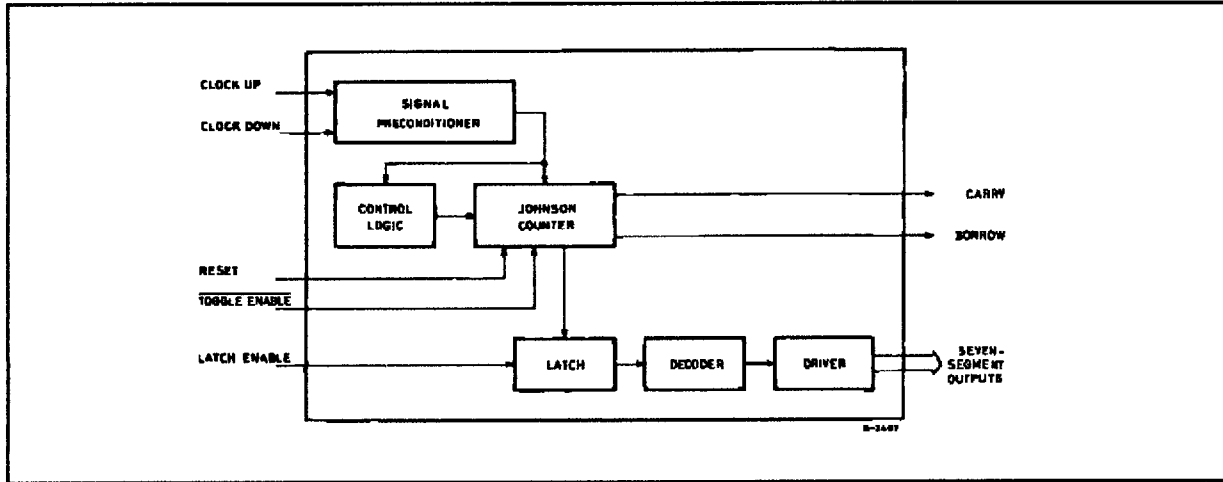




**FUNCTIONAL DIAGRAM**



**ABSOLUTE MAXIMUM RATING**

Symbol	Parameter	Value	Unit
V <sub>DD</sub> *	Supply Voltage: HCC Types HCF Types	-0.5 to +20	V
		-0.5 to +18	V
V <sub>i</sub>	Input Voltage	-0.5 to V <sub>DD</sub> + 0.5	V
I <sub>i</sub>	DC Input Current (any one input)	± 10	mA
P <sub>tot</sub>	Total Power Dissipation (per package) Dissipation per Output Transistor for T <sub>op</sub> = Full Package Temperature Range	200	mW
		100	mW
T <sub>op</sub>	Operating Temperature: HCC Types HCF Types	-55 to +125	°C
		-40 to +85	°C
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C

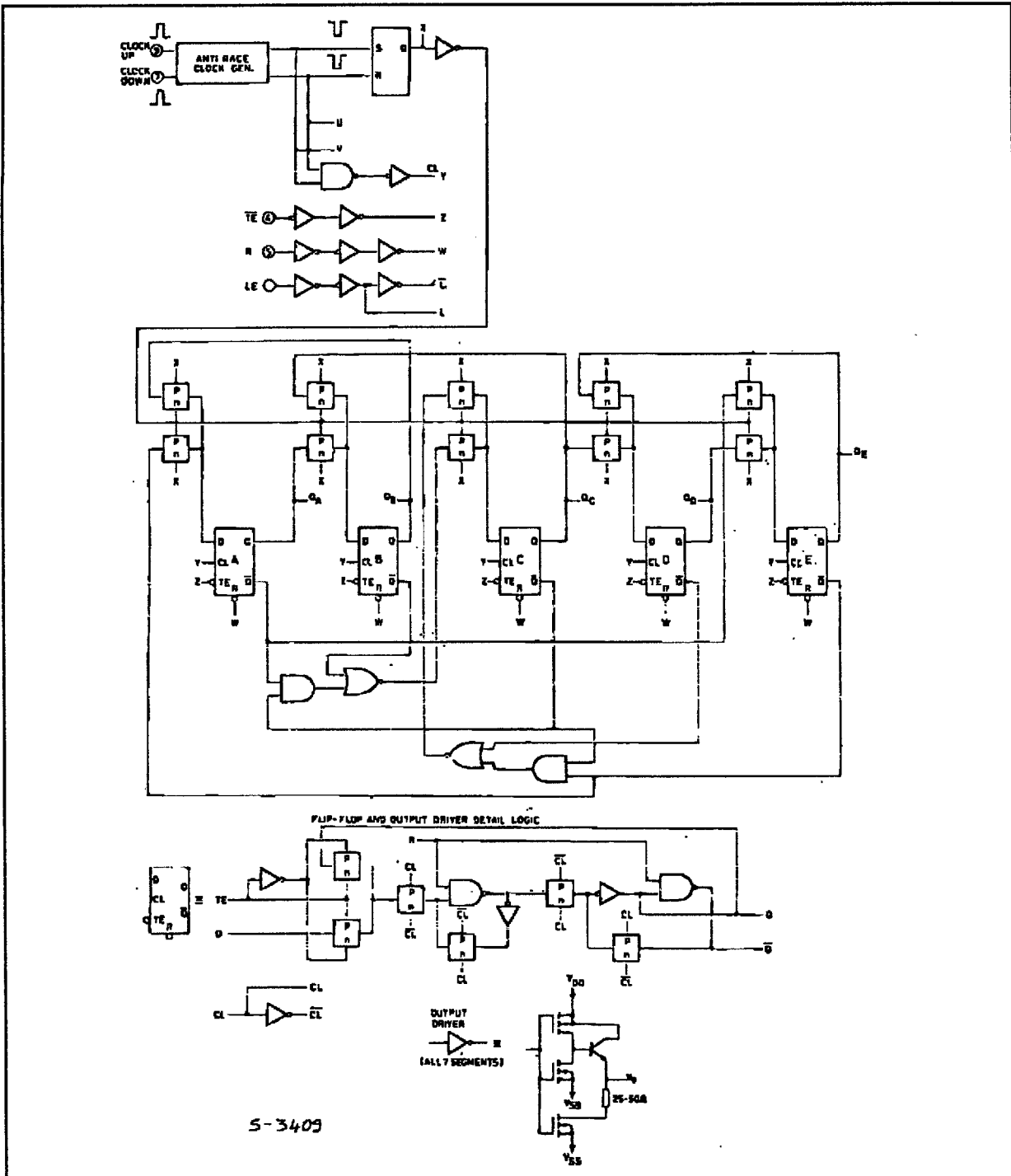
Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure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

\* All voltage values are referred to V<sub>SS</sub> pin voltage.

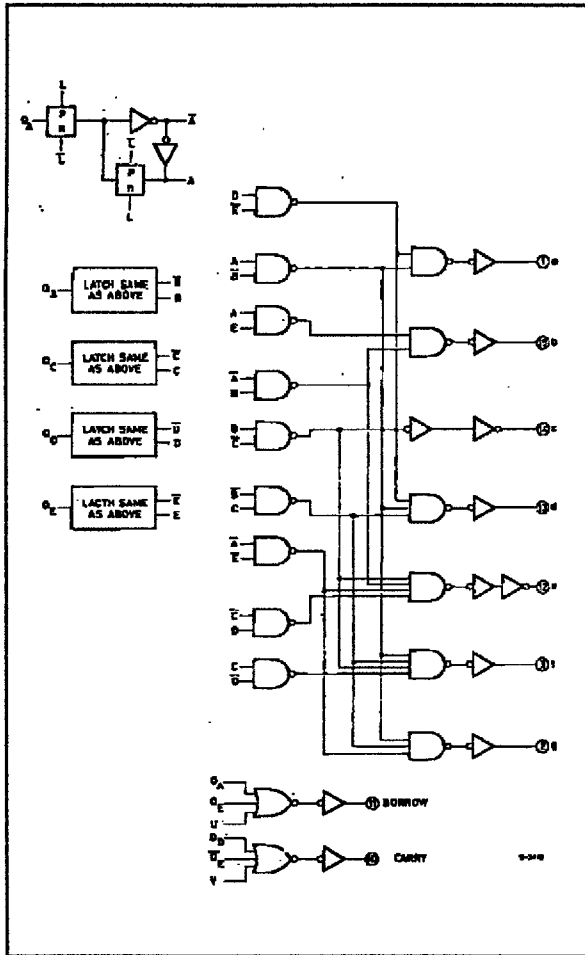
**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
V <sub>DD</sub>	Supply Voltage: HCC Types HCF Types	3 to 18	V
		3 to 15	V
V <sub>I</sub>	Input Voltage	0 to V <sub>DD</sub>	V
T <sub>op</sub>	Operating Temperature: HCC Types HCF Types	-55 to +125	°C
		-40 to +85	°C

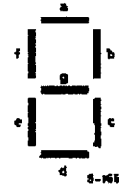
LOGIC DIAGRAMS



LOGIC DIAGRAM (continued)

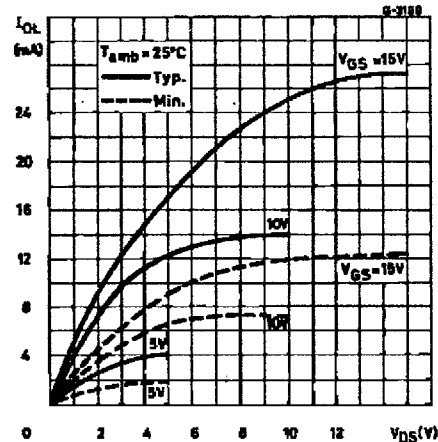


DISPLAY SEGMENTS



S-1662H

Output Low (sink) Current Characteristics.



TRUTH TABLE

CLOCK UP*	CLOCK DOWN*	LATCH ENABLE	TOGGLE ENABLE	RESET	COUNTER	DISPLAY
	X	0	0	0	Increments by 1	Follows Counter
X		0	0	0	Decrement by 1	Follows Counter
		X	X	0	No Change	No Change
X	X	X	X	1	Goes to 00000	Follows Counter (Display = 0)
X	X	X	1	0	Inhibited	Remains Fixed
	X	1	0	0	Increments by 1	Remains Fixed
X		1	0	0	Decrement by 1	Remains Fixed

x = Don't care 1 = High State 2 = Low State

\* Typically 100 ns between clock-up and clock-down positive transitions are required to ensure proper counting

## 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		5		0.04	5		150	$\mu$ A
			0/10			10		10		0.04	10		300	
			0/15			15		15		0.04	20		600	
			0/20			20		20		0.48	100		3000	
		HCF Types	0/5			5		5		0.04	20		150	
			0/10			10		10		0.04	40		300	
			0/15			15		15		0.04	80		600	
V <sub>OH</sub>	Output High Voltage	0/5			5				4.95				V	
		0/10			10				9.55					
		0/15			15				14.55					
V <sub>OL</sub>	Output Low Voltage	5/0			5		0.05		0	0.05		0.05	V	
		10/0			10		0.05		0	0.05		0.05		
		15/0			15		0.05		0	0.05		0.05		
V <sub>IH</sub>	Input High Voltage		0.5/3.8		5	3.5		3.5				3.5	V	
			1/8.8		10	7		7				7		
			1.5/3.8		15	11		11				11		
V <sub>IL</sub>	Input Low Voltage		0.5/3.8		5		1.5			1.5		1.5	V	
			1/8.8		10		3			3		3		
			1.5/3.8		15		4			4		4		
V <sub>OL</sub>	Output Drive Voltage (for HCC/HCF)			0	5				4.55				V	
				10	5				4.13					
				25	5				3.64					
				0	10				9.55					
				10	10				9.25					
				25	10				8.85					
				0	15				14.55					
				10	15				14.21					
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		$\pm 0.1$		$\pm 10^{-5}$	$\pm 0.1$		$\pm 1$	$\mu$ A
		HCF Types	0/15			15		$\pm 0.3$		$\pm 10^{-5}$	$\pm 0.3$		$\pm 1$	
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, 2.5V min. with V<sub>DD</sub> = 15V

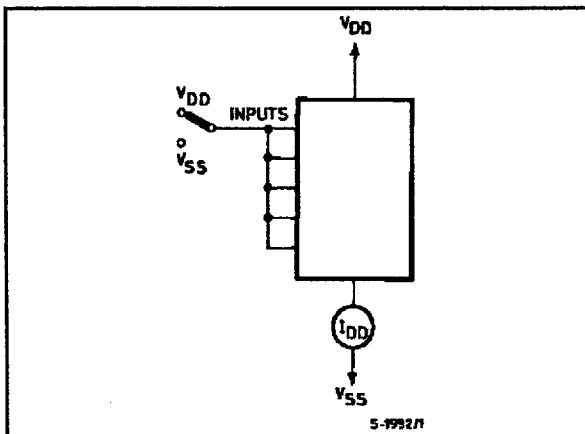
# HCC/HCF40110B

**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ K}\Omega$ , typical temperature coefficient for all  $V_{DD}$  values is  $03\text{ } \%/^{\circ}\text{C}$ , all input rise and fall times =  $20\text{ ns}$ )

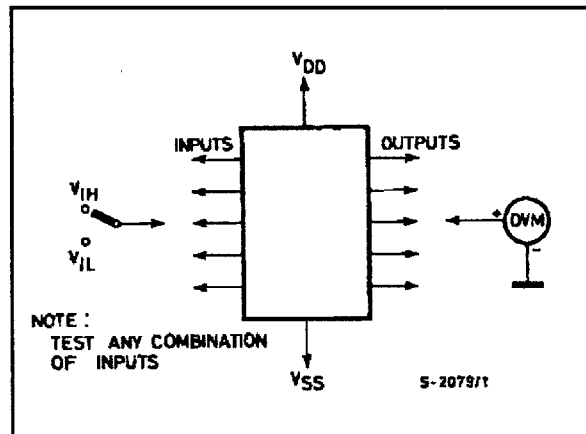
Symbol	Parameter	Test Conditions		Value			Unit
			$V_{DD}$ (V)	Min.	Typ.	Max.	
<b>CLOCK UP/CLOCK DOWN</b>							
$t_w$	Pulse Width		5		85		ns
			10		35		
			15		15		
$f_{CL}$	Maximum Frequency		5		2.5		MHz
			10		5		
			15		8		
$t_{wc}$	Carry Pulse Width		5		225		ns
			10		100		
			15		70		
$t_{WB}$	Borrow Pulse Width		5		260		ns
			10		110		
			15		80		
<b>RESET</b>							
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time Reset to Clock		5		750		ns
			10		285		
			15		200		
	Delay from Reset to First Allowable Clock		5		300		
			10		125		
			15		75		
$t_w$	Pulse Width		5		150		
			10		60		
			15		40		

## TEST CIRCUITS

Quiescent Device Current

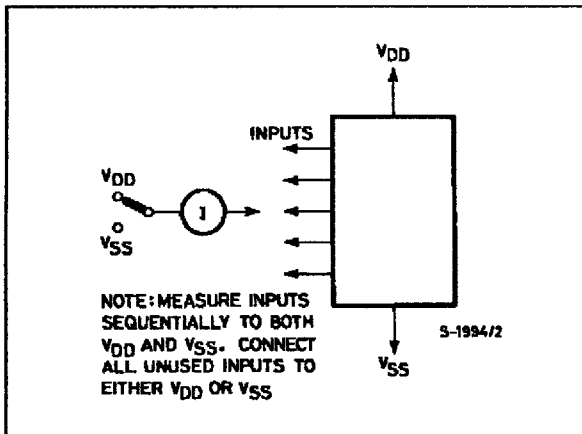


Noise Immunity.



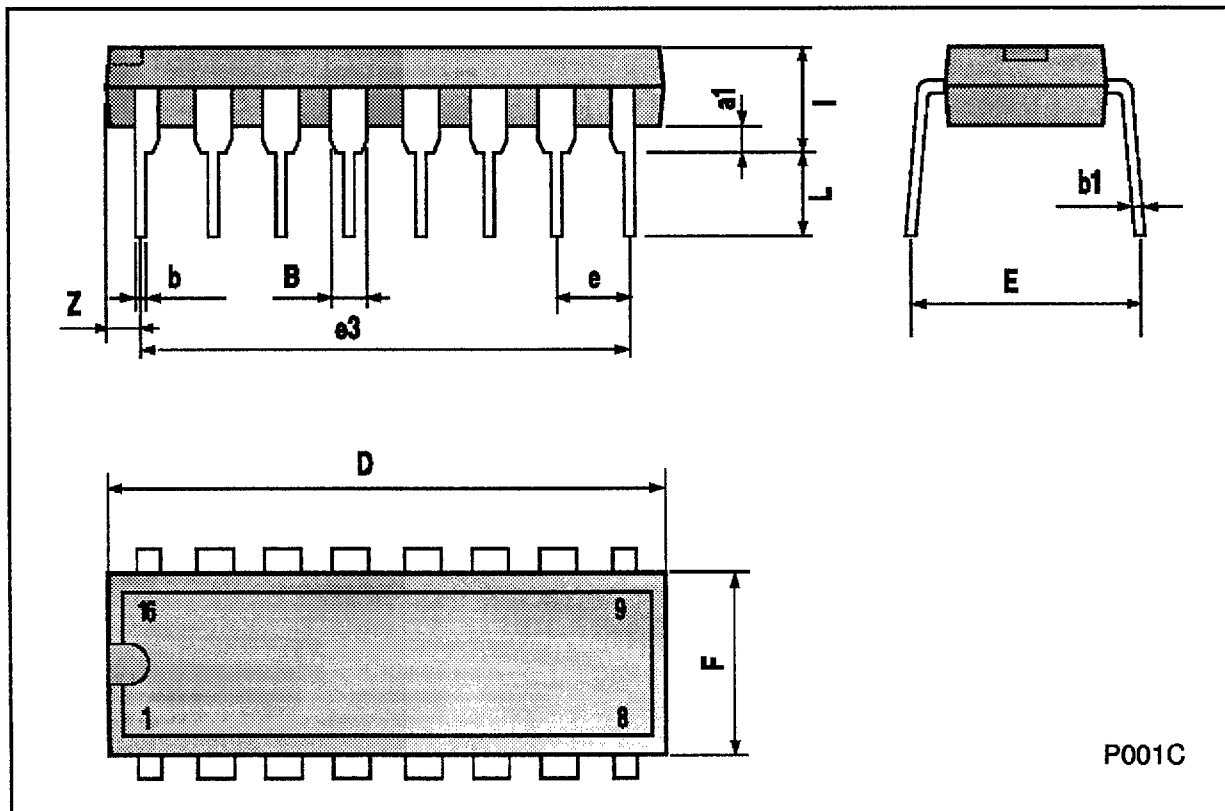
**TEST CIRCUITS**

Input Leakage Current.



**Plastic DIP16 (0.25) MECHANICAL DATA**

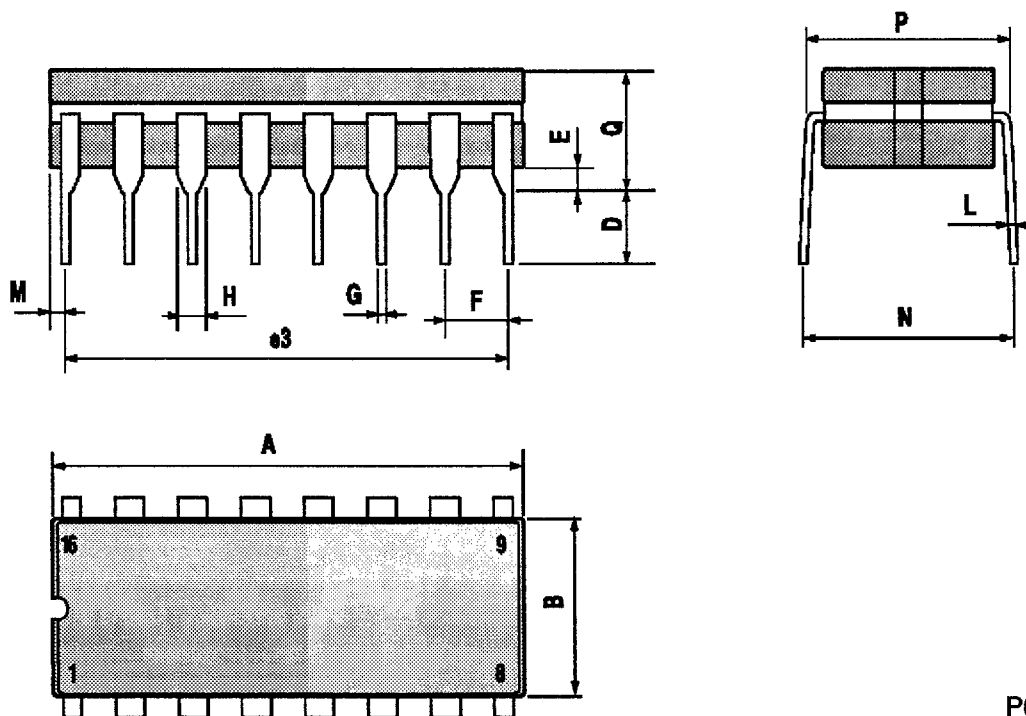
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050





## 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



**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	

