ELECTRONICS, INC.
44 FARRAND STREET
BLOOMFIELD, NJ 07003
(973) 748–5089
http://www.nteinc.com

NTE4047B and NTE4047BT
Integrated Circuit
CMOS, Low–Power Monostable/Astable Multivibrator

Description:

The NTE4047B (14–Lead DIP) and NTE4047BT (SOIC–14) consists of a gatable astable multivibrator with logic techniques incorporated to permit a positive or negative edge–triggered monostable multivibrator action with retriggering and external counting options.

Inputs include (+) TRIGGER, (–) TRIGGER, ASTABLE, $\overline{\text{ASTABLE}}$, RETRIGGER, and EXTERNAL RESET. Buffered outputs are $\overline{\text{Q}}$, Q, and OSCILLATOR. In all modes of operation, an external capacitor must be connected between C–Timing and R–C Common terminals, and an external resistor must be connected between the R–Timing and R–C Common terminals.

Astable operation is enabled by a high level on the ASTABLE input of a low level on the $\overline{\text{ASTABLE}}$ input, or both. The period of the square wave at the Q and $\overline{\text{Q}}$ outputs in this mode of operation i a function of the external components employed. “True” input pulses on the ASTABLE input or “Complement” pulses on the $\overline{\text{ASTABLE}}$ input allow the circuit to be used as a gatable multivibrator. The OSCILLATOR output period will be half of the Q teminal output in the astable mode. However, a 50% duty cycle is not guaranteed at this output.

The NTE4047B/BT triggers in the monostable mode when a positive–going edge occurs on the (+) TRIGGER input while the (–) TRIGGER is held low. Input pulses may be of any duration relative to the output pulse.

If retrigger capability is desired, the RETRIGGER input is pulsed. The retriggerable mode of operation is limited to positive–going edge. The NTE4047B/BT will retrigger as long as the RETRIGGER input is high, with or without transitions.

An external countdown option can be implemented by coupling “Q” to an external “N” counter and resetting the counter with the trigger pulse. The counter output pulse is fed back to the $\overline{\text{ASTABLE}}$ input and has a duration equal to N times the period of the multivibrator.

A high level on the EXTERNAL RESET input assures no output pulse during an “ON” power condition. This input can also be activated to terminate the output pulse at any time. For monostable operation, whenever V_{DD} is applied, an internal power–on reset circuit will clock the Q output low within one output period (t_M).

Features:

- Very Low Power Consumption: Special CMOS Oscillator Configuration
- Monostable (One–Shot) or Astable (Free–Running) Operation
- True and Complemented Buffered Outputs
- Buffered Inputs
- Standardized, Symmetrical Output Characteristics
- 5V, 10V, and 15V Parametric Ratings

Monostable Multivibrator Features:

- Positive−Edge or Negative−Edge Trigger
- Output Pulse Width Independent of Trigger Pulse Duration
- Retriggerable Option for Pulse Width Expansion
- Internal Power−On Reset Cicuit
- Long Pulse Widths Possible using Small RC Components by Means of External Counter Provision
- Fast Recovery Time Essentially Independent of Pulse Width
- Pulse Width Accuracy maintained at Duty Cycle Approaching 100%

Astable Multivibrator Features:

- Free−Running or Gatable Operating
- 50% Duty Cycle
- Oscillator Output Available
- Good Astable Frequency Stability
  Frequency Deviation (Circuits "Trimmed" to Frequency, V_{DD} = 10V ±10%):
  = ±2% + 0.03%/°C at 100kHz
  = ±0.5% + 0.015%/°C at 10kHz

Applications:

Digital equipment where low−power dissipation and/or high noise immunity are primary design requirements:

- Envelope Detection
- Frequency Multiplication
- Frequency Division
- Frequency Discriminators
- Timing Circuits
- Time−Delay Applications

Absolute Maximum Ratings:

DC Supply Voltage Range (Voltages referenced to V_{SS} terminal), V_{DD} . . . . . −0.5 to +20V
Input Voltage Range, All Inputs . . . . . −0.5 to V_{DD}+0.5V
DC Input Current, Any One Input . . . . . ±10mA
Power Dissipation (T_A = −55° to +100°C), P_D 500mW
T_A = +100° to +125°C . . . . . Derate Linearly at 12mW/°C to 200mW
Device Dissipation (Per Output Transistor)
For T_A = Full Package Temperature Range 100mW
Operating Temperature Range, T_A . . . . . −55° to +125°C
Storage Temperature Range, T_{stg} . . . . . −65° to +150°C
Lead Temperature (During Soldering, 1/16" ±1/32" from case, 10sec Max), T_L . . . . . +265°C

Recommended Operating Conditions: (Note 1, Note 2)

Parameter	Min	Typ	Max	Unit
Supply Voltage Range (For T_A = Full package Temperature)	3	−	18	V

Note 1. For maximum reliability, nominal operating conditions should be selected so that operation is always within the above ranges.

Note 2. If at 15V operation, a 10MΩ resistor is used, the operating temperature should be between −25° and +100°C.

Functional Pin Connections: (Note 3)

Function	Pin Connections			Output Pulse From	Output Period or Pulse Width
	To V_{DD}	To V_{SS}	Input To		
Astable Multivibrator Free Running	4,5,6,14	7,8,9,12	–	10,11,13	t_A (10,11) = 4.40 RC t_A (13) = 2.20 RC (Note 4)
True Gating	4,6,14	7,8,9,12	5	10,11,13	
Complement Gating	6,14	5,7,8,9,12	4	10,11,13	
Monostable Multivibrator Positive–Edge Trigger	4,14	5,6,7,9,12	8	10,11	t_M (10,11) = 2.48 RC
Negative–Edge Trigger	4,8,14	5,7,9,12	6	10,11	
Retriggerable	4,14	5,6,7,9	8,12	10,11	
External Countdown (Note 5)	14	5,6,7,8,9,12	–	10,11	

Note 3. In all cases, external resistor between Pin2 and Pin3, external capacitor between Pin1 and Pin3.

Note 4. First positive ½ cycle pulse width = 2.48 RC.

Note 5. Input Pulse to Reset of External Counting Chip External Counting Chip Output to Pin4.

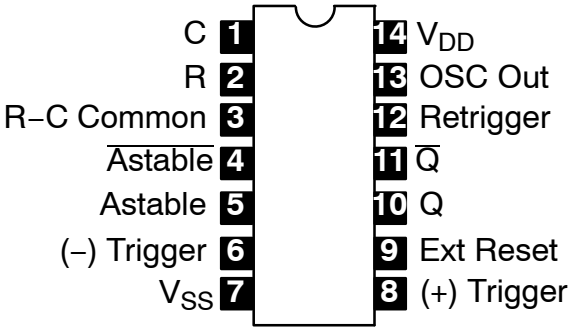
Static Electrical Characteristics:

Characteristic	Conditions			Limits at Indicated Temperature (°C)							Units
	V_O (V)	V_{IN} (V)	V_{DD} (V)	–55°C	–40°C	+85°C	+125°C	+25°C			
								Min.	Typ.	Max.	
Quiescent Device Current I_{DD} Max.	–	0,5	5	1.0	1.0	30	30	–	0.02	1.0	µA
	–	0,10	10	2.0	2.0	60	60	–	0.02	2.0	µA
	–	0,15	15	4.0	4.0	120	120	–	0.02	4.0	µA
	–	0,20	20	20	20	600	600	–	0.04	20	µA
Output Low (Sink) Current I_{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1.0	–	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	–	mA
	1.5	0,15	15	4.2	4.0	2.8	2.4	3.4	6.8	–	mA
Output High (Source) Current I_{OH} Min.	4.6	0,5	5	–0.64	–0.61	–0.42	–0.36	–0.51	–1.0	–	mA
	2.5	0.5	5	–2.0	–1.8	–1.3	–1.15	–1.6	–3.2	–	mA
	9.5	0,10	10	–1.6	–1.5	–1.1	–0.9	–1.3	–2.6	–	mA
	13.5	0,15	15	–4.2	–4.0	–2.8	–2.4	–3.4	–6.8	–	mA
Output Voltage Low–Level V_{OL} Max.	–	0,5	5	0.05				–	0	0.05	V
	–	0,10	10	0.05				–	0	0.05	V
	–	0,15	15	0.05				–	0	0.05	V
Output Voltage High–Level V_{OH} Min.	–	0,5	5	4.95				4.95	5	–	V
	–	0,10	10	9.95				9.95	10	–	V
	–	0,15	15	14.95				14.95	15	–	V
Input Low Voltage V_{IL} Max.	0.5,4.5	–	5	1.5				–	–	1.5	V
	1,9	–	10	3.0				–	–	3.0	V
	1.5,13.5	–	15	4.0				–	–	4.0	V
Input High Voltage V_{IH} Min.	0.5,4.5	–	5	3.5				3.5	–	–	V
	1,9	–	10	7.0				7.0	–	–	V
	1.5,13.5	–	15	11.0				11.0	–	–	V
Input Current, I_{IN} Max.	–	0,18	18	±0.1	±0.1	±1.0	±1.0	–	$\pm 10^{-5}$	±0.1	µA

Dynamic Electrical Characteristics: (T_A = +25°C, C_L = 50pF, R_L = 200kΩ, t_r and t_f = 20ns unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Propagation Delay Time	t_{PHL} or t_{PLH}					
Astable, $\overline{\text{Astable}}$ to OSC Out		V_{DD} = 5V	–	200	400	ns
		V_{DD} = 10V	–	100	200	ns
		V_{DD} = 15V	–	80	160	ns
Astable, $\overline{\text{Astable}}$ to Q, $\overline{Q}$		V_{DD} = 5V	–	350	700	ns
		V_{DD} = 10V	–	175	350	ns
		V_{DD} = 15V	–	125	250	ns
(+) or (–) Trigger to Q, $\overline{Q}$		V_{DD} = 5V	–	500	1000	ns
		V_{DD} = 10V	–	225	450	ns
		V_{DD} = 15V	–	150	300	ns
Retrigger to Q, $\overline{Q}$		V_{DD} = 5V	–	300	600	ns
		V_{DD} = 10V	–	150	300	ns
		V_{DD} = 15V	–	100	200	ns
External Reset to Q, $\overline{Q}$		V_{DD} = 5V	–	250	500	ns
		V_{DD} = 10V	–	100	200	ns
		V_{DD} = 15V	–	70	140	ns
Transition Time	t_{THL} or t_{TLH}	V_{DD} = 5V	–	100	200	ns
OSC Out, Q, $\overline{Q}$		V_{DD} = 10V	–	50	100	ns
		V_{DD} = 15V	–	40	80	ns
Minimum Input Pulse Width	t_w					
(+) Trigger, (–) Trigger		V_{DD} = 5V	–	200	400	ns
		V_{DD} = 10V	–	80	160	ns
		V_{DD} = 15V	–	50	100	ns
Reset		V_{DD} = 5V	–	100	200	ns
		V_{DD} = 10V	–	50	100	ns
		V_{DD} = 15V	–	30	60	ns
Retrigger		V_{DD} = 5V	–	300	600	ns
		V_{DD} = 10V	–	115	230	ns
		V_{DD} = 15V	–	75	150	ns
Input Rise and Fall Time, t_r, t_f						
All Trigger Inputs	t_f	V_{DD} = 5V	–	270	–	µs
For (+) Trigger		V_{DD} = 10V	–	18	–	µs
t_r only is unlimited		V_{DD} = 15V	–	9	–	µs
For (–) Trigger	t_r	V_{DD} = 5V	–	325	–	µs
t_f only is unlimited		V_{DD} = 10V	–	9	–	µs
		V_{DD} = 15V	–	4	–	µs
Q or $\overline{Q}$ Deviation from 50% Duty Factor		V_{DD} = 5V	–	±0.5	±1.0	%
		V_{DD} = 10V	–	±0.5	±1.0	%
		V_{DD} = 15V	–	±0.1	±0.5	%
Input Capacitance	C_{IN}	Any Input	–	5.0	7.7	pF

Pin Connection Diagram



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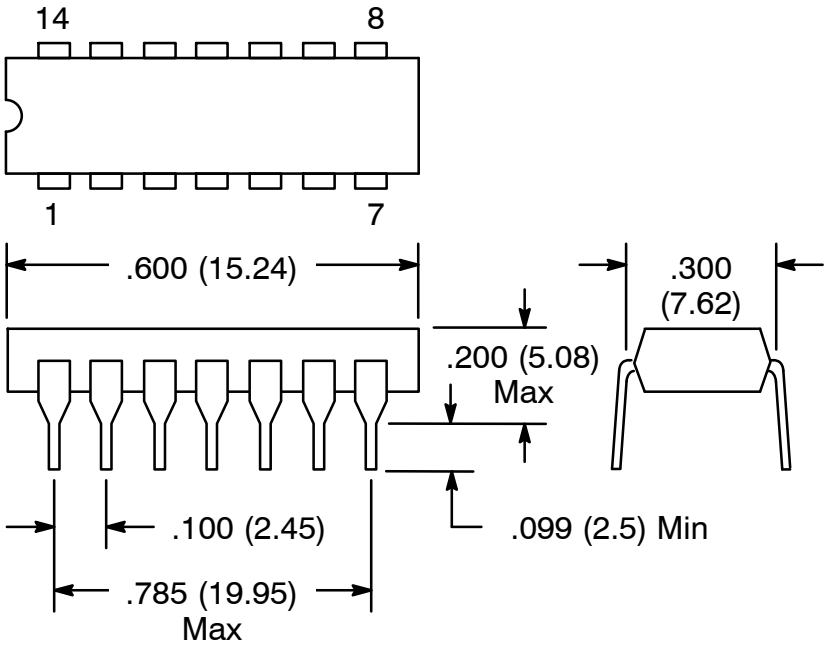

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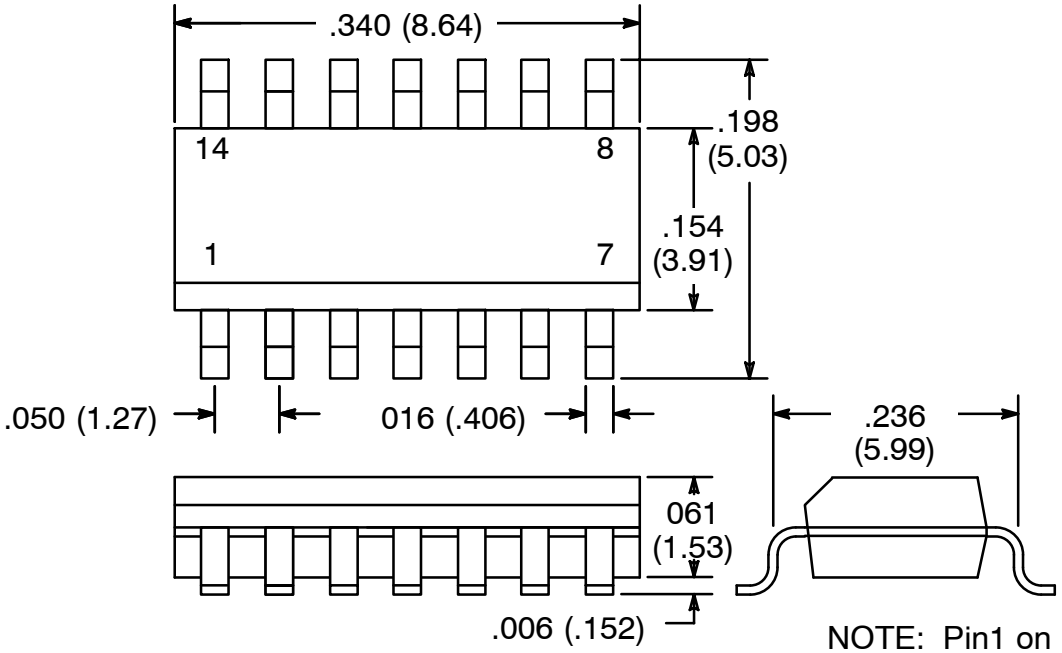

NOTE: Pin1 on Beveled Edge