

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

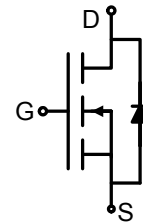
The NCE0102Z uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

- $V_{DS} = 100V, I_D = 2A$   
 $R_{DS(ON)} < 240m\Omega @ V_{GS}=10V$  (Typ:210m $\Omega$ )
- High density cell design for ultra low  $R_{ds(on)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

### Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



TO-92 view

### Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| 0102Z          | NCE0102Z | TO-92          | -         | -          | -        |

### Absolute Maximum Ratings ( $T_A=25^\circ C$ unless otherwise noted)

| Parameter  | Symbol         | Limit      | Unit       |
|--|----------------|------------|------------|
| Drain-Source Voltage                             | $V_{DS}$       | 100        | V          |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | V          |
| Drain Current-Continuous                         | $I_D$          | 2          | A          |
| Drain Current-Pulsed <sup>(Note 1)</sup>         | $I_{DM}$       | 5          | A          |
| Maximum Power Dissipation                        | $P_D$          | 1.25       | W          |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | $^\circ C$ |

### Thermal Characteristic

|   |                 |     |              |
|---|-----------------|-----|--------------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 100 | $^\circ C/W$ |
|---|-----------------|-----|--------------|

### Electrical Characteristics ( $T_A=25^\circ C$ unless otherwise noted)

| Parameter                       | Symbol     | Condition                 | Min | Typ | Max | Unit    |
|---------------------------------|------------|---------------------------|-----|-----|-----|---------|
| <b>Off Characteristics</b>      |            |                           |     |     |     |         |
| Drain-Source Breakdown Voltage  | $BV_{DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 100 | 110 | -   | V       |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{DS}=100V, V_{GS}=0V$  | -   | -   | 1   | $\mu A$ |

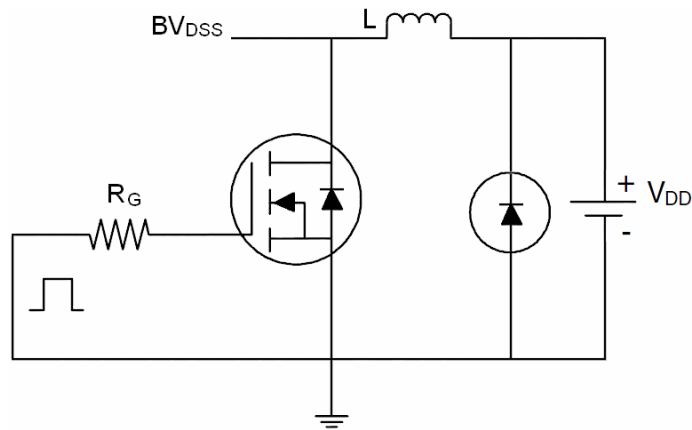
|   |              |   |     |      |           |            |
|---|--------------|---|-----|------|-----------|------------|
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                                       | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> (Note 3)        |              |   |     |      |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                                     | 1.2 | 1.8  | 2.5       | V          |
| Drain-Source On-State Resistance          | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=1A$  | -   | 210  | 240       | m $\Omega$ |
| Forward Transconductance                  | $g_{FS}$     | $V_{DS}=5V, I_D=1A$   | 1   | -    | -         | S          |
| <b>Dynamic Characteristics</b> (Note 4)   |              |   |     |      |           |            |
| Input Capacitance                         | $C_{iss}$    | $V_{DS}=50V, V_{GS}=0V,$<br>$F=1.0MHz$                            | -   | 190  | -         | PF         |
| Output Capacitance                        | $C_{oss}$    |   | -   | 22   | -         | PF         |
| Reverse Transfer Capacitance              | $C_{rss}$    |   | -   | 13   | -         | PF         |
| <b>Switching Characteristics</b> (Note 4) |              |   |     |      |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DD}=50V, I_D=1.3A, R_L=39\Omega$<br>$V_{GS}=10V, R_G=1\Omega$ | -   | 6    | -         | nS         |
| Turn-on Rise Time                         | $t_r$        |   | -   | 10   | -         | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |   | -   | 10   | -         | nS         |
| Turn-Off Fall Time                        | $t_f$        |   | -   | 6    | -         | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=50V, I_D=1.3A,$<br>$V_{GS}=10V$                           | -   | 5.2  | -         | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |   | -   | 0.75 | -         | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |   | -   | 1.4  | -         | nC         |
| <b>Drain-Source Diode Characteristics</b> |              |   |     |      |           |            |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $V_{GS}=0V, I_S=1.3A$   | -   | -    | 1.2       | V          |
| Diode Forward Current (Note 2)            | $I_S$        |   | -   | -    | 2         | A          |

### Notes:

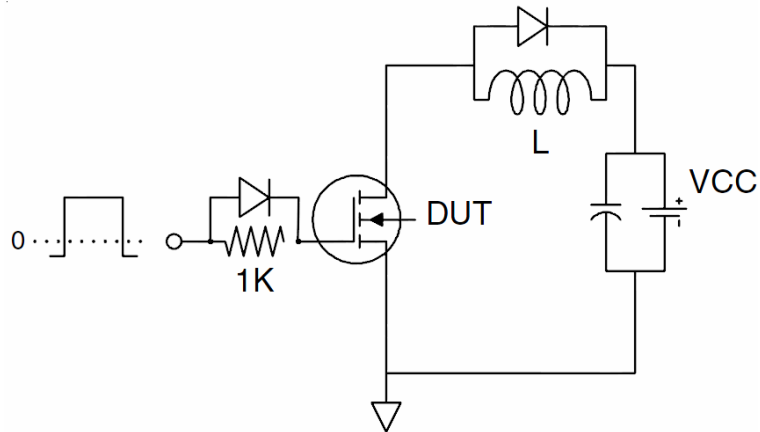
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

**Test Circuit**

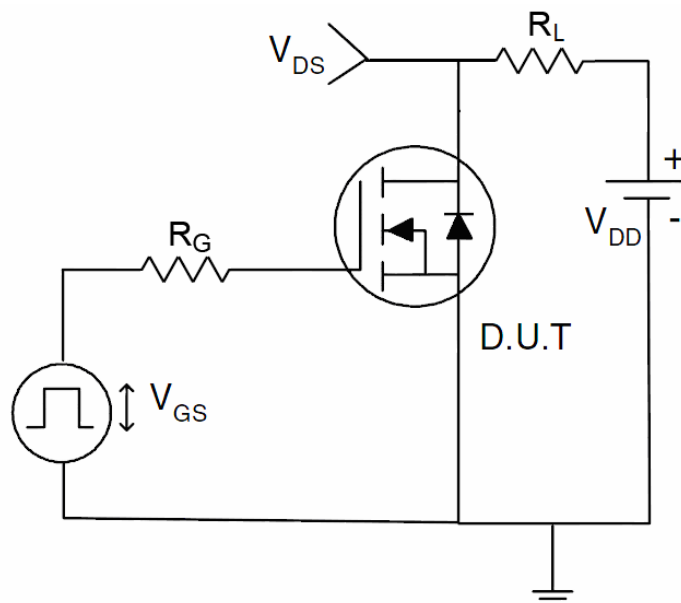
1)  $E_{AS}$  test circuit



2) Gate charge test circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

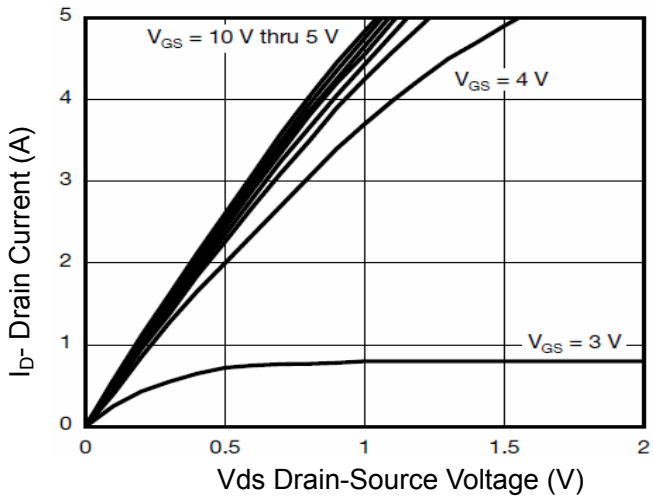


Figure 1 Output Characteristics

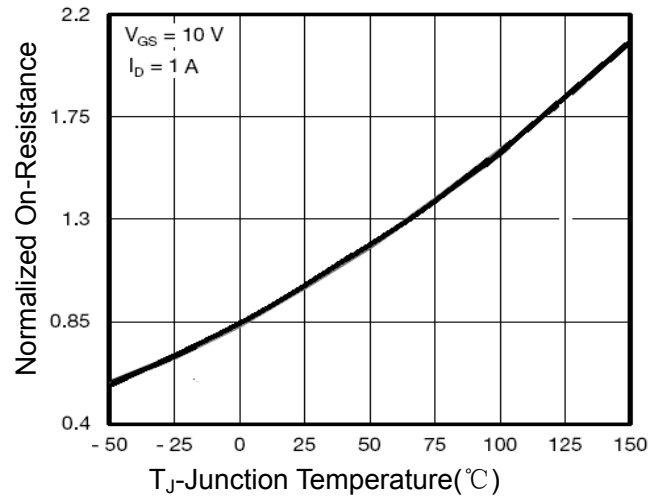


Figure 4  $R_{ds(on)}$ -Junction Temperature

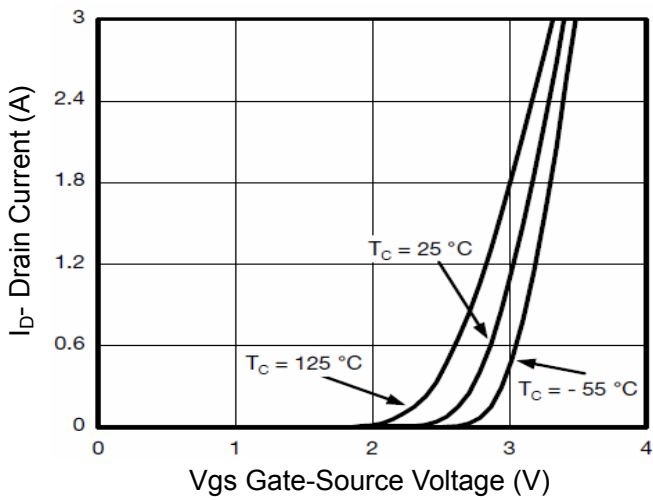


Figure 2 Transfer Characteristics

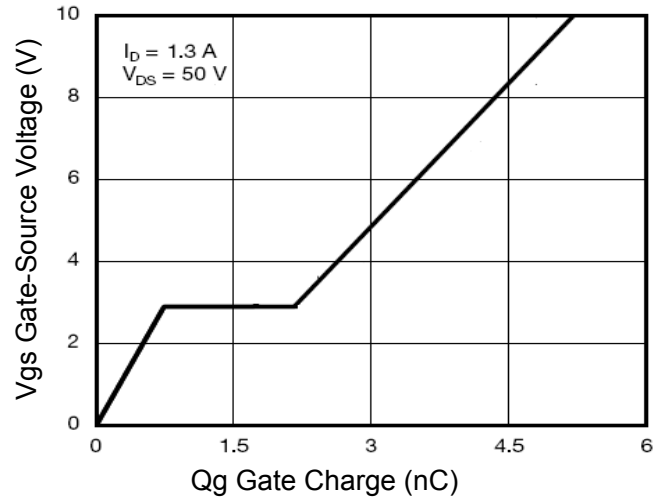


Figure 5 Gate Charge

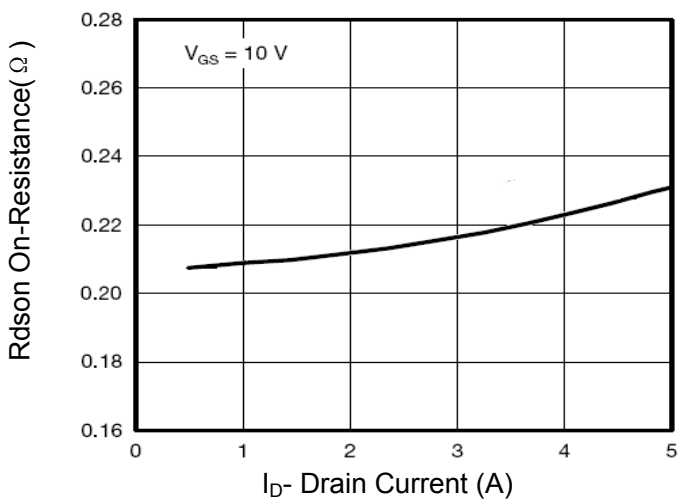


Figure 3  $R_{ds(on)}$ - Drain Current

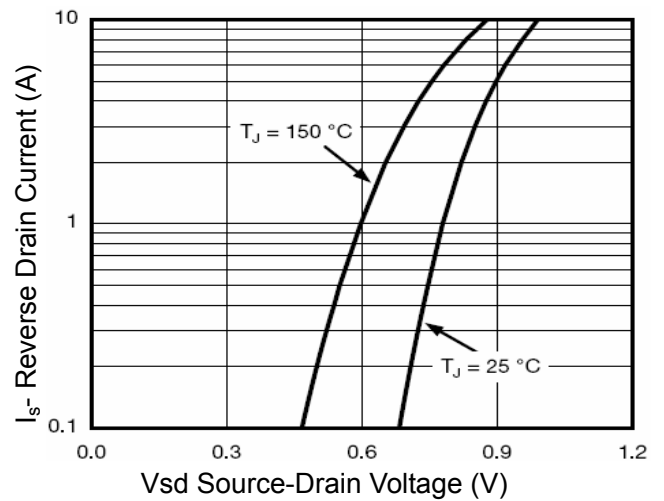


Figure 6 Source- Drain Diode Forward

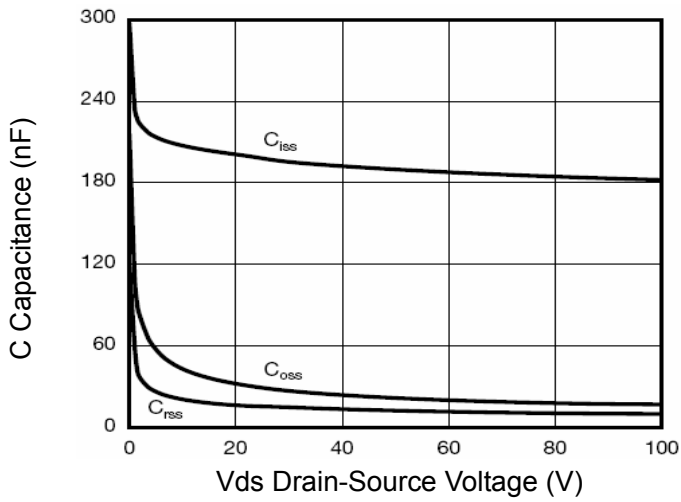


Figure 7 Capacitance vs Vds

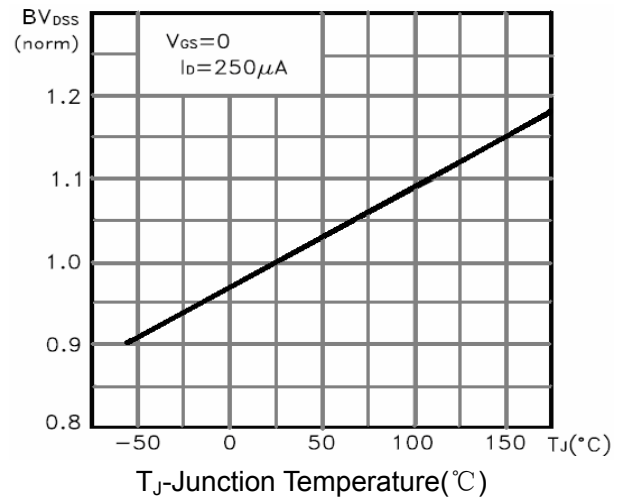


Figure 9  $BV_{DSS}$  vs Junction Temperature

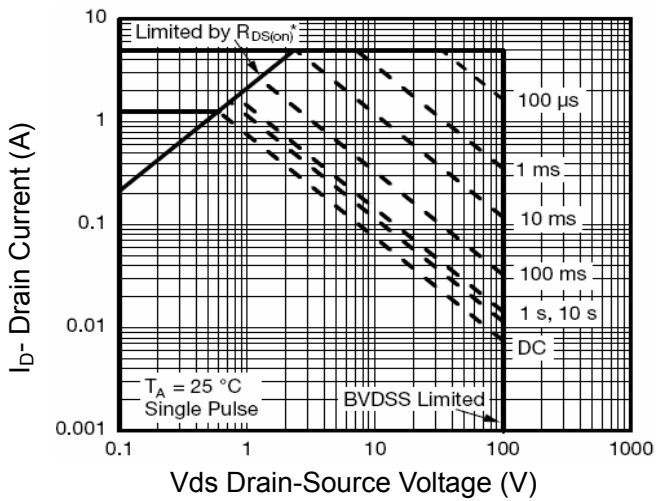


Figure 8 Safe Operation Area

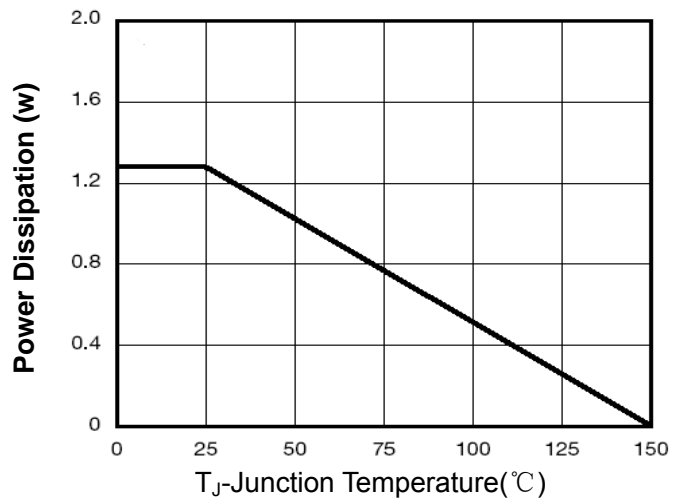


Figure 10 Power De-rating

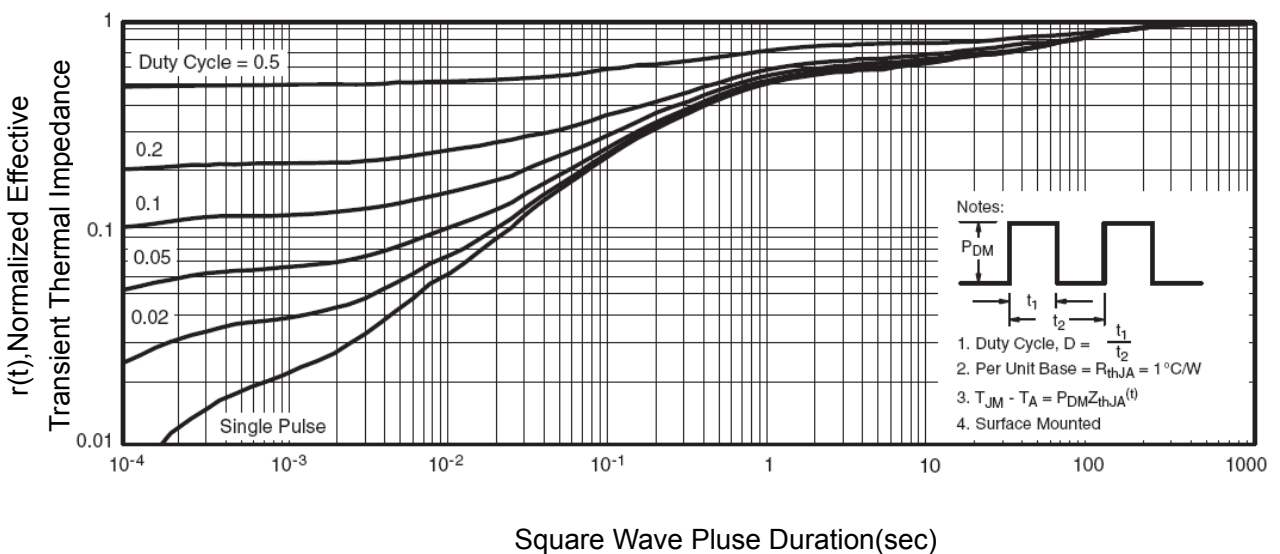
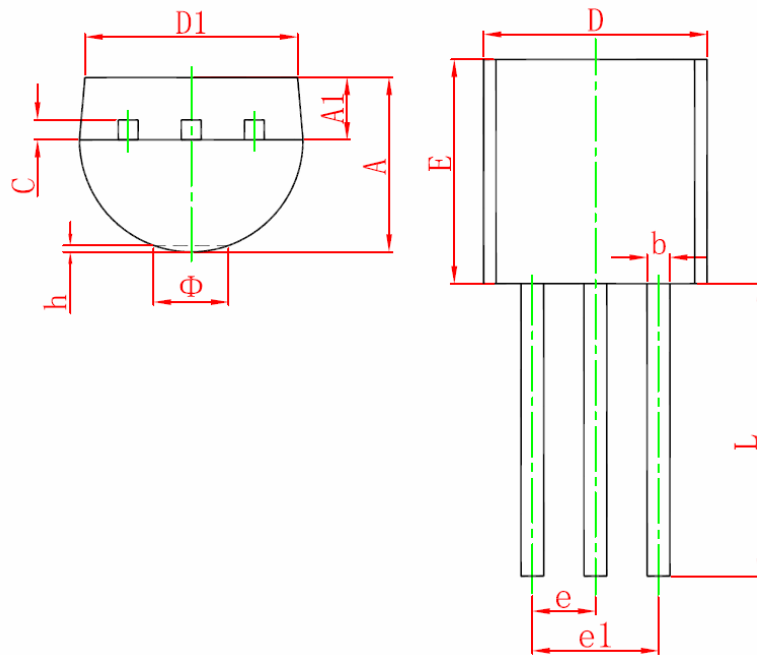


Figure 11 Normalized Maximum Transient Thermal Impedance

**TO-92 Package Information**


| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min                       | Max    | Min                  | Max   |
| A      | 3.300                     | 3.700  | 0.130                | 0.146 |
| A1     | 1.100                     | 1.400  | 0.043                | 0.055 |
| b      | 0.380                     | 0.550  | 0.015                | 0.022 |
| c      | 0.360                     | 0.510  | 0.014                | 0.020 |
| D      | 4.400                     | 4.700  | 0.173                | 0.185 |
| D1     | 3.430                     |        | 0.135                |       |
| E      | 4.300                     | 4.700  | 0.169                | 0.185 |
| e      | 1.270 TYP                 |        | 0.050 TYP            |       |
| e1     | 2.440                     | 2.640  | 0.096                | 0.104 |
| L      | 14.100                    | 14.500 | 0.555                | 0.571 |
| $\Phi$ |                           | 1.600  |                      | 0.063 |
| h      | 0.000                     | 0.380  | 0.000                | 0.015 |

**Notes**

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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