



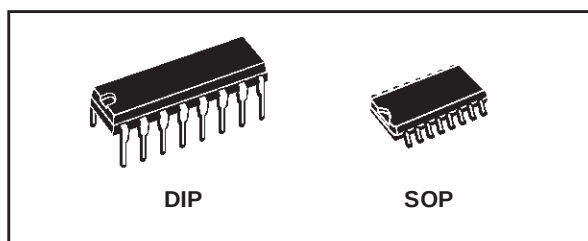
## HCF4009UB

### HEX BUFFER/CONVERTER (INVERTING)

- PROPAGATION DELAY TIME  $t_{PD} = 40\text{ns}$  (Typ.) at  $V_{DD} = 10\text{V}$   $C_L = 50\text{pF}$
- HIGH TO LOW LEVEL LOGIC CONVERSION
- MULTIPLEXER: 1 TO 6 OR 6 TO 1
- HIGH "SINK" AND "SOURCE" CURRENT CAPABILITY
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT  
 $I_I = 100\text{nA}$  (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

The HCF4009UB is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages.



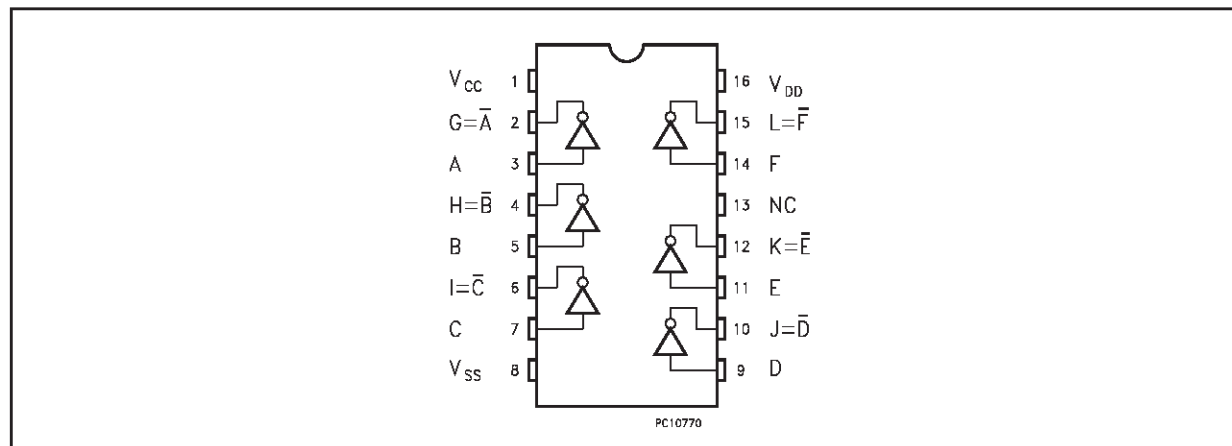
#### ORDER CODES

| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | HCF4009UBEY |                |
| SOP     | HCF4009UBM1 | HCF4009UM013TR |

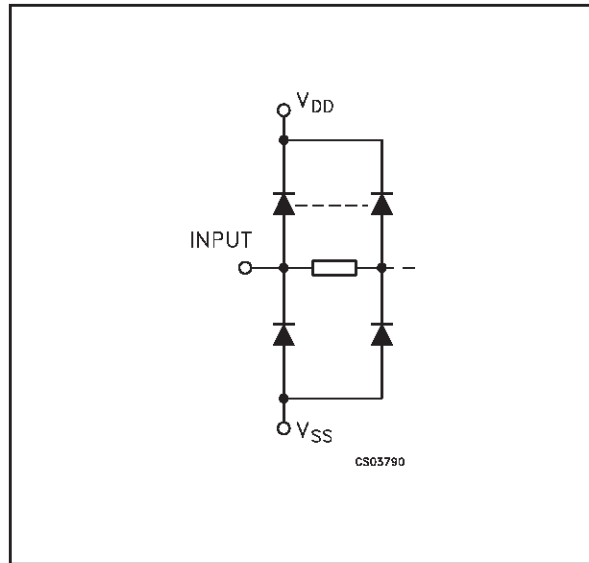
It is an inverting Hex Buffer/Converter and can be used as CMOS to TTL logic level converter as current "sink" or "source" driver or as multiplexer (1 to 6).

It is a preferred replacement of HCF4049UB in buffer applications.

#### PIN CONNECTION



## INPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

| PIN No              | SYMBOL           | NAME AND FUNCTION       |
|---------------------|------------------|-------------------------|
| 3, 5, 7, 9, 11, 14  | A, B, C, D, E, F | Data Inputs             |
| 2, 4, 6, 10, 12, 15 | G, H, I, J, K, L | Data Outputs            |
| 13                  | NC               | Not Connected           |
| 1                   | V <sub>CC</sub>  | Positive Supply Voltage |
| 8                   | V <sub>SS</sub>  | Negative Supply Voltage |
| 16                  | V <sub>DD</sub>  | Positive Supply Voltage |

## TRUTH TABLE

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

## ABSOLUTE MAXIMUM RATINGS

| Symbol           | Parameter                               | Value                         | Unit |
|------------------|-----------------------------------------|-------------------------------|------|
| V <sub>DD</sub>  | Supply Voltage                          | -0.5 to +22                   | V    |
| V <sub>I</sub>   | DC Input Voltage                        | -0.5 to V <sub>DD</sub> + 0.5 | V    |
| I <sub>I</sub>   | DC Input Current                        | ± 10                          | mA   |
| P <sub>D</sub>   | Power Dissipation per Package           | 200                           | mW   |
|                  | Power Dissipation per Output Transistor | 100                           | mW   |
| T <sub>op</sub>  | Operating Temperature                   | -55 to +125                   | °C   |
| T <sub>stg</sub> | 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<sub>SS</sub> pin voltage.

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter             | Value                | Unit |
|-----------------|-----------------------|----------------------|------|
| V <sub>DD</sub> | Supply Voltage        | 3 to 20              | V    |
| V <sub>I</sub>  | Input Voltage         | 0 to V <sub>DD</sub> | V    |
| T <sub>op</sub> | Operating Temperature | -55 to 125           | °C   |

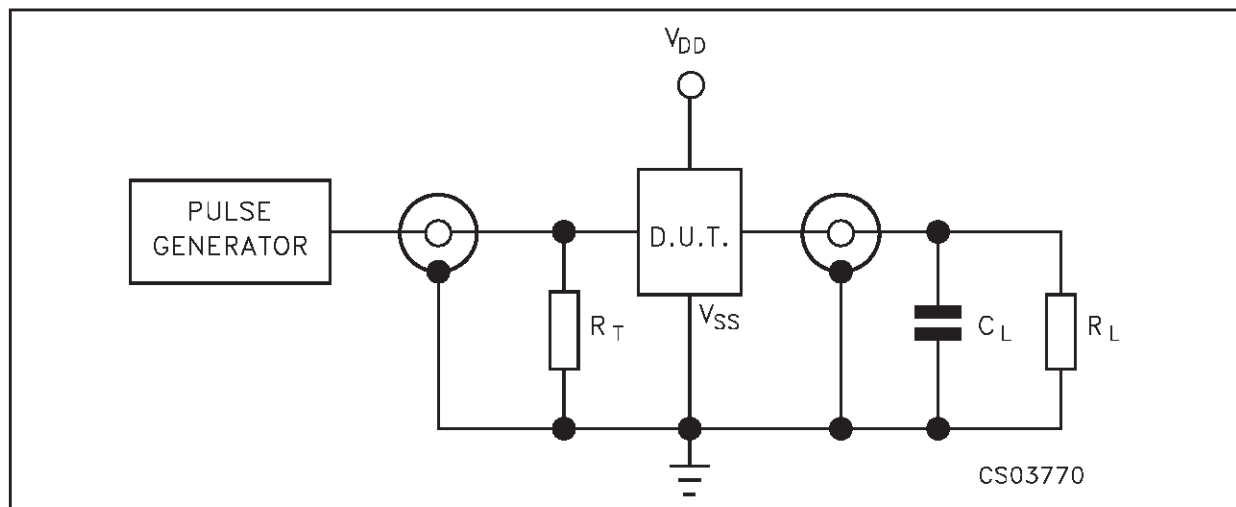
## DC SPECIFICATIONS

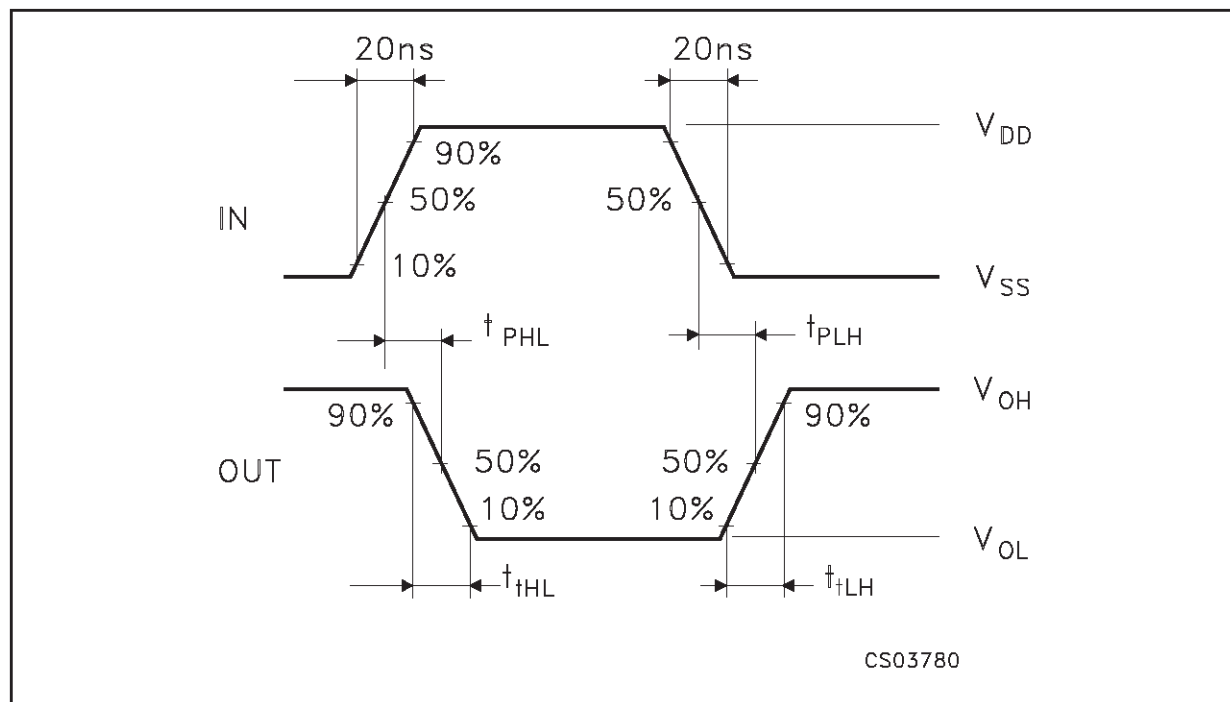
| Symbol          | Parameter                 | Test Condition        |                       |                          |                                             | Value                 |                   |      |             |      |              |      | Unit |
|-----------------|---------------------------|-----------------------|-----------------------|--------------------------|---------------------------------------------|-----------------------|-------------------|------|-------------|------|--------------|------|------|
|                 |                           | V <sub>I</sub><br>(V) | V <sub>O</sub><br>(V) | I <sub>O</sub>  <br>(μA) | V <sub>DD</sub> =<br>V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |                   |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                           |                       |                       |                          |                                             | Min.                  | Typ.              | Max. | Min.        | Max. | Min.         | Max. |      |
| I <sub>L</sub>  | Quiescent Current         | 0/5                   |                       |                          | 5                                           |                       | 0.02              | 1    |             | 30   |              | 30   | μA   |
|                 |                           | 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 <sub>OH</sub> | 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 <sub>OL</sub> | 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 <sub>IH</sub> | High Level Input Voltage  |                       | 0.5/4.5               | <1                       | 5                                           | 4                     |                   |      | 4           |      | 4            |      | V    |
|                 |                           |                       | 1/9                   | <1                       | 10                                          | 8                     |                   |      | 8           |      | 8            |      |      |
|                 |                           |                       | 1.5/13.5              | <1                       | 15                                          | 12.5                  |                   |      | 12.5        |      | 12.5         |      |      |
| V <sub>IL</sub> | Low Level Input Voltage   |                       | 4.5/0.5               | <1                       | 5                                           |                       |                   | 1    |             | 1    |              | 1    | V    |
|                 |                           |                       | 9/1                   | <1                       | 10                                          |                       |                   | 2    |             | 2    |              | 2    |      |
|                 |                           |                       | 13.5/1.5              | <1                       | 15                                          |                       |                   | 2.5  |             | 2.5  |              | 2.5  |      |
| I <sub>OH</sub> | Output Drive Current      | 0/5                   | 2.5                   | <1                       | 5                                           | -0.8                  | -1.6              |      | -0.65       |      | -0.65        |      | mA   |
|                 |                           | 0/5                   | 4.6                   | <1                       | 5                                           | -0.2                  | -0.4              |      | -0.18       |      | -0.18        |      |      |
|                 |                           | 0/10                  | 9.5                   | <1                       | 10                                          | -0.45                 | -0.9              |      | -0.38       |      | -0.38        |      |      |
|                 |                           | 0/15                  | 13.5                  | <1                       | 15                                          | -1.5                  | -3                |      | -1.25       |      | -1.25        |      |      |
| I <sub>OL</sub> | Output Sink Current       | 0/5                   | 0.4                   | <1                       | 5                                           | 3                     | 4                 |      | 2.4         |      | 2.4          |      | mA   |
|                 |                           | 0/10                  | 0.5                   | <1                       | 10                                          | 8                     | 10                |      | 6.4         |      | 6.4          |      |      |
|                 |                           | 0/15                  | 1.5                   | <1                       | 15                                          | 24                    | 36                |      | 19          |      | 19           |      |      |
| I <sub>I</sub>  | Input Leakage Current     | 0/18                  | Any Input             |                          | 18                                          |                       | ±10 <sup>-5</sup> | ±0.1 |             | ±1   |              | ±1   | μA   |
| C <sub>I</sub>  | Input Capacitance         |                       | Any Input             |                          |                                             |                       | 15                | 22.6 |             |      |              |      | pF   |

The Noise Margin for both "1" and "0" level is: 1V min. with V<sub>DD</sub>=5V, 2V min. with V<sub>DD</sub>=10V, 2.5V min. with V<sub>DD</sub>=15V

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

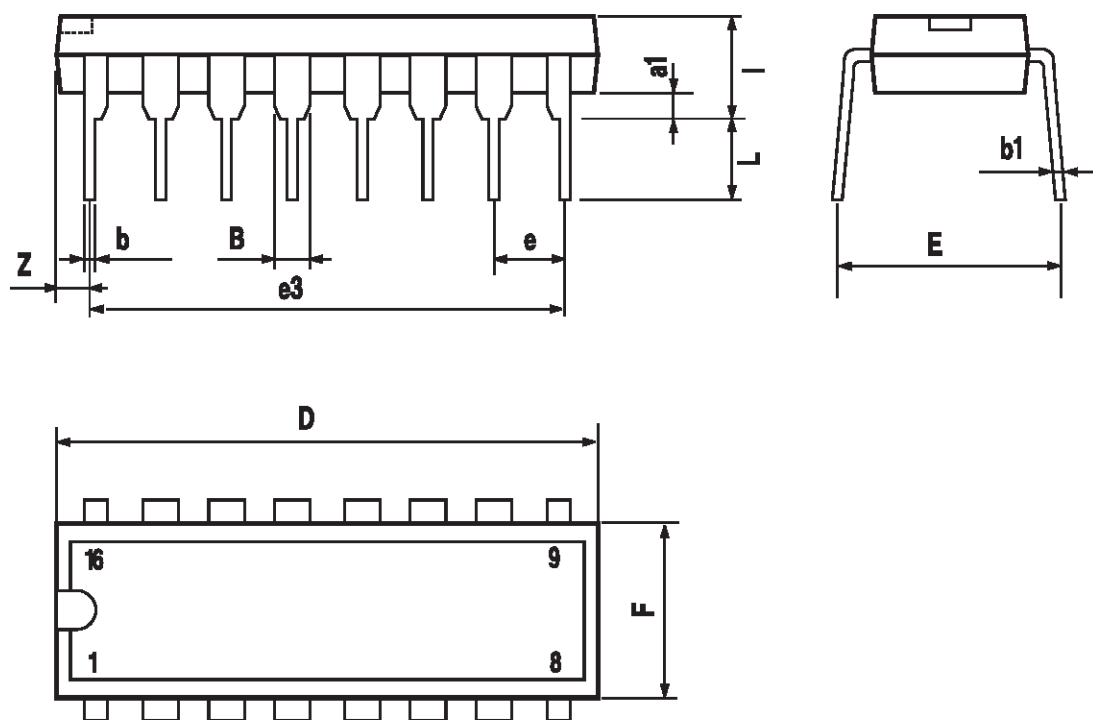
| Symbol    | Parameter              | Test Condition |           |              |  | Value (*) |      |      | Unit |
|-----------|------------------------|----------------|-----------|--------------|--|-----------|------|------|------|
|           |                        | $V_{DD}$ (V)   | $V_I$ (V) | $V_{CC}$ (V) |  | Min.      | Typ. | Max. |      |
| $t_{TLH}$ | Output Transition Time | 5              | 5         | 5            |  |           | 150  | 350  | ns   |
|           |                        | 10             | 10        | 10           |  |           | 75   | 15   |      |
|           |                        | 15             | 15        | 15           |  |           | 55   | 110  |      |
| $t_{THL}$ | Output Transition Time | 5              | 5         | 5            |  |           | 35   | 70   | ns   |
|           |                        | 10             | 10        | 10           |  |           | 20   | 40   |      |
|           |                        | 15             | 15        | 15           |  |           | 15   | 30   |      |
| $t_{PLH}$ | Propagation Delay Time | 5              | 5         | 5            |  |           | 70   | 140  | ns   |
|           |                        | 10             | 10        | 10           |  |           | 40   | 80   |      |
|           |                        | 10             | 10        | 5            |  |           | 35   | 70   |      |
|           |                        | 15             | 15        | 15           |  |           | 30   | 60   |      |
|           |                        | 15             | 15        | 5            |  |           | 30   | 60   |      |
| $t_{PHL}$ | Propagation Delay Time | 5              | 5         | 5            |  |           | 30   | 60   | ns   |
|           |                        | 10             | 10        | 10           |  |           | 20   | 40   |      |
|           |                        | 10             | 10        | 5            |  |           | 15   | 30   |      |
|           |                        | 15             | 15        | 15           |  |           | 15   | 30   |      |
|           |                        | 15             | 15        | 5            |  |           | 10   | 20   |      |

(\*) 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  $50\Omega$ )

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

## Plastic DIP-16 (0.25) MECHANICAL DATA

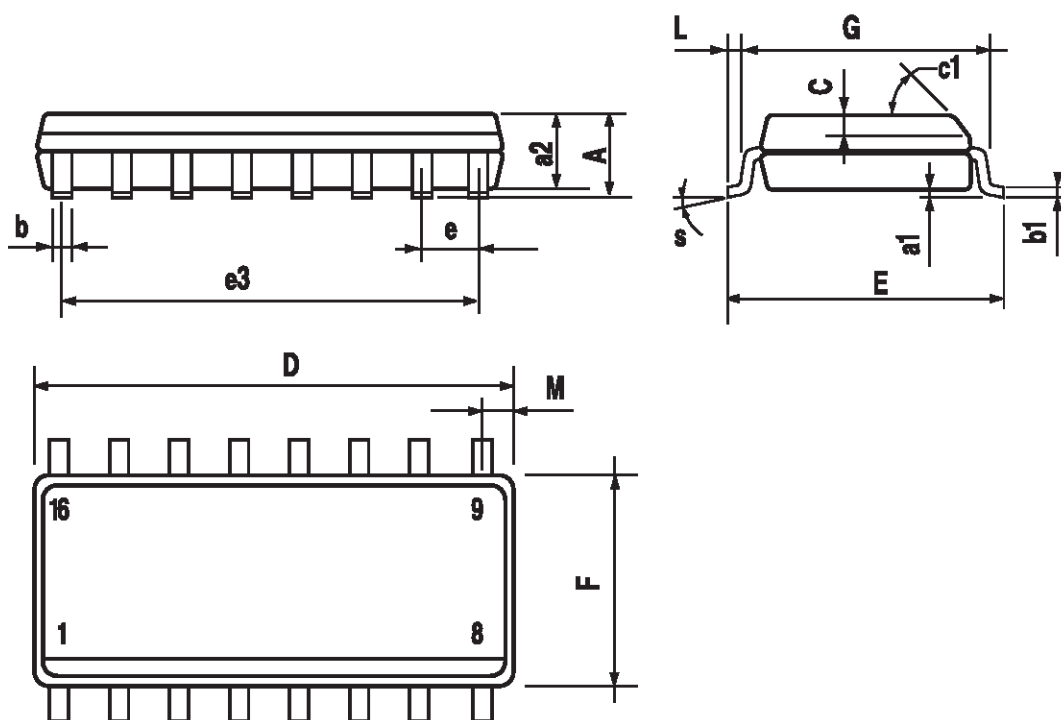
| DIM. | mm.  |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP   | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 0.020 |       |
| b1   |      | 0.25  |      |       | 0.010 |       |
| D    |      |       | 20   |       |       | 0.787 |
| E    |      | 8.5   |      |       | 0.335 |       |
| 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 |



P001C

## 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        |      | 1.27 | 0.019 |       | 0.050 |
| M    |            |      | 0.62 |       |       | 0.024 |
| S    | 8° (max.)  |      |      |       |       |       |



PO13H

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