

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

- HIGH SPEED:
- $f_{MAX} = 180 \text{ MHz (TYP.) at } V_{CC} = 5\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- POWER DOWN PROTECTION ON INPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8 \text{ mA (MIN)}$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC(OPR)} = 2\text{V to } 5.5\text{V}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 574
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.9\text{V (MAX.)}$

### DESCRIPTION

The 74VHC574 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 (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.

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

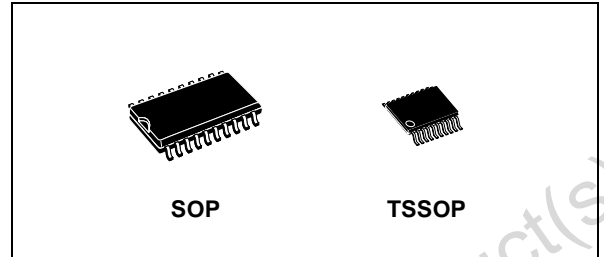


Table 1: Order Codes

| PACKAGE | T & R       |
|---------|-------------|
| SOP     | 74VHC574MTR |
| TSSOP   | 74VHC574TTR |

while high level 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 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.

Figure 1: Pin Connection And IEC Logic Symbols

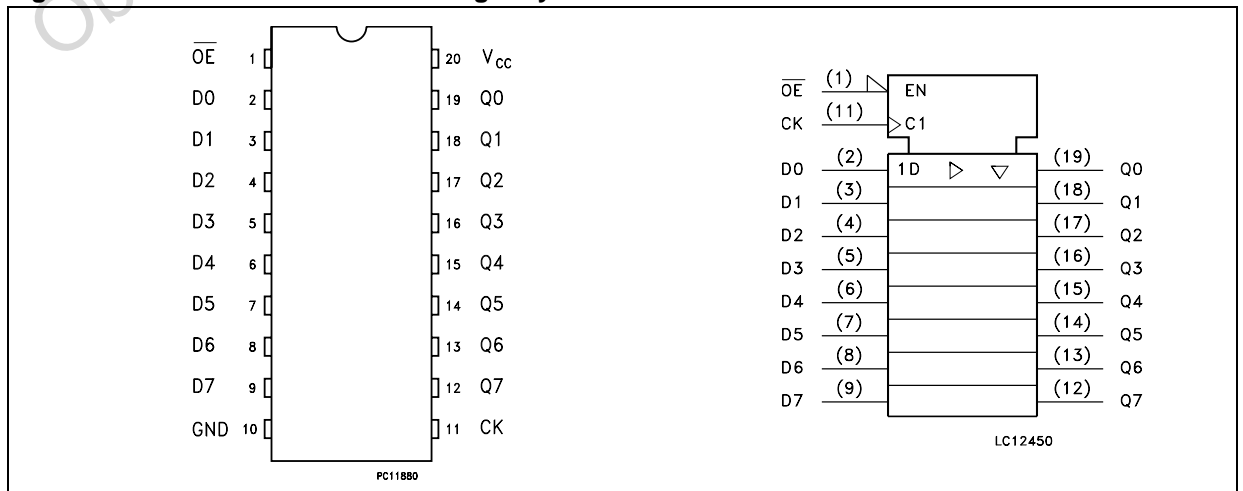


Figure 2: Input Equivalent Circuit

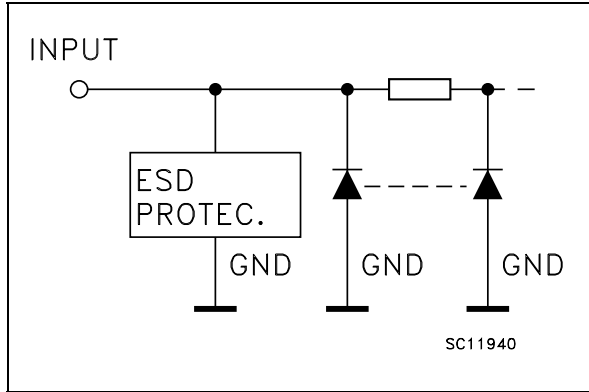


Table 2: Pin Description

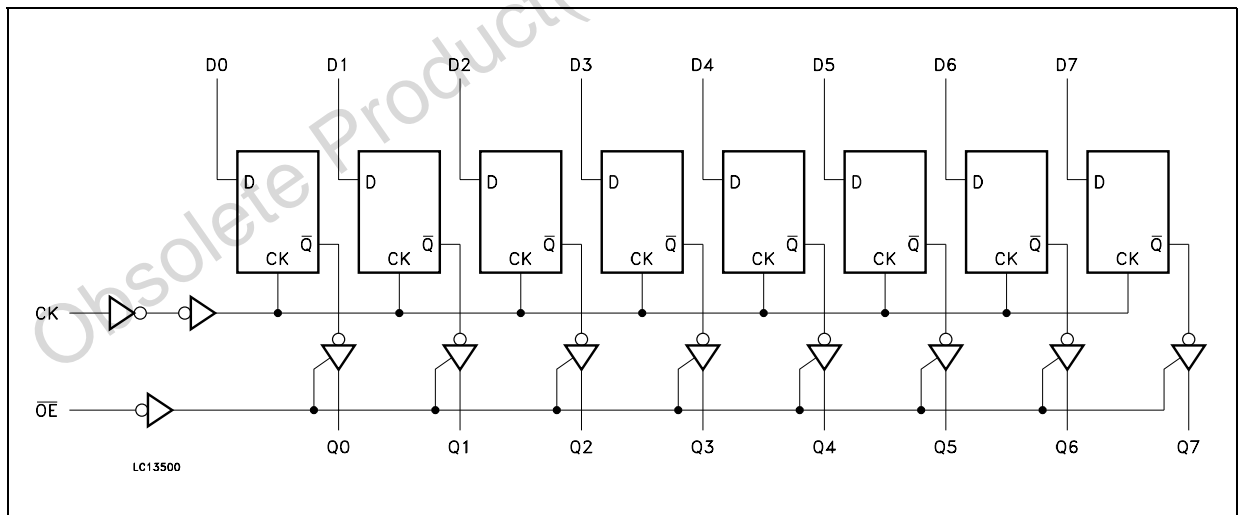
| PIN N°                         | SYMBOL          | NAME AND FUNCTION                        |
|--------------------------------|-----------------|--|
| 1                              | $\overline{OE}$ | 3-State Output Enable Input (Active LOW) |
| 2, 3, 4, 5, 6, 7, 8, 9         | D0 to D7        | 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                  |

Table 3: Truth Table

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

X : Don't Care  
Z : High Impedance

Figure 3: Logic Diagram



This logic diagram has not be used to estimate propagation delays

**Table 4: 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       | $\pm 20$               | mA   |
| $I_O$                 | DC Output Current             | $\pm 25$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | $\pm 75$               | 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

**Table 5: Recommended Operating Conditions**

| Symbol   | Parameter  | Value               | Unit |
|----------|--|---------------------|------|
| $V_{CC}$ | Supply Voltage   | 2 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  | -55 to 125          | °C   |
| dt/dv    | Input Rise and Fall Time (note 1) ( $V_{CC} = 3.3 \pm 0.3V$ )<br>( $V_{CC} = 5.0 \pm 0.5V$ ) | 0 to 100<br>0 to 20 | ns/V |

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

Table 6: 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              | 2.0                    |  | 1.5                   |      |                    | 1.5                |                    | 1.5                |                    | V    |
|                 |                                       | 3.0 to 5.5             |  | 0.7V <sub>CC</sub>    |      |                    | 0.7V <sub>CC</sub> |                    | 0.7V <sub>CC</sub> |                    |      |
| V <sub>IL</sub> | Low Level Input Voltage               | 2.0                    |  |                       |      | 0.5                |                    | 0.5                |                    | 0.5                | V    |
|                 |                                       | 3.0 to 5.5             |  |                       |      | 0.3V <sub>CC</sub> |                    | 0.3V <sub>CC</sub> |                    | 0.3V <sub>CC</sub> |      |
| V <sub>OH</sub> | High Level Output Voltage             | 2.0                    | I <sub>O</sub> =-50 μA   | 1.9                   | 2.0  |                    | 1.9                |                    | 1.9                |                    | V    |
|                 |                                       | 3.0                    | I <sub>O</sub> =-50 μA   | 2.9                   | 3.0  |                    | 2.9                |                    | 2.9                |                    |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =-50 μA   | 4.4                   | 4.5  |                    | 4.4                |                    | 4.4                |                    |      |
|                 |                                       | 3.0                    | I <sub>O</sub> =-4 mA  | 2.58                  |      |                    | 2.48               |                    | 2.4                |                    |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =-8 mA  | 3.94                  |      |                    | 3.8                |                    | 3.7                |                    |      |
| V <sub>OL</sub> | Low Level Output Voltage              | 2.0                    | I <sub>O</sub> =50 μA  |                       | 0.0  | 0.1                |                    | 0.1                |                    | 0.1                | V    |
|                 |                                       | 3.0                    | I <sub>O</sub> =50 μA  |                       | 0.0  | 0.1                |                    | 0.1                |                    | 0.1                |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =50 μA  |                       | 0.0  | 0.1                |                    | 0.1                |                    | 0.1                |      |
|                 |                                       | 3.0                    | I <sub>O</sub> =4 mA   |                       |      | 0.36               |                    | 0.44               |                    | 0.55               |      |
|                 |                                       | 4.5                    | I <sub>O</sub> =8 mA   |                       |      | 0.36               |                    | 0.44               |                    | 0.55               |      |
| I <sub>OZ</sub> | High Impedance Output Leakage Current | 5.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                       |      | ±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                |                    | ± 1                | μA   |
| I <sub>CC</sub> | Quiescent Supply Current              | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND  |                       |      | 4                  |                    | 40                 |                    | 40                 | μA   |

Table 7: AC Electrical Characteristics (Input  $t_r = t_f = 3\text{ns}$ )

| Symbol                   | Parameter                              | Test Condition  |               |                          | Value |      |                             |      |                              |      | Unit |
|--------------------------|--|-----------------|---------------|--------------------------|-------|------|-----------------------------|------|------------------------------|------|------|
|                          |  | $V_{CC}$<br>(V) | $C_L$<br>(pF) | $T_A = 25^\circ\text{C}$ |       |      | $-40$ to $85^\circ\text{C}$ |      | $-55$ to $125^\circ\text{C}$ |      |      |
|                          |  |                 |               | Min.                     | Typ.  | Max. | Min.                        | Max. | Min.                         | Max. |      |
| $t_{PLH}$<br>$t_{PHL}$   | Propagation Delay Time<br>CH to Q      | 3.3(*)          | 15            |                          | 8.5   | 13.2 | 1.0                         | 15.5 | 1.0                          | 15.5 | ns   |
|                          |  | 3.3(*)          | 50            |                          | 11.0  | 16.7 | 1.0                         | 19.0 | 1.0                          | 19.0 |      |
|                          |  | 5.0(**)         | 15            |                          | 5.6   | 8.6  | 1.0                         | 10.0 | 1.0                          | 10.0 |      |
|                          |  | 5.0(**)         | 50            |                          | 7.1   | 10.6 | 1.0                         | 12.0 | 1.0                          | 12.0 |      |
| $t_{PZL}$<br>$t_{PZH}$   | Output Enable Time                     | 3.3(*)          | 15            |                          | 8.2   | 12.8 | 1.0                         | 15.0 | 1.0                          | 15.0 | ns   |
|                          |  | 3.3(*)          | 50            |                          | 10.7  | 16.3 | 1.0                         | 18.5 | 1.0                          | 18.5 |      |
|                          |  | 5.0(**)         | 15            |                          | 5.9   | 9.0  | 1.0                         | 10.5 | 1.0                          | 10.5 |      |
|                          |  | 5.0(**)         | 50            |                          | 7.4   | 11.0 | 1.0                         | 12.5 | 1.0                          | 12.5 |      |
| $t_{PLZ}$<br>$t_{PHZ}$   | Output Disable Time                    | 3.3(*)          | 50            |                          | 11.0  | 15.0 | 1.0                         | 17.0 | 1.0                          | 17.0 | ns   |
|                          |  | 3.3(*)          | 50            |                          | 7.1   | 10.1 | 1.0                         | 11.5 | 1.0                          | 11.5 |      |
| $t_w$                    | Clock Pulse Width<br>HIGH or LOW       | 3.3(*)          |               |                          |       | 5.0  |                             | 5.0  |                              | 5.0  | ns   |
|                          |  | 5.0(**)         |               |                          |       | 5.0  |                             | 5.0  |                              | 5.0  |      |
| $t_s$                    | Setup Time D to CK<br>HIGH or LOW      | 3.3(*)          |               |                          |       | 3.5  |                             | 3.5  |                              | 3.5  | ns   |
|                          |  | 5.0(**)         |               |                          |       | 3.5  |                             | 3.5  |                              | 3.5  |      |
| $t_h$                    | Hold Time D to CK<br>HIGH or LOW       | 3.3(*)          |               |                          |       | 1.5  |                             | 1.5  |                              | 1.5  | ns   |
|                          |  | 5.0(**)         |               |                          |       | 1.5  |                             | 1.5  |                              | 1.5  |      |
| $f_{MAX}$                | Maximum Clock Frequency                | 3.3(*)          | 15            |                          | 80    | 125  |                             | 65   |                              | 65   | MHz  |
|                          |  | 3.3(*)          | 50            |                          | 50    | 75   |                             | 45   |                              | 45   |      |
|                          |  | 5.0(**)         | 15            |                          | 130   | 180  |                             | 110  |                              | 110  |      |
|                          |  | 5.0(**)         | 50            |                          | 85    | 115  |                             | 75   |                              | 75   |      |
| $t_{OSLH}$<br>$t_{OSHL}$ | Output to Output<br>Skew time (note 1) | 3.3(*)          | 50            |                          |       | 1.5  |                             | 1.5  |                              | 1.5  | ns   |
|                          |  | 5.0(**)         | 50            |                          |       | 1.0  |                             | 1.0  |                              | 1.0  |      |

(\*) Voltage range is  $3.3\text{V} \pm 0.3\text{V}$ (\*\*) Voltage range is  $5.0\text{V} \pm 0.5\text{V}$ Note 1: Parameter guaranteed by design.  $t_{soLH} = |t_{pLHm} - t_{pLHn}|$ ,  $t_{soHL} = |t_{pHLm} - t_{pHLn}|$ 

Table 8: Capacitive Characteristics

| Symbol    | Parameter                              | Test Condition |  |  | Value                    |      |                             |      | Unit |                              |      |      |
|-----------|--|----------------|--|--|--------------------------|------|-----------------------------|------|------|------------------------------|------|------|
|           |  |                |  |  | $T_A = 25^\circ\text{C}$ |      | $-40$ to $85^\circ\text{C}$ |      |      | $-55$ to $125^\circ\text{C}$ |      |      |
|           |  |                |  |  | Min.                     | Typ. | Max.                        | Min. |      | Max.                         | Min. | Max. |
| $C_{IN}$  | Input Capacitance                      |                |  |  |                          | 7    | 10                          |      | 10   |                              | 10   | pF   |
| $C_{OUT}$ | Output Capacitance                     |                |  |  |                          | 9    |                             |      |      |                              |      | pF   |
| $C_{PD}$  | Power Dissipation Capacitance (note 1) |                |  |  |                          | 28   |                             |      |      |                              |      | 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.  $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$  (per Flip-Flop)

Table 9: Dynamic Switching Characteristics

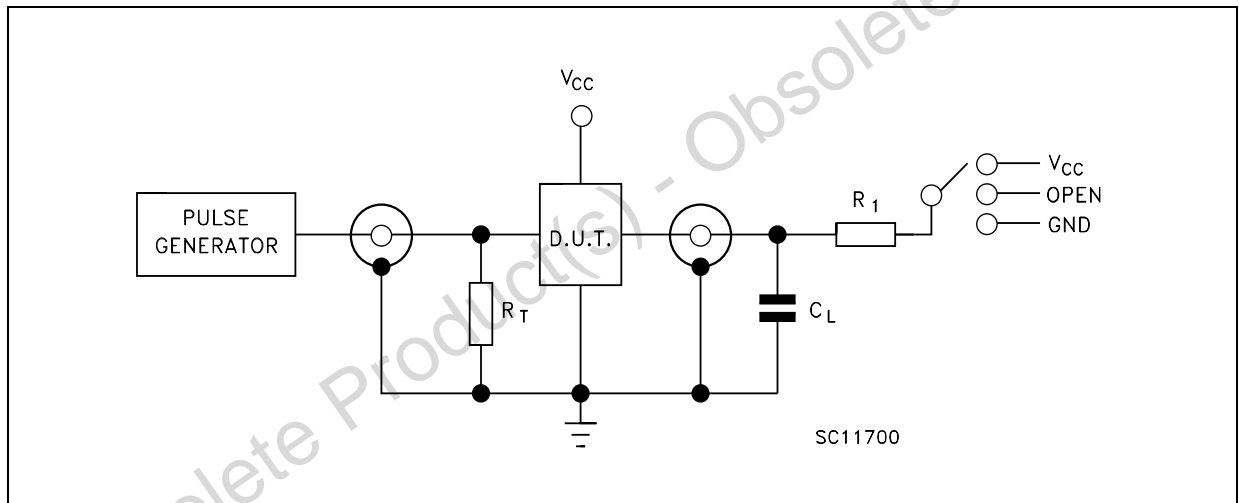
| Symbol    | Parameter                                    | Test Condition  |               | Value                    |      |      |                             |      |                              | Unit |      |
|-----------|--|-----------------|---------------|--------------------------|------|------|-----------------------------|------|------------------------------|------|------|
|           |  | $V_{CC}$<br>(V) | $C_L = 50$ pF | $T_A = 25^\circ\text{C}$ |      |      | $-40$ to $85^\circ\text{C}$ |      | $-55$ to $125^\circ\text{C}$ |      |      |
|           |  |                 |               | Min.                     | Typ. | Max. | Min.                        | Max. | Min.                         |      | Max. |
| $V_{OLP}$ | Dynamic Low Voltage Quiet Output (note 1, 2) | 5.0             | $C_L = 50$ pF |                          | 0.6  | 0.9  |                             |      |                              |      | V    |
| $V_{OLV}$ |  |                 |               | -0.9                     | -0.6 |      |                             |      |                              |      |      |
| $V_{IHD}$ | Dynamic High Voltage Input (note 1, 3)       | 5.0             |               | 3.5                      |      |      |                             |      |                              | V    |      |
| $V_{ILD}$ | Dynamic Low Voltage Input (note 1, 3)        | 5.0             |               |                          |      | 1.5  |                             |      |                              | V    |      |

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 ( $V_{IHD}$ ),  $f=1$ MHz.

Figure 4: 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)

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

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

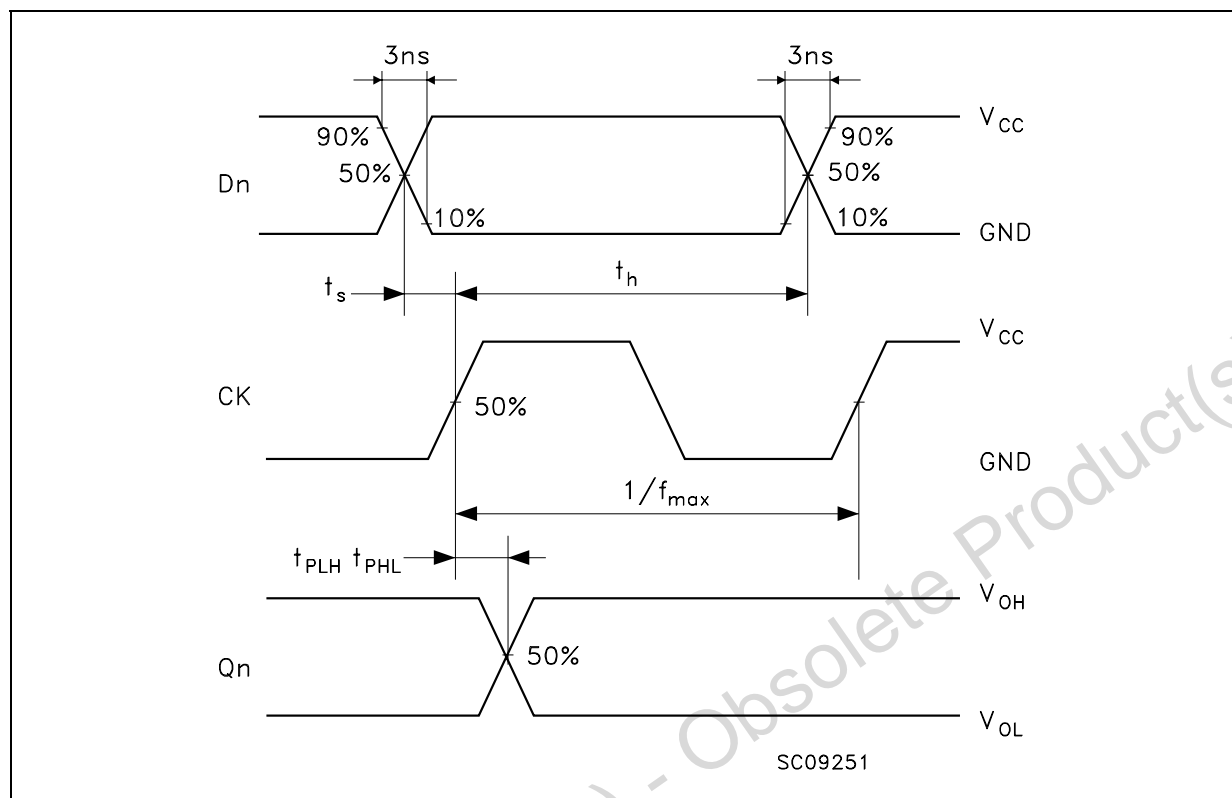
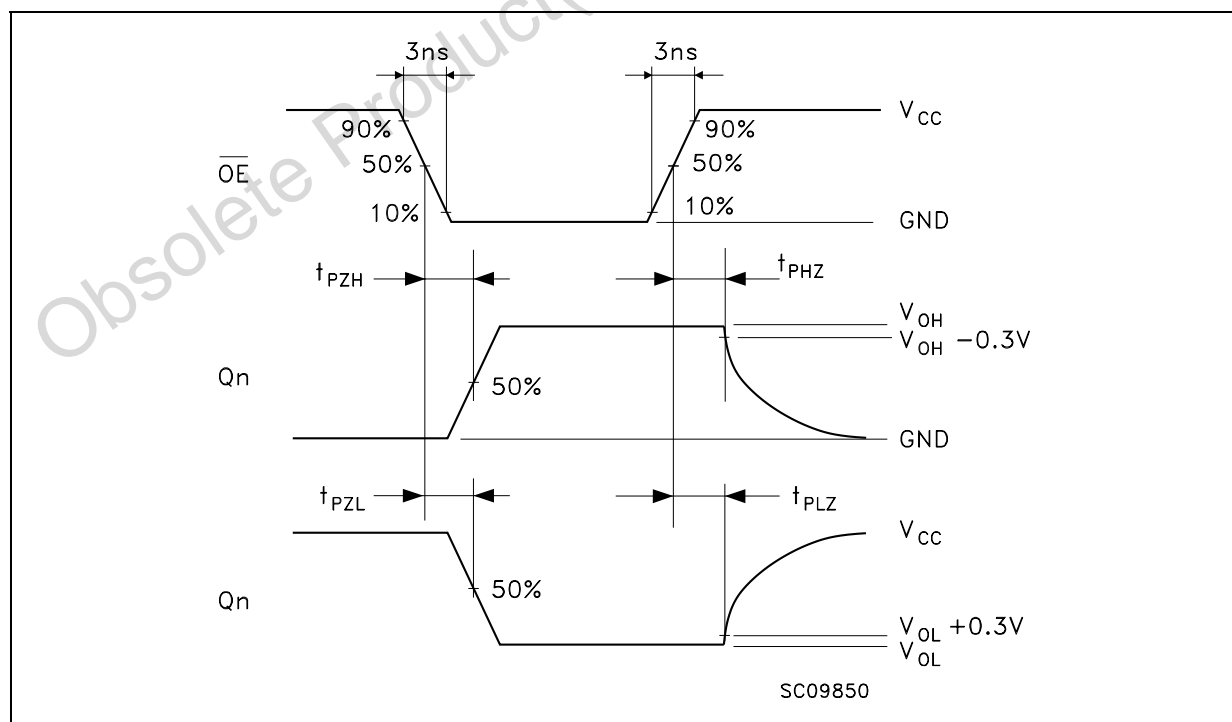
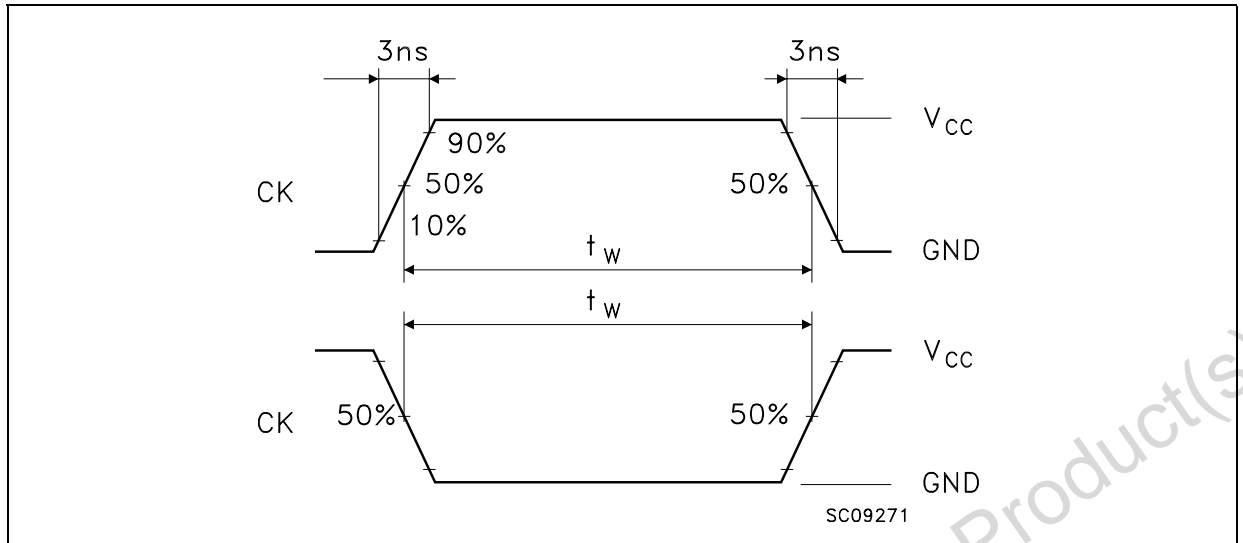
Figure 5: Waveform - Propagation Delays, Setup And Hold Times ( $f=1\text{MHz}$ ; 50% duty cycle)Figure 6: Waveform 2: Output Enable And Disable Times ( $f=1\text{MHz}$ ; 50% duty cycle)

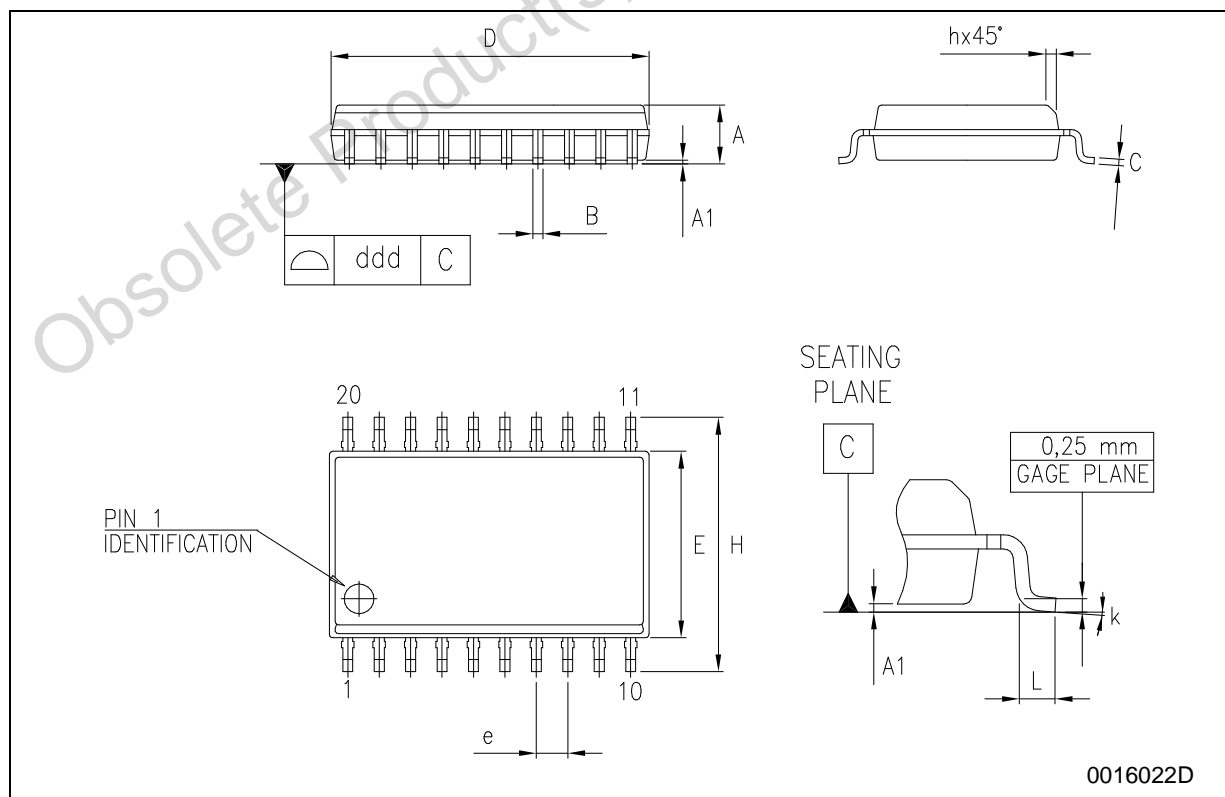
Figure 7: Waveform - Pulse Width (f=1MHz; 50% duty cycle)





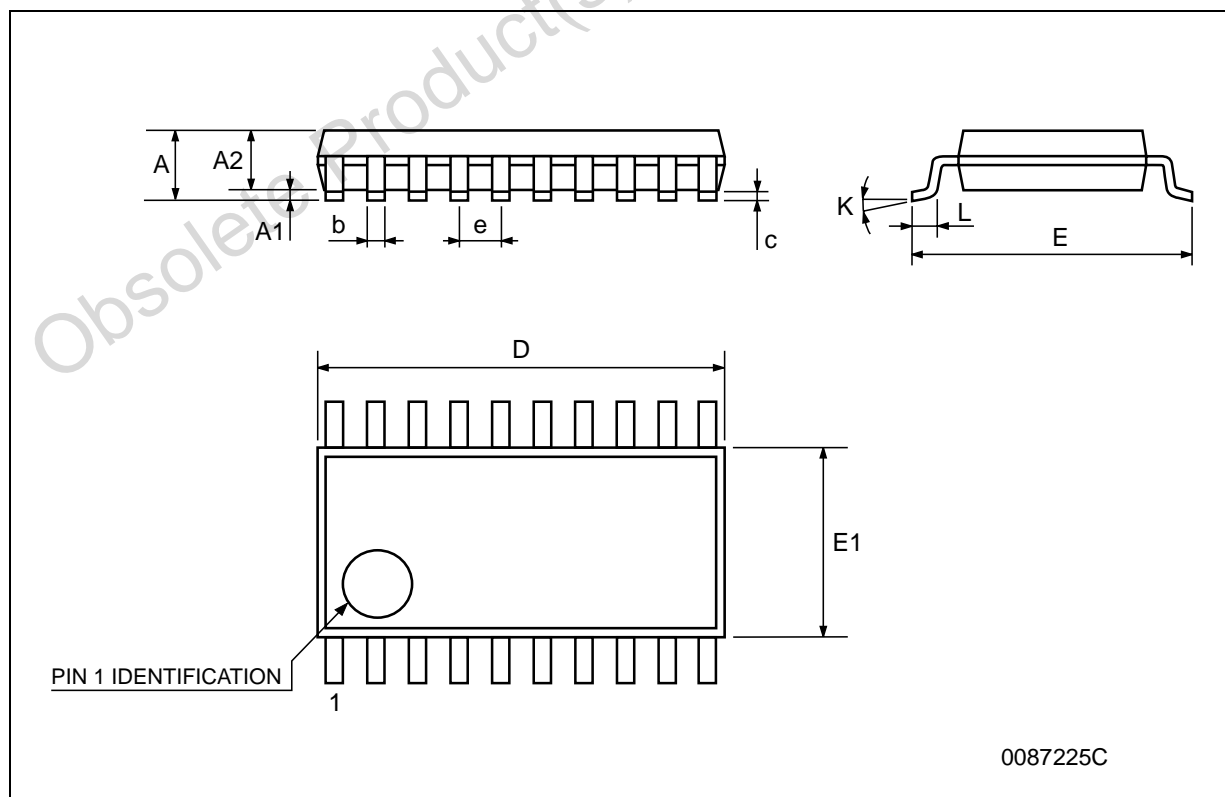
## SO-20 MECHANICAL DATA

| DIM. | mm.   |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 2.35  |      | 2.65  | 0.093 |       | 0.104 |
| A1   | 0.1   |      | 0.30  | 0.004 |       | 0.012 |
| B    | 0.33  |      | 0.51  | 0.013 |       | 0.020 |
| C    | 0.23  |      | 0.32  | 0.009 |       | 0.013 |
| D    | 12.60 |      | 13.00 | 0.496 |       | 0.512 |
| E    | 7.4   |      | 7.6   | 0.291 |       | 0.299 |
| e    |       | 1.27 |       |       | 0.050 |       |
| H    | 10.00 |      | 10.65 | 0.394 |       | 0.419 |
| h    | 0.25  |      | 0.75  | 0.010 |       | 0.030 |
| L    | 0.4   |      | 1.27  | 0.016 |       | 0.050 |
| k    | 0°    |      | 8°    | 0°    |       | 8°    |
| ddd  |       |      | 0.100 |       |       | 0.004 |



## TSSOP20 MECHANICAL DATA

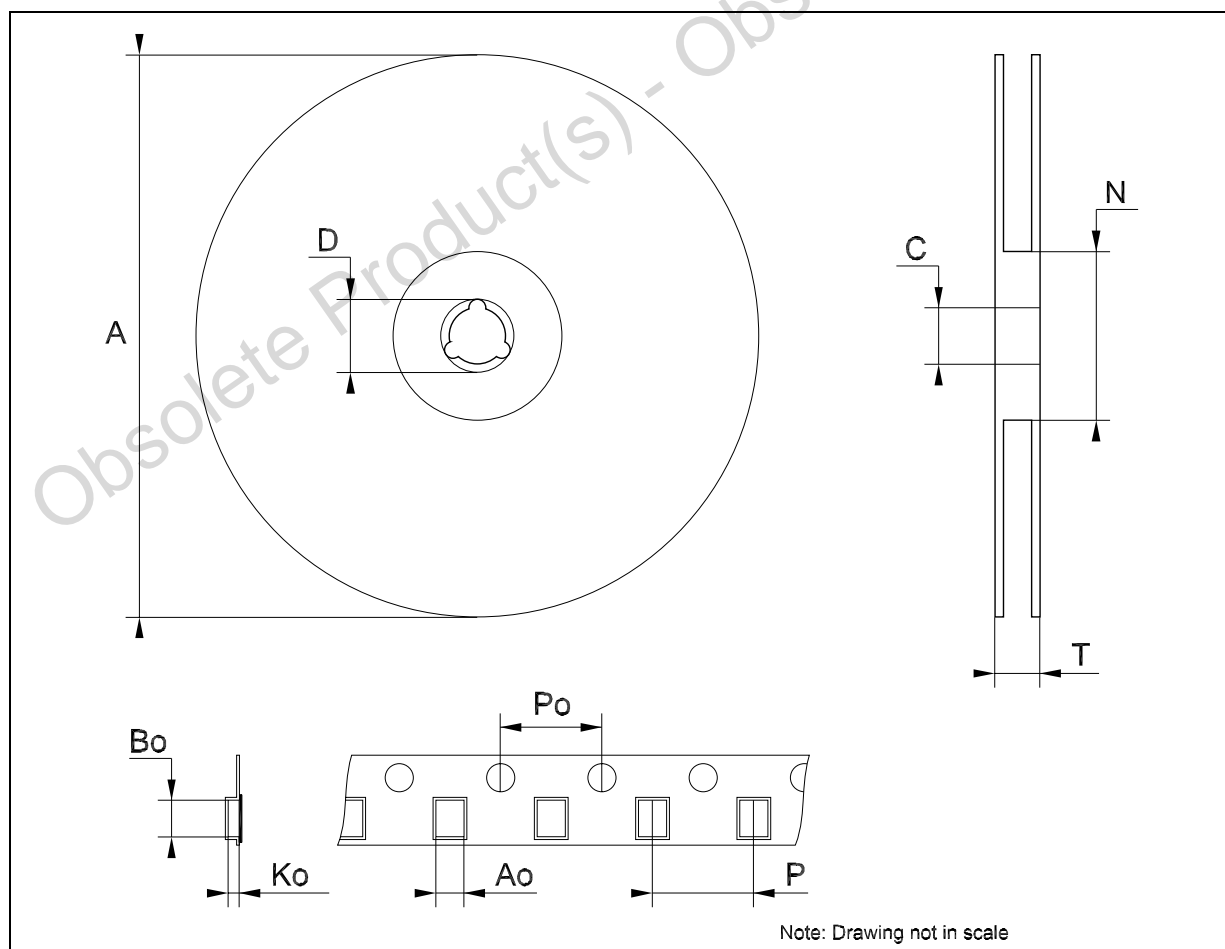
| DIM. | mm.  |          |      | inch  |            |        |
|------|------|----------|------|-------|------------|--------|
|      | MIN. | TYP      | MAX. | MIN.  | TYP.       | MAX.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 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 |            | 0.0079 |
| 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

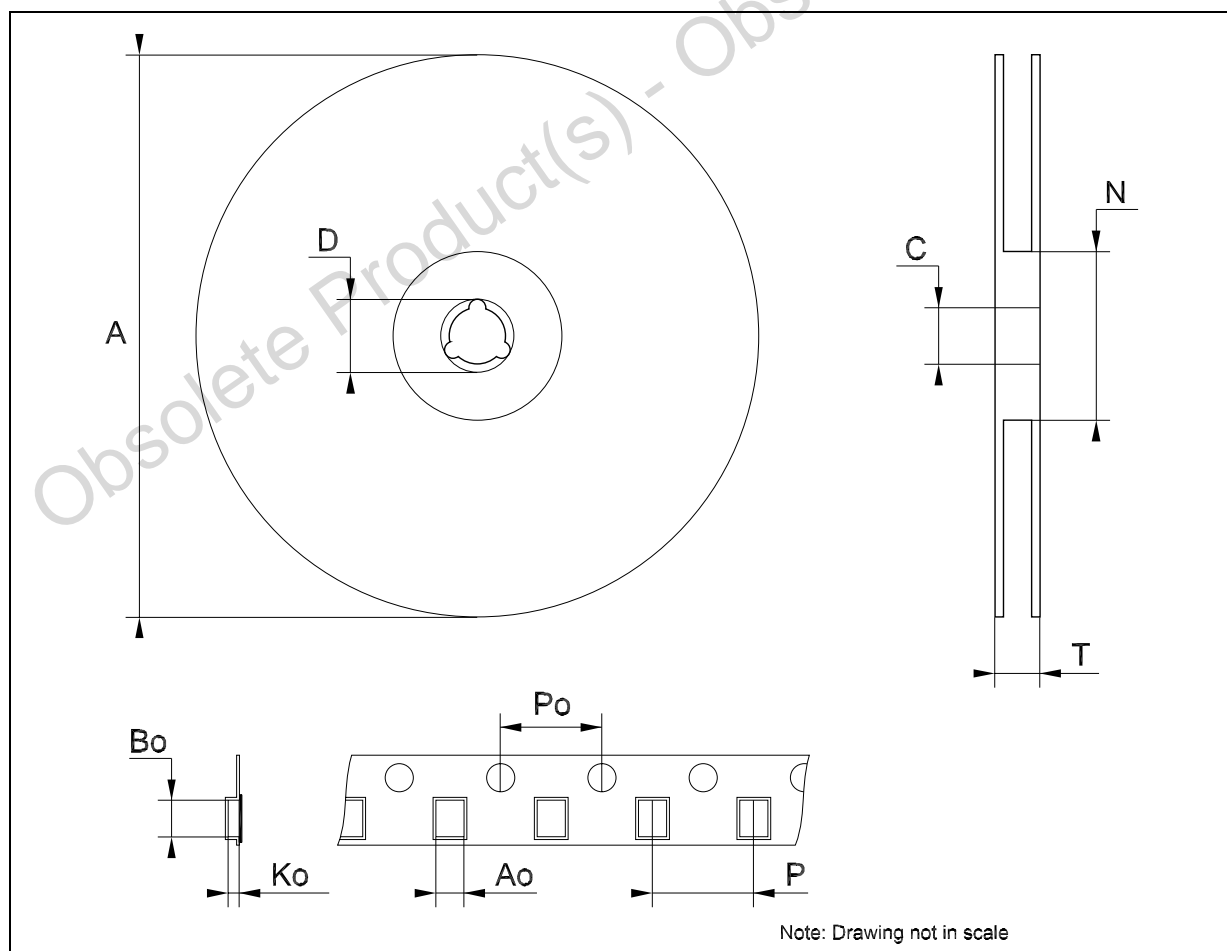
## Tape &amp; Reel SO-20 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 30.4 |       |      | 1.197  |
| Ao   | 10.8 |     | 11   | 0.425 |      | 0.433  |
| Bo   | 13.2 |     | 13.4 | 0.520 |      | 0.528  |
| Ko   | 3.1  |     | 3.3  | 0.122 |      | 0.130  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 11.9 |     | 12.1 | 0.468 |      | 0.476  |



## Tape &amp; Reel TSSOP20 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 22.4 |       |      | 0.882  |
| Ao   | 6.8  |     | 7    | 0.268 |      | 0.276  |
| Bo   | 6.9  |     | 7.1  | 0.272 |      | 0.280  |
| Ko   | 1.7  |     | 1.9  | 0.067 |      | 0.075  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 11.9 |     | 12.1 | 0.468 |      | 0.476  |



**Table 10: Revision History**

| Date        | Revision | Description of Changes         |
|-------------|----------|--------------------------------|
| 12-Nov-2004 | 4        | Order Codes Revision - pag. 1. |

Obsolete Product(s) - Obsolete Product(s)

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

All other names are the property of their respective owners

© 2004 STMicroelectronics - All Rights Reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)