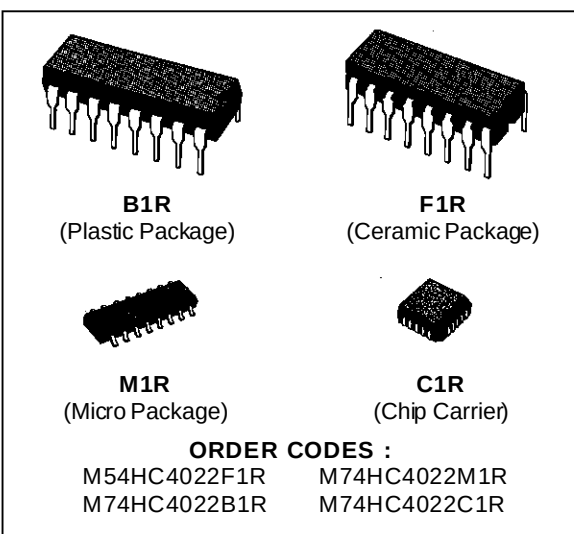


OCTAL COUNTER/DIVIDER

- **HIGH SPEED**
 $f_{MAX} = 57 \text{ MHz (TYP.)}$ at $V_{CC} = 5 \text{ V}$
- **LOW POWER DISSIPATION**
 $I_{CC} 4 \mu\text{A (MAX.)}$ at $T_A = 25^\circ\text{C}$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**
10 LSTTL LOADS
- **SYMMETRICAL OUTPUT IMPEDANCE**
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- **BALANCED PROPAGATION DELAYS**
 $t_{PLH} = t_{PHL}$
- **WIDE OPERATING VOLTAGE RANGE**
 $V_{CC} \text{ (OPR)} = 2 \text{ V to } 6 \text{ V}$
- **PIN AND FUNCTION COMPATIBLE**
WITH 4022B

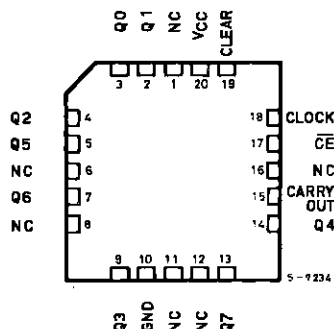
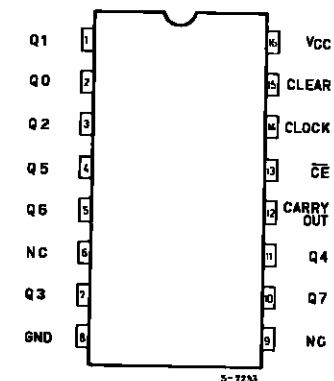


DESCRIPTION

The M54/74HC4022 is a high speed CMOS OCTAL COUNTER/DIVIDER fabricated in silicon gate C²MOS technology.

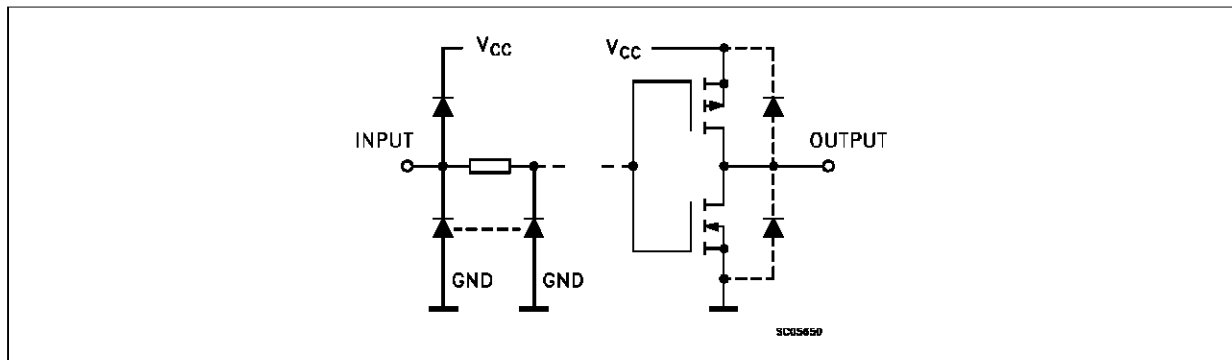
It has the same high speed performance of LSTTL combined with true CMOS low power consumption. It contains a 4-stage divide-by-8 Johnson counter with 8 decoded outputs (Q0-Q7) and a Carry-out bit. This counter is advanced on the positive edge of the clock signal when CLOCK ENABLE input is held low, or is advanced on the negative edge of clock enable signal when CLOCK input is held high, and the selected one of eight outputs goes high. Holding the CLEAR input high clears the counter to zero regardless of the other input conditions. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTIONS (top view)



NC =
No Internal
Connection

INPUT AND OUTPUT EQUIVALENT CIRCUIT

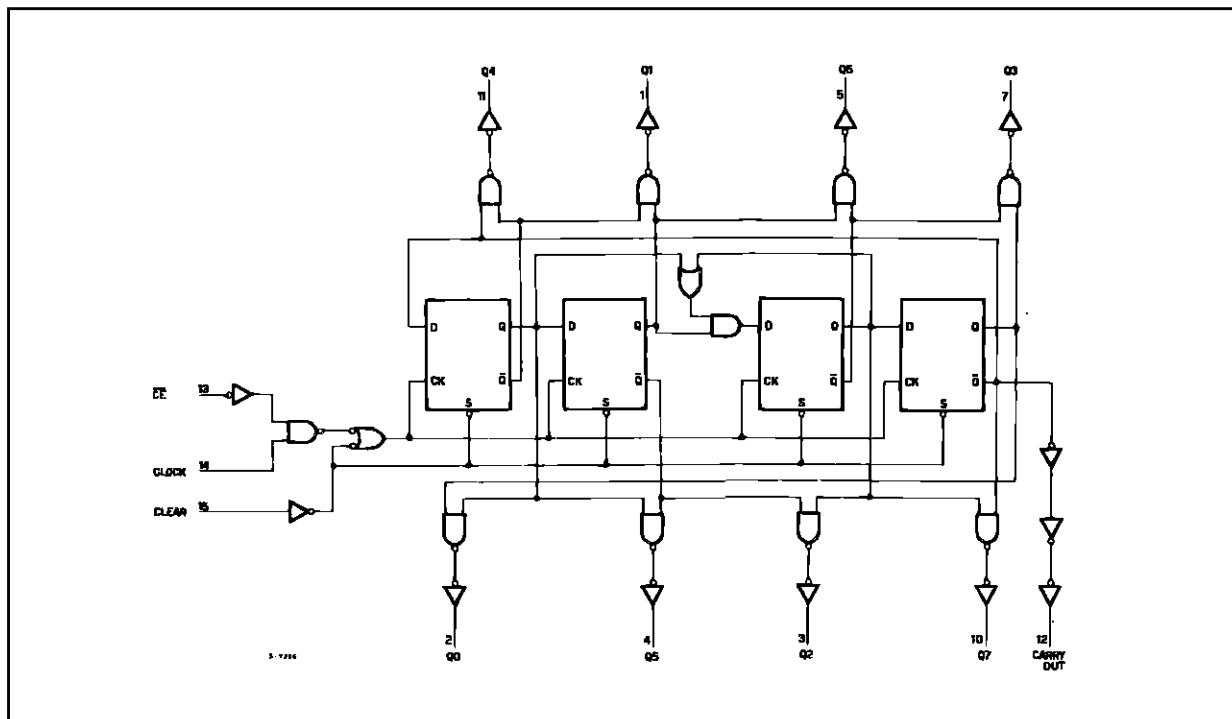


TRUTH TABLE

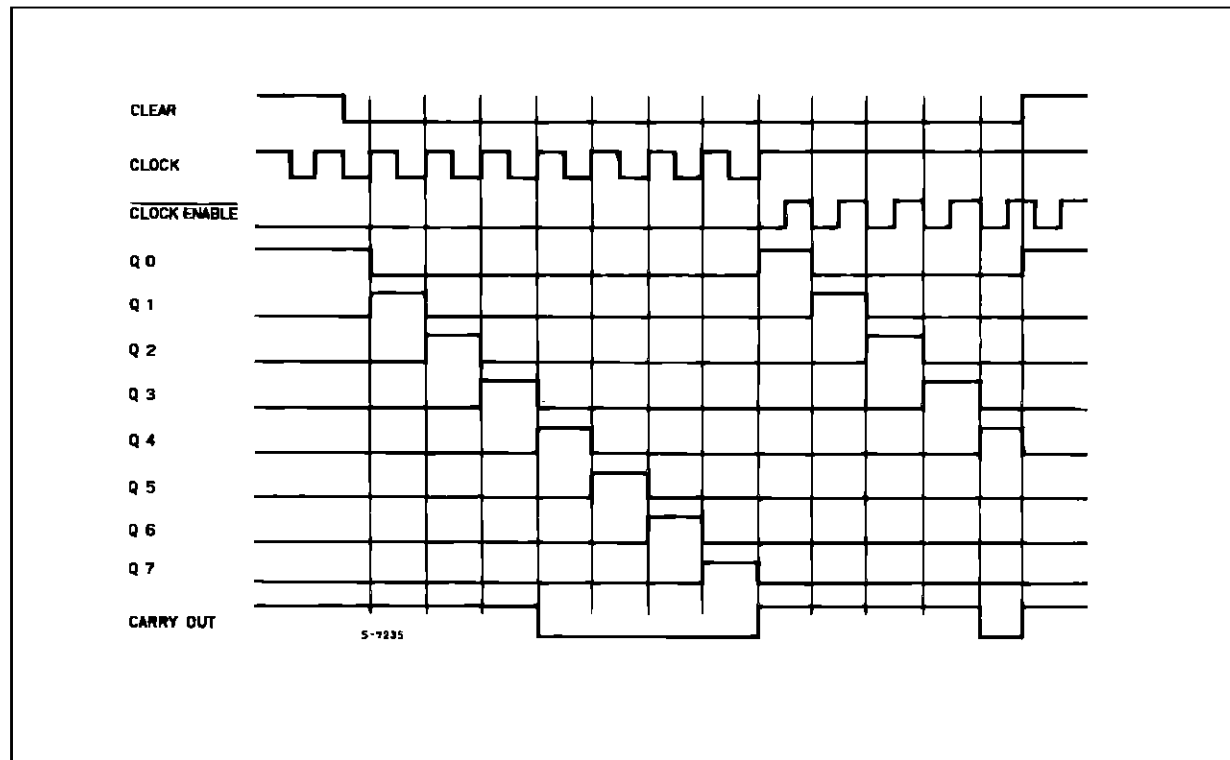
CLOCK	$\overline{CE}$	CLEAR	DECODER OUTPUT (H)
X	X	H	Q0
L	X	L	NO CHANGE
X	H	L	NO CHANGE
	L	L	NO CHANGE + 1
	L	L	NO CHANGE
H		L	NO CHANGE
H		L	NO CHANGE + 1

X: DON'T CARE

LOGIC DIAGRAM



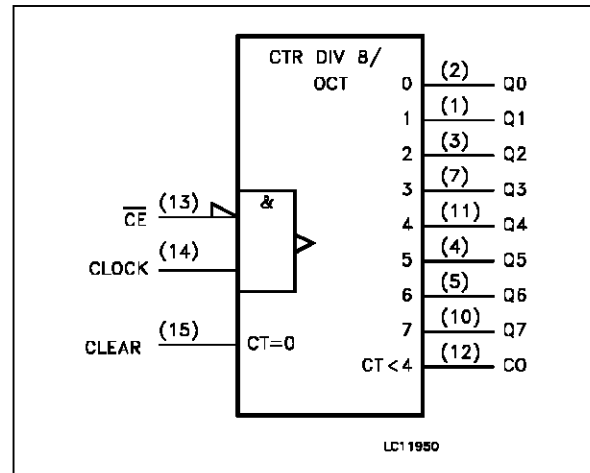
TIMING CHART



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
3, 2, 4, 7, 10, 1, 5, 11	Q0 to Q7	Decoded Outputs
6, 9	NC	Not Connected
12	CARRY OUT	Carry Output (Active LOW)
13	$\overline{CE}$	Clock Input (HIGH to LOW, Edge-triggered)
14	CLOCK	Clock Input (LOW to HIGH, Edge-triggered)
15	CLEAR	Master reset Input (Active HIGH)
8	GND	Ground (0V)
16	V _{CC}	Positive Supply Voltage

IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	-0.5 to +7	V
V _I	DC Input Voltage	-0.5 to V _{CC} + 0.5	V
V _O	DC Output Voltage	-0.5 to V _{CC} + 0.5	V
I _{IK}	DC Input Diode Current	± 20	mA
I _{OK}	DC Output Diode Current	± 20	mA
I _O	DC Output Source Sink Current Per Output Pin	± 25	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 50	mA
P _D	Power Dissipation	500 (*)	mW
T _{stg}	Storage Temperature	-65 to +150	°C
T _L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: ≡ 65 °C derate to 300 mW by 10mW/°C: 65 °C to 85 °C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Value	Unit
V _{CC}	Supply Voltage		2 to 6	V
V _I	Input Voltage		0 to V _{CC}	V
V _O	Output Voltage		0 to V _{CC}	V
T _{op}	Operating Temperature: M54HC Series M74HC Series		-55 to +125 -40 to +85	°C °C
t _r , t _f	Input Rise and Fall Time	V _{CC} = 2 V	0 to 1000	ns
		V _{CC} = 4.5 V	0 to 500	
		V _{CC} = 6 V	0 to 400	

DC SPECIFICATIONS

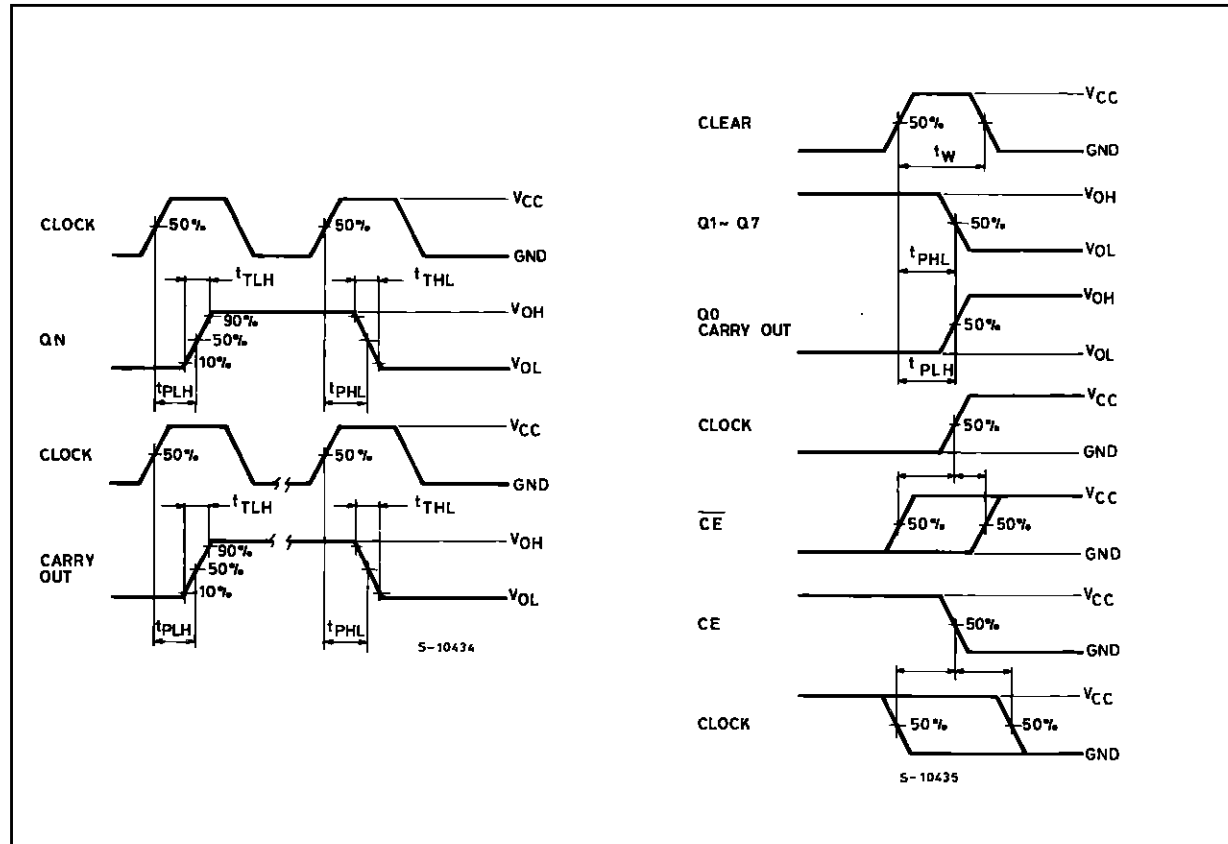
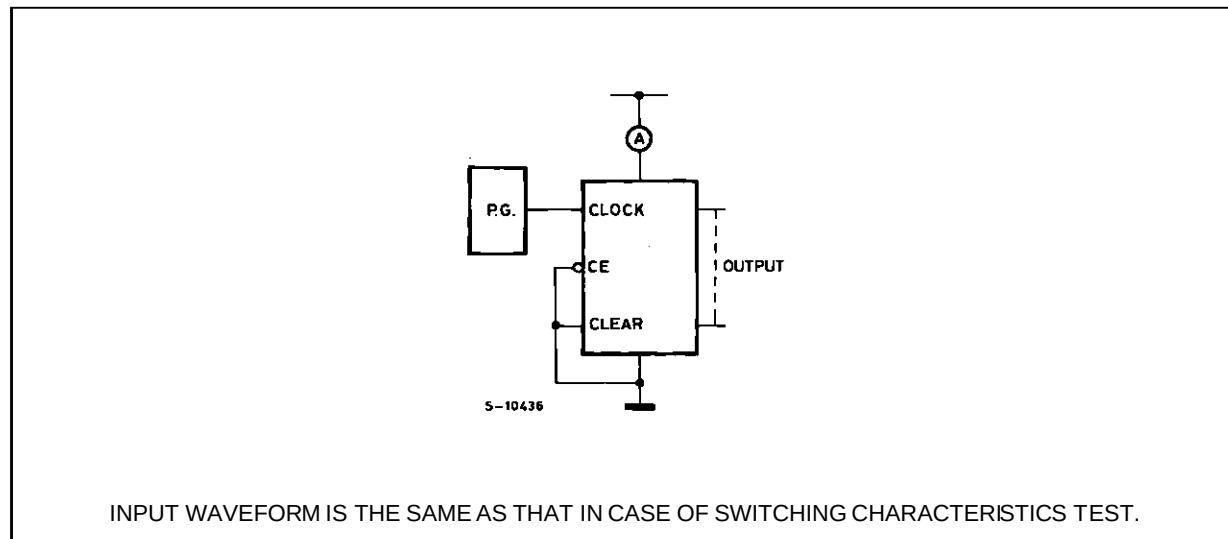
Symbol	Parameter	Test Conditions		Value								Unit
		V _{CC} (V)		T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC			
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
V _{IH}	High Level Input Voltage	2.0		1.5			1.5		1.5		V	
		4.5		3.15			3.15		3.15			
		6.0		4.2			4.2		4.2			
V _{IL}	Low Level Input Voltage	2.0				0.5		0.5		0.5	V	
		4.5				1.35		1.35		1.35		
		6.0				1.8		1.8		1.8		
V _{OH}	High Level Output Voltage	2.0	V _I = V _{IH} or V _{IL}	I _O =-20 μA	1.9	2.0		1.9		1.9		V
		4.5			4.4	4.5		4.4		4.4		
		6.0			5.9	6.0		5.9		5.9		
		4.5		I _O =-4.0 mA	4.18	4.31		4.13		4.10		
		6.0			I _O =-5.2 mA	5.68	5.8		5.63		5.60	
V _{OL}	Low Level Output Voltage	2.0	V _I = V _{IH} or V _{IL}	I _O = 20 μA		0.0	0.1		0.1		0.1	V
		4.5				0.0	0.1		0.1		0.1	
		6.0				0.0	0.1		0.1		0.1	
		4.5		I _O = 4.0 mA		0.17	0.26		0.33		0.40	
		6.0			I _O = 5.2 mA		0.18	0.26		0.33		
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND			±0.1		±1		±1	μA	
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND			4		40		80	μA	

AC ELECTRICAL CHARACTERISTICS ($C_L = 50 \text{ pF}$, Input $t_r = t_f = 6 \text{ ns}$)

Symbol	Parameter	Test Conditions		Value						Unit	
		V _{CC} (V)		T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t _{TLH} t _{THL}	Output Transition Time	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t _{PLH} t _{PHL}	Propagation Delay Time (CLOCK - Q _n , CARRY)	2.0			71	160		200		240	ns
		4.5			21	32		40		48	
		6.0			16	27		34		41	
t _{PLH} t _{PHL}	Propagation Delay Time (CLEAR - Q _n , CARRY)	2.0			69	145		180		220	ns
		4.5			19	29		36		44	
		6.0			15	25		31		38	
f _{MAX}	Maximum Clock Frequency	2.0		6	11		5		4.2		ns
		4.5		31	51		25		21		
		6.0		36	63		29		25		
t _{W(H)} t _{W(L)}	Minimum Pulse Width (CLOCK)	2.0			20	75		95		110	ns
		4.5			7	15		19		22	
		6.0			4	13		16		19	
t _{W(H)}	Minimum Pulse Width (CLEAR)	2.0			19	75		95		110	ns
		4.5			7	15		19		22	
		6.0			3	13		16		198	
t _s	Minimum Set-Up Time	2.0			9	0		0		0	ns
		4.5			3	0		0		0	
		6.0			2.5	0		0		0	
t _h	Minimum Hold Time	2.0			13	75		95		110	ns
		4.5			5	15		19		22	
		6.0			4	13		16		19	
t _{REM}	Minimum Removal Time	2.0			13	50		65		75	ns
		4.5			3	10		13		15	
		6.0			2	9		11		13	
C _{IN}	Input Capacitance				5	10		10		10	pF
C _{PD} (*)	Power Dissipation Capacitance				53						pF

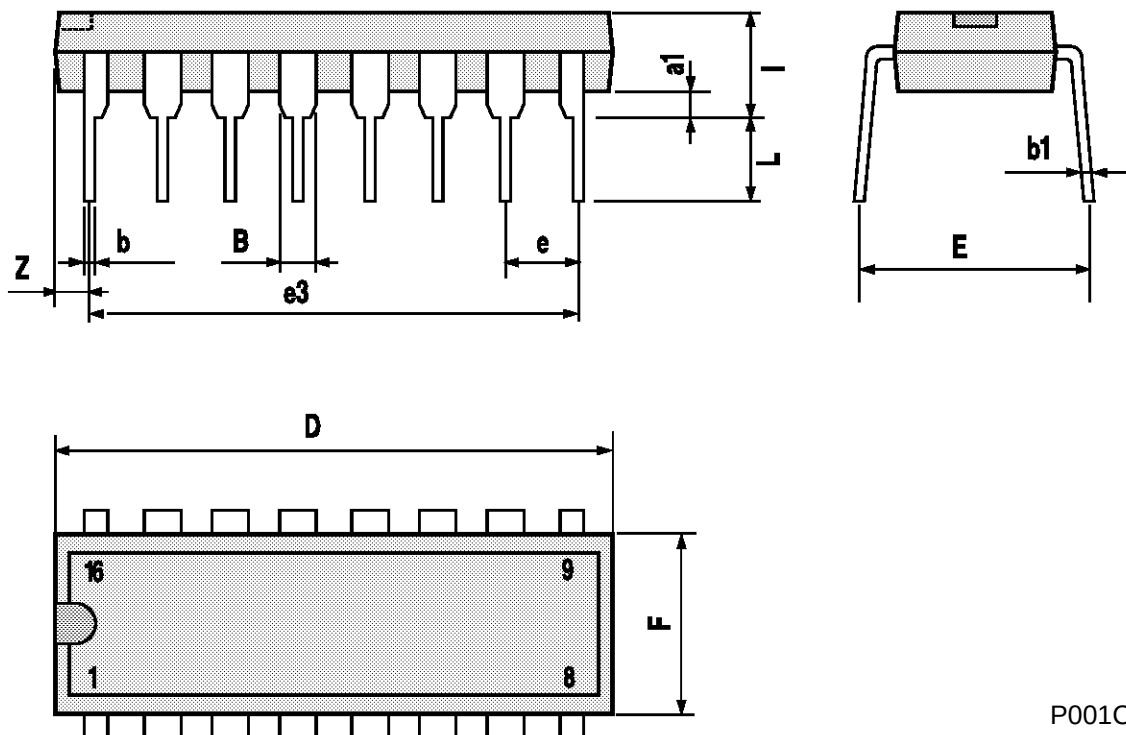
(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$

SWITCHING CHARACTERISTICS TEST WAVEFORM

TEST CIRCUIT I_{cc} (Opr.)

Plastic DIP16 (0.25) MECHANICAL DATA

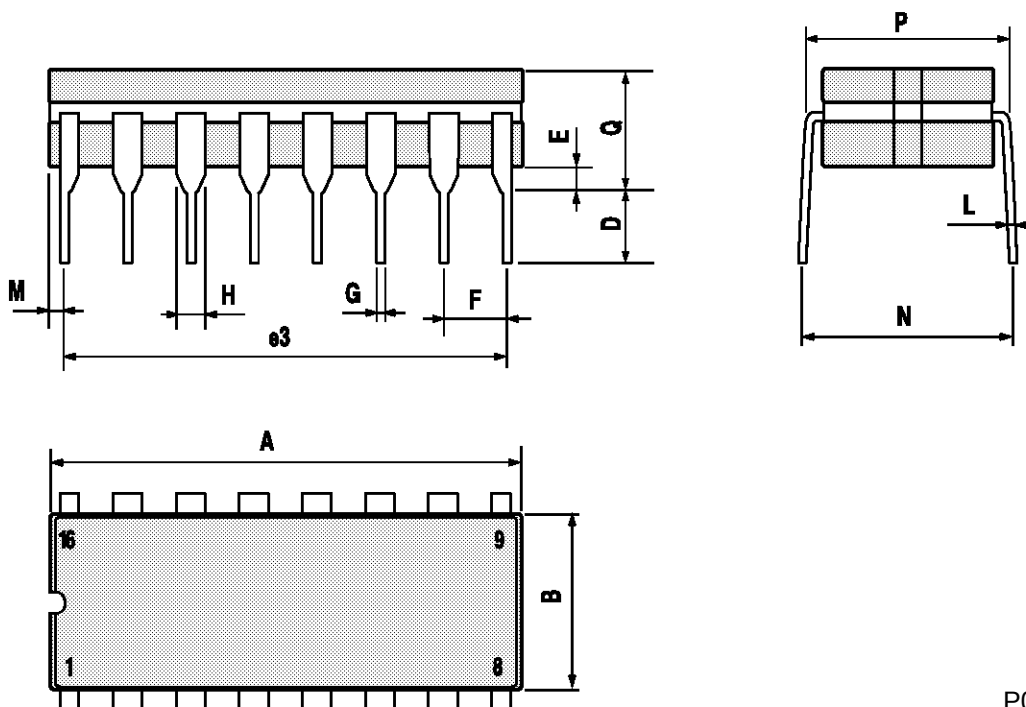
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

Ceramic DIP16/1 MECHANICAL DATA

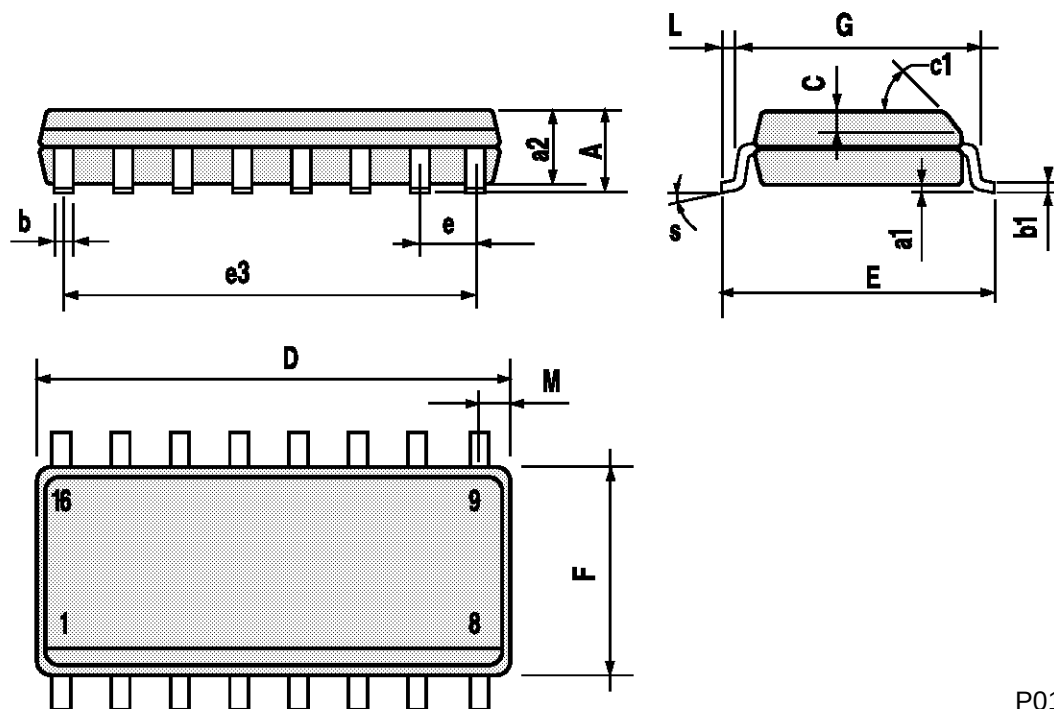
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q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



P053D

SO16 (Narrow) MECHANICAL DATA

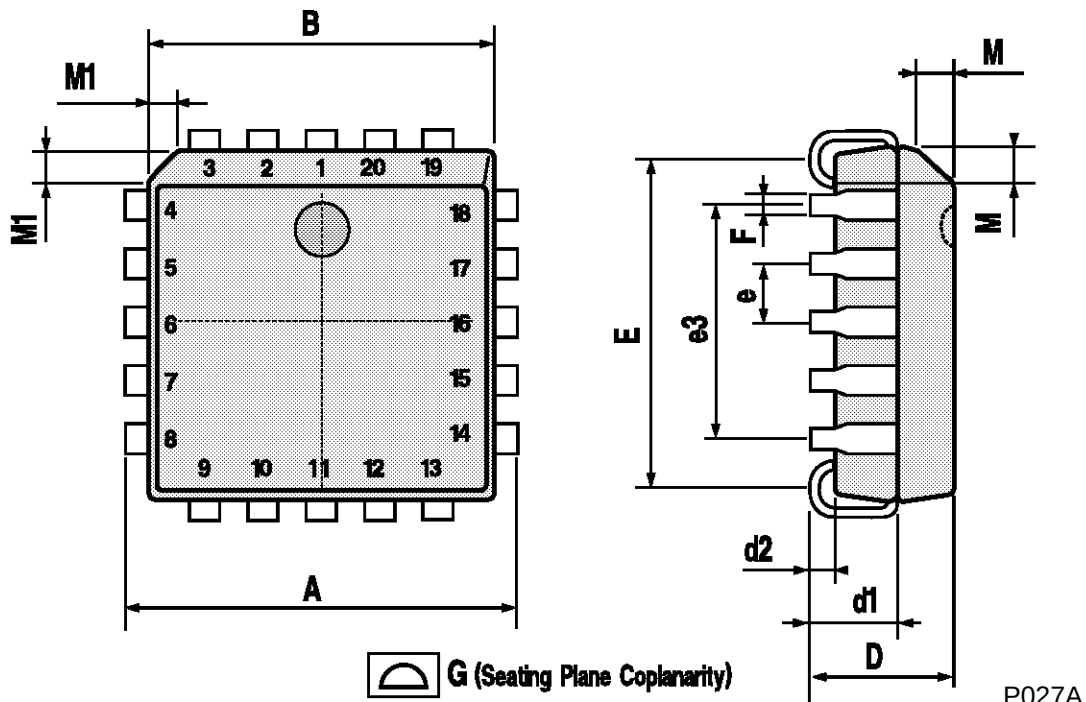
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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