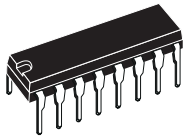
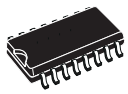
M74HC173

QUAD D-TYPE REGISTER (3 STATE)

- HIGH SPEED:
  f_{MAX} = 84MHz (TYP.) at V_{CC} = 6V
- LOW POWER DISSIPATION:
  I_{CC} = 4µA(MAX.) at T_A=25°C
- HIGH NOISE IMMUNITY:
  $V_{NIH} = V_{NIL}$ = 28 % V_{CC} (MIN.)
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}| = I_{OL}$ =6mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:
  V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 173



DIP



SOP

TSSOP

ORDER CODES

PACKAGE	TUBE	T & R
DIP	M74HC173B1R	
SOP	M74HC173M1R	M74HC173RM13TR
TSSOP		M74HC173TTR

DESCRIPTION

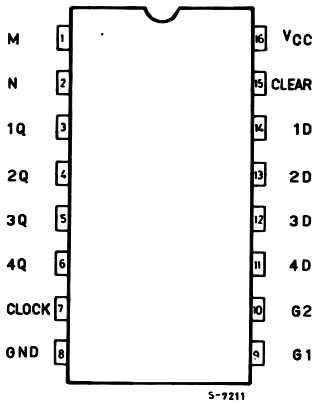
The M74HC173 is an high speed CMOS QUAD D-TYPE REGISTER (3-STATE) fabricated with silicon gate C^2MOS technology.

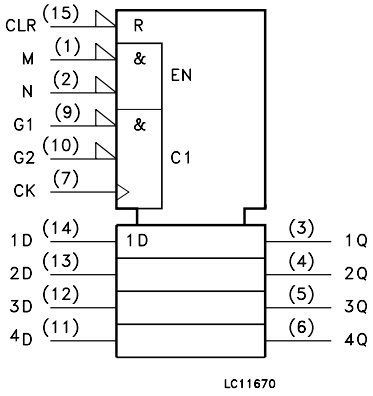
This device is composed of a four-bit register including D-TYPE flip-flops and 3-state buffers. The four flip-flops are controlled by a common clock input (CLOCK) and a common reset input (CLEAR). Signals applied to the data inputs (D_1 - D_4) are stored at the respective flip-flops on the positive going transition of the clock input, only when both clock control inputs (G1 and G2) are held low.

The reset feature is asynchronous and active high. The stored data are provided on each output only when both output control inputs (M and N) are held low, otherwise the outputs go to the high-impedance state.

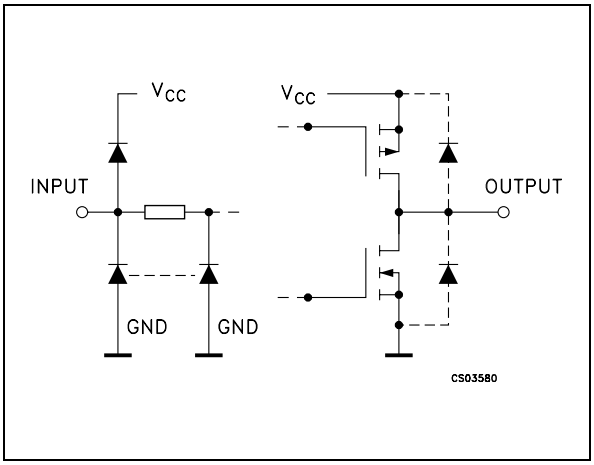
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS





INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

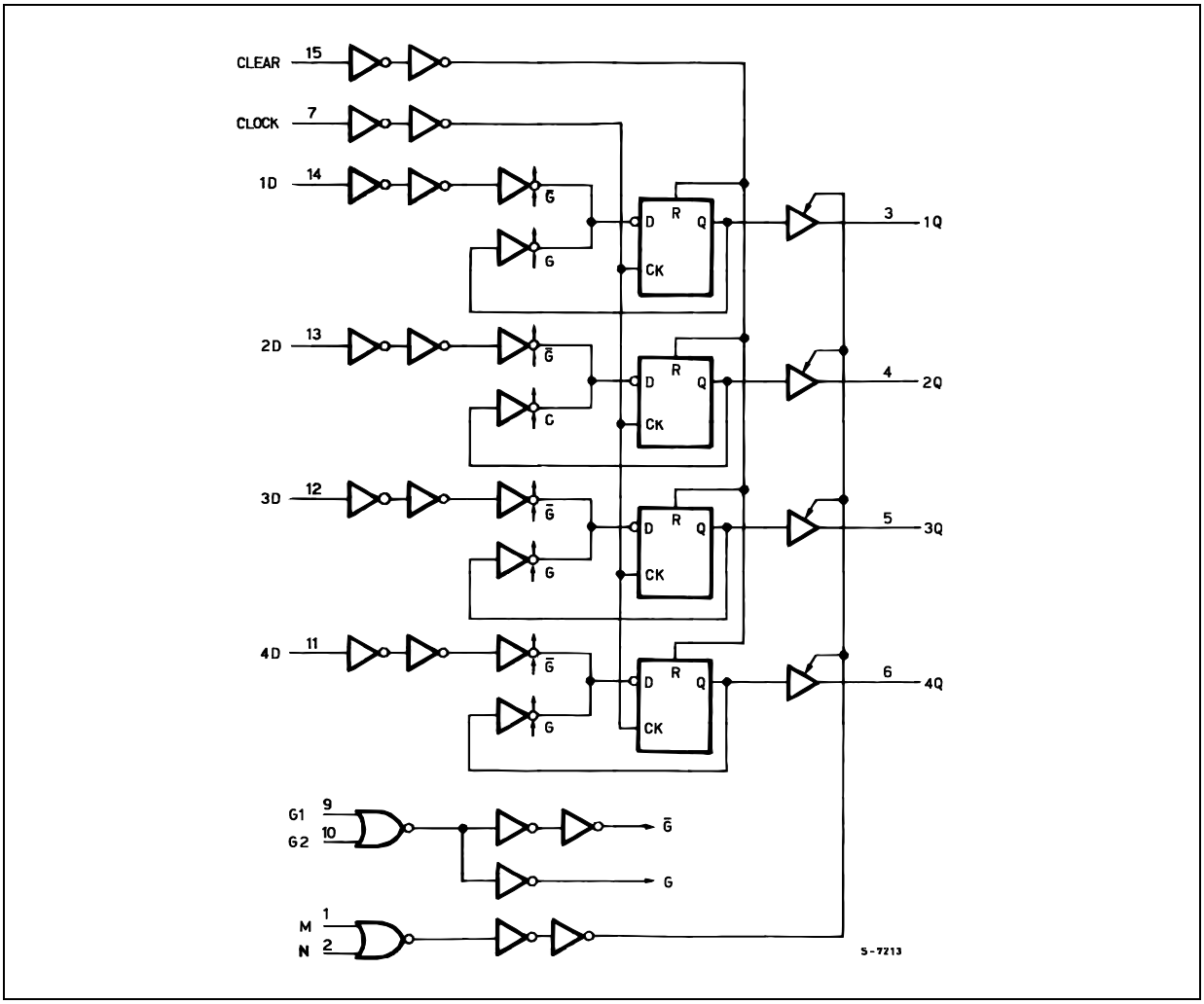
PIN No	SYMBOL	NAME AND FUNCTION
1, 2	M, N	Output Enable Input (Active Low)
3, 4, 5, 6	1Q to 4Q	3-State Flip-Flop Outputs
7	CLOCK	Clock Input (Low to HIGH, Edge-triggered)
9, 10	G1, G2	Data Enable Inputs (Active Low)
14, 13, 12, 11	1D to 4D	Data Inputs
15	CLEAR	Asynchronous Master Reset (Active High)
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

TRUTH TABLE

CLEAR	CLOCK	DATA ENABLE		Dn	OUTPUT CONTROL		Qn
		G1	G2		M	N	
X	X	X	X	X	H	X	Z
X	X	X	X	X	X	H	Z
H	X	X	X	X	L	L	L
L	⎍	X	X	X	L	L	Q0
L	⎍	H	X	X	L	L	Q0
L	⎍	X	H	X	L	L	Q0
L	⎍	L	L	H	L	L	H
L	⎍	L	L	L	L	L	L

X : Don't Care
Z : High Impedance

LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays

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 Current	± 35	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 70	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 conditions is not implied

(*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 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		-55 to 125	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2.0V	0 to 1000	ns
		V_{CC} = 4.5V	0 to 500	ns
		V_{CC} = 6.0V	0 to 400	ns

DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				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	I_O=-20 µA	1.9	2.0		1.9		1.9		V
		4.5	I_O=-20 µA	4.4	4.5		4.4		4.4		
		6.0	I_O=-20 µA	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	I_O=20 µA		0.0	0.1		0.1		0.1	V
		4.5	I_O=20 µA		0.0	0.1		0.1		0.1	
		6.0	I_O=20 µA		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		0.40	
I_I	Input Leakage Current	6.0	V_I = V_{CC} or GND			± 0.1		± 1		± 1	µA
I_{OZ}	High Impedance Output Leakage Current	6.0	V_I = V_{IH} or V_{IL} V_O = V_{CC} or GND			± 0.5		± 5.0		± 10	µA
I_{CC}	Quiescent Supply Current	6.0	V_I = V_{CC} or GND			4		40		80	µA

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

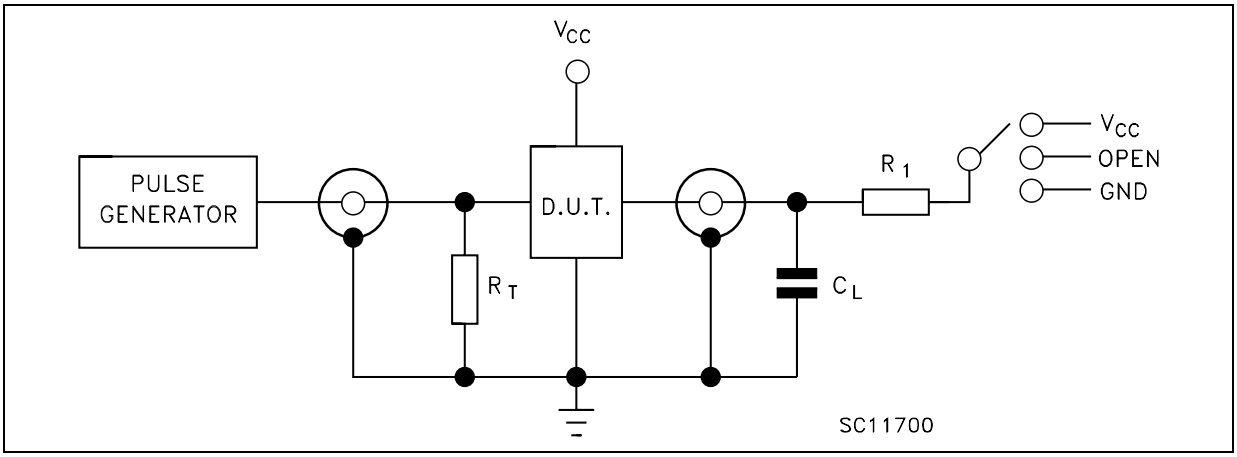
Symbol	Parameter	Test Condition			Value							Unit
		V_{CC} (V)	C_L (pF)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0	50			25	60		75		90	ns
		4.5				7	12		15		18	
		6.0				6	10		13		15	
t_{PLH} t_{PHL}	Propagation Delay Time (CLOCK - Q)	2.0	50			50	115		145		175	ns
		4.5				14	23		29		35	
		6.0				12	20		25		30	
		2.0	150			65	145		180		220	ns
		4.5				18	29		36		44	
		6.0				15	25		31		37	
t_{PLH} t_{PHL}	Propagation Delay Time (CLEAR - Q)	2.0	50			50	115		145		175	ns
		4.5				14	23		29		35	
		6.0				12	20		25		30	
		2.0	150			65	145		180		220	ns
		4.5				18	29		36		44	
		6.0				15	25		31		37	
f_{MAX}	Maximum Clock Frequency	2.0	50		8.6	20		6.8		5.8		MHz
		4.5			43	67		34		29		
		6.0			51	84		40		34		
t_{PZL} t_{PZH}	Output Enable Time	2.0	50	R_L = 1 KΩ		50	115		145		175	ns
		4.5				14	23		29		35	
		6.0				12	20		25		30	
		2.0	150	R_L = 1 KΩ		65	145		180		220	ns
		4.5				18	29		36		44	
		6.0				15	25		31		37	
t_{PLZ} t_{PHZ}	Output Disable Time	2.0	50	R_L = 1 KΩ		36	105		130		160	ns
		4.5				15	21		26		32	
		6.0				13	18		22		27	
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width (CLOCK)	2.0	50			16	75		95		110	ns
		4.5				4	15		19		22	
		6.0				3	13		16		19	
$t_{W(L)}$	Minimum Pulse Width (CLEAR)	2.0	50			16	75		95		110	ns
		4.5				4	15		19		22	
		6.0				3	13		16		19	
t_s	Minimum Set-up Time (G1, G2)	2.0	50			40	100		125		150	ns
		4.5				10	20		25		30	
		6.0				9	17		21		26	
t_s	Minimum Set-up Time (D)	2.0	50			24	75		95		110	ns
		4.5				6	15		19		22	
		6.0				5	13		16		19	
t_h	Minimum Hold Time (G1 ,G2, D)	2.0	50				0		0		0	ns
		4.5					0		0		0	
		6.0					0		0		0	
t_{REM}	Minimum Removal Time	2.0	50				5		5		5	ns
		4.5					5		5		5	
		6.0					5		5		5	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
C_{IN}	Input Capacitance	5.0			5	10		10		10	pF
C_{PD}	Power Dissipation Capacitance (note 1)	5.0			50						pF

1) 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. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (Per Circuit)

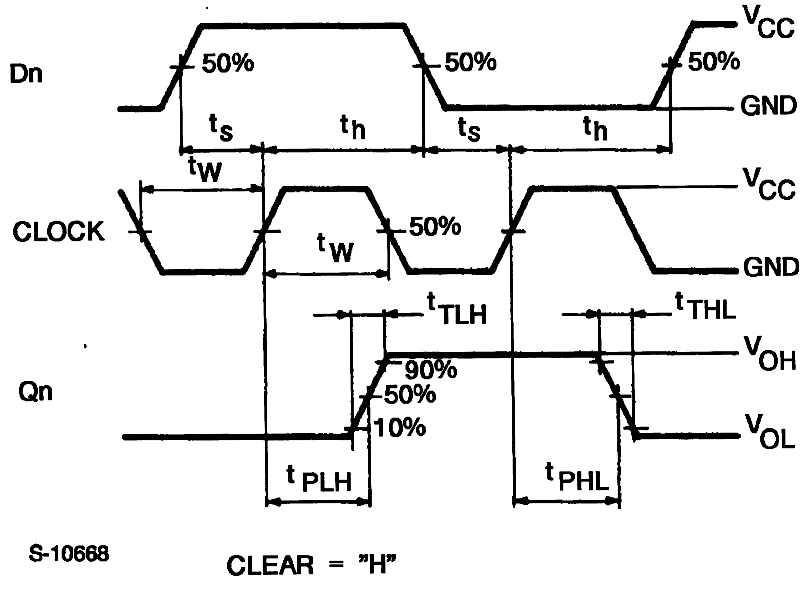
TEST CIRCUIT



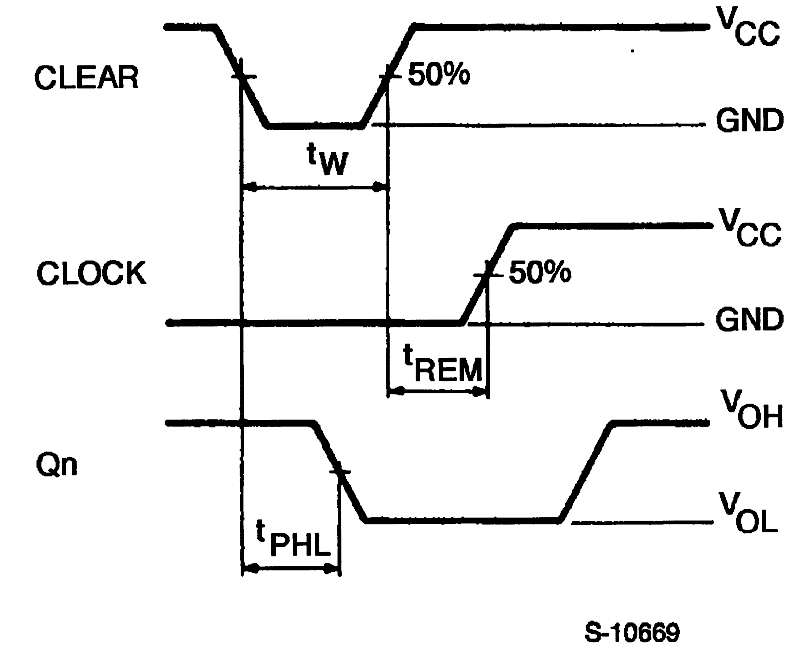
TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	V_{CC}
t_{PZH}, t_{PHZ}	GND

C_L = 50pF/150pF or equivalent (includes jig and probe capacitance)
R_1 = 1KΩ or equivalent
R_T = Z_{OUT} of pulse generator (typically 50Ω)

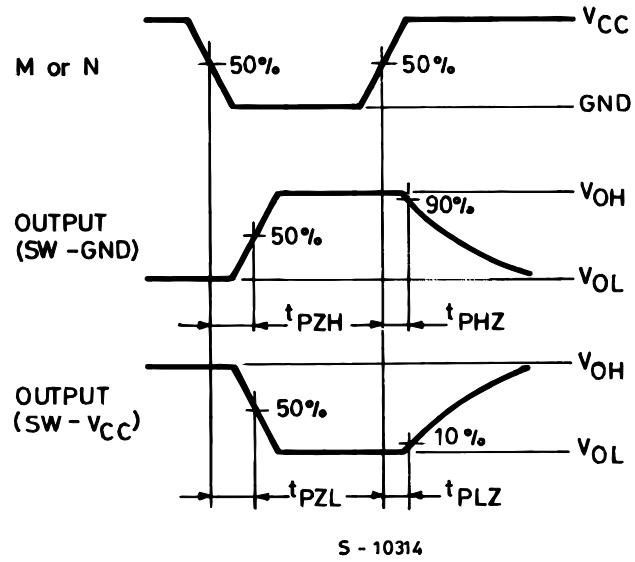
WAVEFORM 1: PROPAGATION DELAY TIMES, MINIMUM PULSE WIDTH (CLOCK), SETUP AND HOLD TIME (Dn TO CLOCK) (f=1MHz; 50% duty cycle)



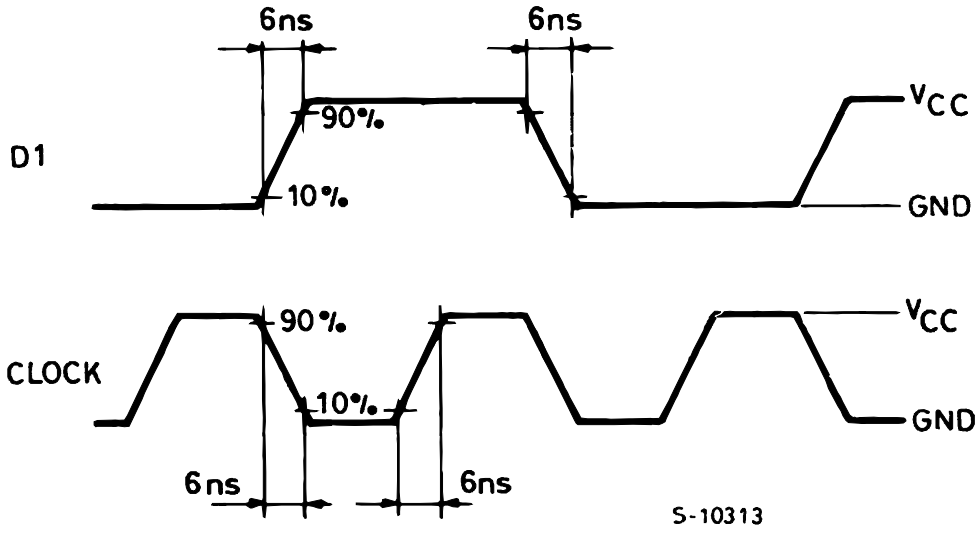
WAVEFORM 2: MINIMUM PULSE WIDTH (CLEAR) AN DREMOVAL TIME (CLEAR TO CLOCK) (f=1MHz; 50% duty cycle)



WAVEFORM 3: OUTPUT ENABLE AND DISABLE TIME(f=1MHz; 50% duty cycle)

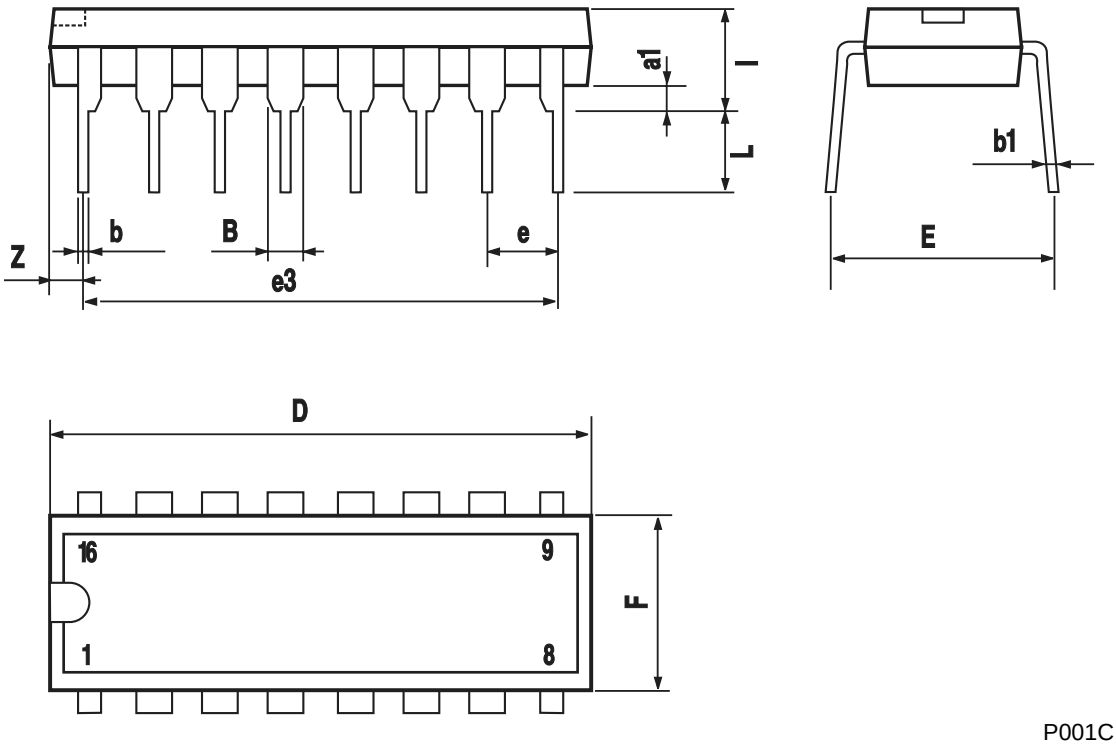


WAVEFORM 4: INPUT WAVEFORMS(f=1MHz; 50% duty cycle)



Plastic DIP-16 (0.25) MECHANICAL DATA

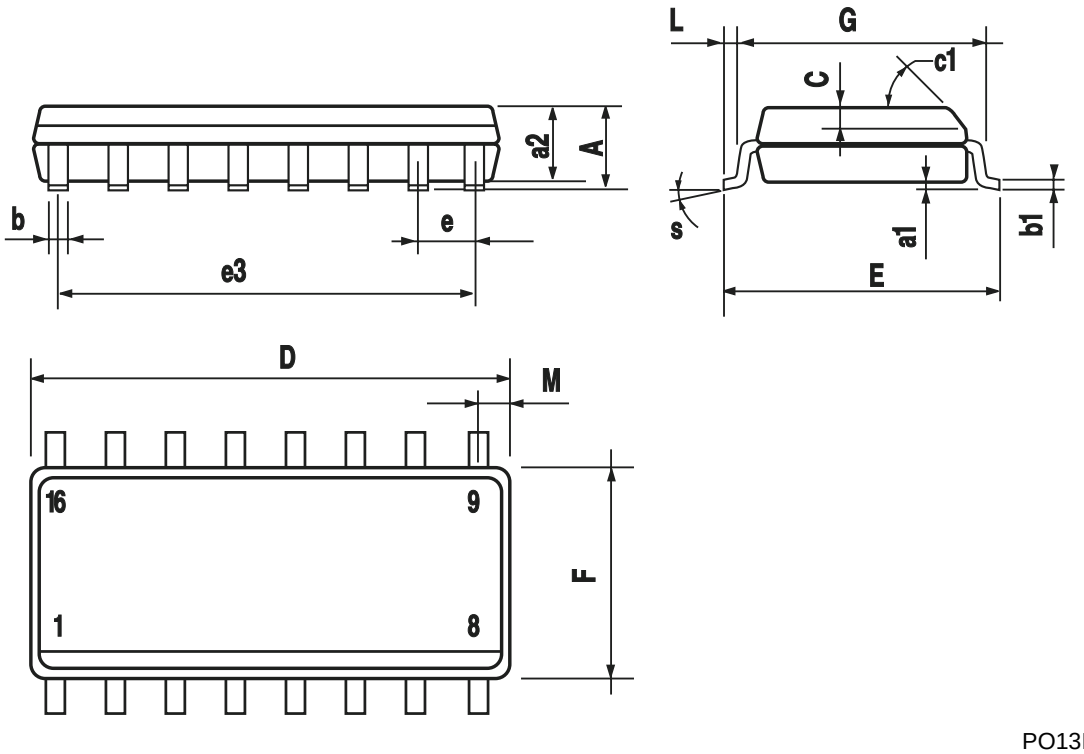
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		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.)					



PO13H

TSSOP16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030