

LOW VOLTAGE 16-BIT D-TYPE LATCH 3-STATE WITH 5V TOLERANT INPUTS AND OUTPUT

PRELIMINARY DATA

- 5V TOLERANT INPUTS AND OUTPUTS
- HIGH SPEED: $t_{PD} = 5.4 \text{ ns (MAX.)}$ at $V_{CC} = 3V$
- POWER-DOWN PROTECTION ON INPUTS AND OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 24 \text{ mA (MIN)}$
- PCI BUS LEVELS GUARANTEED AT 24mA
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \equiv t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC} \text{ (OPR)} = 2.0V \text{ to } 3.6V \text{ (1.5V Data Retention)}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 16373
- LATCH-UP PERFORMANCE EXCEEDS 500mA
- ESD PERFORMANCE:
 $HBM > 2000V$; $MM > 200V$

DESCRIPTION

The LCX16373 is a low level CMOS 16-BIT D-TYPE LATCH with 3 STATE OUTPUT NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. It is ideal for low power and high speed 3.3V applications; it can be interfaced to 5V signal enviroment for both inputs and outputs. These 16 bit D-Type latchs are byte controlled by two latch enable inputs (nLE) and two output enable inputs (nOE).

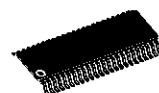
While the nLE input is held at a high level, the nQ outputs will follow the data input precisely.

When the nLE is taken low, the nQ outputs will be latched precisely at the logic level of D input data.

While the (nOE) input is low, the nQ outputs will be in a normal logic state (high or low logic level) and while high level the outputs will be in a high impedance state.

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

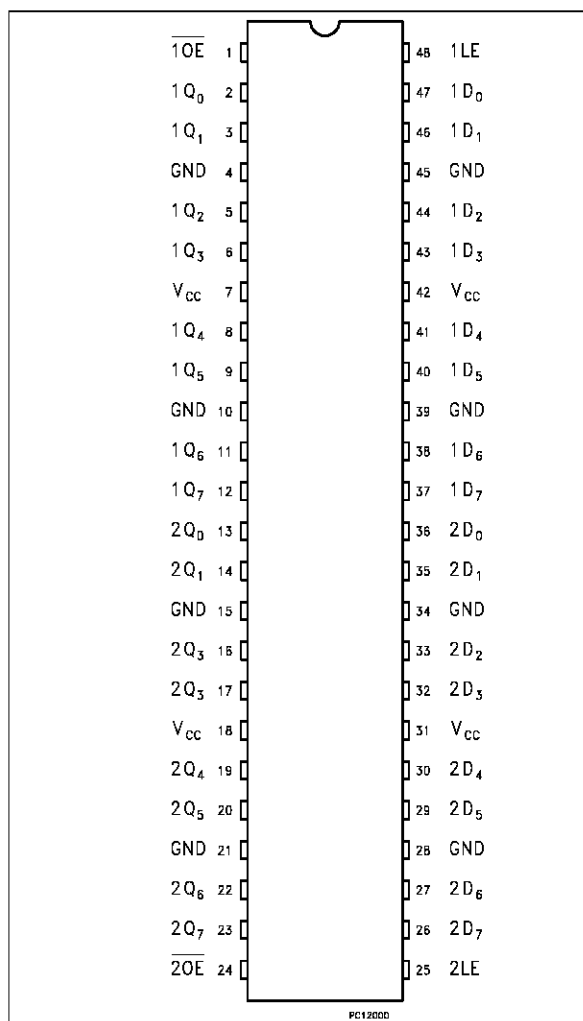
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.



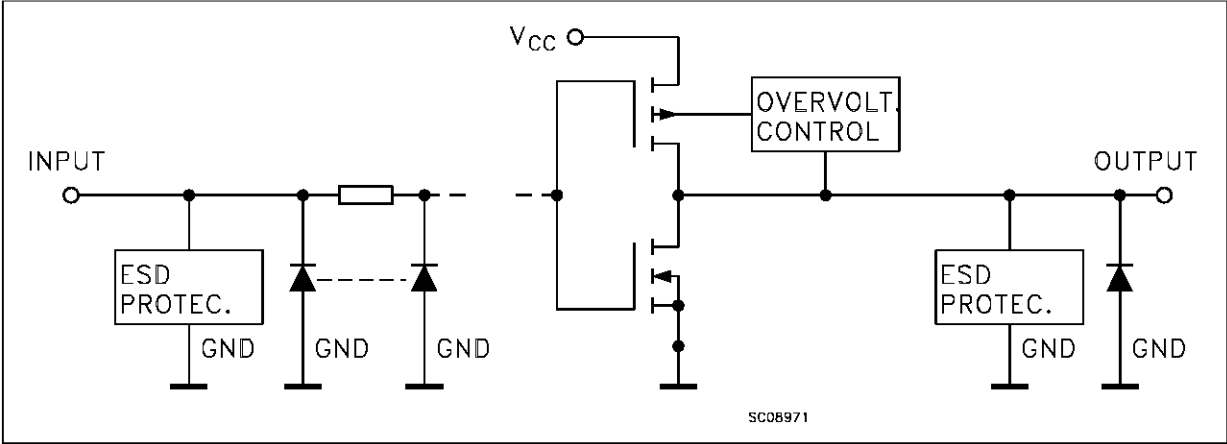
T
(TSSOP48 Package)

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PIN CONNECTION



INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

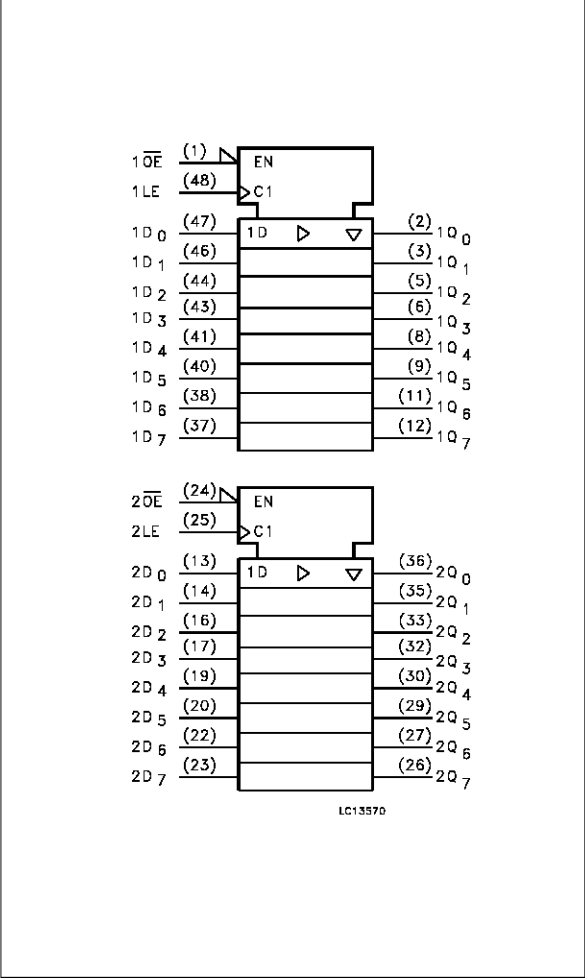
PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{1OE}$	3 State Output Enable Input (Active LOW)
2, 3, 5, 6, 8, 9, 11, 12	1Q0 to 1Q7	Data Inputs
13, 14, 16, 17, 19, 20, 22, 23	2Q0 to 2Q7	Data Inputs
24	$\overline{2OE}$	3 State Output Enable Input (Active LOW)
25	2LE	Latch Enable Input
36, 35, 33, 32, 30, 29, 27, 26	2D0 to 2D7	3 State Outputs
47, 46, 44, 43, 41, 40, 38, 37	1D0 to 1D7	3 State Outputs
48	1LE	Latch Enable Input
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	VCC	Positive Supply Voltage

TRUTH TABLE

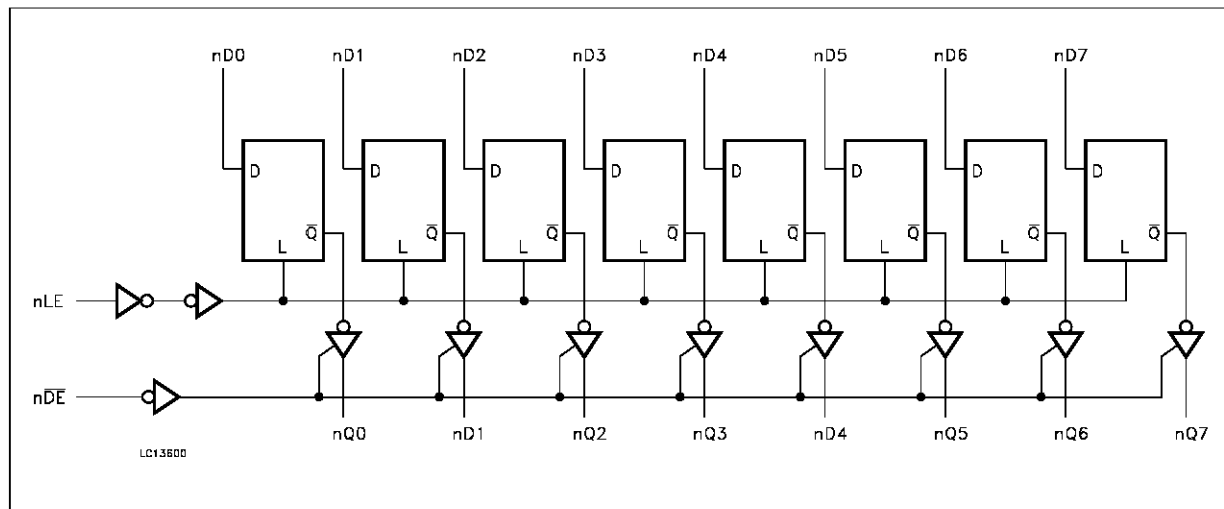
INPUTS			OUTPUTS
$\overline{OE}$	LE	D	Q
H	X	X	Z
L	L	X	NO CHANGE *
L	H	L	L
L	H	H	H

X: Don't care
Z: High impedance
* Q output are latched at the time when the LE inputs taken low logic

IEC LOGIC SYMBOLS



LOGIC DIAGRAM



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 (OFF state)	-0.5 to + 7.0	V
V_O	DC Output Voltage (High or Low State) (note1)	-0.5 to $V_{CC} + 0.5$	V
I_{IK}	DC Input Diode Current	- 50	mA
I_{OK}	DC Output Diode Current (note2)	± 50	mA
I_O	DC Output Source/Sink Current	± 50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current Per Supply Pin	± 100	mA
T_{stg}	Storage Temperature	-65 to +150	$^{\circ}\text{C}$
T_L	Lead Temperature (10 sec)	300	$^{\circ}\text{C}$

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

1) I_O absolute maximum rating must be observed

2) $V_O < GND$, $V_O > V_{CC}$

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage (note 1)	2.0 to 3.6	V
V_I	Input Voltage	0 to 5.5	V
V_O	Output Voltage (OFF state)	0 to 5.5	V
V_O	Output Voltage (High or Low State)	0 to V_{CC}	V
I_{OH} , I_{OL}	High or Low Level Output Current ($V_{CC} = 3.0$ to 3.6V)	± 24	mA
I_{OH} , I_{OL}	High or Low Level Output Current ($V_{CC} = 2.7$ to 3.0V)	± 12	mA
T_{op}	Operating Temperature:	-40 to +85	$^{\circ}\text{C}$
dt/dv	Input Transition Rise or Fall Rate ($V_{CC} = 3.0\text{V}$) (note 2)	0 to 10	ns/V

1) Truth Table guaranteed: 1.5V to 3.6V

2) V_{IN} from 0.8V to 2.0V

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions			Value		Unit
		V _{CC} (V)		-40 to 85 °C			
				Min.	Max.		
V _{IH}	High Level Input Voltage	2.7 to 3.6			2.0		V
V _{IL}	Low Level Input Voltage					0.8	V
V _{OH}	High Level Output Voltage	2.7 to 3.6	V _I = V _{IH} or V _{IL}	I _O =-100 μA	V _{CC} -0.2		V
		2.7		I _O =-12 mA	2.2		
		3.0		I _O =-18 mA	2.4		
				I _O =-24 mA	2.2		
V _{OL}	Low Level Output Voltage	2.7 to 3.6	V _I = V _{IH} or V _{IL}	I _O =100 μA		0.2	V
		2.7		I _O =12 mA		0.4	
		3.0		I _O =16 mA		0.4	
		3.0		I _O =24 mA		0.55	
I _I	Input Leakage Current	2.7 to 3.6	V _I = 0 to 5.5 V			±5	μA
I _{OZ}	3 State Output Leakage Current	2.7 to 3.6	V _I = V _{IH} or V _{IL} V _O = 0 to 5.5V			±5	μA
I _{off}	Power Off Leakage Current	0	V _I or V _O = 5.5V (per pin)			10	μA
I _{CC}	Quiescent Supply Current	2.7 to 3.6	V _I = V _{CC} or GND			20	μA
			V _I or V _O = 3.6 to 5.5V			±20	
ΔI _{CC}	ICC incr. per input	2.7 to 3.6	V _{IH} = V _{CC} -0.6V			500	μA

DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	Test Conditions		Value			Unit
		V _{CC} (V)		T _A = 25 °C			
				Min.	Typ.	Max.	
V _{OLP}	Dynamic Low Voltage Quiet Output (note 1)	3.3	C _L = 50 pF V _{IL} = 0 V V _{IH} = 3.3V		0.8		V
V _{OLV}					-0.8		

1) Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH to LOW or LOW to HIGH. The remaining output is measured in the LOW state.

AC ELECTRICAL CHARACTERISTICS ($C_L = 50 \text{ pF}$, $R_L = 500 \Omega$, Input $t_r = t_f = 2.5 \text{ ns}$)

Symbol	Parameter	Test Condition		Value		Unit
		V _{CC} (V)	Waveform	-40 to 85 °C		
				Min.	Max.	
t _{PLH} t _{PHL}	Propagation Delay Time Dn to Qn	2.7	1	1.5	5.9	ns
		3.0 to 3.6		1.5	5.4	
t _{PLH} t _{PHL}	Propagation Delay Time LE to Qn	2.7	1	1.5	6.4	ns
		3.0 to 3.6		1.5	5.5	
t _{PZL} t _{PZH}	Output Enable Time to HIGH and LOW level	2.7	2	1.5	6.5	ns
		3.0 to 3.6		1.5	6.1	
t _{PLZ} t _{PHZ}	Output Disable Time from HIGH and LOW level	2.7	2	1.5	6.3	ns
		3.0 to 3.6		1.5	6.0	
t _s	Setup Time, HIGH or LOW level Dn to LE	2.7	1	2.5		ns
		3.0 to 3.6		2.5		
t _h	Hold Time, HIGH or LOW level Dn to LE	2.7	1	1.5		ns
		3.0 to 3.6		1.5		
t _w	LE Pulse Width, HIGH or LOW	2.7	3	3.0		ns
		3.0 to 3.6		3.0		
t _{OSLZ} t _{OSHL}	Output to Output Skew Time (note 1, 2)	3.0 to 3.6			1.0	ns

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 ($t_{OSLH} = |t_{PLHM} - t_{PLHN}|$, $t_{OSHL} = |t_{PHLM} - t_{PHLN}|$)

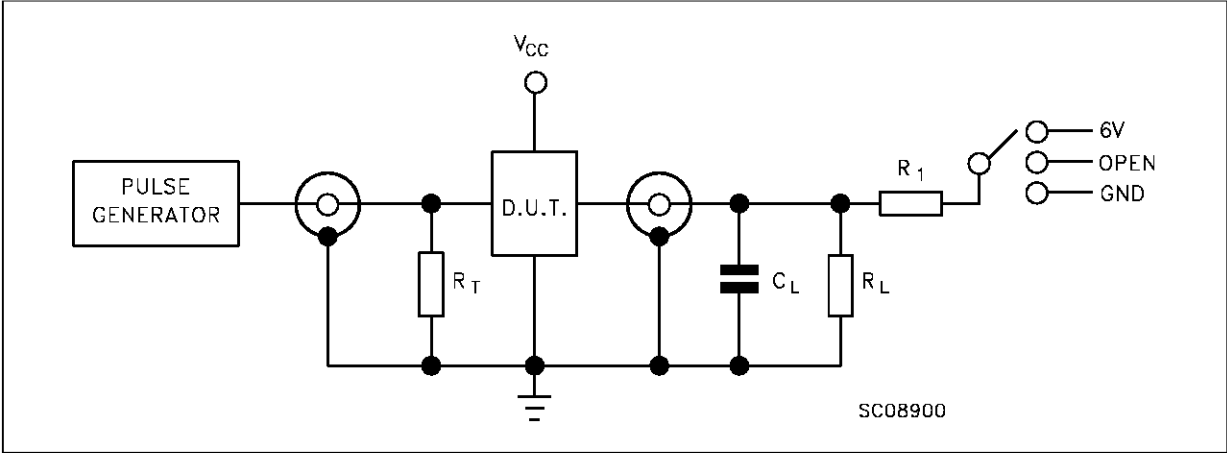
2) Parameter guaranteed by design

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions		Value			Unit
		V _{CC} (V)		T _A = 25 °C			
				Min.	Typ.	Max.	
C _{IN}	Input Capacitance	3.3	V _{IN} = 0 to V _{CC}		7		pF
C _{OUT}	Output Capacitance	3.3	V _{IN} = 0 to V _{CC}		8		pF
C _{PD}	Power Dissipation Capacitance (note 1)	3.3	f _{IN} = 10MHz V _{IN} = 0 or V _{CC}		20		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. Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CD}/n$ (per circuit)

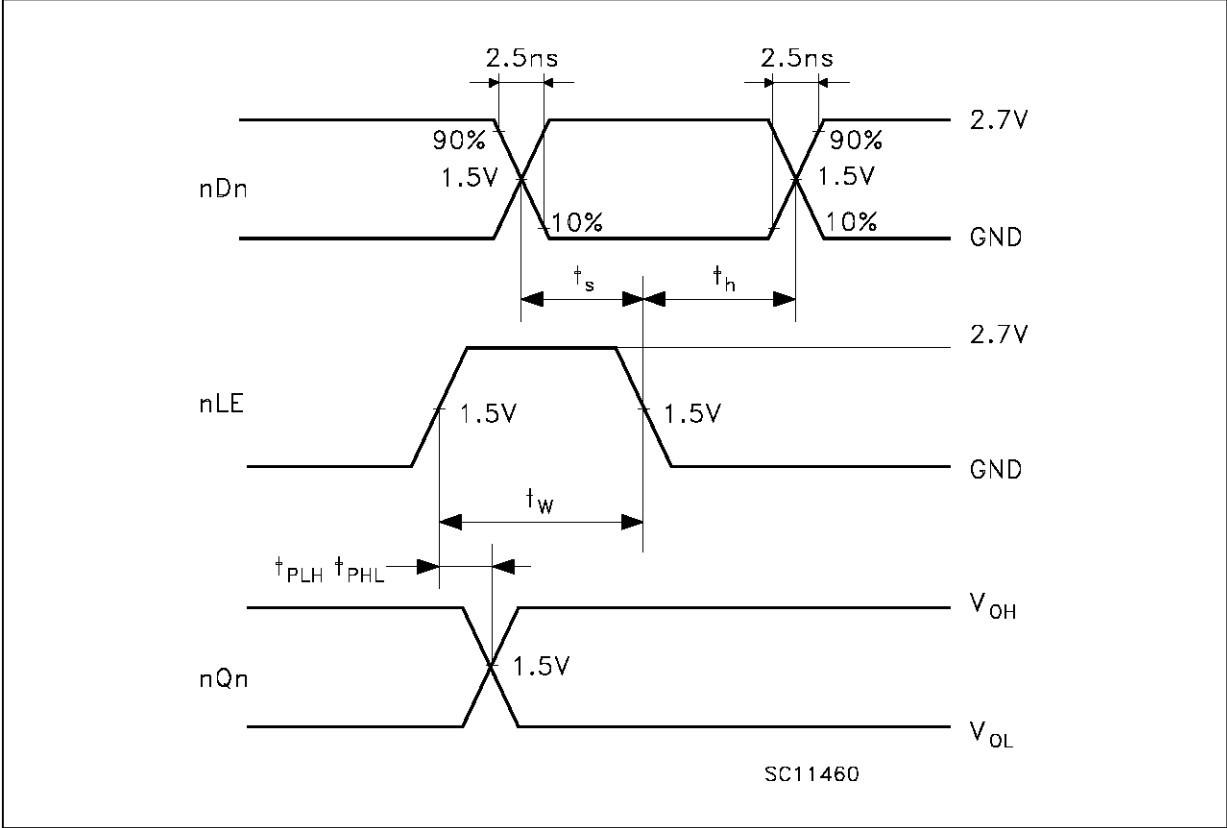
TEST CIRCUIT

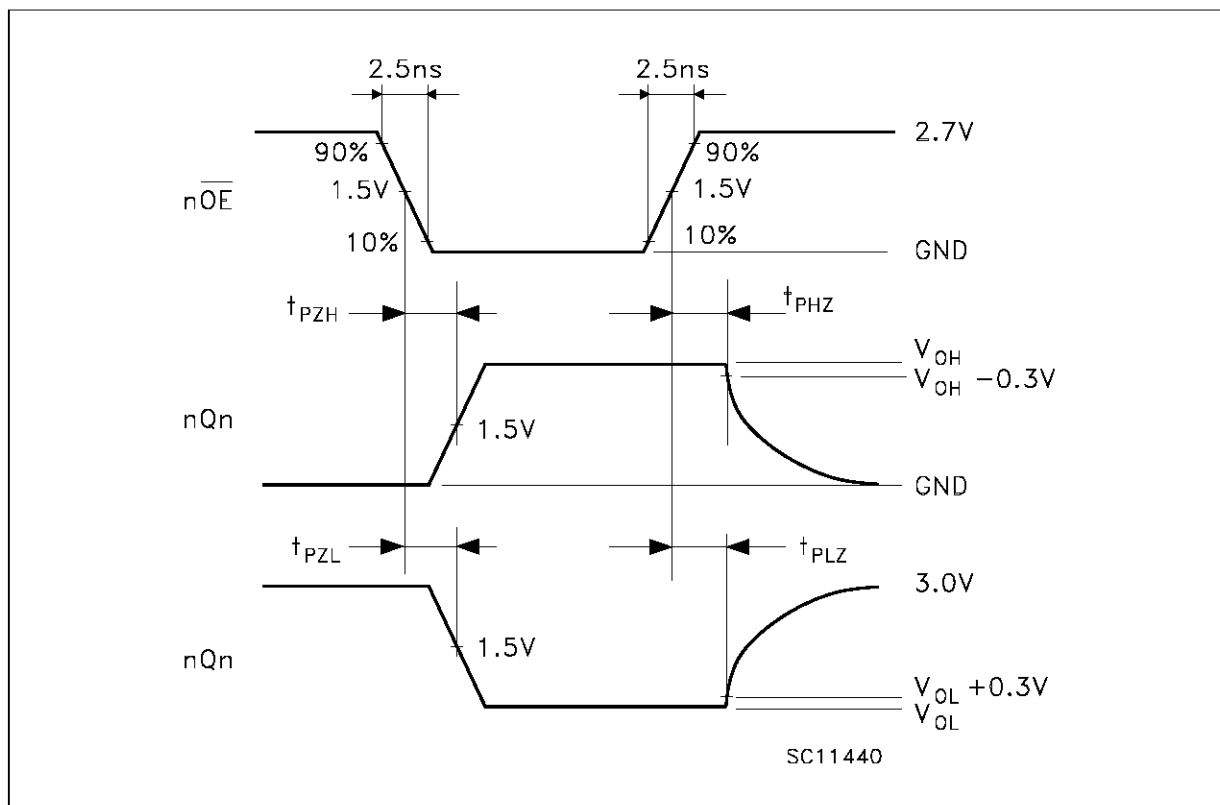
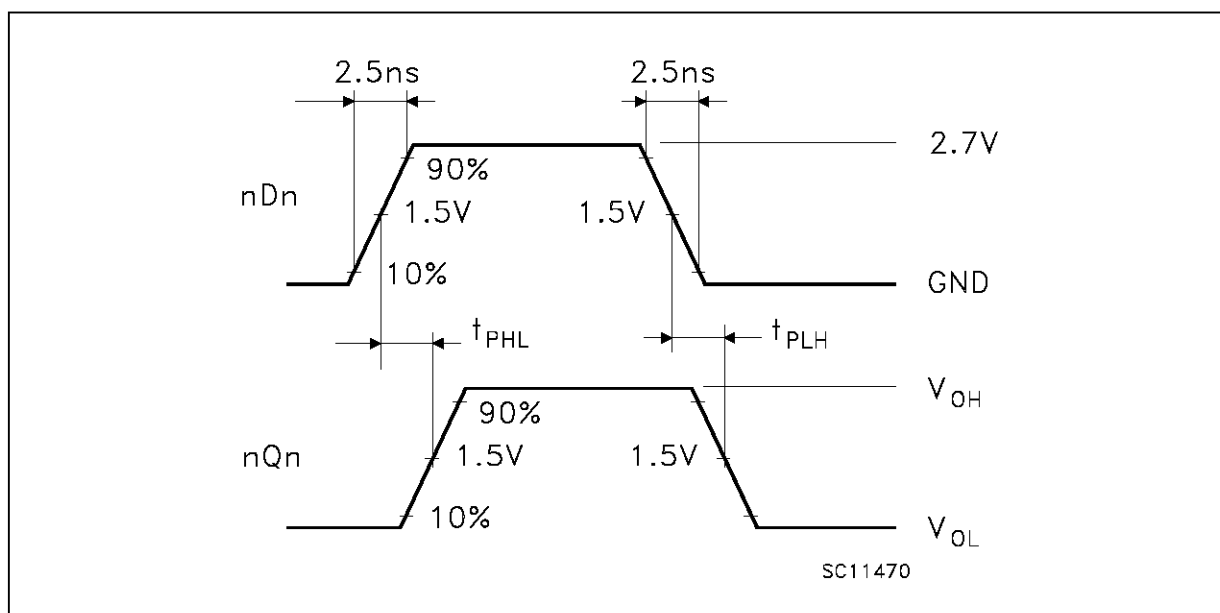


TEST	SWITCH
t_{PLH} , t_{PHL}	Open
t_{PZL} , t_{PLZ}	6V
t_{PZH} , t_{PHZ}	GND

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

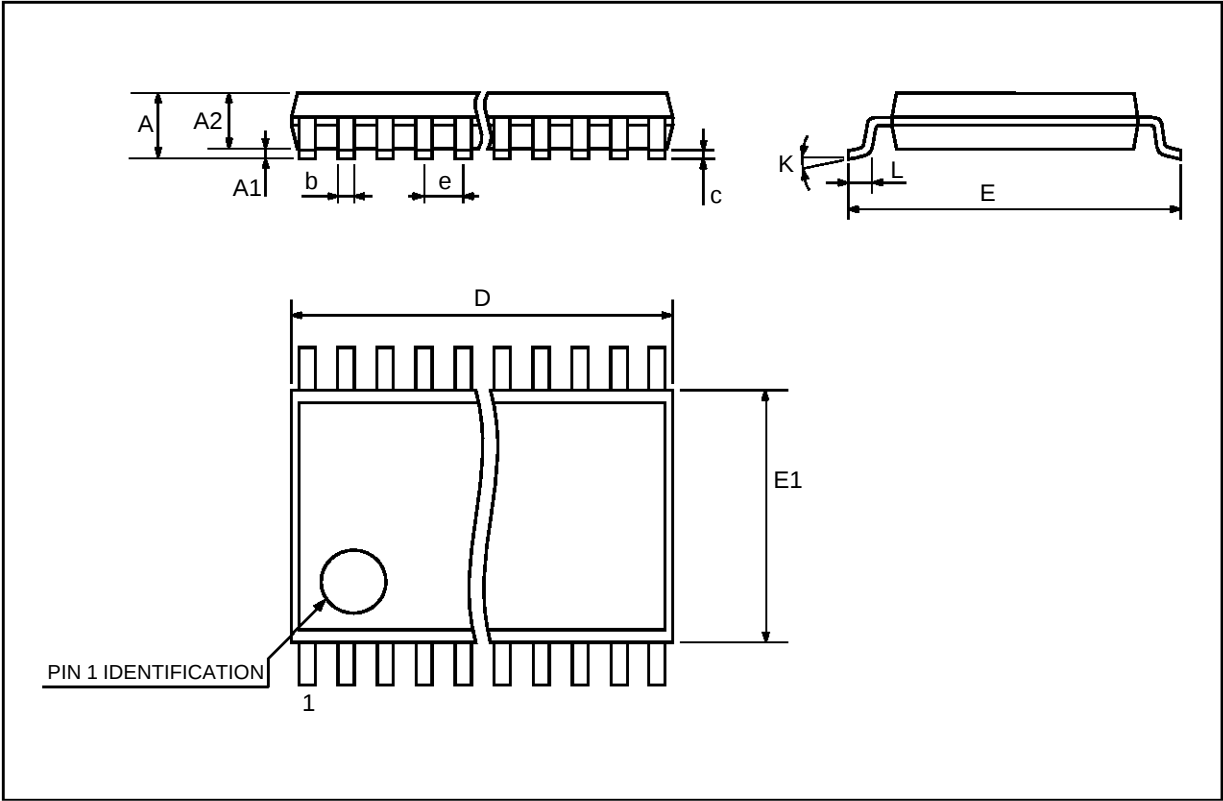
WAVEFORM 1: LE TO Qn PROPAGATION DELAYS, LE MINIMUM PULSE WIDTH, Dn TO LE SETUP AND HOLD TIMES (f=1MHz; 50% duty cycle)



WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIMES ($f=1\text{MHz}$; 50% duty cycle)**WAVEFORM 3: PROPAGATION DELAY TIME** ($f=1\text{MHz}$; 50% duty cycle)

TSSOP48 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	0.17		0.27	0.0067		0.011
c	0.09		0.20	0.0035		0.0079
D	12.4	12.5	12.6	0.408	0.492	0.496
E	7.95	8.1	8.25	0.313	0.319	0.325
E1	6.0	6.1	6.2	0.236	0.240	0.244
e		0.5 BSC			0.0197 BSC	
K	0°	4°	8°	0°	4°	8°
L	0.50	0.60	0.70	0.020	0.024	0.028



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