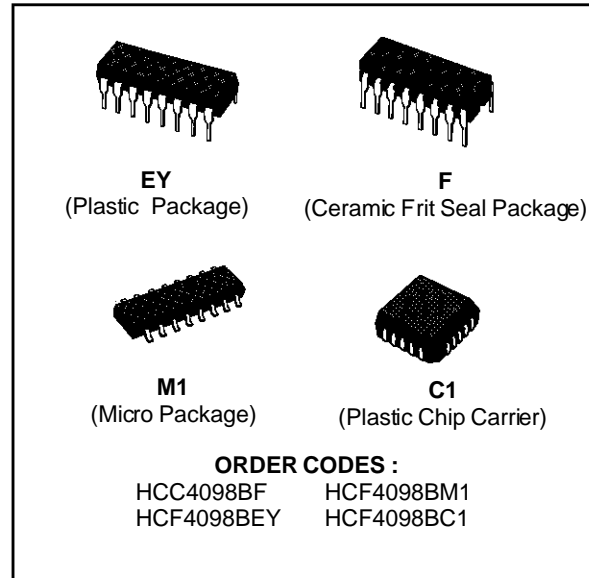


## DUAL MONOSTABLE MULTIVIBRATOR

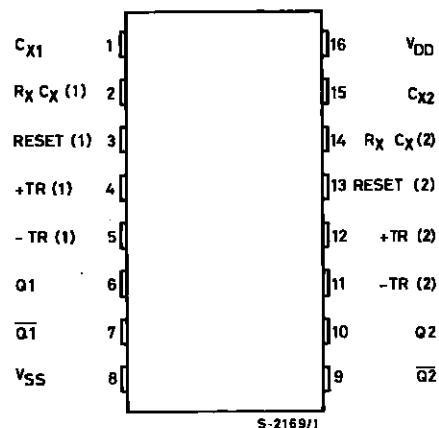
- RETRIGGERABLE/RESETTABLE CAPABILITY
- TRIGGER AND RESET PROPAGATION DELAYS INDEPENDENT OF  $R_X$ ,  $C_X$
- TRIGGERING FROM LEADING OR TRAILING EDGE
- Q AND  $\bar{Q}$  BUFFERED OUTPUTS AVAILABLE
- SEPARATE RESETS
- WIDE RANGE OF OUTPUT-PULSE WIDTHS
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N° 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"



### DESCRIPTION

The **HCC4098B** (extended temperature range) and **HCF4098B** (intermediate temperature range) are monolithic integrated circuit, available in 16-lead dual in-line plastic or ceramic package and plastic micropackage. The **HCC/HCF4098B** dual monostable multivibrator provides stable retriggerable/resettable one-shot operation for any fixed-voltage timing application. An external resistor ( $R_X$ ) and an external capacitor ( $C_X$ ) control the timing for the circuit. Adjustment of  $R_X$  and  $C_X$  provides a wide range of output pulse widths from the Q and  $\bar{Q}$  terminals. The time delay from trigger input to output transition (trigger propagation delay) and the time delay from reset input to output transition (reset propagation delay) are independent of  $R_X$  and  $C_X$ . Leading-edge-triggering (+ TR) and trailing-edge-triggering (- TR) inputs are provided for triggering from either edge of an input pulse. An unused + TR input should be tied to  $V_{SS}$ . An unused - TR input should be tied to  $V_{DD}$ . A RESET (on low level) is provided for immediate termination of the output pulse or to prevent output pulses when power is turned on. An unused RESET input should be tied to  $V_{DD}$ . However, if an entire section of the **4098B** is not used, its RESET should be tied to  $V_{SS}$ . See table I. In normal operation the circuit triggers (extends the output

### PIN CONNECTIONS

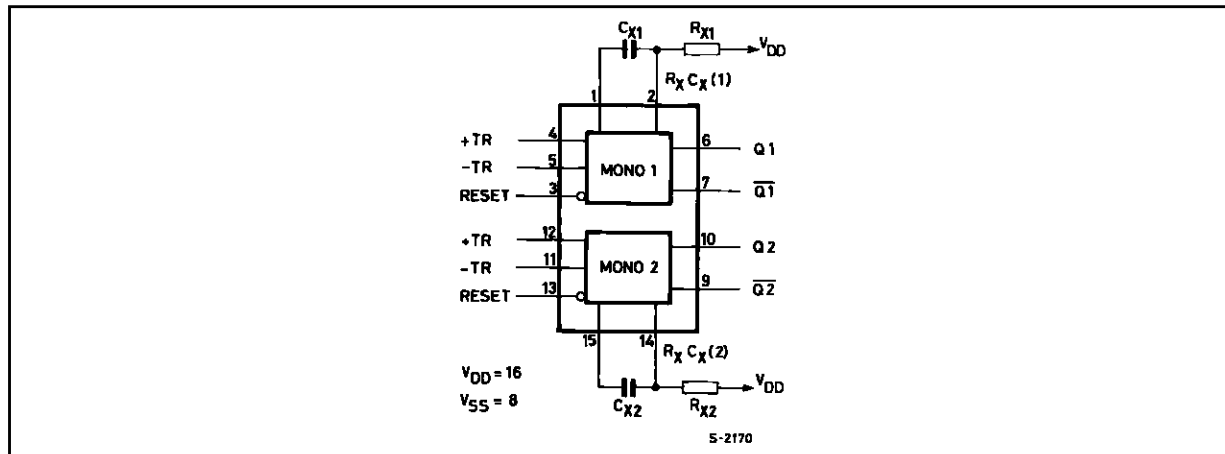


## HCC/HCF4098B

pulse one period) on the application of each new trigger pulse. For operation in the non-triggerable mode, Q is connected to  $-TR$  when leading-edge triggering (+ TR) is used or Q is connected to + TR when trailing-edge triggering ( $-TR$ ) is used. The time period (T) for this multivibrator can be approximated by  $T_X = 1/2 R_X C_X$  for  $C_X \geq 0.01 \mu\text{F}$ . Time periods as a function of  $R_X$  for values of  $C_X$  and  $V_{DD}$  are given in fig. 8. Values of T vary from unit to unit and as a function of voltage, temperature, and  $R_X C_X$ . The minimum value of external resistance,  $R_X$ , is 5 k $\Omega$ . The maxi-

imum value of external capacitance,  $C_X$ , is 100 $\mu\text{F}$ . Fig.9 shows time periods as a function of  $C_X$  for values of  $R_X$  and  $V_{DD}$ . The output pulse width has variations of  $\pm 2.5\%$  typically, over the temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$  for  $C_X = 1000\text{pF}$  and  $R_X = 100\text{k}\Omega$ . For power supply variations of  $\pm 5\%$ , the output pulse width has variations of  $\pm 0.5\%$  typically, for  $V_{DD} = 10\text{V}$  and  $15\text{V}$  and  $\pm 1\%$  typically, for  $V_{DD} = 5\text{V}$  at  $C_X = 1000\text{pF}$  and  $R_X = 5\text{k}\Omega$ .

### FUNCTIONAL DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{DD}^*$	Supply Voltage : HCC Types HCF Types	- 0.5 to + 20 - 0.5 to + 18	V
$V_i$	Input Voltage	- 0.5 to $V_{DD} + 0.5$	V
$I_i$	DC Input Current (any one input)	$\pm 10$	mA
$P_{tot}$	Total Power Dissipation (per package) Dissipation per Output Transistor for $T_{op} = \text{Full Package-temperature Range}$	200 100	mW
$T_{op}$	Operating Temperature : HCC Types HCF Types	- 55 to + 125 - 40 to + 85	$^\circ\text{C}$
$T_{stg}$	Storage Temperature	- 65 to + 150	$^\circ\text{C}$

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.

\* All voltage values are referred to  $V_{SS}$  pin voltage.

### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage : HCC Types HCF Types	3 to 18 3 to 15	V
$V_i$	Input Voltage	0 to $V_{DD}$	V
$T_{op}$	Operating Temperature : HCC Types HCF Types	- 55 to + 125 - 40 to + 85	$^\circ\text{C}$

LOGIC DIAGRAMS

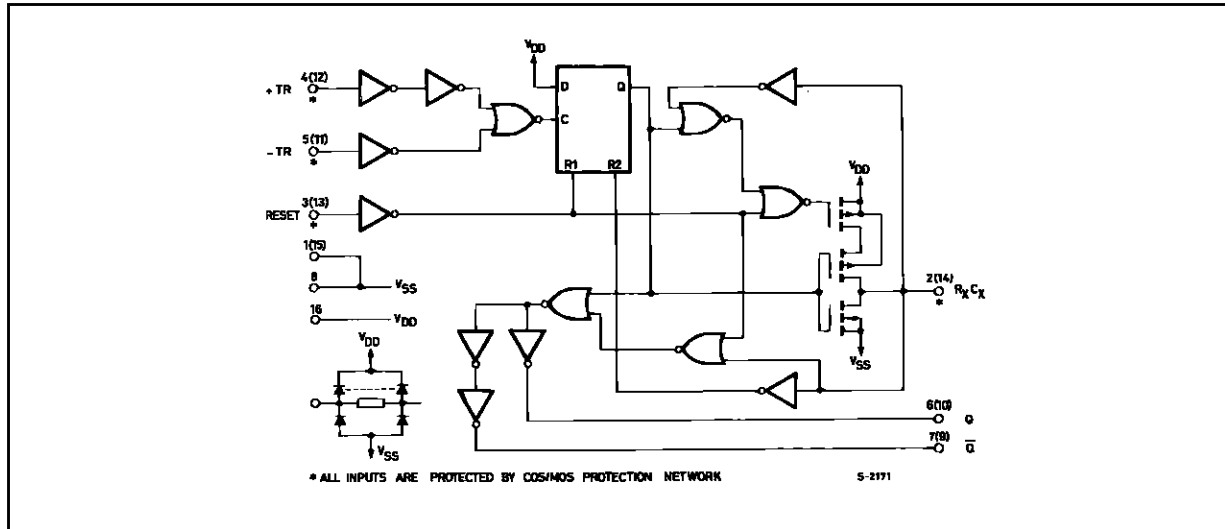
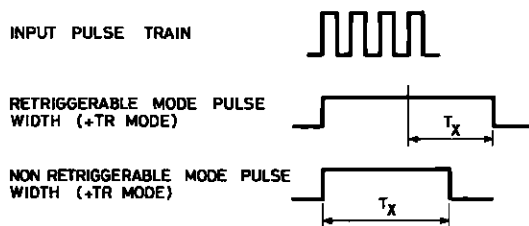


Table 1 : Functional Terminal Connections.

Function	Terminal Connections						Other Connections	
	to V <sub>DD</sub>		to V <sub>SS</sub>		Input Pulse to		Mono (1)	Mono (2)
	Mono (1)	Mono (2)	Mono (1)	Mono (2)	Mono (1)	Mono (2)		
Leading - Edge Trigger/Retriggerable	3,5	11,13			4	12		
Leading - Edge Trigger/Non - retriggerable	3	13			4	12	5,7	11,9
Trailing - Edge Trigger/Retriggerable	3	13	4	12	5	11		
Trailing - Edge Trigger/Non - retriggerable	3	13			5	11	4,6	12,10
Unused Section	5	11	3,4	12,13				

Notes : 1. A Retriggerable one-shot multivibrator has an output pulse width which is extended one full time period (T<sub>x</sub>) after application of the last trigger pulse.

2. A non-retriggerable one-shot multivibrator has a time period T<sub>x</sub> referenced from the application of the first trigger pulse.



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**STATIC ELECTRICAL CHARACTERISTICS** (over recommended operating conditions)

Symbol	Parameter		Test Conditions				Value						Unit	
			V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>O</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>Low</sub> *		25°C			T <sub>High</sub> *		
							Min.	Max.	Min.	Typ.	Max.	Min.		Max.
I <sub>L</sub>	Quiescent Current	HCC Types	0/ 5			5		1		0.02	1		30	$\mu$ A
			0/10			10		2		0.02	2		60	
			0/15			15		4		0.02	4		120	
		0/20			20		20		0.04	20		600		
		HCF Types	0/ 5			5		4		0.02	4		30	
			0/10			10		8		0.02	8		60	
0/15				15		16		0.02	16		120			
V <sub>OH</sub>	Output High Voltage	0/ 5		< 1	5	4.95		4.95			4.95		V	
		0/10		< 1	10	9.95		9.95			9.95			
		0/15		< 1	15	14.95		14.95			14.95			
V <sub>OL</sub>	Output Low Voltage	5/0		< 1	5		0.05			0.05		0.05	V	
		10/0		< 1	10		0.05			0.05		0.05		
		15/0		< 1	15		0.05			0.05		0.05		
V <sub>IH</sub>	Input High Voltage		0.5/4.5	< 1	5	3.5		3.5			3.5		V	
			1/9	< 1	10	7		7			7			
			1.5/13.5	< 1	15	11		11			11			
V <sub>IL</sub>	Input Low Voltage		4.5/0.5	< 1	5		1.5			1.5		1.5	V	
			9/1	< 1	10		3			3		3		
			13.5/1.5	< 1	15		4			4		4		
I <sub>OH</sub>	Output Drive Current	HCC Types	0/ 5	2.5		5	- 2		- 1.6	- 3.2		- 1.15	mA	
			0/ 5	4.6		5	- 0.64		- 0.51	- 1		- 0.36		
			0/10	9.5		10	- 1.6		- 1.3	- 2.6		- 0.9		
		0/15	13.5		15	- 4.2		- 3.4	- 6.8		- 2.4			
		HCF Types	0/ 5	2.5		5	- 1.53		- 1.36	- 3.2		- 1.1		
			0/ 5	4.6		5	- 0.52		- 0.44	- 1		- 0.36		
0/10	9.5			10	- 1.3		- 1.1	- 2.6		- 0.9				
0/15	13.5		15	- 3.6		- 3.0	- 6.8		- 2.4					
I <sub>OL</sub>	Output Sink Current	HCC Types	0/ 5	0.4		5	0.64		0.51	1		0.36	mA	
			0/10	0.5		10	1.6		1.3	2.6		0.9		
			0/15	1.5		15	4.2		3.4	6.8		2.4		
		HCF Types	0/ 5	0.4		5	0.52		0.44	1		0.36		
			0/10	0.5		10	1.3		1.1	2.6		0.9		
			0/15	1.5		15	3.6		3.0	6.8		2.4		
I <sub>IH</sub> , I <sub>IL</sub>	Input Leakage Current	HCC Types	0/18	Any Input		18		$\pm$ 0.1		$\pm$ 10 <sup>-5</sup>	$\pm$ 0.1		$\pm$ 1	$\mu$ A
		HCF Types	0/15	Any Input		15		$\pm$ 0.3		$\pm$ 10 <sup>-5</sup>	$\pm$ 0.3		$\pm$ 1	
C <sub>I</sub>	Input Capacitance		Any Input						5	7.5			pF	

\* T<sub>Low</sub> = - 55°C for HCC device : - 40°C for HCF device.

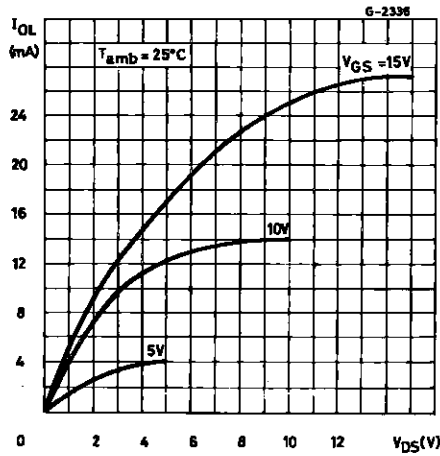
\* T<sub>High</sub> = + 125°C for HCC device : + 85°C for HCF device.

The Noise Margin for both "1" and "0" level is : 1V min. with V<sub>DD</sub> = 5V, 2V min. with V<sub>DD</sub> = 10V, 2.5 V min. with V<sub>DD</sub> = 15V.

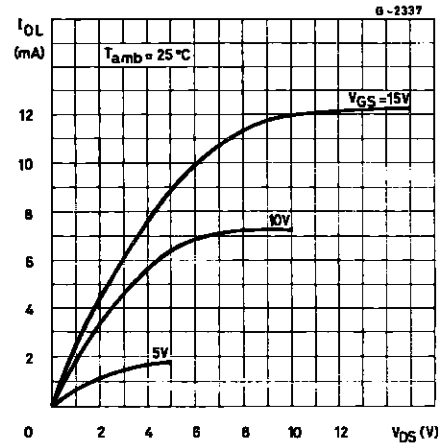
**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 200\text{k}\Omega$ , typical temperature coefficient for all  $V_{DD}$  values is  $0.3\%/^{\circ}\text{C}$ , all input rise and fall times = 20ns)

Symbol	Parameter	Test Conditions			Value			Unit
		$R_X$ (k $\Omega$ )	$C_X$ (pF)	$V_{DD}$ (V)	Min.	Typ.	Max.	
$t_{PLH}$ , $t_{PHL}$	Trigger Propagation Delay Time (+ TR, - TR to Q, $\bar{Q}$ )	5 to 10.000	$\geq 15$	5		250	500	ns
				10		125	250	
				15		100	200	
$t_{WH}$ , $t_{WL}$	Trigger Pulse Width	5 to 10.000	$\geq 15$	5	140	70		ns
				10	60	30		
				15	40	20		
$t_{TLH}$	Transition Time	5 to 10.000	$\geq 15$	5		100	200	
				10		50	100	
				15		40	80	
$t_{THL}$	Transition Time	5 to 10.000	15 to 10.000	5		100	200	ns
				10		50	100	
				15		40	80	
		5 to 10.000	0.01 $\mu\text{F}$ to 0.1 $\mu\text{F}$	5		150	300	
				10		75	150	
				15		65	130	
		5 to 10.000	0.1 $\mu\text{F}$ to 1 $\mu\text{F}$	5		250	500	
				10		150	300	
				15		80	160	
$t_{PLH}$ , $t_{PHL}$	Propagation Delay Time (reset)	5 to 10.000	$\geq 15$	5		225	450	ns
				10		125	250	
				15		75	150	
$t_{WR}$	Pulse Width (reset)	100	15	5	200	100		ns
				10	80	40		
				15	60	30		
			1000	5	1200	600		
				10	600	300		
				15	500	250		
		0.1 $\mu\text{F}$	5	50	250		$\mu\text{s}$	
			10	30	15			
			15	20	10			
$t_r$ , $t_f$ (TR)	Rise or Fall Time (trigger)		5 to 15				100	$\mu\text{s}$
	Pulse Width Match Between Circuits in Same Package	10	10.000	5		5	10	%
				10		7.5	15	
				15		7.5	15	

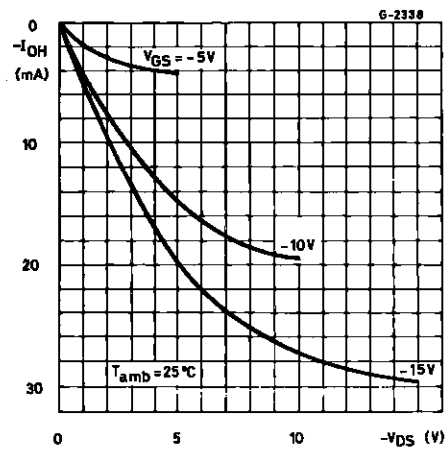
**Figure 2 :** Typical Output Low (sink) Current Characteristics.



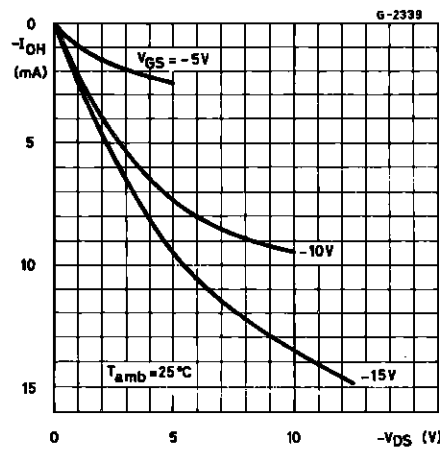
**Figure 3 :** Minimum Output Low (sink) Current Characteristics.



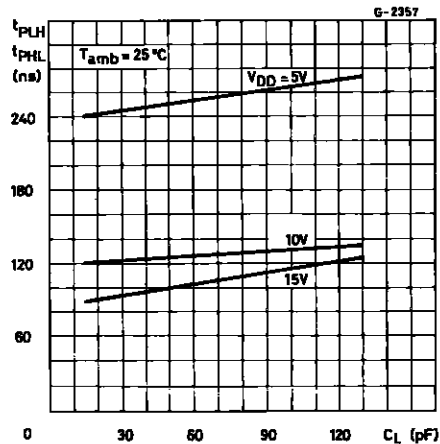
**Figure 4 :** Typical Output High (source) Current Characteristics.



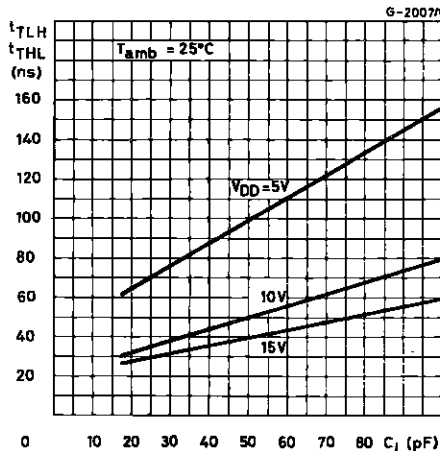
**Figure 5 :** Minimum Output High (source) Current Characteristics.



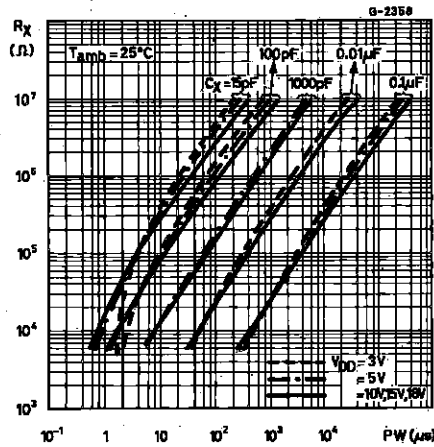
**Figure 6 :** Typical Propagation Delay Times vs. Load Capacitance, Trigger in to Q out. (All values of  $C_x$  and  $R_x$ ).



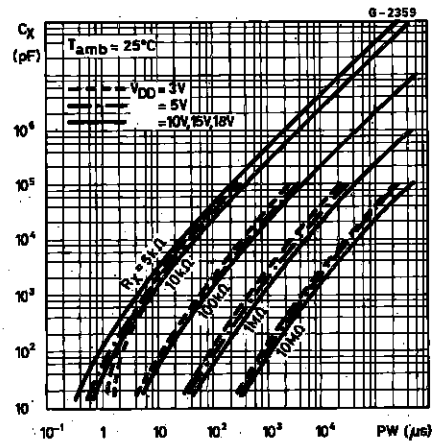
**Figure 7 :** Transition Time vs. Load Capacitance for  $R_x = 5k\Omega$ ,  $10000 k\Omega$  and  $C_x = 15pF$ ,  $10000pF$ .



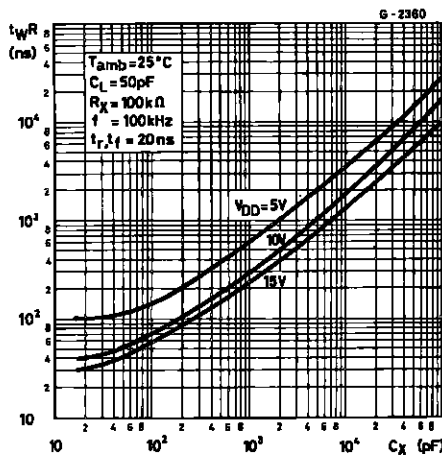
**Figure 8** : Typical External Resistance vs. Pulse Width at Various  $V_{DD}$  and  $C_X$ .



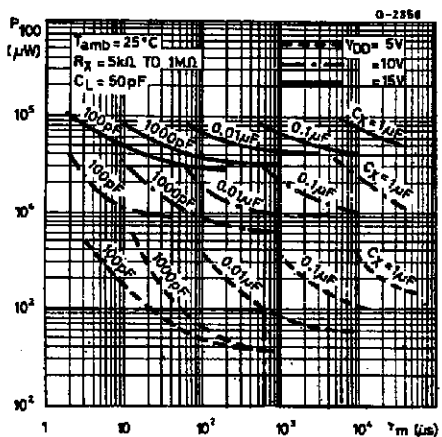
**Figure 9** : Typical External Capacitance vs. Pulse Width at Various  $V_{DD}$  and  $R_X$ .



**Figure 10** : Typical Minimum Reset Pulse Width vs. External Capacitance.



**Figure 11** : Average Power Dissipation for 100% Duty Cycle vs. One-shot Pulse width.



To calculate average power dissipation (P) for less than 100% duty cycle :

$P_{100}$  = average power for 100% duty cycle

$$P = \left( \frac{\tau_m}{\tau_T} \right) P_{100}$$

where  $\tau_m$  = one-shot pulse width  
 $\tau_T$  = trigger pulse period

e.g. : For  $\tau_m = 600ms, \tau_T = 1000ms,$   
 $C_X = 0.01\mu F, V_{DD} = 5V$

$$P = \left( \frac{600}{1000} \right) 103\mu W = 600\mu W$$

(see dotted line on graph)

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TEST CIRCUITS

Figure 12 : Quiescent -Device Current.

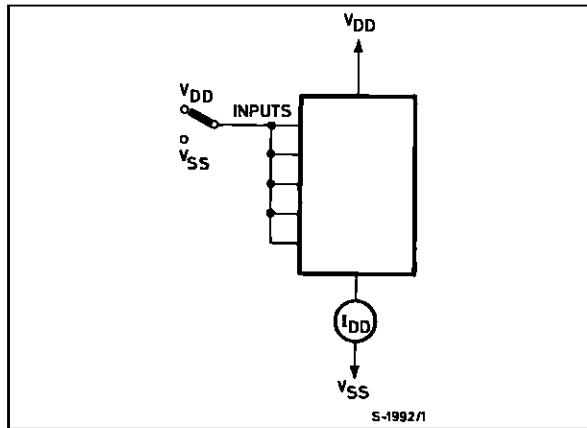


Figure 13 : Input-Voltage.

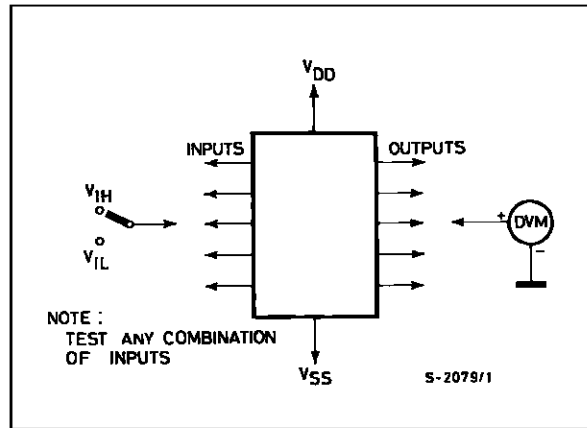
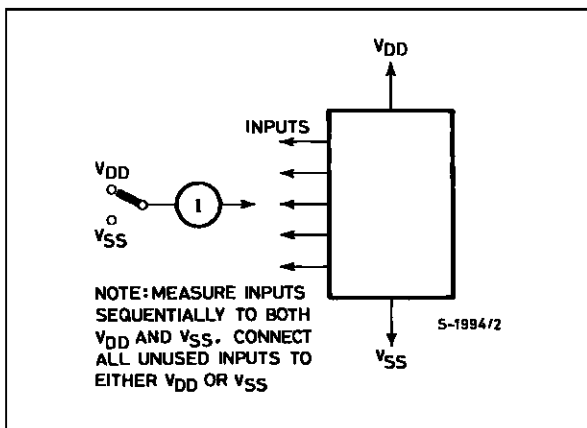


Figure 14 : Input Leakage.





TYPICAL APPLICATIONS

Figure 15 : Astable Multivibrator with Restart after Reset Capability.

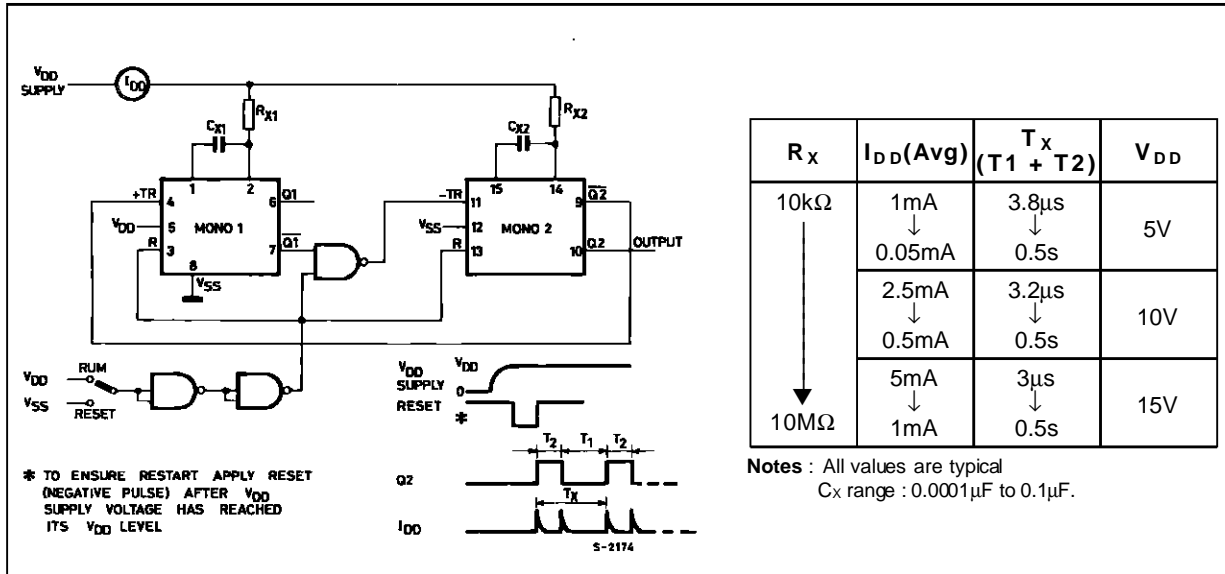
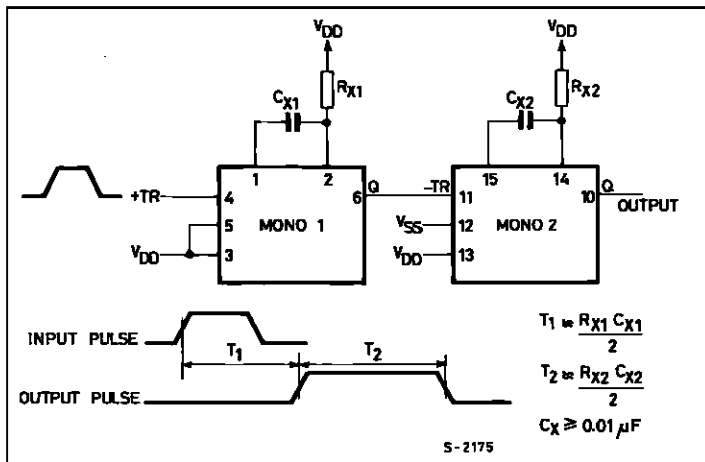


Figure 16 : Pulse Delay.



**Plastic DIP16 (0.25) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

## Ceramic DIP16/1 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



**SO16 (Narrow) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



P013H

## PLCC20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	9.78		10.03	0.385		0.395
B	8.89		9.04	0.350		0.356
D	4.2		4.57	0.165		0.180
d1		2.54			0.100	
d2		0.56			0.022	
E	7.37		8.38	0.290		0.330
e		1.27			0.050	
e3		5.08			0.200	
F		0.38			0.015	
G			0.101			0.004
M		1.27			0.050	
M1		1.14			0.045	



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