

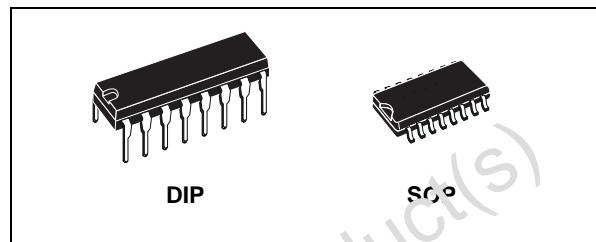


BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER

- HIGH OUTPUT SOURCING CAPABILITY (up to 25mA).
- INPUT LATCHES FOR BCD CODE STORAGE
- LAMP TEST AND BLANKING CAPABILITY.
- 7-SEGMENT OUTPUTS BLANKED FOR BCD INPUT CODES > 1001
- QUIESCENT CURRENT SPECIF. UP TO 20V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT
 $I_l = 100\text{nA}$ (MAX) AT $V_{DD} = 18\text{V}$ $T_A = 25^\circ\text{C}$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"

DESCRIPTION

HCF4511B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. HCF4511B is a BCD to 7 segment decoder driver made up of CMOS logic and n-p-n bipolar transistor output devices on a single monolithic structure. This device combines the low quiescent



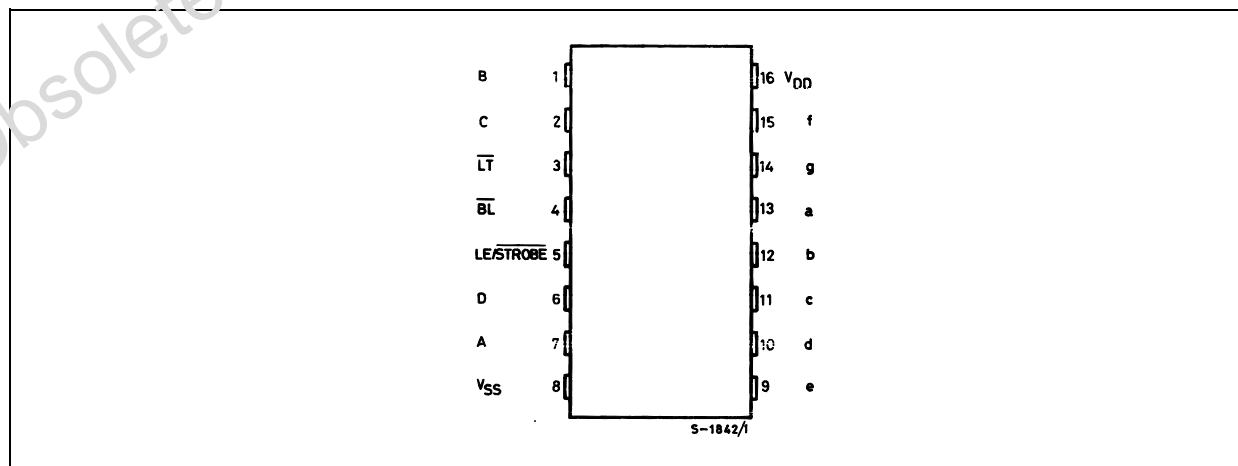
ORDER CODES

| PACKAGE | TUBE | T & R |
|---------|------------|---------------|
| DIP | HCF4511BEY | |
| SOP | HCF4511BM1 | HCF4511M013TR |

power dissipation and high noise immunity features of CMOS with n-p-n bipolar output transistor capable of sourcing up to 25mA. This capability allows HCF4511B to drive LEDs and other displays directly.

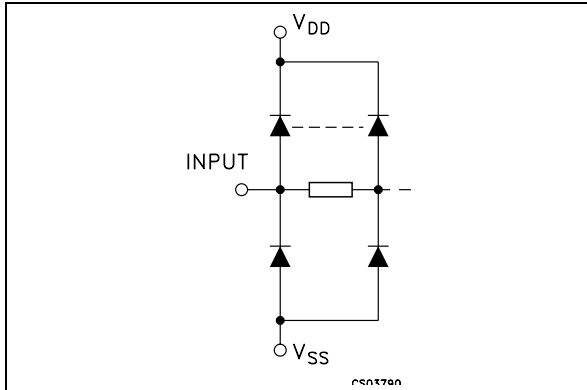
Lamp Test ($\overline{\text{LT}}$), Blanking ($\overline{\text{BL}}$), and Latch Enable or Strobe inputs are provided to test the display, shut off or intensity-modulate it, and store or strobe a BCD code, respectively. Several different signals may be multiplexed and displayed when external multiplexing circuitry is used.

PIN CONNECTION



HCF4511B

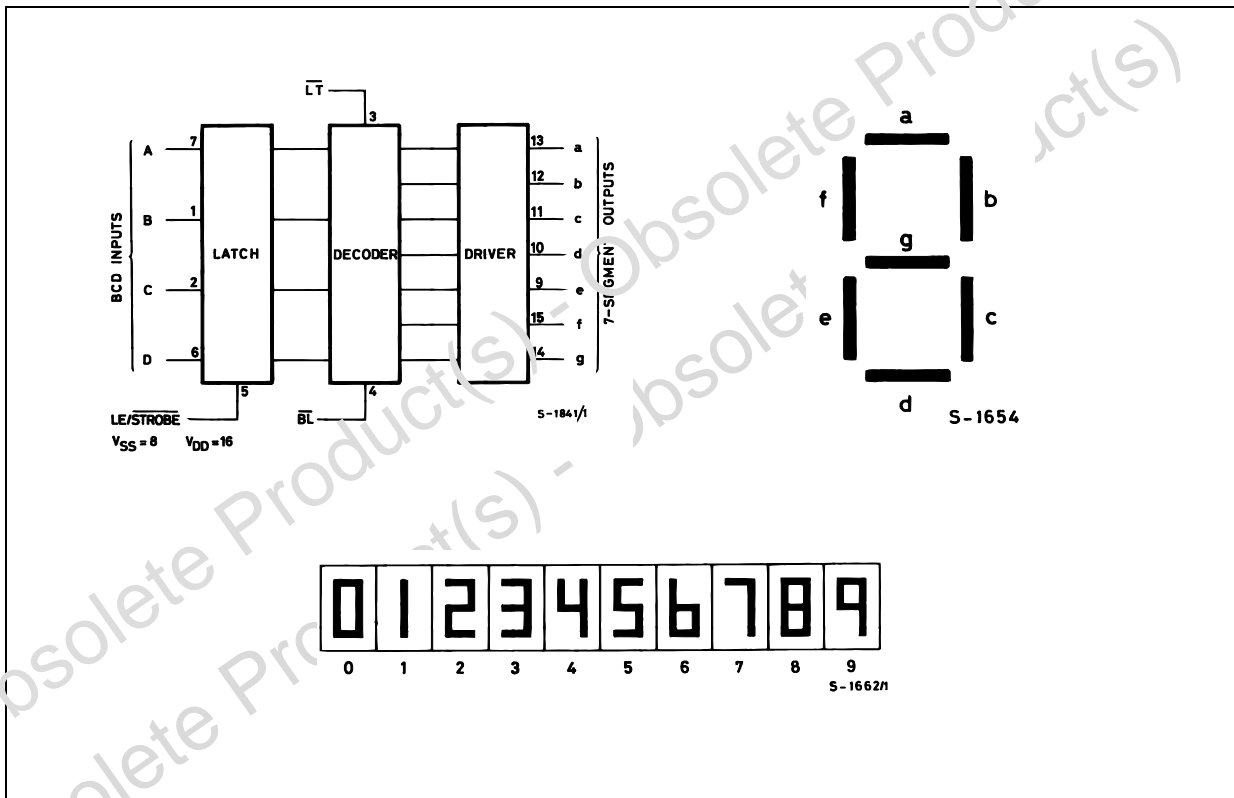
INPUT EQUIVALENT CIRCUIT



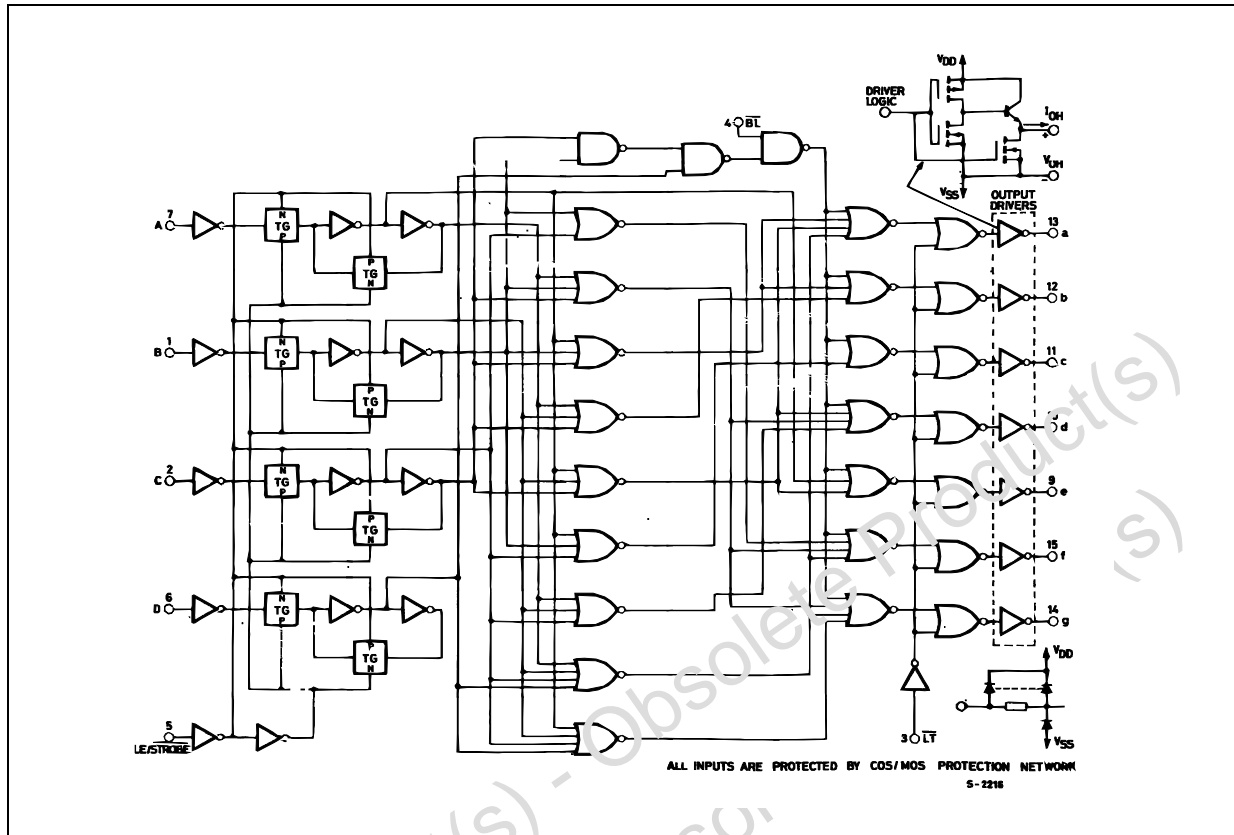
PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|---------------------------|-------------------------|------------------------------|
| 7, 1, 2, 6 | A, B, C, D | Bcd Inputs |
| 13, 12, 11, 10, 9, 15, 14 | a to g | 7-Segment Outputs |
| 3 | \overline{LT} | Lamp Test Input |
| 4 | BL | Blanking Input |
| 5 | LE/ \overline{STROBE} | Latch Enable or Strobe Input |
| 8 | V_{SS} | Negative Supply Voltage |
| 16 | V_{DD} | Positive Supply Voltage |

FUNCTIONAL DIAGRAM



LOGIC DIAGRAM



TRUTH TABLE

| LE | \overline{BL} | \overline{LT} | D | C | B | A | a | b | c | d | e | f | g | DISPLAY |
|----|-----------------|-----------------|---|---|---|---|---|---|---|---|---|---|---|---------|
| X | X | L | X | X | X | X | H | H | H | H | H | H | H | 8 |
| X | L | H | X | X | X | X | L | L | L | L | L | L | L | Blank |
| L | H | L | L | L | L | L | H | H | H | H | H | H | L | 0 |
| L | H | H | L | L | L | H | L | H | H | L | L | L | L | 1 |
| L | H | H | L | L | H | L | H | H | L | H | H | L | H | 2 |
| L | H | H | L | L | H | H | H | H | H | H | L | L | H | 3 |
| L | H | H | L | H | L | L | L | H | H | L | L | H | H | 4 |
| L | H | H | L | H | L | H | H | L | H | H | L | H | H | 5 |
| L | H | H | L | H | H | L | L | L | H | H | H | H | H | 6 |
| L | H | H | L | H | H | H | H | H | H | L | L | L | L | 7 |
| L | H | H | H | L | L | L | H | H | H | H | H | H | H | 8 |
| L | H | H | H | L | L | H | H | H | H | L | L | H | H | 9 |
| L | H | H | H | L | H | L | L | L | L | L | L | L | L | Blank |
| L | H | H | H | L | H | H | L | L | L | L | L | L | L | Blank |
| L | H | H | H | H | L | L | L | L | L | L | L | L | L | Blank |
| L | H | H | H | H | L | H | L | L | L | L | L | L | L | Blank |
| L | H | H | H | H | H | L | L | L | L | L | L | L | L | Blank |
| L | H | H | H | H | H | H | L | L | L | L | L | L | L | Blank |
| H | H | H | X | X | X | X | | | | * | | | | * |

X: Don't Care

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------|---|------------------------|------|
| V_{DD} | Supply Voltage | -0.5 to +22 | V |
| V_I | DC Input Voltage | -0.5 to $V_{DD} + 0.5$ | V |
| I_I | DC Input Current | ± 10 | mA |
| P_D | Power Dissipation per Package | 200 | mW |
| | Power Dissipation per Output Transistor | 100 | mW |
| T_{op} | Operating Temperature | -55 to +125 | °C |
| T_{stg} | Storage Temperature | -65 to +150 | °C |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

All voltage values are referred to V_{SS} pin voltage.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|----------|-----------------------|---------------|------|
| V_{DD} | Supply Voltage | 3 to 20 | V |
| V_I | Input Voltage | 0 to V_{DD} | V |
| T_{op} | Operating Temperature | -55 to 125 | °C |

DC SPECIFICATIONS

| Symbol | Parameter | Test Condition | | | | Value | | | | | | Unit | | |
|-----------------|-----------------------------------|-----------------------|-----------------------|---------------------------------|------------------------|-----------------------|---------------|-----------|-------------|---------|--------------|---------|---------|---|
| | | V _I (V) | V _O (V) | I _{OL} (μ A) | V _{DD} (V) | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | | |
| | | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. | |
| I _L | Quiescent Current | 0/5 | | | 5 | | 0.04 | 5 | | 150 | | 150 | μ A | |
| | | 0/10 | | | 10 | | 0.04 | 10 | | 300 | | 300 | | |
| | | 0/15 | | | 15 | | 0.04 | 20 | | 600 | | 600 | | |
| | | 0/20 | | | 20 | | 0.08 | 100 | | 3000 | | 3000 | | |
| V _{OH} | High Level Output Voltage | 0/5 | | | 5 | 4.95 | | | 4.95 | | 4.95 | | V | |
| | | 0/10 | | | 10 | 9.95 | | | 9.95 | | 9.95 | | | |
| | | 0/15 | | | 15 | 14.95 | | | 14.95 | | 14.95 | | | |
| V _{OL} | Low Level Output Voltage | 5/0 | | | 5 | | 0.05 | | | 0.05 | | 0.05 | V | |
| | | 10/0 | | | 10 | | 0.05 | | | 0.05 | | 0.05 | | |
| | | 15/0 | | | 15 | | 0.05 | | | 0.05 | | 0.05 | | |
| V _{IH} | High Level Input Voltage | | 0.5/3.8 | | 5 | 3.5 | | | 3.5 | | 3.5 | | V | |
| | | | 1/8.8 | | 10 | 7 | | | 7 | | 7 | | | |
| | | | 1.5/13.8 | | 15 | 11 | | | 11 | | 11 | | | |
| V _{IL} | Low Level Input Voltage | | 3.8/0.5 | | 5 | | | 1.5 | | 1.5 | | 1.5 | V | |
| | | | 8.8/1 | | 10 | | | 3 | | 3 | | 3 | | |
| | | | 13.8/1.5 | | 15 | | | 4 | | 4 | | 4 | | |
| V _{OH} | Output Drive Voltage | | | 0 | 5 | 4.1 | 4.57 | | 4.1 | | 4.1 | | V | |
| | | | | 5 | | | 4.24 | | | | | | | |
| | | | | 10 | | | 3.6 | 4.12 | | 3.3 | | 3.3 | | |
| | | | | 15 | | | | 3.94 | | | | | | |
| | | | | 20 | | | 2.8 | 3.75 | | 2.5 | | 2.5 | | |
| | | | | 25 | | | 3.54 | | | | | | | |
| | | | | 0 | 10 | 9.1 | 9.58 | | 9.1 | | 9.1 | | | V |
| | | | | 5 | | | | 9.26 | | | | | | |
| | | | | 10 | | | 8.75 | 9.17 | | 8.45 | | 8.45 | | |
| | | | | 15 | | | | 9.04 | | | | | | |
| | | | | 20 | | | 8.1 | 8.90 | | 7.8 | | 7.8 | | |
| | | | | 25 | | | 8.75 | | | | | | | |
| | | | | 0 | 15 | 14.1 | 14.59 | | 14.1 | | 14.1 | | | V |
| | | | | 5 | | | | 14.27 | | | | | | |
| | | | | 10 | | | 13.75 | 14.18 | | 13.45 | | 13.45 | | |
| | | 15 | | | | 14.07 | | | | | | | | |
| | | 20 | | 13.1 | | 13.95 | | 12.8 | | 12.8 | | | | |
| | | 25 | | | 13.80 | | | | | | | | | |
| I _{OL} | Output Sink Current | 0/5 | 0.4 | | 5 | 0.44 | 1 | | 0.36 | | 0.36 | | mA | |
| | | 0/10 | 0.5 | | 10 | 1.1 | 2.6 | | 0.9 | | 0.9 | | | |
| | | 0/15 | 1.5 | | 15 | 3 | 6.8 | | 2.4 | | 2.4 | | | |
| I _I | Input Leakage Current (any input) | 0/18 | | | 18 | | $\pm 10^{-5}$ | ± 0.1 | | ± 1 | | ± 1 | μ A | |
| C _I | Input Capacitance (any input) | | | | | | 5 | 7.5 | | | | | pF | |

The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}=5V, 2V min. with V_{DD}=10V, 2.5V min. with V_{DD}=15V

HCF4511B

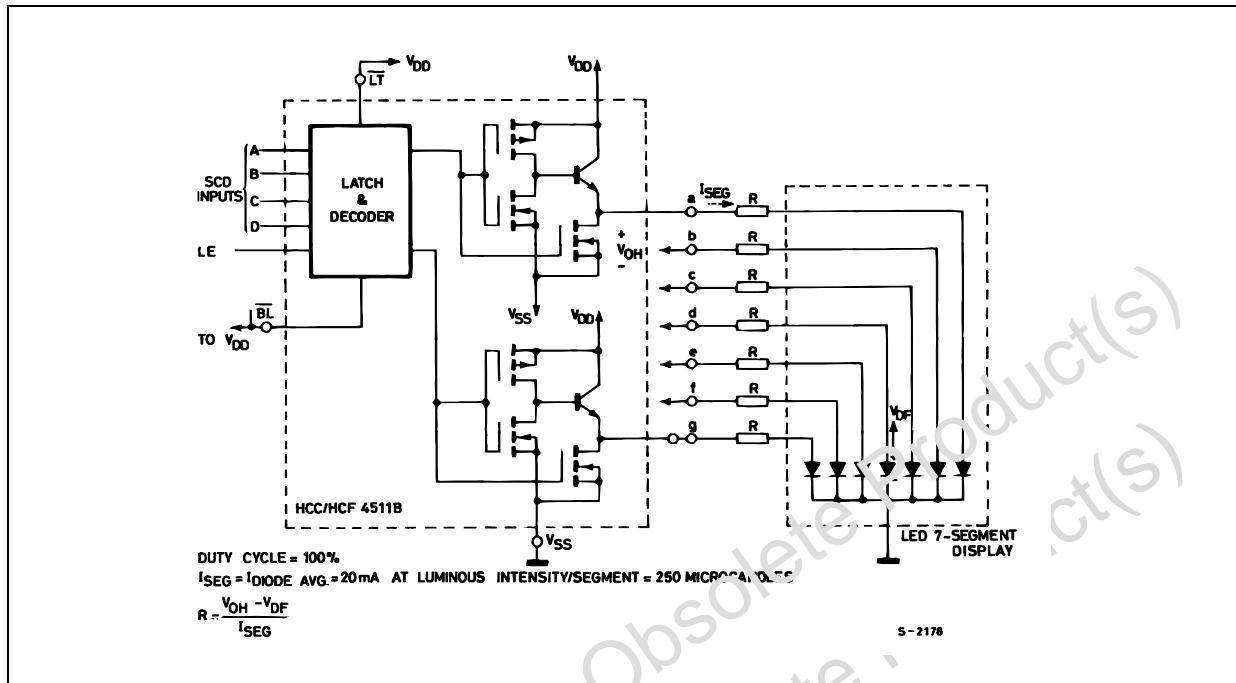
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$, $C_L = 50\text{pF}$, $R_L = 200\text{K}\Omega$, $t_r = t_f = 20\text{ ns}$)

| Symbol | Parameter | TEST CONDITION | | Value (*) | | | Unit |
|-------------|-------------------------------|-----------------|--|-----------|------|------|------|
| | | V_{DD} (V) | | Min. | Typ. | Max. | |
| t_{PHL} | Propagation Delay Time (DATA) | 5 | | | 520 | 1040 | ns |
| | | 10 | | | 210 | 420 | |
| | | 15 | | | 150 | 300 | |
| t_{PLH} | Propagation Delay Time (DATA) | 5 | | | 660 | 1320 | ns |
| | | 10 | | | 260 | 520 | |
| | | 15 | | | 180 | 360 | |
| t_{PHL} | Propagation Delay Time (BL) | 5 | | | 350 | 700 | ns |
| | | 10 | | | 175 | 350 | |
| | | 15 | | | 125 | 250 | |
| t_{PLH} | Propagation Delay Time (BL) | 5 | | | 400 | 800 | ns |
| | | 10 | | | 175 | 350 | |
| | | 15 | | | 150 | 300 | |
| t_{PHL} | Propagation Delay Time (LT) | 5 | | | 250 | 500 | ns |
| | | 10 | | | 125 | 250 | |
| | | 15 | | | 85 | 170 | |
| t_{PLH} | Propagation Delay Time (LT) | 5 | | | 150 | 300 | ns |
| | | 10 | | | 75 | 150 | |
| | | 15 | | | 50 | 100 | |
| t_{TLH} | Transition Time | 5 | | | 40 | 80 | ns |
| | | 10 | | | 30 | 60 | |
| | | 15 | | | 20 | 50 | |
| t_{THL} | Transition Time | 5 | | | 125 | 310 | ns |
| | | 10 | | | 75 | 185 | |
| | | 15 | | | 65 | 160 | |
| t_{setup} | Setup Time | 5 | | 150 | 75 | | ns |
| | | 10 | | 70 | 35 | | |
| | | 15 | | 40 | 20 | | |
| t_{hold} | Hold Time | 5 | | 0 | -75 | | ns |
| | | 10 | | 0 | -35 | | |
| | | 15 | | 0 | -20 | | |
| t_{V} | Strobe Pulse Width | 5 | | 400 | 200 | | ns |
| | | 10 | | 160 | 80 | | |
| | | 15 | | 100 | 50 | | |

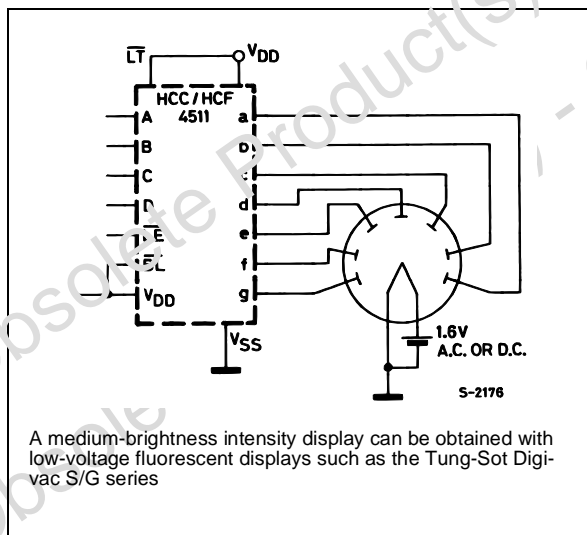
(*) Typical temperature coefficient for all V_{DD} value is 0.3 %/°C.

TYPICAL APPLICATIONS (Interfacing with various displays)

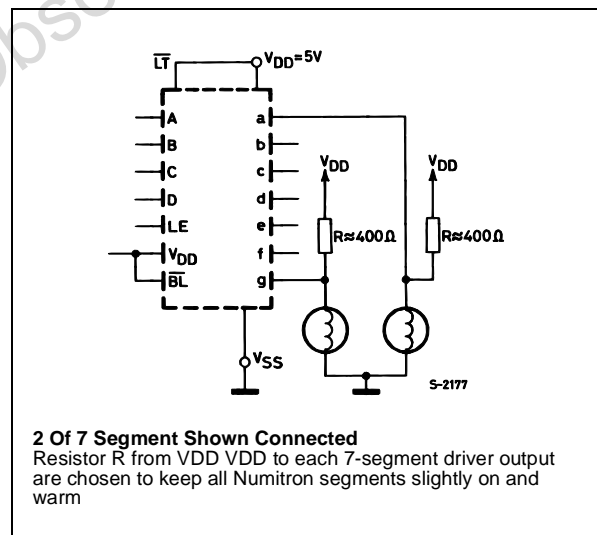
Driving Common-cathode 7 Segment Led Displays



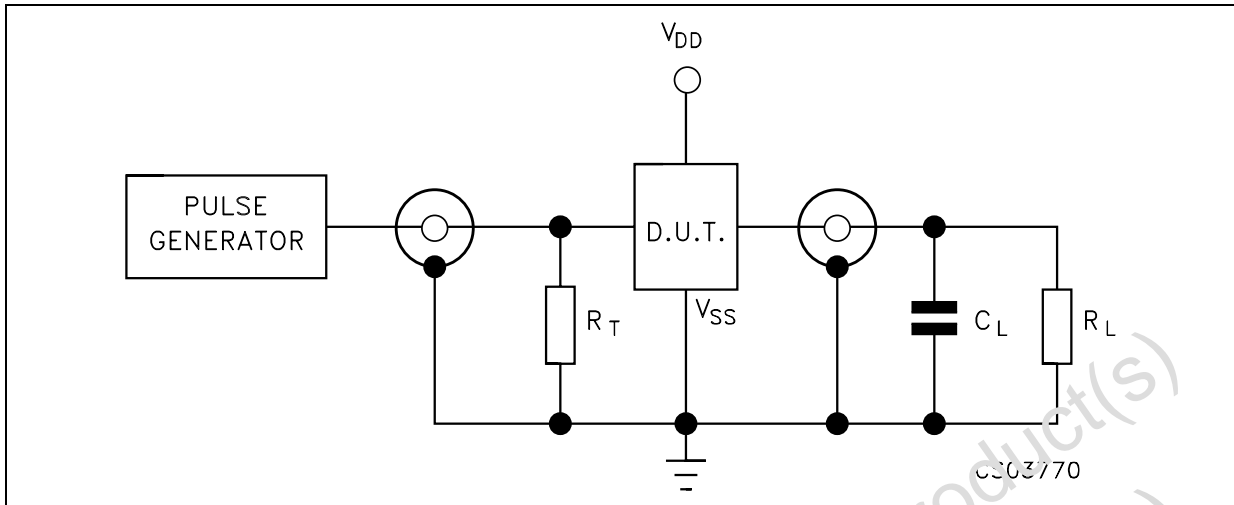
Driving Low-voltage Fluorescent Displays



Driving Incandescent Displays

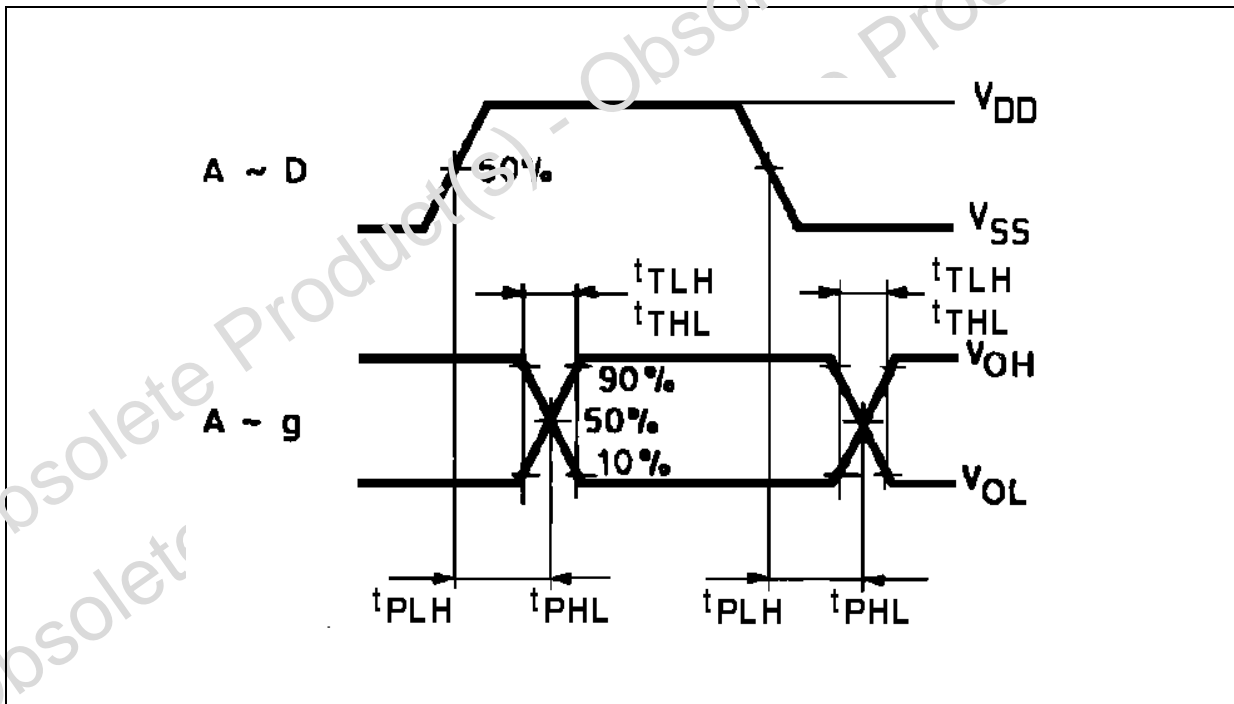


TEST CIRCUIT

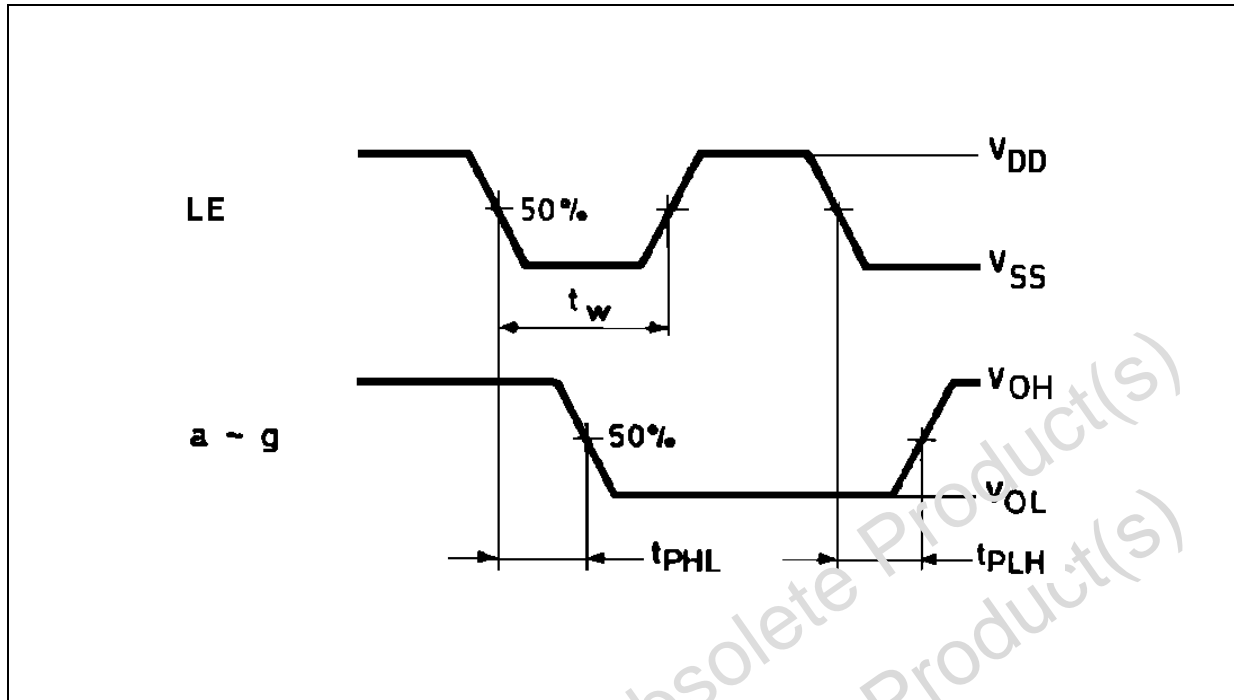


$C_L = 50\text{pF}$ or equivalent (includes jig and probe capacitance)
 $R_L = 200\text{K}\Omega$
 $R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

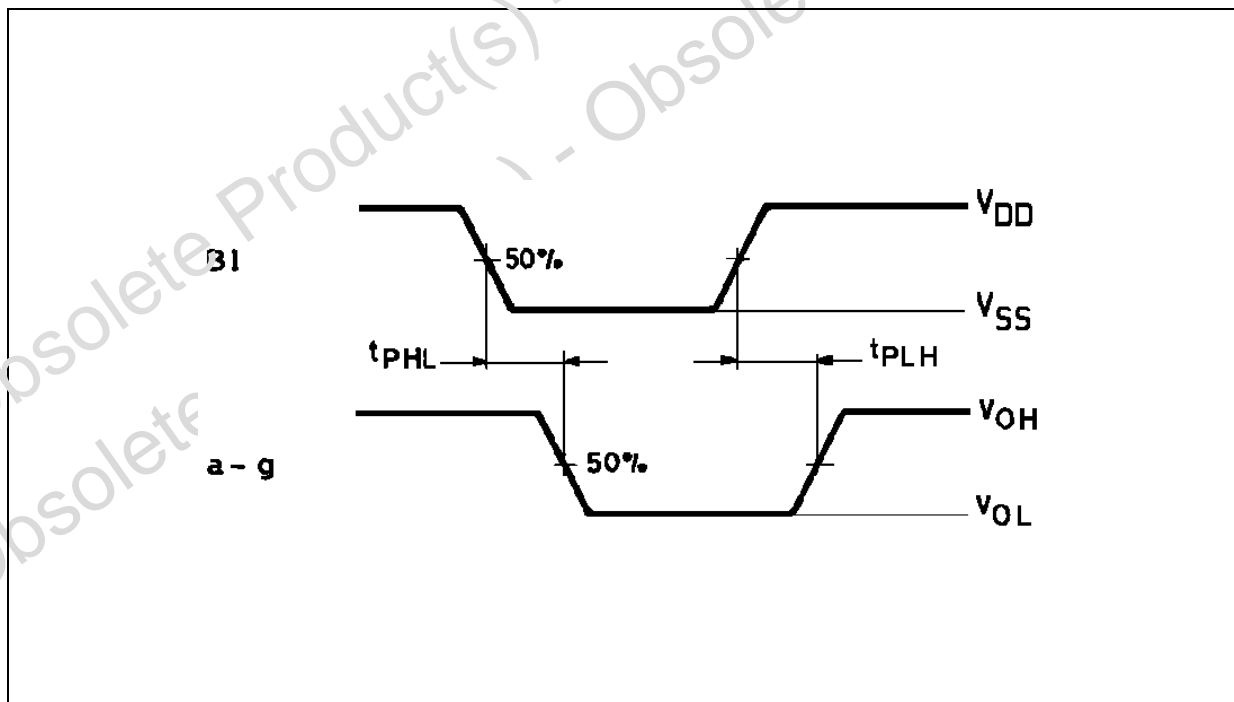
WAVEFORM 1 : PROPAGATION DELAY TIMES ($f=1\text{MHz}$; 50% duty cycle)



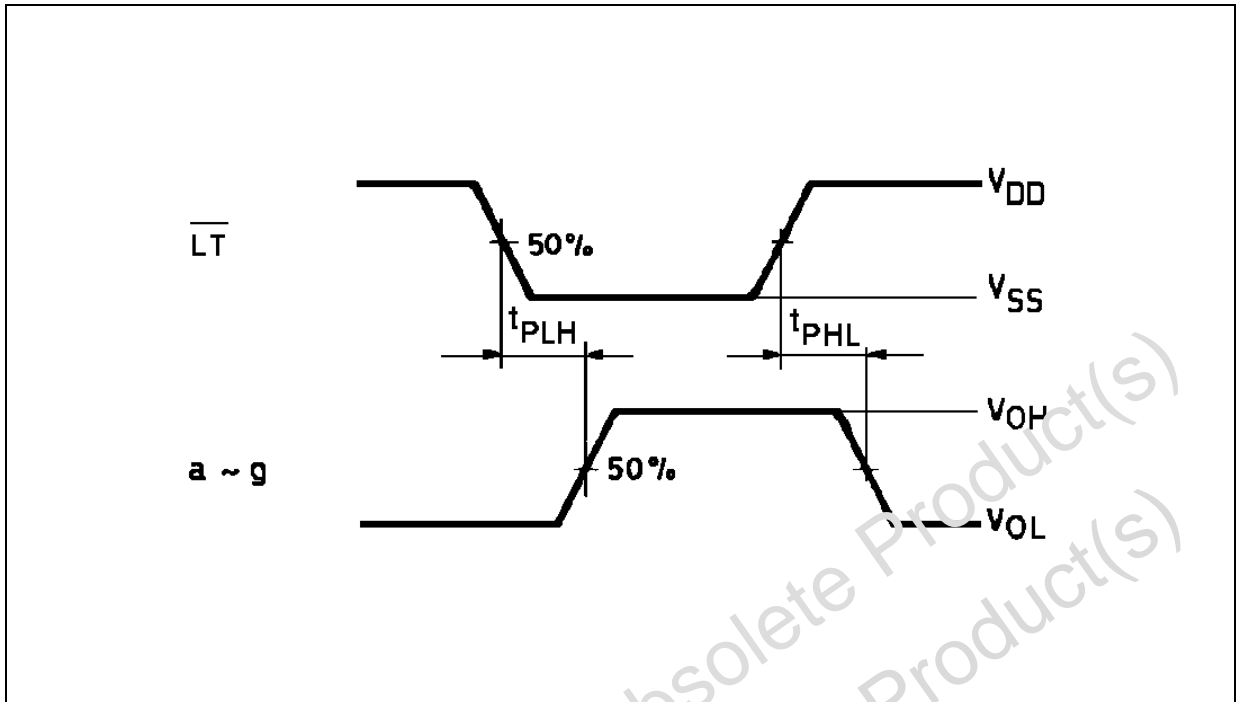
WAVEFORM 2 : MINIMUM PULSE WIDTH (f=1MHz; 50% duty cycle)



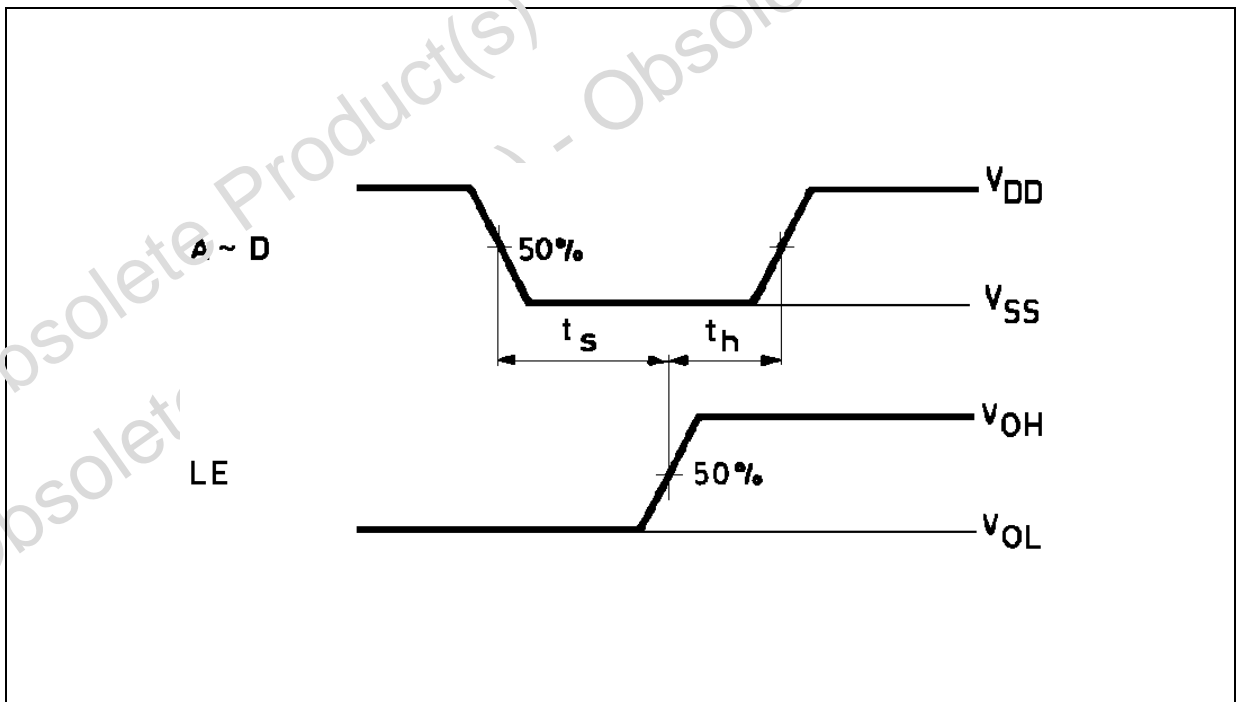
WAVEFORM 3 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



WAVEFORM 4 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)

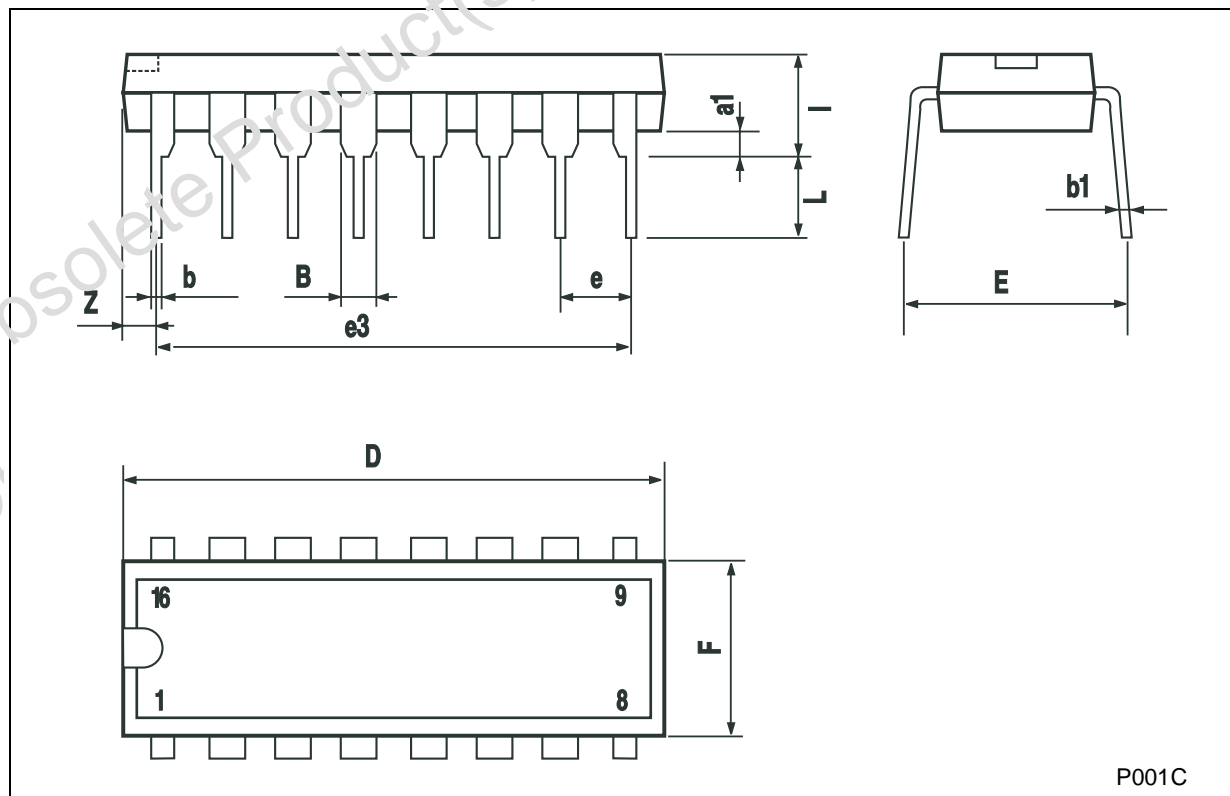


WAVEFORM 5 : MINIMUM SETUP AND HOLD TIME (f=1MHz; 50% duty cycle)



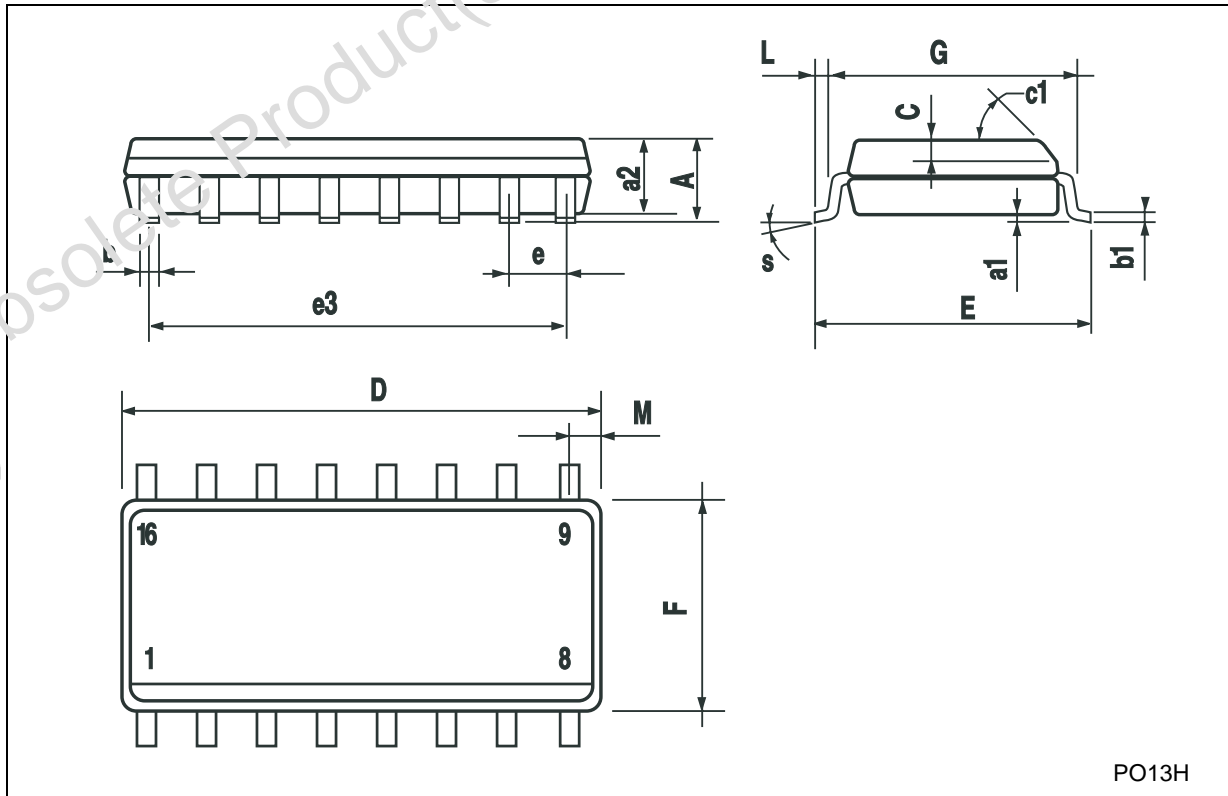
Plastic DIP-16 (0.25) MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.333 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |



SO-16 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 | 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 | | 0.7 | 0.019 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



PO13H

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