

N-Channel Enhancement Mode Power MOSFET

Description

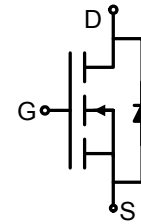
The HM2300D uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a battery protection or in other switching application.

General Features

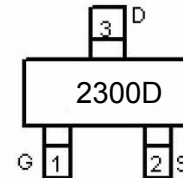
- $V_{DS} = 20V, I_D = 6.0A$
 $R_{DS(ON)} < 38m\Omega @ V_{GS}=2.5V$
 $R_{DS(ON)} < 25m\Omega @ V_{GS}=4.5V$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

Application

- Battery protection
- Load switch
- Power management



Schematic diagram



Marking and pin assignment



SOT-23 top view

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|---------|----------------|-----------|------------|------------|
| 2300D | HM2300D | SOT-23 | Ø180mm | 8 mm | 3000 units |

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

| Parameter | Symbol | Limit | Unit |
|--|----------------|--------------------------|------------------|
| Drain-Source Voltage | V_{DS} | 20 | V |
| Gate-Source Voltage | V_{GS} | ± 12 | V |
| Continuous Drain Current | I_D | $T_A = 25^\circ\text{C}$ | 6.0 |
| | | $T_A = 70^\circ\text{C}$ | 4.8 |
| Drain Current-Pulsed (Note 1) | I_{DM} | 18.0 | A |
| Maximum Power Dissipation | P_D | 1.25 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 150 | $^\circ\text{C}$ |

Thermal Characteristic

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

Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--------------------------------|------------|---------------------------|-----|-----|-----|------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 20 | 22 | - | V |

| | | | | | | |
|---|--------------|--|-----|-----|-----------|------------|
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=20V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 12V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 0.5 | 0.7 | 1.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=2.5V, I_D=4.0 A$ | - | 30 | 38 | m Ω |
| | | $V_{GS}=4.5V, I_D=4.5A$ | - | 22 | 25 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=10V, I_D=4A$ | - | 10 | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=8V, V_{GS}=0V,$ $F=1.0MHz$ | - | 500 | - | PF |
| Output Capacitance | C_{oss} | | - | 300 | - | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 140 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=10V, I_D=1A$ $V_{GS}=4.5V, R_{GEN}=6\Omega$ | - | 20 | 40 | nS |
| Turn-on Rise Time | t_r | | - | 18 | 40 | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 60 | 108 | nS |
| Turn-Off Fall Time | t_f | | - | 28 | 56 | nS |
| Total Gate Charge | Q_g | $V_{DS}=10V, I_D=3A, V_{GS}=4.5V$ | - | 10 | 15 | nC |
| Gate-Source Charge | Q_{gs} | | - | 2.3 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 2.9 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V_{SD} | $V_{GS}=0V, I_S=1A$ | - | - | 1.2 | V |
| Diode Forward Current (Note 2) | I_S | | - | - | 1 | 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

Typical Electrical and Thermal Characteristics

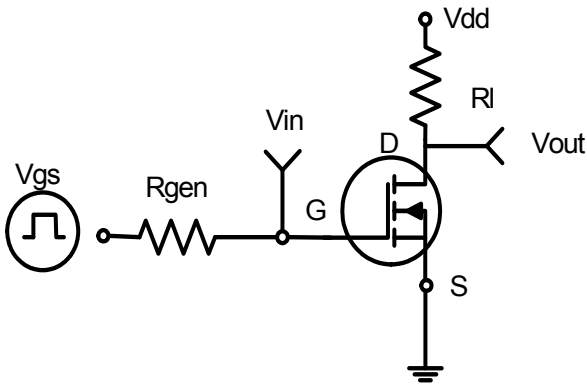


Figure 1: Switching Test Circuit

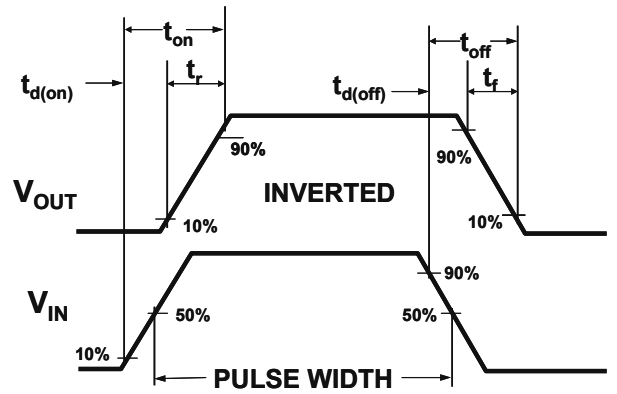


Figure 2: Switching Waveforms

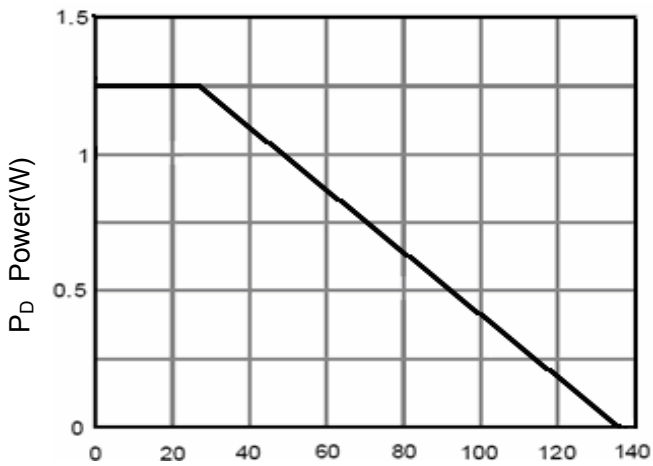


Figure 3 Power Dissipation

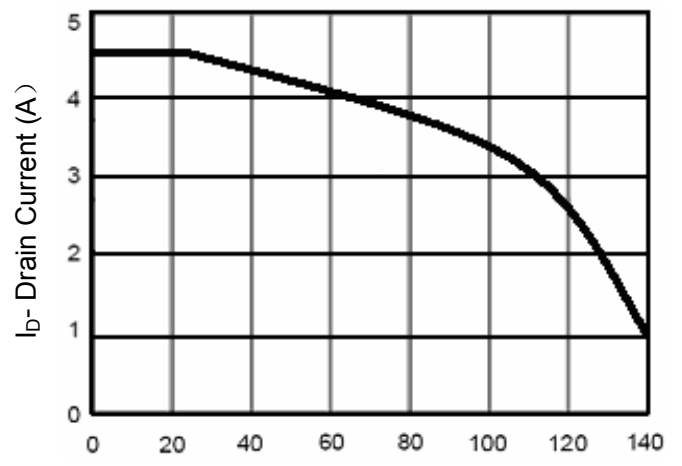


Figure 4 Drain Current

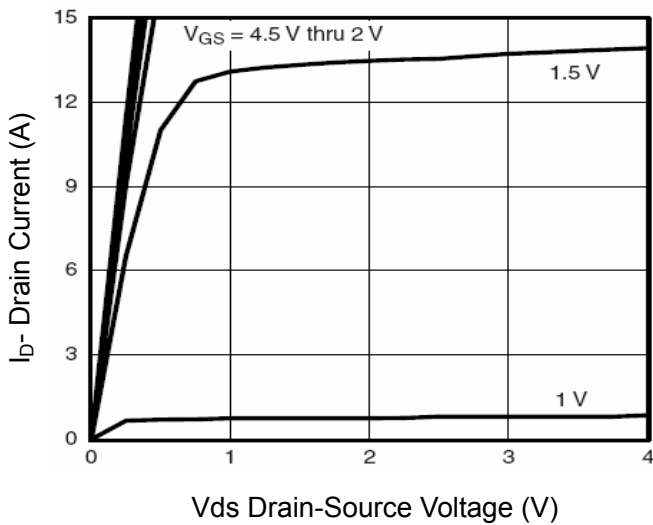


Figure 5 Output CHARACTERISTICS

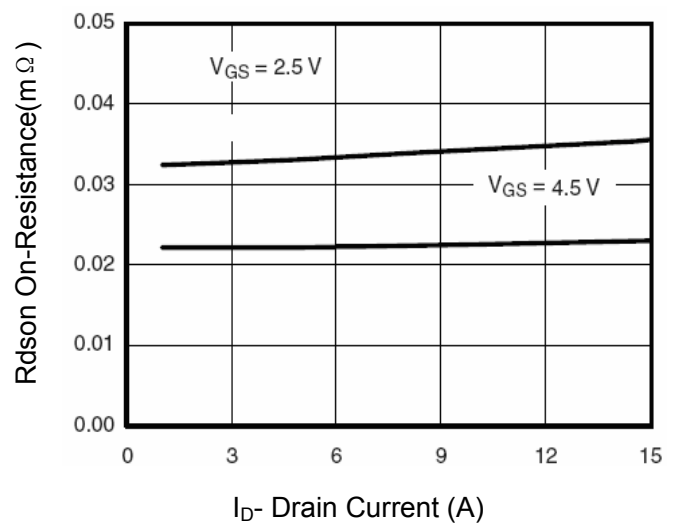
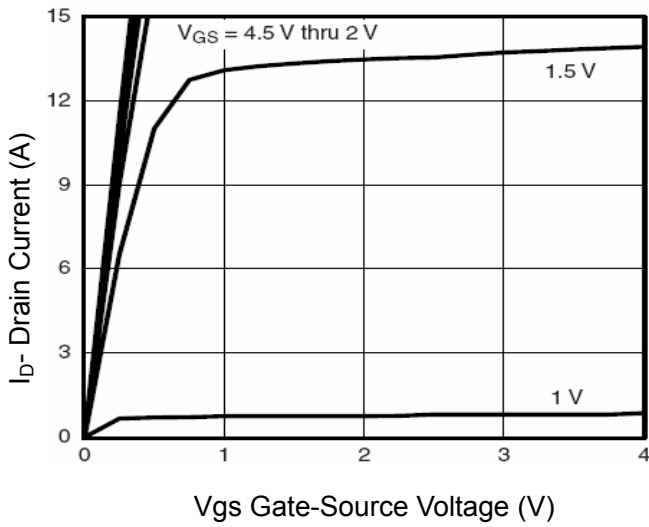
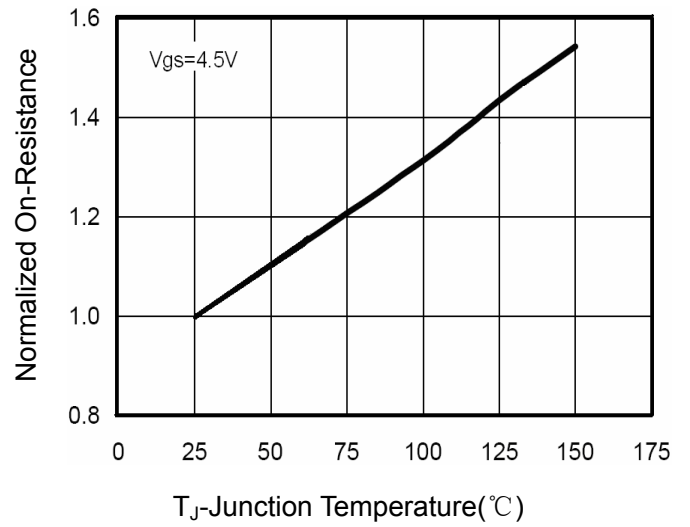


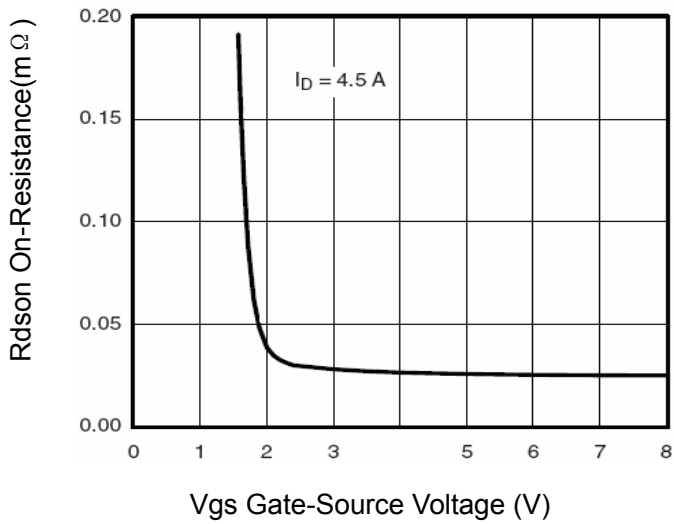
Figure 6 Drain-Source On-Resistance



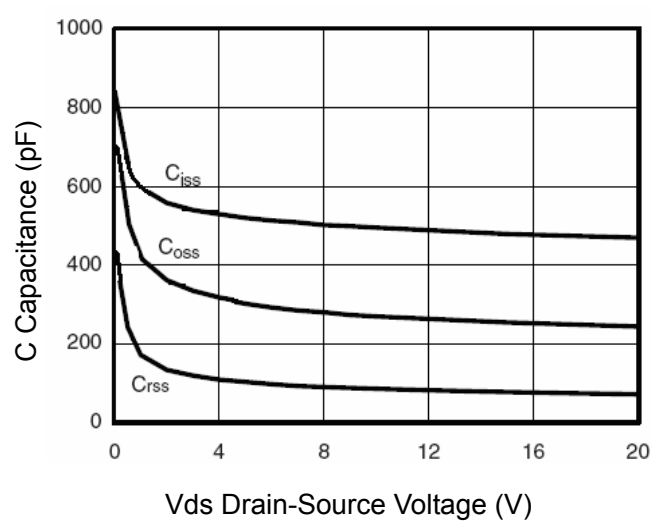
Vgs Gate-Source Voltage (V)
Figure 7 Transfer Characteristics



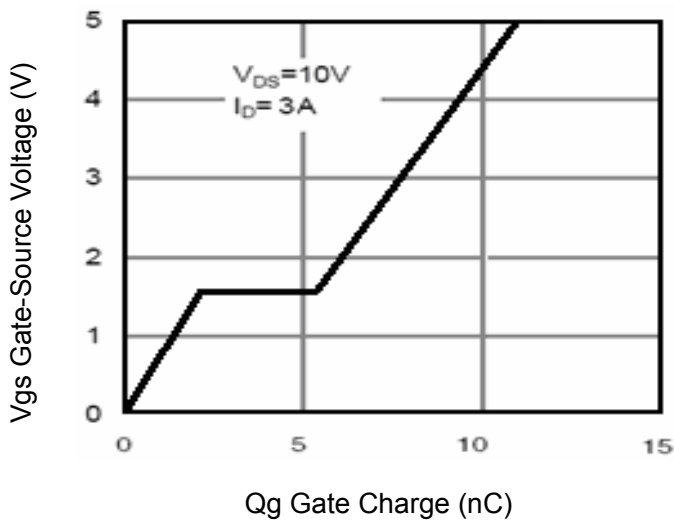
T_J -Junction Temperature($^{\circ}\text{C}$)
Figure 8 Drain-Source On-Resistance



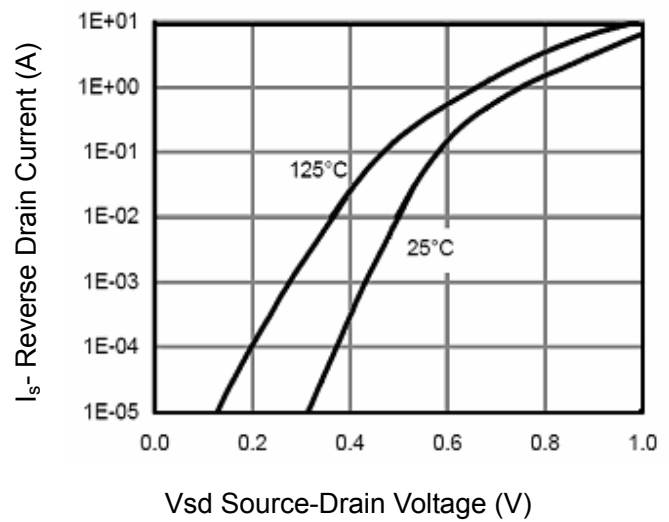
Vgs Gate-Source Voltage (V)
Figure 9 Rdson vs Vgs



V_{DS} Drain-Source Voltage (V)
Figure 10 Capacitance vs Vds



Q_g Gate Charge (nC)
Figure 11 Gate Charge



V_{SD} Source-Drain Voltage (V)
Figure 12 Source- Drain Diode Forward

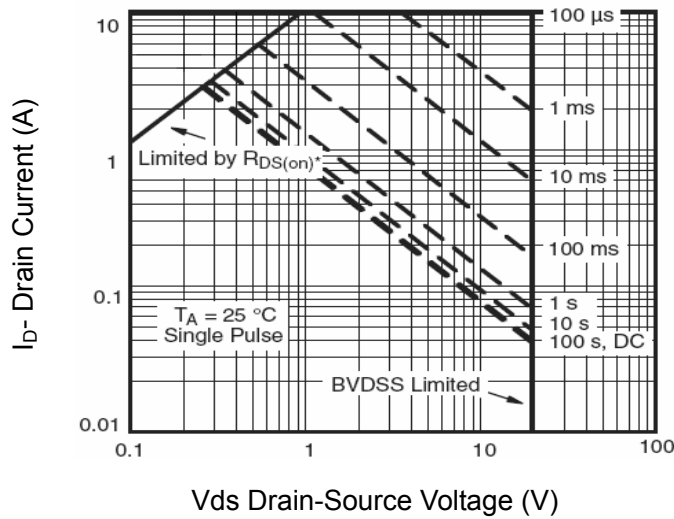


Figure 13 Safe Operation Area

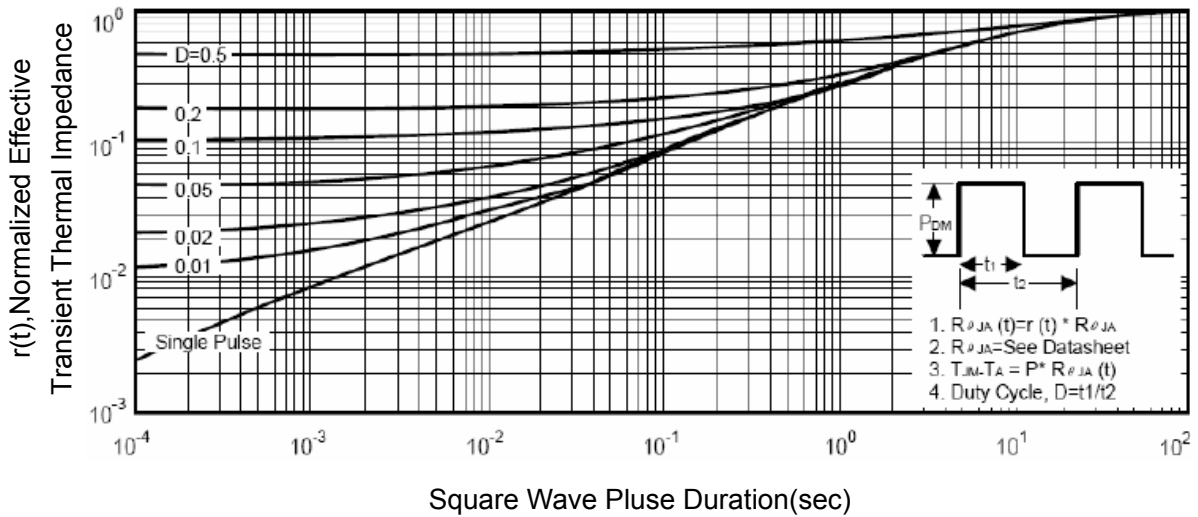
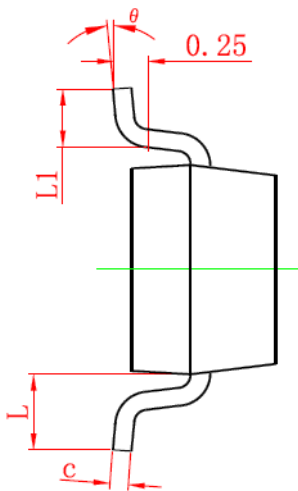
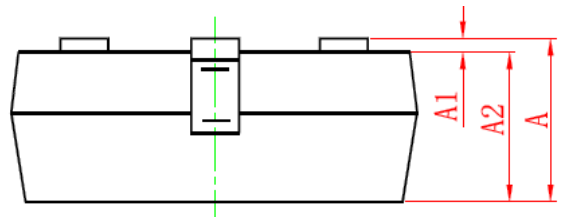
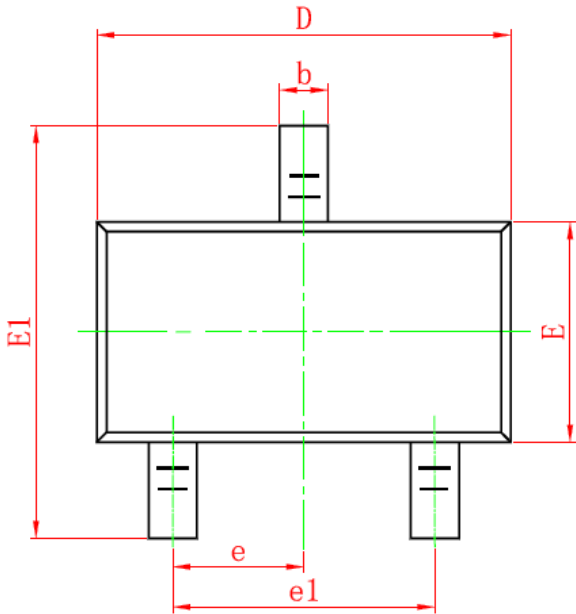


Figure 14 Normalized Maximum Transient Thermal Impedance

SOT-23 Package Information



| Symbol | Dimensions in Millimeters | |
|----------|---------------------------|-------|
| | MIN. | MAX. |
| A | 0.900 | 1.150 |
| A1 | 0.000 | 0.100 |
| A2 | 0.900 | 1.050 |
| b | 0.300 | 0.500 |
| c | 0.080 | 0.150 |
| D | 2.800 | 3.000 |
| E | 1.200 | 1.400 |
| E1 | 2.250 | 2.550 |
| e | 0.950TYP | |
| e1 | 1.800 | 2.000 |
| L | 0.550REF | |
| L1 | 0.300 | 0.500 |
| θ | 0° | 8° |

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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