

QUAD EXCLUSIVE OR GATE

- HIGH SPEED: $t_{pD} = 5.5\text{ns}$ (TYP.) at $V_{CC} = 5\text{V}$
- LOW POWER DISSIPATION:
 $I_{CC} = 2\ \mu\text{A}$ (MAX.) at $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS:
 $V_{IH} = 2\text{V}$ (MIN.), $V_{IL} = 0.8\text{V}$ (MAX)
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 8\ \text{mA}$ (MIN)
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC}(\text{OPR}) = 4.5\text{V}$ to 5.5V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 86
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE: $V_{OLP} = 0.8\text{V}$ (MAX.)

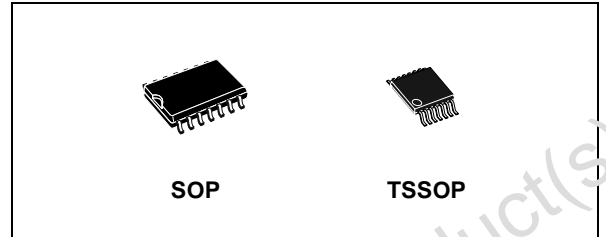


Table 1: Order Codes

| PACKAGE | T & R |
|---------|--------------|
| SOP | 74VHCT86AMTR |
| TSSOP | 74VHCT86ATTR |

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.

DESCRIPTION

The 74VHCT86A is an advanced high-speed CMOS QUAD EXCLUSIVE OR GATE fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology.

Figure 1: Pin Connection And IEC Logic Symbols

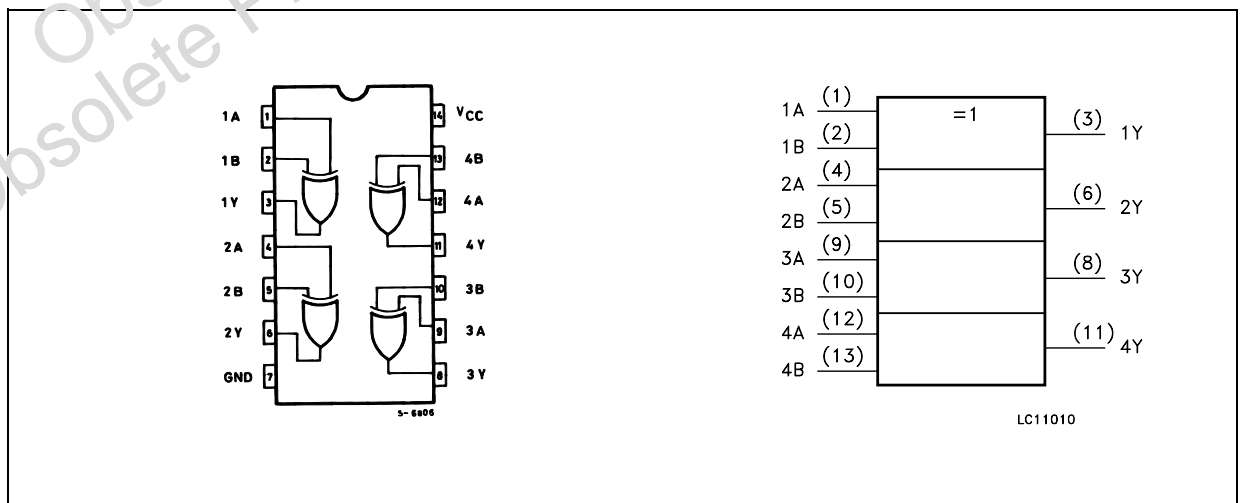


Figure 2: Input Equivalent Circuit

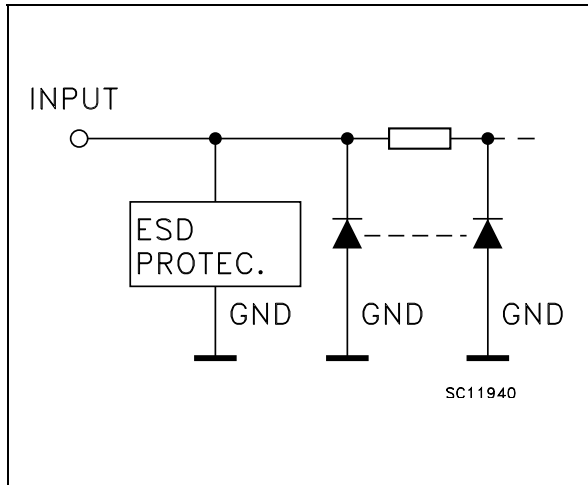


Table 2: Pin Description

| PIN N° | SYMBOL | NAME AND FUNCTION |
|--------------|-----------------|-------------------------|
| 1, 4, 9, 12 | 1A to 4A | Data Inputs |
| 2, 5, 10, 13 | 1B to 4B | Data Inputs |
| 3, 6, 8, 11 | 1Y to 4Y | Data Outputs |
| 7 | GND | Ground (0V) |
| 14 | V _{CC} | Positive Supply Voltage |

Table 3: Truth Table

| A | B | Y |
|---|---|---|
| L | L | L |
| L | H | H |
| H | L | H |
| H | H | L |

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 (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 | ± 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 conditions is not implied.

- 1) V_{CC} = 0V
- 2) High or Low State

Table 5: 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 ± 0.5V) | 0 to 20 | ns/V |

- 1) V_{CC} = 0V
- 2) High or Low State
- 3) V_{IN} from 0.8V to 2V

Table 6: DC Specifications

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|------------------|--------------------------------------|------------------------|----------------------------------------------------------|-----------------------|------|-------|-------------|-------|--------------|-------|------|
| | | V _{CC} (V) | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| V _{IH} | High Level Input Voltage | 4.5 to 5.5 | | 2 | | | 2 | | 2 | | V |
| V _{IL} | Low Level Input Voltage | 4.5 to 5.5 | | | | 0.8 | | 0.8 | | 0.8 | V |
| V _{OH} | High Level Output Voltage | 4.5 | I _O =-50 μA | 4.4 | 4.5 | | 4.4 | | 4.4 | | V |
| | | 4.5 | I _O =-8 mA | 3.94 | | | 3.8 | | 3.7 | | |
| V _{OL} | Low Level Output Voltage | 4.5 | I _O =50 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | I _O =8 mA | | | 0.36 | | 0.44 | | 0.55 | |
| I _I | Input Leakage Current | 0 to 5.5 | V _I = 5.5V or GND | | | ± 0.1 | | ± 1.0 | | ± 1.0 | μA |
| I _{CC} | Quiescent Supply Current | 5.5 | V _I = V _{CC} or GND | | | 2 | | 20 | | 20 | μA |
| +I _{CC} | Additional Worst Case Supply Current | 5.5 | One Input at 3.4V, other input at V _{CC} or GND | | | 1.35 | | 1.5 | | 1.5 | mA |
| I _{OPD} | Output Leakage Current | 0 | V _{OUT} = 5.5V | | | 0.5 | | 5.0 | | 5.0 | μA |

Table 7: AC Electrical Characteristics (Input t_r = t_f = 3ns)

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|------------------|------------------------|----------------------------|------------------------|-----------------------|------|------|-------------|------|--------------|------|------|
| | | V _{CC} (*) (V) | C _L (pF) | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| t _{PLH} | Propagation Delay Time | 5.0 | 15 | | 5.5 | 7.9 | 1.0 | 9.0 | 1.0 | 9.0 | ns |
| t _{PHL} | | 5.0 | 50 | | 6.3 | 8.5 | 1.0 | 10.0 | 1.0 | 10.0 | |

(*) Voltage range is 5.0V ± 0.5V

Table 8: Capacitive Characteristics

| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|-----------------|----------------------------------------|----------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
| | | | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| C _{IN} | Input Capacitance | | | | 6 | 10 | | 10 | | 10 | pF |
| C _{PD} | Power Dissipation Capacitance (note 1) | | | | 18 | | | | | | 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/4} (per gate)

Table 9: Dynamic Switching Characteristics

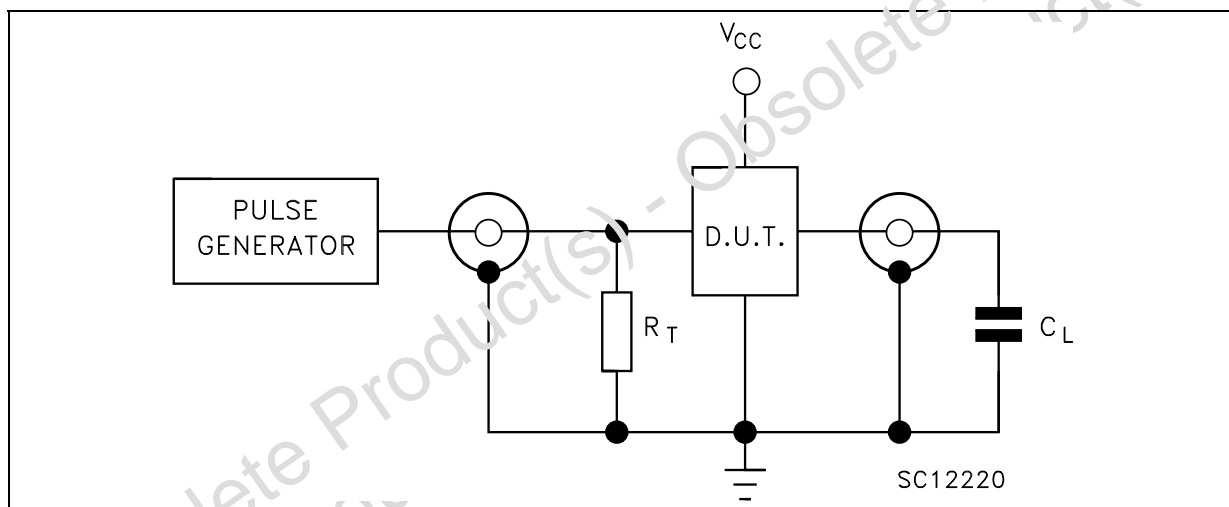
| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|------------------|----------------------------------------------|------------------------|------------------------|-----------------------|------|------|-------------|------|--------------|------|------|
| | | V _{CC} (V) | C _L = 50 pF | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| V _{OLP} | Dynamic Low Voltage Quiet Output (note 1, 2) | 5.0 | C _L = 50 pF | | 0.3 | 0.8 | | | | | V |
| V _{OLV} | | | | -0.8 | -0.3 | | | | | | |
| V _{IHD} | Dynamic High Voltage Input (note 1, 3) | 5.0 | | 2.0 | | | | | | | |
| V _{ILD} | Dynamic Low Voltage Input (note 1, 3) | 5.0 | | | | 0.8 | | | | | |

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.

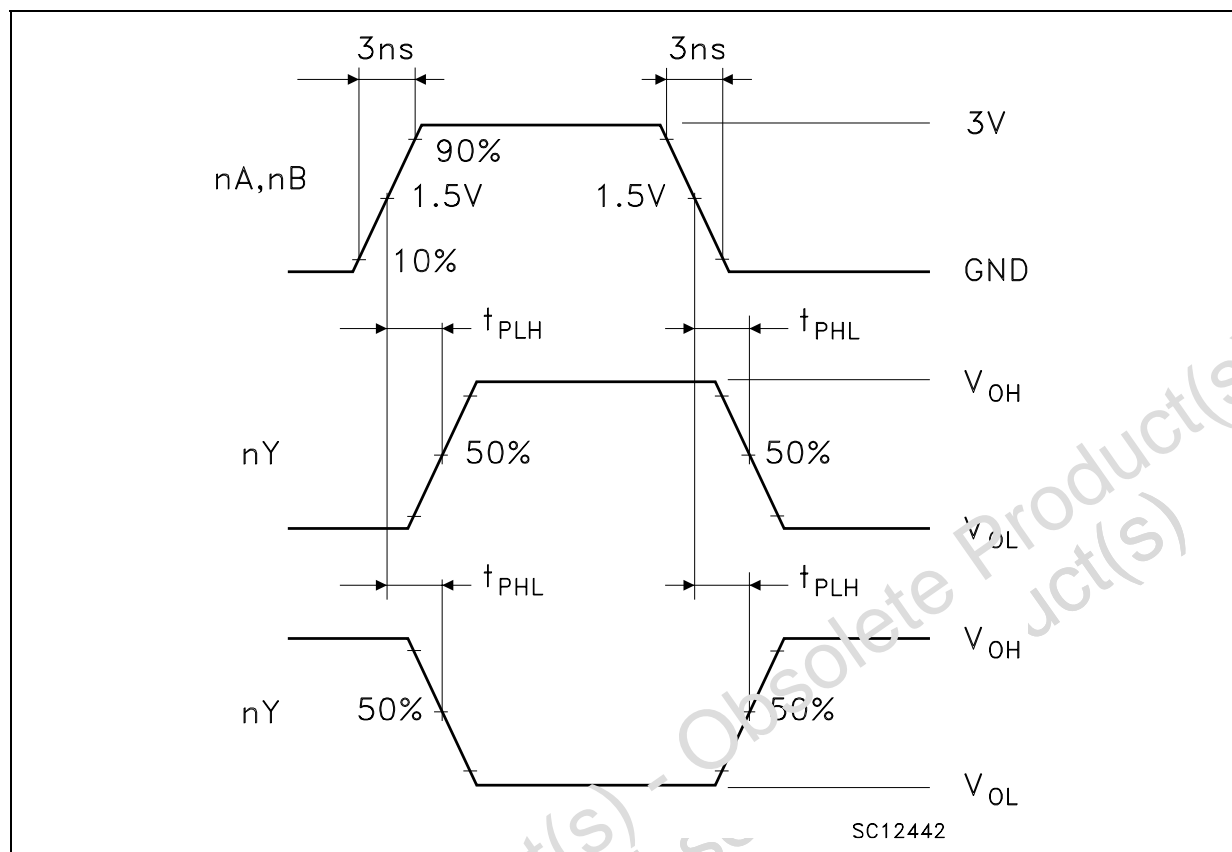
3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.0V. Inputs under test switching: 3.0V to threshold (V_{IL}), 0V to threshold (V_{IHD}), f=1MHz.

Figure 3: Test Circuit



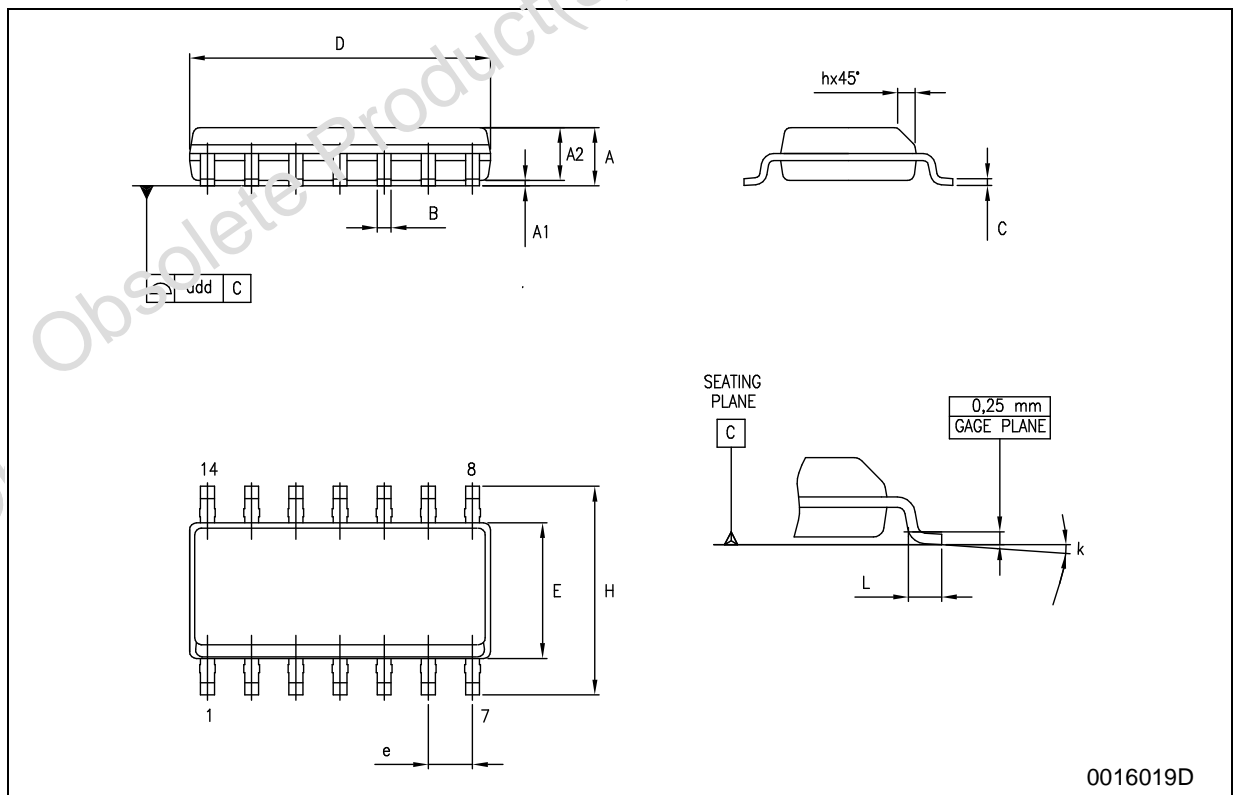
C_L = 15/50pF or equivalent (includes jig and probe capacitance)

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

Figure 4: Waveform - Propagation Delays ($f=1\text{MHz}$; 50% duty cycle)

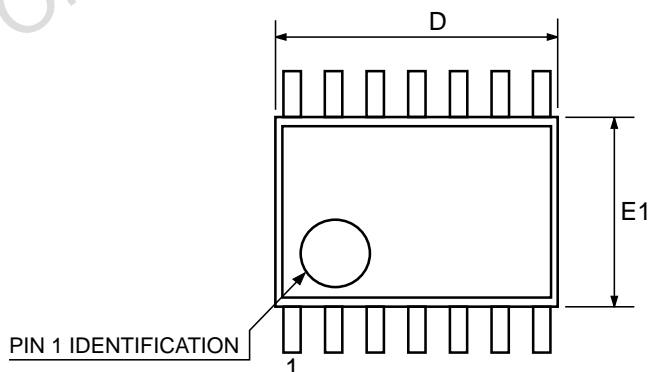
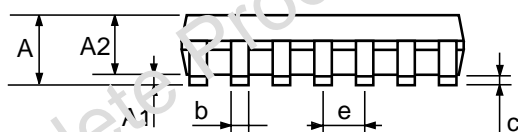
SO-14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 1.35 | | 1.75 | 0.053 | | 0.069 |
| A1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| A2 | 1.10 | | 1.65 | 0.043 | | 0.065 |
| B | 0.33 | | 0.51 | 0.013 | | 0.020 |
| C | 0.19 | | 0.25 | 0.007 | | 0.010 |
| D | 8.55 | | 8.75 | 0.337 | | 0.344 |
| E | 3.8 | | 4.0 | 0.150 | | 0.157 |
| e | | 1.27 | | | 0.050 | |
| H | 5.8 | | 6.2 | 0.228 | | 0.244 |
| h | 0.25 | | 0.50 | 0.010 | | 0.020 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| k | 0° | | 8° | 0° | | 8° |
| ddd | | | 0.100 | | | 0.004 |



TSSOP14 MECHANICAL DATA

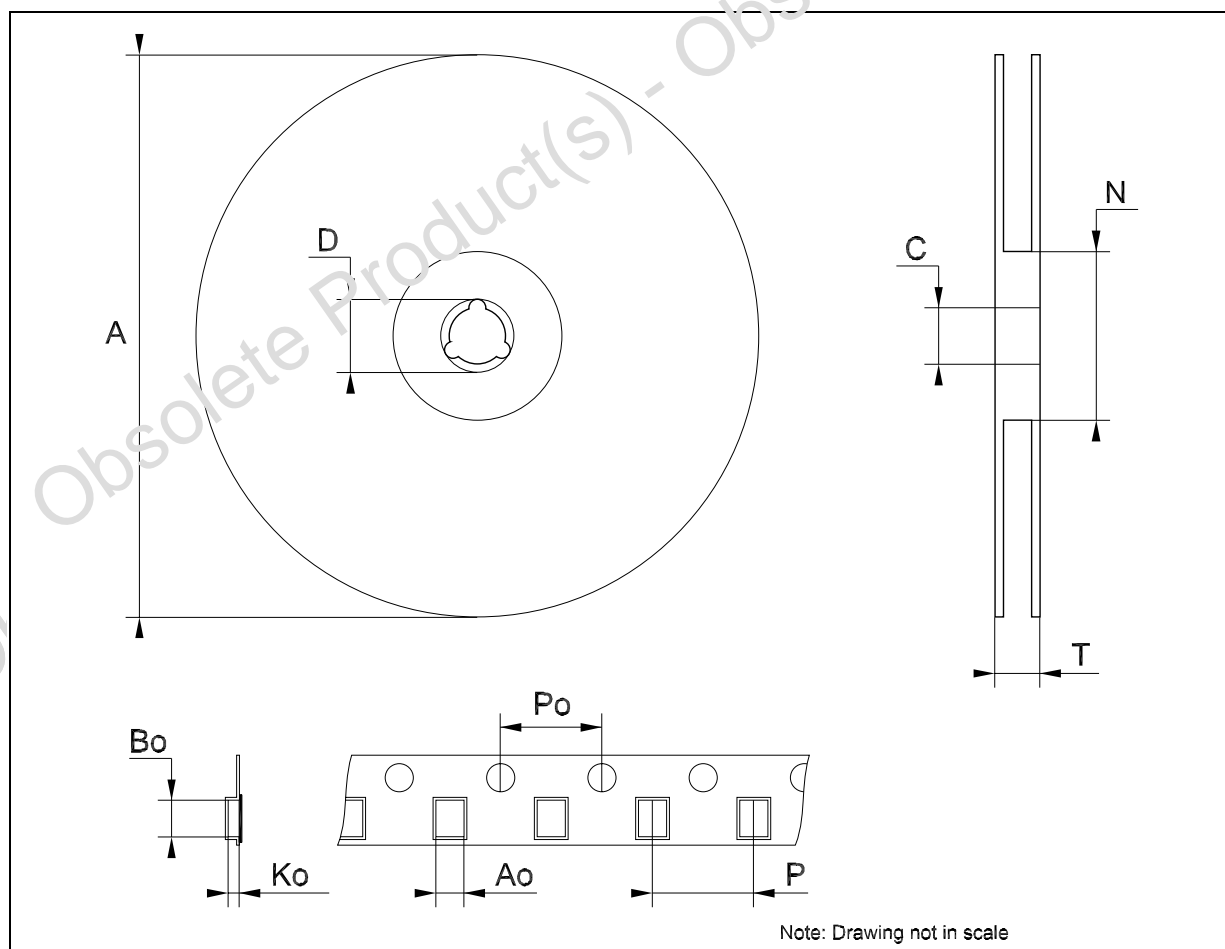
| DIM. | mm. | | | inch | | |
|------|------|----------|------|-------|------------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.2 | | | 0.047 |
| A1 | 0.05 | | 0.15 | 0.002 | 0.004 | 0.006 |
| A2 | 0.8 | 1 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.012 |
| c | 0.09 | | 0.20 | 0.004 | | 0.008 |
| D | 4.9 | 5 | 5.1 | 0.193 | 0.197 | 0.201 |
| 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 |



0080337D

Tape & Reel SO-14 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 | 6.4 | | 6.6 | 0.252 | | 0.260 |
| Bo | 9 | | 9.2 | 0.354 | | 0.362 |
| Ko | 2.1 | | 2.3 | 0.082 | | 0.090 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |



Tape & Reel TSSOP14 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 | 6.7 | | 6.9 | 0.264 | | 0.272 |
| Bo | 5.3 | | 5.5 | 0.209 | | 0.217 |
| Ko | 1.6 | | 1.8 | 0.063 | | 0.071 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |

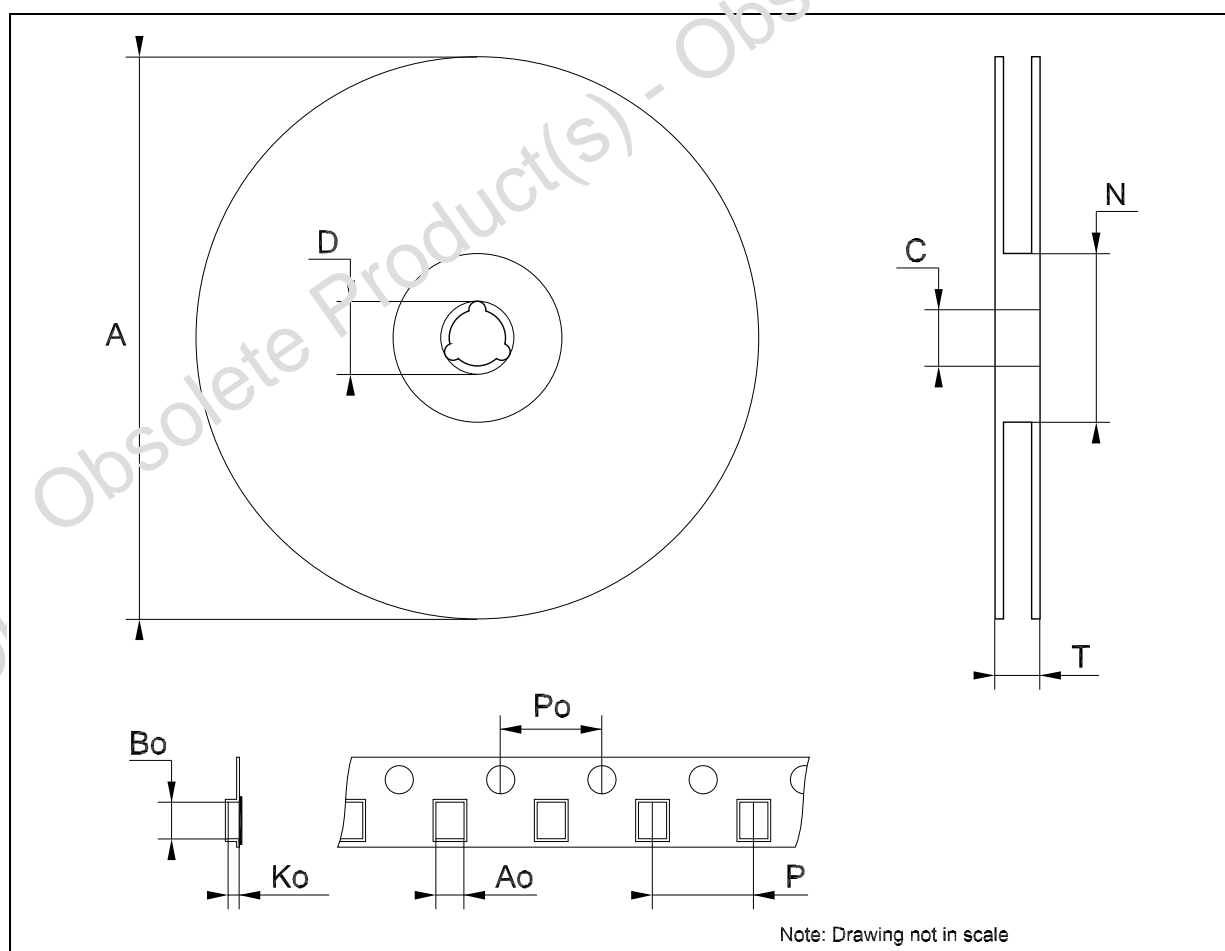


Table 10: Revision History

| Date | Revision | Description of Changes |
|-------------|----------|--------------------------------|
| 16-Dec-2004 | 4 | Order Codes Revision - pag. 1. |

Obsolete Product(s) - Obsolete Product(s)
Obsolete Product(s) - Obsolete Product(s)

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