



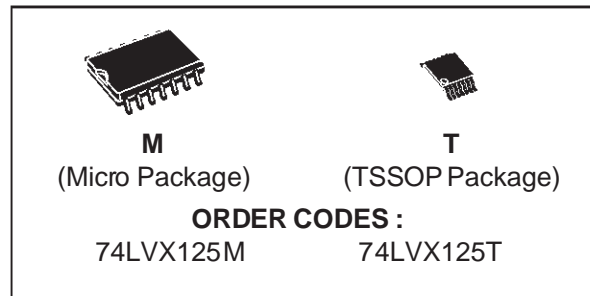
74LVX125

LOW VOLTAGE QUAD BUS BUFFERS (3-STATE) WITH 5V TOLERANT INPUTS

- HIGH SPEED: $t_{PD} = 4.4 \text{ ns}$ (TYP.) at $V_{CC} = 3.3V$
- 5V TOLERANT INPUTS
- POWER-DOWN PROTECTION ON INPUTS
INPUT VOLTAGE LEVEL:
 $V_{IL} = 0.8V$, $V_{IH} = 2V$ at $V_{CC} = 3V$
- LOW POWER DISSIPATION:
 $I_{CC} = 2 \mu A$ (MAX.) at $T_A = 25^\circ C$
- LOW NOISE:
 $V_{OLP} = 0.3V$ (TYP.) at $V_{CC} = 3.3V$
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 4 \text{ mA}$ (MIN)
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
 V_{CC} (OPR) = 2V to 3.6V (1.2V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH
74 SERIES 125
- IMPROVED LATCH-UP IMMUNITY

DESCRIPTION

The LVX125 is a low voltage CMOS QUAD BUS BUFFERS fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. It is ideal for low power and low noise 3.3V applications.



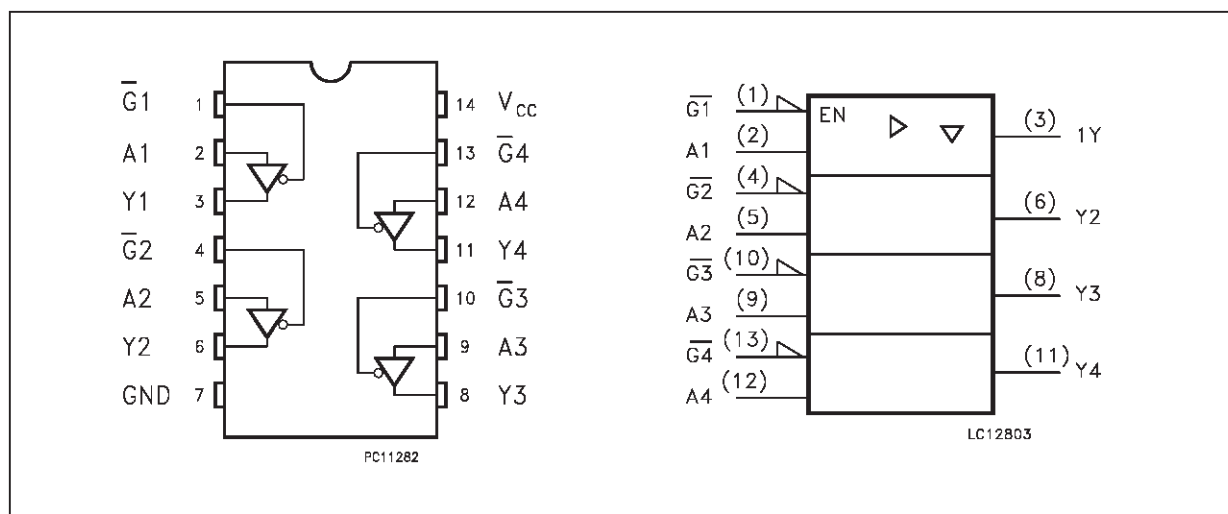
This device requires the 3-STATE control input \bar{G} to be set high to place the output into the high impedance state.

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

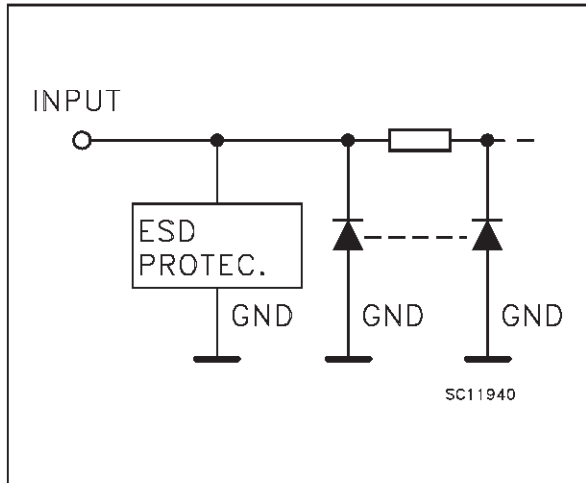
Power down protection is provided on all inputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V.

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

PIN CONNECTION AND IEC LOGIC SYMBOLS



INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|--------------|------------------------------------|-------------------------|
| 1, 4, 10, 13 | $\overline{G1}$ to $\overline{G4}$ | Output Enable Inputs |
| 2, 5, 9, 12 | A1 to A4 | Data Inputs |
| 3, 6, 8, 11 | Y1 to Y4 | Data Outputs |
| 7 | GND | Ground (0V) |
| 14 | V _{CC} | Positive Supply Voltage |

TRUTH TABLE

| A | \overline{G} | Y |
|---|----------------|---|
| X | H | Z |
| L | L | L |
| H | L | H |

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 | °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 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 | °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 | |
|-----------------|--------------------------------|-----------------|--|------------------------|------------------------|------|-------|--------------|------|------|
| | | | | V _{CC} (V) | T _A = 25 °C | | | -40 to 85 °C | | |
| | | | | | 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 = 5.5V 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 | | | | 4 | | 40 | μA |

(*) All outputs loaded.

DYNAMIC SWITCHING CHARACTERISTICS

| Symbol | Parameter | Test Conditions | | Value | | | | | Unit | |
|------------------|--|-----------------|------------------------|------------------------|------------------------|------|------|--------------|------|------|
| | | | | V _{CC} (V) | T _A = 25 °C | | | -40 to 85 °C | | |
| | | | | | Min. | Typ. | Max. | Min. | | Max. |
| V _{OLP} | Dynamic Low Voltage | 3.3 | C _L = 50 pF | | 0.3 | 0.5 | | | V | |
| V _{OLV} | Quiet Output (note 1, 2) | | | -0.5 | -0.3 | | | | | |
| V _{IHD} | Dynamic High Voltage Input (note 1, 3) | | | | | 2 | | | | |
| V _{ILD} | Dynamic Low Voltage Input (note 1, 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 (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 | 2.7 | 15 | | | 5.8 | 10.1 | 1.0 | 13.5 | ns |
| | | 2.7 | 50 | | | 8.3 | 13.6 | 1.0 | 17.0 | |
| | | 3.3 ^(*) | 15 | | | 4.4 | 6.2 | 1.0 | 8.5 | |
| | | 3.3 ^(*) | 50 | | | 6.9 | 9.7 | 1.0 | 12.0 | |
| t _{PZL} t _{PZH} | Output Enable Time | 2.7 | 15 | R _L = 1 KΩ | | 5.3 | 9.3 | 1.0 | 12.5 | ns |
| | | 2.7 | 50 | | | 7.8 | 12.8 | 1.0 | 16.0 | |
| | | 3.3 ^(*) | 15 | | | 4.0 | 5.6 | 1.0 | 7.5 | |
| | | 3.3 ^(*) | 50 | | | 6.5 | 9.1 | 1.0 | 11.0 | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 2.7 | 50 | R _L = 1 KΩ | | 10.0 | 15.7 | 1.0 | 19.0 | ns |
| | | 3.3 ^(*) | 50 | | | 8.3 | 11.2 | 1.0 | 13.0 | |
| t _{OSLH} t _{OSHL} | Output to Output Skew Time (note 1, 2) | 2.7 | 50 | | | | 1.5 | | 1.5 | ns |
| | | 3.3 ^(*) | 50 | | | | 1.5 | | 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

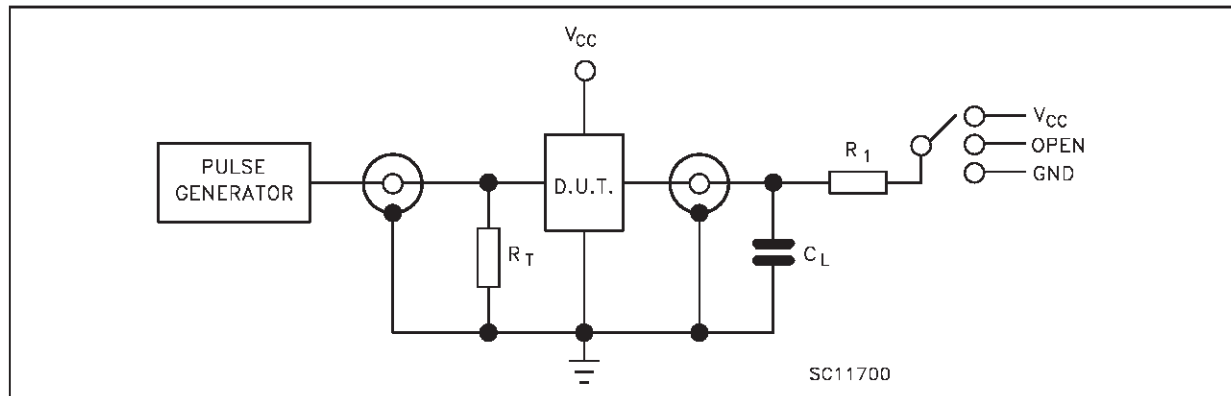
(*) Voltage range is 3.3V ± 0.3V

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 | | | 4 | 10 | | 10 | pF |
| C _{OUT} | Output Capacitance | 3.3 | | | 6 | | | | pF |
| C _{PD} | Power Dissipation Capacitance (note 1) | 3.3 | f _{IN} = 10 MHz | | 14 | | | | 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 circuit)

TEST CIRCUIT

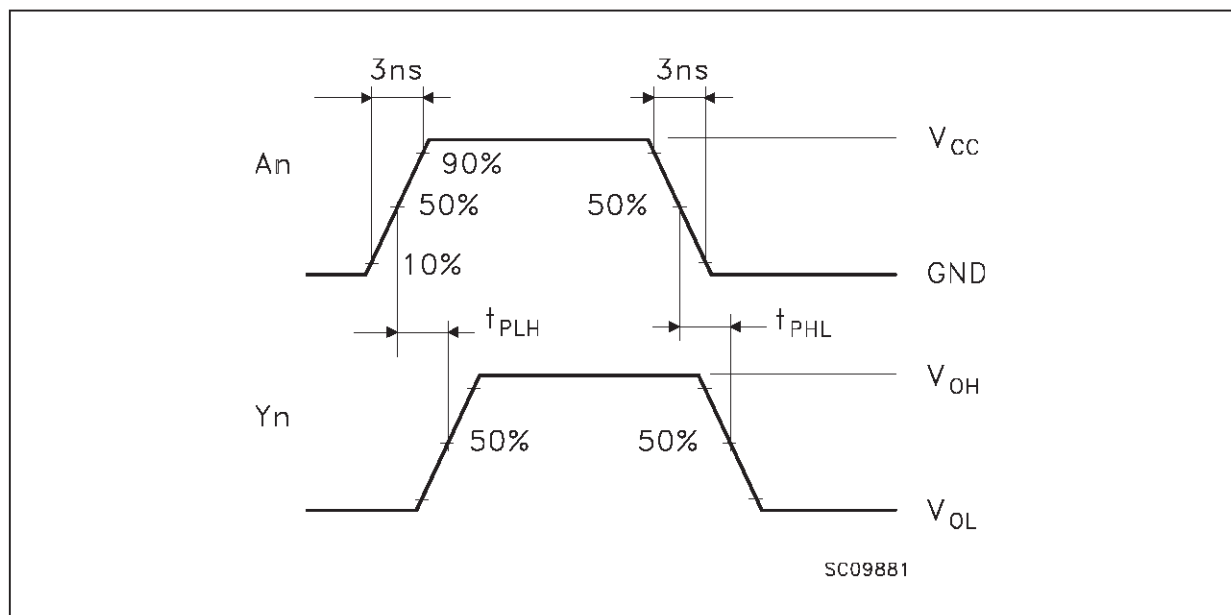


| TEST | SWITCH |
|-----------------------|----------|
| t_{PLH} , t_{PHL} | Open |
| t_{PZL} , t_{PLZ} | V_{CC} |
| t_{PZH} , t_{PHZ} | GND |

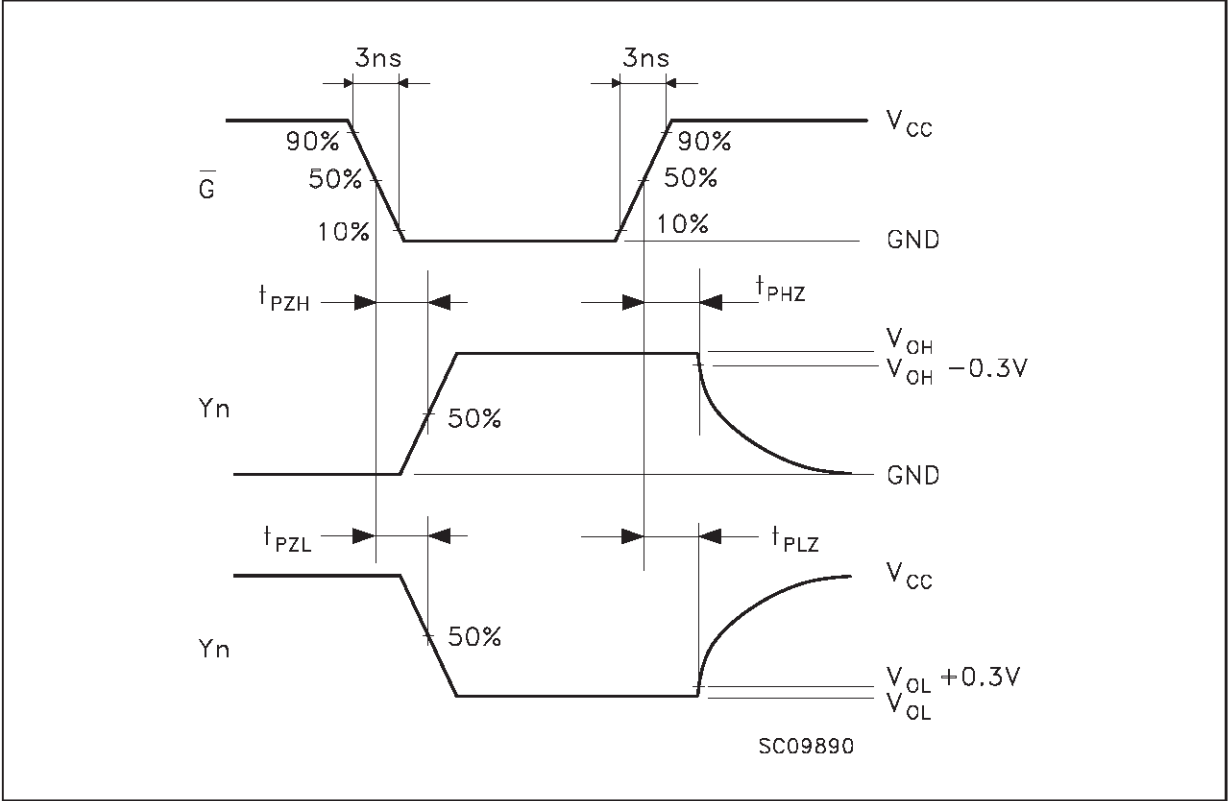
C_L = 15/50 pF or equivalent (includes jig and probe capacitance)

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

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

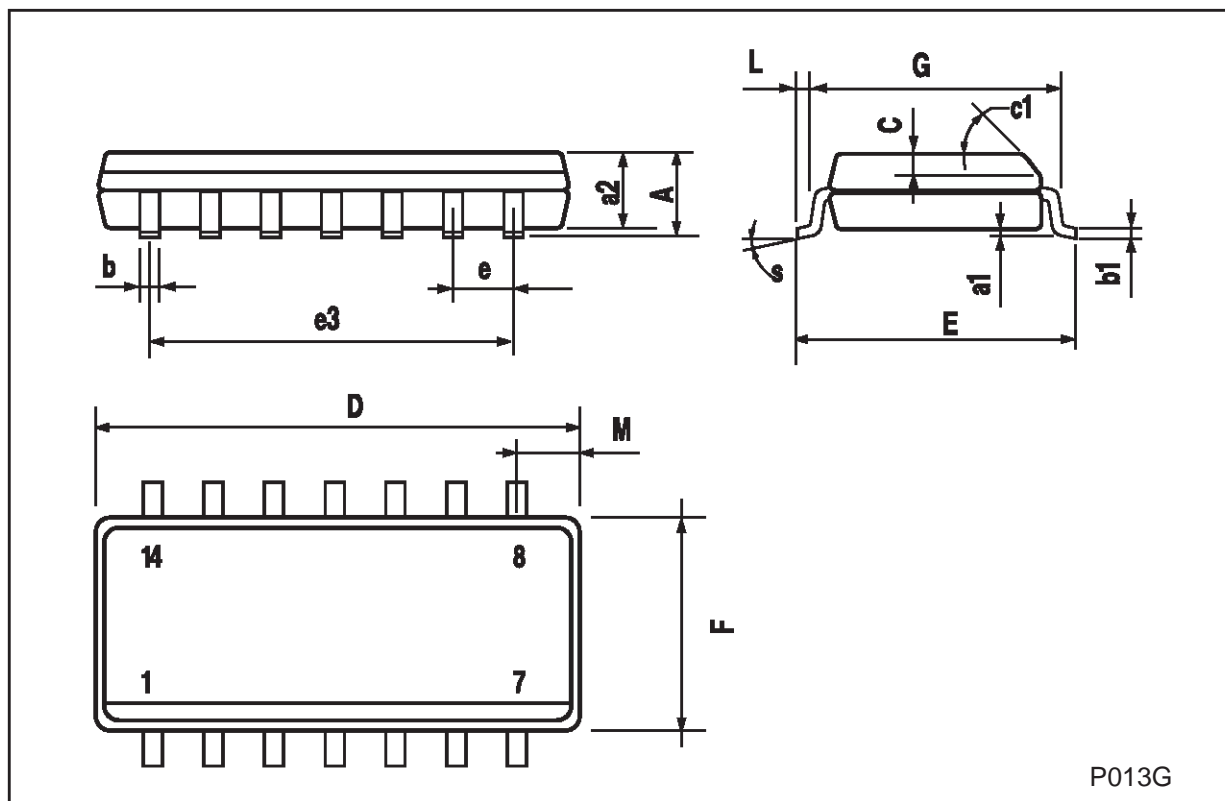
WAVEFORM 1: PROPAGATION DELAYS ($f=1\text{MHz}$; 50% duty cycle)

WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME (f=1MHz; 50% duty cycle)



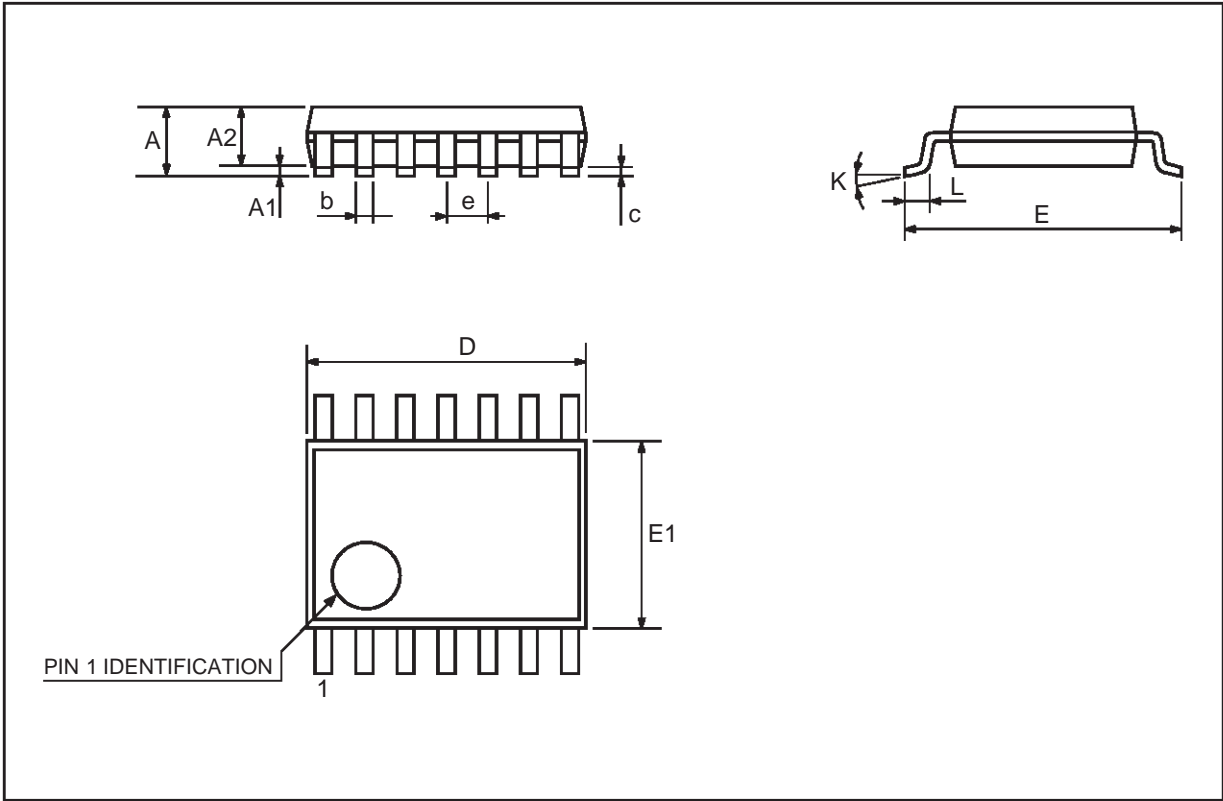
SO-14 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-----------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.003 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45 (typ.) | | | | | |
| D | 8.55 | | 8.75 | 0.336 | | 0.344 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 7.62 | | | 0.300 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.68 | | | 0.026 |
| S | 8 (max.) | | | | | |



TSSOP14 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 | | 0.20 | 0.0035 | | 0.0079 |
| D | 4.9 | 5 | 5.1 | 0.193 | 0.197 | 0.201 |
| 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 |



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