



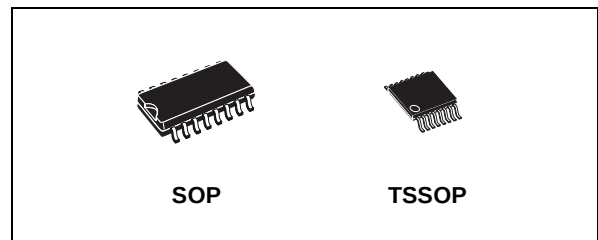
74VHCT174A

HEX D-TYPE FLIP FLOP WITH CLEAR

- HIGH SPEED:
 $f_{\text{MAX}} = 150 \text{ MHz (TYP.)}$ at $V_{\text{CC}} = 5\text{V}$
- LOW POWER DISSIPATION:
 $I_{\text{CC}} = 4 \mu\text{A (MAX.)}$ at $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS:
 $V_{\text{IH}} = 2\text{V (MIN.)}$, $V_{\text{IL}} = 0.8\text{V (MAX.)}$
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{\text{OH}}| = I_{\text{OL}} = 8 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS:
 $t_{\text{PLH}} \approx t_{\text{PHL}}$
- OPERATING VOLTAGE RANGE:
 $V_{\text{CC(OPR)}} = 4.5\text{V to } 5.5\text{V}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 174
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE: $V_{\text{OLP}} = 0.8\text{V (MAX.)}$

DESCRIPTION

The 74VHCT174A is an advanced high-speed CMOS HEX D-TYPE FLIP FLOP WITH CLEAR fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. Information signals applied to D inputs are transferred to the Q outputs on the positive going edge of the clock pulse.

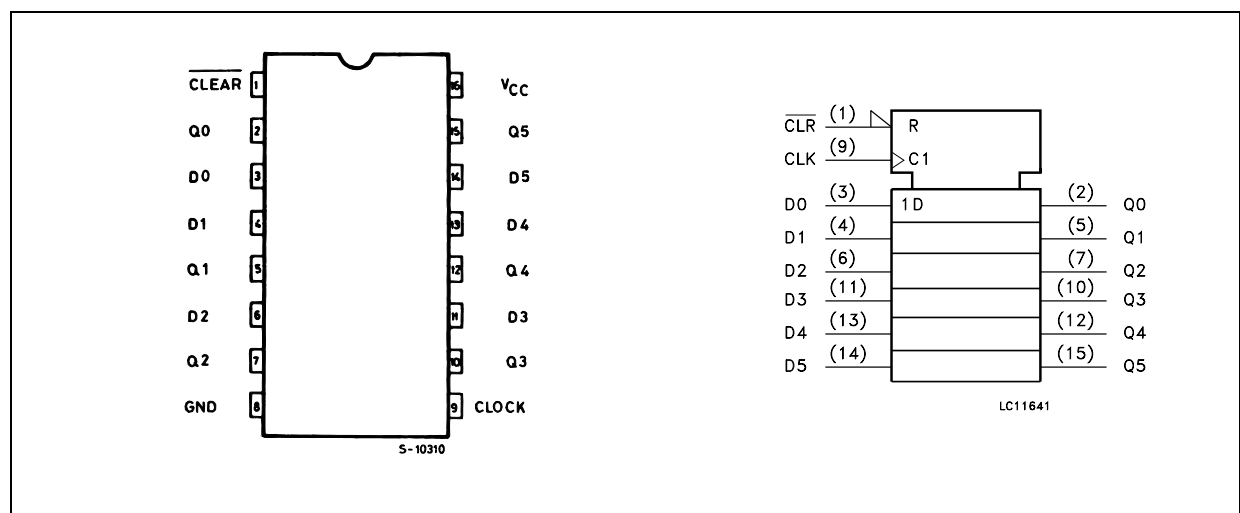


ORDER CODES

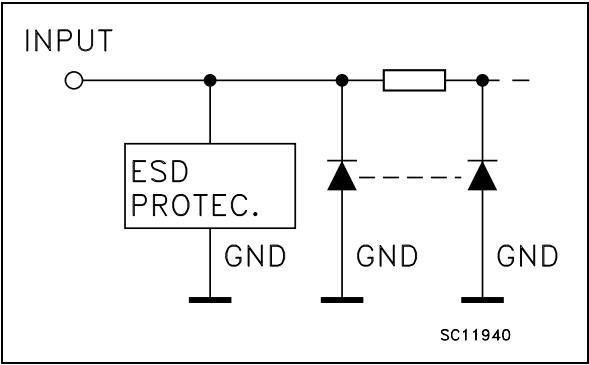
PACKAGE	TUBE	T & R
SOP	74VHCT174AM	74VHCT174AMTR
TSSOP		74VHCT174ATTR

When the $\overline{\text{CLEAR}}$ input is held low, the Q outputs are held low independently of the other inputs. Power down protection is provided on all inputs and outputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V since all inputs are equipped with TTL threshold. All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS



INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

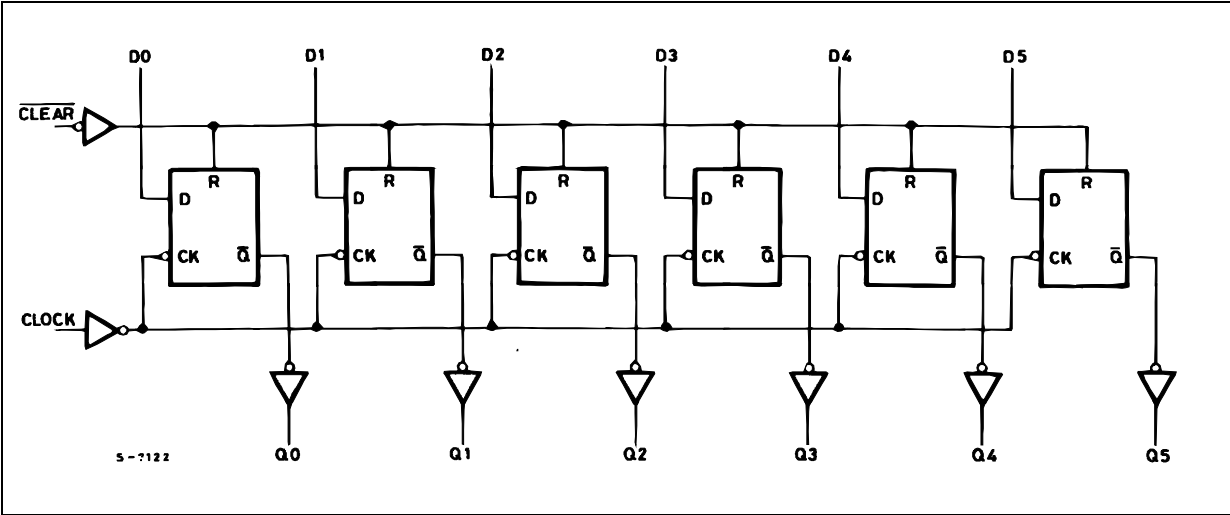
PIN No	SYMBOL	NAME AND FUNCTION
1	CLEAR	Asynchronous Master Reset (Active LOW)
2, 5, 7, 10, 12, 15	Q0 to Q5	Flip-Flop Outputs
3, 4, 6, 11, 13, 14	D0 to D5	Data Inputs
9	CLOCK	Clock Input (LOW-to-HIGH, Edge Triggered)
8	GND	Ground (0V)
16	V _{CC}	Positive Supply Voltage

TRUTH TABLE

INPUTS			OUTPUTS	FUNCTION
CLEAR	D	CLOCK	Q	
L	X	X	L	CLEAR
H	L		L	
H	H		H	
H	X		Q _n	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 +7.0	V
V_I	DC Input Voltage	-0.5 to +7.0	V
V_O	DC Output Voltage (see note 1)	-0.5 to +7.0	V
V_O	DC Output Voltage (see note 2)	-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	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
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.

1) $V_{CC} = 0V$

2) High or Low State

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	4.5 to 5.5	V
V_I	Input Voltage	0 to 5.5	V
V_O	Output Voltage (see note 1)	0 to 5.5	V
V_O	Output Voltage (see note 2)	0 to V_{CC}	V
T_{op}	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time (see note 3) ($V_{CC} = 5.0 \pm 0.5V$)	0 to 20	ns/V

1) $V_{CC} = 0V$

2) High or Low State

3) V_{IN} from 0.8V to 2V

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	4.5 to 5.5		2			2		2		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 =-50 μA	4.4	4.5		4.4		4.4		V
		4.5	I _O =-8 mA	3.94			3.8		3.7		
V _{OL}	Low Level Output Voltage	4.5	I _O =50 μA		0.0	0.1		0.1		0.1	V
		4.5	I _O =8 mA			0.36		0.44		0.55	
I _I	Input Leakage Current	0 to 5.5	V _I = 5.5V or GND			± 0.1		± 1.0		± 1.0	μA
I _{CC}	Quiescent Supply Current	5.5	V _I = V _{CC} or GND			4		40		40	μA
Δ I _{CC}	Additional Worst Case Supply Current	5.5	One Input at 3.4V, other input at V _{CC} or GND			1.35		1.5		1.5	mA
I _{OPD}	Output Leakage Current	0	V _{OUT} = 5.5V			0.5		5.0		5.0	μA

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3ns)

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 _{PLH} t _{PHL}	Propagation Delay Time CLOCK to Q	5.0 ^(*)	15			5.8	7.8	1.0	9.0	1.0	9.0	ns
		5.0 ^(*)	50			6.3	8.8	1.0	10.0	1.0	10.0	
t _{PHL}	Propagation Delay Time CLEAR to Q	5.0 ^(*)	15			7.6	10.4	1.0	13.0	1.0	13.0	ns
		5.0 ^(*)	50			8.1	11.4	1.0	13.0	1.0	13.0	
t _W	CLEAR Pulse Width LOW	5.0 ^(*)					5.0		5.0		5.0	ns
t _W	CLEAR Pulse Width HIGH or LOW	5.0 ^(*)					5.0		5.0		5.0	ns
t _s	Setup Time D to CLOCK, HIGH or LOW	5.0 ^(*)					5.0		6.0		6.0	ns
t _h	Hold Time D to CLOCK, HIGH or LOW	5.0 ^(*)					0.0		0.0		0.0	ns
t _{REM}	Recovery Time CLEAR to CLOCK	5.0 ^(*)					3.0		3.0		3.0	ns
f _{MAX}	Maximum Clock Frequency	5.0 ^(*)	15		95	150		80		80		MHz
		5.0 ^(*)	50		55	85		50		50		

(*) Voltage range is 5.0V ± 0.5V

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition	Value								Unit
			T _A = 25°C			-40 to 85°C		-55 to 125°C			
			Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
C _{IN}	Input Capacitance			6	10		10		10	pF	
C _{PD}	Power Dissipation Capacitance (note 1)			28						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)

DYNAMIC SWITCHING CHARACTERISTICS

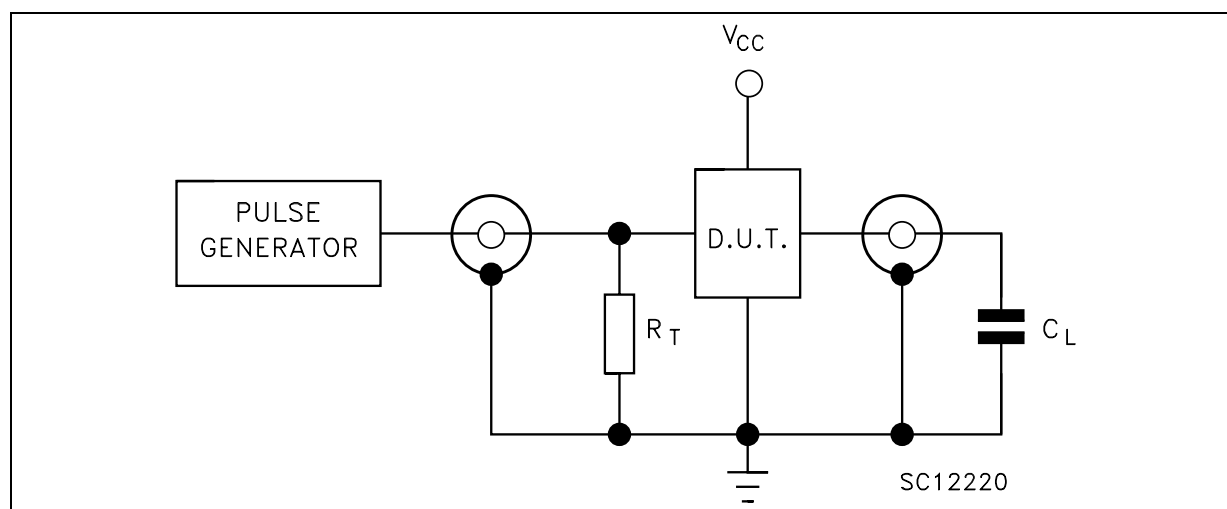
Symbol	Parameter	Test Condition		Value								Unit
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C			
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
V _{OLP}	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C _L = 50 pF		0.3	0.8					V	
V _{OLV}				-0.8	-0.3							
V _{IHD}	Dynamic High Voltage Input (note 1, 3)	5.0		2.0								
V _{ILD}	Dynamic Low Voltage Input (note 1, 3)	5.0					0.8					

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.0V, (n-1) outputs switching and one output at GND.

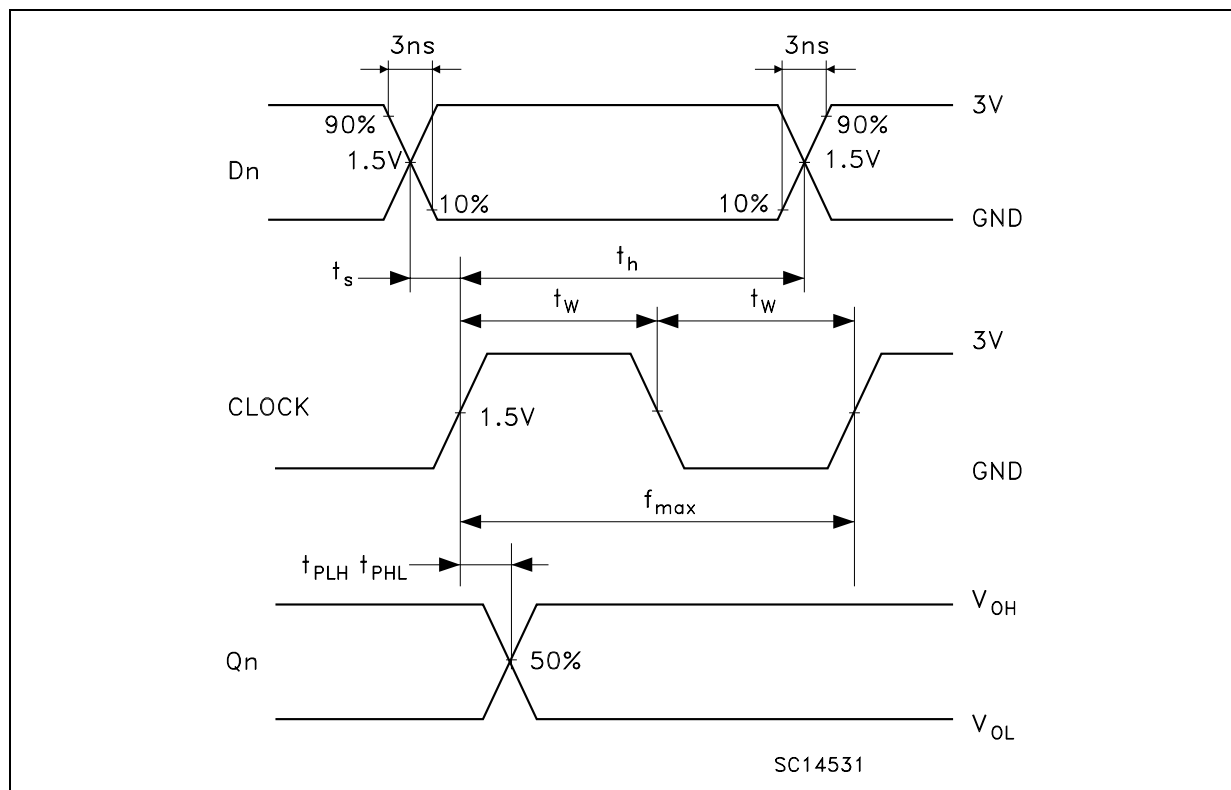
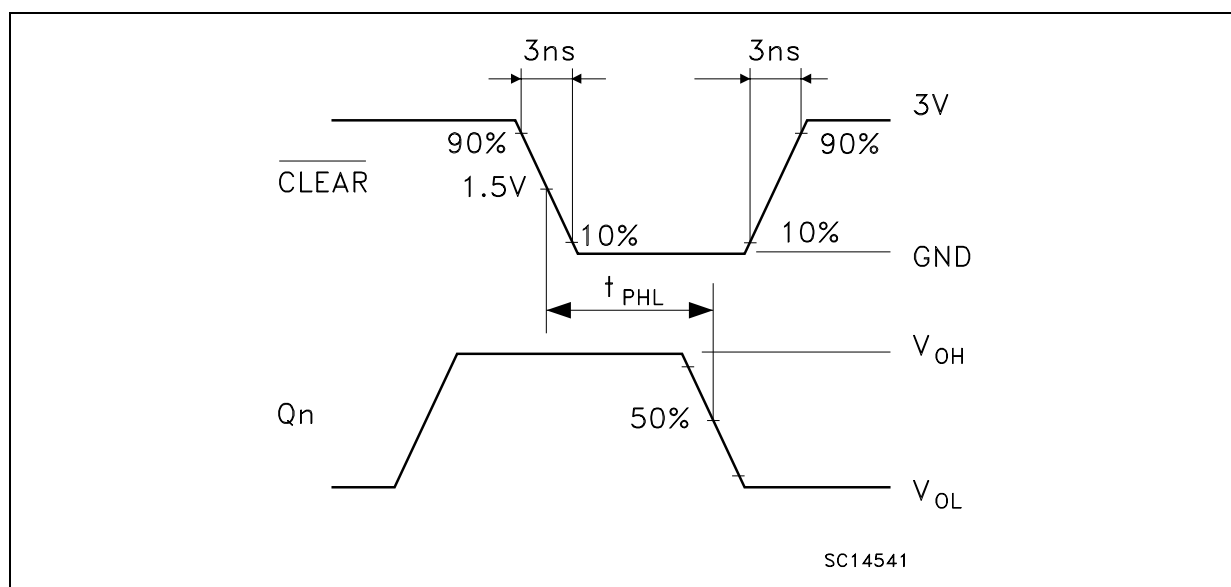
3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.0V. Inputs under test switching: 3.0V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), $f=1\text{MHz}$.

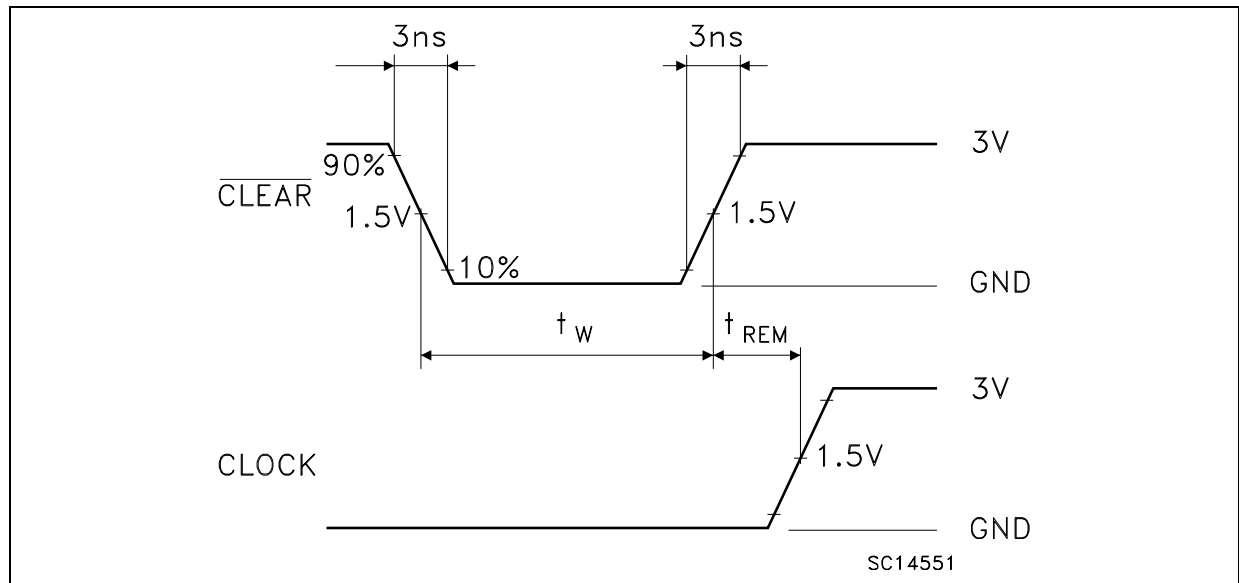
TEST CIRCUIT



$C_L = 15/50\text{pF}$ or equivalent (includes jig and probe capacitance)

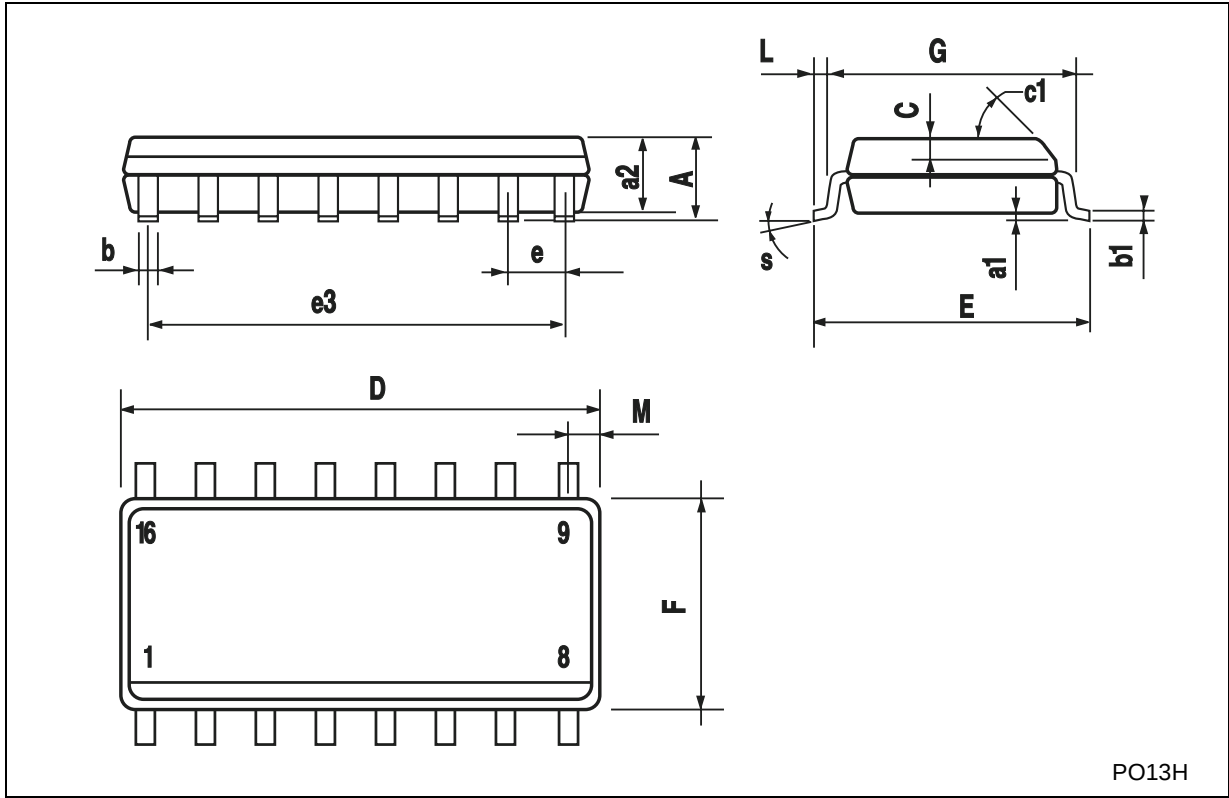
$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES ($f=1\text{MHz}$; 50% duty cycle)**WAVEFORM 2: PROPAGATION DELAYS ($f=1\text{MHz}$; 50% duty cycle)**

WAVEFORM 3: REMOVAL TIME ($f=1\text{MHz}$; 50% duty cycle)

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.)					

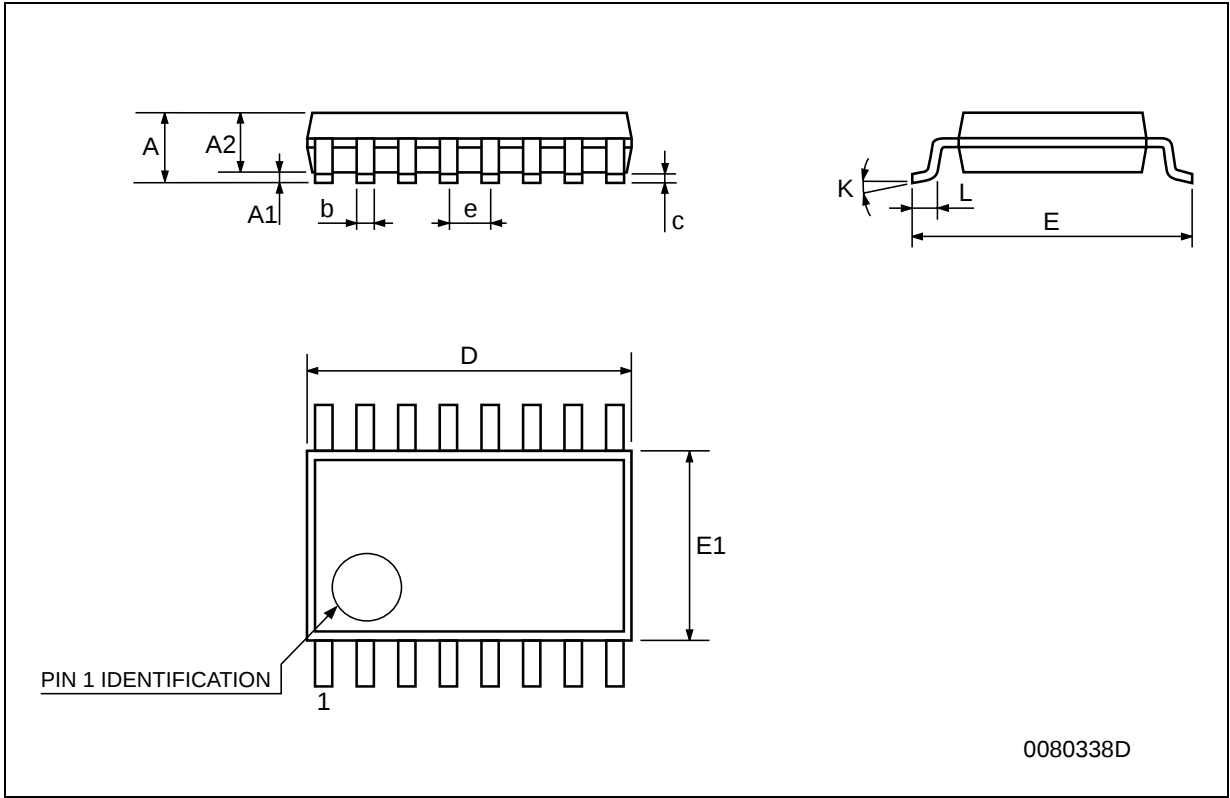


PO13H



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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