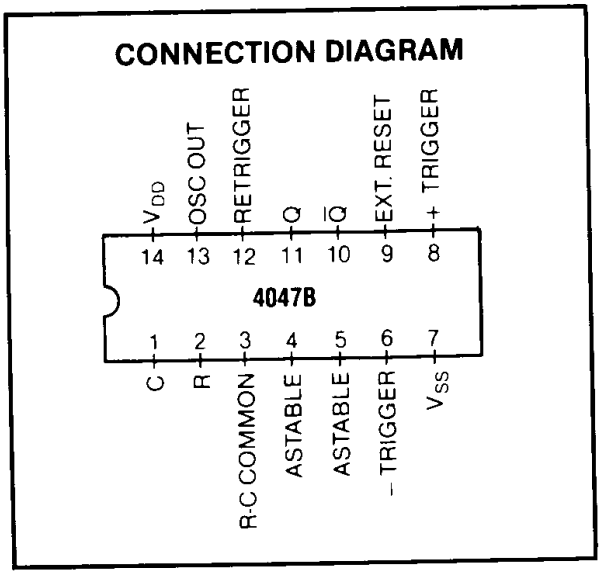
CMOS MONOSTABLE/ASTABLE MULTIVIBRATOR

FEATURES

- Low Power Consumption
- Monostable (one-shot) or (Astable) Operation
- True and Complementary Buffered Outputs
- Only One External R and C Required
- Enabled with either a Low or a High Level in Astable Mode
- Triggered on either a Low to High or High to Low Transition in Monostable Mode
- Asynchronous Master Reset
- Output Pulse Width Independent of Trigger Pulse, in Monostable Mode
- May Be Utilized as Free Running or Gated Oscillator, in Astable Mode

CONNECTION DIAGRAM



DESCRIPTION

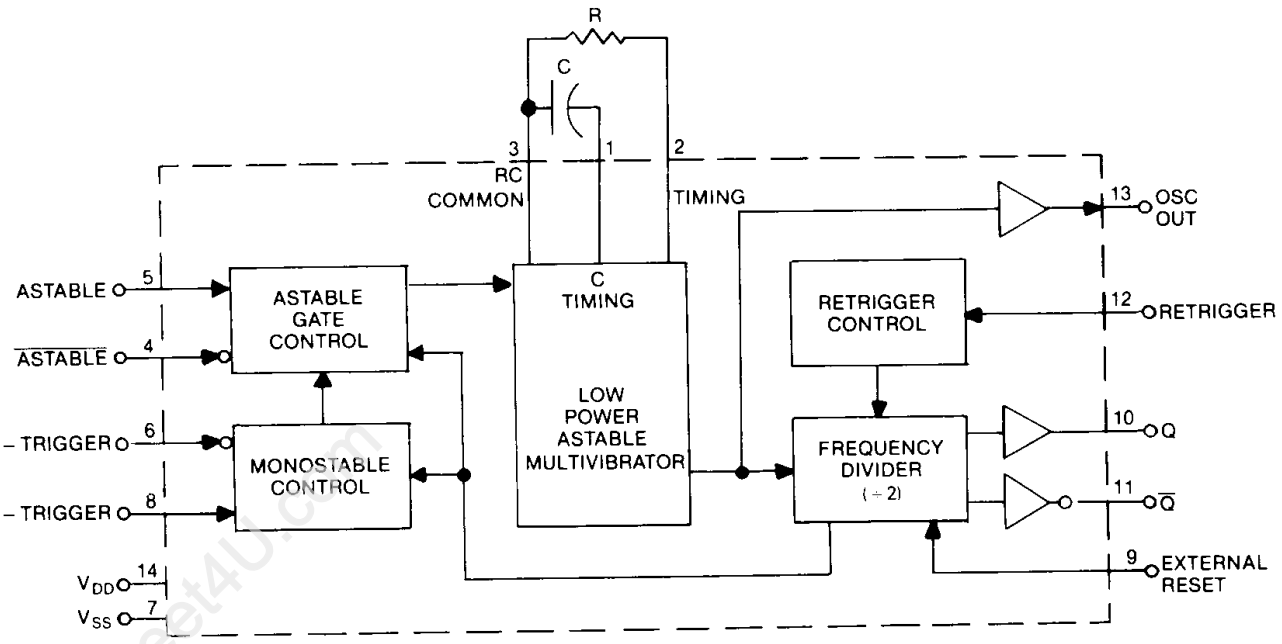
4047B is capable of operating in either the monostable or astable mode. It requires an external capacitor (between pins 1 and 3) and an external resistor (between pins 2 and 3) to determine the output pulse width in the monostable mode, and the output frequency in the astable mode.

Astable operation is enabled by a high level on the astable input or low level on the astable input. The output frequency (at 50% duty cycle) at Q and $\overline{Q}$ outputs is determined by the timing components. A frequency twice that of Q is available at the Oscillator Output; a 50% duty cycle is not guaranteed.

Monostable operation is obtained when the device is triggered by low-to-high transition at + trigger input or high-to-low transition at —trigger input. The device can be retriggered by applying a simultaneous low-to-high transition to both the + trigger and retrigger inputs.

A high level on Reset input resets the outputs Q to low, $\overline{Q}$ to high.

BLOCK DIAGRAM



Absolute Maximum Ratings

V_{DD} DC Supply Voltage	-0.5 to $+18V_{DC}$
V_{IN} Input Voltage	-0.5 to $V_{DD}+0.5V_{DC}$
T_S Storage Temperature Range	$-65°C$ to $+150°C$
P_D Package Dissipation	500mW
T_L Lead Temperature (Soldering, 10 seconds)	300°C

Recommended Operating Conditions

V_{DD} DC Supply Voltage	3 to $15V_{DC}$
V_{IN} Input Voltage	0 to V_{DD} V_{DC}
T_A Operating Temperature Range	
SCL4047BC, D, F, H	$-55°C$ to $+125°C$
SCL4047BE	$-40°C$ to $+85°C$

ELECTRICAL CHARACTERISTICS

STATIC CHARACTERISTICS [1]

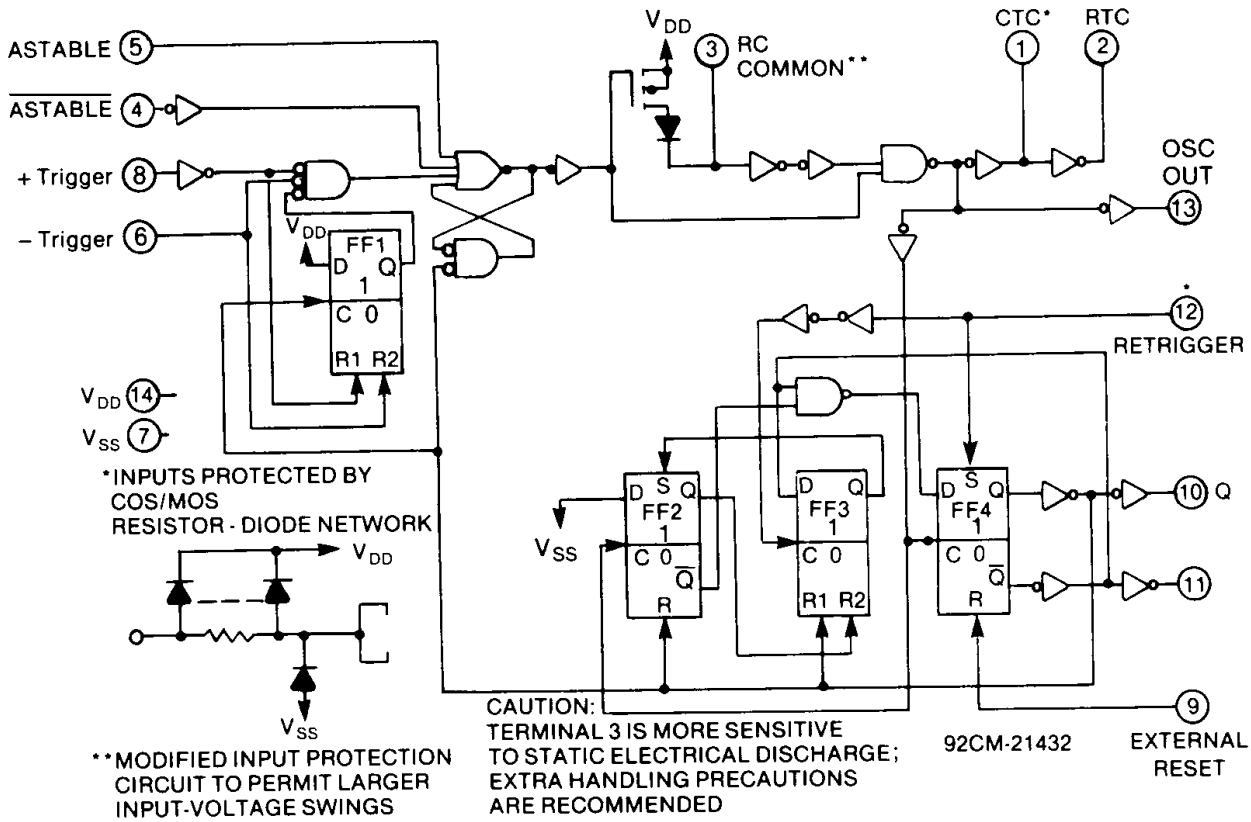
PARAMETER		V_{DD} (Vdc)	CONDITIONS	T_{LOW} [2]		+25°C			T_{HIGH} [2]		Units
				Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
QUIESCENT DEVICE CURRENT	I_{DD}	5	$V_{IN}=V_{SS}$ or V_{DD}	–	1.0	–	0.0005	1.0	–	30	μAdc
		10	All valid input	–	2.0	–	0.001	2.0	–	60	
		15	combinations	–	4.0	–	0.002	4.0	–	120	

NOTES: [1] Remaining Static Electrical Characteristics are listed under "4000B Series Family Specifications".
[2] T_{LOW} = -55°C for C, D, F, H device.
= -40°C for E device.
T_{HIGH} = +125°C for C, D, F, H device.
= + 85°C for E device.

AC ELECTRICAL CHARACTERISTICS

$T_A = 25°C, C_L = 50\ pF$

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
t_{PHL}, t_{PLH}	Propagation Delay Time Astable. Astable to OSC Out	V_{DD} = 5V		200	400	ns
		V_{DD} = 10V		100	200	ns
		V_{DD} = 15V		80	160	ns
t_{PHL}, t_{PLH}	Astable, Astable to Q Q	V_{DD} = 5V		550	900	ns
		V_{DD} = 10V		250	500	ns
		V_{DD} = 15V		200	400	ns
t_{PHL}, t_{PLH}	+ Trigger, – Trigger to Q Q	V_{DD} = 5V		700	1200	ns
		V_{DD} = 10V		300	600	ns
		V_{DD} = 15V		240	480	ns
t_{PHL}, t_{PLH}	+ Trigger, Retrigger to Q Q	V_{DD} = 5V		300	600	ns
		V_{DD} = 10V		175	300	ns
		V_{DD} = 15V		150	250	ns
t_{PHL}, t_{PLH}	Reset to Q Q	V_{DD} = 5V		300	500	ns
		V_{DD} = 10V		125	250	ns
		V_{DD} = 15V		100	200	ns
t_{THL}, t_{TLH}	Transition Time Q, Q, OSC Out	V_{DD} = 5V		100	200	ns
		V_{DD} = 10V		50	100	ns
		V_{DD} = 15V		40	80	ns
t_{WL}, t_{WH}	Minimum Input Pulse Duration	Any Input				
		V_{DD} = 5V		500	1000	ns
		V_{DD} = 10V		200	400	ns
		V_{DD} = 15V		160	320	ns
t_{RCL}, t_{FCL}	+ Trigger, Retrigger, Rise and Fall Time	V_{DD} = 5V			15	μs
		V_{DD} = 10V			5	μs
		V_{DD} = 15V			5	μs
C_{IN}	Average Input Capacitance	Any Input		5	7.5	pF

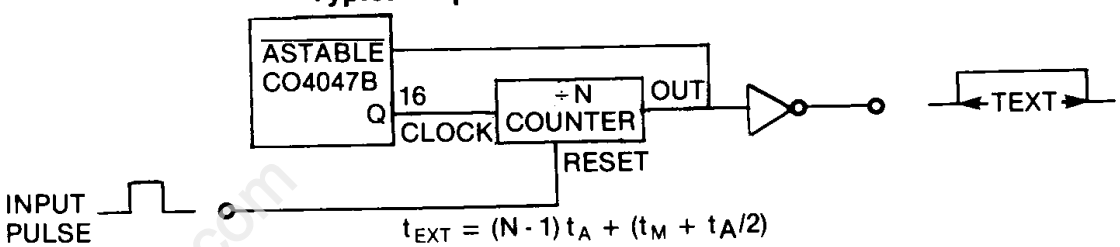


TRUTH TABLE

FUNCTION	TERMINAL CONNECTIONS			OUTPUT PULSE FROM	TYPICAL OUTPUT PERIOD OR PULSE WIDTH
	TO V_{DD}	TO V_{SS}	INPUT PULSE TO		
Astable Multivibrator					
Free-Running	4, 5, 6, 14	7, 8, 9, 12		10, 11, 13	$t_A(10, 11) = 4.40\ RC$
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	$t_A(13) = 2.20\ RC$
Monostable Multivibrator					
Positive-Edge Trigger	4, 14	5, 6, 7, 9, 12	8	10, 11	
Negative-Edge Trigger	4, 8, 14	5, 7, 9, 12	6	10, 11	$t_M(10, 11) = 2.48\ RC$
Retriggerable	4, 14	5, 6, 7, 9	8, 12	10, 11	
External Countdown*	14	5, 6, 7, 8, 9,12	(See Figure)	(See Figure)	(See Figure)

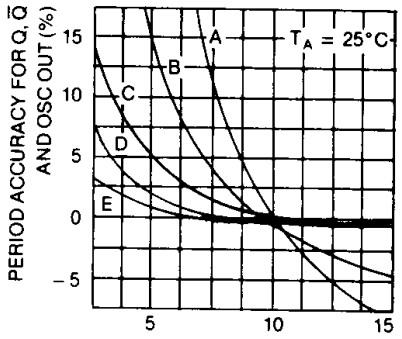
Note: External resistor between terminals 2 and 3. External capacitor between terminals 1 and 3.

*Typical Implementation of External Countdown Option



TYPICAL PERFORMANCE CHARACTERISTICS

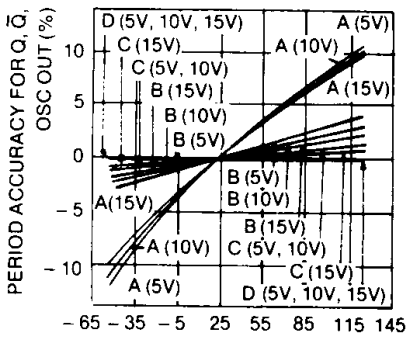
Typical Q, $\overline{Q}$, Osc Out Period Accuracy vs Supply Voltage (Astable Mode Operation)



V_{DD} — SUPPLY VOLTAGE (V)

	$f_{Q,\overline{Q}}$	R	C
A	1000 kHz	22k	10 pF
B	100 kHz	22k	100 pF
C	10 kHz	220k	100 pF
D	1 kHz	220k	1000 pF
E	100 Hz	2.2M	1000 pF

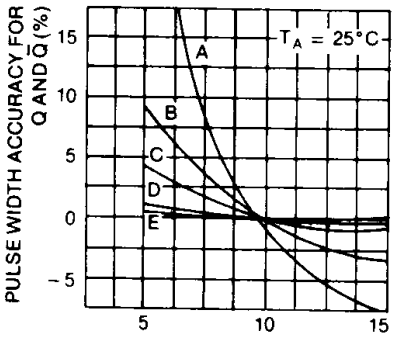
Typical Q, $\overline{Q}$ and Osc Out Period Accuracy vs Temperature Astable Mode Operation



T_A — AMBIENT TEMPERATURE (°C)

	$f_{Q,\overline{Q}}$	R	C
A	1000 kHz	22k	10 pF
B	100 kHz	22k	100 pF
C	10 kHz	220k	100 pF
D	1 kHz	220k	1000 pF

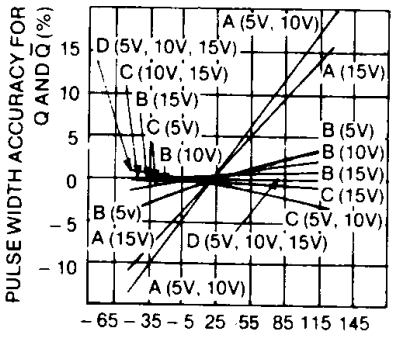
Typical Q, $\overline{Q}$, Pulse Width Accuracy vs Supply Voltage Monostable Mode Operation



V_{DD} — SUPPLY VOLTAGE (V)

	t_M	R	C
A	2μs	22K	10 pF
B	7μs	22k	100 pF
C	60μs	220k	100 pF
D	550μs	220k	1000 pF
E	5.5ms	2.2M	1000 pF

Typical Q and $\overline{Q}$ Pulse Width Accuracy vs Temperature Monostable Mode Operation



T_A — TEMPERATURE (°C)

	t_M	R	C
A	2μs	22K	10 pF
B	7μs	22k	100 pF
C	60μs	220k	100 pF
D	550μs	220k	1000 pF

TIMING DIAGRAMS