



# M74HCT174

## HEX D-TYPE FLIP FLOP WITH CLEAR

- HIGH SPEED :  
 $f_{MAX} = 56\text{MHz}$  (TYP.) at  $V_{CC} = 4.5\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS :  
 $V_{IH} = 2\text{V}$  (MIN.)  $V_{IL} = 0.8\text{V}$  (MAX)
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4\text{mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- PIN AND FUNCTION COMPATIBLE WITH  
 74 SERIES 174



### ORDER CODES

PACKAGE	TUBE	T & R
DIP	M74HCT174B1R	
SOP	M74HCT174M1R	M74HCT174RM13TR
TSSOP		M74HCT174TTR

### DESCRIPTION

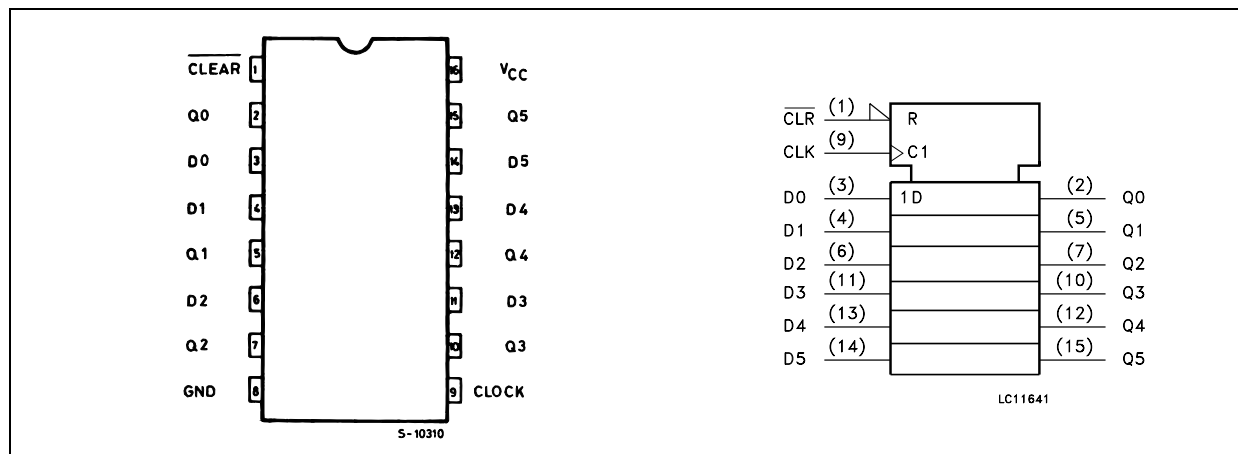
The M74HCT174 is an high speed CMOS HEX D-TYPE FLIP FLOP WITH CLEAR fabricated with silicon gate C<sup>2</sup>MOS technology.

Information signals applied to D inputs are transferred to the Q output on the positive going edge of the CLOCK (CK) pulse. When the  $\overline{\text{CLEAR}}$

(CLR) input is held low, the Q outputs are held low independently of the other inputs.

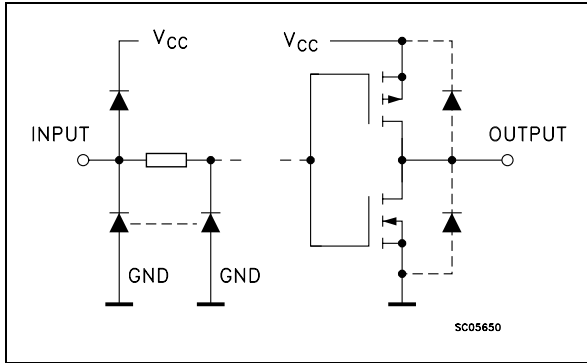
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# M74HCT174

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

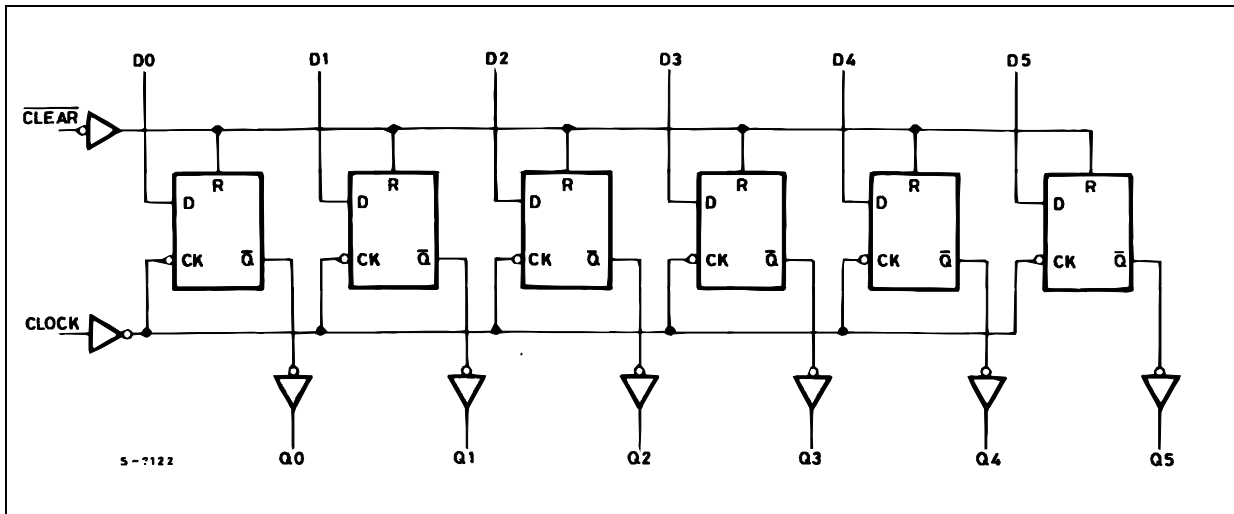
PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{\text{CLEAR}}$	Asynchronous Master Reset (Active Low)
2, 5, 7, 10, 12, 15	Q0 to Q5	Flip-Flop Outputs
3, 4, 6, 11, 13, 14	D0 to D5	Data Inputs
9	CLOCK	Clock Input (LOW to HIGH, edge triggered)
8	GND	Ground (0V)
16	Vcc	Positive Supply Voltage

## TRUTH TABLE

INPUTS			OUTPUTS	FUNCTION
$\overline{\text{CLEAR}}$	D	CK	Q	
L	X	X	L	CLEAR
H	L		L	
H	H		H	
H	X		Qn	NO CHANGE

X : Don't Care

## LOGIC DIAGRAM



This logic diagram has not to 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	$\pm 20$	mA
$I_{OK}$	DC Output Diode Current	$\pm 20$	mA
$I_O$	DC Output Current	$\pm 25$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current	$\pm 50$	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 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	4.5 to 5.5	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 ( $V_{CC} = 4.5$ to $5.5V$ )	0 to 500	ns

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$V_{IH}$	High Level Input Voltage	4.5 to 5.5		2.0			2.0		2.0		V
$V_{IL}$	Low Level Input Voltage	4.5 to 5.5				0.8		0.8		0.8	V
$V_{OH}$	High Level Output Voltage	4.5	$I_O = -20 \mu\text{A}$	4.4	4.5		4.4		4.4		V
			$I_O = -4.0 \text{ mA}$	4.18	4.31		4.13		4.10		
$V_{OL}$	Low Level Output Voltage	4.5	$I_O = 20 \mu\text{A}$		0.0	0.1		0.1		0.1	V
			$I_O = 4.0 \text{ mA}$		0.17	0.26		0.33		0.40	
$I_I$	Input Leakage Current	5.5	$V_I = V_{CC}$ or GND			$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu\text{A}$
$I_{CC}$	Quiescent Supply Current	5.5	$V_I = V_{CC}$ or GND			4		40		80	$\mu\text{A}$
$\Delta I_{CC}$	Additional Worst Case Supply Current	5.5	Per Input pin $V_I = 0.5V$ or $V_I = 2.4V$ Other Inputs at $V_{CC}$ or GND $I_O = 0$			2.0		2.9		3.0	mA

## M74HCT174

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

Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$		$-55 \text{ to } 125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{TLH} \ t_{THL}$	Output Transition Time	4.5			8	15		19		22	ns
$t_{PLH} \ t_{PHL}$	Propagation Delay Time (CLOCK - Q)	4.5			18	28		35			ns
$t_{PLH} \ t_{PHL}$	Propagation Delay Time (CLEAR - Q)	4.5			18	28		35		42	ns
$f_{MAX}$	Maximum Clock Frequency	4.5		30	56		24				MHz
$t_{W(H)} \ t_{W(L)}$	Minimum Pulse Width (CLOCK)	4.5			8	15		19		22	ns
$t_{W(L)}$	Minimum Pulse Width (CLEAR)	4.5			8	15		19		22	ns
$t_s$	Minimum Set-up Time	4.5			2	10		13		15	ns
$t_h$	Minimum Hold Time	4.5				5		6		8	ns
$t_{REM}$	Minimum Removal Time	4.5			5	5		5		5	ns

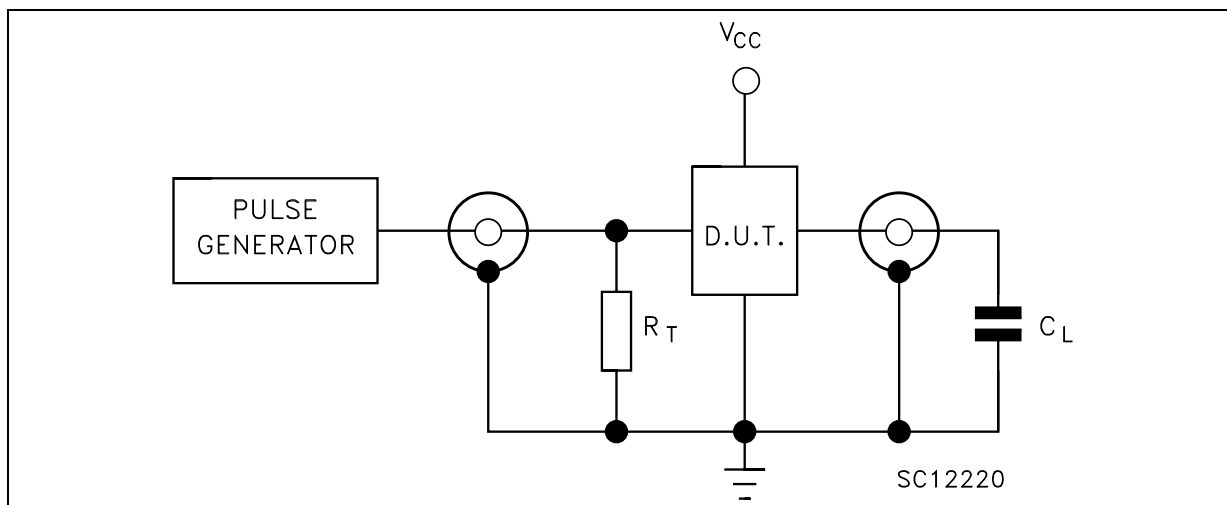
### CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$		$-55 \text{ to } 125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$C_{IN}$	Input Capacitance				5	10		10		10	pF
$C_{PD}$	Power Dissipation Capacitance (note 1)				68						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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/6$  (per FLIP/FLOP)

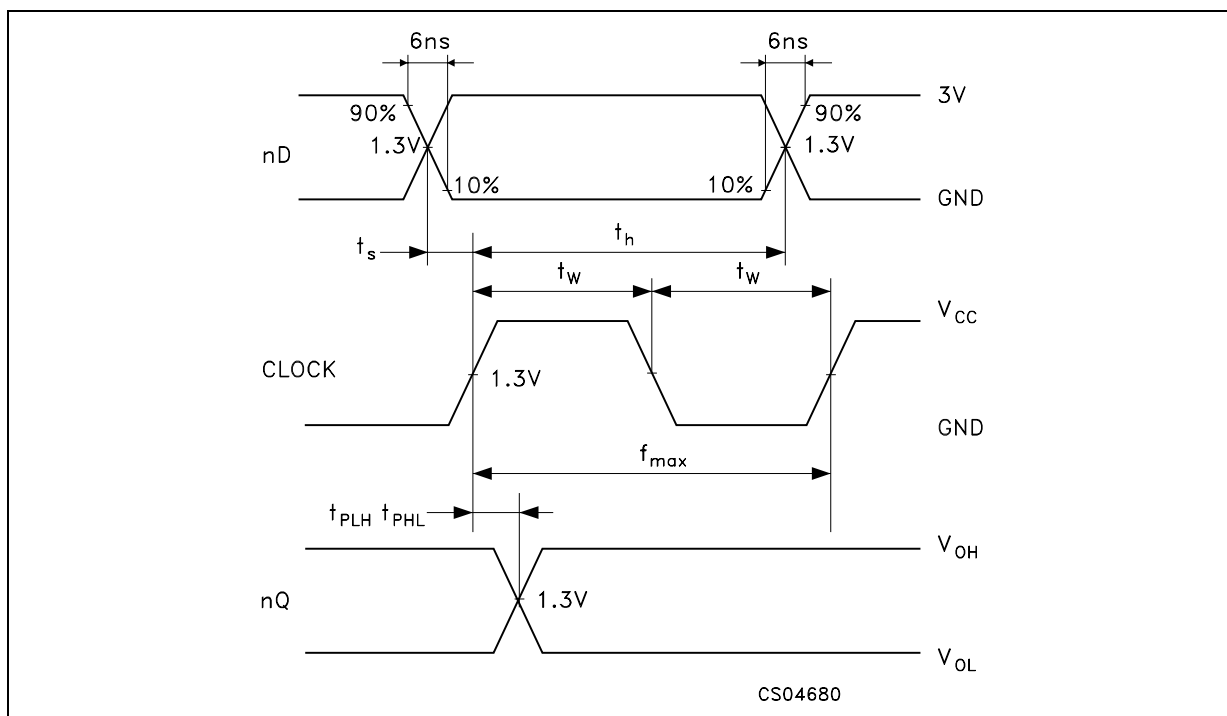
And the total CPD when N pcs of FLIP-FLOP operate can be gained by the following equation :  $CPD \text{ (total)} = 38 + 15 \times n$

TEST CIRCUIT

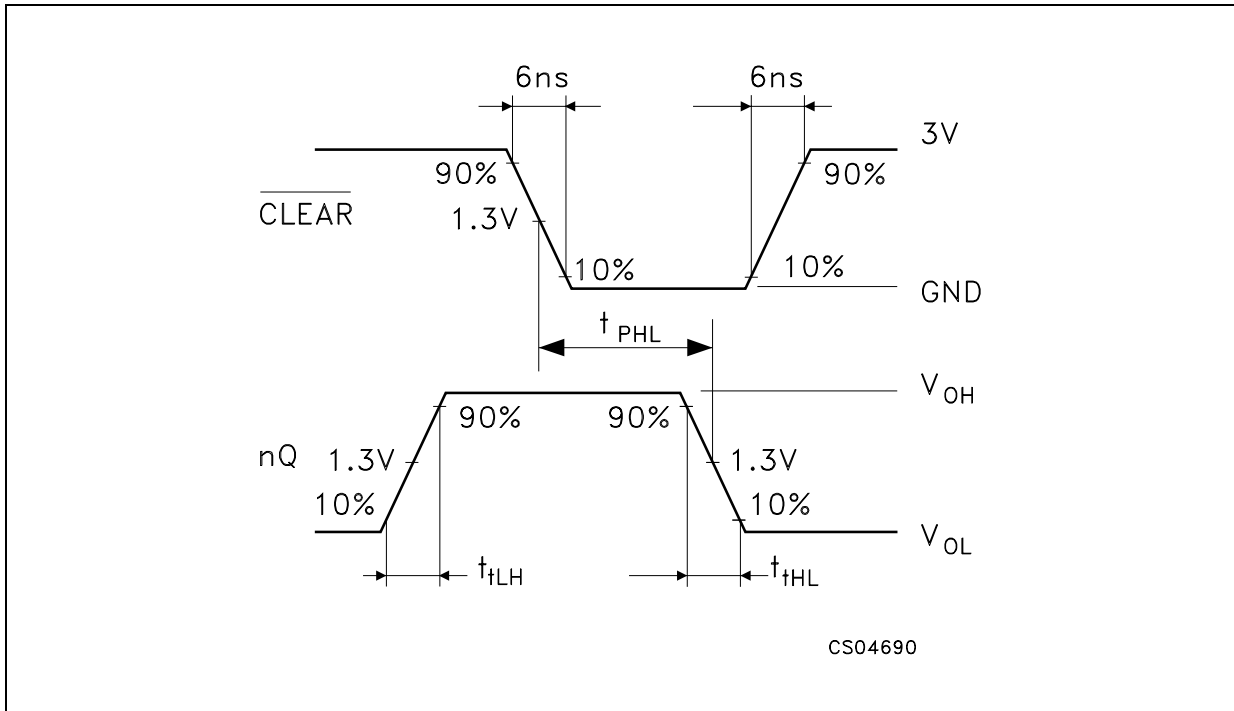


$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

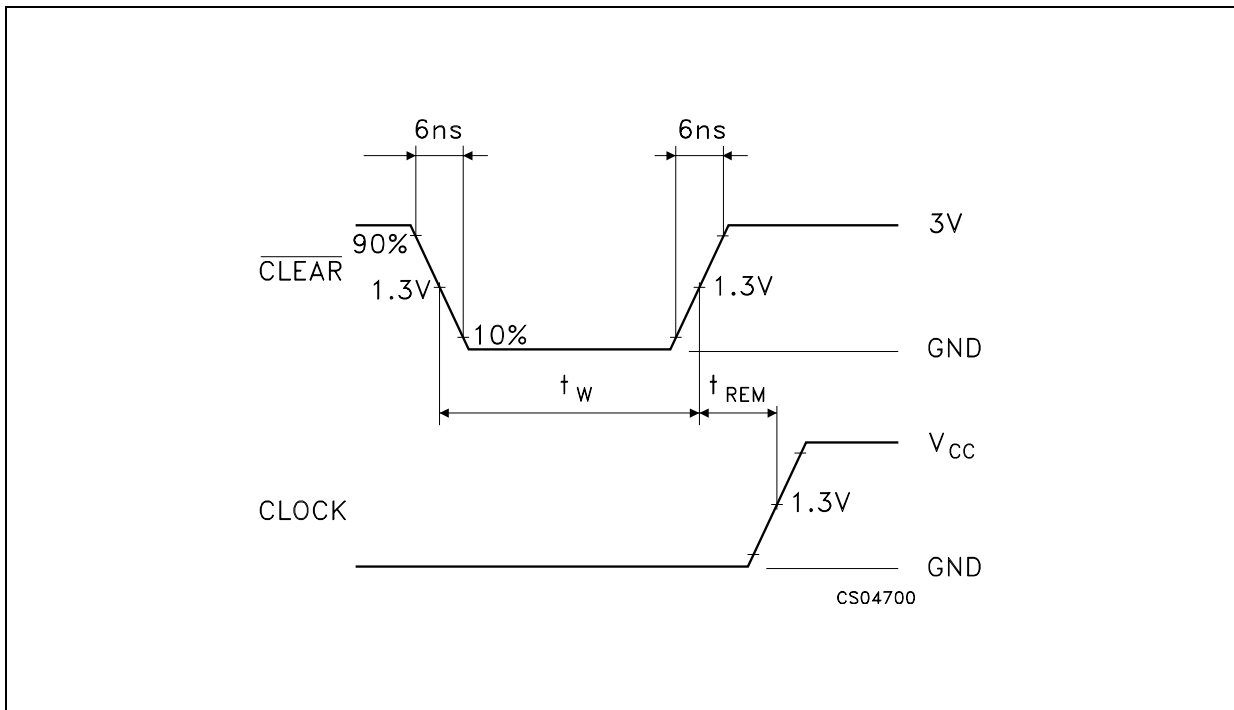
**WAVEFORM 1 : PROPAGATION DELAY TIME, MINIMUM PULSE WIDTH (CLOCK), SETUP AND HOLD TIME (nD TO CLOCK), CLOCK MAXIMUM FREQUENCY ( $f=1\text{MHz}$ ; 50% duty cycle)**



WAVEFORM 2 : PROPAGATION DELAY TIME (nQ TO  $\overline{\text{CLEAR}}$ )(f=1MHz; 50% duty cycle)

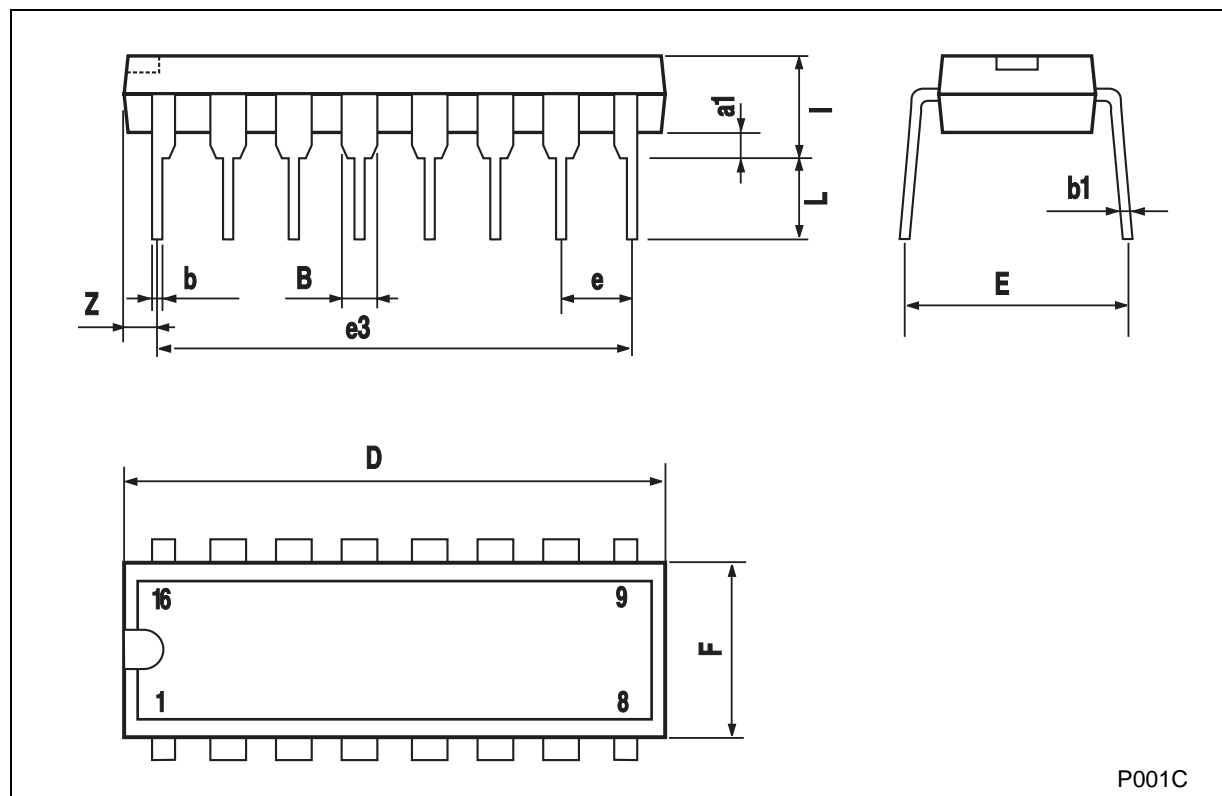


WAVEFORM 3 : MINIMUM PULSE WIDTH ( $\overline{\text{CLEAR}}$ ), MINIMUM REMOVAL TIME ( $\overline{\text{CLEAR}}$  TO CLOCK)(f=1MHz; 50% duty cycle)



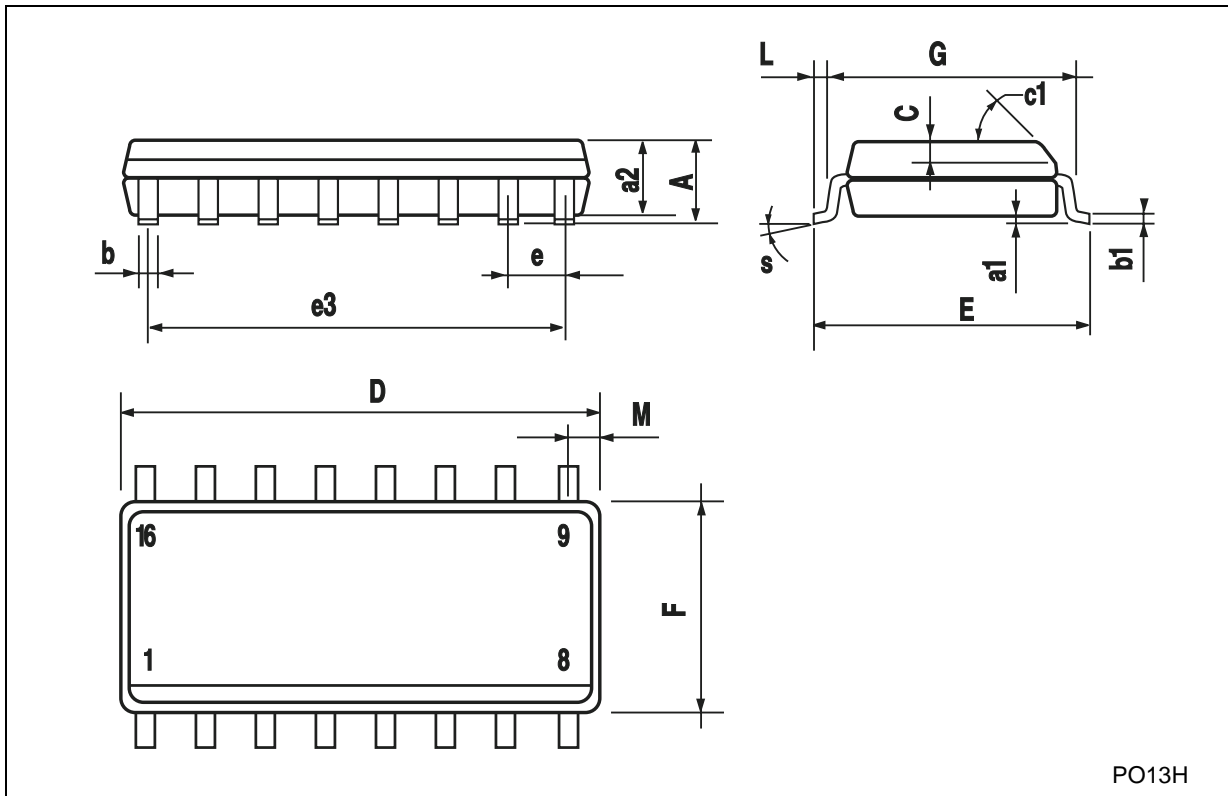
**Plastic DIP-16 (0.25) MECHANICAL DATA**

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



**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.)					

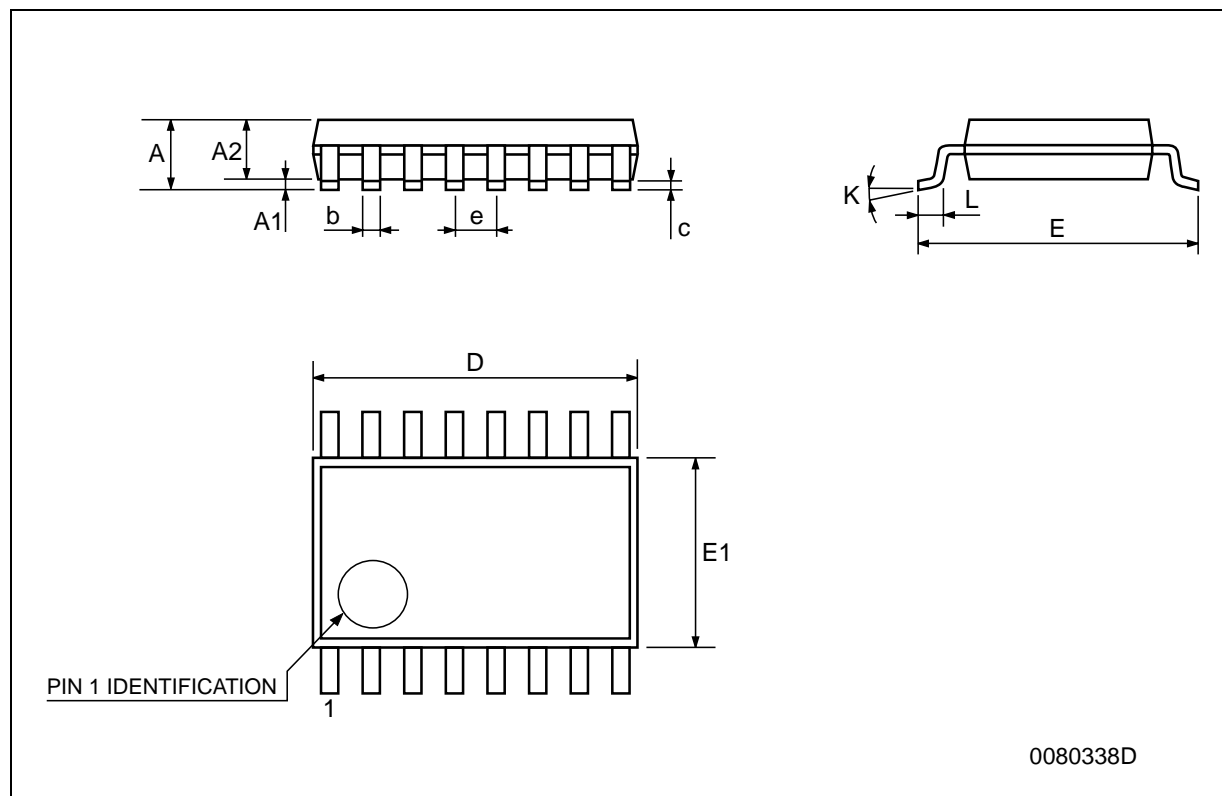


PO13H



## 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



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