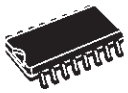
74LVQ174

HEX D-TYPE FLIP FLOP WITH CLEAR

- HIGH SPEED:
  f_{MAX} = 150 MHz (TYP.) at V_{CC} = 3.3V
- COMPATIBLE WITH TTL OUTPUTS
- LOW POWER DISSIPATION:
  I_{CC} = 4 µA (MAX.) at T_A = 25 °C
- LOW NOISE:
  V_{OLP} = 0.3 V (TYP.) at V_{CC} = 3.3V
- 75Ω TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}| = I_{OL}$ = 12 mA (MIN)
- PCI BUS LEVELS GUARANTEED AT 24mA
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
  V_{CC} (OPR) = 2V to 3.6V (1.2V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 174
- IMPROVED LATCH-UP IMMUNITY



M
(Micro Package)

T
(TSSOP Package)

ORDER CODES :

74LVQ174M 74LVQ174T

DESCRIPTION

The LVQ174 is a low voltage CMOS HEX D-TYPE FLIP FLOP WITH CLEAR NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C^2MOS technology. It is ideal for low power and low noise 3.3V applications.

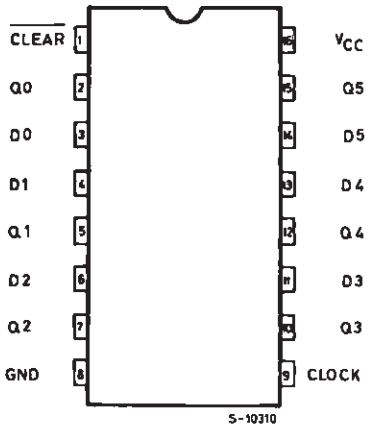
Information signals applied to D inputs are transfered to the Q outputs on the positive going edge of the clock pulse.

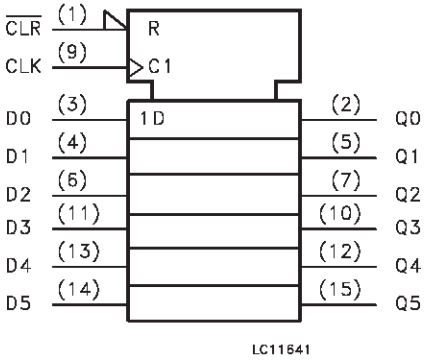
When the $\overline{CLEAR}$ input is held low, the Q outputs are held low independentely of the other inputs .

It has better speed performance at 3.3V than 5V LS-TTL family combined with the true CMOS low power consumption.

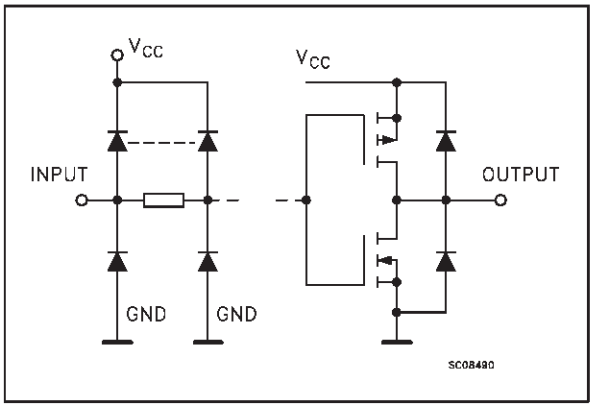
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS





INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

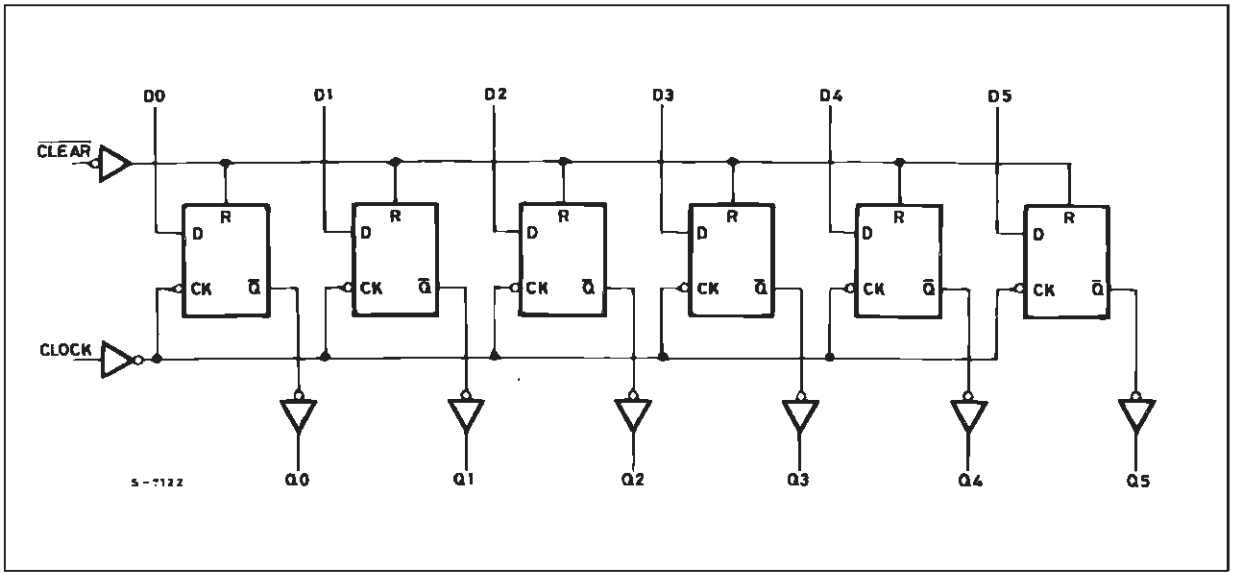
PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{CLEAR}$	Asyncronous Master Reset (Active LOW)
2, 5, 7, 10, 12, 15	Q0 to Q5	Flip-Flop Outputs
3, 4, 6, 11, 13, 14	D0 to D5	Data Inputs
9	CLOCK	Clock Input (LOW-to-HIGH, Edge- Triggered)
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

TRUTH TABLE

INPUTS			OUTPUTS	FUNCTION
$\overline{CLEAR}$	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 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	± 50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 300	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 condition is not implied.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage (note 1)	2 to 3.6	V
V_I	Input Voltage	0 to V_{CC}	V
V_O	Output Voltage	0 to V_{CC}	V
T_{op}	Operating Temperature:	-40 to +85	°C
dt/dv	Input Rise and Fall Time (V_{CC} = 3V) (note 2)	0 to 10	ns/V

1) Truth Table guaranteed: 1.2V to 3.6V
2) V_{IN} from 0.8V to 2V

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions			Value					Unit
		V_{CC} (V)			T_A = 25 °C			-40 to 85 °C		
					Min.	Typ.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	3.0 to 3.6			2.0			2.0		V
V_{IL}	Low Level Input Voltage						0.8		0.8	V
V_{OH}	High Level Output Voltage	3.0	V_I(*) = V_{IH} or V_{IL}	I_O=-50 µA	2.9	2.99		2.9		V
				I_O=-12 mA	2.58			2.48		
				I_O=-24 mA				2.2		
V_{OL}	Low Level Output Voltage	3.0	V_I(*) = V_{IH} or V_{IL}	I_O=50 µA		0.002	0.1		0.1	V
				I_O=12 mA		0	0.36		0.44	
				I_O=24 mA					0.55	
I_I	Input Leakage Current	3.6	V_I = V_{CC} or GND				±0.1		±1	µA
I_{CC}	Quiescent Supply Current	3.6	V_I = V_{CC} or GND				4		40	µA
I_{OLD}	Dynamic Output Current (note 1, 2)	3.6	V_{OLD} = 0.8 V max					36		mA
I_{OHD}			V_{OHD} = 2 V min					-25		mA

1) Maximum test duration 2ms, one output loaded at time
2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50 Ω.
(*) All outputs loaded.

DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	Test Conditions		Value					Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
V_{OLP}	Dynamic Low Voltage Quiet Output (note 1, 2)	3.3	C_L = 50 pF		0.3	0.8			V
V_{OLV}				-0.8	-0.3				
V_{IHD}	Dynamic High Voltage Input (note 1, 3)	3.3				2			
V_{ILD}	Dynamic Low Voltage Input (note 1, 3)	3.3		0.8					

1) Worst case package
2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V, (n -1) outputs switching and one output at GND
3) max number of data inputs (n) switching. (n-1) switching 0V to 3.3V. Inputs under test switching: 3.3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}). f=1MHz

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, R_L = 500 Ω, Input $t_r = t_f$ =3 ns)

Symbol	Parameter	Test Condition		Value					Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay Time CK to Q	2.7			7.0	15.0		17.0	ns
		3.3(*)			5.5	11.0		12.0	
t_{PHL}	Propagation Delay Time $\overline{CLR}$ to Q	2.7			8.5	16.0		18.0	ns
		3.3(*)			7.0	12.0		13.0	
$t_{w(L)}$	$\overline{CLR}$ pulse Width, LOW	2.7			1.0	7.0		10.0	ns
		3.3(*)			1.0	5.5		7.0	
t_w	CK pulse Width, HIGH or LOW, 2.7			1.0	7.0		10.0	ns	
		3.3(*)			1.0	5.5		7.0	
t_{sL} t_{sH}	Setup Time D to CK HIGH or LOW	2.7			-0.5	8.0		10.0	ns
		3.3(*)			-0.4	6.5		7.0	
t_{hL} t_{hH}	Hold Time D to CK HIGH or LOW	2.7			0.5	4.0		4.5	ns
		3.3(*)			0.4	3.0		3.0	
t_{REM}	Recovery Time $\overline{CLR}$ to CK	2.7			0.5	3.5		3.5	ns
		3.3(*)			0.4	2.5		2.5	
f_{MAX}	Maximum Clock Frequency	2.7		60	150		50		MHz
		3.3(*)		90	150		70		
t_{OSLH} t_{OSHL}	Output to Output Skew Time (note 1, 2)	2.7			0.5	1.0		1.5	ns
		3.3(*)			0.5	1.0		1.5	

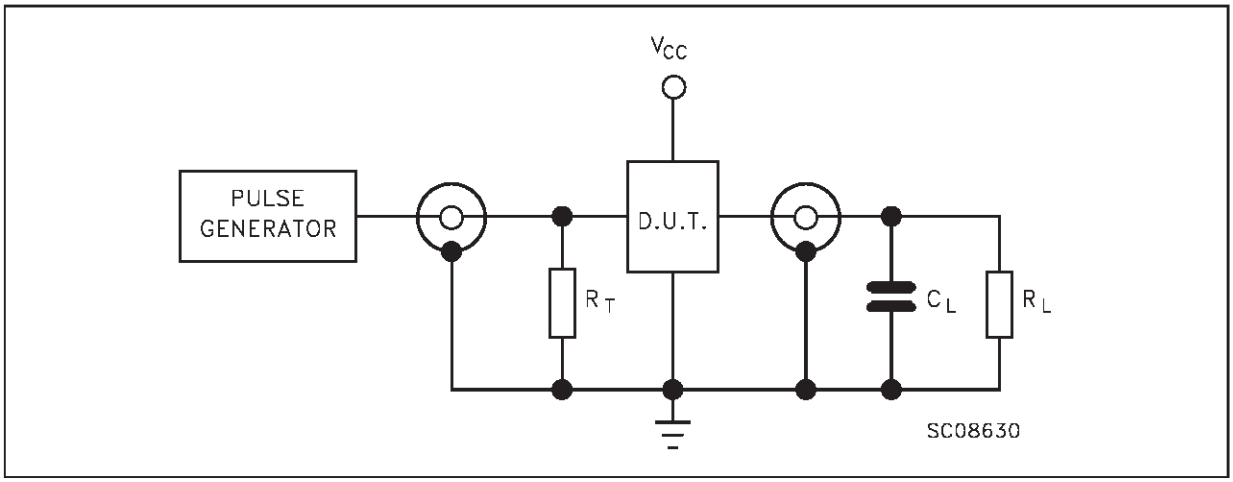
1) Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW ($t_{OSLH} = |t_{PLHm} - t_{PLHn}|$, $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$)
2) Parameter guaranteed by design
(*) Voltage range is 3.3V ± 0.3V

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions		Value					Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
C_{IN}	Input Capacitance	3.3			5				pF
C_{PD}	Power Dissipation Capacitance (note 1)	3.3	f_{IN} = 10 MHz		23				pF

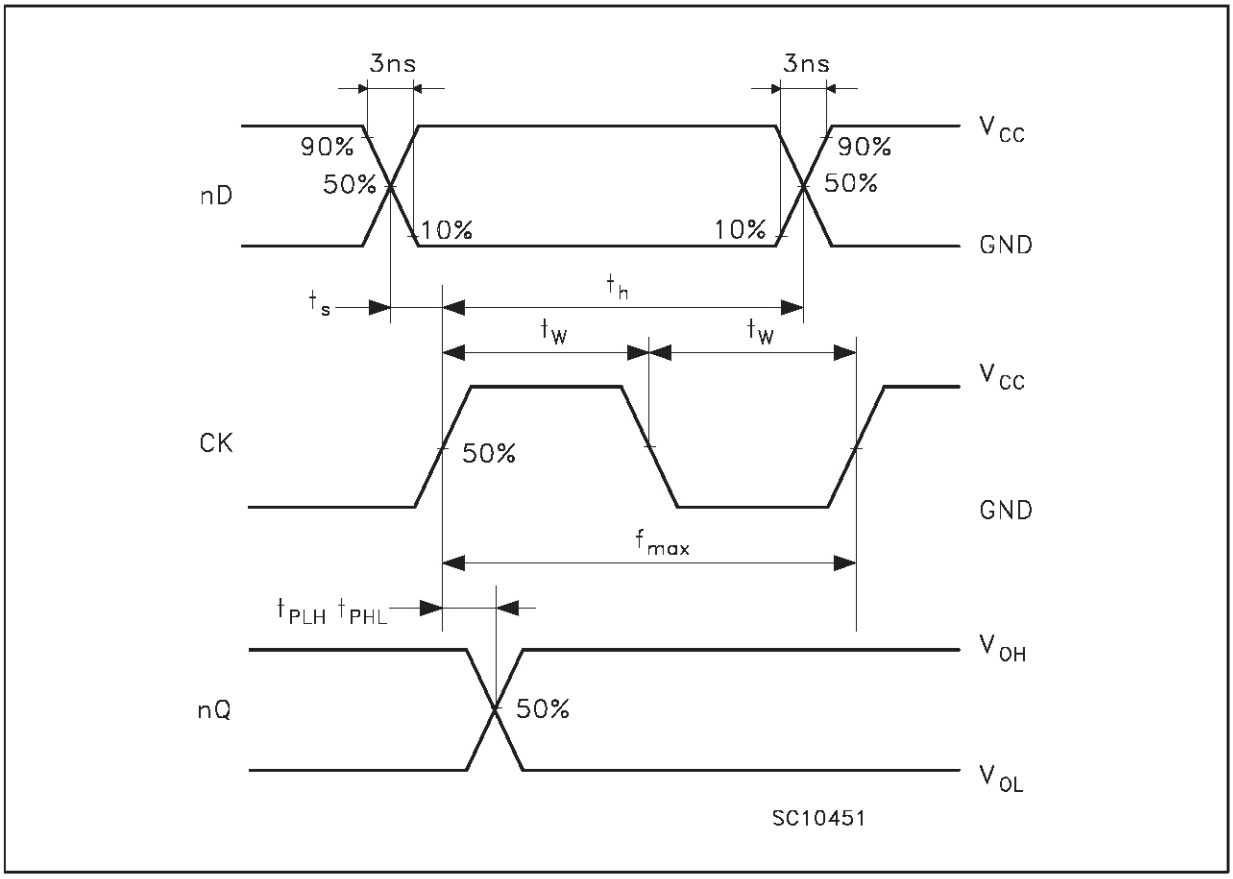
1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/6$ (per flip flop)

TEST CIRCUIT

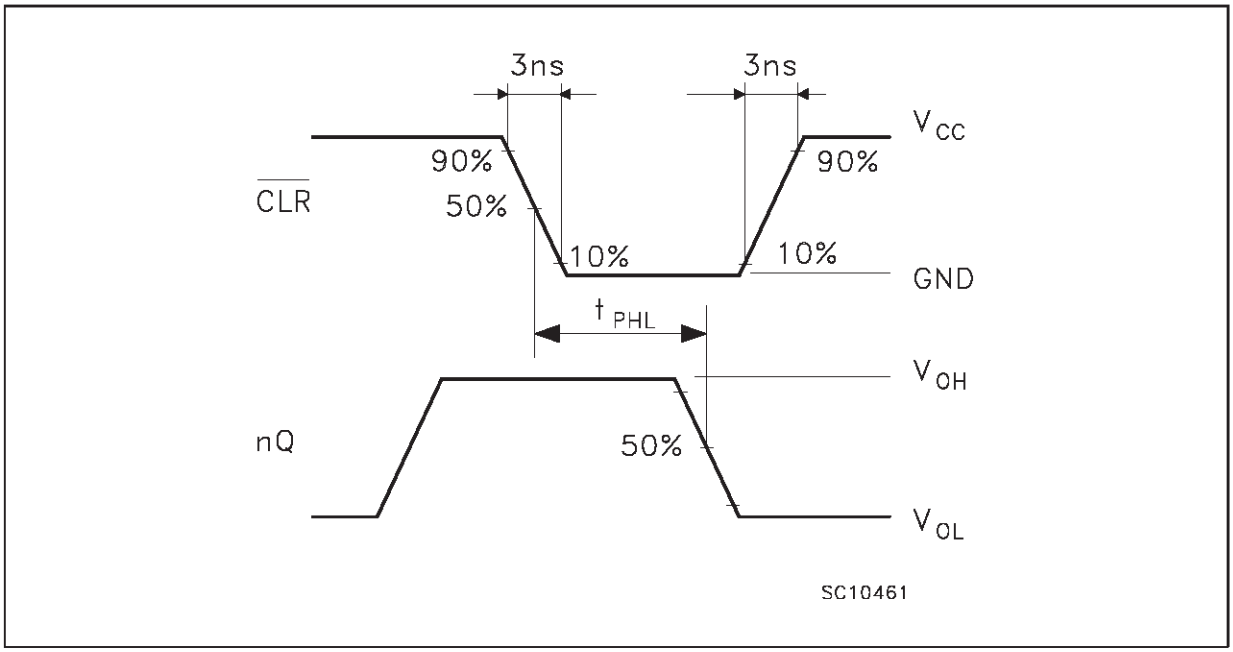


C_L = 50 pF or equivalent (includes jig and probe capacitance)
$R_L = R_1$ = 500Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

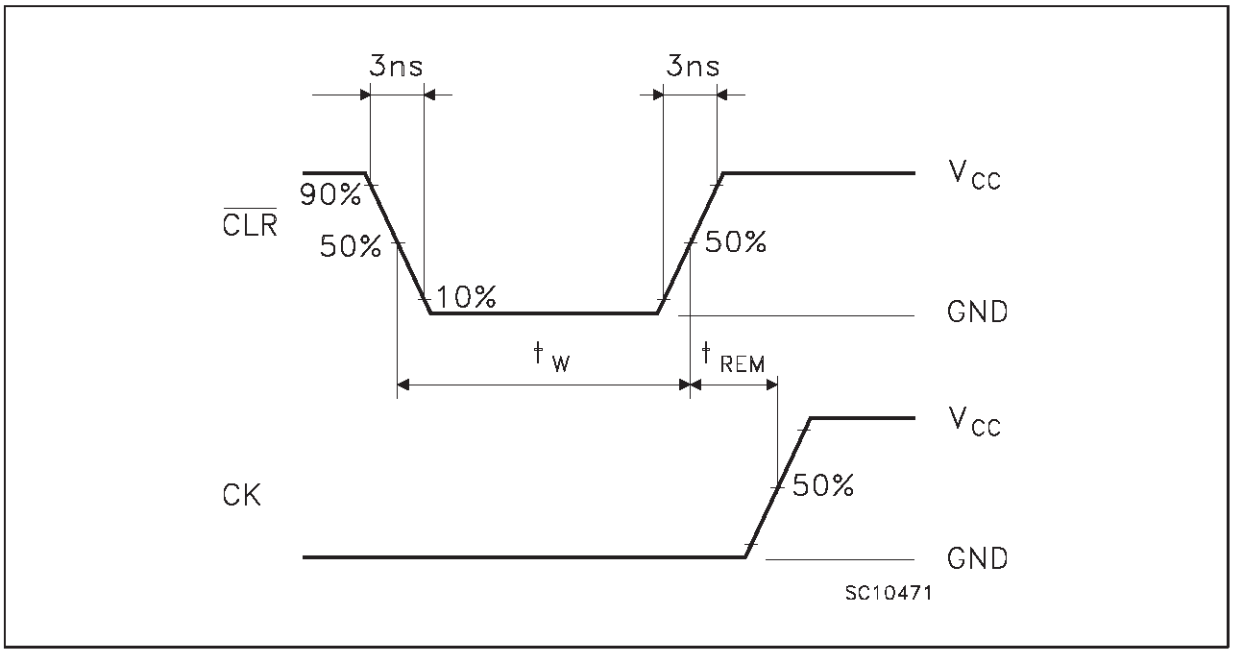
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES, CLOCK PULSE WIDTH (f=1MHz; 50% duty cycle)



WAVEFORM 2: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)

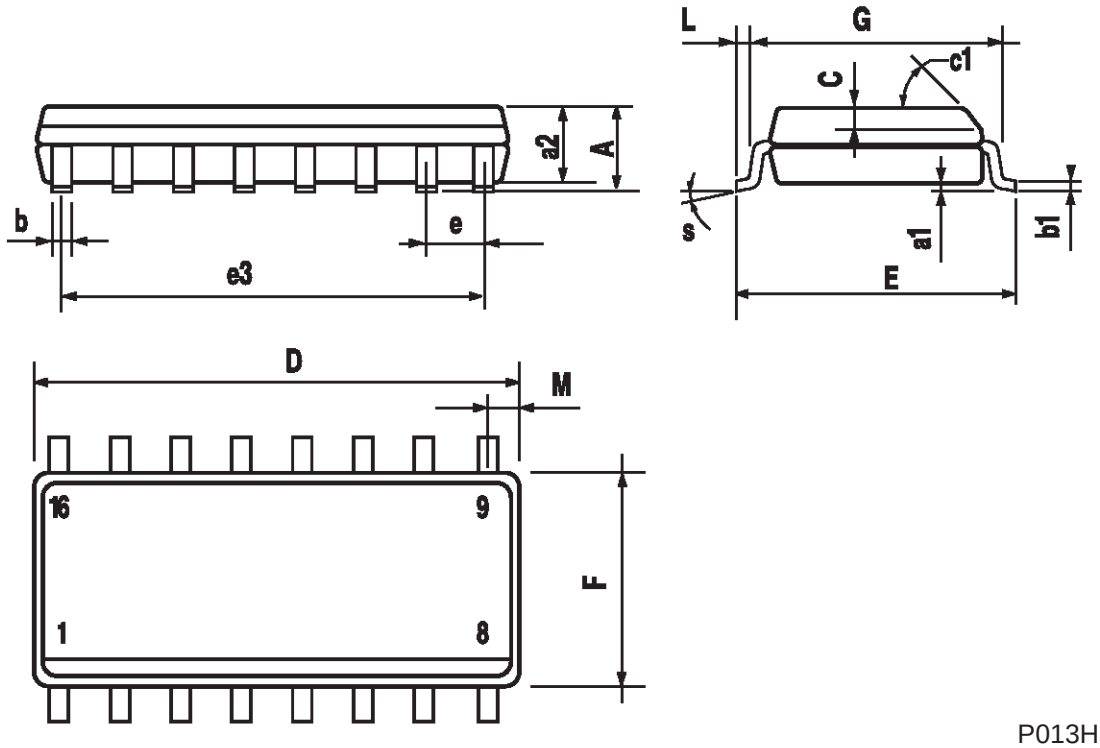


WAVEFORM 3: RECOVERY TIME, $\overline{\text{CLEAR}}$ **PULSE WIDTH** (f=1MHz; 50% duty cycle)



SO-16 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		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.)					



P013H

TSSOP16 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.1			0.433
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.85	0.9	0.95	0.335	0.354	0.374
b	0.19		0.30	0.0075		0.0118
c	0.09		0.20	0.0035		0.0079
D	4.9	5	5.1	0.193	0.197	0.201
E	6.25	6.4	6.5	0.246	0.252	0.256
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0^o	4^o	8^o	0^o	4^o	8^o
L	0.50	0.60	0.70	0.020	0.024	0.028