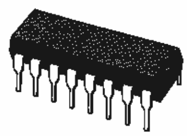
SGS-THOMSON MICROELECTRONICS

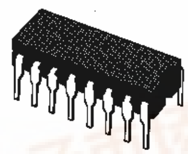
HCC4538B
HCF4538B

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 $\overline{Q}$ 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
- SCHMITT TRIGGER INPUT ALLOWS UNLIMITER RISE AND FALL TIMES ON + TR AND – TR INPUTS
- 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"



EY
(Plastic Package)



F
(Ceramic Package)

M1
(Micro Package)

C1
(Chip Carrier)

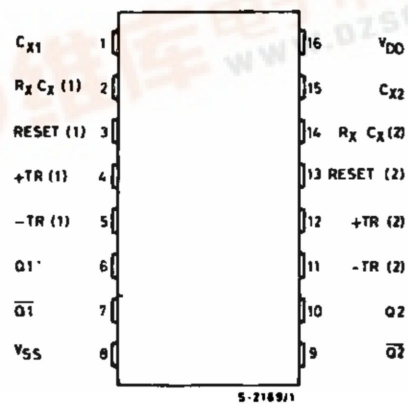
ORDER CODES :

HCC4538BF HCF4538BM1
HCF4538BEY HCF4538BC1

DESCRIPTION

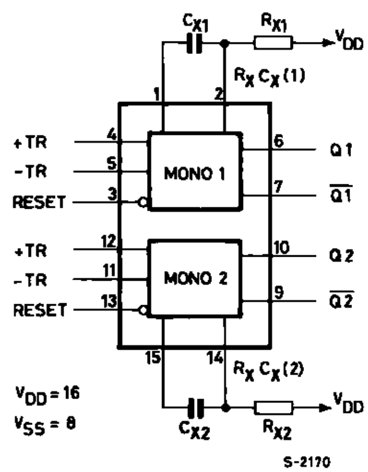
The **HCC4538B** (extended temperature range) and **HCF4538B** (intermediate temperature range) are monolithic integrated circuit, available in 16-lead dual in-line plastic or-ceramic package and plastic micro package. The **HCC/HCF4538B** dual precision monostable multivibrator provides stable retriggerable/resettable one-shot operation for any fixed-voltage timing application. An external resistor (R_X) and an external capacitor (C_X) control the timing and accuracy for the circuit. Adjustment of R_X and C_X provides a wide range of output pulse widths from the Q and $\overline{Q}$ 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. Precision control of output pulse widths is achieved through linear CMOS techniques. 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

PIN CONNECTIONS



TERMINALS 1,8,15, ARE ELECTRICALLY CONNECTED INTERNALLY 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 **HCC/HCF4538B** is not used, its inputs must be tied to either V_{DD} or V_{SS} (see table 1). In normal operation the circuit triggers (extends the output pulse one period) on the application of each new trigger pulse. For operation in the non-retriggerable mode, $\overline{Q}$ is connected to – TR when leading-edge triggering (+ TR) is used or Q is connected to + TR when trailingedge triggering (– TR) is used. The time period (T) for this multivibrator can be calculated by : $T = R_X C_X$. The min. value of external resistance, R_X, is 4KΩ. The max. and min. values of external capacitance, C_X, are 100µF and 5nF, respectively.

FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
V_{DD} *	Supply Voltage: **HCC** Types **HCF** Types	-0.5 to +20 -0.5 to +18	V V
V_i	Input Voltage	-0.5 to V_{DD} + 0.5	V
I_I	DC Input Current (any one input)	± 10	mA
P_{tot}	Total Power Dissipation (per package) Dissipation per Output Transistor for Top = Full Package Temperature Range	200 100	mW mW
T_{op}	Operating Temperature: **HCC** Types **HCF** Types	-55 to +125 -40 to +85	°C °C
T_{stg}	Storage Temperature	-65 to +150	°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
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature: **HCC** Types **HCF** Types	-55 to +125 -40 to +85	°C °C

LOGIC DIAGRAM (1/2 of device shown)

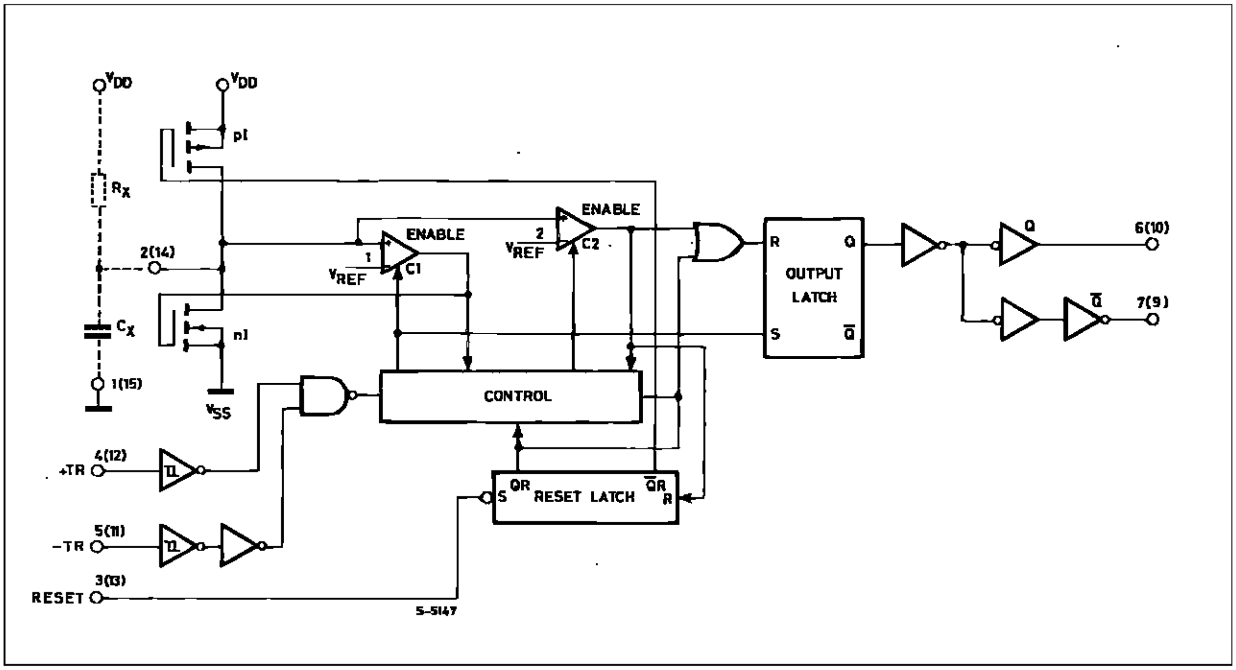
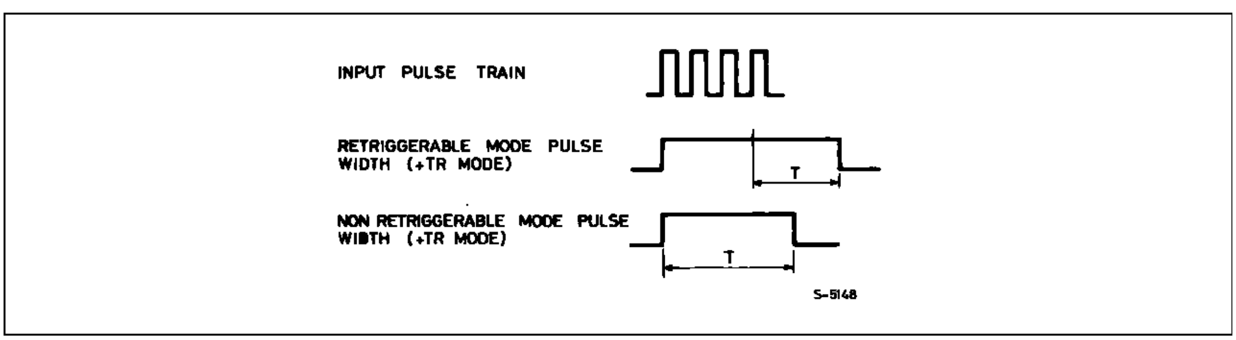


TABLE 1: Functional Terminal Connections

Function	V_{DD} to Term. NO		V_{SS} to Term. NO		Input Pulse to Term. No		Other Connections	
	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

Notes :
1. A Retriggerable one-shot multivibrator has an output pulse width which is extended on full time period (T) after application of the last trigger pulse.
2. A Non-retriggerable one-shot multivibrator has a time period (T) referenced from the application of the first trigger pulse.

Pulse Width



STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter		Test Conditios				Value							Unit
			V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_{LOW} *		25 °C			T_{HIGH} *		
							Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
I_L	Quiescent Current	HCC Types	0/5			5		5		0.04	5		150	μA
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	
		HCF Types	0/5			5		5		0.04	5		150	
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
V_{OH}	Output High Voltage		0/5		< 1	5	4.95		4.95	5		4.95		V
			0/10		< 1	10	9.95		9.95	10		9.95		
			0/15		< 1	15	14.95		14.95	15		14.95		
V_{OL}	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_{IH}	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_{IL}	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_{OH}	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	-1.8		-1.6	-3.2		-1.3		
			0/5	4.6		5	-0.61		-0.51	-1		-0.42		
			0/10	9.5		10	-1.5		-1.3	-2.6		-1.1		
			0/15	13.5		15	-4		-3.4	-6.8		-2.8		
I_{OL}	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	0.61		0.51	1		0.42		
			0/10	0.5		10	1.5		1.3	2.6		1.1		
			0/15	1.5		15	3.6		3.4	6.8		2.8		
I_{IH}, I_{IL}	Input Leakage Current		0/18	Any Input		18		±0.1		$\pm 10^{-5}$	±0.1		±1	μA
C_I	Input Capacitance			Any Input						5	7.5			pF

* T_{LOW} = -55 °C for **HCC** device: -40 °C for **HCF** device.

* T_{HIGH} = +125 °C for **HCC** device: +85 °C for **HCF** device.

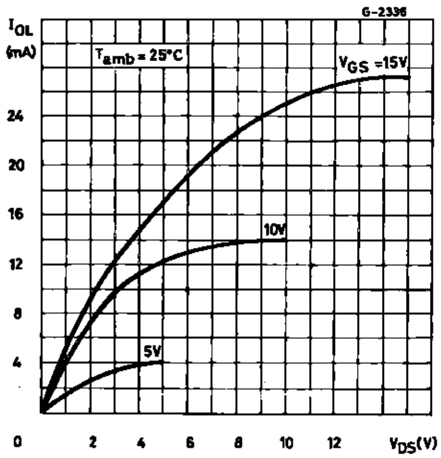
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD} = 5 V, 2 V min. with V_{DD} = 10 V, 2.5 V min. with V_{DD} = 15 V

DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25 ^{o}C, C_L = 50 pF, R_L = 200 KΩ, typical temperature coefficent for all V_{DD} values is 03 %/^{o}C, all input rise and fall times= 20 ns)

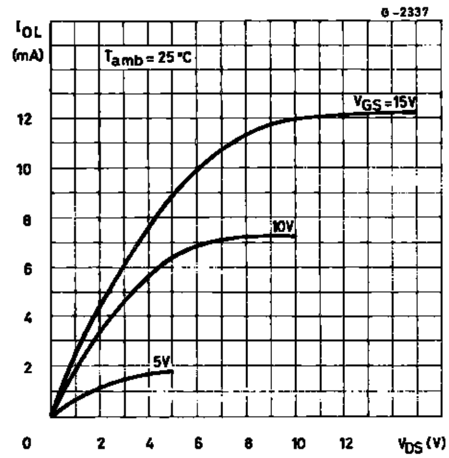
Symbol	Parameter	Test Conditions		Value			Unit
			V_{DD} (V)	Min.	Typ.	Max.	
t_{TLH} t_{THL}	Transition Time		5		100	200	ns
			10		50	100	
			15		40	80	
t_{PLH} t_{PHL}	Propagation Delay Time +TR or -TR to Q or $\overline{Q}$		5		300	600	ns
			10		150	300	
			15		100	220	
t_{PLH} t_{PHL}	Propagation Delay Time Reset to Q or $\overline{Q}$	R_L = 1KΩ	5		250	500	ns
			10		125	250	
			15		95	190	
t_{WH} t_{WL}	Minimum Input Pulse Width +TR, -TR or Reset	R_L = 1KΩ	5		80	140	ns
			10		40	80	
			15		30	60	
t_{WT}	Output Pulse Width - Q or $\overline{Q}$ (C_X = 0.005 µF, R_X = 10 KΩ *)		5	57	60.6	64.5	µs
			10	55	58.9	63.0	
			15	55	59.1	63.5	
t_{WT}	Output Pulse Width - Q or $\overline{Q}$ (C_X = 0.1 µF, R_X = 100 KΩ)		5	9.4	9.97	10.5	ms
			10	9.4	9.95	10.6	
			15	9.5	10.00	10.6	
t_{WT}	Output Pulse Width - Q or $\overline{Q}$ (C_X = 10 µF, R_X = 100 KΩ)		5	0.95	1.00	1.06	s
			10	0.95	1.00	1.06	
			15	0.96	1.00	1.07	
t_W	Pulse Width Match Between Circuits in Same Package: $\frac{100\,(T_1 - T_2)}{T_1}$ (C_X = 0.1 µF, R_X = 100 KΩ)		5		±1		%
			10		±1		
			15		±1		
t_{rr}	Minimum Retrigger Time		5	0			ns
			10	0			
			15	0			
C_{IN}	Input Capacitance		Any Input		5	7.5	pF

* Minimum R_X value = 4 KΩ, minimum C_X value = 500 pF

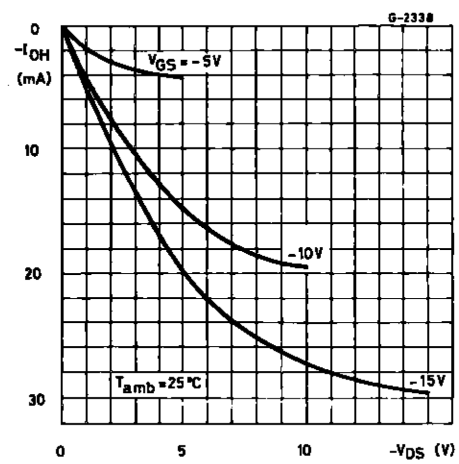
Typical Output Low (sink) Current Characteristics



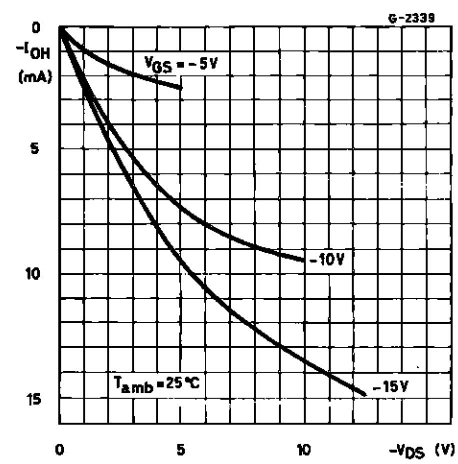
Minimum Output Low (sink) Current Characteristics



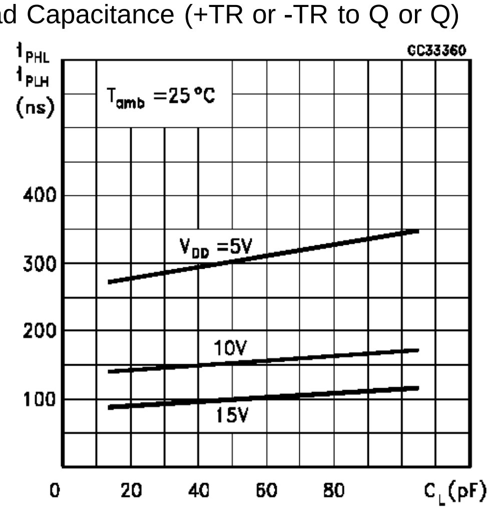
Typical Output High (source) Current Characteristics



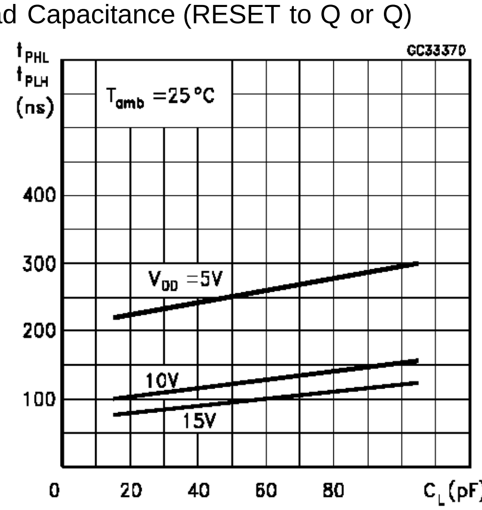
Minimum Output High (source) Current Characteristics



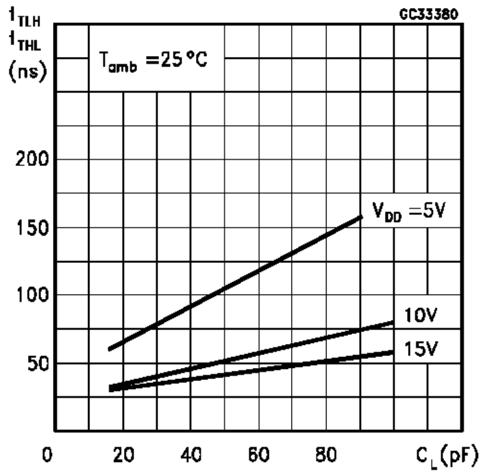
Typical Propagation Delay Time as a Function of Load Capacitance (+TR or -TR to Q or $\overline{Q}$)



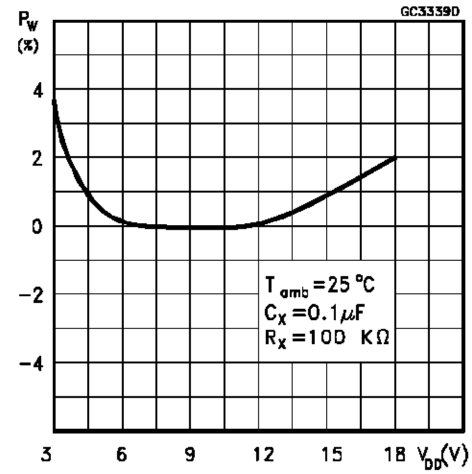
Typical Propagation Delay TIme as a Function of Load Capacitance (RESET to Q or $\overline{Q}$)



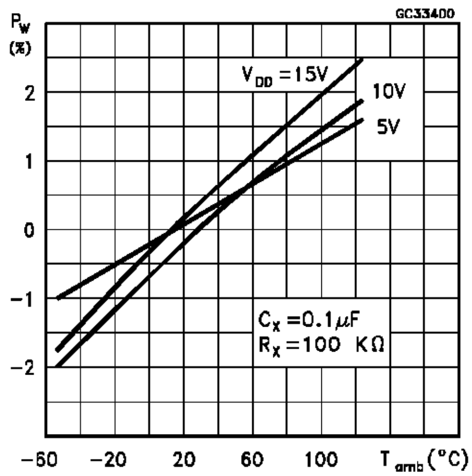
Typical Transition Time as a Function of Load Capacitance



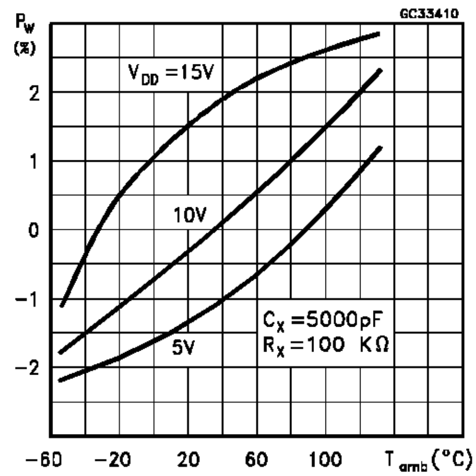
Typical Pulse Width Variation as a Function of Supply Voltage



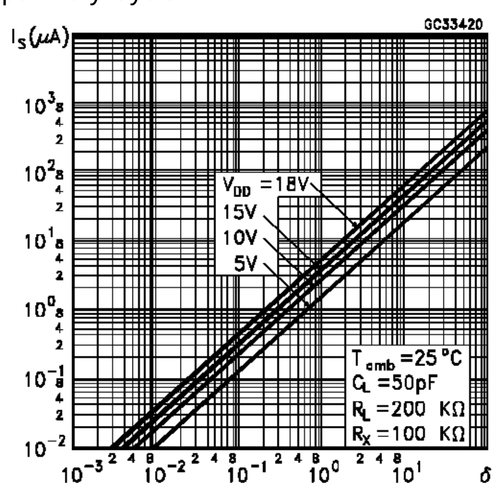
Typical Pulse Width Variation as a Function of Temperature



Typical Pulse Width Variation as a Function of Temeprature



Typical Total Supply Current as a Function of Output Duty Cycle



Power Down Mode

During a rapid power-down conditiona, as would occur with a power supply short circuit or with a poorly filtered power supply, the energy stored in C_X could discharge into Pin 2 or 14. To Avoid possible device damage in this mode, when C_X is $\leq$0.5 microfarad, a aprotection diode with a 1 Ampere or higher rating (1N5395 or equivalent) and a separate ground return for C_X should be provided as shown in Fig. 1

An alternate protection method is shown in Fig. 2, where a 51 Ω current limit resistor is inserted in series with CX. Note that a small pulse width decrease will occour however, and RX must be appropriately increased to obtain the originally desired pulse width.

Figure 1: rapid Power Down Protection Circuit

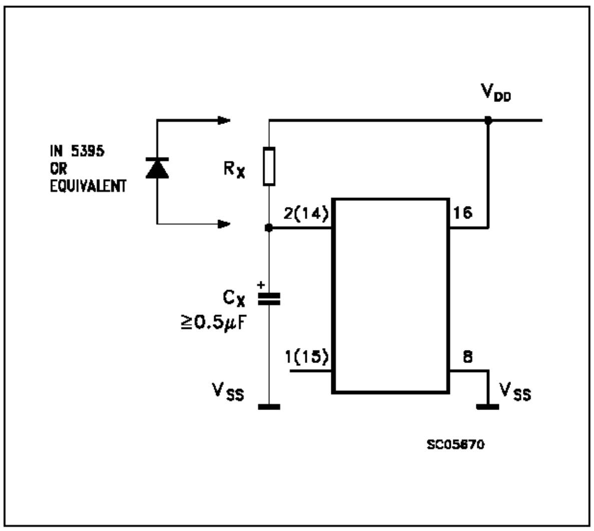
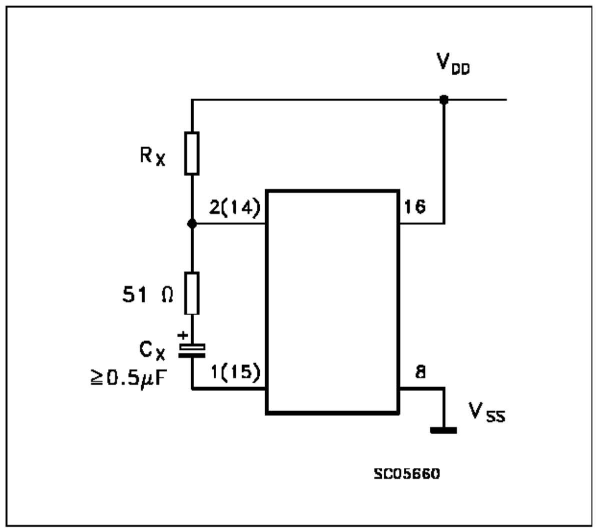
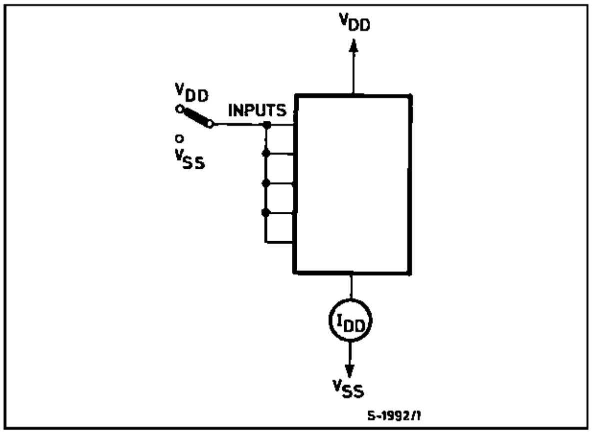


Figure 2: Alternate rapid Power Down Protection Circuit

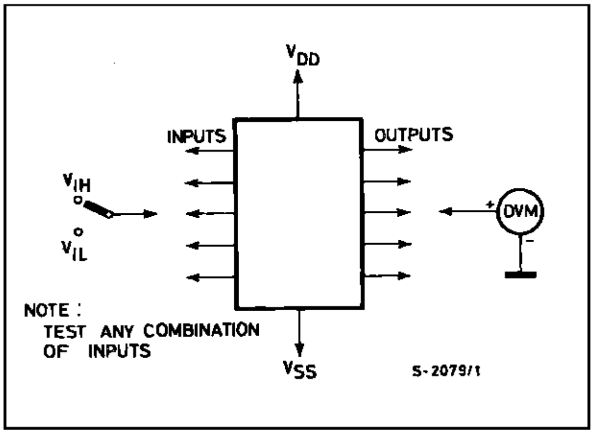


TEST CIRCUITS

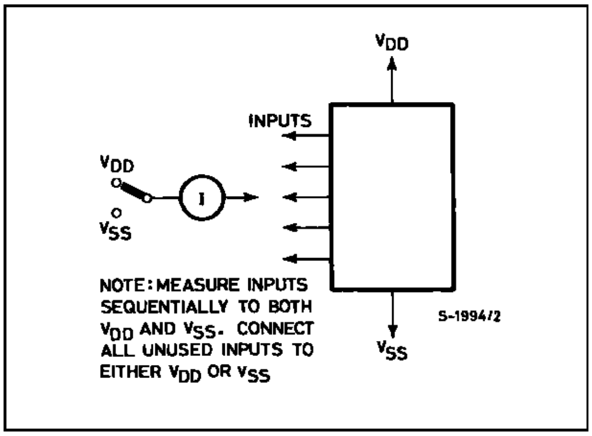
Quiescent Device Current.



Noise Immunity.

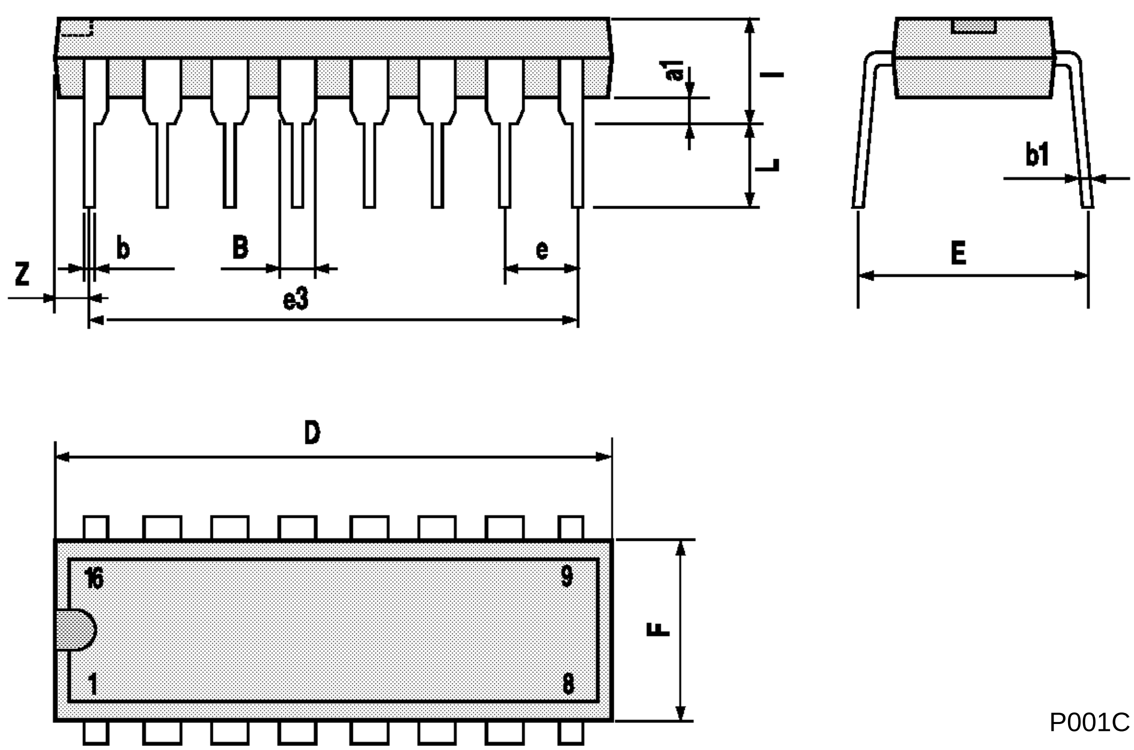


Input Leakage Current.



Plastic DIP16 (0.25) MECHANICAL DATA

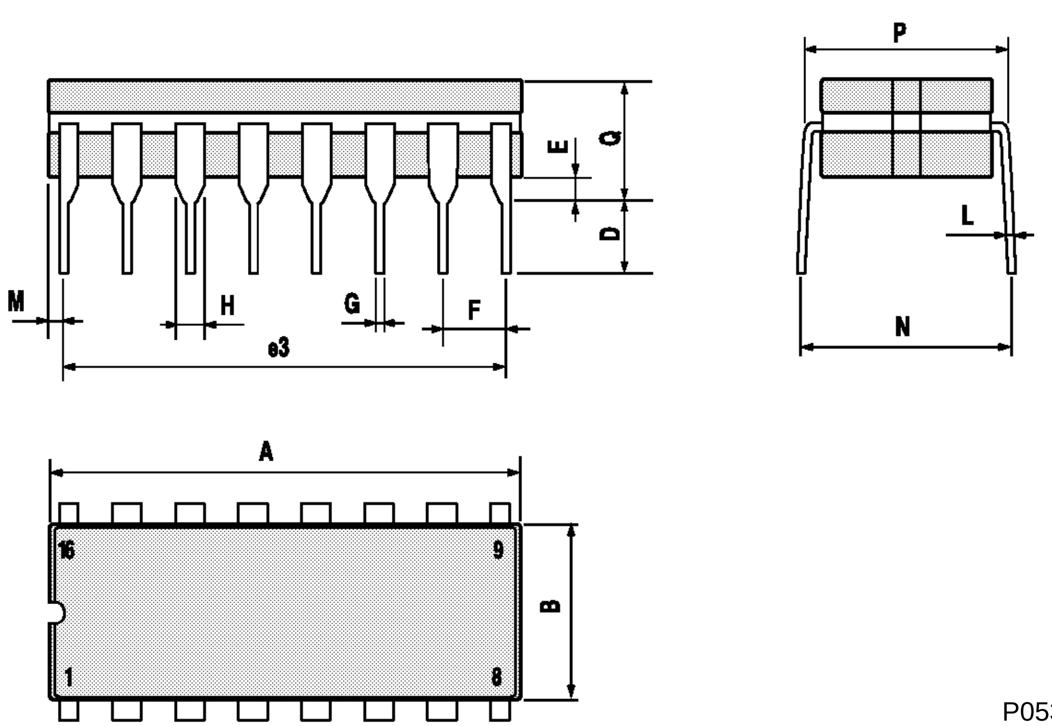
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

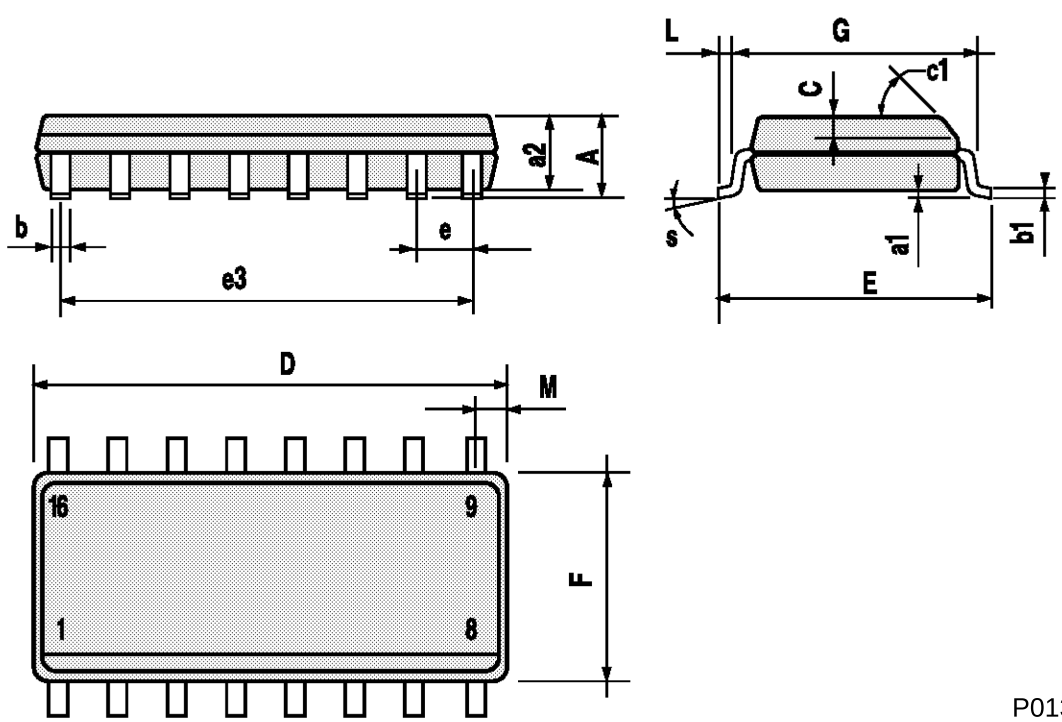
Ceramic DIP16/1 MECHANICAL DATA

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