



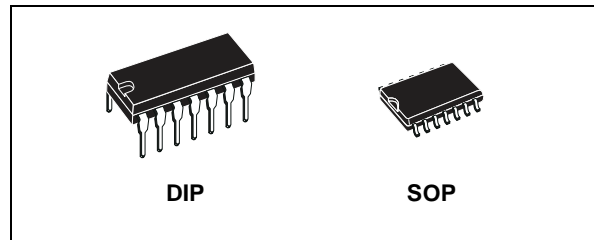
HCF4093B

QUAD 2 INPUT NAND SCHMITT TRIGGER

- SCHMITT TRIGGER ACTION ON EACH INPUT WITH NO EXTERNAL COMPONENTS
- HYSTERESIS VOLTAGE TYPICALLY 0.9V at $V_{DD} = 5V$ AND 2.3V at $V_{DD} = 10V$
- NOISE IMMUNITY GREATER THAN 50% OF V_{DD} (Typ.)
- NO LIMIT ON INPUT RISE AND FALL TIMES
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT
 $I_l = 100nA$ (MAX) AT $V_{DD} = 18V$ $T_A = 25^\circ C$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"

DESCRIPTION

The HCF4093B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages.

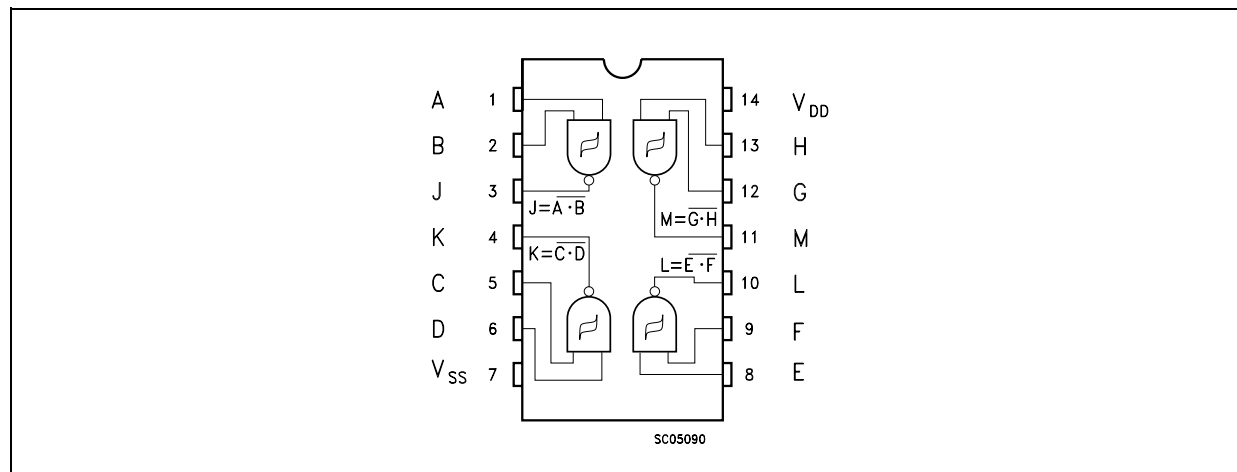


ORDER CODES

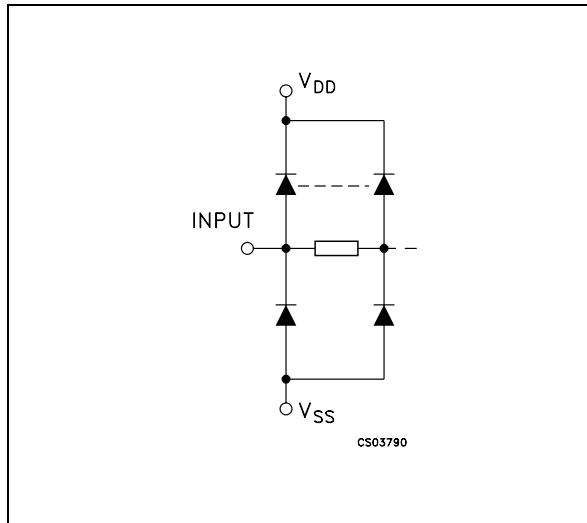
| PACKAGE | TUBE | T & R |
|---------|------------|---------------|
| DIP | HCF4093BEY | |
| SOP | HCF4093BM1 | HCF4093M013TR |

The HCF4093B type consists of four schmitt trigger circuits. Each circuit functions as a two input NAND gate with schmitt trigger action on both inputs. The gate switches at different points for positive and negative going signals. The difference between the positive voltage (V_P) and the negative voltage (V_N) is defined as hysteresis voltage (V_H).

PIN CONNECTION



INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|--------------------------|------------------------|-------------------------|
| 1, 2, 5, 6, 8, 9, 12, 13 | A, B, C, D, E, F, G, H | Data Inputs |
| 3, 4, 10, 11 | J, K, L, M | Data Outputs |
| 7 | V _{SS} | Negative Supply Voltage |
| 14 | V _{DD} | Positive Supply Voltage |

TRUTH TABLE

| INPUTS | | OUTPUTS |
|------------|------------|------------|
| A, C, E, G | B, D, F, H | J, K, L, M |
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

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 | | 0.02 | 1 | | 30 | | 30 | μ A |
| | | 0/10 | | | 10 | | 0.02 | 2 | | 60 | | 60 | |
| | | 0/15 | | | 15 | | 0.02 | 4 | | 120 | | 120 | |
| | | 0/20 | | | 20 | | 0.04 | 20 | | 600 | | 600 | |
| V _{OH} | High Level Output Voltage | 0/5 | | <1 | 5 | 4.95 | | | 4.95 | | 4.95 | | V |
| | | 0/10 | | <1 | 10 | 9.95 | | | 9.95 | | 9.95 | | |
| | | 0/15 | | <1 | 15 | 14.95 | | | 14.95 | | 14.95 | | |
| V _{OL} | Low Level Output Voltage | 5/0 | | <1 | 5 | | 0.05 | | | 0.05 | | 0.05 | V |
| | | 10/0 | | <1 | 10 | | 0.05 | | | 0.05 | | 0.05 | |
| | | 15/0 | | <1 | 15 | | 0.05 | | | 0.05 | | 0.05 | |
| V _P | Positive Trigger Threshold Voltage | a | | | 5 | 2.2 | 2.9 | 3.6 | 2.2 | 3.6 | 2.2 | 3.6 | V |
| | | a | | | 10 | 4.6 | 5.9 | 7.1 | 4.6 | 7.1 | 4.6 | 7.1 | |
| | | a | | | 15 | 6.8 | 8.8 | 10.8 | 6.8 | 10.8 | 6.8 | 10.8 | |
| | | b | | | 5 | 2.6 | 3.3 | 4.0 | 2.6 | 4 | 2.6 | 4 | |
| | | b | | | 10 | 5.6 | 7 | 8.2 | 5.6 | 8.2 | 5.6 | 8.2 | |
| | | b | | | 15 | 6.3 | 9.4 | 12.7 | 6.3 | 12.7 | 6.3 | 12.7 | |
| V _N | Negative Trigger Threshold Voltage | a | | | 5 | 0.9 | 1.9 | 2.8 | 0.9 | 2.8 | 0.9 | 2.8 | V |
| | | a | | | 10 | 2.5 | 3.9 | 5.2 | 2.5 | 5.2 | 2.5 | 5.2 | |
| | | a | | | 15 | 4 | 5.8 | 7.4 | 4 | 7.4 | 4 | 7.4 | |
| | | b | | | 5 | 1.4 | 2.3 | 3.2 | 1.4 | 3.2 | 1.4 | 3.2 | |
| | | b | | | 10 | 3.4 | 5.1 | 6.6 | 3.4 | 6.6 | 3.4 | 6.6 | |
| | | b | | | 15 | 4.8 | 7.3 | 9.6 | 4.8 | 9.6 | 4.8 | 9.6 | |
| V _H | Hysteresis Voltage | a | | | 5 | 0.3 | 0.9 | 1.6 | 0.3 | 1.6 | 0.3 | 1.6 | V |
| | | a | | | 10 | 1.2 | 2.3 | 3.4 | 1.2 | 3.4 | 1.2 | 3.4 | |
| | | a | | | 15 | 1.6 | 3.5 | 5 | 1.6 | 5 | 1.6 | 5 | |
| | | b | | | 5 | 0.3 | 0.9 | 1.6 | 0.3 | 1.6 | 0.3 | 1.6 | |
| | | b | | | 10 | 1.2 | 2.3 | 3.4 | 1.2 | 3.4 | 1.2 | 3.4 | |
| | | b | | | 15 | 1.6 | 3.5 | 5 | 1.6 | 5 | 1.6 | 5 | |
| I _{OH} | Output Drive Current | 0/5 | 2.5 | <1 | 5 | -1.36 | -3.2 | | -1.15 | | -1.1 | | mA |
| | | 0/5 | 4.6 | <1 | 5 | -0.44 | -1 | | -0.36 | | -0.36 | | |
| | | 0/10 | 9.5 | <1 | 10 | -1.1 | -2.6 | | -0.9 | | -0.9 | | |
| | | 0/15 | 13.5 | <1 | 15 | -3.0 | -6.8 | | -2.4 | | -2.4 | | |
| I _{OL} | Output Sink Current | 0/5 | 0.4 | <1 | 5 | 0.44 | 1 | | 0.36 | | 0.36 | | mA |
| | | 0/10 | 0.5 | <1 | 10 | 1.1 | 2.6 | | 0.9 | | 0.9 | | |
| | | 0/15 | 1.5 | <1 | 15 | 3.0 | 6.8 | | 2.4 | | 2.4 | | |
| I _I | Input Leakage Current | 0/18 | Any Input | 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

a : Input on terminals 1, 5, 8, 12 or 2, 6, 9, 13; other inputs to V_{DD}.

b : Input on terminals 1 and 2, 5 and 6, 8 and 9, or 12 and 13; other inputs to V_{DD}.

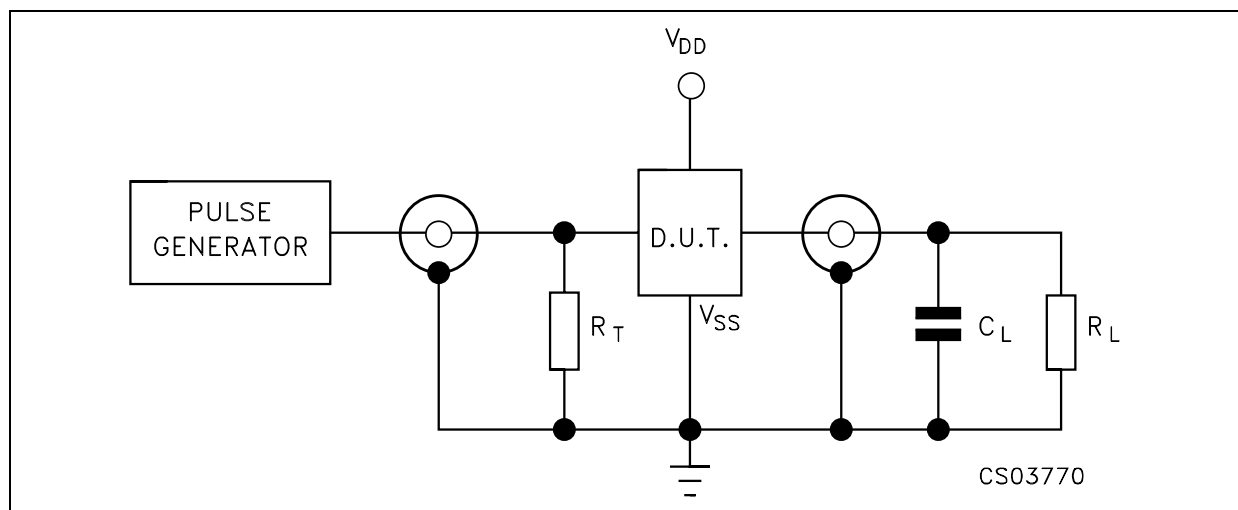
HCF4093B

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_{PLH} t_{PHL} | Propagation Delay Time | 5 | | | 190 | 380 | ns |
| | | 10 | | | 90 | 180 | |
| | | 15 | | | 65 | 130 | |
| t_{TLH} t_{THL} | Output Transition Time | 5 | | | 100 | 200 | ns |
| | | 10 | | | 50 | 100 | |
| | | 15 | | | 40 | 80 | |

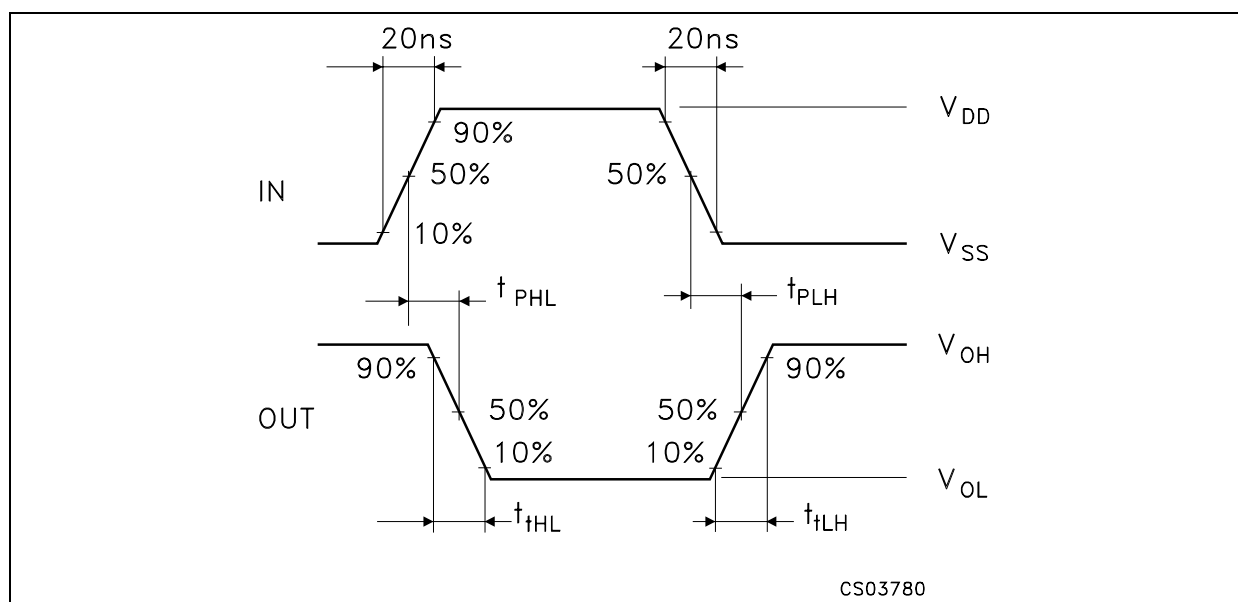
(*) Typical temperature coefficient for all V_{DD} value is 0.3 %/°C.

TEST CIRCUIT



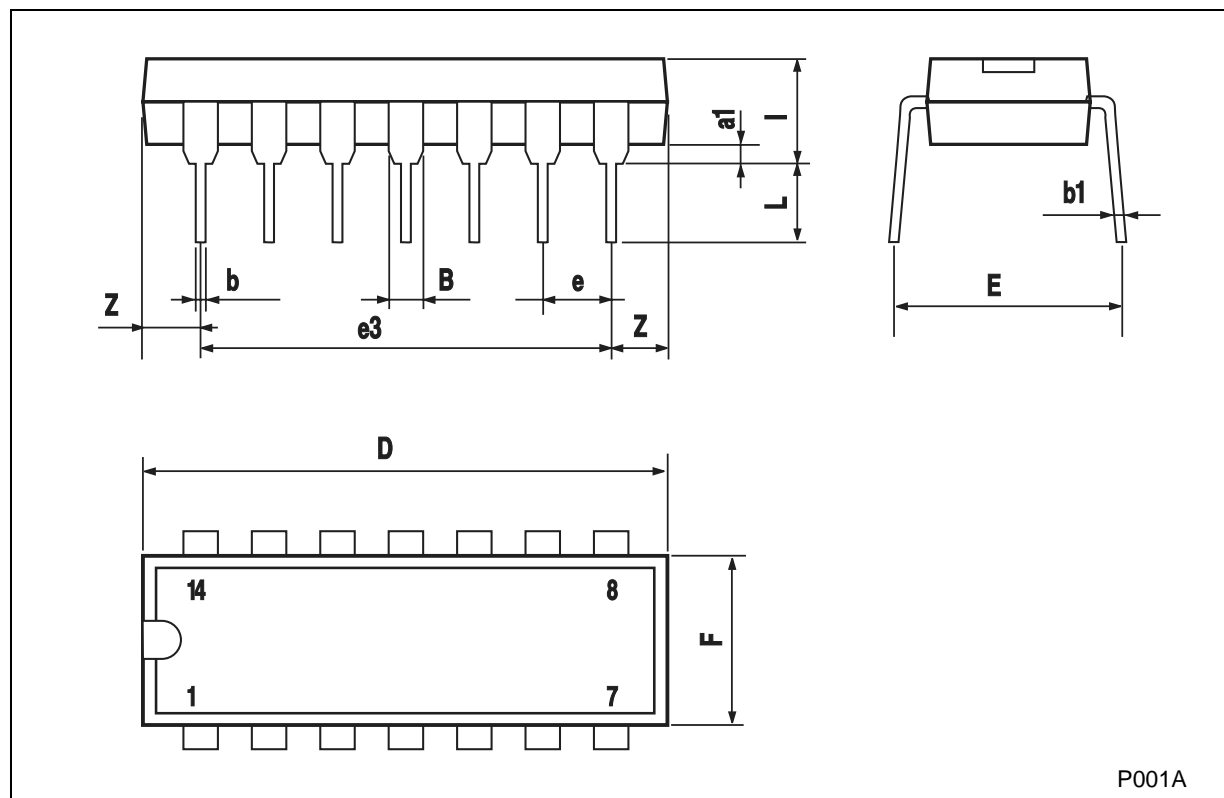
$C_L = 50\text{pF}$ or equivalent (includes jig and probe capacitance)
 $R_L = 200\text{K}\Omega$
 $R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

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



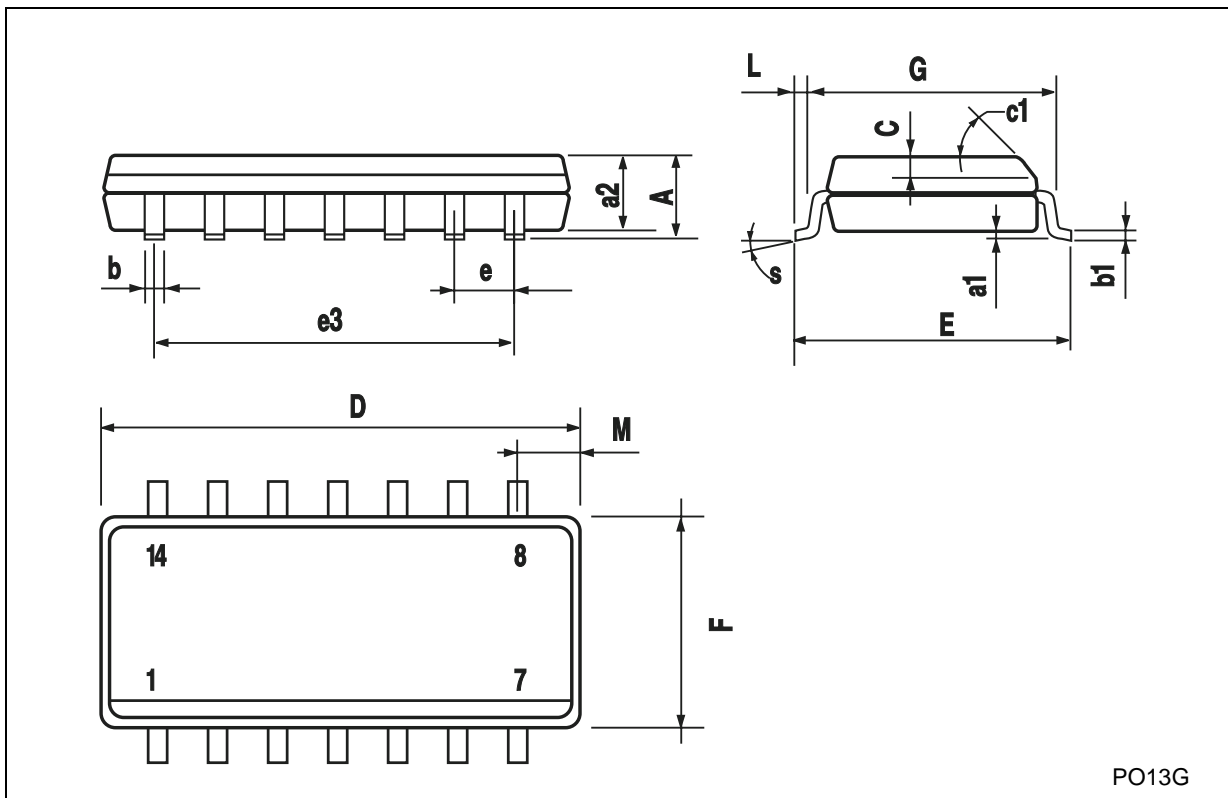
Plastic DIP-14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 15.24 | | | 0.600 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | 1.27 | | 2.54 | 0.050 | | 0.100 |



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.) | | | | | |



PO13G

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