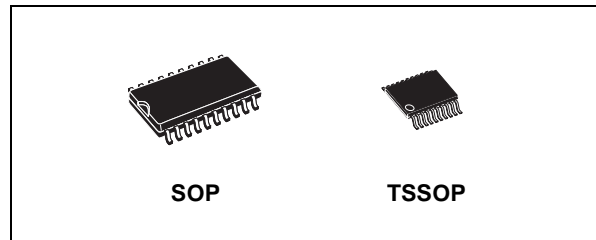




74LCX541

LOW VOLTAGE CMOS OCTAL BUS BUFFER (3-STATE) WITH 5V TOLERANT INPUTS AND OUTPUTS

- 5V TOLERANT INPUTS AND OUTPUTS
- HIGH SPEED :
 $t_{PD} = 8.0 \text{ ns (MAX.) at } V_{CC} = 3V$
- POWER DOWN PROTECTION ON INPUTS AND OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 24\text{mA (MIN) at } V_{CC} = 3V$
- PCI BUS LEVELS GUARANTEED AT 24 mA
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC(OPER)} = 2.0V \text{ to } 3.6V \text{ (1.5V Data Retention)}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 541
- LATCH-UP PERFORMANCE EXCEEDS 500mA (JESD 17)
- ESD PERFORMANCE:
HBM > 2000V (MIL STD 883 method 3015);
MM > 200V



ORDER CODES

| PACKAGE | TUBE | T & R |
|---------|-----------|-------------|
| SOP | 74LCX541M | 74LCX541MTR |
| TSSOP | | 74LCX541TTR |

The 3 STATE control gate operates as two input AND such that if either G1 and G2 are high, all eight outputs are in the high impedance state. In order to enhance PC board layout the 74LCX541 offers a pinout having inputs and outputs on opposite sides of the package.

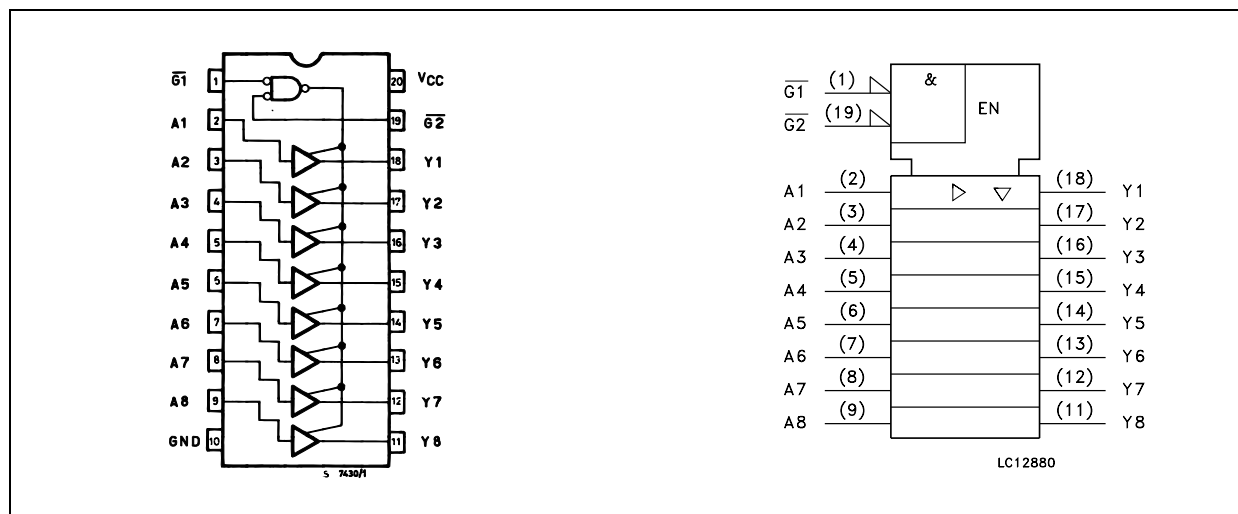
It has same speed performance at 3.3V than 5V AC/ACT family, combined with a lower power consumption.

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

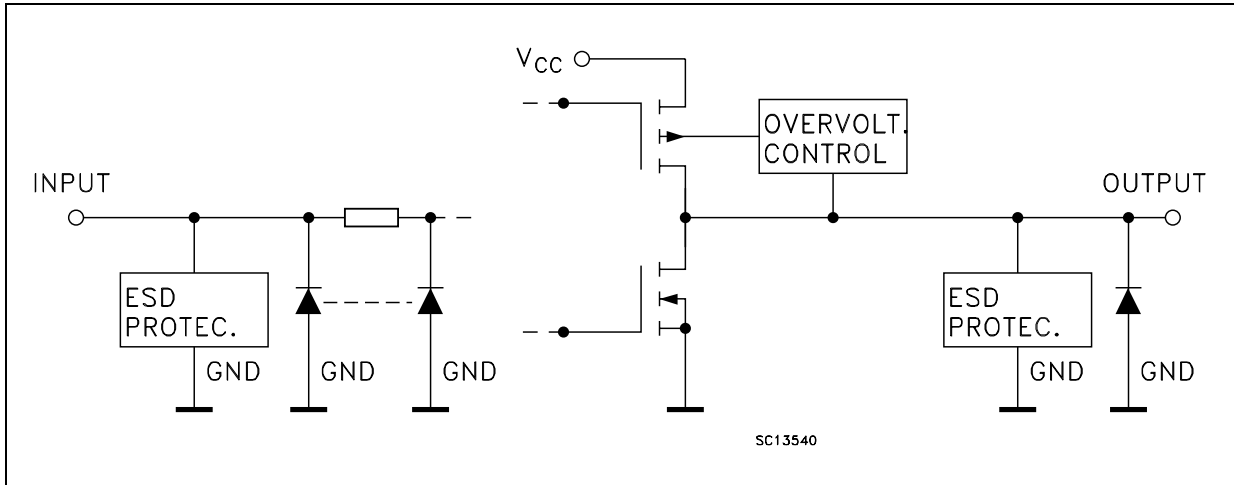
DESCRIPTION

The 74LCX541 is a low voltage CMOS OCTAL BUS BUFFER (NON-INVERTED) fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. It is ideal for low power and high speed 3.3V applications; it can be interfaced to 5V signal environment for both inputs and outputs.

PIN CONNECTION AND IEC LOGIC SYMBOLS



INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|--------------------------------|-----------------|-------------------------|
| 1, 19 | G1, G2 | Output Enable Inputs |
| 2, 3, 4, 5, 6, 7, 8, 9 | A1 to A8 | Data Inputs |
| 18, 17, 16, 15, 14, 13, 12, 11 | Y1 to Y8 | Data Outputs |
| 10 | GND | Ground (0V) |
| 20 | V _{CC} | Positive Supply Voltage |

TRUTH TABLE

| INPUT | | | OUTPUT |
|-------|----|----------------|----------------|
| G1 | G2 | A _n | Y _n |
| H | X | X | Z |
| X | H | X | Z |
| L | L | H | H |
| L | L | L | L |

X : Don't Care
Z : High Impedance

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 (OFF State) | -0.5 to +7.0 | V |
| V _O | DC Output Voltage (High or Low State) (note 1) | -0.5 to V _{CC} + 0.5 | V |
| I _{IK} | DC Input Diode Current | - 50 | mA |
| I _{OK} | DC Output Diode Current (note 2) | - 50 | mA |
| I _O | DC Output Current | ± 50 | mA |
| I _{CC} | DC Supply Current per Supply Pin | ± 100 | mA |
| I _{GND} | DC Ground Current per Supply Pin | ± 100 | 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) I_O absolute maximum rating must be observed
- 2) V_O < GND

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|------------------|---|---------------|-------------|
| V_{CC} | Supply Voltage (note 1) | 2.0 to 3.6 | V |
| V_I | Input Voltage | 0 to 5.5 | V |
| V_O | Output Voltage (OFF State) | 0 to 5.5 | V |
| V_O | Output Voltage (High or Low State) | 0 to V_{CC} | V |
| I_{OH}, I_{OL} | High or Low Level Output Current ($V_{CC} = 3.0$ to $3.6V$) | ± 24 | mA |
| I_{OH}, I_{OL} | High or Low Level Output Current ($V_{CC} = 2.7V$) | ± 12 | mA |
| T_{op} | Operating Temperature | -55 to 125 | $^{\circ}C$ |
| dt/dv | Input Rise and Fall Time (note 2) | 0 to 10 | ns/V |

1) Truth Table guaranteed: 1.5V to 3.6V

2) V_{IN} from 0.8V to 2V at $V_{CC} = 3.0V$

DC SPECIFICATIONS

| Symbol | Parameter | Test Condition | | Value | | | | Unit |
|-----------------|---------------------------------------|-----------------|---|-----------------------|----------|------------------------|----------|---------|
| | | V_{CC} (V) | | -40 to 85 $^{\circ}C$ | | -55 to 125 $^{\circ}C$ | | |
| | | | | Min. | Max. | Min. | Max. | |
| V_{IH} | High Level Input Voltage | 2.7 to 3.6 | | 2.0 | | 2.0 | | V |
| V_{IL} | Low Level Input Voltage | | | | 0.8 | | 0.8 | V |
| V_{OH} | High Level Output Voltage | 2.7 to 3.6 | $I_O = -100 \mu A$ | $V_{CC} - 0.2$ | | $V_{CC} - 0.2$ | | V |
| | | 2.7 | $I_O = -12 \text{ mA}$ | 2.2 | | 2.2 | | |
| | | 3.0 | $I_O = -18 \text{ mA}$ | 2.4 | | 2.4 | | |
| | | | $I_O = -24 \text{ mA}$ | 2.2 | | 2.2 | | |
| V_{OL} | Low Level Output Voltage | 2.7 to 3.6 | $I_O = 100 \mu A$ | | 0.2 | | 0.2 | V |
| | | 2.7 | $I_O = 12 \text{ mA}$ | | 0.4 | | 0.4 | |
| | | 3.0 | $I_O = 16 \text{ mA}$ | | 0.4 | | 0.4 | |
| | | | $I_O = 24 \text{ mA}$ | | 0.55 | | 0.55 | |
| I_I | Input Leakage Current | 2.7 to 3.6 | $V_I = 0$ to $5.5V$ | | ± 5 | | ± 5 | μA |
| I_{off} | Power Off Leakage Current | 0 | V_I or $V_O = 5.5V$ | | 10 | | 10 | μA |
| I_{OZ} | High Impedance Output Leakage Current | 2.7 to 3.6 | $V_I = V_{IH}$ or V_{IL} $V_O = 0$ to V_{CC} | | ± 5 | | ± 5 | μA |
| I_{CC} | Quiescent Supply Current | 2.7 to 3.6 | $V_I = V_{CC}$ or GND | | 10 | | 10 | μA |
| | | | V_I or $V_O = 3.6$ to $5.5V$ | | ± 10 | | ± 10 | |
| ΔI_{CC} | I_{CC} incr. per Input | 2.7 to 3.6 | $V_{IH} = V_{CC} - 0.6V$ | | 500 | | 500 | μA |

DYNAMIC SWITCHING CHARACTERISTICS

| Symbol | Parameter | Test Condition | | Value | | | Unit |
|--------------------------------------|---|------------------------|---|------------------------|-------------|------|------|
| | | V _{CC} (V) | | T _A = 25 °C | | | |
| | | | | Min. | Typ. | Max. | |
| V _{OLP} V _{OLV} | Dynamic Low Level Quiet Output (note 1) | 3.3 | C _L = 50pF V _{IL} = 0V, V _{IH} = 3.3V | | 0.8 -0.8 | | V |

1) Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH to LOW or LOW to HIGH. The remaining output is measured in the LOW state.

AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test Condition | | | | Value | | | | Unit |
|--|---------------------------------------|------------------------|------------------------|-----------------------|---|--------------|------|---------------|------|------|
| | | V _{CC} (V) | C _L (pF) | R _L (Ω) | t _s = t _r (ns) | -40 to 85 °C | | -55 to 125 °C | | |
| | | | | | | Min. | Max. | Min. | Max. | |
| t _{PLH} t _{PHL} | Propagation Delay Time | 2.7 | 50 | 500 | 2.5 | 1.5 | 9.0 | 1.5 | 9.0 | ns |
| | | 3.0 to 3.6 | | | | 1.5 | 8.0 | 1.5 | 8.0 | |
| t _{pZL} t _{pZH} | Output Enable Time | 2.7 | 50 | 500 | 2.5 | 1.5 | 9.5 | 1.5 | 9.5 | ns |
| | | 3.0 to 3.6 | | | | 1.5 | 8.5 | 1.5 | 8.5 | |
| t _{PLZ} t _{PHZ} | Output Disable Time | 2.7 | 50 | 500 | 2.5 | 1.5 | 8.5 | 1.5 | 8.5 | ns |
| | | 3.0 to 3.6 | | | | 1.5 | 7.5 | 1.5 | 7.5 | |
| t _{OSLH} t _{OSHL} | Output To Output Skew Time (note1, 2) | 3.0 to 3.6 | 50 | 500 | 2.5 | | 1.0 | | 1.0 | ns |

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 (t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|)

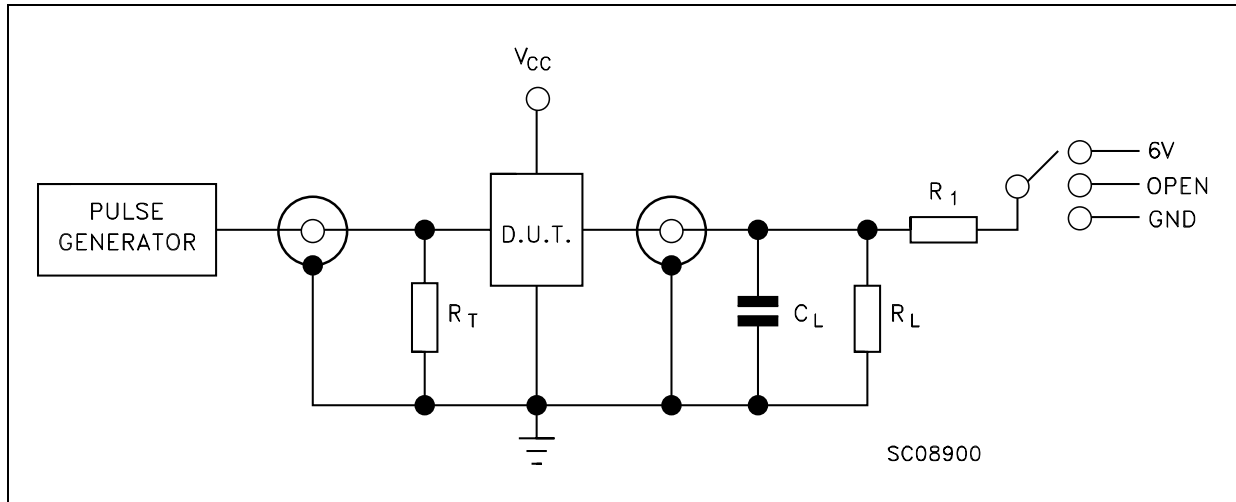
2) Parameter guaranteed by design

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Condition | | Value | | | Unit |
|------------------|--|------------------------|---|------------------------|------|------|------|
| | | V _{CC} (V) | | T _A = 25 °C | | | |
| | | | | Min. | Typ. | Max. | |
| C _{IN} | Input Capacitance | 3.3 | V _{IN} = 0 to V _{CC} | | 6 | | pF |
| C _{OUT} | Output Capacitance | 3.3 | V _{IN} = 0 to V _{CC} | | 12 | | pF |
| C _{PD} | Power Dissipation Capacitance (note 1) | 3.3 | f _{IN} = 10MHz V _{IN} = 0 or V _{CC} | | 25 | | 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 buffer)

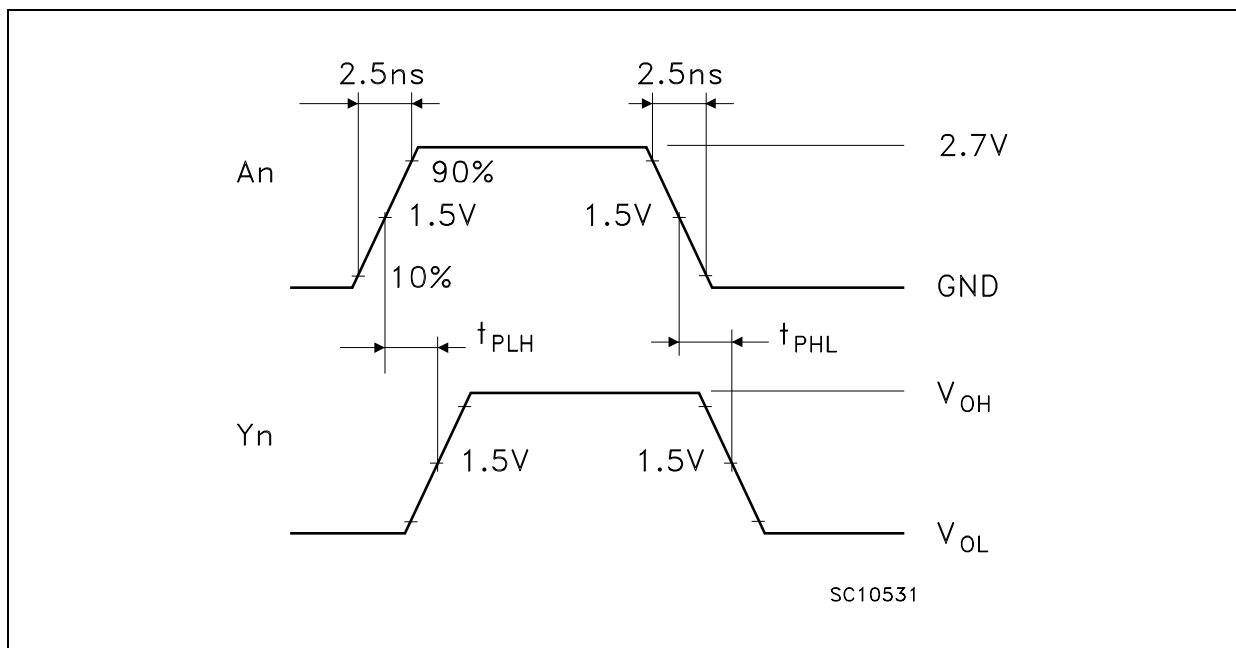
TEST CIRCUIT



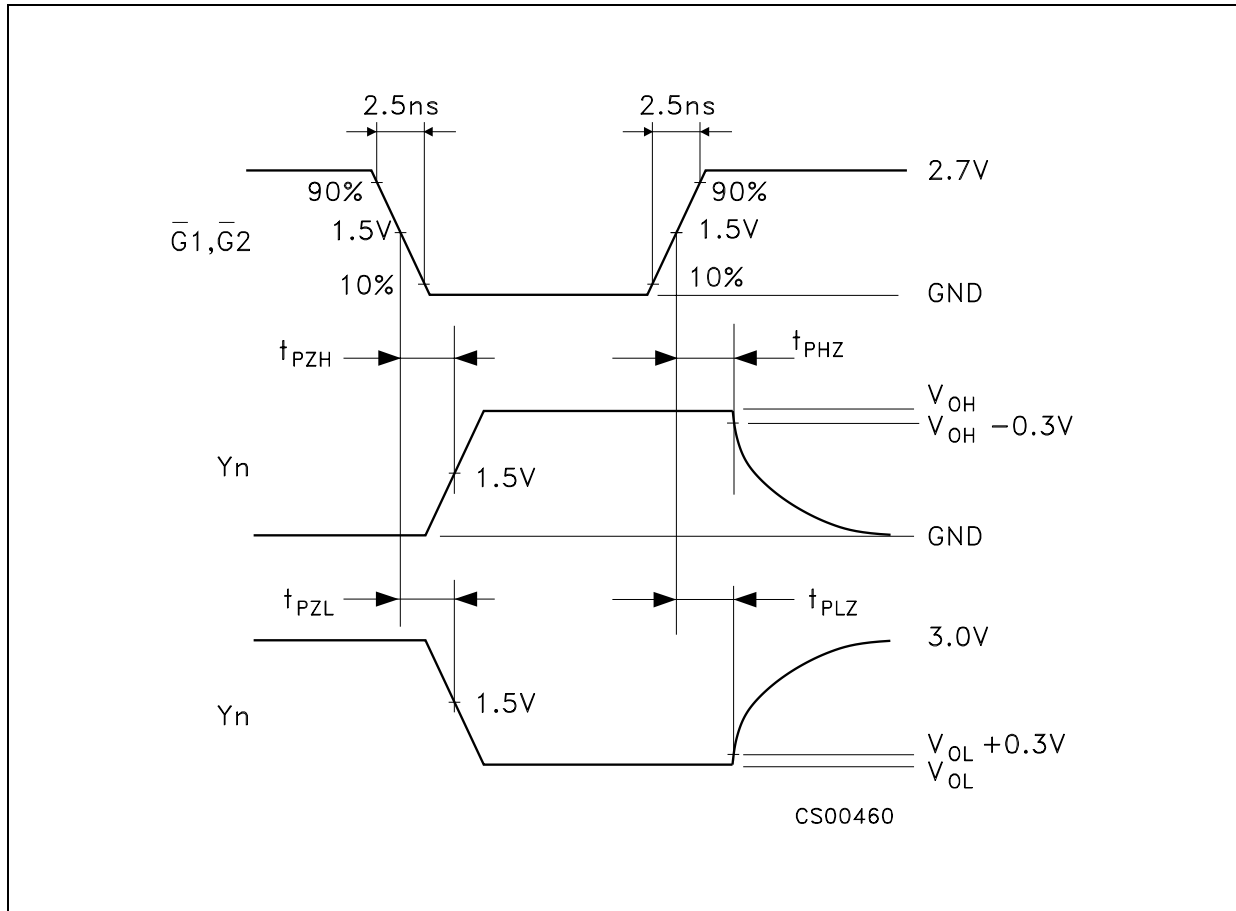
| TEST | SWITCH |
|-----------------------|--------|
| t_{PLH} , t_{PHL} | Open |
| t_{PZL} , t_{PLZ} | 6V |
| t_{PZH} , t_{PHZ} | GND |

C_L = 50 pF or equivalent (includes jig and probe capacitance)
 R_L = R_1 = 500 Ω or equivalent
 R_T = Z_{OUT} of pulse generator (typically 50 Ω)

WAVEFORM 1 : PROPAGATION DELAYS (f=1MHz; 50% duty cycle)

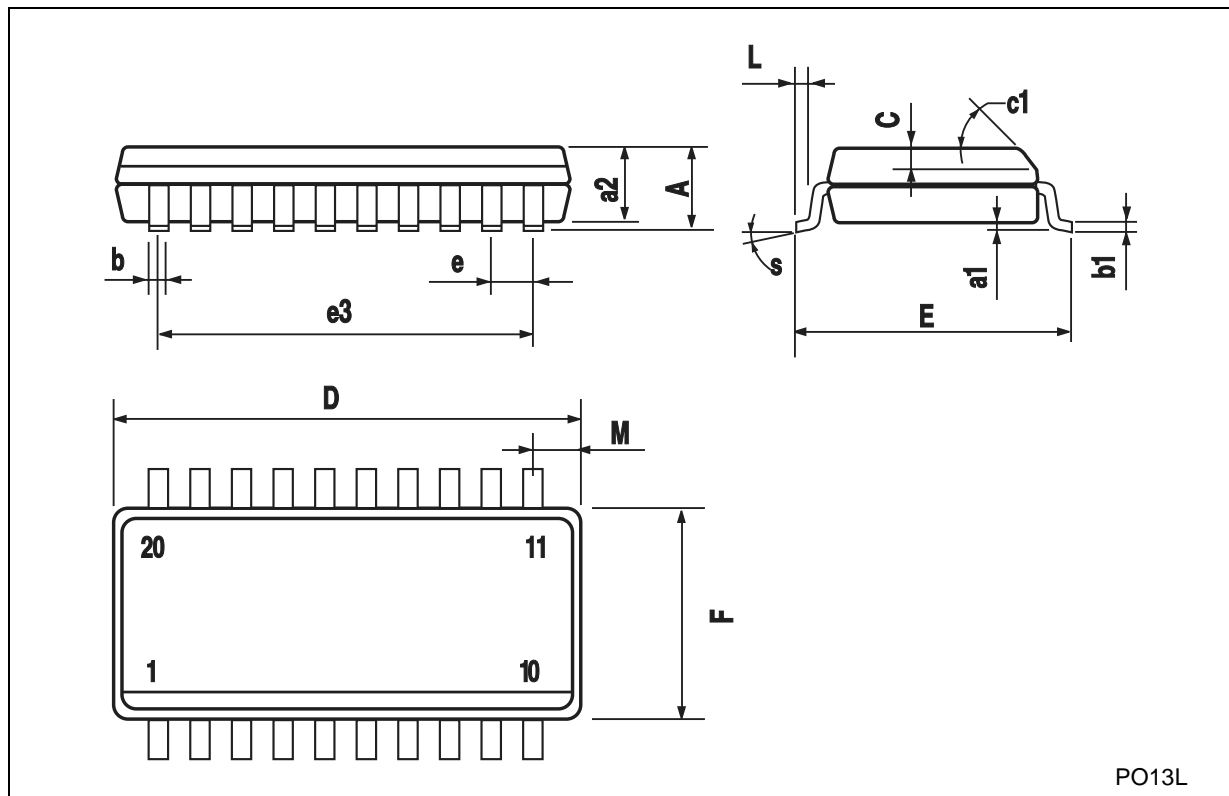


WAVEFORM 2 : OUTPUT ENABLE AND DISABLE TIME (f=1MHz; 50% duty cycle)



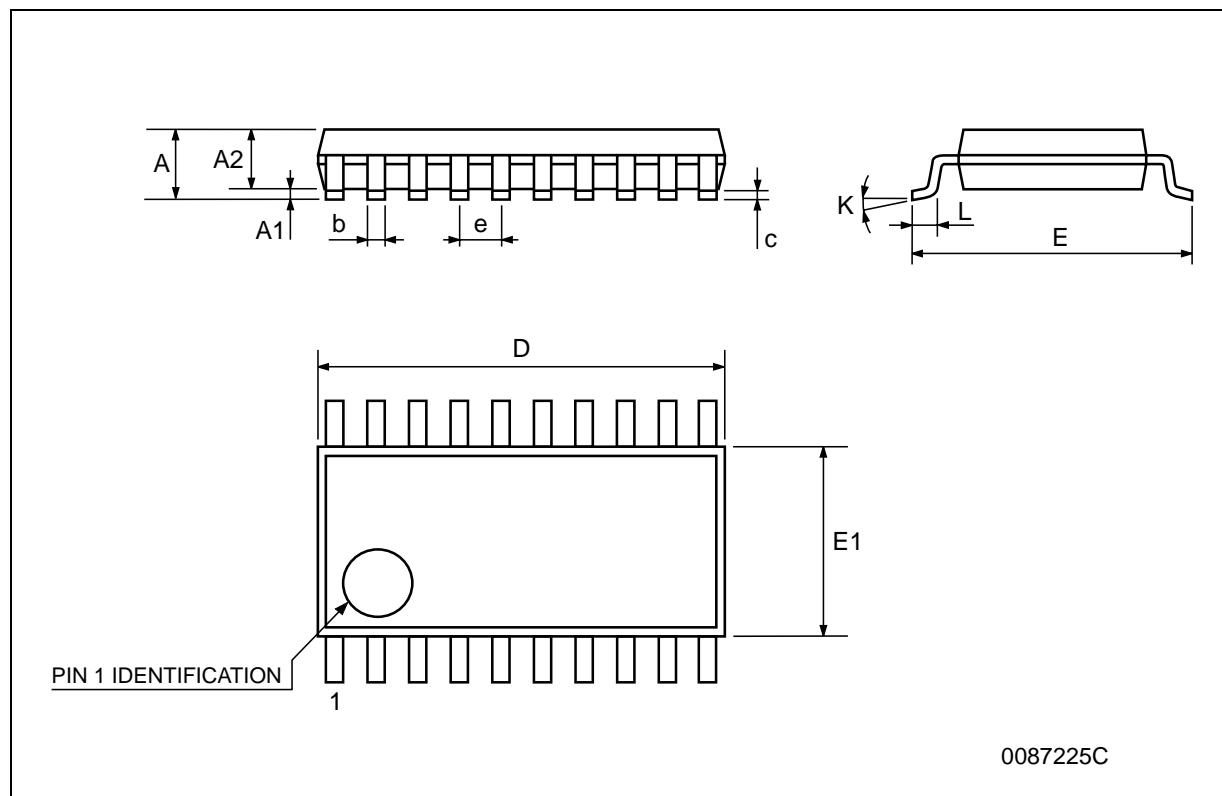
SO-20 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 2.65 | | | 0.104 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 2.45 | | | 0.096 |
| b | 0.35 | | 0.49 | 0.014 | | 0.019 |
| b1 | 0.23 | | 0.32 | 0.009 | | 0.012 |
| C | | 0.5 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D | 12.60 | | 13.00 | 0.496 | | 0.512 |
| E | 10.00 | | 10.65 | 0.393 | | 0.419 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 11.43 | | | 0.450 | |
| F | 7.40 | | 7.60 | 0.291 | | 0.300 |
| L | 0.50 | | 1.27 | 0.020 | | 0.050 |
| M | | | 0.75 | | | 0.029 |
| S | 8° (max.) | | | | | |



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 | | 0.0089 |
| 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 |



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