



# 74VHCT574A

## OCTAL D-TYPE FLIP FLOP WITH 3 STATE OUTPUTS NON INVERTING

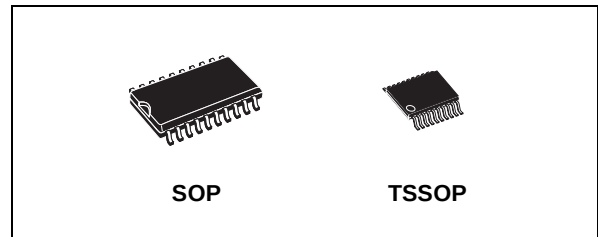
- HIGH SPEED:  
 $f_{MAX} = 180 \text{ MHz (TYP.) at } V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu A \text{ (MAX.) at } T_A = 25^\circ C$
- COMPATIBLE WITH TTL OUTPUTS:  
 $V_{IH} = 2V \text{ (MIN.)}, V_{IL} = 0.8V \text{ (MAX)}$
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8 \text{ mA (MIN)}$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC(OPR)} = 4.5V \text{ to } 5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 574
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.9V \text{ (MAX.)}$

### DESCRIPTION

The 74VHCT574A is an advanced high-speed CMOS OCTAL D-TYPE FLIP FLOP with 3 STATE OUTPUTS NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

These 8 bit D-Type flip-flop is controlled by a clock input (CK) and an output enable input ( $\overline{OE}$ ).

On the positive transition of the clock, the Q outputs will be set to the logic states that were setup at the D inputs.



### ORDER CODES

| PACKAGE | TUBE        | T & R         |
|---------|-------------|---------------|
| SOP     | 74VHCT574AM | 74VHCT574AMTR |
| TSSOP   |             | 74VHCT574ATTR |

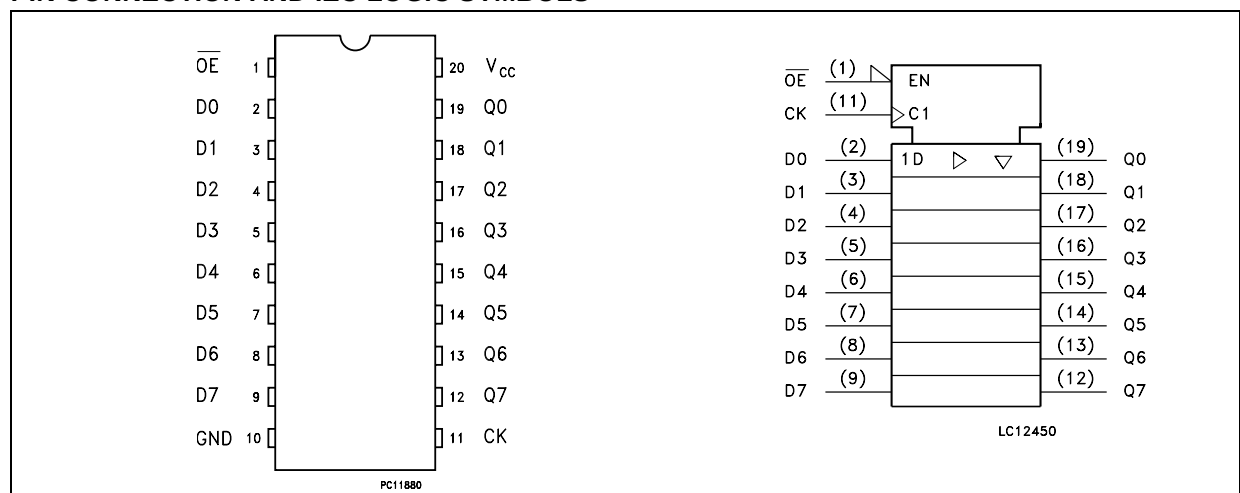
When the ( $\overline{OE}$ ) input is low, the 8 outputs will be in a normal logic state (high or low logic level) and when ( $\overline{OE}$ ) is high, the outputs will be in a high impedance state.

The Output control does not affect the internal operation of flip flop; that is, the old data can be retained or the new data can be entered even while the outputs are off.

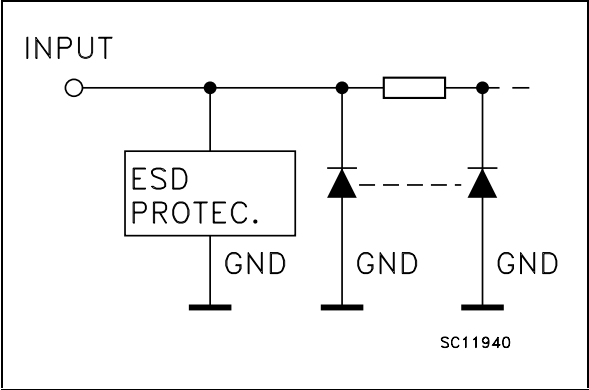
Power down protection is provided on all inputs and outputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V since all inputs are equipped with TTL threshold.

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

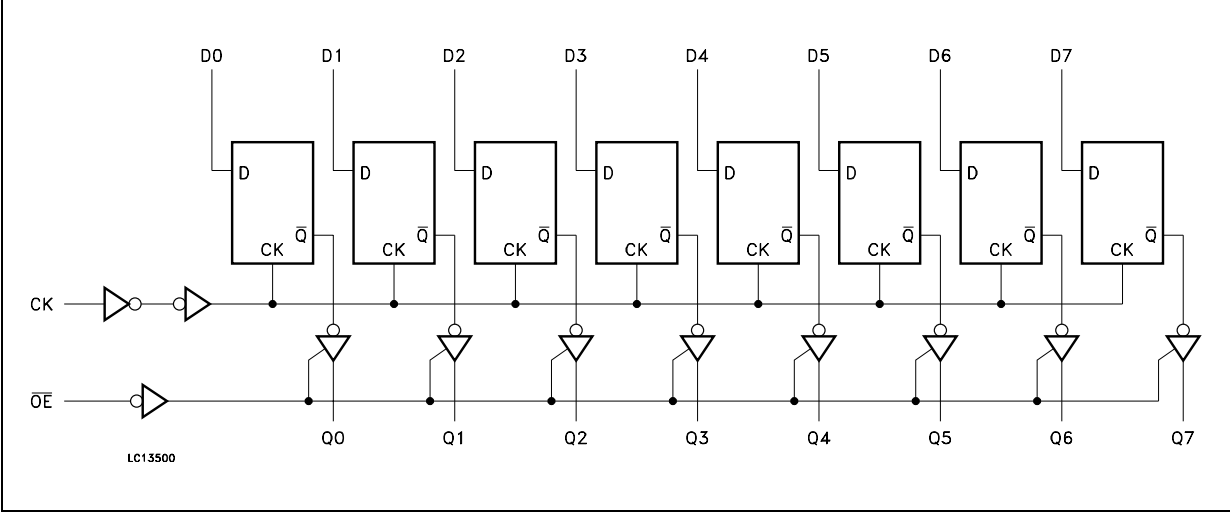
| PIN No                         | SYMBOL                 | NAME AND FUNCTION                        |
|--------------------------------|------------------------|------------------------------------------|
| 1                              | $\overline{\text{OE}}$ | 3-State Output Enable Input (Active LOW) |
| 2, 3, 4, 5, 6, 7, 8, 9         | D0 to D7               | Data Inputs                              |
| 12, 13, 14, 15, 16, 17, 18, 19 | Q0 to Q7               | 3-State Outputs                          |
| 11                             | CK                     | Clock Input (LOW-to-HIGH Edge Triggered) |
| 10                             | GND                    | Ground (0V)                              |
| 20                             | V <sub>CC</sub>        | Positive Supply Voltage                  |

TRUTH TABLE

| INPUTS                 |    |   | OUTPUT    |
|------------------------|----|---|-----------|
| $\overline{\text{OE}}$ | CK | D | Q         |
| H                      | X  | X | Z         |
| L                      |    | X | NO CHANGE |
| L                      |    | L | L         |
| L                      |    | H | H         |

X : Don't Care  
Z : High Impedance

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 (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        | $\pm 20$               | mA   |
| $I_O$                 | DC Output Current              | $\pm 25$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current  | $\pm 50$               | 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) Output in OFF State

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) Output in OFF State

2) High or Low State

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

## DC SPECIFICATIONS

| Symbol           | Parameter                             | Test Condition         |                                                                                    | Value                 |      |       |             |       |              |       | Unit |
|------------------|---------------------------------------|------------------------|------------------------------------------------------------------------------------|-----------------------|------|-------|-------------|-------|--------------|-------|------|
|                  |                                       | V <sub>CC</sub><br>(V) |                                                                                    | T <sub>A</sub> = 25°C |      |       | -40 to 85°C |       | -55 to 125°C |       |      |
|                  |                                       |                        |                                                                                    | Min.                  | Typ. | Max.  | Min.        | Max.  | Min.         | Max.  |      |
| V <sub>IH</sub>  | High Level Input Voltage              | 4.5 to 5.5             |                                                                                    | 2                     |      |       | 2           |       | 2            |       | V    |
| V <sub>IL</sub>  | Low Level Input Voltage               | 4.5 to 5.5             |                                                                                    |                       |      | 0.8   |             | 0.8   |              | 0.8   | V    |
| V <sub>OH</sub>  | High Level Output Voltage             | 4.5                    | I <sub>O</sub> =-50 μA                                                             | 4.4                   | 4.5  |       | 4.4         |       | 4.4          |       | V    |
|                  |                                       | 4.5                    | I <sub>O</sub> =-8 mA                                                              | 3.94                  |      |       | 3.8         |       | 3.7          |       |      |
| V <sub>OL</sub>  | Low Level Output Voltage              | 4.5                    | I <sub>O</sub> =50 μA                                                              |                       | 0.0  | 0.1   |             | 0.1   |              | 0.1   | V    |
|                  |                                       | 4.5                    | I <sub>O</sub> =8 mA                                                               |                       |      | 0.36  |             | 0.44  |              | 0.55  |      |
| I <sub>OZ</sub>  | High Impedance Output Leakage Current | 4.5 to 5.5             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = 0V to 5.5V |                       |      | ±0.25 |             | ± 2.5 |              | ± 2.5 | μA   |
| I <sub>I</sub>   | Input Leakage Current                 | 0 to 5.5               | V <sub>I</sub> = 5.5V or GND                                                       |                       |      | ± 0.1 |             | ± 1.0 |              | ± 1.0 | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current              | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                            |                       |      | 4     |             | 40    |              | 40    | μA   |
| ΔI <sub>CC</sub> | Additional Worst Case Supply Current  | 5.5                    | One Input at 3.4V, other input at V <sub>CC</sub> or GND                           |                       |      | 1.35  |             | 1.5   |              | 1.5   | mA   |
| I <sub>OPD</sub> | Output Leakage Current                | 0                      | V <sub>OUT</sub> = 5.5V                                                            |                       |      | 0.5   |             | 5.0   |              | 5.0   | μA   |

AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

| Symbol                                 | Parameter                              | Test Condition         |                        |          | Value                 |      |      |             |      |              |      | Unit |
|----------------------------------------|----------------------------------------|------------------------|------------------------|----------|-----------------------|------|------|-------------|------|--------------|------|------|
|                                        |                                        | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) |          | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                                        |                                        |                        |                        |          | Min.                  | Typ. | Max. | Min.        | Max. | Min.         | Max. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay<br>Time CK to Q      | 5.0 <sup>(*)</sup>     | 15                     |          |                       | 5.5  | 8.6  | 1.0         | 10.0 | 1.0          | 10.0 | ns   |
|                                        |                                        | 5.0 <sup>(*)</sup>     | 50                     |          |                       | 7.0  | 10.6 | 1.0         | 12.0 | 1.0          | 12.0 |      |
| t <sub>PZL</sub><br>t <sub>PZH</sub>   | Output Enable<br>Time                  | 5.0 <sup>(*)</sup>     | 15                     | RL = 1KΩ |                       | 5.0  | 9.0  | 1.0         | 10.5 | 1.0          | 10.5 | ns   |
|                                        |                                        | 5.0 <sup>(*)</sup>     | 50                     |          |                       | 6.0  | 11.0 | 1.0         | 12.5 | 1.0          | 12.5 |      |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub>   | Output Disable<br>Time                 | 5.0 <sup>(*)</sup>     | 50                     | RL = 1KΩ |                       | 7.0  | 10.1 | 1.0         | 11.5 | 1.0          | 11.5 | ns   |
| f <sub>MAX</sub>                       | Maximum Clock<br>Frequency             | 5.0 <sup>(*)</sup>     | 15                     |          | 90                    | 140  |      | 80          |      | 80           |      | MHz  |
|                                        |                                        | 5.0 <sup>(*)</sup>     | 50                     |          | 85                    | 130  |      |             |      |              |      |      |
| t <sub>OSLH</sub><br>t <sub>OSHL</sub> | Output to Output<br>Skew time (note 1) | 5.0 <sup>(*)</sup>     | 50                     |          |                       |      | 1.5  |             | 1.5  |              | 1.5  | ns   |

(\*) Voltage range is 5.0V ± 0.5V

Note 1 : Parameter guaranteed by design. t<sub>soLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|, t<sub>soHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|

## CAPACITIVE CHARACTERISTICS

| Symbol           | Parameter                              | Test Condition | Value                 |      |      |             |      |              |      |    | Unit |
|------------------|----------------------------------------|----------------|-----------------------|------|------|-------------|------|--------------|------|----|------|
|                  |                                        |                | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |    |      |
|                  |                                        |                | Min.                  | Typ. | Max. | Min.        | Max. | Min.         | Max. |    |      |
| C <sub>IN</sub>  | Input Capacitance                      |                |                       | 4    | 10   |             | 10   |              | 10   | pF |      |
| C <sub>OUT</sub> | Output Capacitance                     |                |                       | 9    |      |             |      |              |      | pF |      |
| C <sub>PD</sub>  | Power Dissipation Capacitance (note 1) |                |                       | 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 operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$  (per Flip-Flop)

## DYNAMIC SWITCHING CHARACTERISTICS

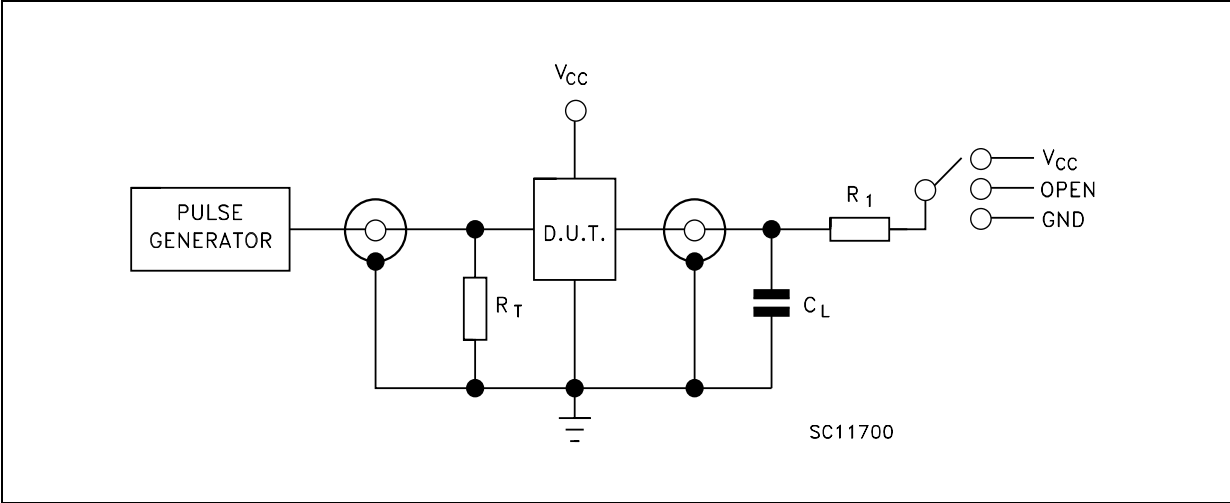
| Symbol           | Parameter                                    | Test Condition         |                        | Value                 |      |      |             |      |              | Unit |      |
|------------------|----------------------------------------------|------------------------|------------------------|-----------------------|------|------|-------------|------|--------------|------|------|
|                  |                                              | V <sub>CC</sub><br>(V) |                        | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                  |                                              |                        |                        | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| V <sub>OLP</sub> | Dynamic Low Voltage Quiet Output (note 1, 2) | 5.0                    | C <sub>L</sub> = 50 pF |                       | 1.2  | 1.6  |             |      |              |      | V    |
| V <sub>OLV</sub> |                                              |                        |                        | -1.6                  | -1.2 |      |             |      |              |      |      |
| V <sub>IHD</sub> | Dynamic High Voltage Input (note 1, 3)       | 5.0                    |                        | 3.5                   |      |      |             |      |              |      |      |
| V <sub>ILD</sub> | 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 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 ( $V_{IHD}$ ),  $f=1\text{MHz}$ .

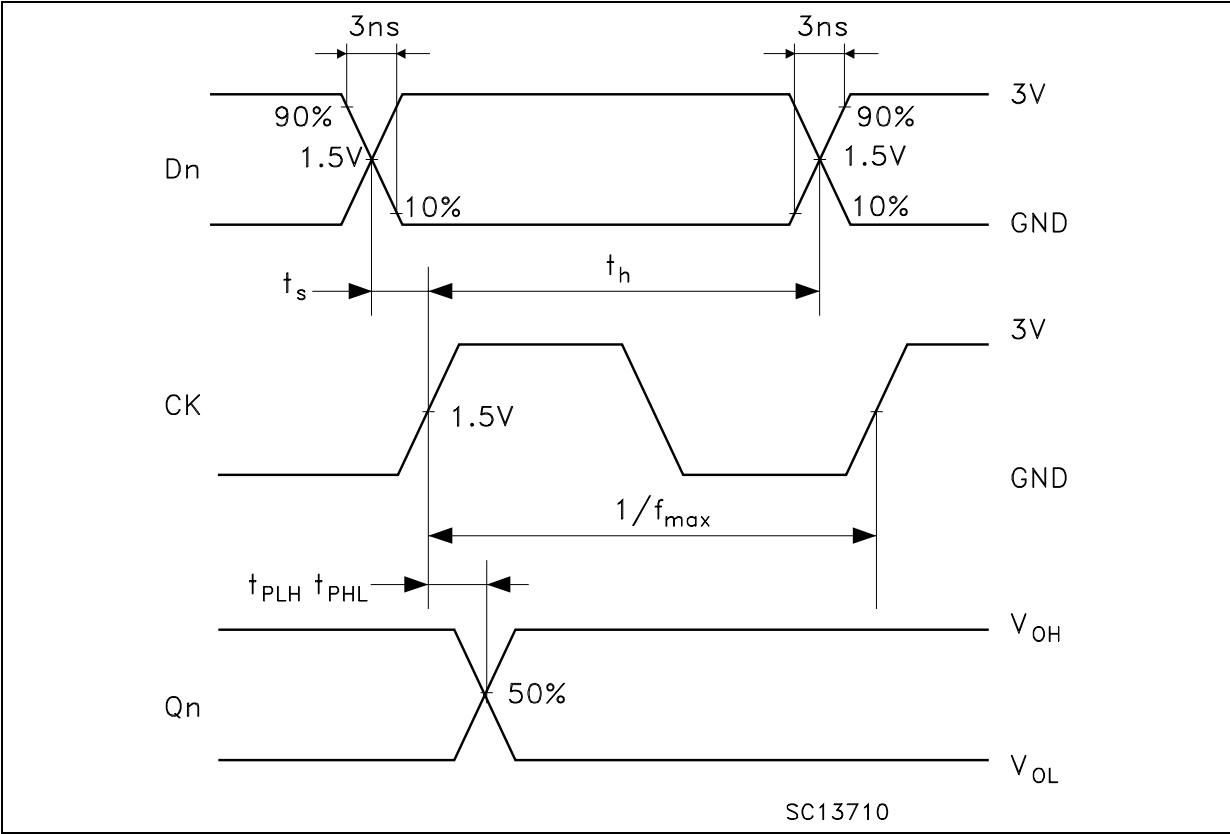
TEST CIRCUIT

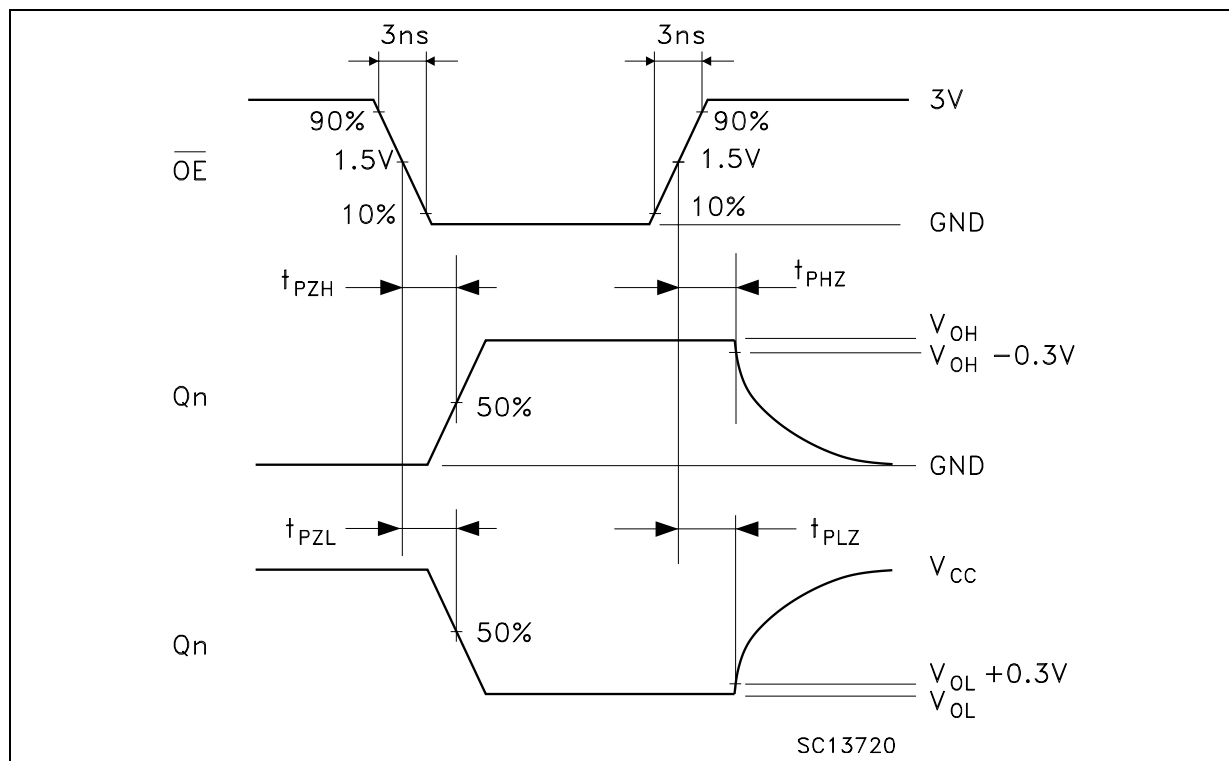
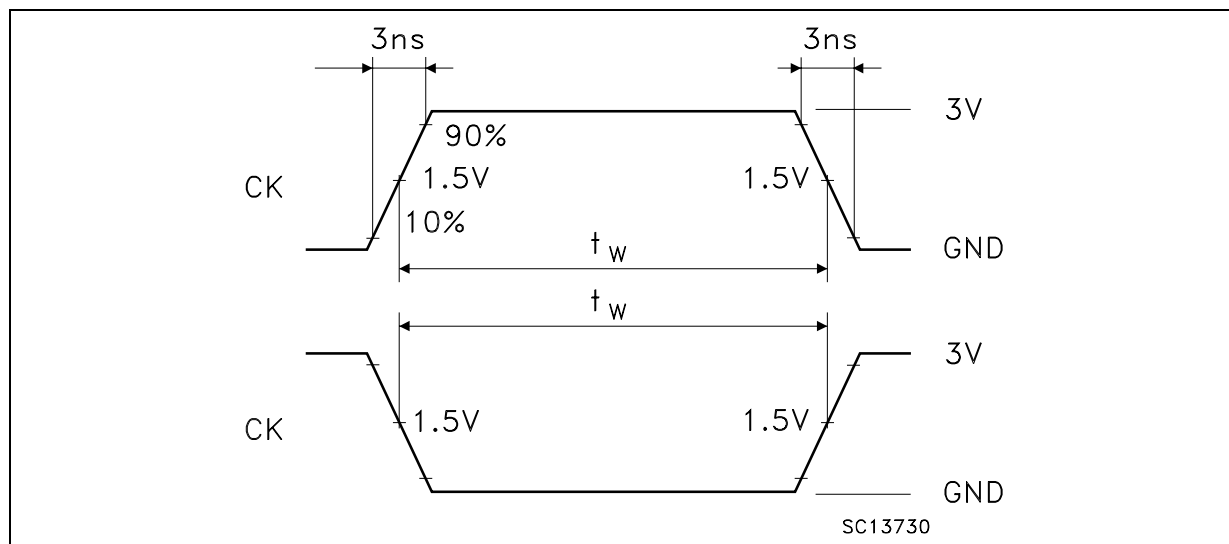


| TEST               | SWITCH   |
|--------------------|----------|
| $t_{PLH}, t_{PHL}$ | Open     |
| $t_{PZL}, t_{PLZ}$ | $V_{CC}$ |
| $t_{PZH}, t_{PHZ}$ | GND      |

$C_L = 15/50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 1\text{K}\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

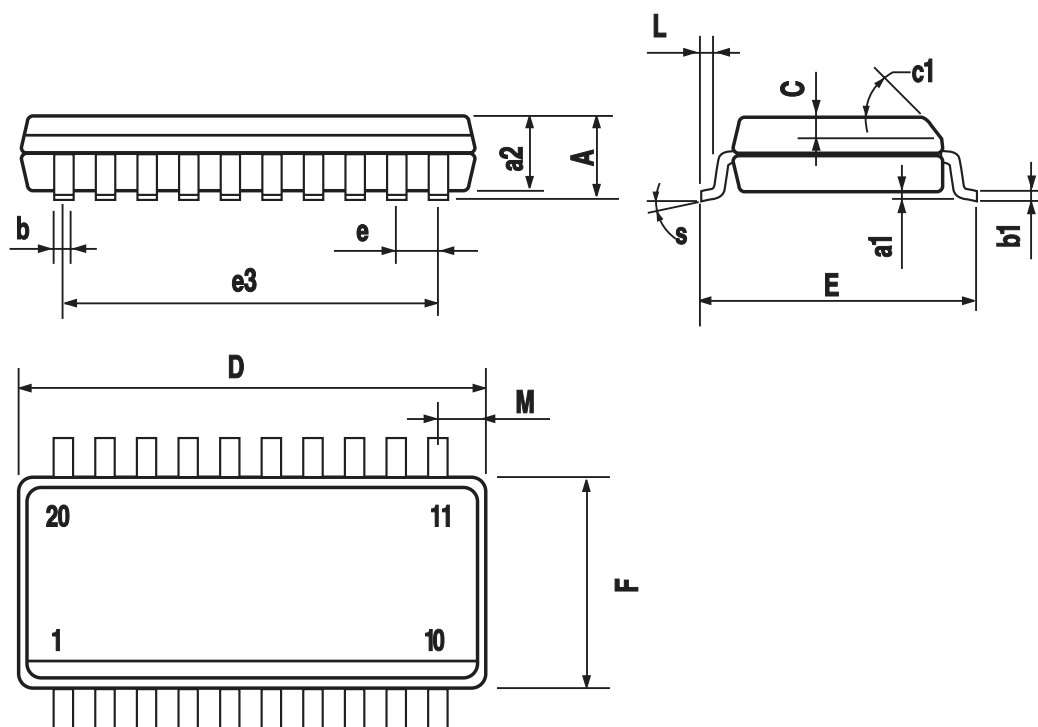
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES (f=1MHz; 50% duty cycle)



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

## SO-20 MECHANICAL DATA

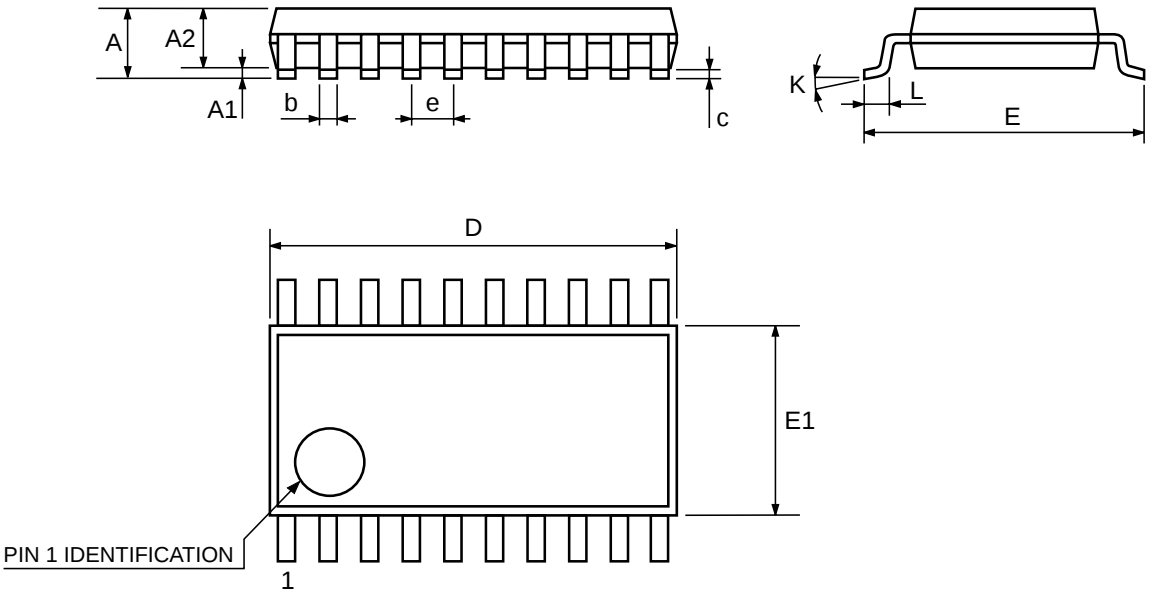
| DIM. | mm.        |       |       | inch  |       |       |
|------|------------|-------|-------|-------|-------|-------|
|      | MIN.       | TYP   | MAX.  | MIN.  | TYP.  | MAX.  |
| A    |            |       | 2.65  |       |       | 0.104 |
| a1   | 0.1        |       | 0.2   | 0.004 |       | 0.008 |
| a2   |            |       | 2.45  |       |       | 0.096 |
| b    | 0.35       |       | 0.49  | 0.014 |       | 0.019 |
| b1   | 0.23       |       | 0.32  | 0.009 |       | 0.012 |
| C    |            | 0.5   |       |       | 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 |       | 0.300 |
| L    | 0.50       |       | 1.27  | 0.020 |       | 0.050 |
| M    |            |       | 0.75  |       |       | 0.029 |
| S    | 8° (max.)  |       |       |       |       |       |



PO13L

TSSOP20 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    | 6.4  | 6.5      | 6.6  | 0.252 | 0.256      | 0.260  |
| 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  |



0087225C

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. Specifications 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 registered trademark of STMicroelectronics

© 2001 STMicroelectronics - Printed in Italy - All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - China - Finland - France - Germany - Hong Kong - India - Italy - Japan - Malaysia - Malta - Morocco  
Singapore - Spain - Sweden - Switzerland - United Kingdom

© <http://www.st.com>