

OCTAL BUS TRANSCEIVER (3-STATE)

- HIGH SPEED: $t_{pD} = 4.5 \text{ ns}$ (TYP.) at $V_{CC} = 5V$
- LOW POWER DISSIPATION:
 $I_{CC} = 4 \mu\text{A}$ (MAX.) at $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS:
 $V_{IH} = 2V$ (MIN.), $V_{IL} = 0.8V$ (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:
 $V_{CC}(\text{OPR}) = 4.5V \text{ to } 5.5V$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 245
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE: $V_{OLP} = 0.9V$ (MAX.)

DESCRIPTION

The 74VHCT245A is an advanced high-speed CMOS OCTAL BUS TRANSCEIVER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. This IC is intended for two-way asynchronous communication between data busses; the

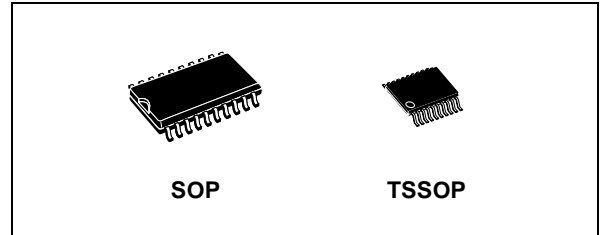


Table 1: Order Codes

| PACKAGE | T & R |
|---------|---------------|
| SOP | 74VHCT245AMTR |
| TSSOP | 74VHCT245ATTR |

direction of data transmission is determined by DIR input. The enable input \bar{G} can be used to disable the device so that the busses are effectively isolated.

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

All floating bus terminals during High Z State must be held HIGH or LOW.

Figure 1: Pin Connection And IEC Logic Symbols

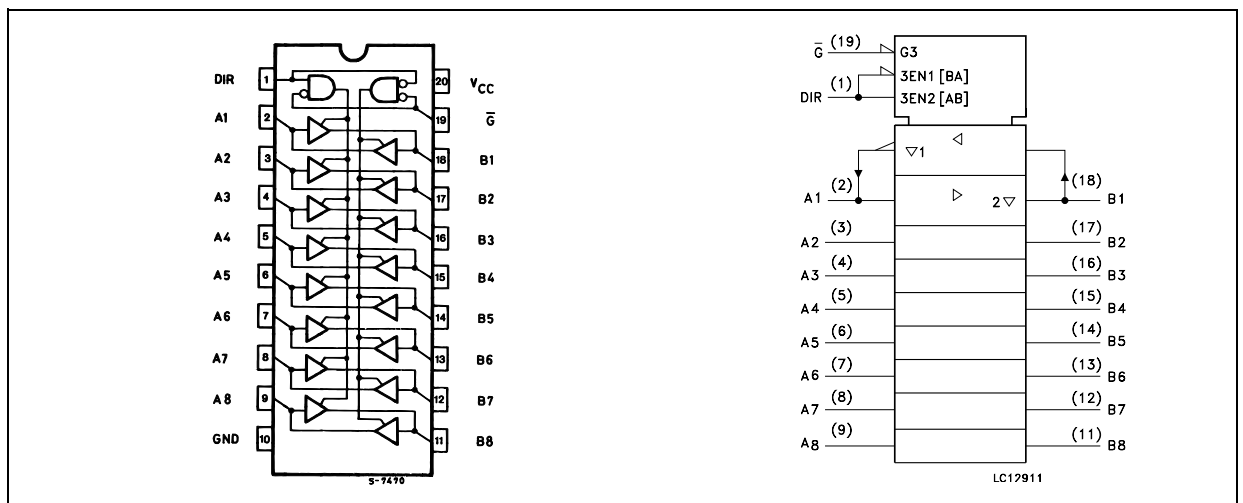


Figure 2: Input/ Output Equivalent Circuit

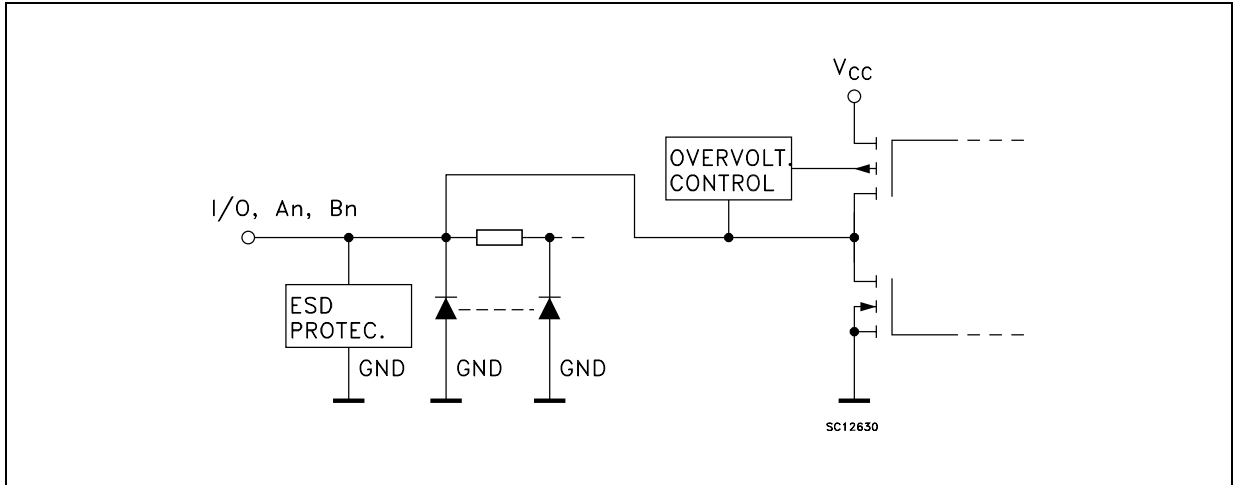


Figure 3: Input Equivalent Circuit

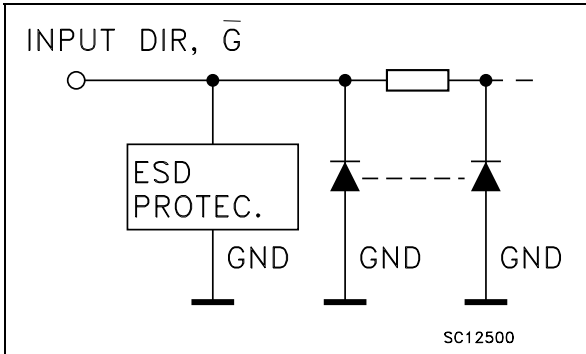


Table 2: Pin Description

| PIN N° | SYMBOL | NAME AND FUNCTION |
|--------------------------------|-----------------|-------------------------|
| 1 | DIR | Directional Control |
| 2, 3, 4, 5, 6, 7, 8, 9 | A1 to A8 | Data Inputs/Outputs |
| 18, 17, 16, 15, 14, 13, 12, 11 | B1 to B8 | Data Inputs/Outputs |
| 19 | G-bar | Enable Input |
| 10 | GND | Ground (0V) |
| 20 | V _{CC} | Positive Supply Voltage |

Table 3: Truth Table

| INPUTS | | FUNCTION | | OUTPUT |
|--------|-----|----------|--------|--------|
| G-bar | DIR | A BUS | B BUS | |
| L | L | OUTPUT | INPUT | A = B |
| L | H | INPUT | OUTPUT | B = A |
| H | X | Z | Z | Z |

X : Don't Care
Z : High Impedance

Table 4: Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|-----------------------|---------------------------------|------------------------|------|
| V_{CC} | Supply Voltage | -0.5 to +7.0 | V |
| V_I | DC Input Voltage (DIR, G) | -0.5 to +7.0 | V |
| $V_{I/O}$ | DC BUS I/O Voltage (see note 1) | -0.5 to +7.0 | V |
| $V_{I/O}$ | DC BUS I/O 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 | ± 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

- 1) Output in OFF State
- 2) High or Low State. I_O absolute maximum rating must be observed

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 |
| $V_{I/O}$ | BUS I/O Voltage (see note 1) | 0 to 5.5 | V |
| $V_{I/O}$ | BUS I/O 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. I_O absolute maximum rating must be observed
- 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 _{OZ} | High Impedance Output Leakage Current | 5.5 | V _I = V _{IH} or V _{IL} V _O = 0V to 5.5V | | | ±0.25 | | ± 2.5 | | ± 2.5 | μA |
| 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 | | | 4 | | 40 | | 40 | 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} t _{PHL} | Propagation Delay Time | 5.0 | 15 | | | 4.5 | 7.5 | 1.0 | 8.5 | 1.0 | 10.0 | ns |
| | | 5.0 | 50 | | | 5.3 | 8.7 | 1.0 | 9.5 | 1.0 | 11.0 | |
| t _{PZL} t _{PZH} | Output Enable Time | 5.0 | 15 | RL = 1KΩ | | 9.0 | 13.8 | 1.0 | 15.0 | 1.0 | 16.0 | ns |
| | | 5.0 | 50 | | | 9.7 | 14.8 | 1.0 | 16.0 | 1.0 | 17.0 | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 5.0 | 50 | RL = 1KΩ | | 10.0 | 15.4 | 1.0 | 16.5 | 1.0 | 17.5 | ns |
| t _{OSLH} t _{OSHL} | Output to Output Skew Time (note 1) | 5.0 | 50 | | | | 1.0 | | 1.0 | | 1.0 | ns |

(*) Voltage range is 5.0V ± 0.5V

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°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 _{I/O} | Bus Input Capacitance | | 8 | | | | | | 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}/8 (per circuit)

Table 4: DYNAMIC SWITCHING CHARACTERISTICS

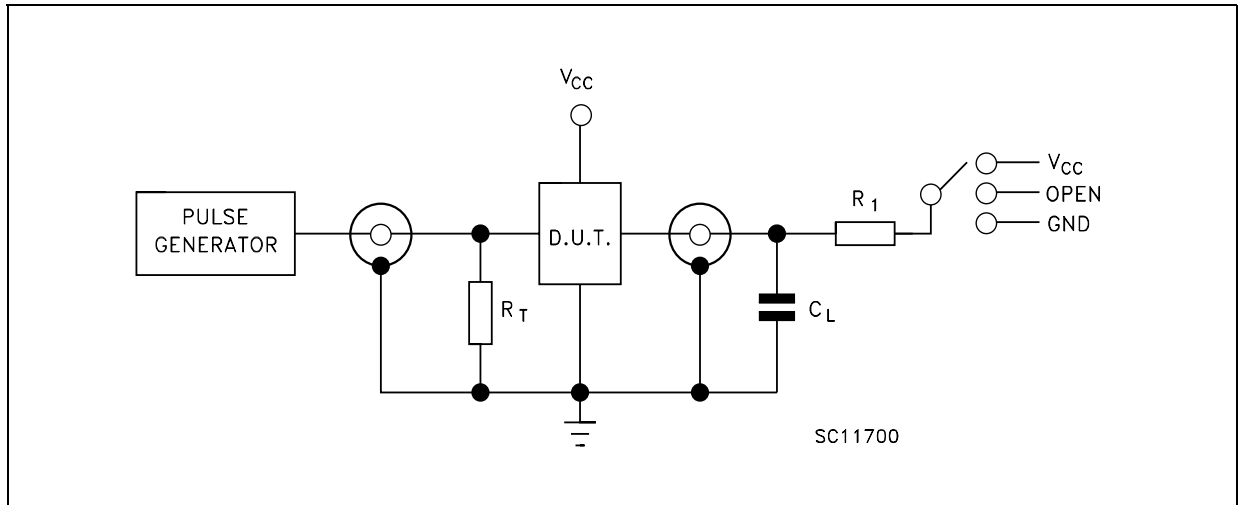
| Symbol | Parameter | Test Condition | | Value | | | | | | Unit | |
|------------------|--|---------------------|------------------------|-----------------------|------|------|-------------|------|--------------|------|------|
| | | | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | V _{CC} (V) | | 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 | | 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_{ILD}), 0V to threshold (V_{IHD}), f=1MHz.

Figure 5: 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 50Ω)

Figure 6: Waveform - Propagation Delays ($f=1\text{MHz}$; 50% duty cycle)

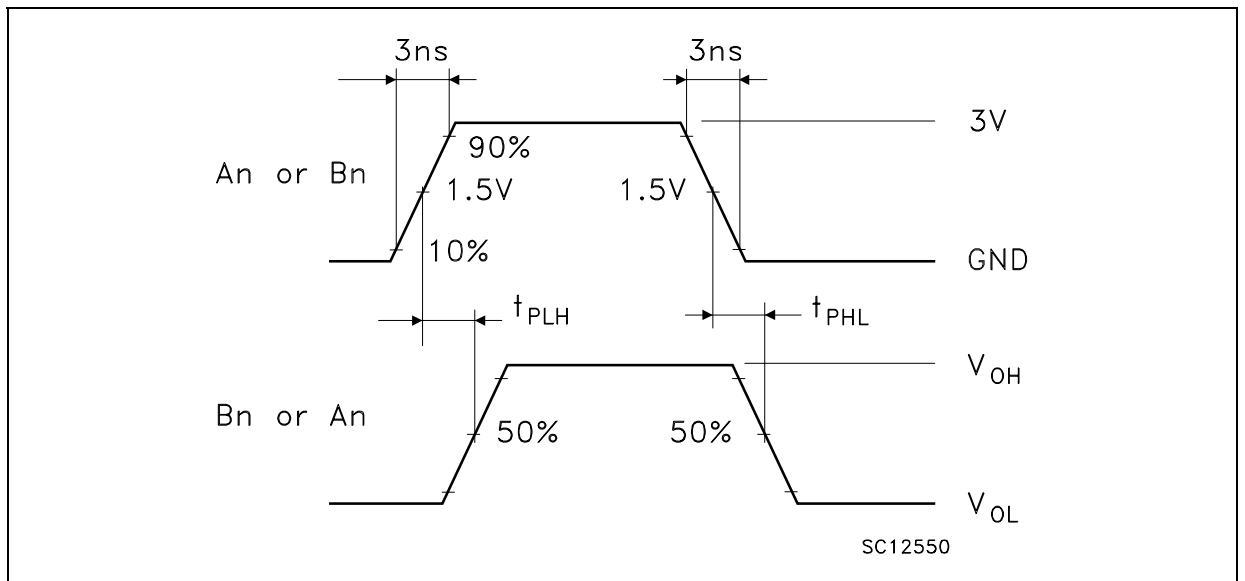
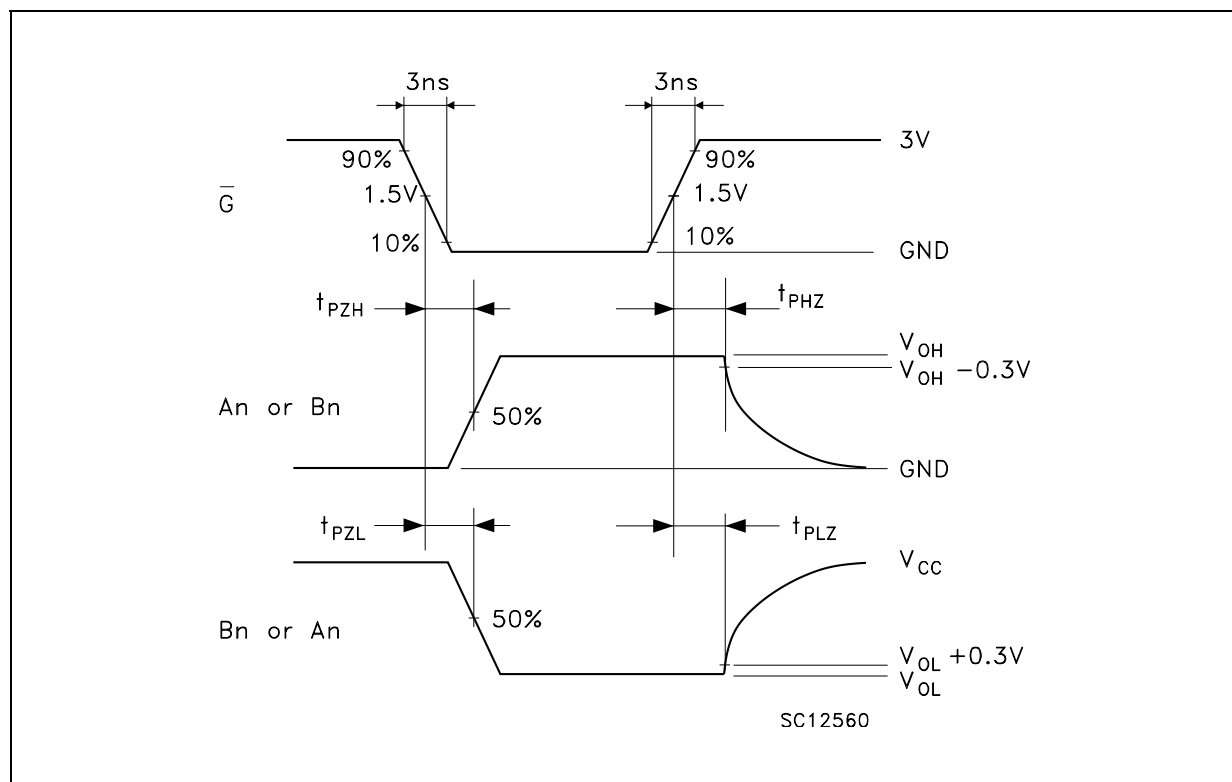
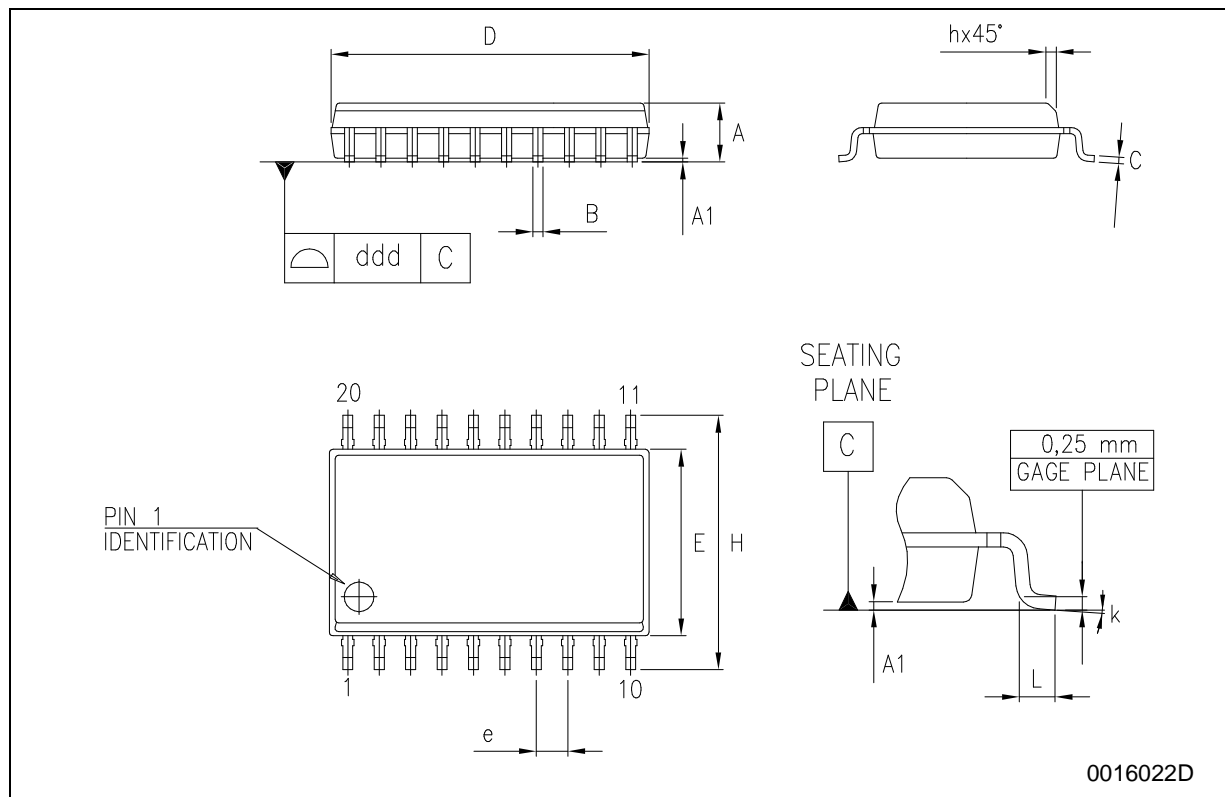


Figure 7: Waveform - Output Enable And Disable Time (f=1MHz; 50% duty cycle)



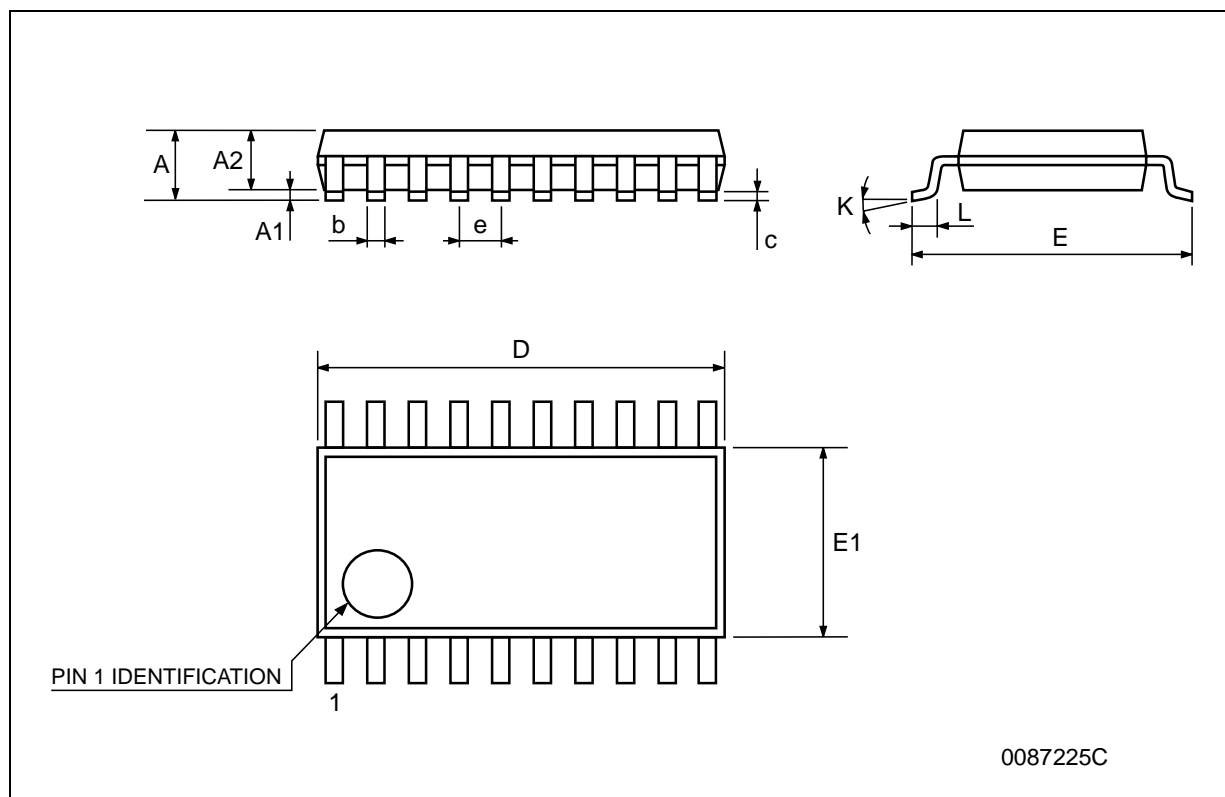
SO-20 MECHANICAL DATA

| 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 |



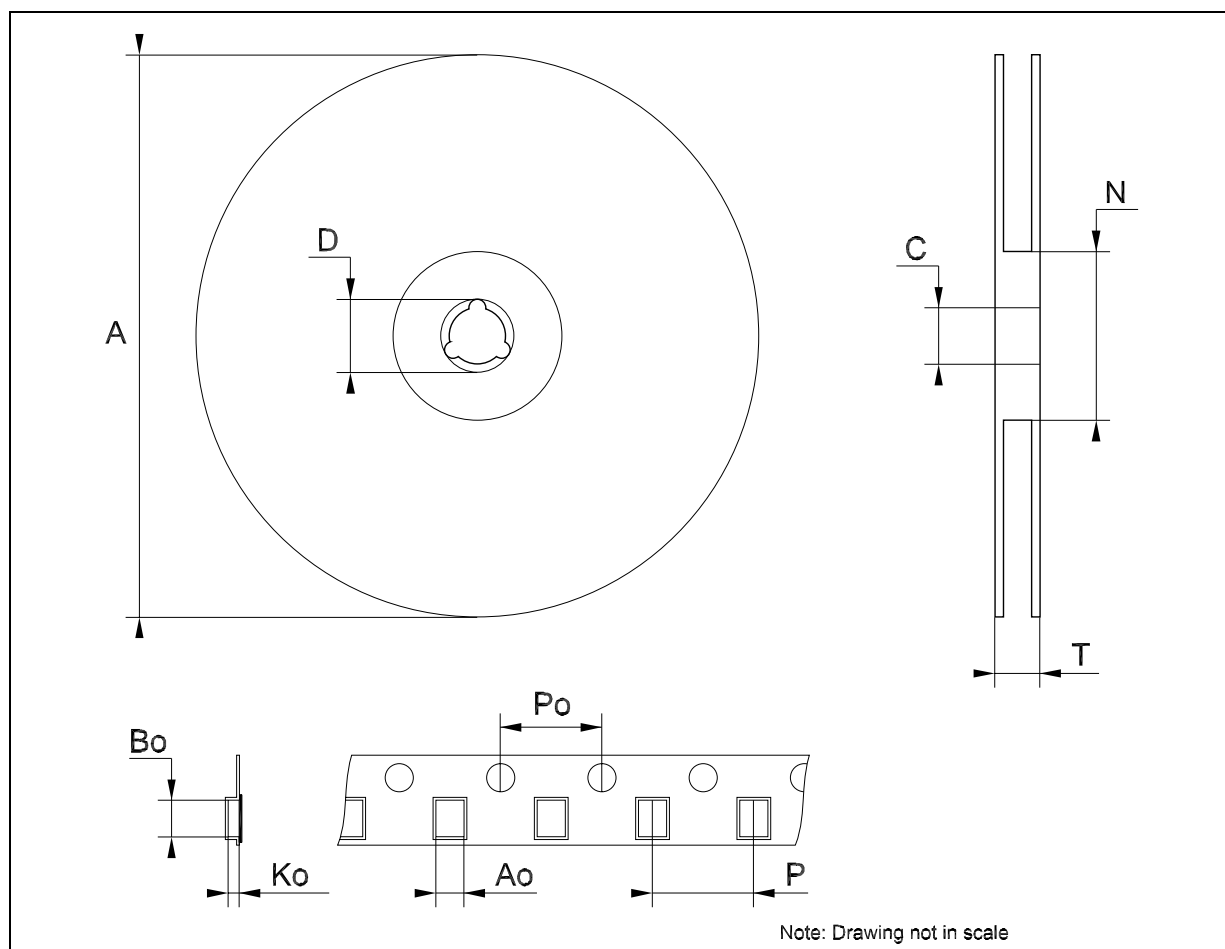
TSSOP20 MECHANICAL DATA

| 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 |



Tape & 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 & 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 |

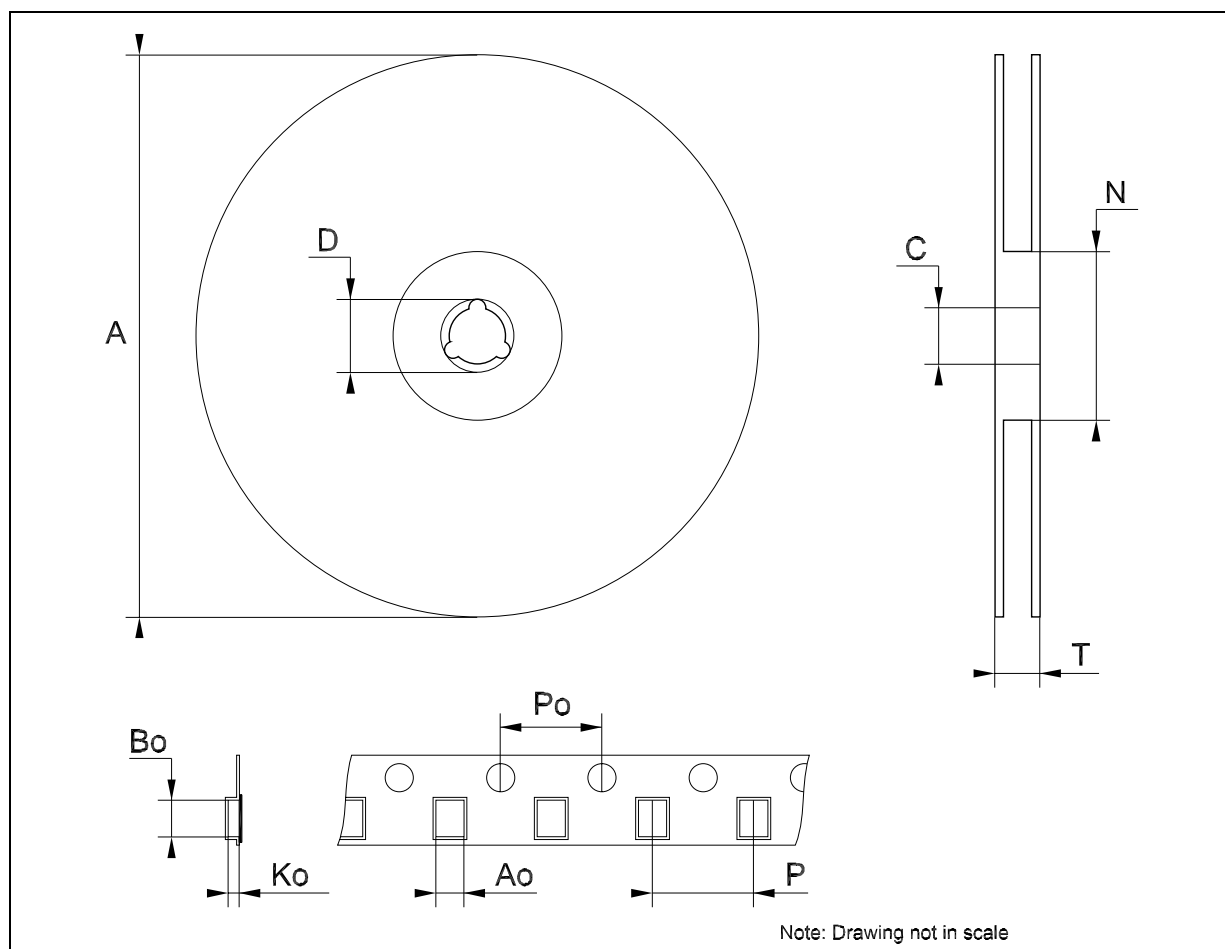


Table 9: Revision History

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

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