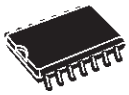
DUAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR

- HIGH SPEED:
  f_{MAX} =170 MHz (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION:
  I_{CC} = 2 µA (MAX.) at T_A = 25 °C
- HIGH NOISE IMMUNITY:
  $V_{NIH} = V_{NIL}$ = 28% V_{CC} (MIN.)
- POWER DOWN PROTECTION ON INPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}| = I_{OL}$ = 8 mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
  V_{CC} (OPR) = 2V to 5.5V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 74
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE: V_{OLP} = 0.8V (Max.)



M
(Micro Package)

T
(TSSOP Package)

ORDER CODES :

74VHC74M 74VHC74T

DESCRIPTION

The 74VHC74 is an advanced high-speed CMOS DUAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR fabricated with sub-micron silicon gate and double-layer metal wiring C^2MOS technology.

It has similar high speed performance of equivalent Bipolar Schottky TTL combined with true CMOS low power dissipation.

A signal on the D INPUT is transfered to the Q OUTPUT during the positive going transition of the clock pulse.

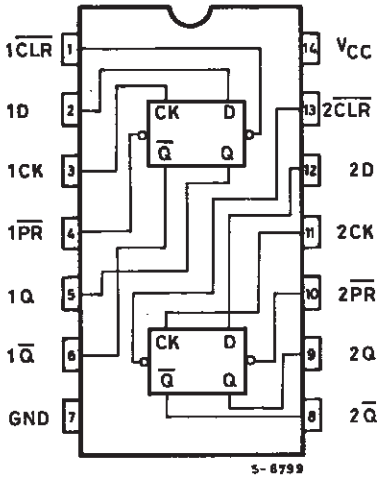
CLEAR and PRESET are independent of the clock and accomplished by a low setting on the appropriate input.

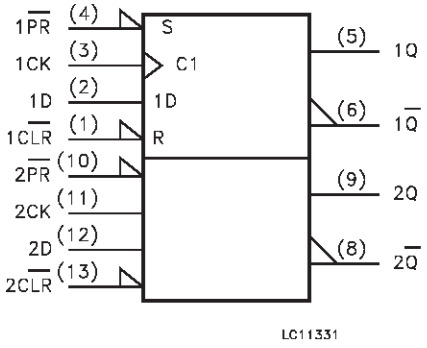
It is ideal for low power applications maintaining high speed operation similar to equivalent Bipolar Schottky TTL.

Power down protection is provided on all inputs 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.

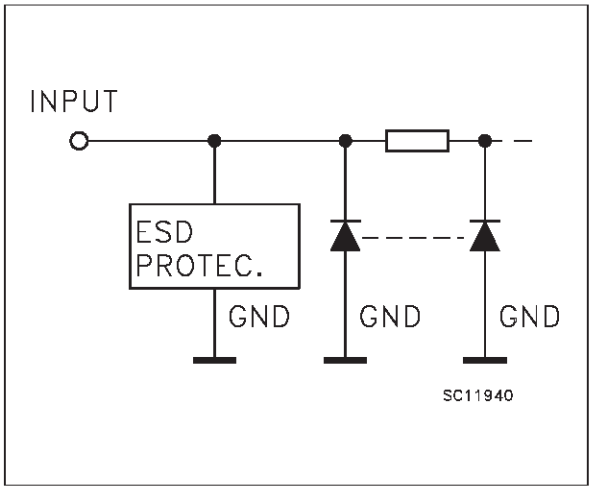
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess

PIN CONNECTION AND IEC LOGIC SYMBOLS





INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

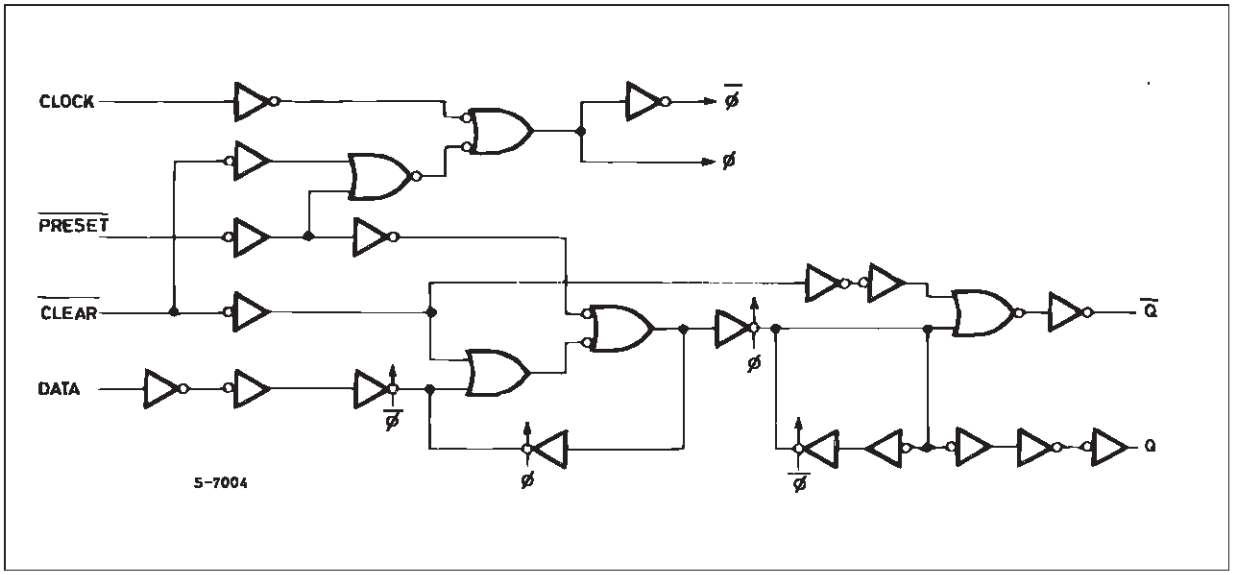
PIN No	SYMBOL	NAME AND FUNCTION
1, 13	$1\overline{CLR}$, $2\overline{CLR}$	Asyncronous Reset - Direct Input
2, 12	1D, 2D	Data Input
3, 11	1CK, 2CK	Clock Input (LOW-to-HIGH, Edge-Triggered)
4, 10	$1\overline{PR}$, $2\overline{PR}$	Asyncronous Set - Direct Input
5, 9	1Q, 2Q	True Flip-Flop Outputs
6, 8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



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 +7.0	V
V_I	DC Input Voltage	-0.5 to +7.0	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	± 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 condition is not implied.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2.0 to 5.5	V
V_I	Input Voltage	0 to 5.5	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 (see note 1) (V_{CC} = 3.3 ± 0.3V) (V_{CC} = 5.0 ± 0.5V)	0 to 100 0 to 20	ns/V ns/V

1) V_{IN} from 30% to 70% of V_{CC}

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	2.0			1.5			1.5		V
		3.0 to 5.5			0.7V_{CC}			0.7V_{CC}		
V_{IL}	Low Level Input Voltage	2.0					0.5		0.5	V
		3.0 to 5.5					0.3V_{CC}		0.3V_{CC}	
V_{OH}	High Level Output Voltage	2.0	V_I(*) = V_{IH} or V_{IL}	I_O=-50 µA	1.9	2.0		1.9		V
		3.0		I_O=-50 µA	2.9	3.0		2.9		
		4.5		I_O=-50 µA	4.4	4.5		4.4		
		3.0		I_O=-4 mA	2.58			2.48		
		4.5		I_O=-8 mA	3.94			3.8		
V_{OL}	Low Level Output Voltage	2.0	V_I(*) = V_{IH} or V_{IL}	I_O=50 µA		0.0	0.1		0.1	V
		3.0		I_O=50 µA		0.0	0.1		0.1	
		4.5		I_O=50 µA		0.0	0.1		0.1	
		3.0		I_O=4 mA			0.36		0.44	
		4.5		I_O=8 mA			0.36		0.44	
I_I	Input Leakage Current	0 to 5.5	V_I = 5.5V or GND				±0.1		±1.0	µA
I_{CC}	Quiescent Supply Current	5.5	V_I = V_{CC} or GND				2		20	µA

(*) All outputs loaded.

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

Symbol	Parameter	Test Condition			Value					Unit
		V_{CC} (V)	C_L (pF)		T_A = 25 °C			-40 to 85 °C		
					Min.	Typ.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay Time CK to Q or $\overline{Q}$	3.3(*)	15			6.7	11.9	1.0	14.0	ns
		3.3(*)	50			9.2	15.4	1.0	17.5	
		5.0(**)	15			4.6	7.3	1.0	8.5	
		5.0(**)	50			6.1	9.3	1.0	10.5	
t_{PLH} t_{PHL}	Propagation Delay Time $\overline{PR}$ or $\overline{CLR}$ to Q or $\overline{Q}$	3.3(*)	15			7.6	12.3	1.0	14.5	ns
		3.3(*)	50			10.1	15.8	1.0	18.0	
		5.0(**)	15			4.8	7.7	1.0	9.0	
		5.0(**)	50			6.3	9.7	1.0	11.0	
t_w	CK Pulse Width HIGH or LOW	3.3(*)					6.0		7.0	ns
		5.0(**)					5.0		5.0	
t_w	PR or CLR Pulse Width LOW	3.3(*)					6.0		7.0	ns
		5.0(**)					5.0		5.0	
t_s	Setup Time D to CK HIGH or LOW	3.3(*)					6.0		7.0	ns
		5.0(**)					5.0		5.0	
t_h	Hold Time D to CK HIGH or LOW	3.3(*)					0.5		0.5	ns
		5.0(**)					0.5		0.5	
t_{REM}	Removal Time $\overline{CLR}$ or $\overline{PR}$ to CK	3.3(*)					5.0		5.0	ns
		5.0(**)					3.0		3.0	
f_{MAX}	Maximum Clock Frequency	3.3(*)	15		80	125		70		MHz
		3.3(*)	50		50	75		45		
		5.0(**)	15		130	170		110		
		5.0(**)	50		90	115		75		

(*) Voltage range is 3.3V ± 0.3V
(**) Voltage range is 5V ± 0.5V

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			4	10		10	pF
C_{PD}	Power Dissipation Capacitance (note 1)	3.3	f_{IN} = 10 MHz		25				pF

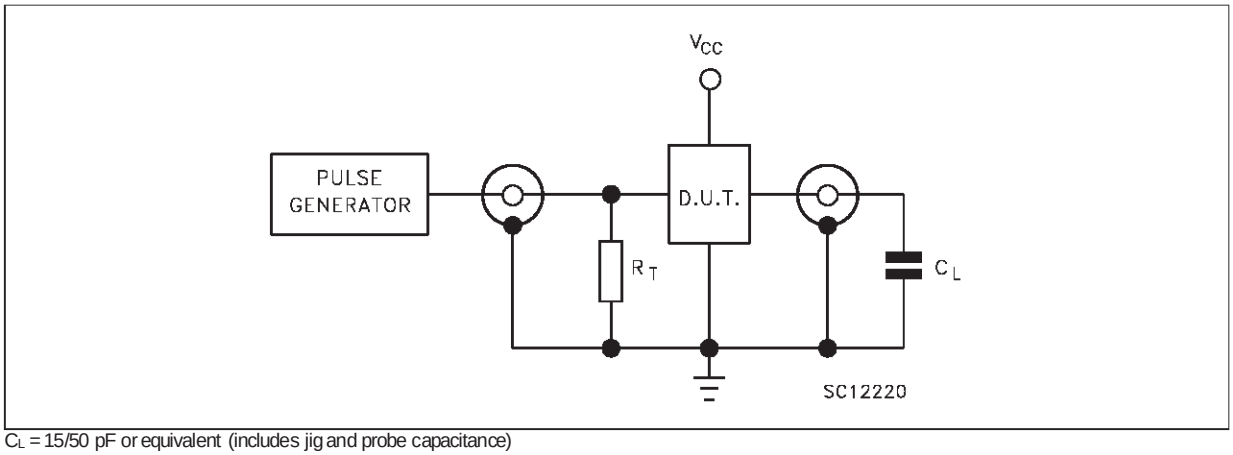
1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/2$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

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)	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		3.5					
V_{ILD}	Dynamic Low Voltage Input (note 1, 3)	5.0				1.5			

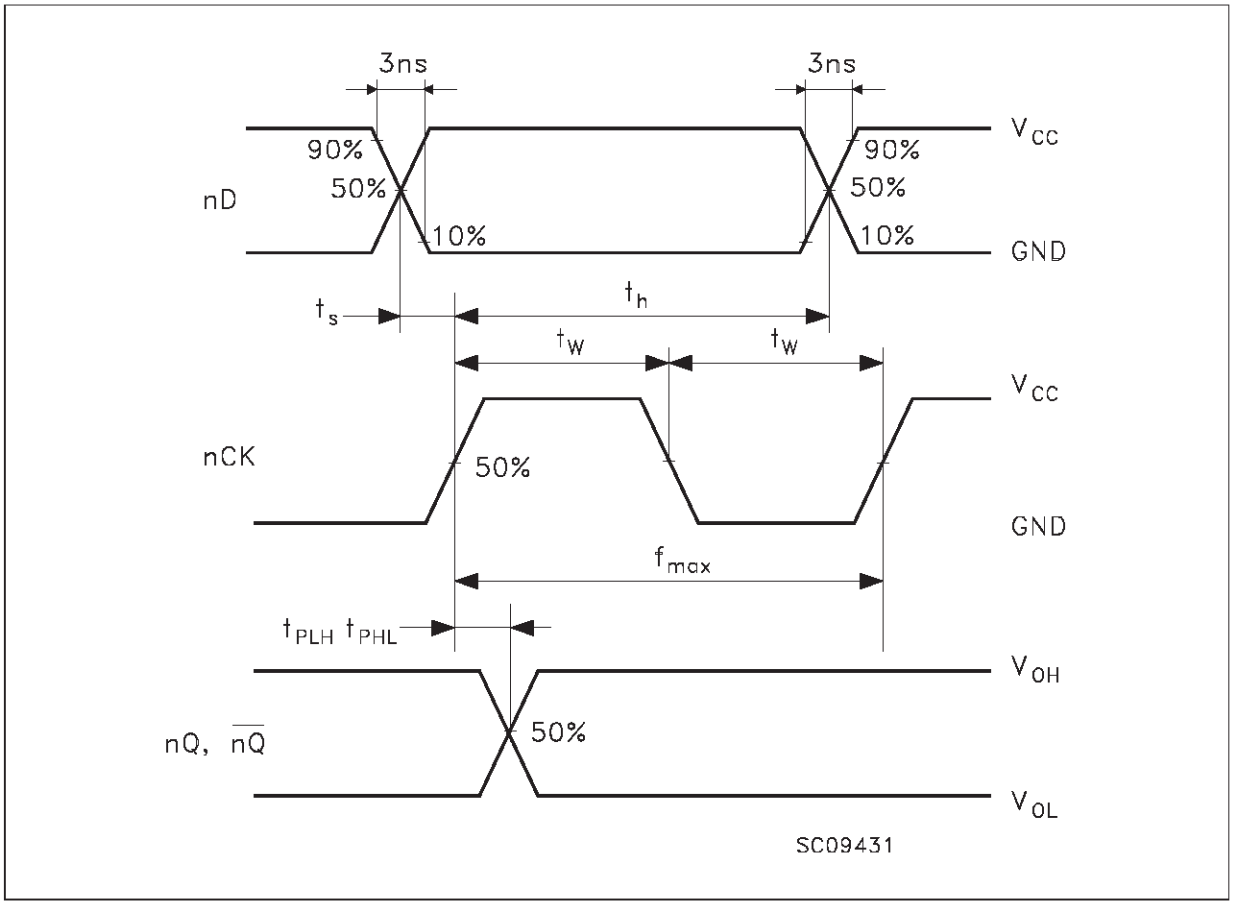
1) Worst case package.
2) Max number of outputs defined as (n). Data inputs are driven 0V to 5.0V, (n -1) outputs switching and one output at GND.
3) Max number of data inputs (n) switching. (n-1) switching 0V to 5.0V. Inputs under test switching: 5.0V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), f=1MHz.

TEST CIRCUIT

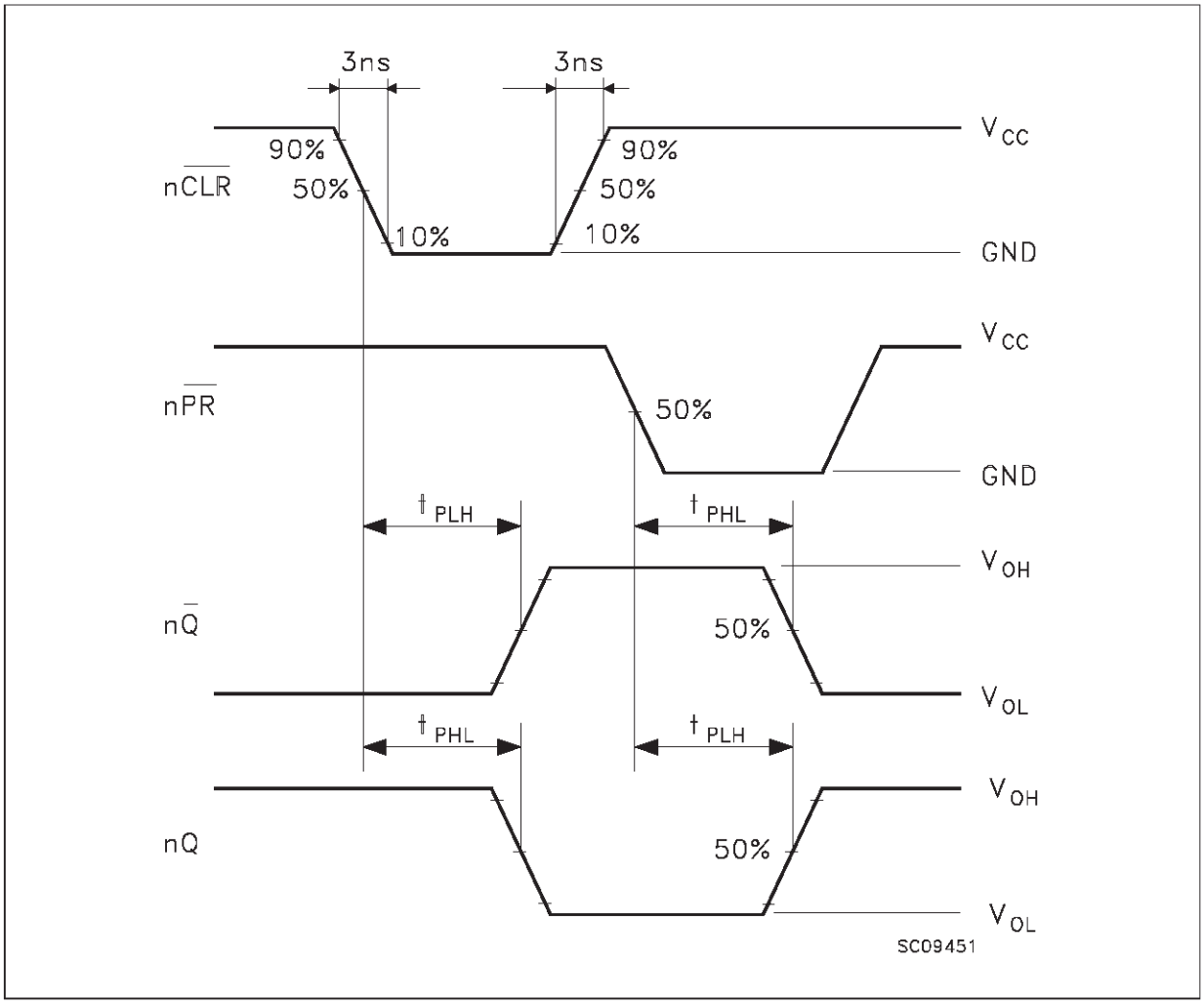


C_L = 15/50 pF or equivalent (includes jig and probe capacitance)
R_T = Z_{OUT} of pulse generator (typically 50Ω)

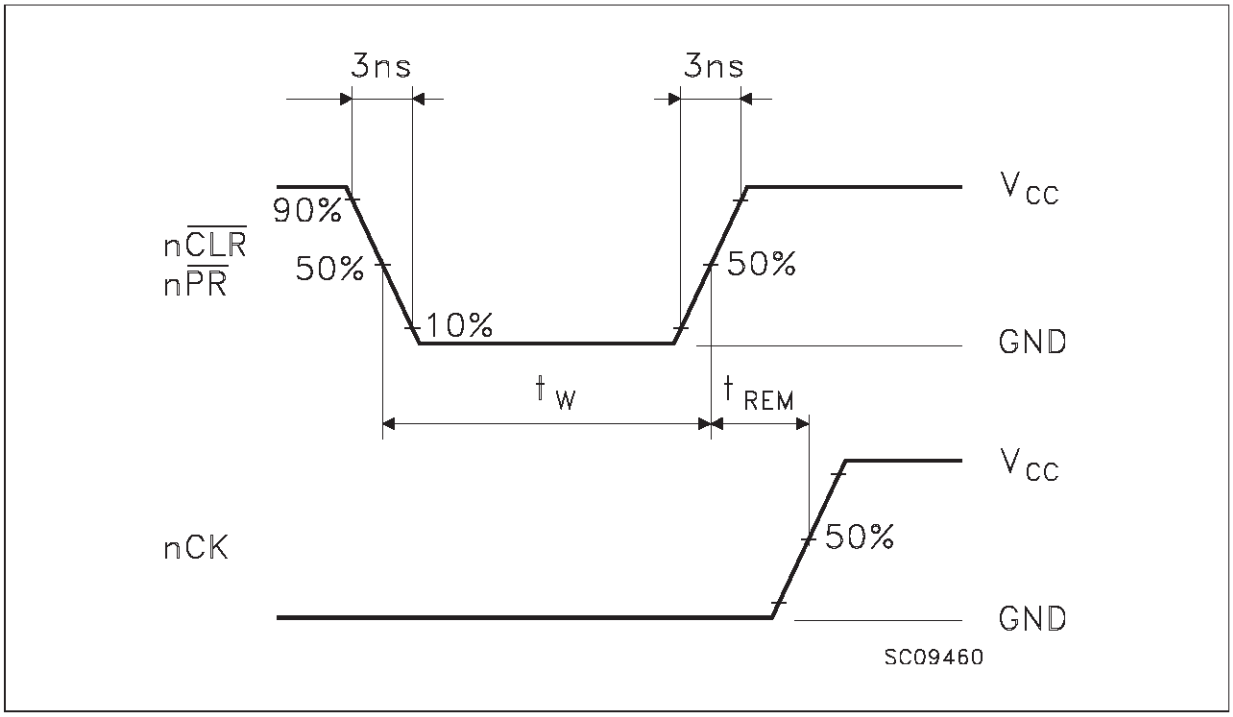
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES (f=1MHz; 50% duty cycle)



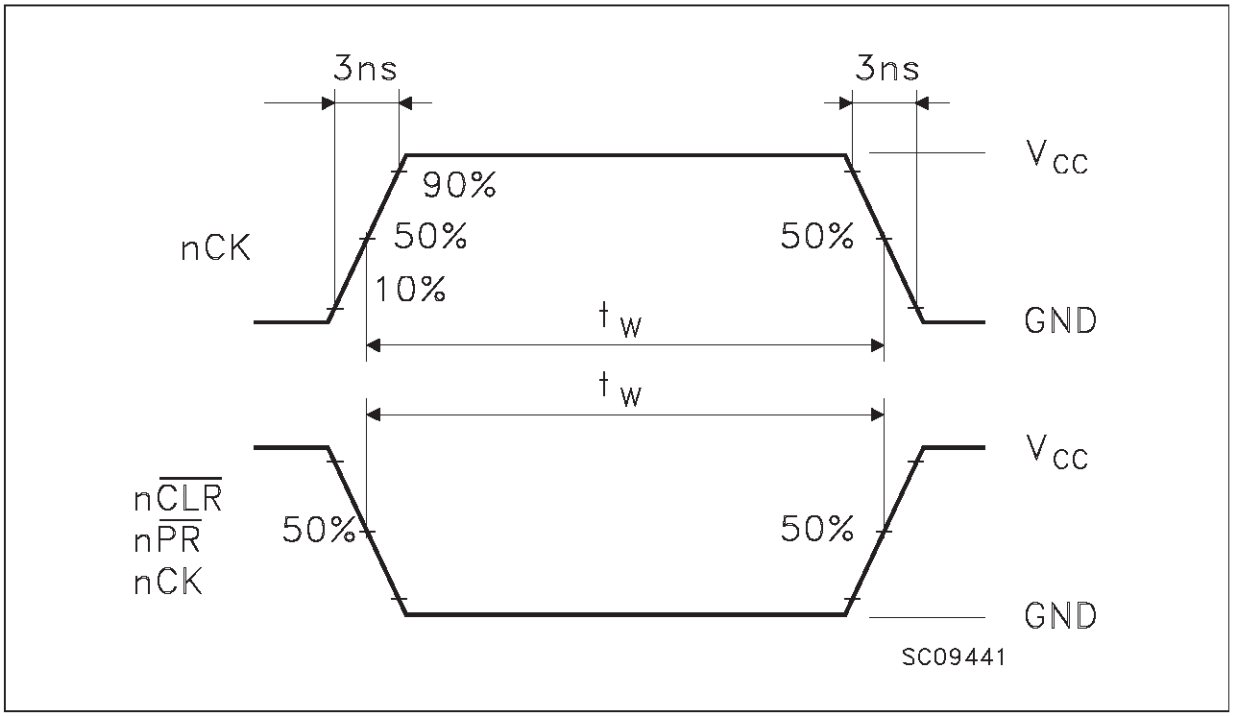
WAVEFORM 2: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)



WAVEFORM 3: RECOVERY TIMES (f=1MHz; 50% duty cycle)

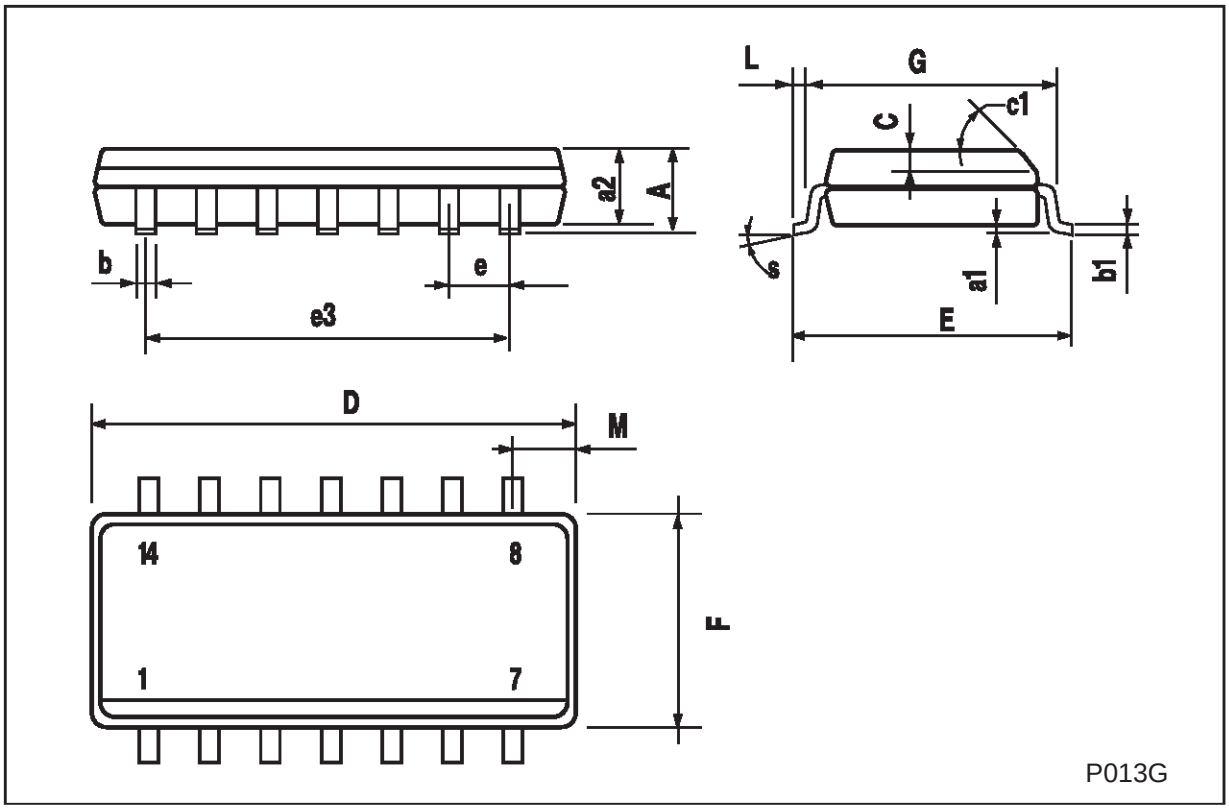


WAVEFORM 3: PULSE WIDTH



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.)					



P013G

TSSOP14 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