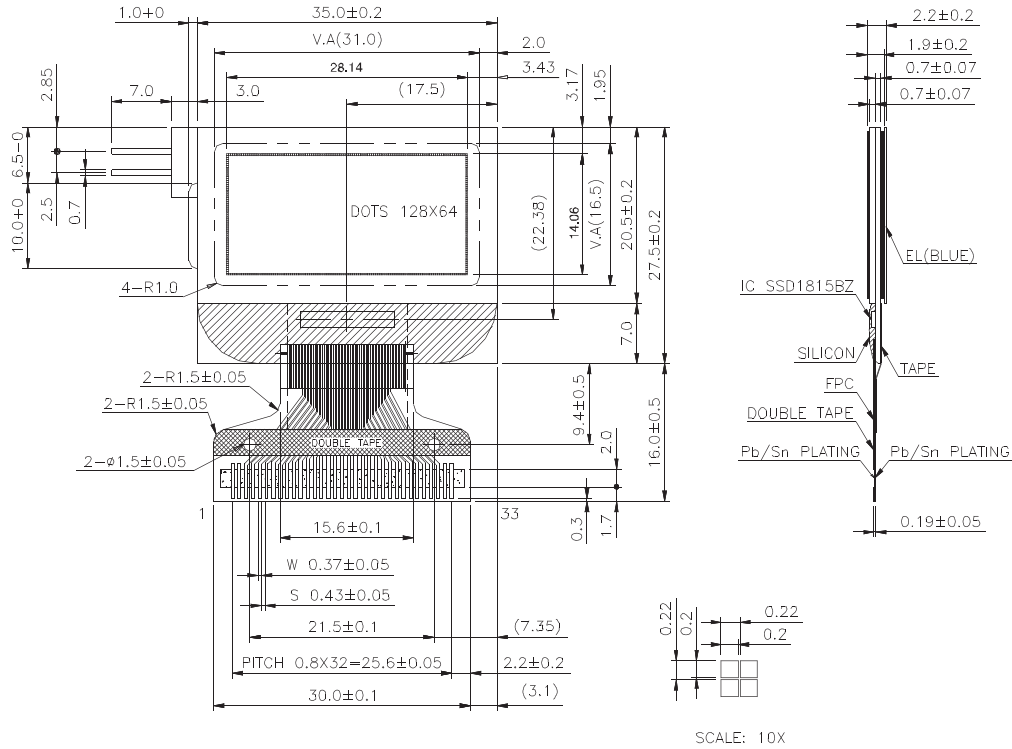
- Resolution: 128S*64C Dots
- Duty ratio:1/64
- LCD option: STN, FSTN
- Backlight option(H2/H1mm): None(-/1.9), LED(5.0/6.0)
- Controller IC:ST7565S

Optional:

- RE12864LRF-001-H-C1, with FPC cable for ZIF connector, LED backlight built-in.

Pin Assignment		
Pin no.	Symbol	Function
1	IRS	Selection to voltage
2	HPM	Power control terminal
3	P/S	Selection to parallel/serial data input
4	C86	Switch to 6800 or 8080 MPU interface
5	VR	Contrast adjust
6~10	V1~V5	Multi-level power supply for LCD
11	VRS	Power supply for LCD voltage regulator
12~18	CAP	Capacitor selection to DC/DC voltage
19	VOUT	DC/DC converter
20	VSS	Ground
21	VDD	Power supply
22~29	D0~D7	Data bus
30	RD(E)	Read enable
31	WR(R/w)	Read/write selection
32	A0	Selection to display or control data
33	/RES	Reset
34	/CS1	Chip selection

Absolute Maximum Rating								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	5.0	V			
LCD driving supply voltage	Vdd-Vee	25°C	-4.0	-13.0	V			
Input Voltage	Vin	25°C	-0.3	Vdd+0.3	V			
Electrical Characteristics								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	3.2	3.3	3.4	V		
LCD operation voltage	Vop	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	-	-	-	-	V	
		25°C	-	9.4	-	9.6	-	V
		50°C	-	-	-	-	-	V
70°C	-	-	-	-	-	V		
LCM current consumption (No B/L)	Idd	Vdd=3.3V	-	0.27	0.55	mA		
Backlight current consumption	LED/edge	V B/L=2.1V	-	4.0	-	mA		



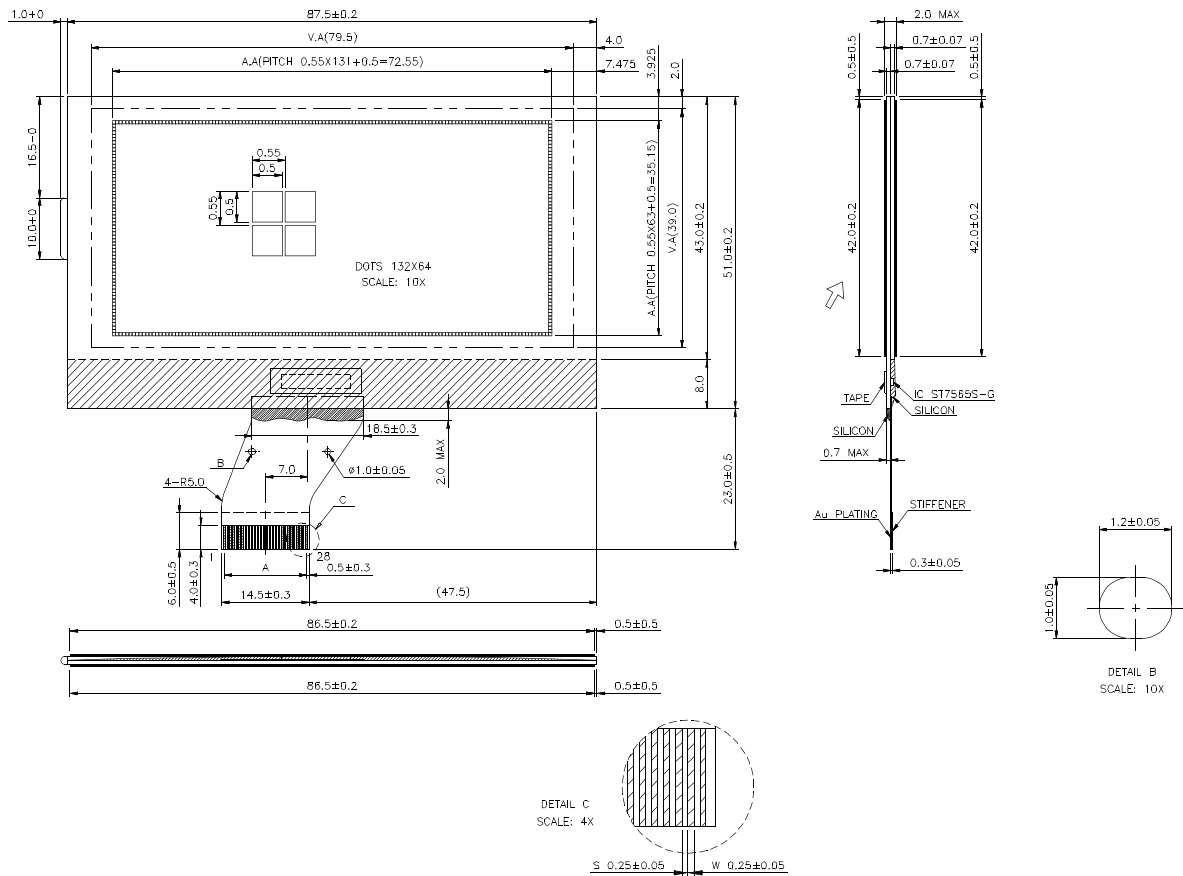
SCALE: 10X

Features:

- Resolution: 128S*64C Dots
- Duty ratio: 1/65
- LCD Option: FSTN
- Backlight option (H2/H1): EL (-/2.2)
- Controller IC: SSD1815BZ

Pin Assignment			
Pin No.	Symbol	Pin No	Symbol
1	NC	18	VSS
2	NC	19	D7
3	VDD	20	D6
4	P/S	21	D5
5	C68/80	22	D4
6	VSS	23	D3
7	VL6	24	D2
8	VL5	25	D1
9	VL4	26	D0
10	VL3	27	E/RD
11	VL2	28	R/W
12	C2P	29	D/C
13	C2N	30	/RES
14	C1N	31	/CS1
15	C1P	32	NC
16	C3N	33	NC
17	VEE		

Absolute Maximum Rating									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	Vdd-Vss	25°C	-0.3	4.0	V				
LCD driving supply voltage	Vdd-Vee	25°C	-12.0	-1.8	V				
Input Voltage	Vin	25°C	Vss-0.3	Vdd+0.3	V				
Electrical Characteristics									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	Vdd-VSS	25°C	-	2.8	-	V			
		Top	N	W	N	W	N	W	V
LCD operation voltage	Vop	-20°C	-	-	-	-	V		
		0°C	-	-	-	-	-	V	
		25°C	-	9.8	-	10.0	-	10.2	V
		50°C	-	-	-	-	-	V	
		70°C	-	-	-	-	-	V	
LCM current consumption (No B/L)	Idd	Vdd=2.8V	-	0.23	0.45	mA			

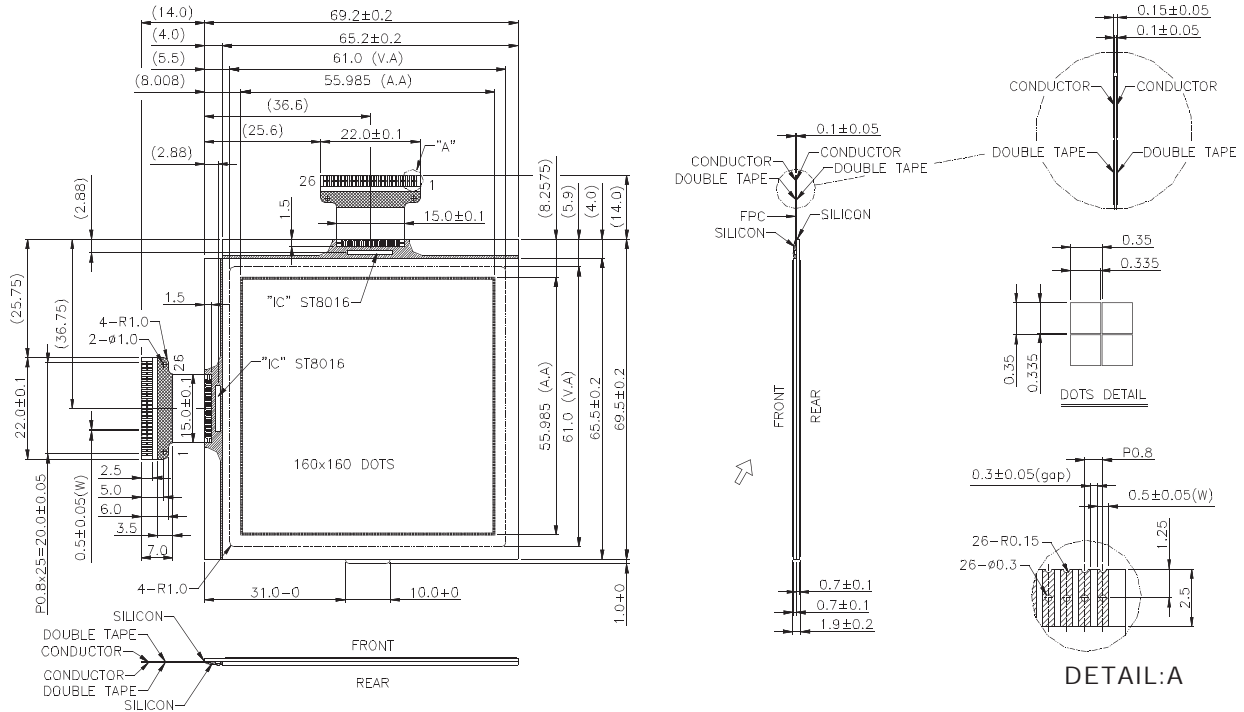


Features:

- Resolution: 132S*64C Dots
 - Duty ratio: 1/65
 - LCD Option: STN
 - Backlight option (H2/H1): None (-/2.0)
- Controller IC: ST7565S

Pin Assignment			
Pin No.	Symbol	Pin No.	Symbol
1	/CS1	15	VSS
2	/RES	16	VOUT
3	AO	17	CAP3-
4	/WR	18	CAP1+
5	/RD	19	CAP1-
6	D0	20	CAP2-
7	D1	21	CAP2+
8	D2	22	CAP4-
9	D3	23	V1
10	D4	24	V2
11	D5	25	V3
12	D6	26	V4
13	D7	27	V5
14	VDD	28	VR

Absolute Maximum Rating								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	5.0	V			
LCD driving supply voltage	Vdd-Vee	25°C	-13.0	+0.3	V			
Input voltage	Vin	25°C	-0.3	Vdd+0.3	V			
Electrical Characteristics								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	3.1	3.3	3.5	V		
LCD operation voltage	Vop	Top	N	W	N	W	V	
		-20°C	-	-	-	-	V	
		0°C	-	-	-	-	V	
		25°C	-	8.85	-	9.0	9.15	V
		50°C	-	-	-	-	V	
		70°C	-	-	-	-	V	
LCM current consumption (No B/L)	Idd	Vdd=3.3V	-	1.1	1.65	mA		



Features:

- Resolution: 160S*160C Dots
- Duty ratio: 1/160
- LCD option: FSTN
- Backlight option(H2/H1mm): None(-/1.9)

Pin Assignment

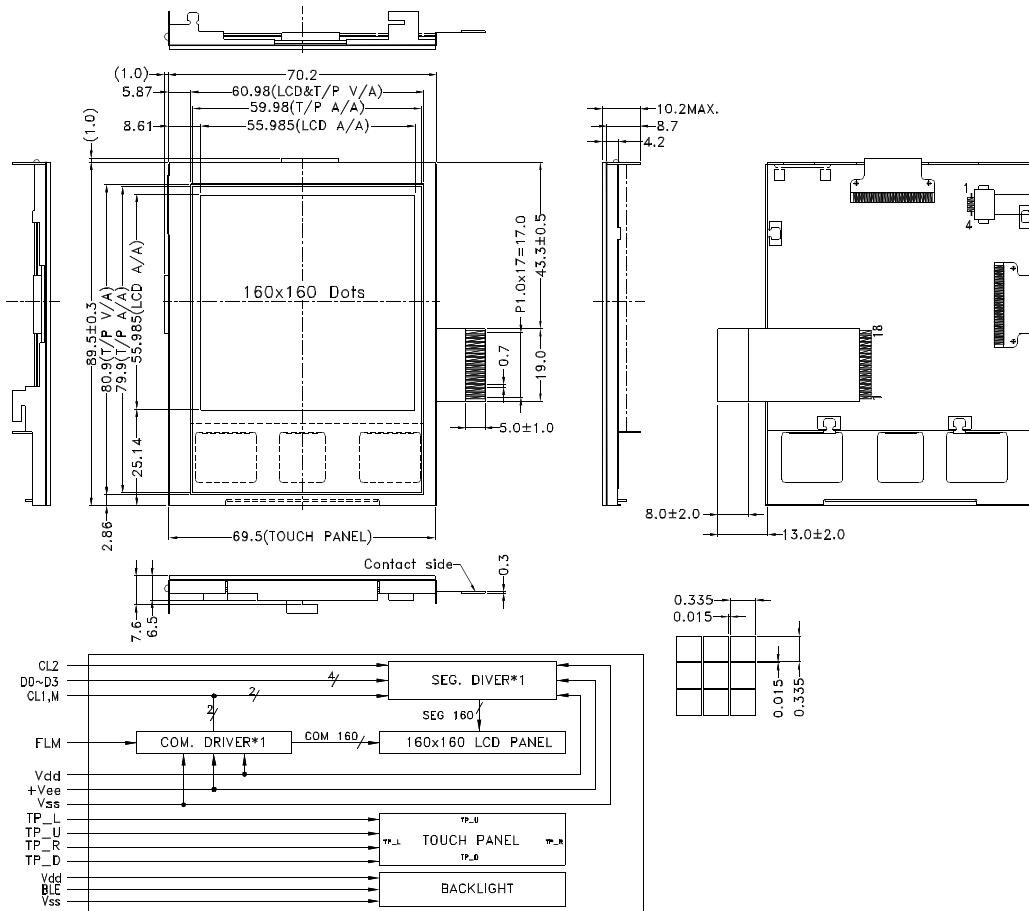
Pin No.	Symbol	Function
1~3	V0R,V12R,V43R	Bias power supply for LCD drive voltage
4	VSS	Ground
5	MD	Mode selection
6	FR	AC signal input for LCD drive waveform
7	EI01	Input/output for chip selection
8	LP	Latch pulse input for display data
9	DISPOFF	Control input for output of non-select
10	XCK	Clock input for taking display data
11~18	DI7~DI0	Display data input
19	EIO2	Input/output selection
20	S/C	Segment/common mode selection
21	VDD	Logic power supply
22	L/R	Input selection to reading direction
23	VSS	Ground
24~26	V43L,V12L,V0L	Bias power supply for LCD drive voltage

Absolute Maximum Rating

Item	Symbol	Condition	Min.	Max.	Units
Supply for logic voltage	V _{dd} -V _{ss}	25°C	-0.3	7.0	V
LCD driving supply voltage	V ₅ -V _{ss}	25°C	-0.3	+30.0	V
Input Voltage	V _{IN}	25°C	-0.3	V _{DD} +0.3	V

Electrical Characteristics

Item	Symbol	Condition	Min.	Typical	Max.	Units				
Power supply voltage	V _{dd} -V _{ss}	25°C	2.7	3.0	5.5	V				
LCD operation voltage	V _{OP}	Top	N	W	N	W	N	W	V	
		-20°C	-	-	-	20.6	-	-	-	V
		0°C	-	-	-	-	-	-	-	V
		25°C	-	-	-	19.0	-	-	-	V
		50°C	-	-	-	-	-	-	-	V
		70°C	-	-	-	17.0	-	-	V	
LCM current consumption (No B/L)	I _{dd}	V _{dd} =3.0V	-	0.1	-	mA				
	I _{ee}	V _{ee} =19.0V	-	4.0	-	mA				
Backlight current consumption	-	-	-	-	-	mA				



Features:

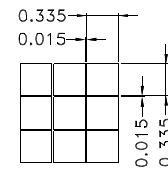
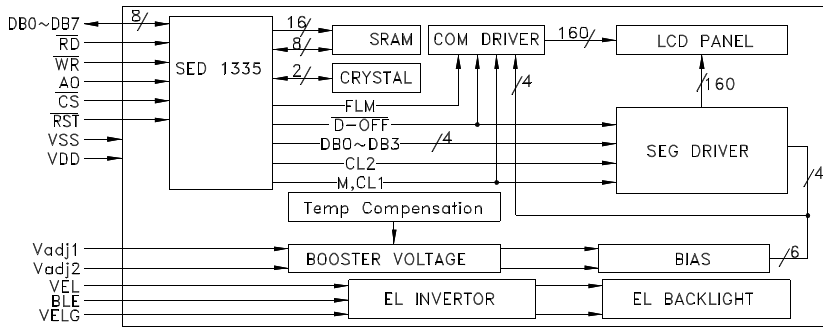
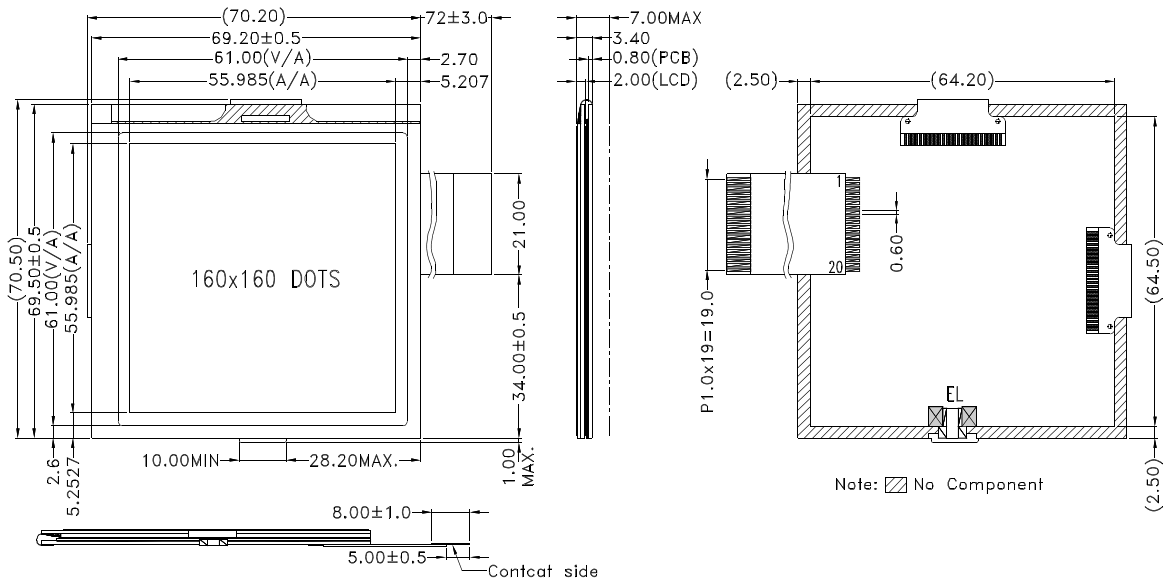
- Resolution: 160S*160C Dots
- Duty ratio: 1/160
- LCD option: FSTN
- Backlight option(H2/H1mm): EL(6.5/10.2)
- PDA Solution
- EL Driver IC built-in
- Touch panel built-in

Optional:

- TDF film version available
- The icon of membrane can be modified by requested

Pin Assignment		
Pin No.	Symbol	Function
1	Vss	Power supply (0V)
2	FLM	Frame pulse
3	CL1(LP)	Line pulse
4	CL2(SCP)	Shift clock
5	M	Frame reverse signal (Alternate signal)
6	VDD	Power supply voltage for logic.
7	BLE	Backlight ON/OFF control,HIGH enable.
8	VEE	Power supply voltage for LCD (+V)
9	D3	Data Display
10	D2	Data Display
11	D1	Data Display
12	D0	Data Display
13	TP_L	Touch Panel Pin Output Left
14	TP_U	Touch Panel Pin Output Up
15	TP_R	Touch Panel Pin Output Right
16	TP_D	Touch Panel Pin Output Down
17	VSS	Power supply (0V)
18	VSS	Power supply (0V)

Absolute Maximum Rating							
Item	Symbol	Condition	Min.	Max.	Units		
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V		
LCD driving supply voltage	Vee-Vss	25°C	-0.3	30.0	V		
Input Voltage	VIN	25°C	-0.3	Vdd+0.3	V		
Electrical Characteristics							
Item	Symbol	Condition	Min.	Typical	Max.	Units	
Power supply voltage	Vdd-Vss	25°C	2.7	3.0	3.3	V	
			N	W	N	W	N
LCD operation voltage	VOP	-20°C	-	-	20.6	-	V
		0°C	-	-	-	-	V
		25°C	-	-	19.0	-	V
		50°C	-	-	-	-	V
		70°C	-	-	17.0	-	V
LCM current consumption (with:EL B/L)	Idd	Vdd=3V	-	20	-	mA	
	Iee	Vee=19.0V	-	1.0	-	mA	
Backlight current consumption	EL	-	-	-	-	mA	



Features:

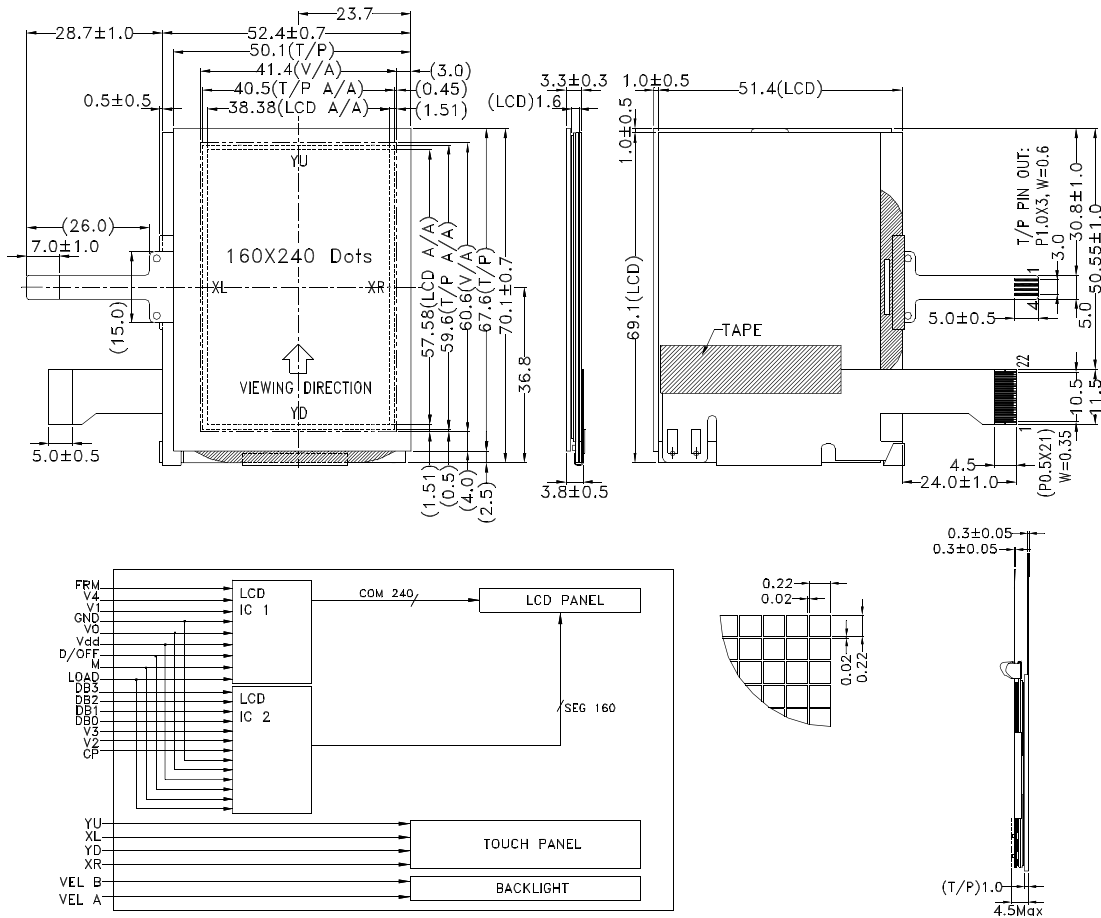
- Resolution: 160S*160C Dots
- Duty ratio: 1/160
- LCD option: FSTN
- Backlight option(H2/H1mm): EL(3.4/7.0)
- Controller IC: S1D13305
- EL Driver IC built-in
- DC-DC converter and temperature compensation circuit built-in

Optional:

- Touch panel version available

Pin Assignment		
Pin No.	Symbol	Function
1	/RST	Controller reset
2	/RD	This signal acts as the active-LOW read strobe.
3	/WR	This signal acts as the active-LOW write strobe.
4	/CS	Chip enable for the module
5	A0	Command/Data select
6-13	DB0~DB7	Data bus (DB0=LSB, DB7=MSB)
14	Vdd	Power supply for logic (+5V)
15	VSS	Signal ground (GND)
16	Adj1	The pin for the contrast setted by customer
17	Adj2	The pin for the contrast setted by customer
18	BLE	H: EL Enable L: EL Disable
19	VEL	Power supply for EL (+)
20	VELG	Power supply for EL (-)

Absolute Maximum Rating								
Item	Symbol	Condition	Min.	Max.	Units			
Supply for logic voltage	Vdd-Vss	25°C	-0.3	7.0	V			
LCD driving supply voltage	Vee-Vss	25°C	-0.3	30.0	V			
Input Voltage	VIN	25°C	-0.3	VDD+0.3	V			
Electrical Characteristics								
Item	Symbol	Condition	Min.	Typical	Max.	Units		
Power supply voltage	Vdd-Vss	25°C	4.75	5.0	5.5	V		
LCD operation voltage	VOP	Top	N	W	N	W	V	
		-20°C	-	-	-	20.6	-	V
		0°C	-	-	-	-	-	V
		25°C	-	-	-	19.0	-	V
		50°C	-	-	-	-	-	V
		70°C	-	-	-	17.0	-	V
LCM current consumption (No B/L)	Idd	Vdd=5V	-	20	-	mA		
Backlight current consumption	EL	VEL=5V	-	40.0	-	mA		



Features:

- Resolution: 160S*240C Dots
- Duty ratio: 1/240
- LCD option: FSTN
- Backlight option(H2/H1mm): EL(-/3.8)
- Touch panel built-in

Pin Assignment			
LCD Module		LCD Module	
Pin No.	Symbol	Pin No.	Symbol
1	V4	19	GND
2	V1	20	VEL B
3	V0	21	GND
4	VDD	22	VEL A
5	FRM		
6	GND	Touch panel	
7	LOAD	Pin No.	Symbol
8	GND	1	YU
9	M	2	XL
10	D/OFF	3	YD
11	CP	4	XR
12	V3		
13	V2		
14	DB3		
15	DB2		
16	DB1		
17	DB0		
18	GND		

Absolute Maximum Rating									
Item	Symbol	Condition	Min.	Max.	Units				
Supply for logic voltage	$V_{dd}-V_{ss}$	25°C	-0.3	7.0	V				
LCD driving supply voltage	$V_{ee}-V_{ss}$	25°C	-0.3	30.0	V				
Input Voltage	V_{IN}	25°C	-0.3	$V_{dd}+0.3$	V				
Electrical Characteristics									
Item	Symbol	Condition	Min.	Typical	Max.	Units			
Power supply voltage	$V_{dd}-V_{ss}$	25°C	2.7	5.0	5.5	V			
LCD operation voltage	VOP	Top	N	W	N	W	V		
		-20°C	-	20.2	-	20.5	-	20.8	V
		0°C	-	-	-	-	-	V	
		25°C	-	18.2	-	18.5	-	18.8	V
		50°C	-	-	-	-	-	V	
		70°C	-	16.2	-	16.5	-	16.8	V
LCM current consumption (No B/L)	I_{dd}	$V_{dd}=5V$	-	0.3	-	mA			
	I_{ee}	$V_{ee}=18.5V$	-	3.0	-	mA			
Backlight current consumption	EL	$V_{EL}=5V$	-	40.0	-	mA			