



74LVX373

LOW VOLTAGE OCTAL D-TYPE LATCH (3-STATE NON INV.) WITH 5V TOLERANT INPUTS

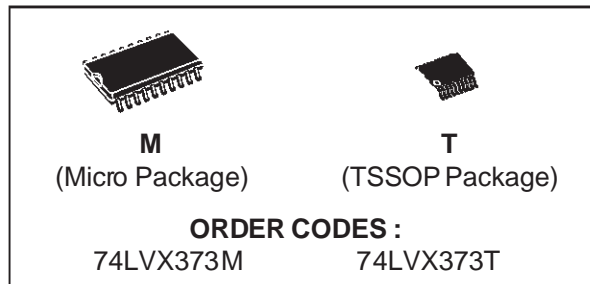
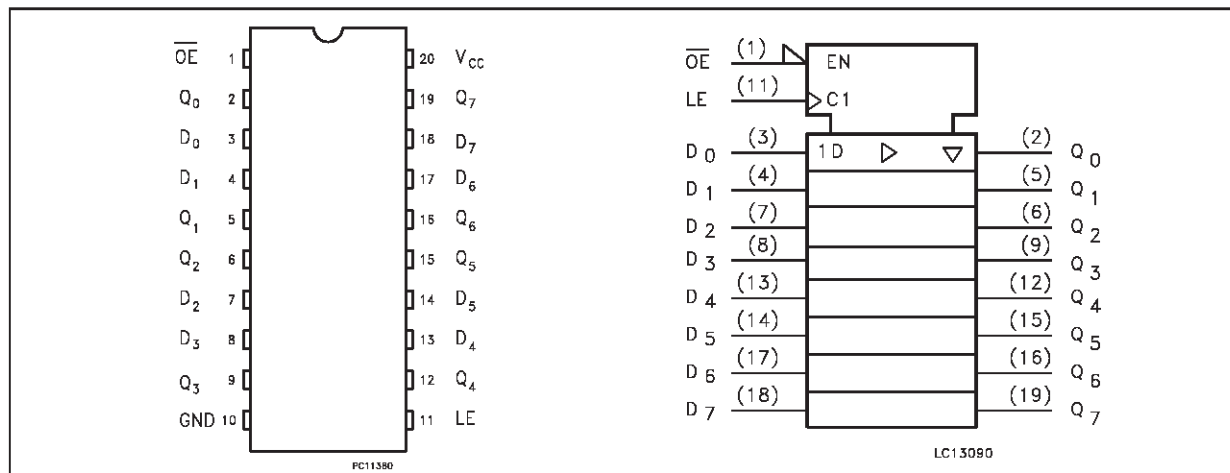
- HIGH SPEED: $t_{PD} = 5.8 \text{ ns}$ (TYP.) at $V_{CC} = 3.3\text{V}$
- 5V TOLERANT INPUTS
- POWER-DOWN PROTECTION ON INPUTS
- INPUT VOLTAGE LEVEL:
 $V_{IL} = 0.8\text{V}$, $V_{IH} = 2\text{V}$ at $V_{CC} = 3\text{V}$
- LOW POWER DISSIPATION:
 $I_{CC} = 4 \mu\text{A}$ (MAX.) at $T_A = 25^\circ\text{C}$
- LOW NOISE:
 $V_{OLP} = 0.3\text{V}$ (TYP.) at $V_{CC} = 3.3\text{V}$
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 4 \text{ mA}$ (MIN)
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC} \text{ (OPR)} = 2\text{V to } 3.6\text{V}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 373
- IMPROVED LATCH-UP IMMUNITY

DESCRIPTION

The LVX373 is a low voltage CMOS OCTAL D-TYPE LATCH with 3 STATE OUTPUT NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring CMOS technology. It is ideal for low power and low noise 3.3V applications.

This 8 bit D-Type latch is controlled by a latch enable input (LE) and an output enable input (OE).

PIN CONNECTION AND IEC LOGIC SYMBOLS



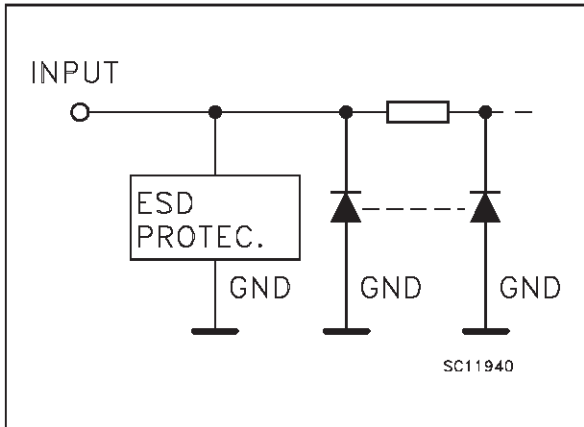
While the LE input is held at a high level, the Q outputs will follow the data input precisely. When the LE is taken low, the Q outputs will be latched precisely at the logic level of D input data. While the (OE) input is low, the 8 outputs will be in a normal logic state (high or low logic level) and while high level the outputs will be in a high impedance state.

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

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 voltage.

INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

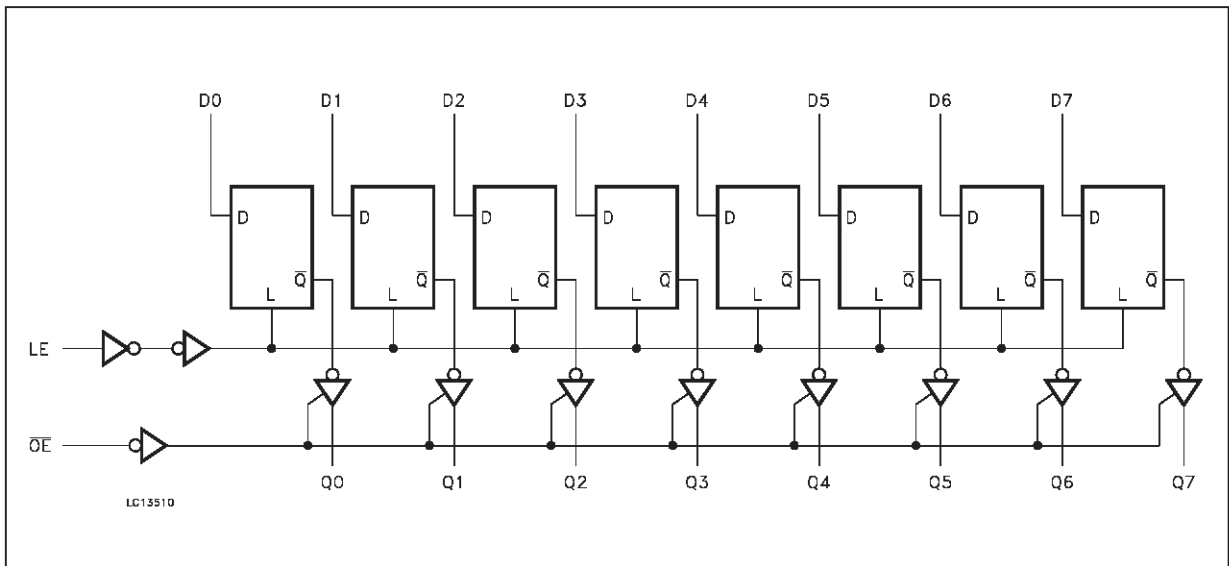
| PIN No | SYMBOL | NAME AND FUNCTION |
|----------------------------|-----------------|--|
| 1 | \overline{OE} | 3 State Output Enable Input (Active LOW) |
| 2, 5, 6, 9, 12, 15, 17, 18 | Q0 to Q7 | 3 State Outputs |
| 3, 4, 7, 8, 13, 14, 17, 18 | D0 to D7 | Data Inputs |
| 11 | LE | Latch Enable Input |
| 10 | GND | Ground (0V) |
| 20 | V _{CC} | 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 outputs are latched at the time when the LE input is taken low.

LOGICS 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 | -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 | $^{\circ}C$ |
| 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 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 5.5 | V |
| V_O | Output Voltage | 0 to V_{CC} | V |
| T_{op} | Operating Temperature: | -40 to +85 | $^{\circ}C$ |
| dt/dv | Input Rise and Fall Time ($V_{CC} = 3V$) (note 2) | 0 to 100 | 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 | |
|-----------------|--------------------------------|-----------------|--|------------------------|------|------|--------------|------|------|------|
| | | | | T _A = 25 °C | | | -40 to 85 °C | | | |
| | | | | V _{CC} (V) | Min. | Typ. | Max. | Min. | | Max. |
| V _{IH} | High Level Input Voltage | 2.0 | | 1.5 | | | 1.5 | | V | |
| | | 3.0 | | 2.0 | | | 2.0 | | | |
| | | 3.6 | | 2.4 | | | 2.4 | | | |
| V _{IL} | Low Level Input Voltage | 2.0 | | | | | 0.5 | 0.5 | V | |
| | | 3.0 | | | | | 0.8 | 0.8 | | |
| | | 3.6 | | | | | 0.8 | 0.8 | | |
| 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 | | |
| | | 3.0 | | I _O =-4 mA | 2.58 | | | 2.48 | | |
| 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 | | |
| | | 3.0 | | I _O =4 mA | | | 0.36 | 0.44 | | |
| I _I | Input Leakage Current | 3.6 | V _I = 5V or GND | | | | ±0.1 | | ±1 | μA |
| I _{OZ} | 3 State Output Leakage Current | 3.6 | V _I = V _{IH} or V _{IL} V _O = V _{CC} or GND | | | | ±0.25 | | ±2.5 | μA |
| I _{CC} | Quiescent Supply Current | 3.6 | V _I = V _{CC} or GND | | | | 2 | | 20 | μA |

(*) All outputs loaded.

DYNAMIC SWITCHING CHARACTERISTICS

| Symbol | Parameter | Test Conditions | | Value | | | | | Unit |
|------------------|--|-----------------|------------------------|------------------------|------|------|--------------|------|------|
| | | | | T _A = 25 °C | | | -40 to 85 °C | | |
| | | | | V _{CC} (V) | Min. | Typ. | Max. | Min. | |
| 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, 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 LE to Q | 2.7 | 15 | | 7.5 | 14.5 | 1.0 | 17.5 | ns | |
| | | 2.7 | 50 | | 10.0 | 18.0 | 1.0 | 21.0 | | |
| | | 3.3 ^(*) | 15 | | 6.8 | 10.3 | 1.0 | 12.0 | | |
| | | 3.3 ^(*) | 50 | | 9.3 | 13.8 | 1.0 | 15.5 | | |
| t _{PLH} t _{PHL} | Propagation Delay Time D to Q | 2.7 | 15 | | 7.7 | 15.0 | 1.0 | 18.5 | ns | |
| | | 2.7 | 50 | | 10.2 | 18.5 | 1.0 | 22.0 | | |
| | | 3.3 ^(*) | 15 | | 6.0 | 9.7 | 1.0 | 11.5 | | |
| | | 3.3 ^(*) | 50 | | 8.5 | 13.2 | 1.0 | 15.0 | | |
| t _{PZL} t _{PZH} | Output Enable Time | 2.7 | 15 | R _L = 1 kΩ | 7.7 | 15.0 | 1.0 | 18.5 | ns | |
| | | 2.7 | 50 | | 10.2 | 18.5 | 1.0 | 22.0 | | |
| | | 3.3 ^(*) | 15 | | 6.0 | 9.7 | 1.0 | 11.5 | | |
| | | 3.3 ^(*) | 50 | | 8.5 | 13.2 | 1.0 | 15.0 | | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 2.7 | 50 | R _L = 1 kΩ | 9.8 | 18.0 | 1.0 | 21.0 | ns | |
| | | 3.3 ^(*) | 50 | | 8.2 | 12.8 | 1.0 | 14.5 | | |
| t _w | LE pulse Width, HIGH | 2.7 | 50 | | 6.5 | | | 7.5 | ns | |
| | | 3.3 ^(*) | 50 | | 5.0 | | | 5.0 | | |
| t _s | Setup Time D to LE HIGH or LOW | 2.7 | 50 | | 6.0 | | | 6.0 | ns | |
| | | 3.3 ^(*) | 50 | | 4.0 | | | 4.0 | | |
| t _h | Hold Time D to LE HIGH or LOW | 2.7 | 50 | | 1.0 | | | 1.0 | ns | |
| | | 3.3 ^(*) | 50 | | 1.0 | | | 1.0 | | |
| t _{OSLH} t _{OSSL} | Output to Output Skew Time (note 1, 2) | 2.7 | 50 | | 0.5 | 1.0 | | 1.5 | ns | |
| | | 3.3 ^(*) | 50 | | 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

2) Parameter guaranteed by design

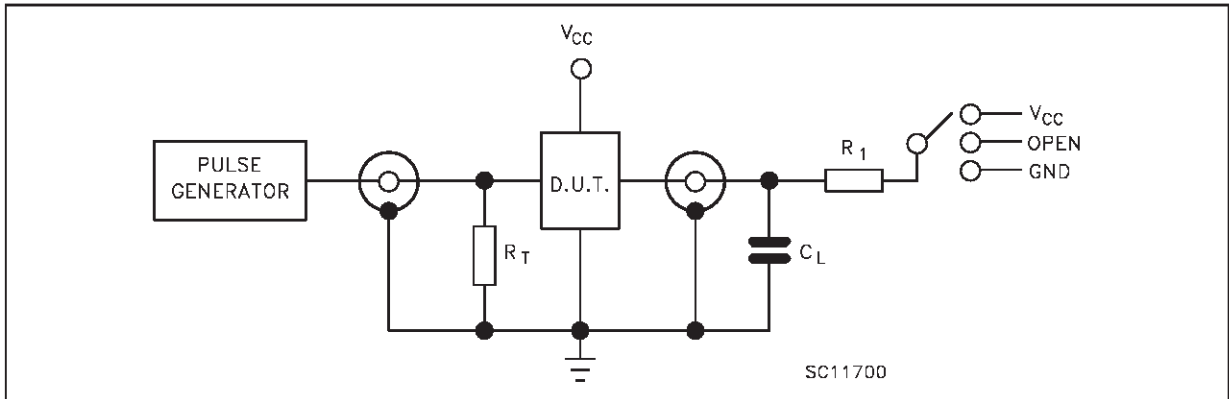
(*) Voltage range is 3.3V ± 0.3V

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 _{OUT} | Output Capacitance | 3.3 | | | 10 | | | | pF |
| C _{PD} | Power Dissipation Capacitance (note 1) | 3.3 | f _{IN} = 10 MHz | | 10 | | | | 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} • V_{CC} • f_{IN} + I_{CC}/8 (per circuit)

TEST CIRCUIT



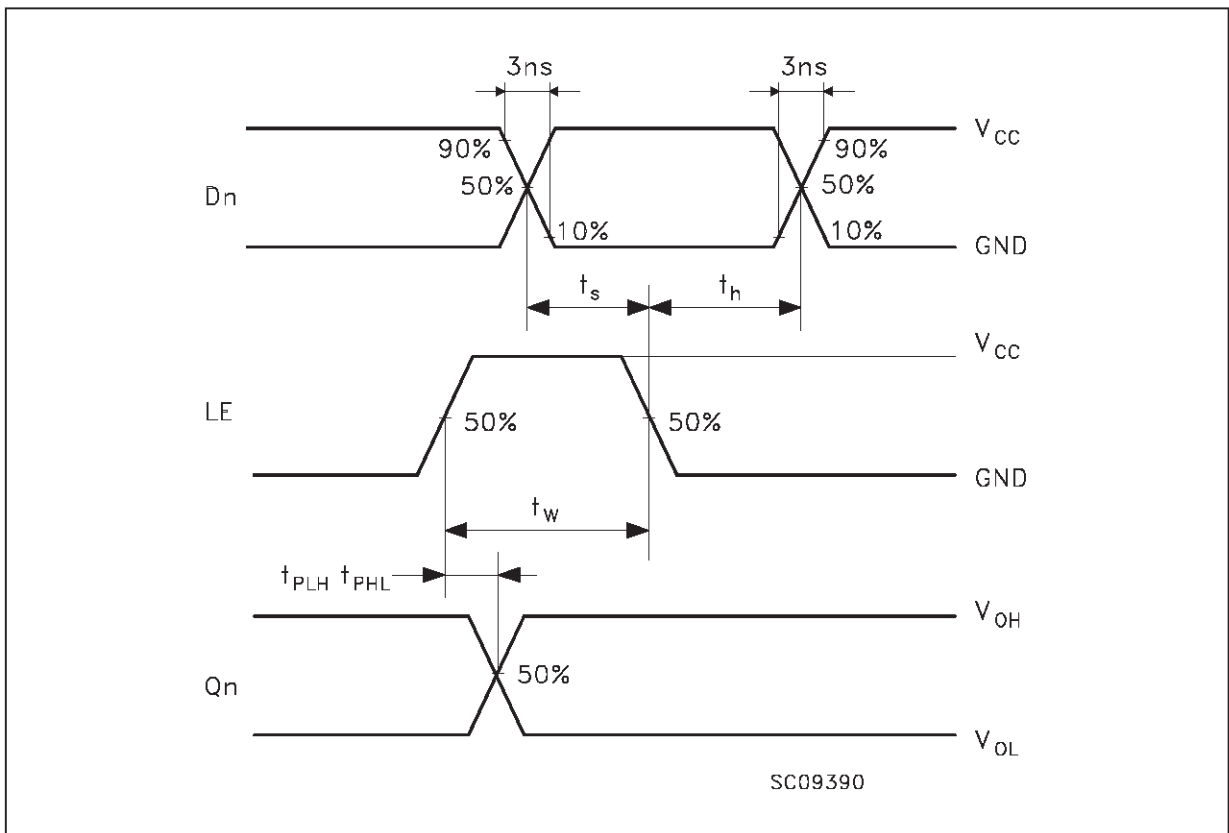
| TEST | SWITCH |
|-----------------------|----------|
| t_{PLH} , t_{PHL} | Open |
| t_{PZL} , t_{PLZ} | V_{CC} |
| t_{PZH} , t_{PHZ} | GND |

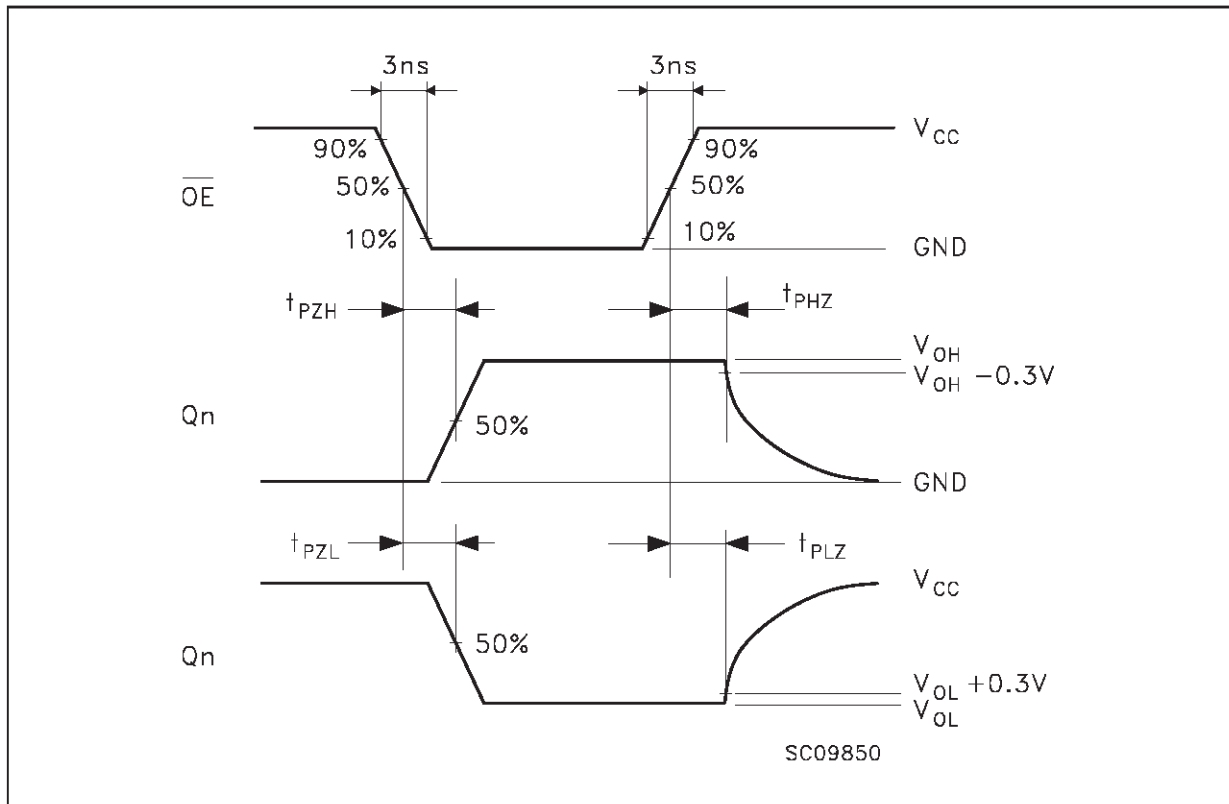
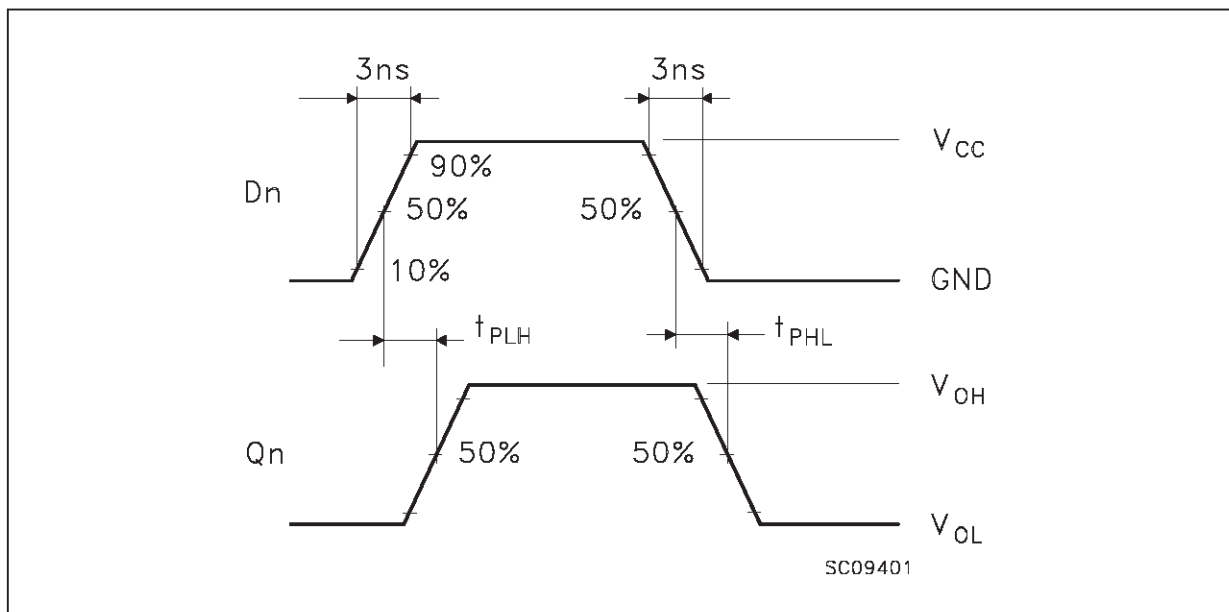
$C_L = 15/50$ pF or equivalent (includes jig and probe capacitance)

$R_L = R_1 = 1K\Omega$ or equivalent

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

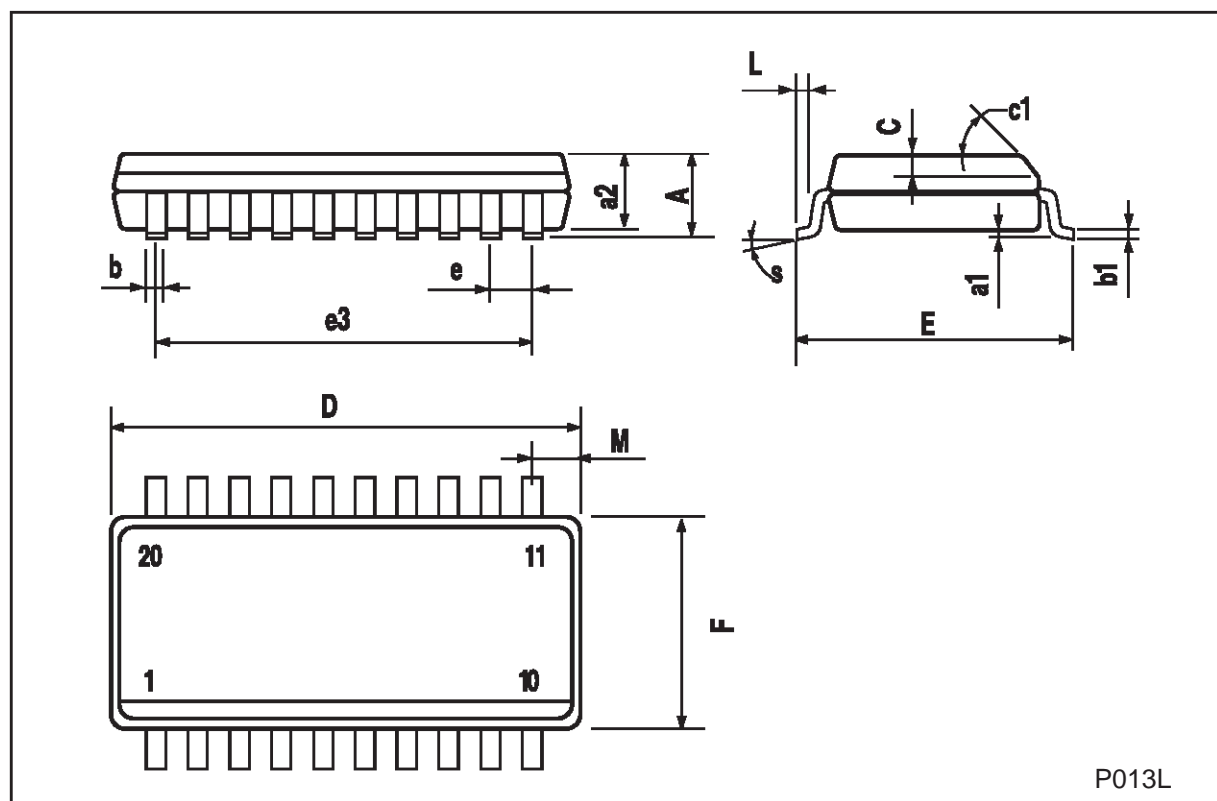
WAVEFORM 1: LE TO Qn PROPAGATION DELAYS, LE MINIMUM PULSE WIDTH, Dn TO LE SETUP AND HOLD TIMES ($f=1MHz$; 50% duty cycle)



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)

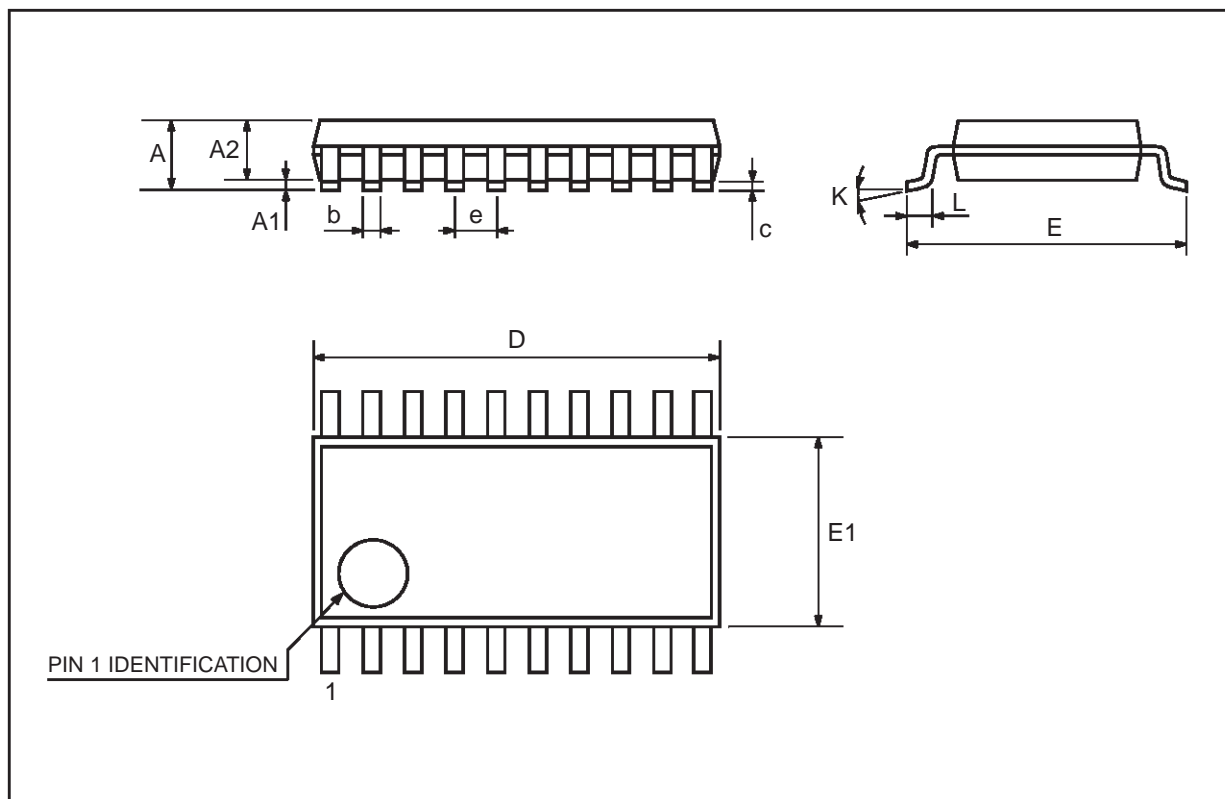
SO-20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-----------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 2.65 | | | 0.104 |
| a1 | 0.10 | | 0.20 | 0.004 | | 0.007 |
| a2 | | | 2.45 | | | 0.096 |
| b | 0.35 | | 0.49 | 0.013 | | 0.019 |
| b1 | 0.23 | | 0.32 | 0.009 | | 0.012 |
| C | | 0.50 | | | 0.020 | |
| c1 | 45 (typ.) | | | | | |
| D | 12.60 | | 13.00 | 0.496 | | 0.512 |
| E | 10.00 | | 10.65 | 0.393 | | 0.419 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 11.43 | | | 0.450 | |
| F | 7.40 | | 7.60 | 0.291 | | 0.299 |
| L | 0.50 | | 1.27 | 0.19 | | 0.050 |
| M | | | 0.75 | | | 0.029 |
| S | 8 (max.) | | | | | |



TSSOP20 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 | | 0.2 | 0.0035 | | 0.0079 |
| D | 6.4 | 6.5 | 6.6 | 0.252 | 0.256 | 0.260 |
| 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° | 4° | 8° | 0° | 4° | 8° |
| L | 0.50 | 0.60 | 0.70 | 0.020 | 0.024 | 0.028 |



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specification mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a trademark of STMicroelectronics

© 1999 STMicroelectronics – Printed in Italy – All Rights Reserved

STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - France - Germany - Italy - Japan - Korea - Malaysia - Malta - Mexico - Morocco - The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.

<http://www.st.com>