



# M74HCT74

## DUAL D TYPE FLIP FLOP WITH PRESET AND CLEAR

- HIGH SPEED :  
 $f_{MAX} = 48\text{MHz}$  (TYP.) at  $V_{CC} = 4.5\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 2\mu\text{A}$  (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)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4\text{mA}$  (MIN)
- PIN AND FUNCTION COMPATIBLE WITH  
 74 SERIES 74



### ORDER CODES

PACKAGE	TUBE	T & R
DIP	M74HCT74B1R	
SOP	M74HCT74M1R	M74HCT74RM13TR
TSSOP		M74HCT74TTR

### DESCRIPTION

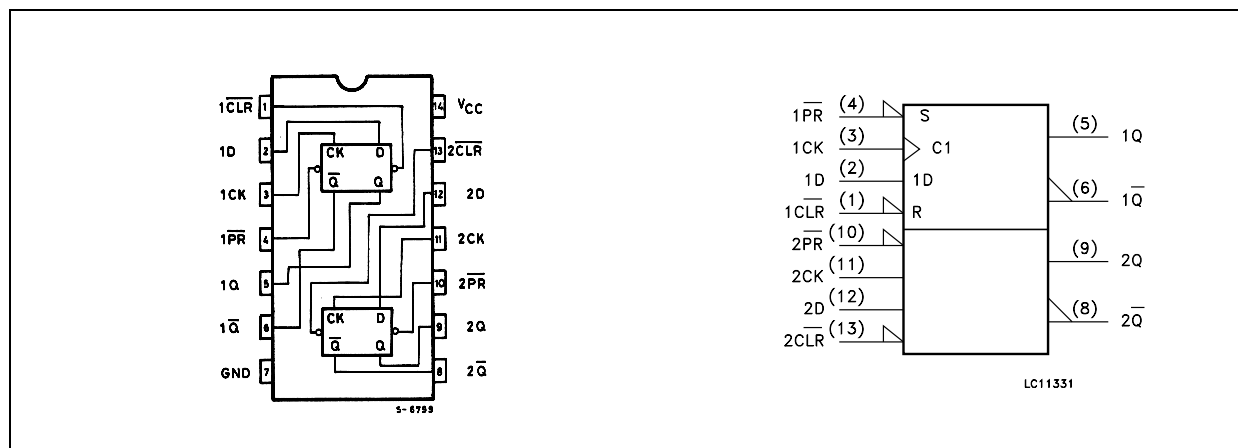
The M74HCT74 is an high speed CMOS DUAL D TYPE FLIP FLOP WITH CLEAR fabricated with silicon gate C<sup>2</sup>MOS technology.

A signal on the D INPUT (nD) is transferred on the Q OUTPUT during the positive going transition of the clock pulse. CLEAR ( $\overline{\text{CLR}}$ ) and PRESET ( $\overline{\text{PR}}$ ) are independent of the clock and accomplished by a low on the appropriate input.

The M74HCT74 is designed to directly interface HSC<sup>2</sup>MOS systems with TTL and NMOS components.

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

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# M74HCT74

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

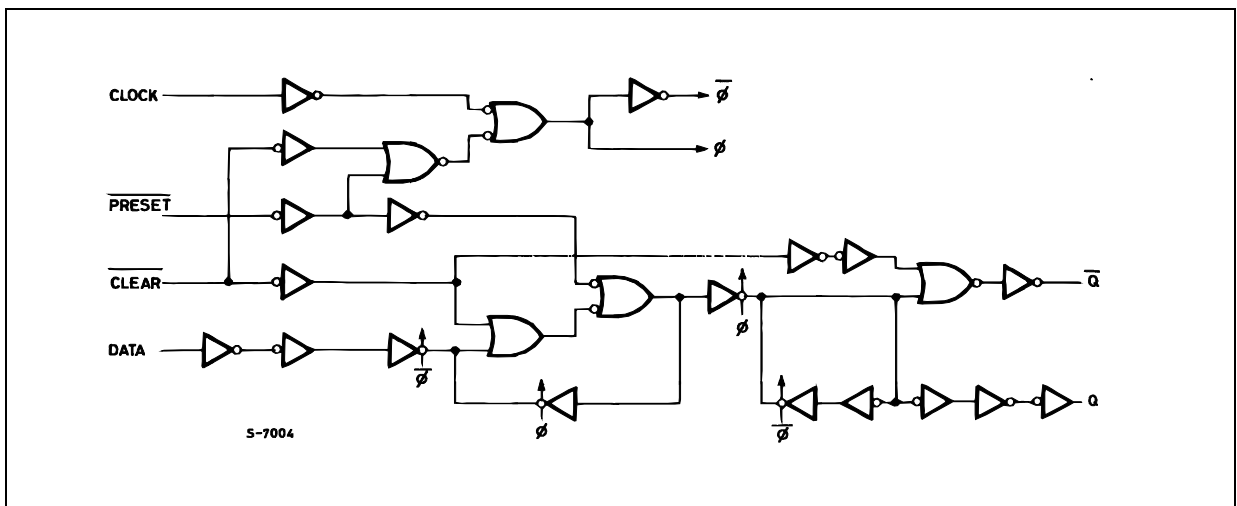
PIN No	SYMBOL	NAME AND FUNCTION
1, 13	$\overline{1CLR}, \overline{2CLR}$	Asynchronous Reset - Direct Input
2, 12	1D, 2D	Data Inputs
3, 11	1CK, 2CK	Clock Input (LOW-to-HIGH, Edge-Triggered)
4, 10	$\overline{1PR}, \overline{2PR}$	Asynchronous Set - Direct Input
5, 9	1Q, 2Q	True Flip-Flop Outputs
6, 8	$\overline{1Q}, \overline{2Q}$	Complement Flip-Flop Outputs
7	GND	Ground (0V)
14	Vcc	Positive Supply Voltage

## TRUTH TABLE

INPUTS				OUTPUTS		FUNCTION
$\overline{CLR}$	$\overline{PR}$	D	CK	Q	$\overline{Q}$	
L	H	X	X	L	H	CLEAR
H	L	X	X	H	L	PRESET
L	L	X	X	H	H	----
H	H	L		L	H	----
H	H	H		H	L	----
H	H	X		$Q_n$	$\overline{Q}_n$	NO CHANGE

X : Don't Care

## 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	$\pm 20$	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)		$T_A = 25^\circ C$			-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	$I_O = -20 \mu A$	4.4	4.5		4.4		4.4		V
			$I_O = -4.0 mA$	4.18	4.31		4.13		4.10		
$V_{OL}$	Low Level Output Voltage	4.5	$I_O = 20 \mu A$		0.0	0.1		0.1		0.1	V
			$I_O = 4.0 mA$		0.17	0.26		0.33		0.40	
$I_I$	Input Leakage Current	5.5	$V_I = V_{CC}$ or GND			$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu A$
$I_{CC}$	Quiescent Supply Current	5.5	$V_I = V_{CC}$ or GND			2		20		40	$\mu A$
$\Delta I_{CC}$	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

## M74HCT74

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

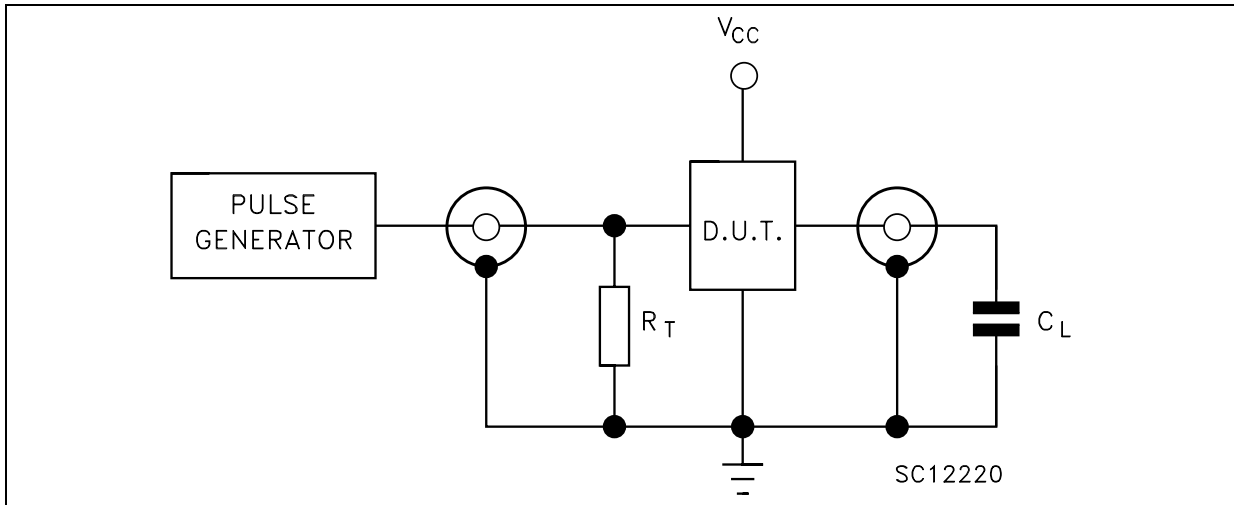
Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40$ to $85^\circ\text{C}$		$-55$ to $125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{TLH}$ $t_{THL}$	Output Transition Time	4.5			8	15		19		22	ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time (CLOCK-Q)	4.5			21	33		41		50	ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time (CL, PR - Q, Q)	4.5			18	30		38		45	ns
$f_{MAX}$	Maximum Clock Frequency	4.5		27	48		22		18		MHz
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width (CLOCK)	4.5			6	15		19		23	ns
$t_{W(L)}$	Minimum Pulse Width (CLR, PR)	4.5			8	15		19		23	ns
$t_s$	Minimum Set-Up Time	4.5			7	15		19		23	ns
$t_h$	Minimum Hold Time	4.5				0		0		0	ns
$t_{REM}$	Minimum Removal Time (CLR, PR to CLOCK)	4.5			1	5	5	6	5	8	ns

### CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40$ to $85^\circ\text{C}$		$-55$ 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)				32						pF

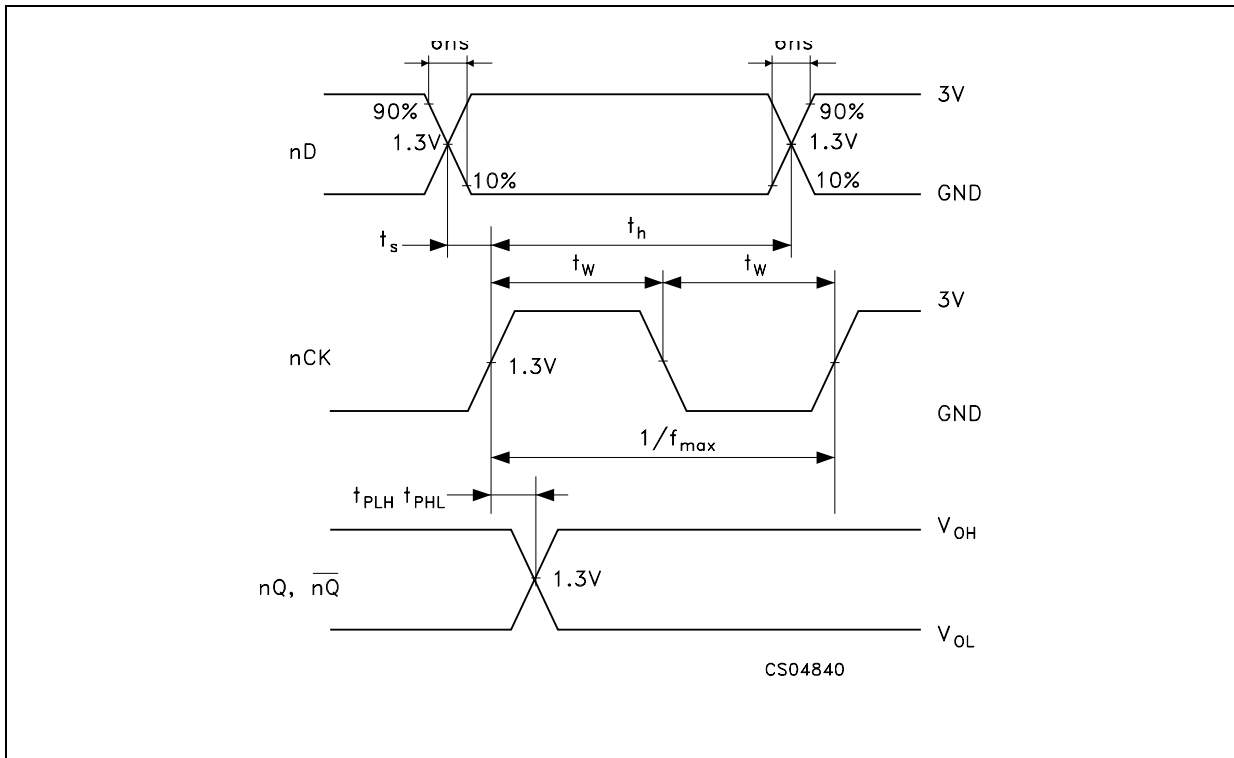
1)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2$  (per FLIP/FLOP)

TEST CIRCUIT

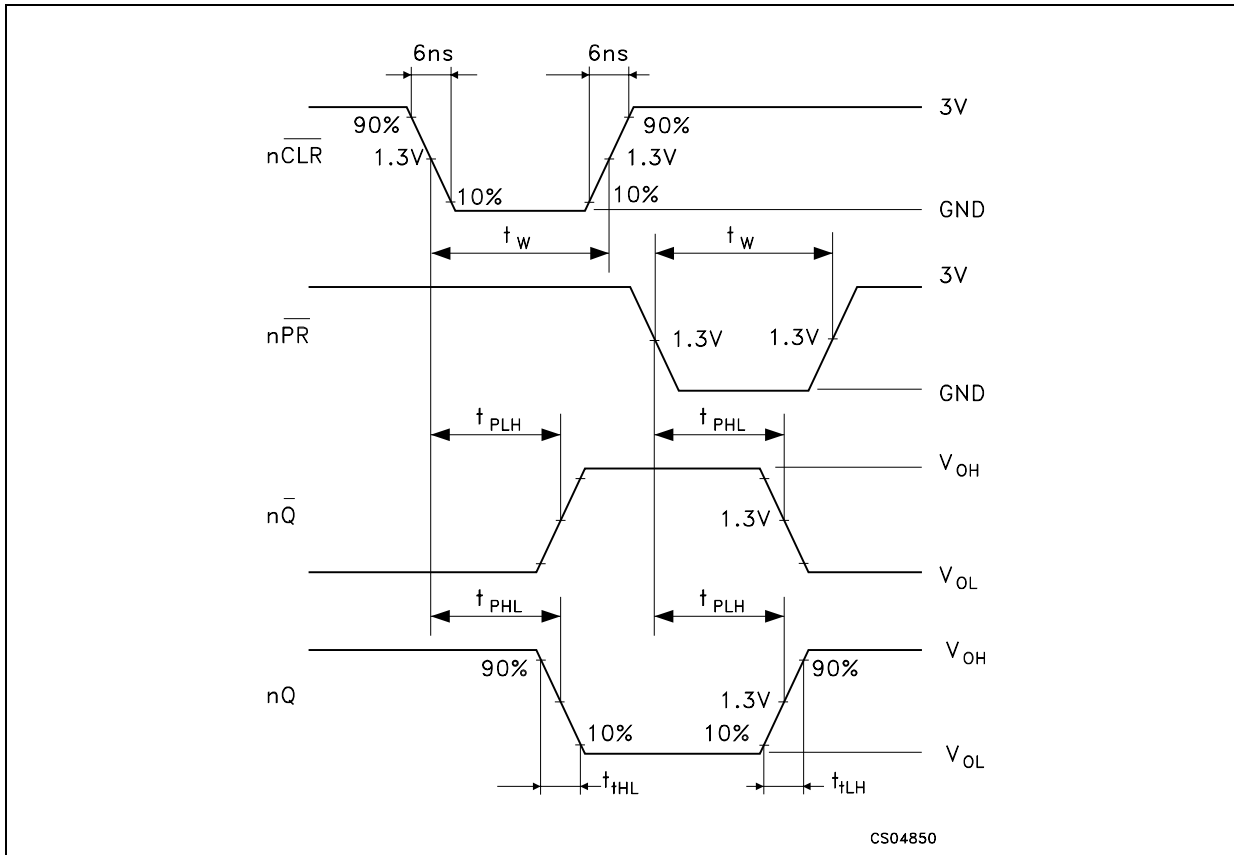


$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

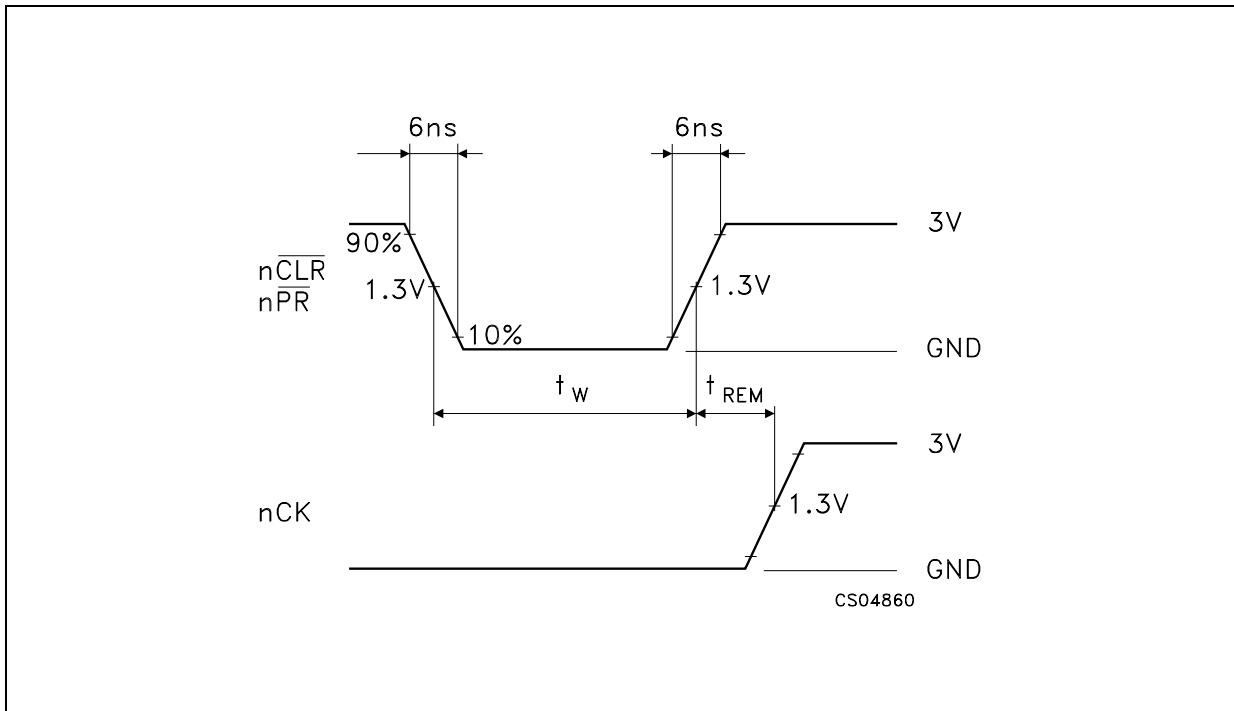
WAVEFORM 1 : PROPAGATION DELAY, MINIMUM SETUP AND HOLD TIME, CK MINIMUM PULSE WIDTH AND MAXIMUM FREQUENCY ( $f=1\text{MHz}$ ; 50% duty cycle)



WAVEFORM 2 : MINIMUM PULSE WIDTH, PROPAGATION DELAY (f=1MHz; 50% duty cycle)



WAVEFORM 3 : MINIMUM PULSE WIDTH AND REMOVAL TIME (f=1MHz; 50% duty cycle)



### Plastic DIP-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		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		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



**SO-14 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	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
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			0.68			0.026
S	8° (max.)					

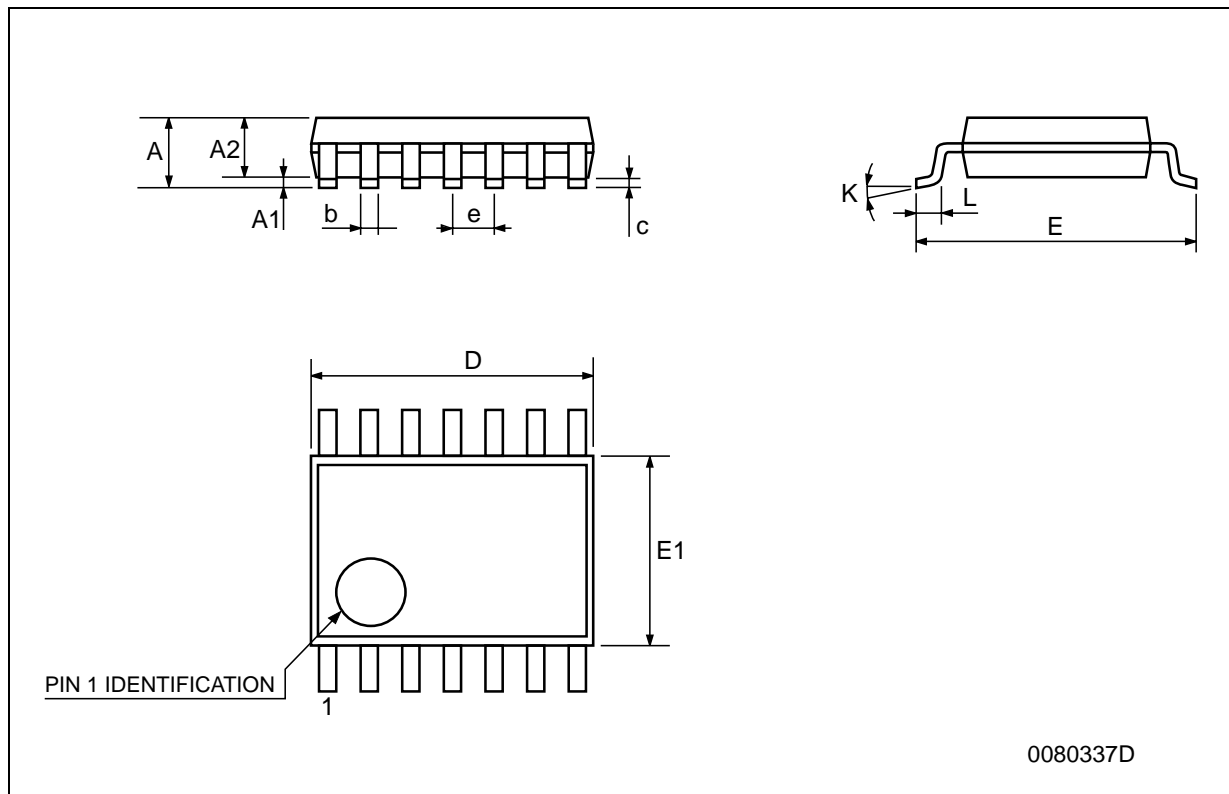


PO13G



## TSSOP14 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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