



# M74HC592

## 8 BIT REGISTER BINARY COUNTER

- HIGH SPEED:  
 $f_{MAX} = 53 \text{ MHz (TYP.) at } V_{CC} = 6V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu A(\text{MAX.}) \text{ at } T_A = 25^\circ C$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 4\text{mA (MIN)}$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- PIN AND FUNCTION COMPATIBLE WITH  
 74 SERIES 592



### ORDER CODES

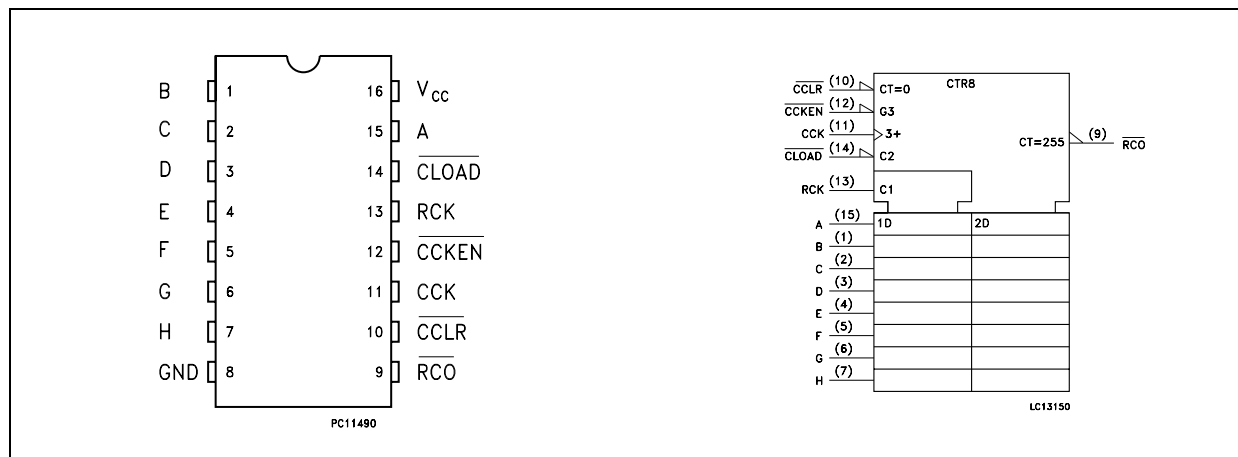
PACKAGE	TUBE	T & R
DIP	M74HC592B1R	
SOP	M74HC592M1R	M74HC592RM13TR
TSSOP		M74HC592TTR

### DESCRIPTION

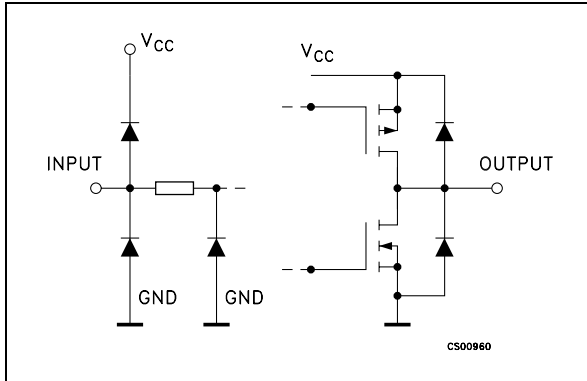
The M74HC592 is an high speed CMOS 8-BIT REGISTER COUNTER fabricated with silicon gate C<sup>2</sup>MOS technology. The M74HC592 is a parallel input, 8 bit storage register feeding an 8 bit binary counter. Both the register and the counter have individual positive edge triggered clock. In addition, the counter has

direct load and clear functions. Expansion is easily accomplished by connecting RCO at the first stage to the count enable of the second stage. 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 to 7, 15	A to H	Data Inputs
9	$\overline{RCO}$	Ripple Carry Output
10	$\overline{CCLR}$	Counter Clear Input
11	CCK	Counter Clock Input
12	$\overline{CCKEN}$	Counter Clock Enable Input
13	RCK	Register Clock Input
14	$\overline{CLOAD}$	Counter Load Input
8	GND	Ground (0V)
16	V <sub>CC</sub>	Positive Supply Voltage

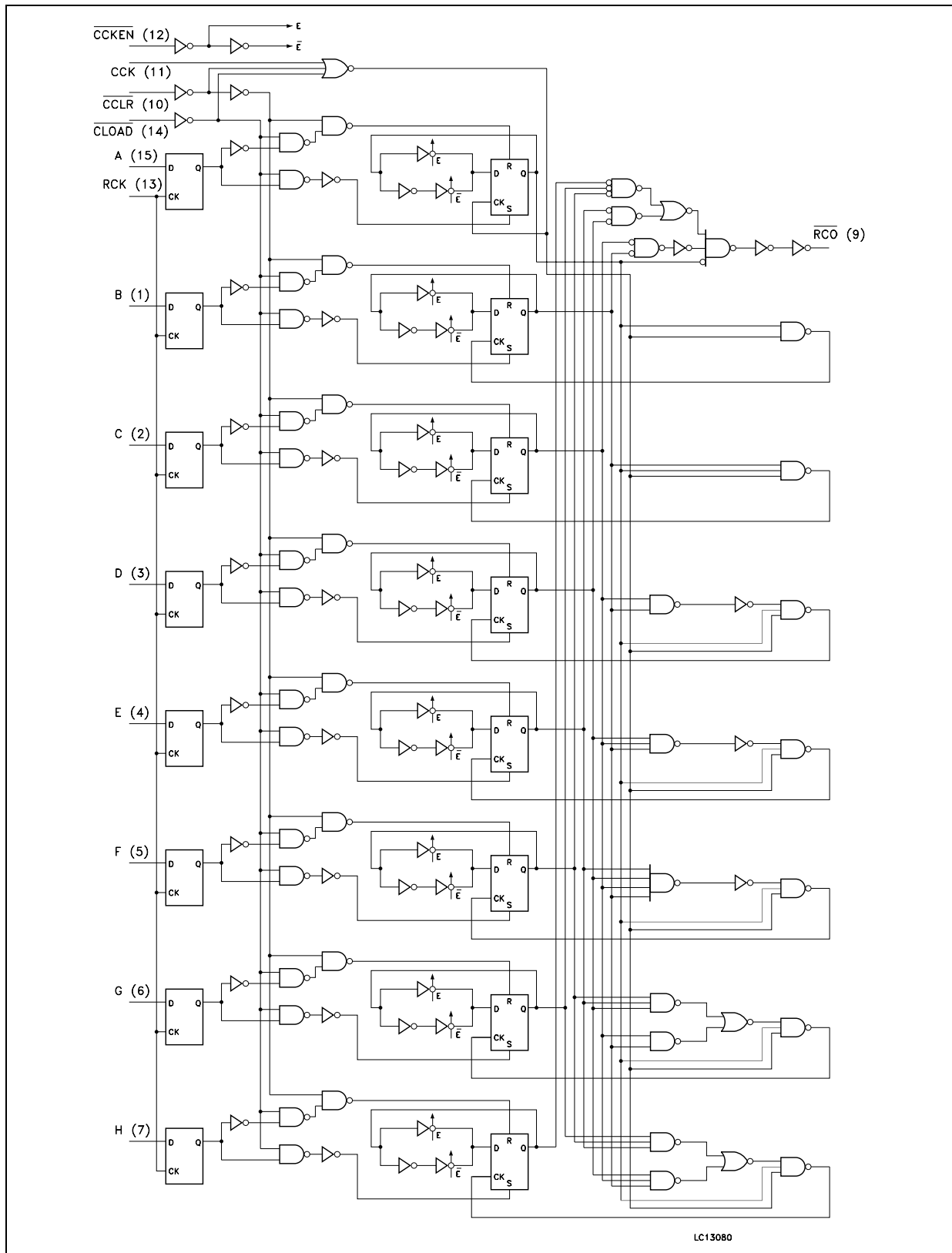
TRUTH TABLE

INPUTS					OUTPUT
RCK	$\overline{CLOAD}$	$\overline{CCLR}$	$\overline{CCKEN}$	CCK	
x	L	H	X	X	REGISTER DATA IS LOADED INTO COUNTER
x	H	L	X	X	COUNTER CLEAR
	H	H	X	X	THE DATA OF A THRU H INPUTS IS STORED INTO REGISTER
	H	H	X	X	REGISTER STATE IS NOT CHANGED
X	H	H	L		COUNTER ADVANCES THE COUNT
X	H	H	L		NO COUNT
X	H	H	H	X	NO COUNT

X: Don't Care

$\overline{RCO} = QA' \cdot QB' \cdot QC' \cdot QD' \cdot QE' \cdot QF' \cdot QG' \cdot QH'$  (QA' to QH' : INTERNAL OUTPUTS OF THE COUNTER)

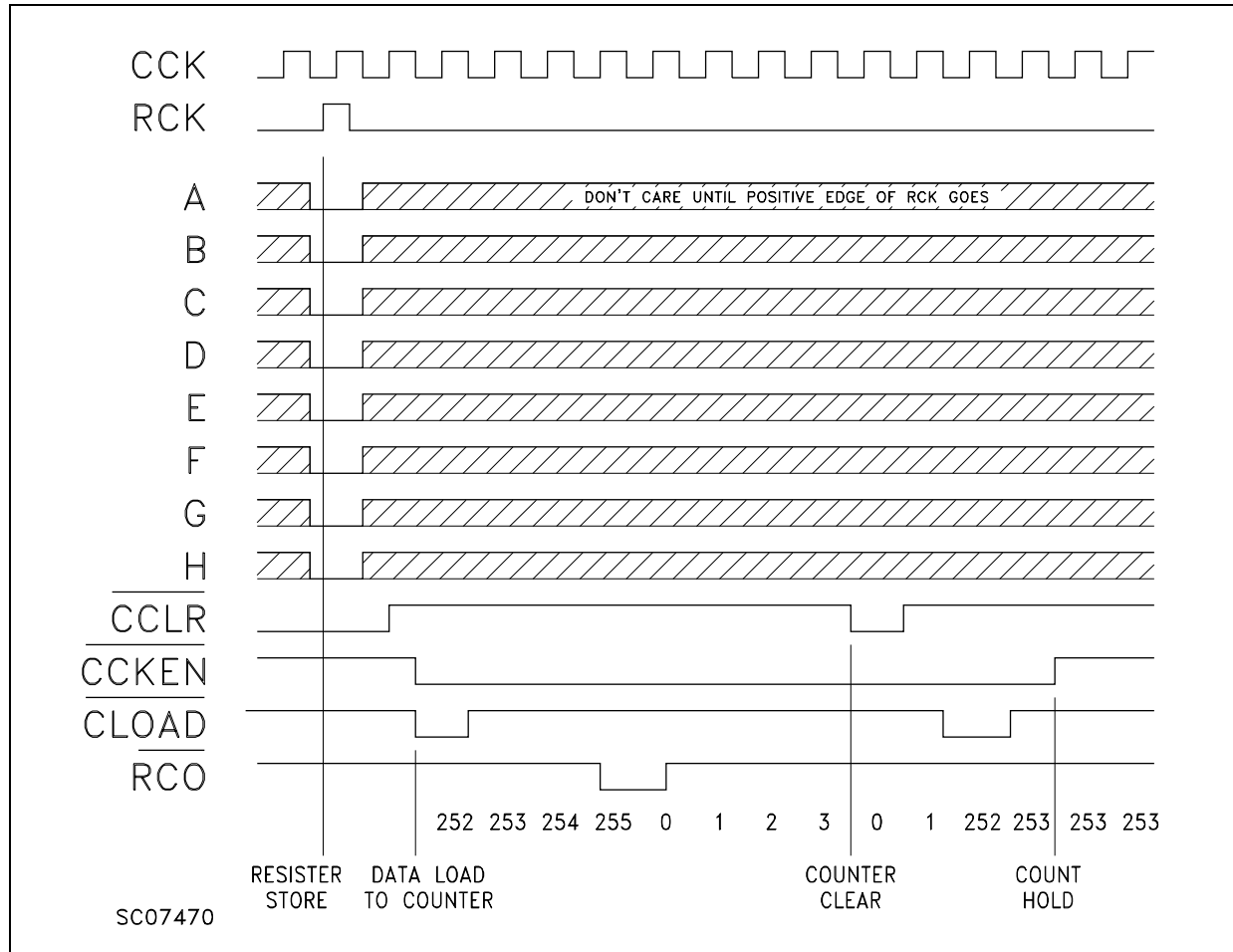
LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays



**TIMING CHART**



**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	$^{\circ}C$
$T_L$	Lead Temperature (10 sec)	300	$^{\circ}C$

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  $^{\circ}C$ ; derate to 300mW by 10mW/ $^{\circ}C$  from 65 $^{\circ}C$  to 85 $^{\circ}C$

## 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)		$T_A = 25^\circ C$			-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	$I_O = -20 \mu A$	1.9	2.0		1.9		1.9		V
		4.5	$I_O = -20 \mu A$	4.4	4.5		4.4		4.4		
		6.0	$I_O = -20 \mu A$	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	$I_O = 20 \mu A$		0.0	0.1		0.1		0.1	V
		4.5	$I_O = 20 \mu A$		0.0	0.1		0.1		0.1	
		6.0	$I_O = 20 \mu A$		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			$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu A$
$I_{CC}$	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND			4		40		80	$\mu A$

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

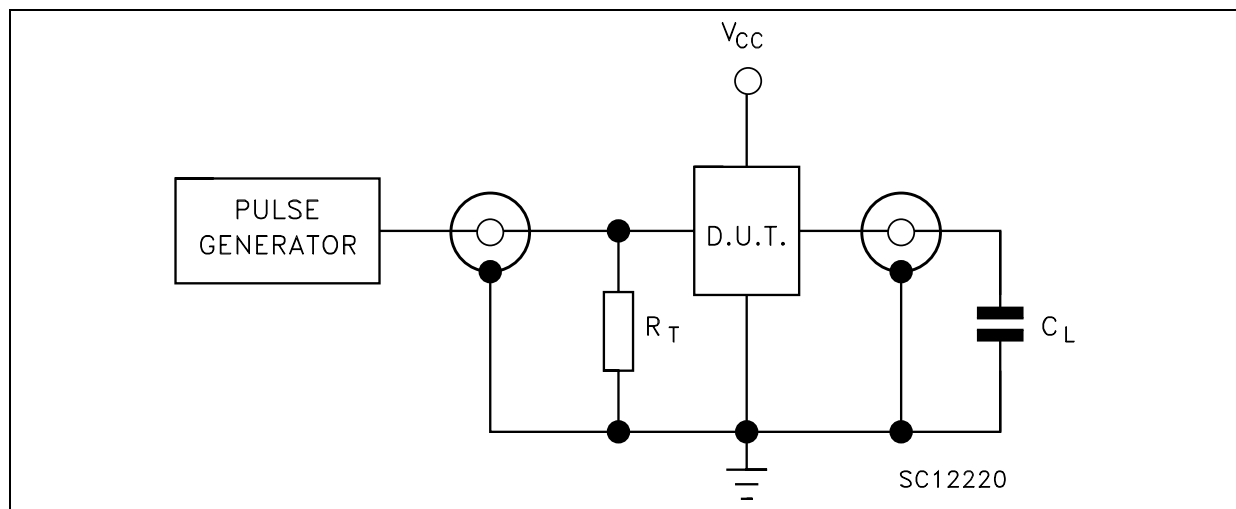
Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$		$-55 \text{ to } 125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{TLH}$ $t_{THL}$	Output Transition Time	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time ( $\overline{\text{CCK}} - \overline{\text{RCO}}$ )	2.0			63	165		205		250	ns
		4.5			21	33		41		50	
		6.0			18	28		35		43	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time ( $\overline{\text{CLOAD}} - \overline{\text{RCO}}$ )	2.0			110	235		295		355	ns
		4.5			30	47		59		71	
		6.0			26	40		50		60	
$t_{PHL}$	Propagation Delay Time ( $\overline{\text{CCLR}} - \overline{\text{RCO}}$ )	2.0			70	160		200		240	ns
		4.5			20	32		40		48	
		6.0			17	27		34		41	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time ( $\overline{\text{RCK}} - \overline{\text{RCO}}$ )	2.0			120	260		325		390	ns
		4.5			34	52		65		78	
		6.0			29	44		55		66	
$f_{MAX}$	Maximum Clock Frequency	2.0		5.4	11		4.4		3.6		MHz
		4.5		27	45		22		18		
		6.0		32	53		26		21		
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width	2.0			40	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
$t_{W(L)}$	Minimum Pulse Width ( $\overline{\text{CCLR}}$ , $\overline{\text{CLOAD}}$ )	2.0			40	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
$t_s$	Minimum Set-up Time ( $\overline{\text{CCKEN}} - \overline{\text{CCK}}$ )	2.0			28	75		95		110	ns
		4.5			7	15		19		22	
		6.0			6	13		16		19	
$t_s$	Minimum Set-up Time ( $\overline{\text{RCK}} - \overline{\text{CLOAD}}$ ) ( $\overline{\text{A...H}} - \overline{\text{RCK}}$ )	2.0			40	100		125		145	ns
		4.5			10	20		25		29	
		6.0			9	17		21		25	
$t_h$	Minimum Hold Time	2.0				0		0		0	ns
		4.5				0		0		0	
		6.0				0		0		0	
$t_{REM}$	Minimum Removal Time	2.0			28	75		95		110	ns
		4.5			7	15		19		22	
		6.0			6	13		16		19	

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition			Value						Unit	
		V <sub>CC</sub> (V)			T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
			Min.	Typ.	Max.	Min.	Max.	Min.	Max.			
C <sub>IN</sub>	Input Capacitance					5	10		10		10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)					30						pF

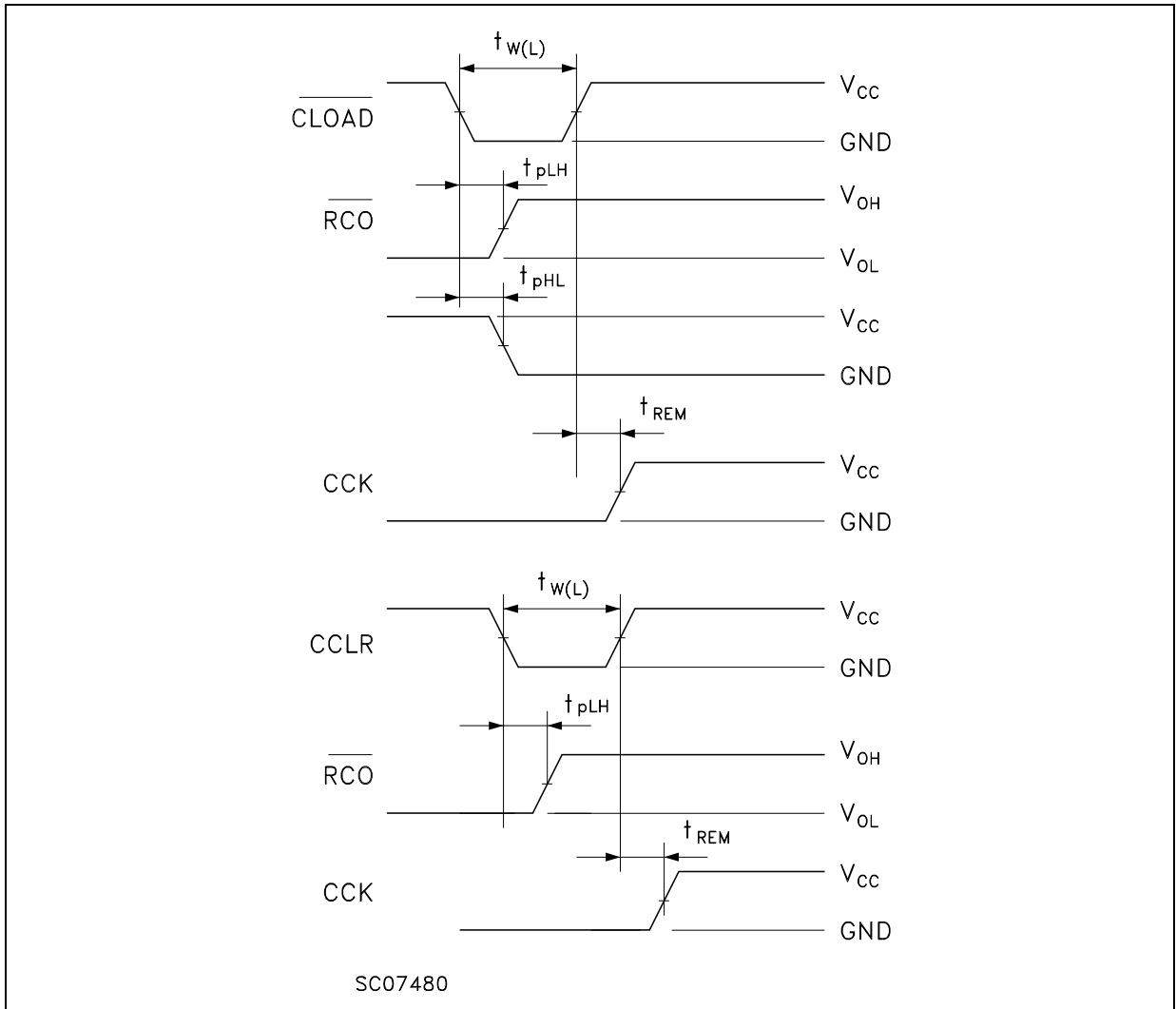
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN}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

## TEST CIRCUIT

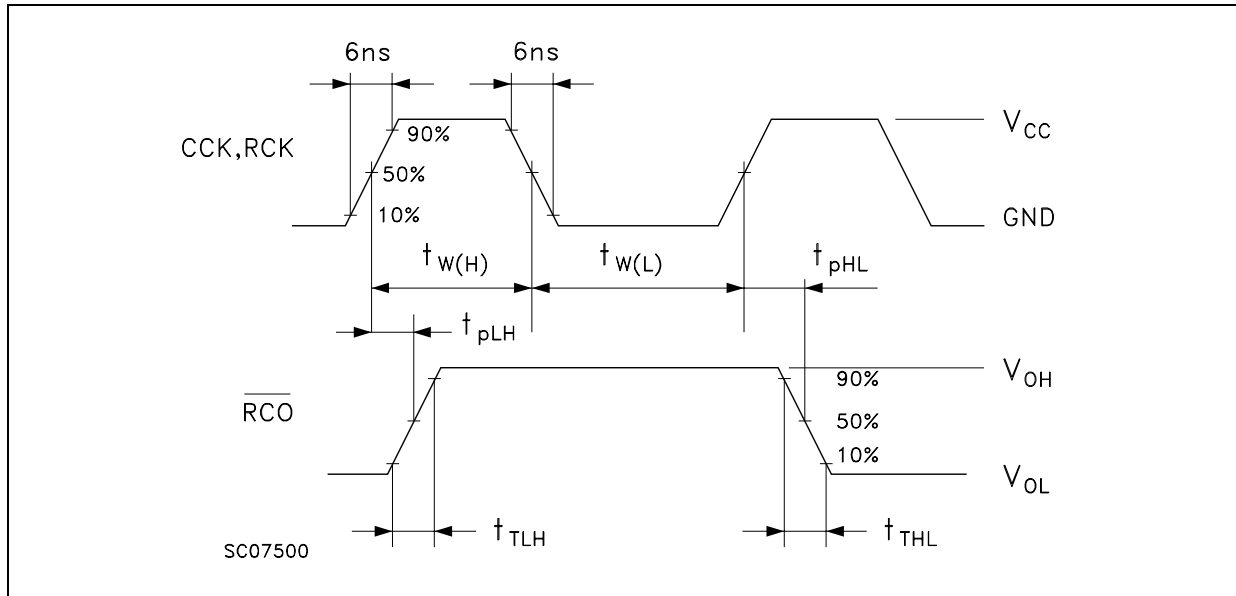
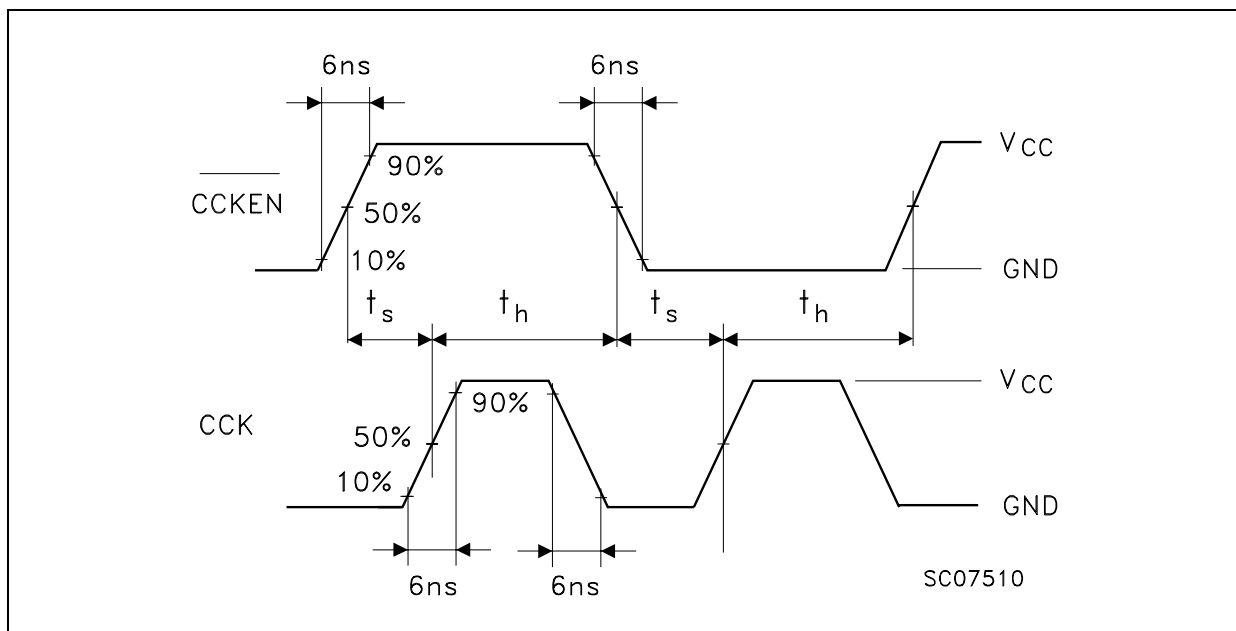


C<sub>L</sub> = 50pF or equivalent (includes jig and probe capacitance)  
R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

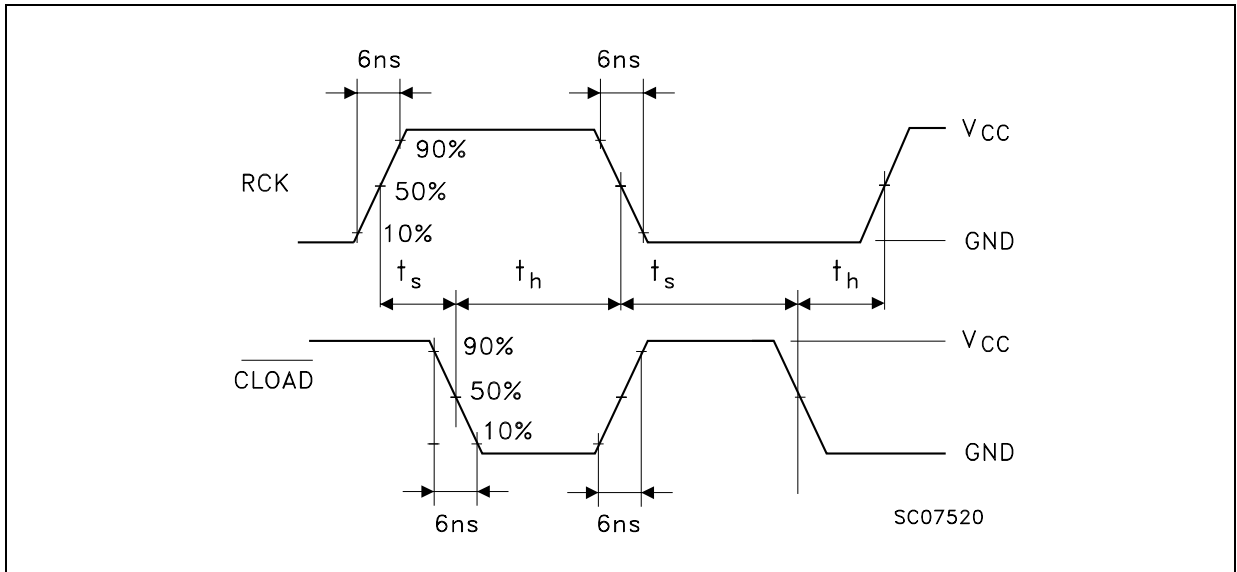
WAVEFORM 1 : MINIMUM PULSE WIDTH, REMOVAL TIME (f=1MHz; 50% duty cycle)



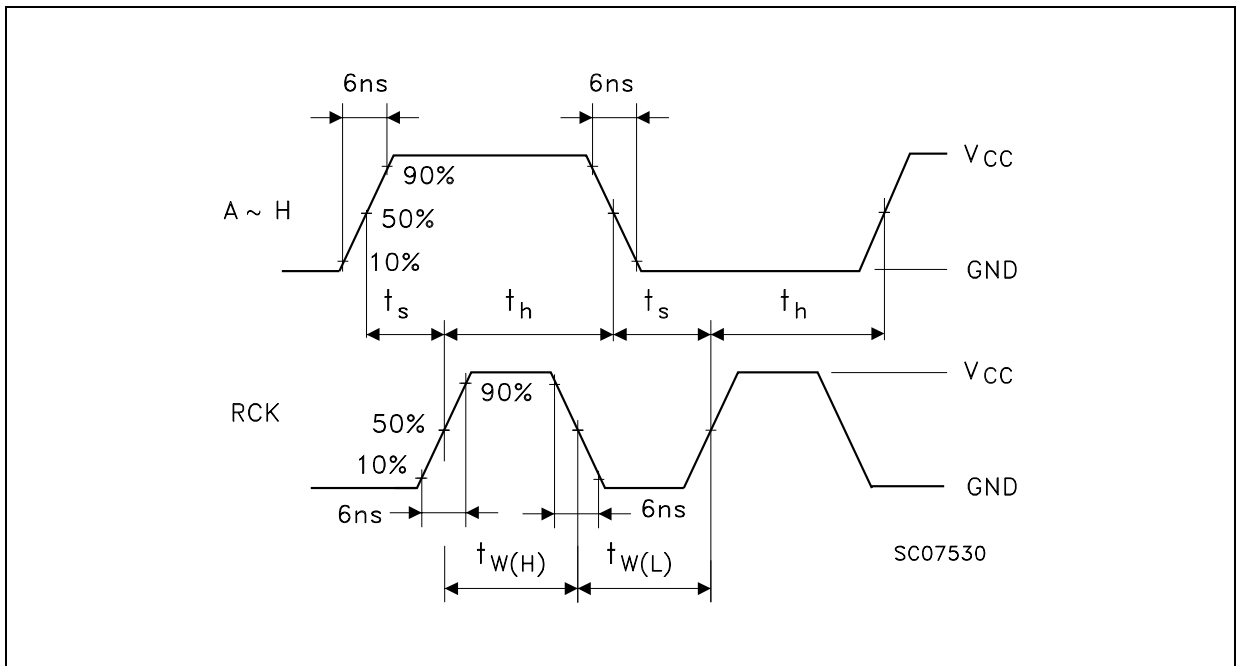


**WAVEFORM 2 : PROPAGATION DELAY TIME, MINIMUM PULSE WIDTH** (f=1MHz; 50% duty cycle)**WAVEFORM 3 : MINIMUM SETUP AND HOLD TIME** (f=1MHz; 50% duty cycle)

WAVEFORM 4 : MINIMUM SETUP AND HOLD TIME (f=1MHz; 50% duty cycle)

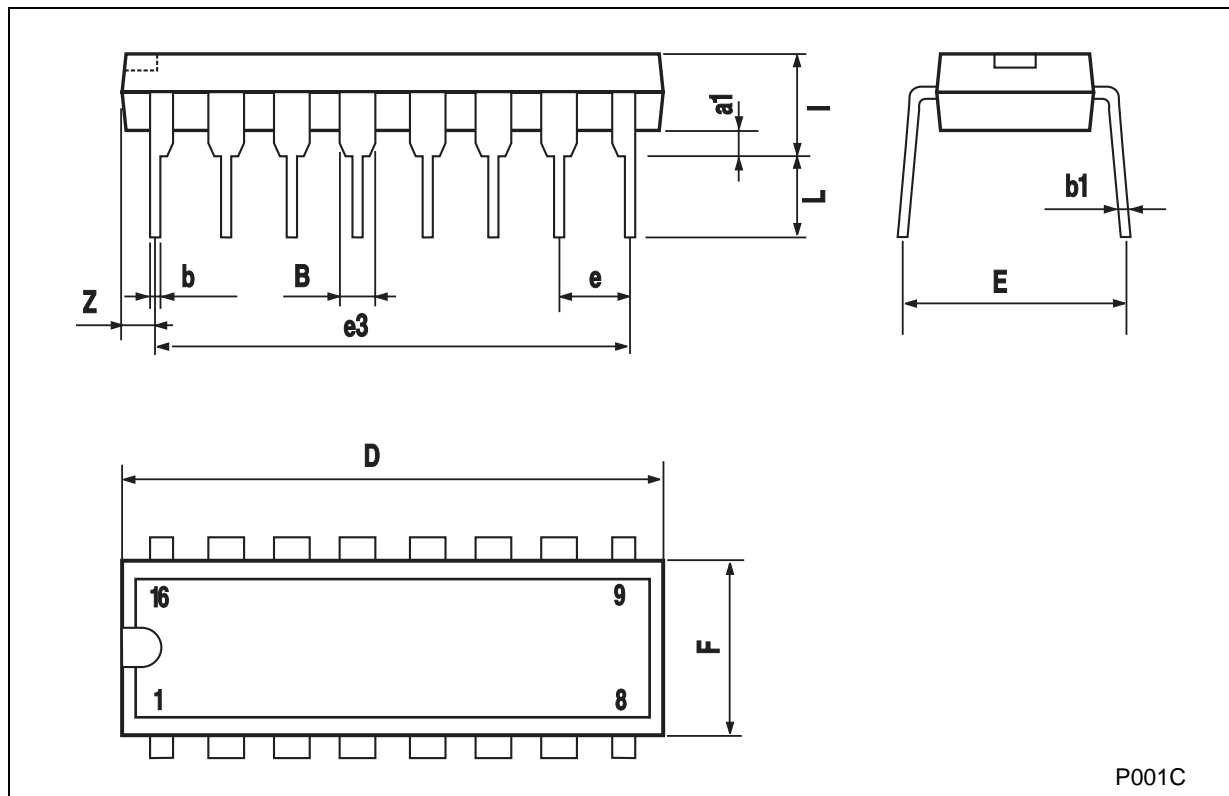


WAVEFORM 5 : MINIMUM PULSE WIDTH, SETUP AND HOLD TIME (f=1MHz; 50% duty cycle)



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

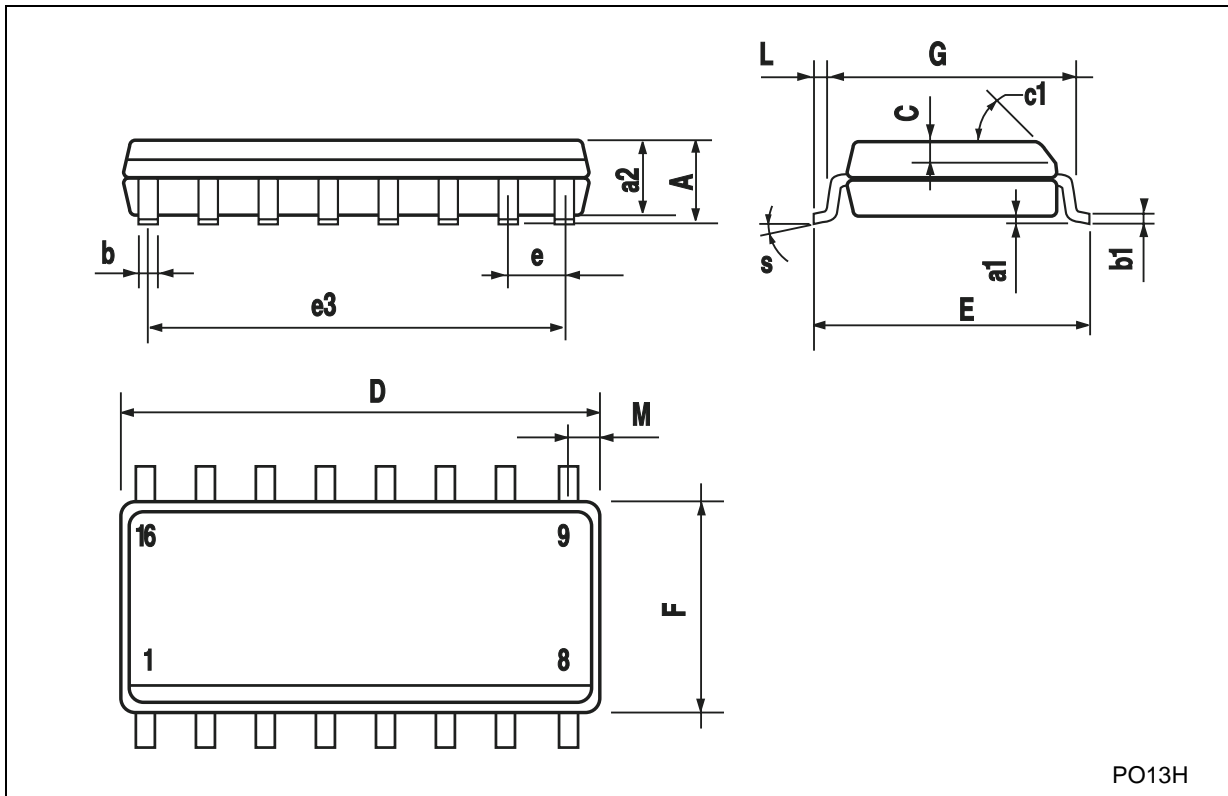
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

**SO-16 MECHANICAL DATA**

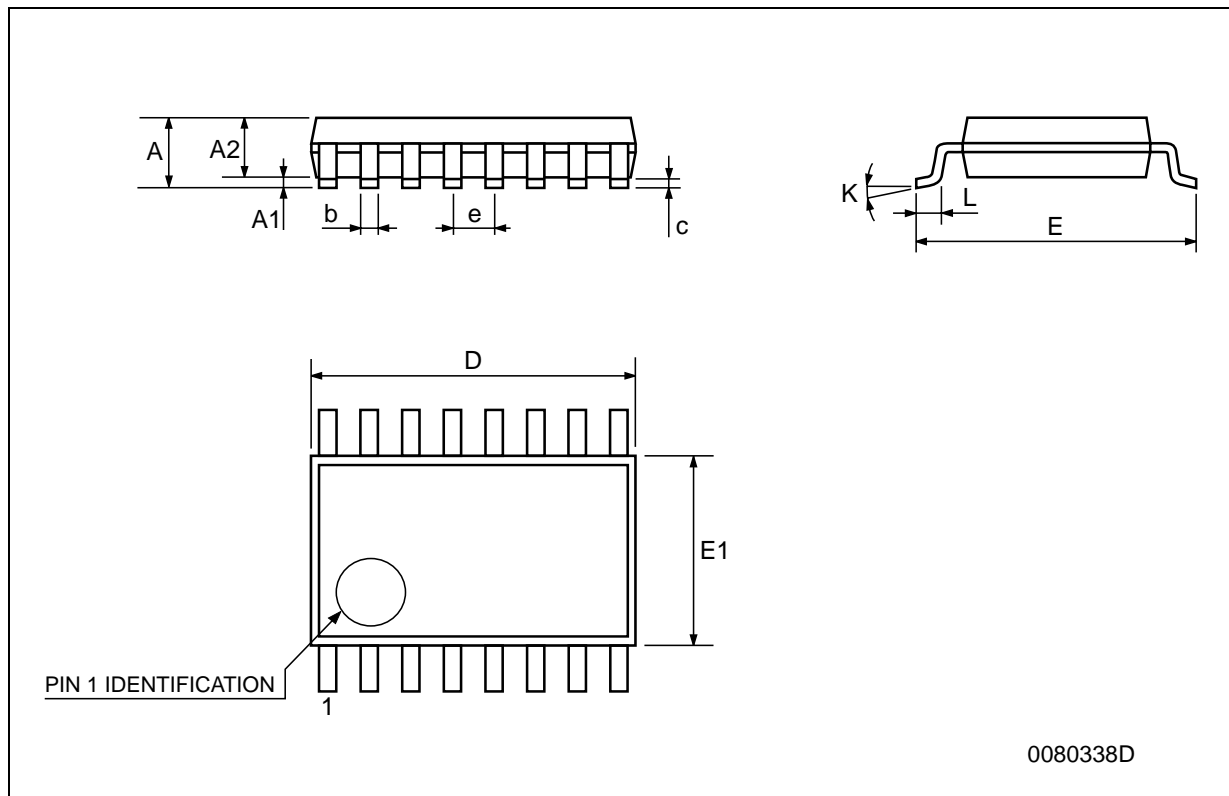
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
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



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