



# LM833

## LOW NOISE DUAL OPERATIONAL AMPLIFIER

- LOW VOLTAGE NOISE:  $4.5\text{nV}/\sqrt{\text{Hz}}$
- HIGH GAIN BANDWIDTH PRODUCT: **15MHz**
- HIGH SLEW RATE:  $7\text{V}/\mu\text{s}$
- LOW DISTORTION: 0.002%
- EXCELLENT FREQUENCY STABILITY
- ESD PROTECTION 2kV

### DESCRIPTION

The LM833 is a monolithic dual operational amplifier particularly well suited for audio applications. It offers low voltage noise ( $4.5\text{nV}/\sqrt{\text{Hz}}$ ) and high frequency performances (15MHz Gain Bandwidth product,  $7\text{V}/\mu\text{s}$  slew rate).

In addition the LM833 has also a very low distortion (0.002%) and excellent phase/gain margins.

### ORDER CODE

| Part Number | Temperature Range | Package |   |
|-------------|-------------------|---------|---|
|             |                   | N       | D |
| LM833       | -40°C, +105°C     | •       | • |

N = Dual in Line Package (DIP)

D = Small Outline Package (SO) - also available in Tape & Reel (DT)

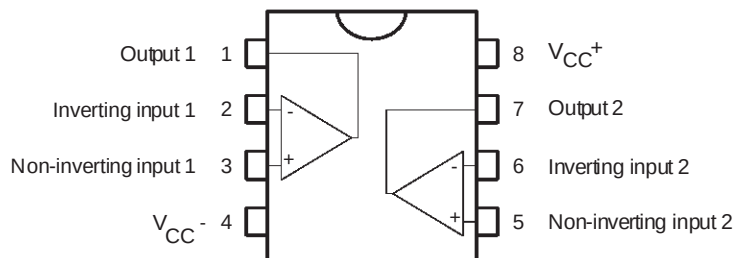


**N  
DIP8**  
(Plastic Package)



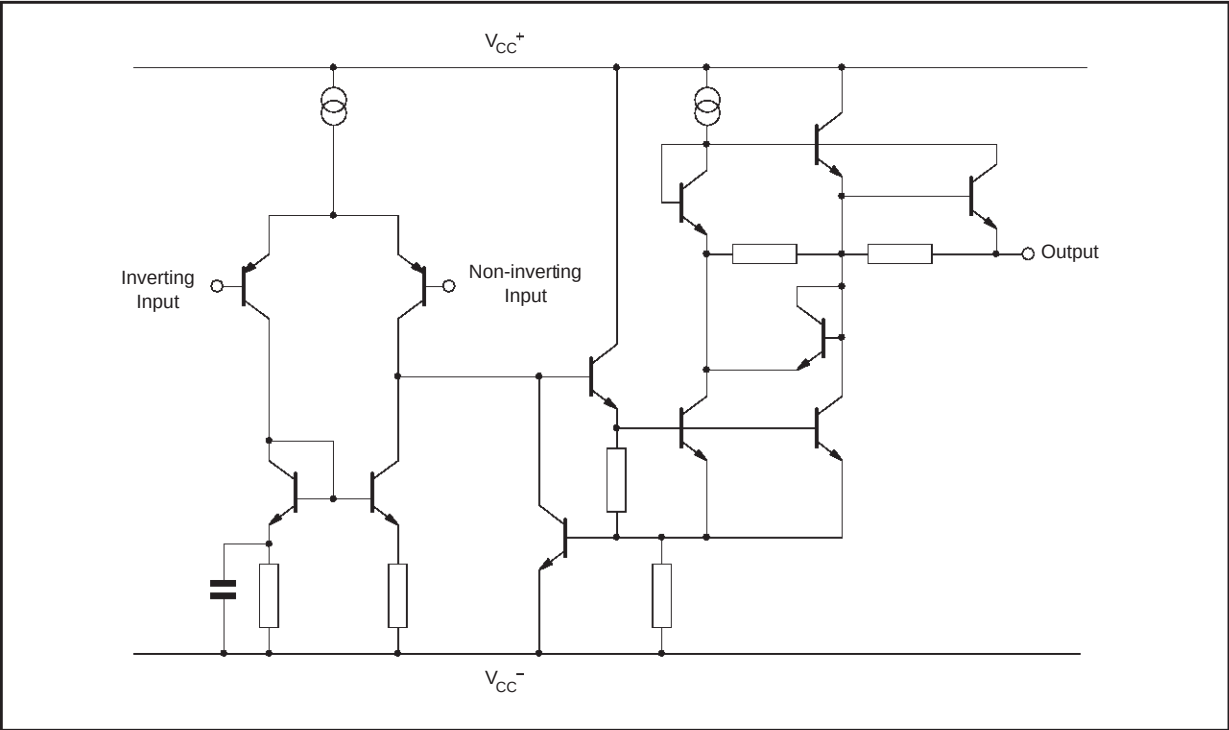
**D  
SO8**  
(Plastic Micropackage)

### PIN CONNECTIONS (top view)



# LM833

## SCHEMATIC DIAGRAM (1/2 LM833)



## ABSOLUTE MAXIMUM RATINGS

| Symbol     | Parameter                                       | Value             | Unit |
|------------|-------------------------------------------------|-------------------|------|
| $V_{CC}$   | Supply Voltage                                  | $\pm 18$ or $+36$ | V    |
| $V_{id}$   | Differential Input Voltage - note <sup>1)</sup> | $\pm 30$          | V    |
| $V_i$      | Input Voltage - see note 1                      | $\pm 15$          | V    |
|            | Output Short Circuit Duration                   | Infinite          | s    |
| $T_{oper}$ | Operating Free-Air Temperature Range            | -40 to 105        | °C   |
| $T_j$      | Junction Temperature                            | +150              | °C   |
| $T_{stg}$  | Storage Temperature                             | -65 to +150       | °C   |
| $P_{tot}$  | Maximum Power Dissipation - note <sup>2)</sup>  | 500               | mW   |

1. Either or both input voltages must not exceed the magnitude of  $V_{CC}^{+}$  or  $V_{CC}^{-}$ .
2. Power dissipation must be considered to ensure maximum junction temperature ( $T_j$ ) is not exceeded.

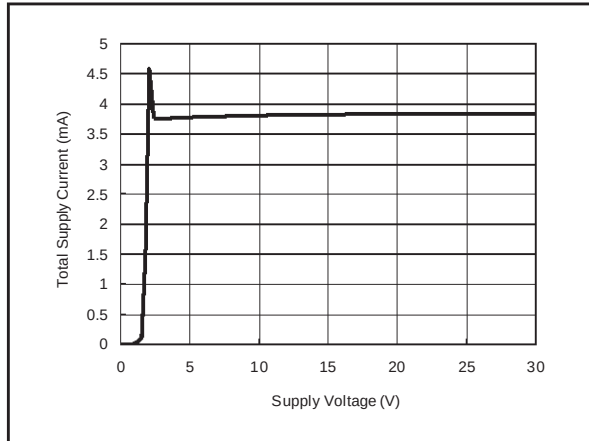
## OPERATING CONDITIONS

| Symbol   | Parameter      | Value                 | Unit |
|----------|----------------|-----------------------|------|
| $V_{CC}$ | Supply Voltage | $\pm 2.5$ to $\pm 15$ | V    |

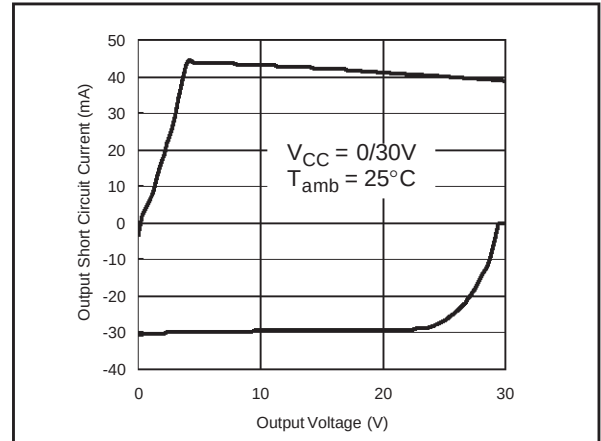
**ELECTRICAL CHARACTERISTICS**
 $V_{CC}^{+} = +15V$ ,  $V_{CC}^{-} = -15V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

| Symbol          | Parameter                                                                                                                            | Min.         | Typ.                         | Max.       | Unit                   |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------|------------|------------------------|
| $V_{io}$        | Input Offset Voltage ( $R_S = 10\Omega$ , $V_o = 0V$ , $V_{ic} = 0V$ )                                                               |              | 0.3                          | 5          | mV                     |
| $DV_{io}$       | Input Offset Voltage Drift<br>$R_S = 10\Omega$ , $V_o = 0V$ , $T_{min} \leq T_{amb} \leq T_{max}$ .                                  |              | 2                            |            | $\mu V/^{\circ}C$      |
| $I_{io}$        | Input Offset Current ( $V_o = 0V$ , $V_{ic} = 0V$ )                                                                                  |              | 25                           | 200        | nA                     |
| $I_{ib}$        | Input Bias Current ( $V_o = 0V$ , $V_{ic} = 0V$ )                                                                                    |              | 300                          | 1000       | nA                     |
| $V_{icm}$       | Input Common Mode Voltage Range                                                                                                      | $\pm 12$     | $\pm 14$                     |            | V                      |
| $A_{vd}$        | Large Signal Voltage Gain ( $R_L = 2k\Omega$ , $V_o = \pm 10V$ )                                                                     | 90           | 100                          |            | dB                     |
| $\pm V_{opp}$   | Output Voltage Swing ( $V_{id} = \pm 1V$ )<br><br>$R_L = 2.0k\Omega$<br>$R_L = 2.0k\Omega$<br>$R_L = 10k\Omega$<br>$R_L = 10k\Omega$ | 10<br><br>12 | 13.7<br>-14<br>13.9<br>-14.4 | -10<br>-12 | V                      |
| CMR             | Common-mode Rejection Ratio ( $V_{ic} = \pm 13V$ )                                                                                   | 80           | 100                          |            | dB                     |
| SVR             | Supply Voltage Rejection Ratio ( $V_{CC}^{+} / V_{CC}^{-} = +15V / -15V$ to $+5V / -5V$ )                                            | 80           | 105                          |            | dB                     |
| $I_{CC}$        | Supply Current ( $V_o = 0V$ , All amplifiers)                                                                                        |              | 4                            | 8          | mA                     |
| SR              | Slew Rate ( $V_i = -10V$ to $+10V$ , $R_L = 2k\Omega$ , $A_V = +1$ )                                                                 | 5            | 7                            |            | V/ $\mu s$             |
| GBP             | Gain Bandwidth Product ( $R_L = 2k\Omega$ , $C_L = 100pF$ , $f = 100kHz$ )                                                           | 10           | 15                           |            | MHz                    |
| B               | Unity Gain Bandwidth (Open loop)                                                                                                     |              | 9                            |            | MHz                    |
| $\phi_m$        | Phase Margin ( $R_L = 2k\Omega$ )                                                                                                    |              | 60                           |            | Degrees                |
| $e_n$           | Equivalent Input Noise Voltage ( $R_S = 100\Omega$ , $f = 1kHz$ )                                                                    |              | 4.5                          |            | $\frac{nV}{\sqrt{Hz}}$ |
| $i_n$           | Equivalent Input Noise Current ( $f = 1kHz$ )                                                                                        |              | 0.5                          |            | $\frac{pA}{\sqrt{Hz}}$ |
| THD             | Total Harmonic Distortion ( $R_L = 2k\Omega$ , $f = 20Hz$ to $20kHz$ , $V_o = 3V_{rms}$ , $A_V = +1$ )                               |              | 0.002                        |            | %                      |
| $V_{O1}/V_{O2}$ | Channel Separation ( $f = 20Hz$ to $20kHz$ )                                                                                         |              | 120                          |            | dB                     |
| FPB             | Full Power Bandwidth ( $V_o = 27V_{pp}$ , $R_L = 2k\Omega$ , $THD \leq 1\%$ )                                                        |              | 120                          |            | kHz                    |

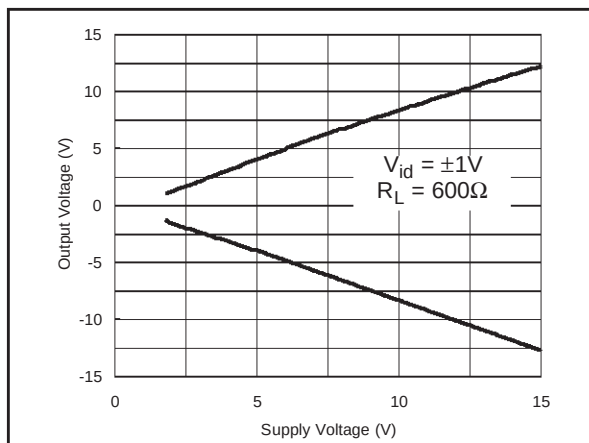
TOTAL SUPPLY CURRENT vs SUPPLY VOLTAGE



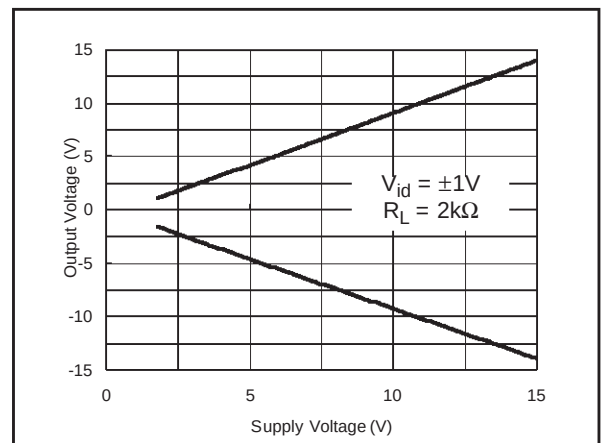
OUTPUT SHORT CIRCUIT CURRENT vs OUTPUT VOLTAGE



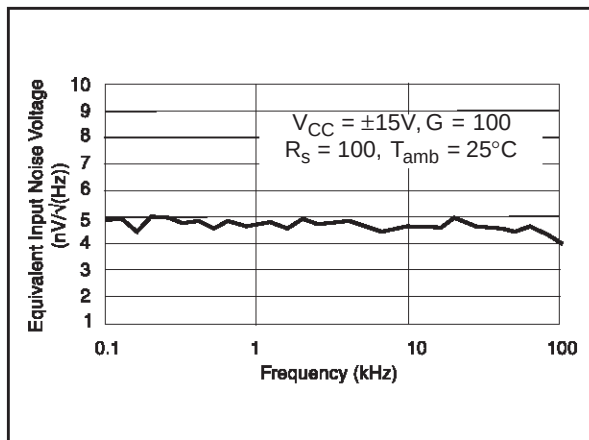
OUTPUT VOLTAGE vs SUPPLY VOLTAGE



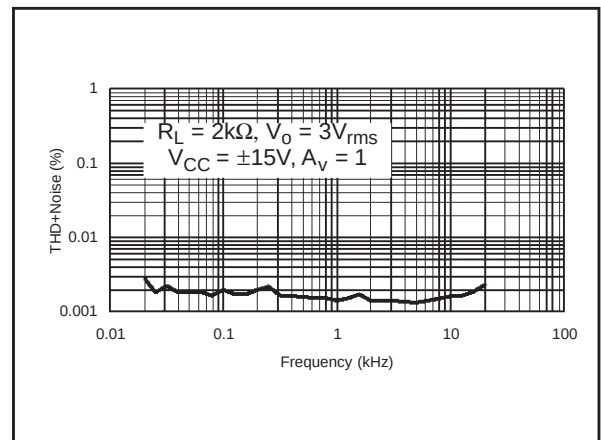
OUTPUT VOLTAGE vs SUPPLY VOLTAGE



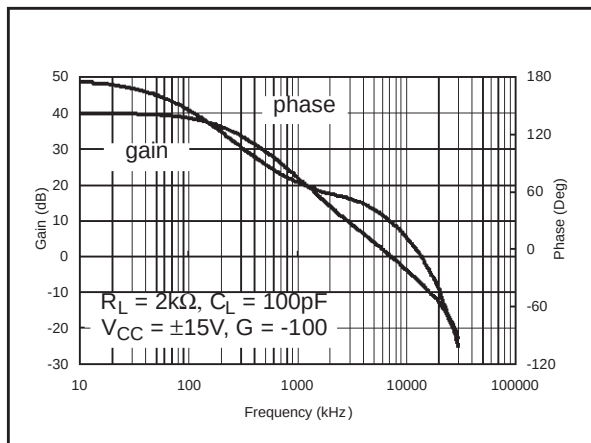
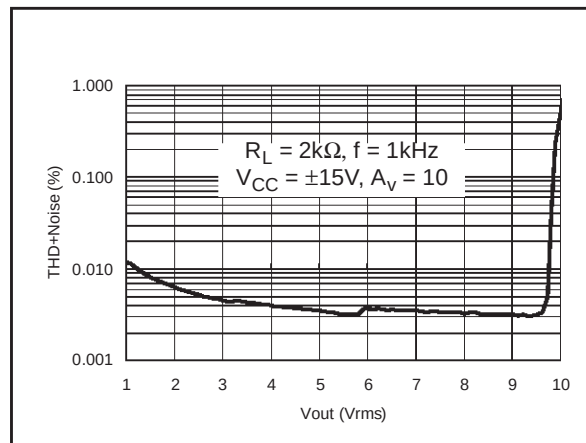
EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY



THD + NOISE vs FREQUENCY



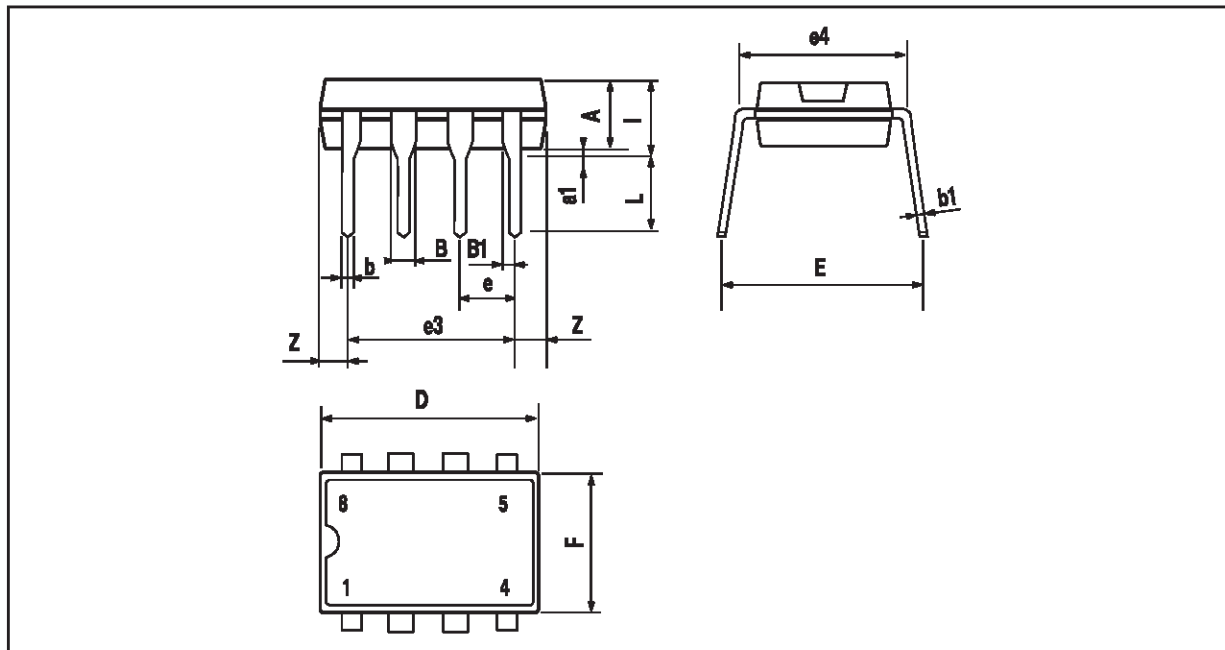
## VOLTAGE GAIN AND PHASE vs FREQUENCY

THD + NOISE vs  $V_{out}$ 

## LM833

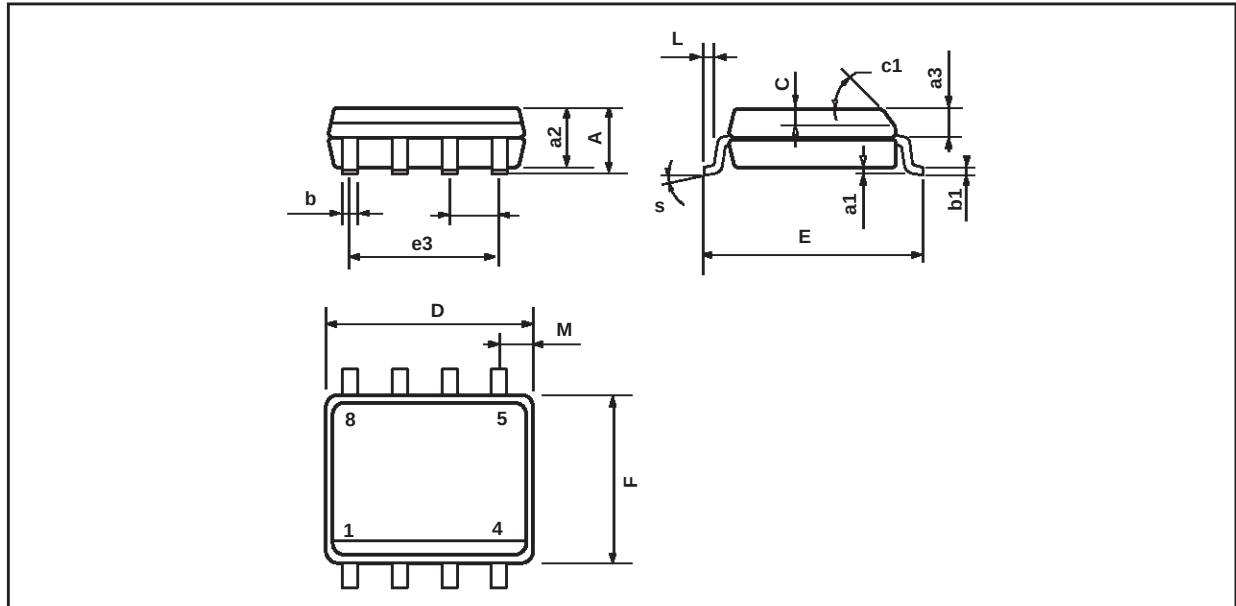
### PACKAGE MECHANICAL DATA

8 PINS - PLASTIC DIP



| Dimensions | Millimeters |      |       | Inches |       |       |
|------------|-------------|------|-------|--------|-------|-------|
|            | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A          |             | 3.32 |       |        | 0.131 |       |
| a1         | 0.51        |      |       | 0.020  |       |       |
| B          | 1.15        |      | 1.65  | 0.045  |       | 0.065 |
| b          | 0.356       |      | 0.55  | 0.014  |       | 0.022 |
| b1         | 0.204       |      | 0.304 | 0.008  |       | 0.012 |
| D          |             |      | 10.92 |        |       | 0.430 |
| E          | 7.95        |      | 9.75  | 0.313  |       | 0.384 |
| e          |             | 2.54 |       |        | 0.100 |       |
| e3         |             | 7.62 |       |        | 0.300 |       |
| e4         |             | 7.62 |       |        | 0.300 |       |
| F          |             |      | 6.6   |        |       | 0.260 |
| i          |             |      | 5.08  |        |       | 0.200 |
| L          | 3.18        |      | 3.81  | 0.125  |       | 0.150 |
| Z          |             |      | 1.52  |        |       | 0.060 |

# **PACKAGE MECHANICAL DATA** **8 PINS - PLASTIC MICROPACKAGE (SO)**



| Dimensions | Millimeters |      |      | Inches |       |       |
|------------|-------------|------|------|--------|-------|-------|
|            | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A          |             |      | 1.75 |        |       | 0.069 |
| a1         | 0.1         |      | 0.25 | 0.004  |       | 0.010 |
| a2         |             |      | 1.65 |        |       | 0.065 |
| a3         | 0.65        |      | 0.85 | 0.026  |       | 0.033 |
| b          | 0.35        |      | 0.48 | 0.014  |       | 0.019 |
| b1         | 0.19        |      | 0.25 | 0.007  |       | 0.010 |
| C          | 0.25        |      | 0.5  | 0.010  |       | 0.020 |
| c1         | 45° (typ.)  |      |      |        |       |       |
| D          | 4.8         |      | 5.0  | 0.189  |       | 0.197 |
| E          | 5.8         |      | 6.2  | 0.228  |       | 0.244 |
| e          |             | 1.27 |      |        | 0.050 |       |
| e3         |             | 3.81 |      |        | 0.150 |       |
| F          | 3.8         |      | 4.0  | 0.150  |       | 0.157 |
| L          | 0.4         |      | 1.27 | 0.016  |       | 0.050 |
| M          |             |      | 0.6  |        |       | 0.024 |
| S          | 8° (max.)   |      |      |        |       |       |

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