
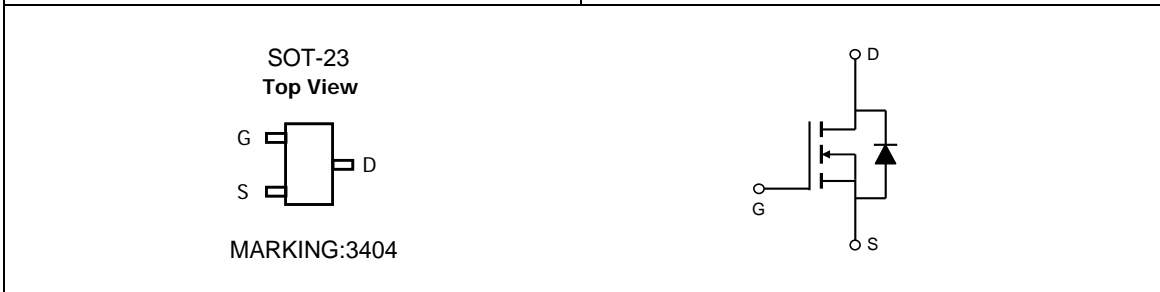


TM3404

N-CHANNEL ENHANCEMENT MOSFET

| | | | | | | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----|--------------------------|----|---------------------------------|----------------|----------------------------------|----------------|
| <p>General Description</p> <p>The TM3404 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. This device may be used as a load switch or in PWM applications.</p> | <p>Product Summary</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">V_{DS}</td> <td style="text-align: right;">30V</td> </tr> <tr> <td>I_D (at $V_{GS}=10V$)</td> <td style="text-align: right;">5A</td> </tr> <tr> <td>$R_{DS(ON)}$ (at $V_{GS}=10V$)</td> <td style="text-align: right;">< 31mΩ</td> </tr> <tr> <td>$R_{DS(ON)}$ (at $V_{GS}=4.5V$)</td> <td style="text-align: right;">< 43mΩ</td> </tr> </table> <p>100% UIS Tested 100% R_g Tested</p> <div style="text-align: right;">  </div> | V_{DS} | 30V | I_D (at $V_{GS}=10V$) | 5A | $R_{DS(ON)}$ (at $V_{GS}=10V$) | < 31m Ω | $R_{DS(ON)}$ (at $V_{GS}=4.5V$) | < 43m Ω |
| V_{DS} | 30V | | | | | | | | |
| I_D (at $V_{GS}=10V$) | 5A | | | | | | | | |
| $R_{DS(ON)}$ (at $V_{GS}=10V$) | < 31m Ω | | | | | | | | |
| $R_{DS(ON)}$ (at $V_{GS}=4.5V$) | < 43m Ω | | | | | | | | |



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

| Parameter | Symbol | Maximum | Units |
|----------------------------------------|----------------|------------------|------------|
| Drain-Source Voltage | V_{DS} | 30 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current | I_D | $T_A=25^\circ C$ | 5 |
| | | $T_A=70^\circ C$ | 4 |
| Pulsed Drain Current ^C | I_{DM} | 20 | A |
| Power Dissipation ^B | P_D | $T_A=25^\circ C$ | 1.4 |
| | | $T_A=70^\circ C$ | 0.9 |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | $^\circ C$ |

Thermal Characteristics

| Parameter | Symbol | Typ | Max | Units |
|--------------------------------------------|-----------------|-----|-----|--------------|
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | 70 | 90 | $^\circ C/W$ |
| Maximum Junction-to-Ambient ^{A D} | | 100 | 125 | $^\circ C/W$ |
| Maximum Junction-to-Lead | $R_{\theta JL}$ | 63 | 80 | $^\circ C/W$ |

Electrical Characteristics (T_J=25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|---------------------------------------|-----------------------------------------------------------------------------------------|-----|------------|----------|-------|
| STATIC PARAMETERS | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | I _D =-250μA, V _{GS} =0V | 30 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =30V, V _{GS} =0V T _J =55°C | | | 1 5 | μA |
| I _{GSS} | Gate-Body leakage current | V _{DS} =0V, V _{GS} =±20V | | | ±100 | nA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _D =250μA | 1.2 | 1.8 | 2.4 | V |
| I _{D(ON)} | On state drain current | V _{GS} =10V, V _{DS} =5V | 20 | | | A |
| R _{DS(ON)} | Static Drain-Source On-Resistance | V _{GS} =10V, I _D =5A T _J =125°C | | 25.5 41 | 31 50 | mΩ |
| | | V _{GS} =4.5V, I _D =4A | | 34 | 43 | |
| g _{FS} | Forward Transconductance | V _{DS} =5V, I _D =5A | | 15 | | S |
| V _{SD} | Diode Forward Voltage | I _S =1A, V _{GS} =0V | | 0.76 | 1 | V |
| I _S | Maximum Body-Diode Continuous Current | | | | 1.5 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C _{iss} | Input Capacitance | V _{GS} =0V, V _{DS} =15V, f=1MHz | | 255 | 310 | pF |
| C _{oss} | Output Capacitance | | | 45 | | pF |
| C _{riss} | Reverse Transfer Capacitance | | | 35 | 50 | pF |
| R _g | Gate resistance | V _{GS} =0V, V _{DS} =0V, f=1MHz | 1.6 | 3.25 | 4.9 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q _{g(10V)} | Total Gate Charge | V _{GS} =10V, V _{DS} =15V, I _D =5A | | 5.2 | 6.3 | nC |
| Q _{g(4.5V)} | | | | 2.55 | 3.2 | |
| Q _{gs} | Gate Source Charge | | | 0.85 | | nC |
| Q _{gd} | Gate Drain Charge | | | 1.3 | | nC |
| t _{D(on)} | Turn-On DelayTime | V _{GS} =10V, V _{DS} =15V, R _L =3Ω, R _{GEN} =3Ω | | 4.5 | | ns |
| t _r | Turn-On Rise Time | | | 2.5 | | ns |
| t _{D(off)} | Turn-Off DelayTime | | | 14.5 | | ns |
| t _f | Turn-Off Fall Time | | | 3.5 | | ns |
| t _{rr} | Body Diode Reverse Recovery Time | I _F =5A, dI/dt=100A/μs | | 8.5 | | ns |
| Q _{rr} | Body Diode Reverse Recovery Charge | I _F =5A, dI/dt=100A/μs | | 2.2 | | nC |

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on T_{J(MAX)}=150°C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150°C. Ratings are based on low frequency and duty cycles to keep initial T_J=25°C.

D. The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T_{J(MAX)}=150°C. The SOA curve provides a single pulse rating.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

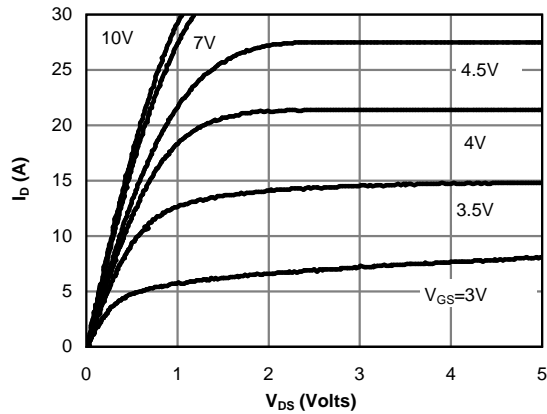


Fig 1: On-Region Characteristics (Note E)

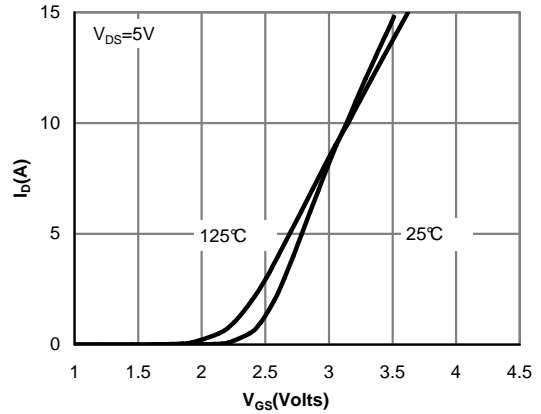


Figure 2: Transfer Characteristics (Note E)

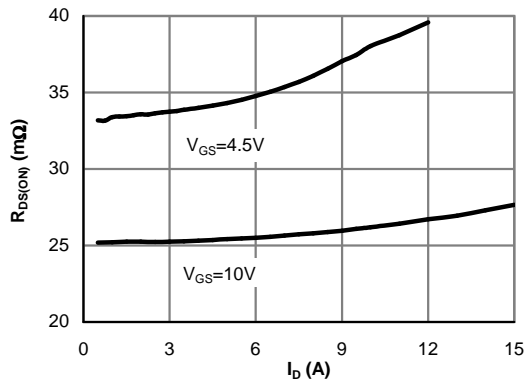


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

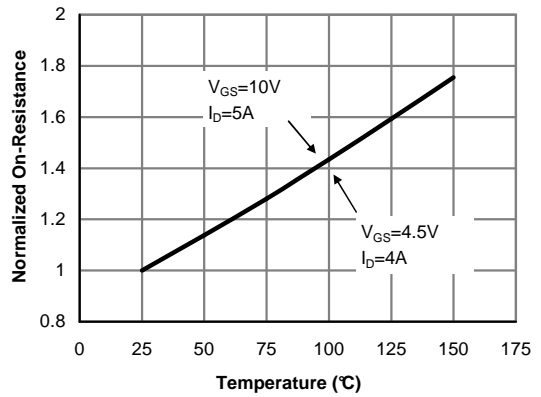


Figure 4: On-Resistance vs. Junction Temperature (Note E)

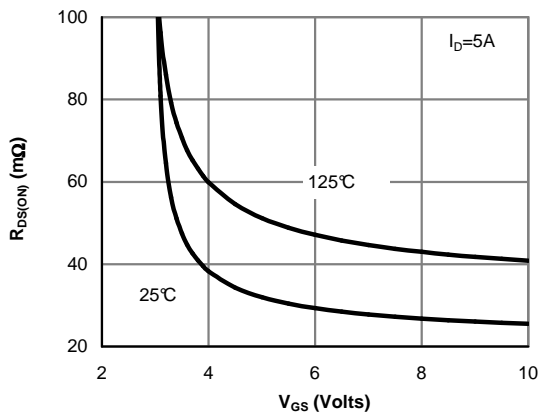


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

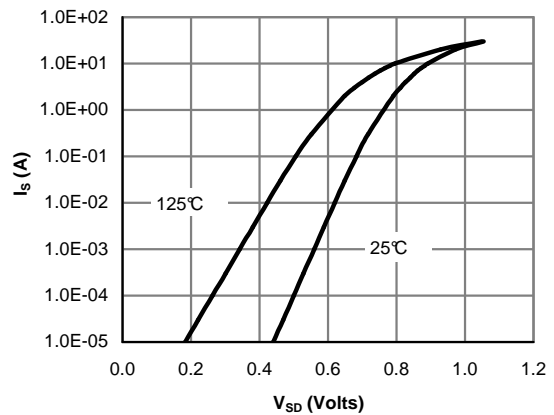


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

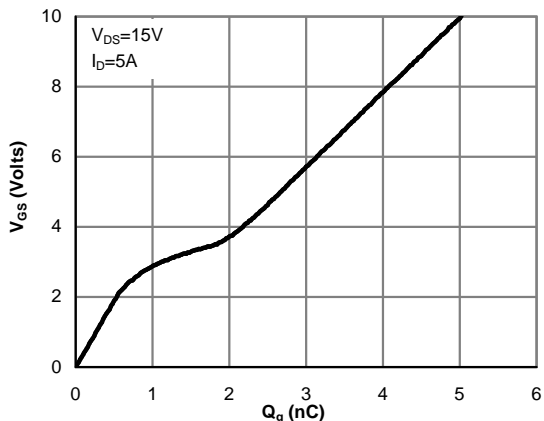


Figure 7: Gate-Charge Characteristics

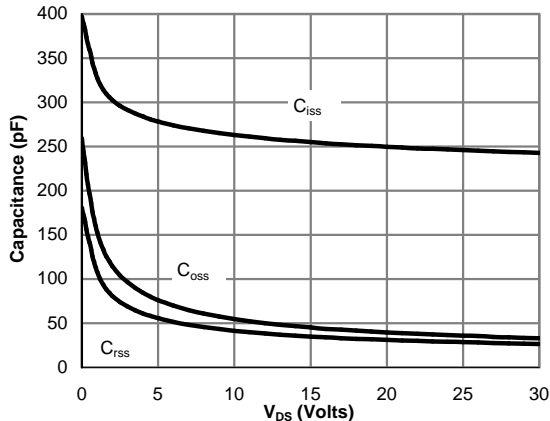


Figure 8: Capacitance Characteristics

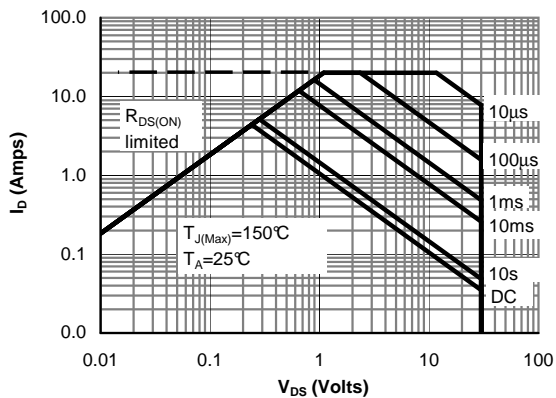


Figure 10: Maximum Forward Biased Safe Operating Area (Note F)

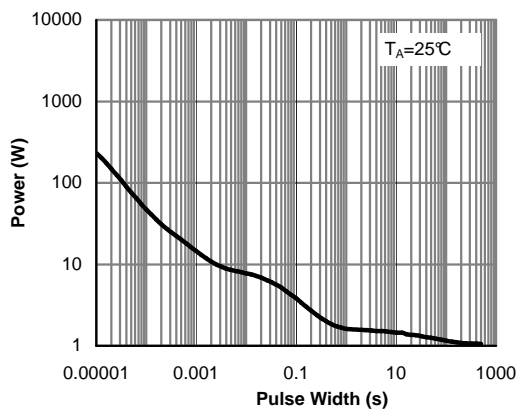


Figure 11: Single Pulse Power Rating Junction-to-Ambient (Note F)

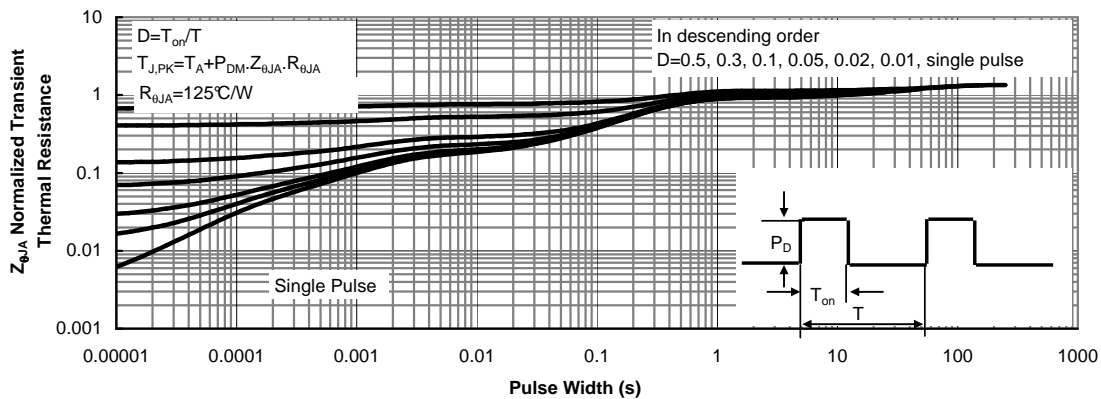
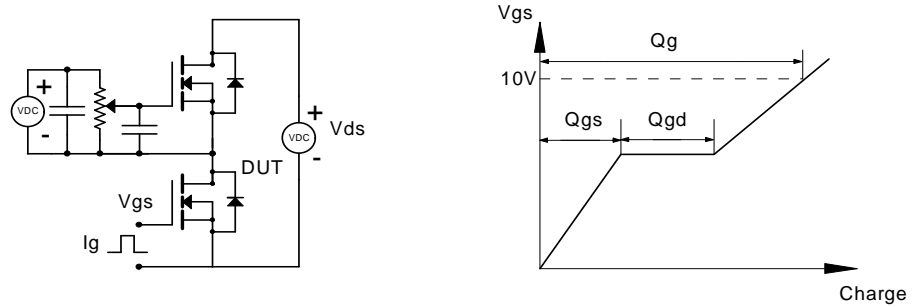
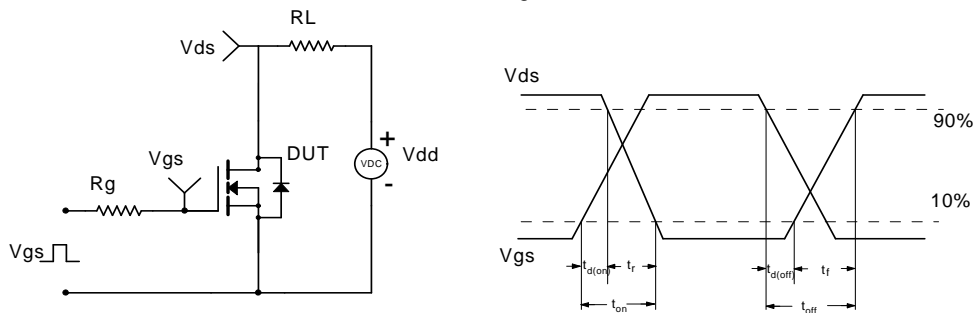


Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)

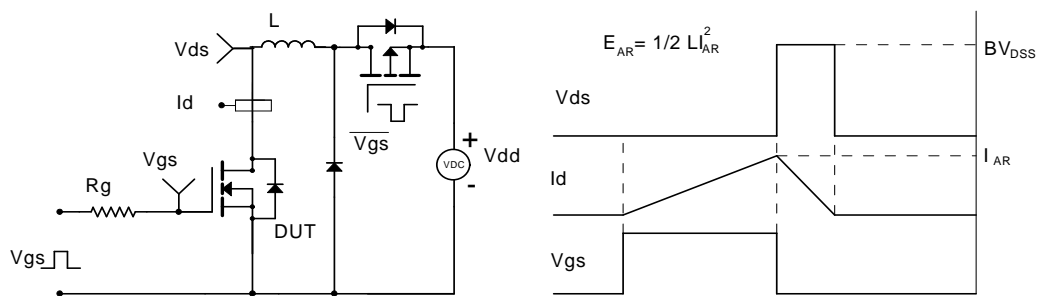
Gate Charge Test Circuit & Waveform



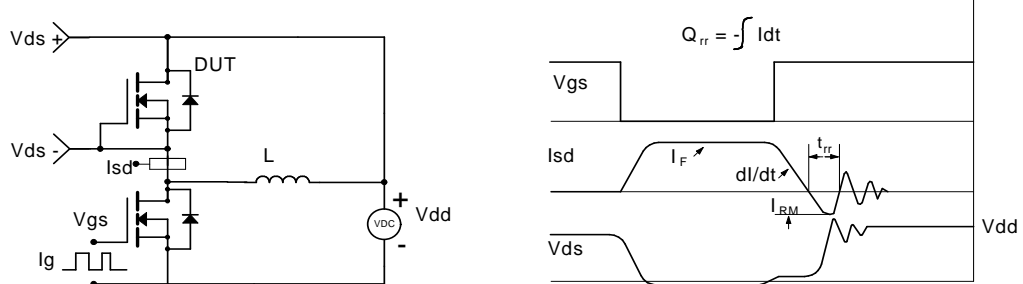
Resistive Switching Test Circuit & Waveforms



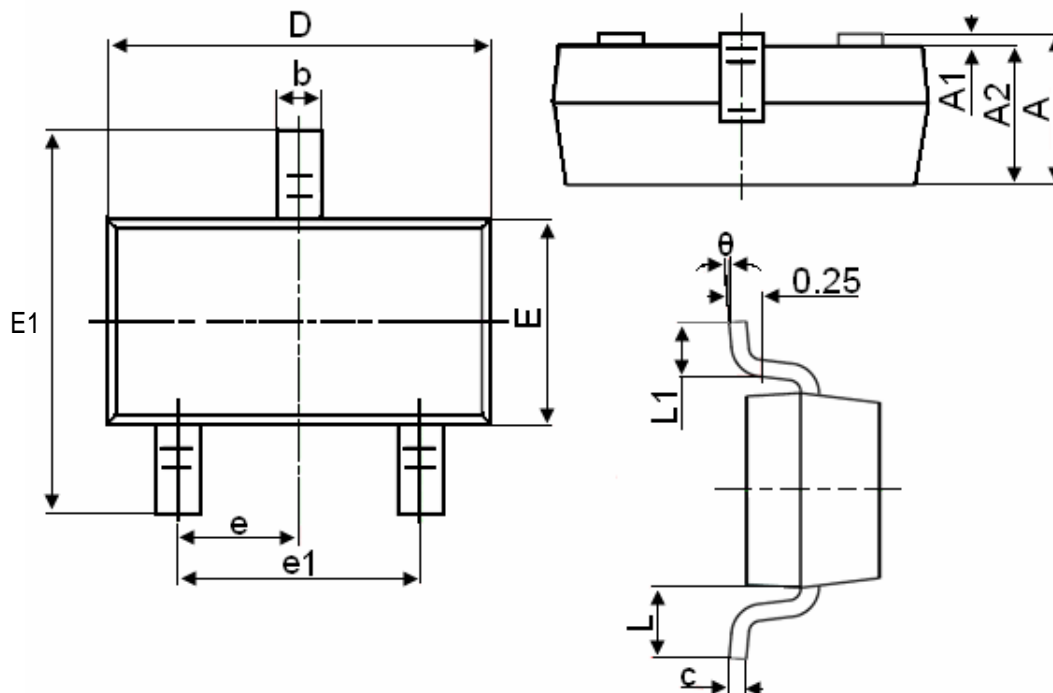
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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.