

# MOSFET – Power, N-Channel, SUPERFET® III, Easy-Drive 650 V, 10 A, 360 mΩ

## FCMT360N65S3

### General Description

SuperFET III MOSFET is ON Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate.

Consequently, SuperFET III MOSFET Easy-drive series helps manage EMI issues and allows for easier design implementation.

The Power88 package is an ultra-slim surface-mount package (1 mm high) with a low profile and small footprint (8x8 mm<sup>2</sup>). SuperFET III MOSFET in a Power88 package offers excellent switching performance due to lower parasitic source inductance and separated power and drive sources. Power88 offers Moisture Sensitivity Level 1 (MSL 1).

### Features

- 700 V @ T<sub>J</sub> = 150°C
- Typ R<sub>DS(on)</sub> = 310 mΩ
- Ultra Low Gate Charge (Typ. Q<sub>g</sub> = 18 nC)
- Low Effective Output Capacitance (Typ. C<sub>oss(eff.)</sub> = 173 pF)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

### Applications

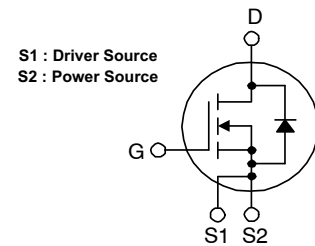
- Computing / Display Power Supplies
- Telecom / Server Power Supplies
- Industrial Power Supplies
- Lighting / Charger / Adapter



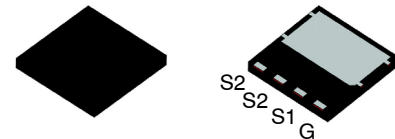
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

V <sub>DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX
650 V	360 mΩ @ 10 V	10 A

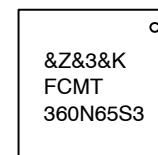


N-CHANNEL MOSFET



PQFN4 8X8 2P  
CASE 483AP

### MARKING DIAGRAM



- &Z = Assembly Plant Code
- &3 = Data Code (Year & Week)
- &K = Lot
- FCMT360N65S3 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FCMT360N65S3

## ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , Unless otherwise specified)

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain to Source Voltage	650	V
$V_{GSS}$	Gate to Source Voltage	DC	$\pm 30$
		AC ( $f > 1\text{ Hz}$ )	$\pm 30$
$I_D$	Drain Current	Continuous ( $T_C = 25^\circ\text{C}$ )	10
		Continuous ( $T_C = 100^\circ\text{C}$ )	6
$I_{DM}$	Drain Current	Pulsed (Note 1)	25
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	40	mJ
$I_{AS}$	Avalanche Current (Note 1)	2.1	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	0.83	mJ
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt (Note 3)	20	
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	83
		Derate Above $25^\circ\text{C}$	0.67
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 s	300	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{AS} = 2.1\text{ A}$ ,  $R_G = 25\ \Omega$  starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 5\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 400\text{ V}$ , starting  $T_J = 25^\circ\text{C}$

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max. (Note 4)	45	

4. Device on 1 in<sup>2</sup> pad 2 oz copper pad on 1.5 x 1.5 in. board of FR-4 material.

## ORDERING INFORMATION

Device	Marking	Package	Reel Size	Tape Width	Quantity†
FCMT360N65S3	FCMT360N65S3	PQFN8	13"	13.3 mm	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# FCMT360N65S3

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA, T <sub>J</sub> = 25°C	650			V
		V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA, T <sub>J</sub> = 150°C	700			V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 1mA, referenced to 25°C		0.68		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0 V			10	μA
		V <sub>DS</sub> = 520 V, T <sub>C</sub> = 125 °C		0.58		
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V			±100	nA

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 200 μA	2.5		4.5	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A		310	360	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 5 A		6		S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, f = 1 MHz		730		pF
C <sub>oss</sub>	Output Capacitance			15		pF
C <sub>oss(eff.)</sub>	Effective Output Capacitance	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		173		pF
C <sub>oss(er.)</sub>	Energy Related Output Capacitance	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		26		pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10 V	V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A (Note 5)		18		nC
Q <sub>gs</sub>	Gate to Source Gate Charge			4.3		nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge			7.6		nC
ESR	Equivalent Series Resistance	f = 1 MHz		1		Ω

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 5 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 4.7 Ω (Note 5)		12		ns
t <sub>r</sub>	Rise Time			11		ns
t <sub>d(off)</sub>	Turn-Off Delay Time			34		ns
t <sub>f</sub>	Fall Time			10		ns

### SOURCE-DRAIN DIODE CHARACTERISTICS

I <sub>S</sub>	Source to Drain Diode Forward Voltage	Maximum Continuous Source to Drain Diode Forward Current			10	A
I <sub>SM</sub>	Maximum Pulsed Source to Drain Diode Forward Current				25	A
V <sub>SD</sub>	Source to Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 5 A			1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>DD</sub> = 400 V, I <sub>SD</sub> = 5 A, di <sub>F</sub> /dt = 100 A/μs		241		ns
Q <sub>rr</sub>	Reverse Recovery Charge			2.4		μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

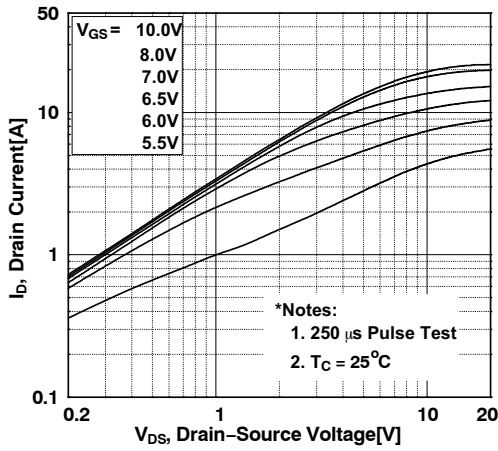


Figure 1. On-Region Characteristics

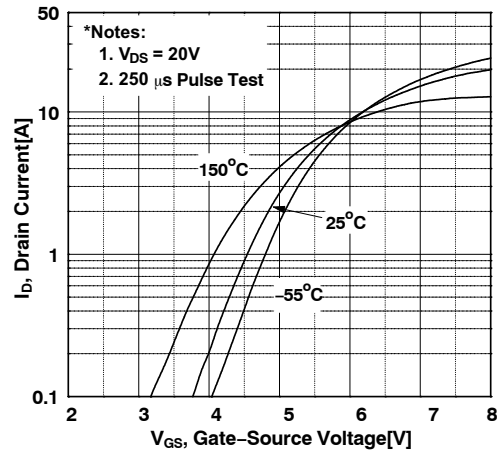


Figure 2. Transfer Characteristics

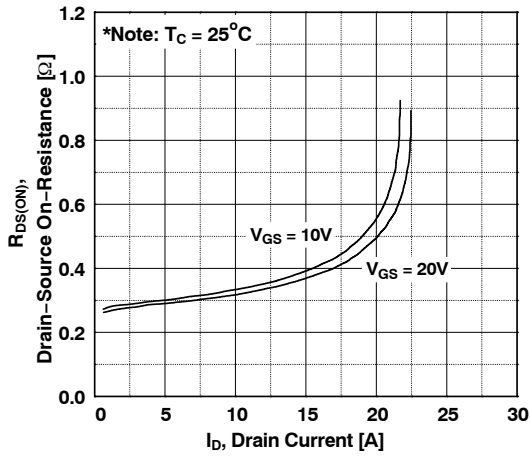


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

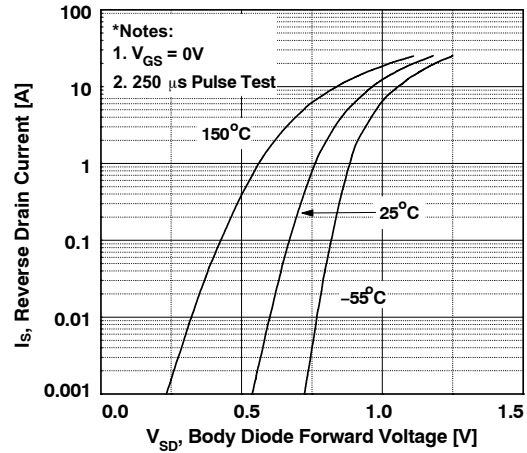


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

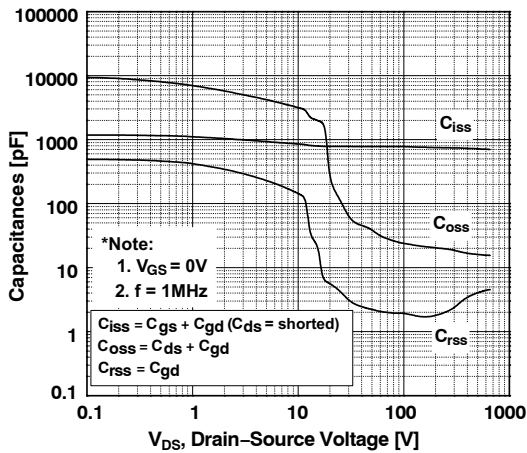


Figure 5. Capacitance Characteristics

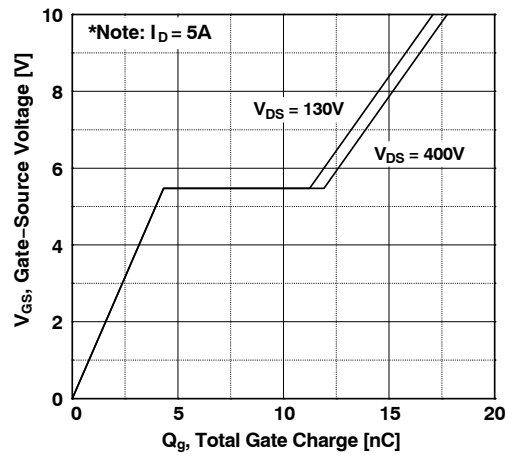


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

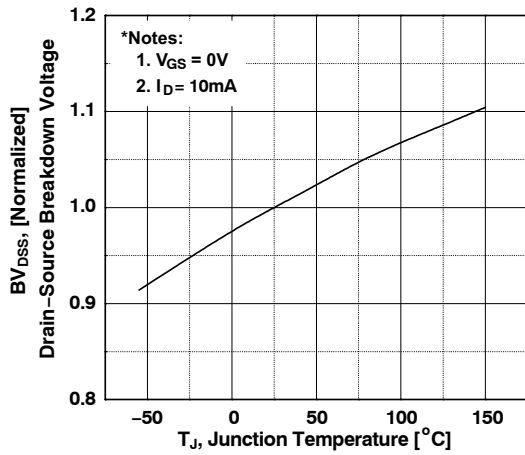


Figure 7. Breakdown Voltage Variation vs. Temperature

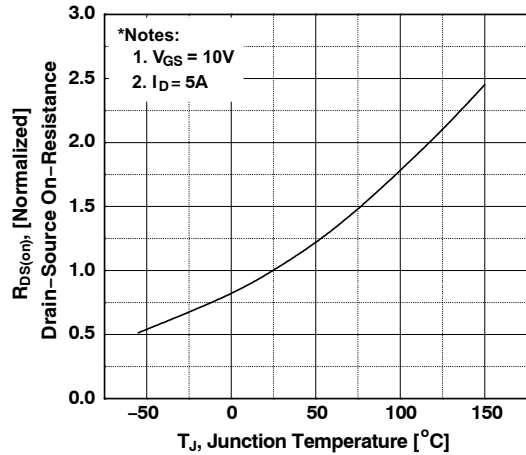


Figure 8. On-Resistance Variant vs. Temperature

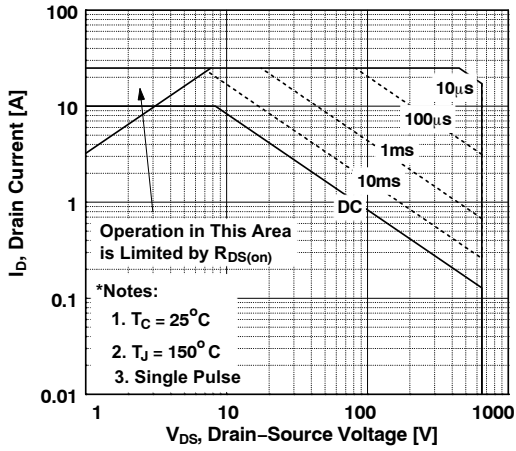


Figure 9. Maximum Safe Operation Area

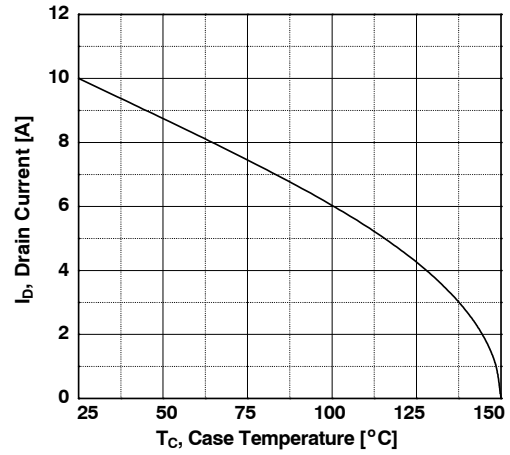


Figure 10. Maximum Drain Current vs. Case Temperature

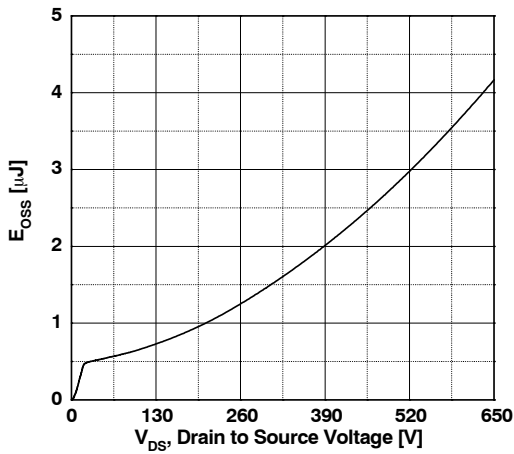


Figure 11.  $E_{OSS}$  vs. Drain to Source Voltage

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## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

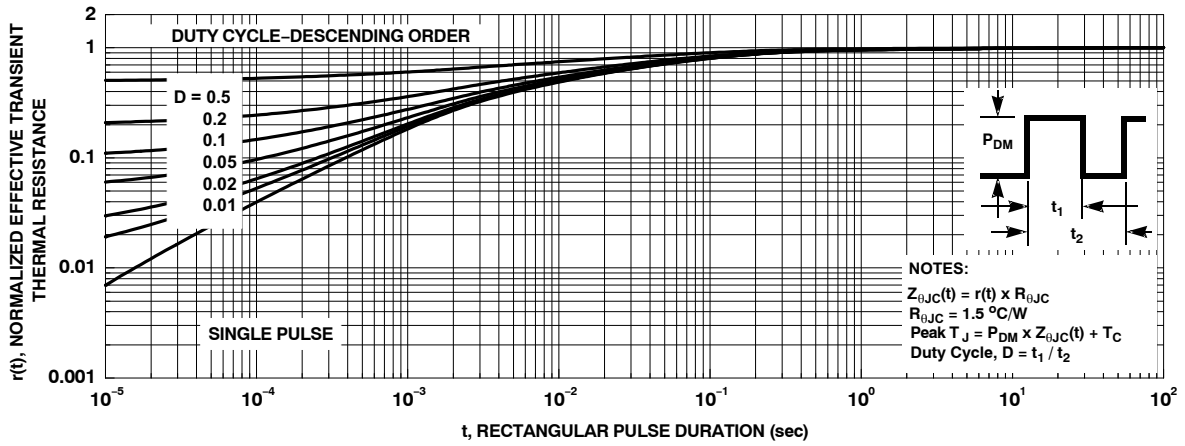


Figure 12. Transient Thermal Response Curve

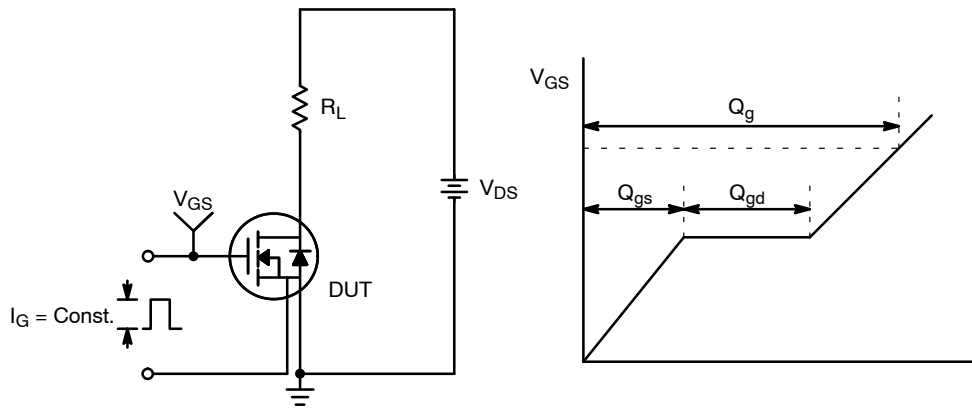


Figure 13. Gate Charge Test Circuit & Waveform

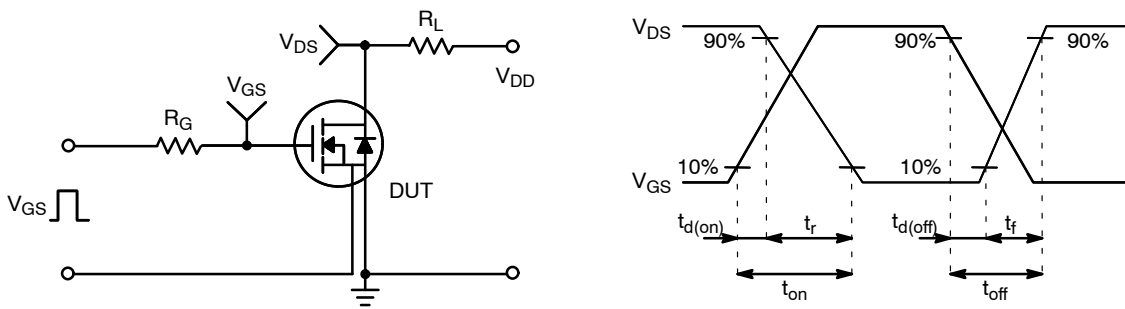


Figure 14. Resistive Switching Test Circuit & Waveforms

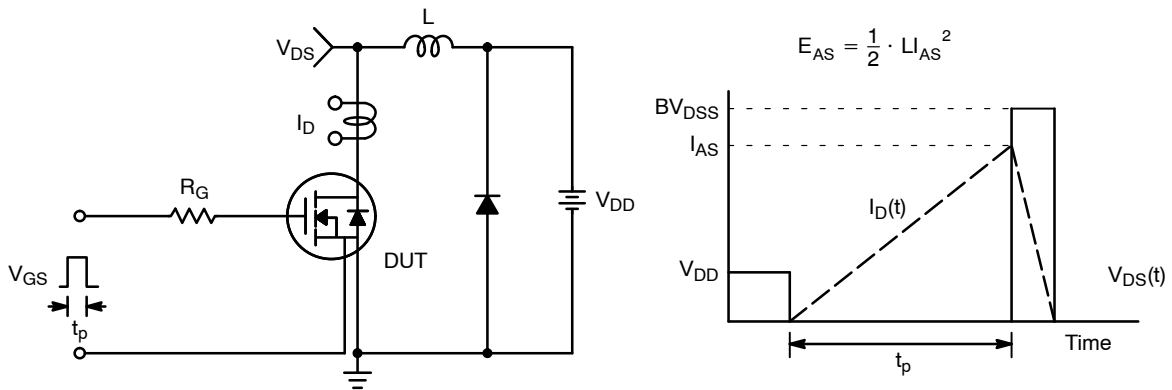


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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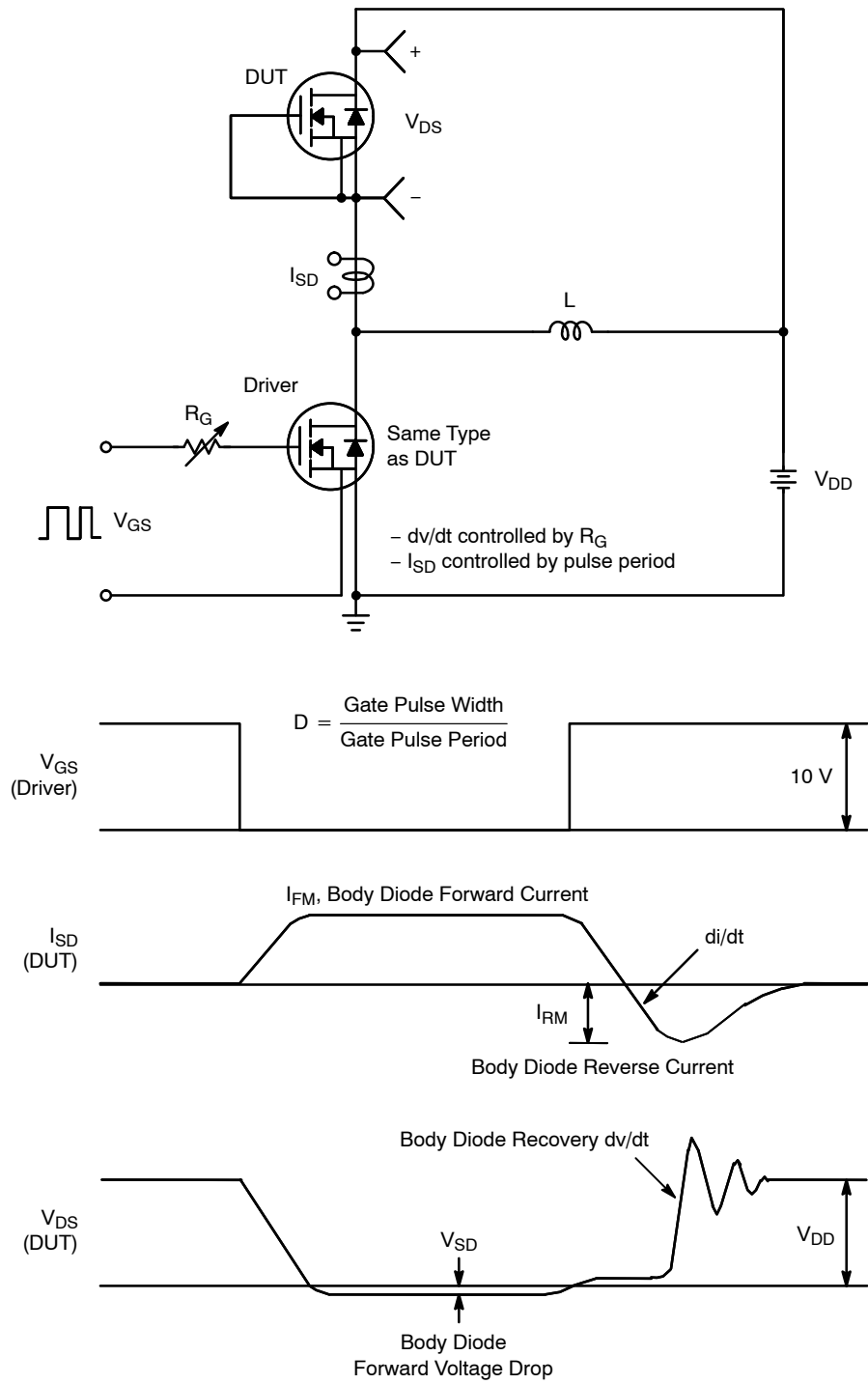
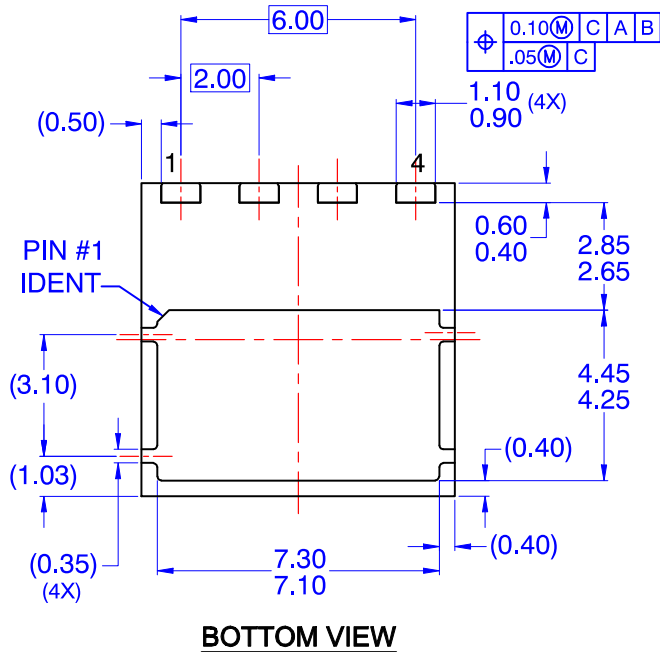
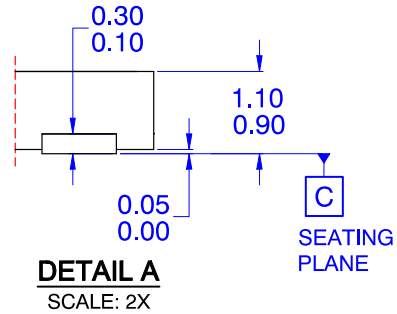
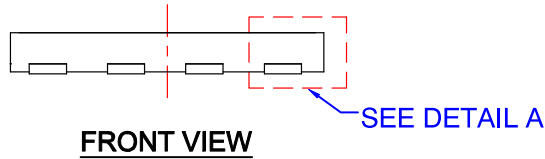
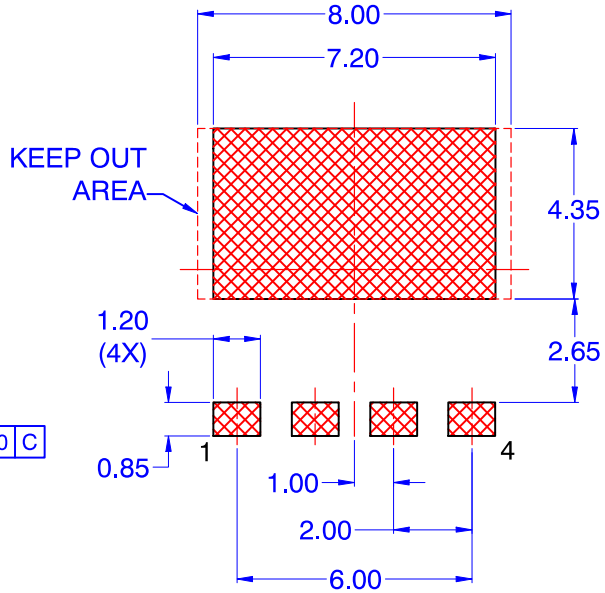
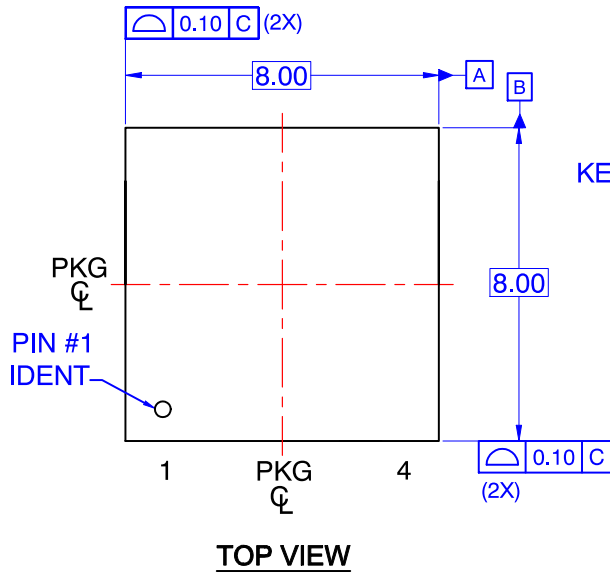


Figure 16. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# FCMT360N65S3


## PACKAGE DIMENSIONS

PQFN4 8X8, 2P  
CASE 483AP  
ISSUE O



NOTES: UNLESS OTHERWISE SPECIFIED  
A) THIS PACKAGE IS NOT PRESENTLY REGISTERED WITH ANY STANDARDS COMMITTEE.  
B) DIMENSIONS ARE INCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR PROTRUSIONS.  
C) ALL DIMENSIONS ARE IN MILLIMETERS.  
D) DRAWING CONFORMS TO ASME Y14.5M-1994.

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