

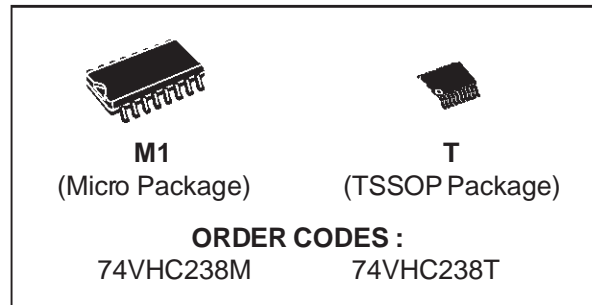
3 TO 8 LINE DECODER

- HIGH SPEED: $t_{PD} = 5.5 \text{ ns}$ (TYP.) at $V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION:
 $I_{CC} = 4 \mu\text{A}$ (MAX.) at $T_A = 25 \text{ }^\circ\text{C}$
- HIGH NOISE IMMUNITY:
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (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:
 $V_{CC} \text{ (OPR)} = 2 \text{ V to } 5.5 \text{ V}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 238
- IMPROVED LATCH-UP IMMUNITY

DESCRIPTION

The 74VHC238 is an advanced high-speed CMOS 3 TO 8 LINE DECODER fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology.

If the device is enabled, 3 binary select inputs (A, B and C) determine which one of the outputs will go high. If enable input G1 is held low or either



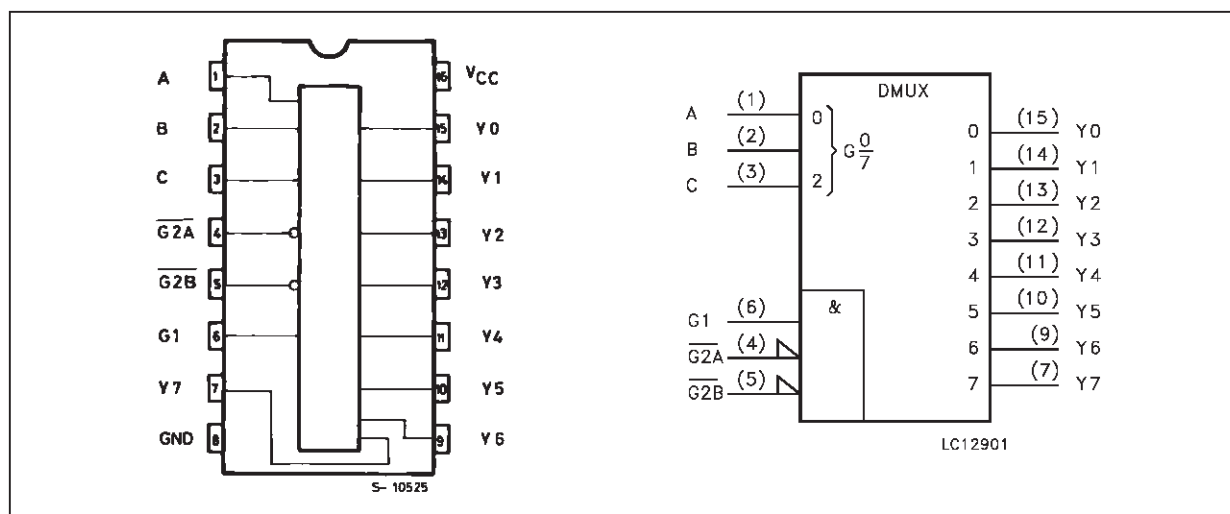
$\overline{G2A}$ or $\overline{G2B}$ is held high, decoding function is inhibited and all the 8 outputs go to low.

Three enable inputs are provided to ease cascade connection and application of this address decoders for memory systems.

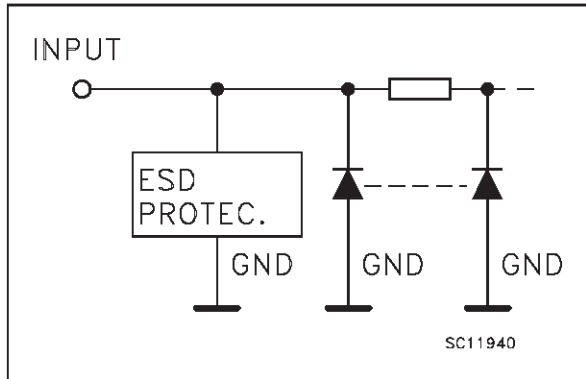
Power down protection is provided on all inputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V.

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

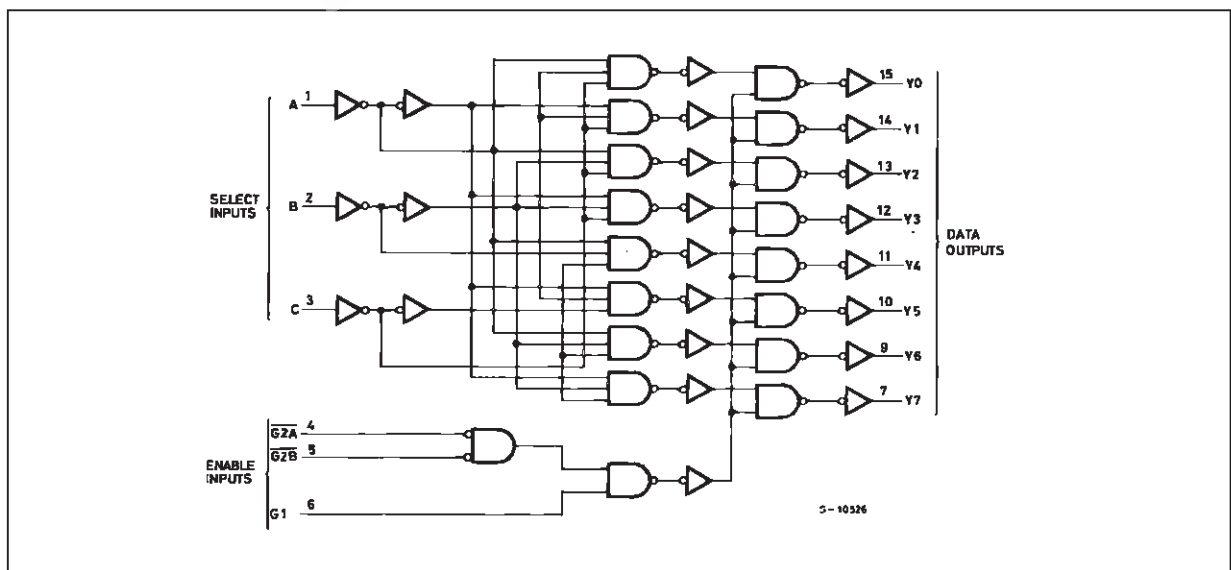
| PIN No | SYMBOL | NAME AND FUNCTION |
|------------------------------|----------------------------------|-------------------------|
| 1, 2, 3 | A, B, C | Address Inputs |
| 4, 5 | $\overline{G2A}, \overline{G2B}$ | Enable Inputs |
| 6 | G1 | Enable Input |
| 15, 14, 13, 12, 11, 10, 9, 7 | Y0 to Y7 | Outputs |
| 8 | GND | Ground (0V) |
| 16 | V _{CC} | Positive Supply Voltage |

TRUTH TABLE

| INPUTS | | | | | | OUTPUTS | | | | | | | |
|------------------|------------------|----|--------|---|---|---------|----|----|----|----|----|----|----|
| ENABLE | | | SELECT | | | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| $\overline{G2B}$ | $\overline{G2A}$ | G1 | C | B | A | | | | | | | | |
| X | X | L | X | X | X | L | L | L | L | L | L | L | L |
| X | H | X | X | X | X | L | L | L | L | L | L | L | L |
| H | X | X | X | X | X | L | L | L | L | L | L | L | L |
| L | L | H | L | L | L | H | L | L | L | L | L | L | L |
| L | L | H | L | L | H | L | H | L | L | L | L | L | L |
| L | L | H | L | H | L | L | L | H | L | L | L | L | L |
| L | L | H | L | H | H | L | L | L | H | L | L | L | L |
| L | L | H | H | L | L | L | L | L | L | H | L | L | L |
| L | L | H | H | L | H | L | L | L | L | L | H | L | L |
| L | L | H | H | H | L | L | L | L | L | L | L | H | L |
| L | L | H | H | H | H | L | L | L | L | L | L | L | H |

X: Don't Care

LOGIC DIAGRAM



This logic diagram has not been used to estimate propagation delays

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 | ± 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 condition is not implied.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|-----------------|--|----------------------|--------------|
| V _{CC} | Supply Voltage | 2.0 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 | -40 to +85 | °C |
| dt/dv | Input Rise and Fall Time (see note 1) (V _{CC} = 3.3 ± 0.3V) (V _{CC} = 5.0 ± 0.5V) | 0 to 100 0 to 20 | ns/V ns/V |

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

DC SPECIFICATIONS

| Symbol | Parameter | Test Conditions | | Value | | | | | Unit |
|-----------------|---------------------------|-----------------|---|------------------------|------|--------------------|--------------------|--------------------|------|
| | | | | 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 to 5.5 | | 0.7V _{CC} | | | 0.7V _{CC} | | |
| V _{IL} | Low Level Input Voltage | 2.0 | | | | 0.5 | | 0.5 | V |
| | | 3.0 to 5.5 | | | | 0.3V _{CC} | | 0.3V _{CC} | |
| V _{OH} | High Level Output Voltage | 2.0 | I _O =-50 μA | 1.9 | 2.0 | | 1.9 | | V |
| | | 3.0 | I _O =-50 μA | 2.9 | 3.0 | | 2.9 | | |
| | | 4.5 | I _O =-50 μA | 4.4 | 4.5 | | 4.4 | | |
| | | 3.0 | I _O =-4 mA | 2.58 | | | 2.48 | | |
| | | 4.5 | I _O =-8 mA | 3.94 | | | 3.8 | | |
| V _{OL} | Low Level Output Voltage | 2.0 | I _O =50 μA | | 0.0 | 0.1 | | 0.1 | V |
| | | 3.0 | I _O =50 μA | | 0.0 | 0.1 | | 0.1 | |
| | | 4.5 | I _O =50 μA | | 0.0 | 0.1 | | 0.1 | |
| | | 3.0 | I _O =4 mA | | | 0.36 | | 0.44 | |
| | | 4.5 | I _O =8 mA | | | 0.36 | | 0.44 | |
| I _I | Input Leakage Current | 0 to 5.5 | V _I = 5.5V or GND | | | ±0.1 | | ±1.0 | μA |
| I _{CC} | Quiescent Supply Current | 5.5 | V _I = V _{CC} or GND | | | 4 | | 40 | μA |

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 A, B, C to Y | 3.3 ^(*) | 15 | | 8.0 | 12.3 | 1.0 | 14.5 | ns |
| | | 3.3 ^(*) | 50 | | 10.5 | 15.8 | 1.0 | 18.0 | |
| | | 5.0 ^(**) | 15 | | 5.5 | 8.1 | 1.0 | 9.5 | |
| | | 5.0 ^(**) | 50 | | 7.0 | 10.1 | 1.0 | 11.5 | |
| t _{PLH} t _{PHL} | Propagation Delay Time G1 to Y | 3.3 ^(*) | 15 | | 8.1 | 12.8 | 1.0 | 15.0 | ns |
| | | 3.3 ^(*) | 50 | | 10.6 | 16.3 | 1.0 | 18.5 | |
| | | 5.0 ^(**) | 15 | | 5.4 | 8.1 | 1.0 | 9.5 | |
| | | 5.0 ^(**) | 50 | | 6.9 | 10.1 | 1.0 | 11.5 | |
| t _{PLH} t _{PHL} | Propagation Delay Time G2A, G2B to Y | 3.3 ^(*) | 15 | | 8.1 | 12.3 | 1.0 | 14.5 | ns |
| | | 3.3 ^(*) | 50 | | 10.6 | 15.8 | 1.0 | 18.0 | |
| | | 5.0 ^(**) | 15 | | 5.7 | 8.1 | 1.0 | 9.5 | |
| | | 5.0 ^(**) | 50 | | 7.2 | 10.1 | 1.0 | 11.5 | |

(*) Voltage range is 3.3V ± 0.3V

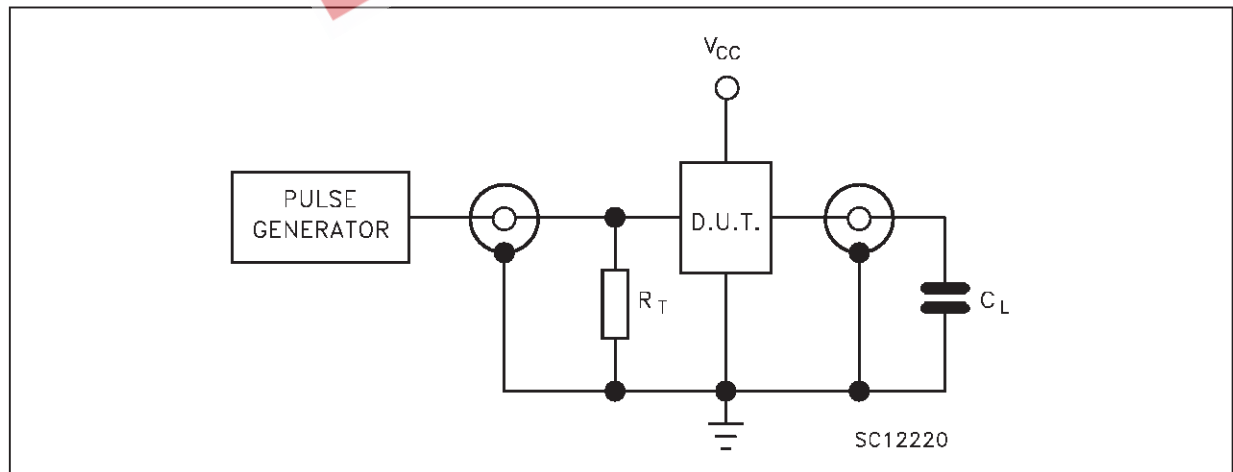
(**) Voltage range is 5V ± 0.5V

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Conditions | Value | | | | | Unit |
|-----------------|--|-----------------|------------------------|------|------|--------------|------|------|
| | | | T _A = 25 °C | | | -40 to 85 °C | | |
| | | | Min. | Typ. | Max. | Min. | Max. | |
| C _{IN} | Input Capacitance | | | 4 | 10 | | 10 | pF |
| C _{PD} | Power Dissipation Capacitance (note 1) | | | 37 | | | | 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. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

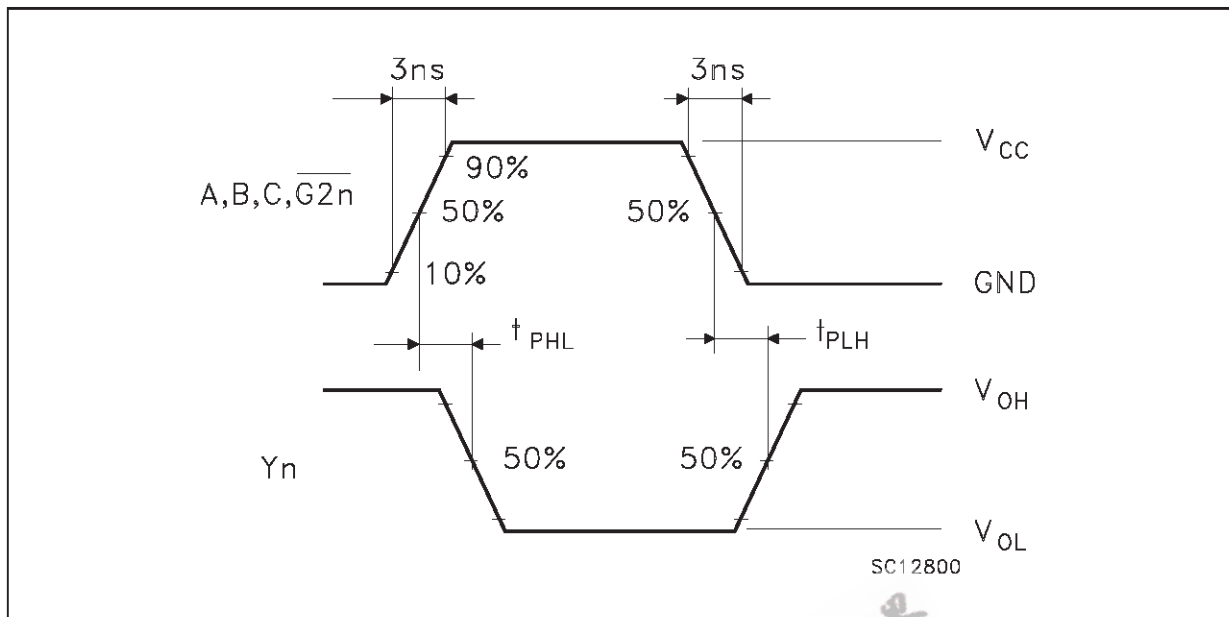
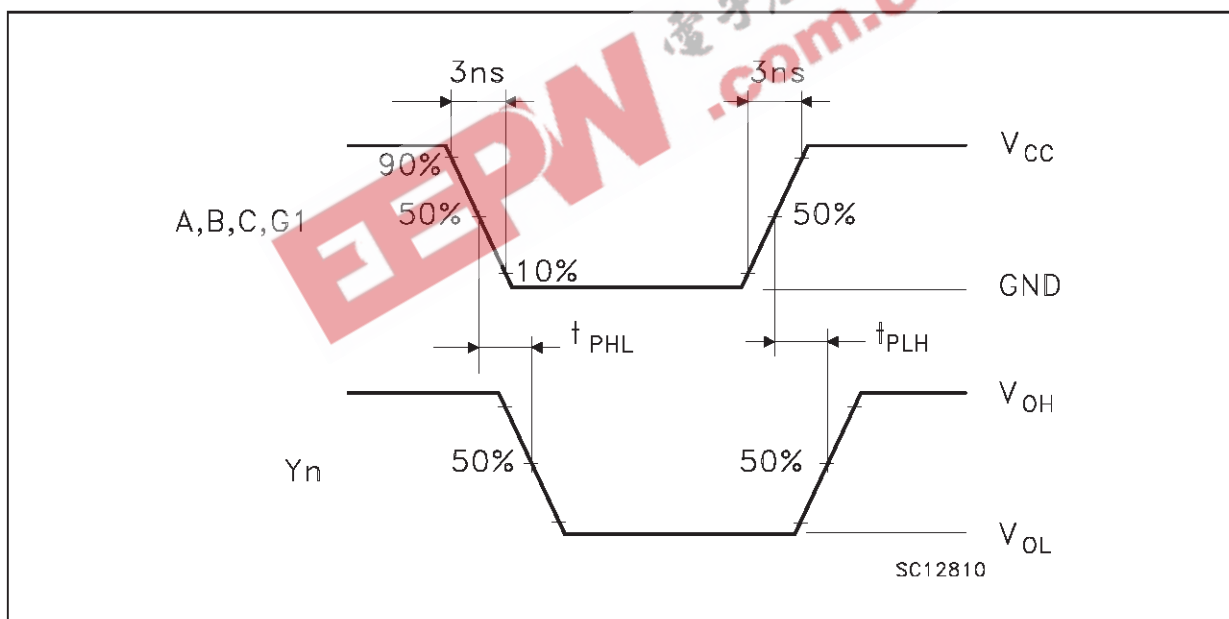
TEST CIRCUIT



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

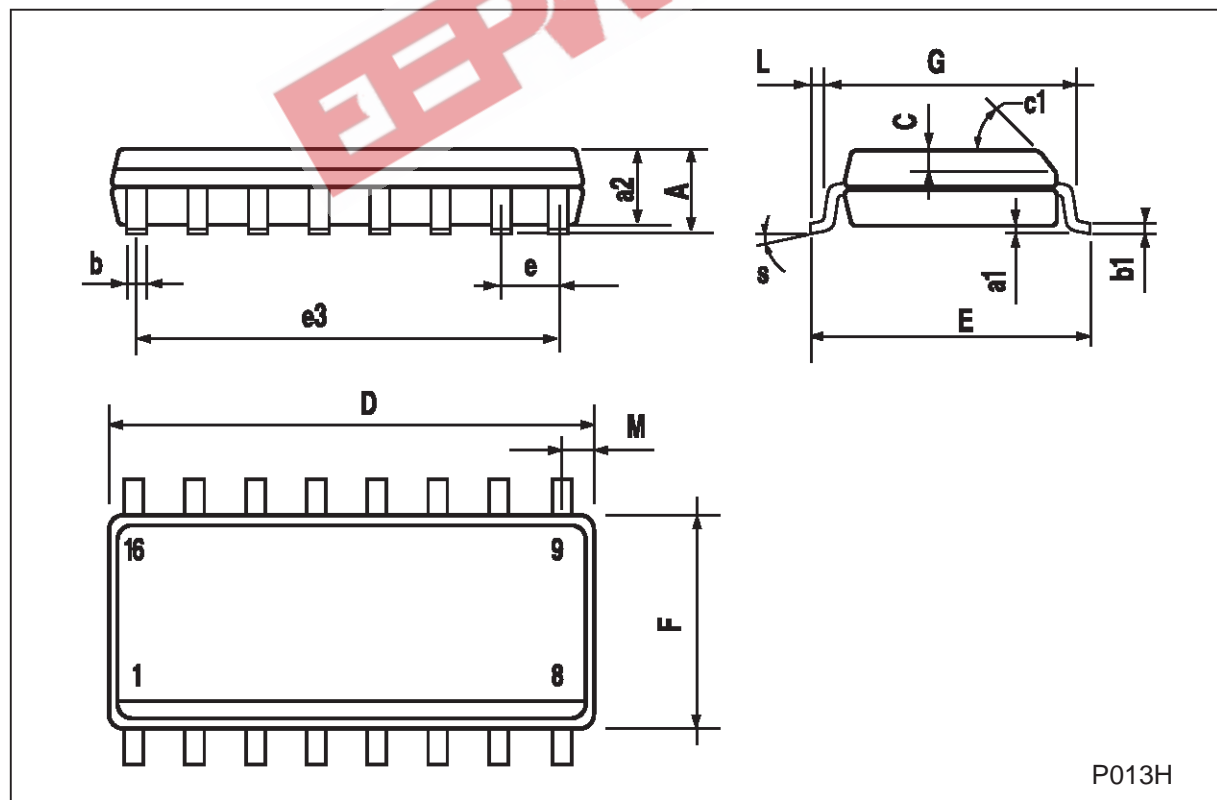
R_L = R₁ = 500Ω or equivalent

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

WAVEFORM 1: PROPAGATION DELAYS FOR INVERTING OUTPUTS ($f=1\text{MHz}$; 50% duty cycle)**WAVEFORM 2: PROPAGATION DELAYS FOR NON-INVERTING OUTPUTS** ($f=1\text{MHz}$; 50% duty cycle)

SO-16 MECHANICAL DATA

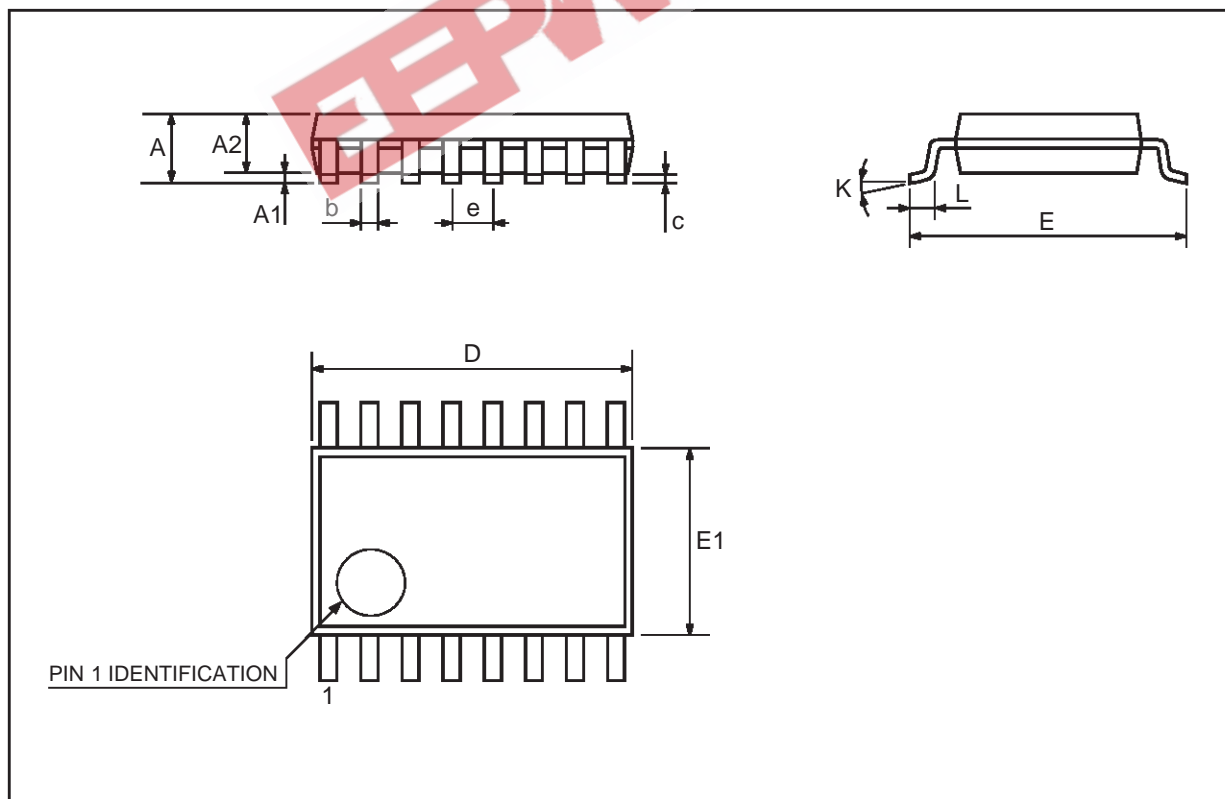
| DIM. | mm | | | inch | | |
|------|-----------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45 (typ.) | | | | | |
| D | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| 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 | | | 0.62 | | | 0.024 |
| S | 8 (max.) | | | | | |



P013H

TSSOP16 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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