# MT3205B

## N-Channel Power MOSFET
## 60V, 140A, 3.6mΩ

MT Semiconductor®

http://www.mtsemi.com

## General Description

This N-channel MOSFET is produced using MOS-TECH Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

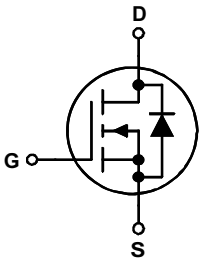
## Features

- $R_{DS(on)}$ = 3.6mΩ( Typ.)@ $V_{GS}$= 10V, $I_D$= 100A
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- RoHS compliant

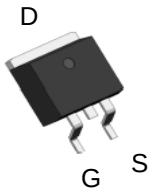
## Applications

- DC/DC converters

**Simplified Schematic**




**MARKING DIAGRAM & PIN ASSIGNMENT**




TO-263-2L

## Absolute Maximum Ratings ($T_A$ = 25℃ unless otherwise noted)

| Symbol | Parameter | | | Ratings | Units |
|---|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | | 60 | V |
| $V_{GSS}$ | Gate to Source Voltage | | | ±20 | V |
| $I_D$ | Drain Current | -Continuous ($T_C$ = 25°C) | (Note 1) | 140 | A |
| $I_{DM}$ | Drain Current | - Pulsed | | 470 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | | (Note 2) | 397 | mJ |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | | 250 | W |
| | | - Derate above 25°C | | 1.0 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | | -55 to +175 | °C |

## Thermal Characteristics

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 0.65 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 35 | |

## Electrical Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V, $T_J$ = 25 | 60 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 44V, $V_{GS}$ = 0V | - | - | 25 | μA |
| | | $V_{DS}$ = 44V, $T_C$ = 150°C | - | - | 250 | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | VGS = VDS, ID = 250μA | 2 | | 4 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10V, $I_D$ = 100A | - | 3.6 | 4. 5 | mΩ |
| | | $V_{GS}$ = 10V, $I_D$ = 56A<br>$T_J$ = 175°C | - | 10 | - | |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V<br>f = 1MHz | - | 3520 | 4360 | pF |
| $C_{oss}$ | Output Capacitance | | - | 550 | 760 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 340 | 470 | pF |
| $R_G$ | Gate Resistance | $V_{GS}$ = 0V, f = 1MHz | 3 | 4 | 5 | Ω |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{GS}$ = 0V to 10V; $V_{DS}$ = 44V, $I_D$ = 59A, $I_g$ = 1mA | - | 121 | 145 | nC |
| $Q_{g(th)}$ | Threshold Gate Charge | $V_{GS}$ = 0V to 2V; $V_{DS}$ = 44V, $I_D$ = 59A, $I_g$ = 1mA | - | 35 | 46 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | $V_{DS}$ = 44V, $I_D$ = 59A, $I_g$ = 1mA | - | 45 | - | nC |
| $Q_{gs2}$ | Gate Charge Threshold to Plateau | $V_{DS}$ = 44V, $I_D$ = 59A, $I_g$ = 1mA | | 18 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | $V_{DS}$ = 44V, $I_D$ = 59A, $I_g$ = 1mA | - | 39 | - | nC |
| **Switching Characteristics** | | | | | | |
| $t_{ON}$ | Turn-On Time | $V_{DD}$ = 28V, $I_D$ = 59A<br>$V_{GS}$ = 10V, $R_{GEN}$ = 2.5Ω | - | 99 | 137 | ns |
| $t_{d(on)}$ | Turn-On Delay Time | | - | 19 | 38 | ns |
| $t_r$ | Turn-On Rise Time | | - | 127 | 251 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 47 | 73 | ns |
| $t_f$ | Turn-Off Fall Time | | - | 19 | 49 | ns |
| $t_{OFF}$ | Turn-Off Time | | - | 67 | 89 | ns |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0V, $I_{SD}$ = 59A | - | - | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0V, $I_{SD}$ = 59A<br>$dI_F/dt$ = 100A/μs | - | 49 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 78 | - | nC |

**Notes:**
1: Calculated continuous current based on maximum allowable junction temperature. Package limited to 75A continuous, see Figure 9.
2: L = 0.21mH, $I_{AS}$ = 59A, $V_{DD}$ = 50V, $V_{GS}$ = 10V, $R_G$ = 25Ω, Starting $T_J$ = 25°C

## Typical Performance Characteristics

**Figure 1. On-Region Characteristics**

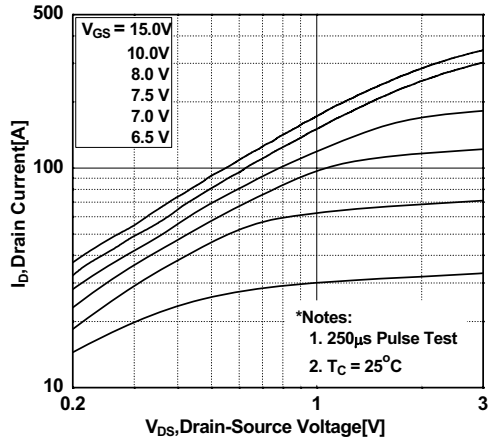



**Figure 2. Transfer Characteristics**

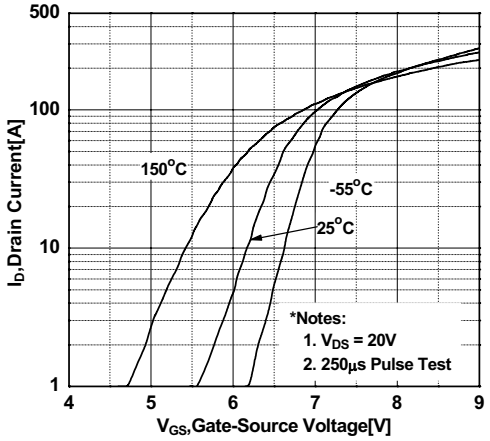



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

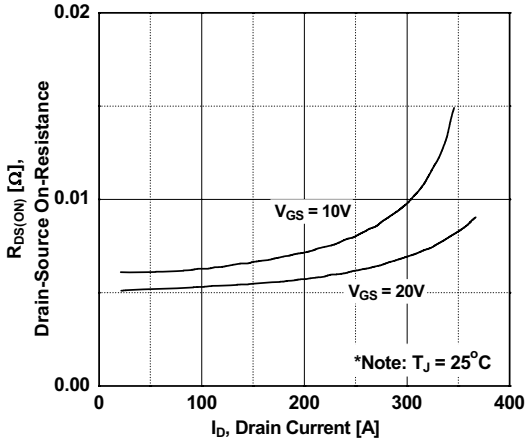



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

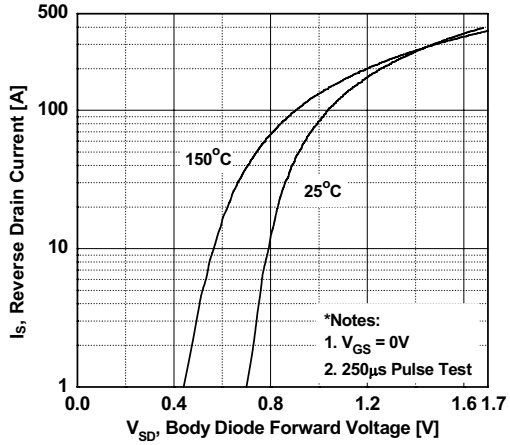



**Figure 5. Capacitance Characteristics**

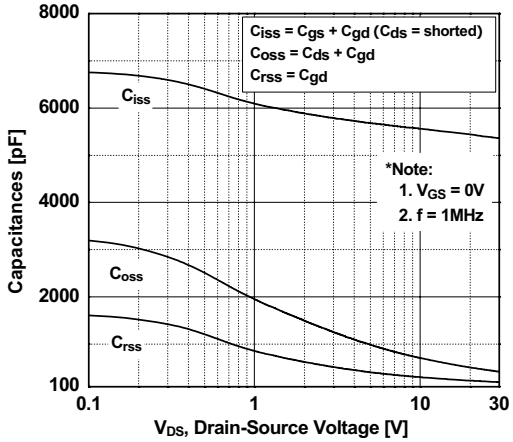
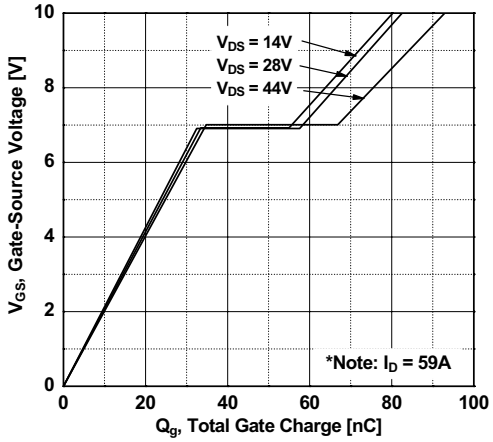



**Figure 6. Gate Charge Characteristics**



## Typical Performance Characteristics (Continued)

**Figure 7. Breakdown Voltage Variation vs. Temperature**

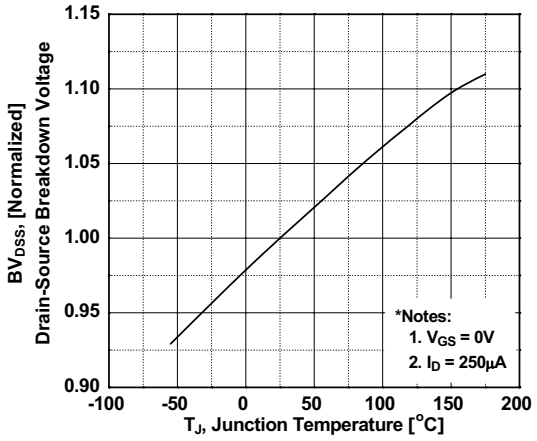



**Figure 8. On-Resistance Variation vs. Temperature**

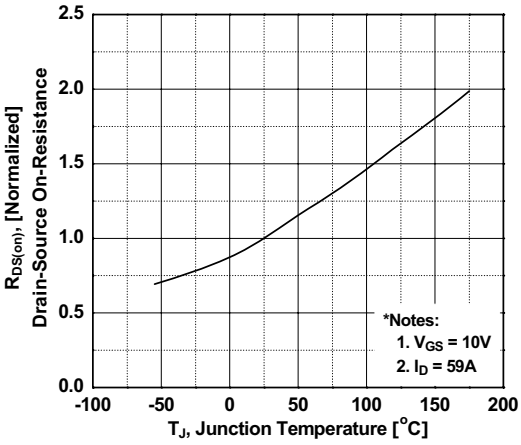



**Figure 9. Maximum Safe Operating Area**

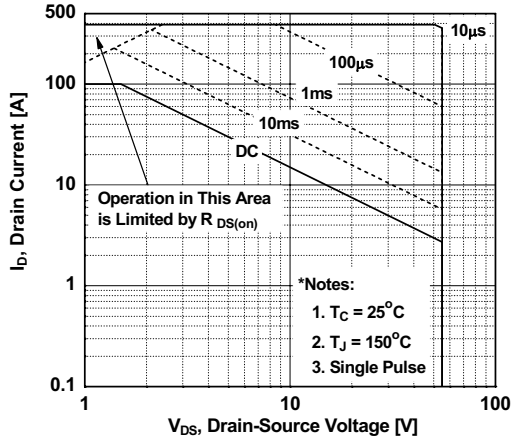



**Figure 10. Maximum Drain Current vs. Case Temperature**

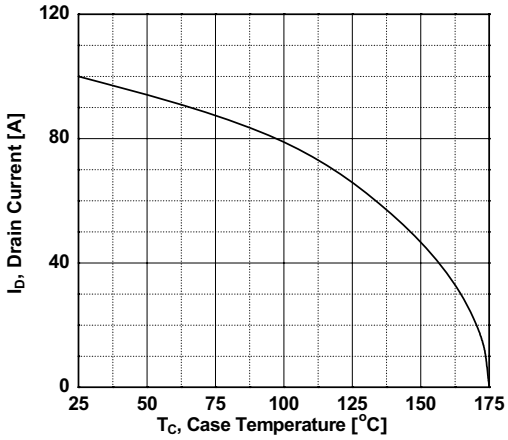
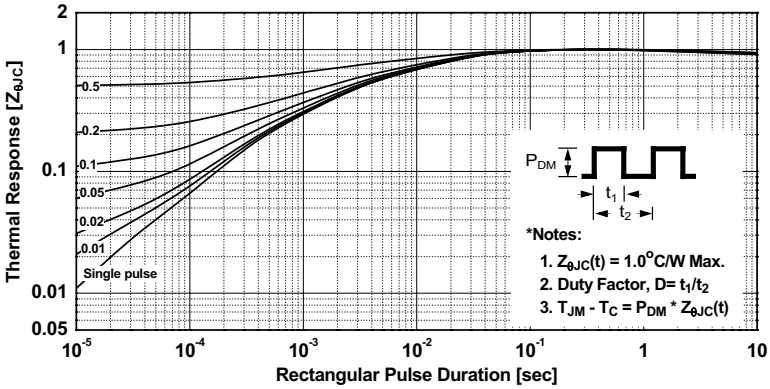
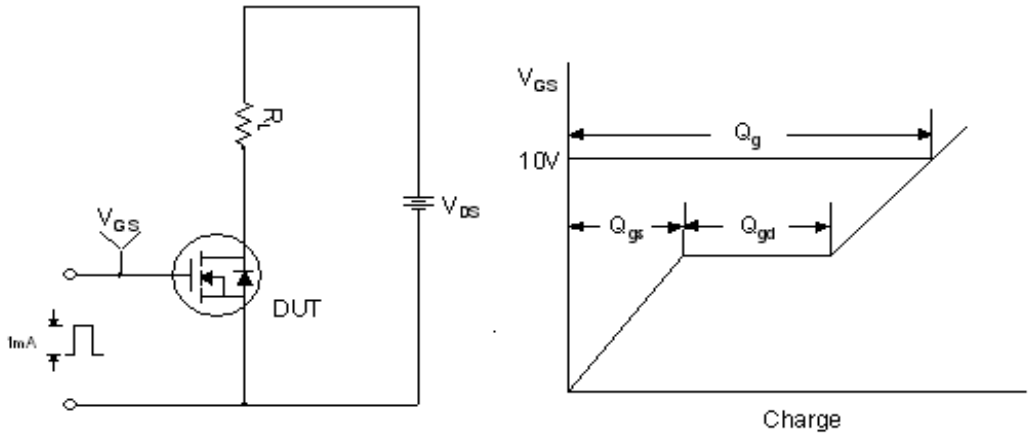


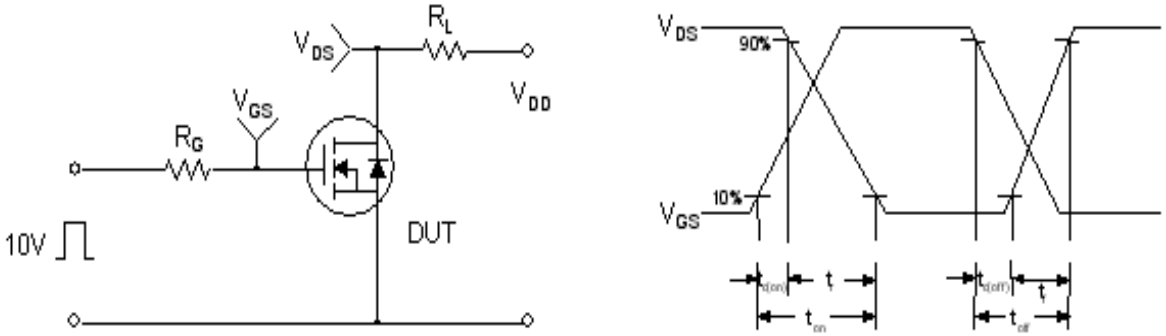

**Figure 11. Transient Thermal Response Curve**



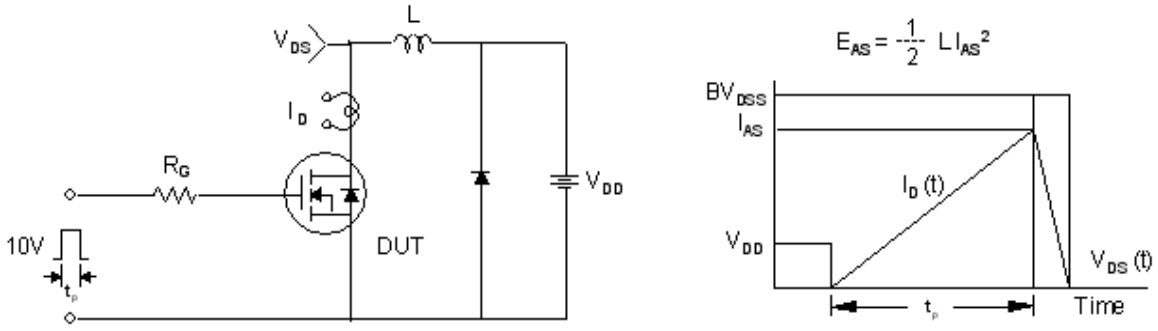
**Gate Charge Test Circuit & Waveform**



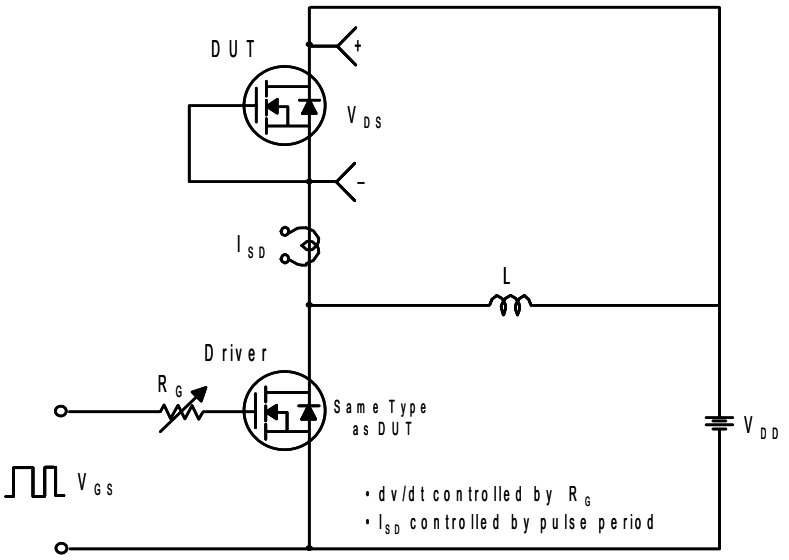

**Resistive Switching Test Circuit & Waveforms**

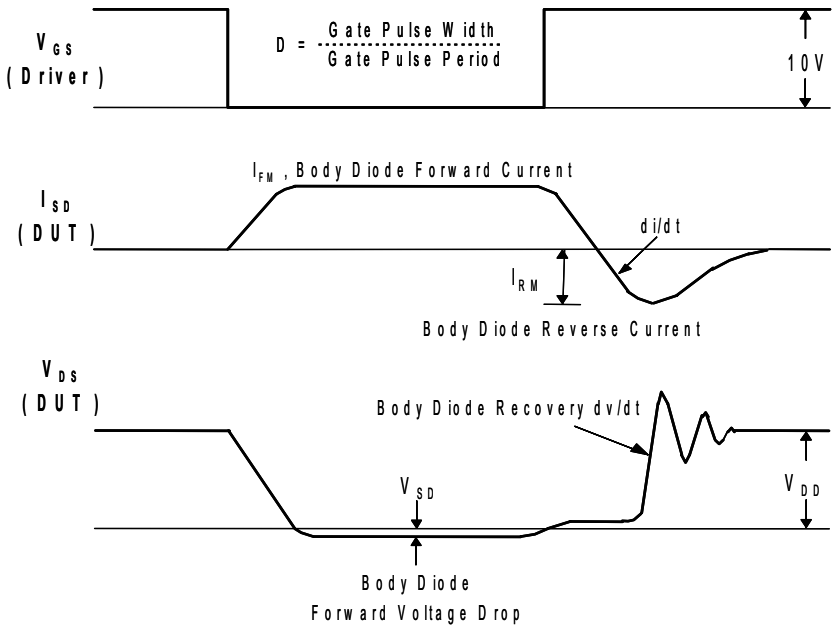



**Unclamped Inductive Switching Test Circuit & Waveforms**



**Peak Diode Recovery dv/dt Test Circuit & Waveforms**



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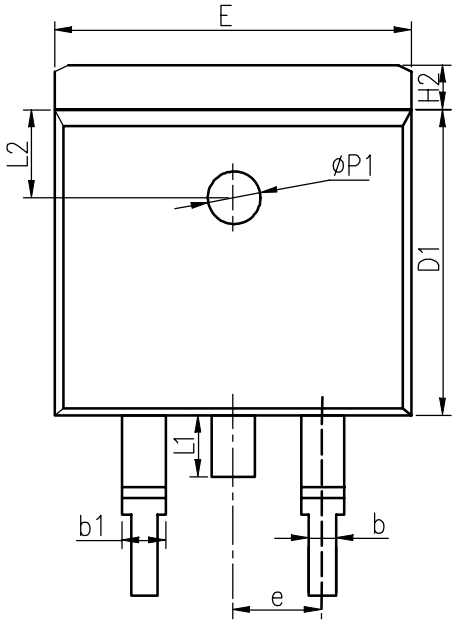


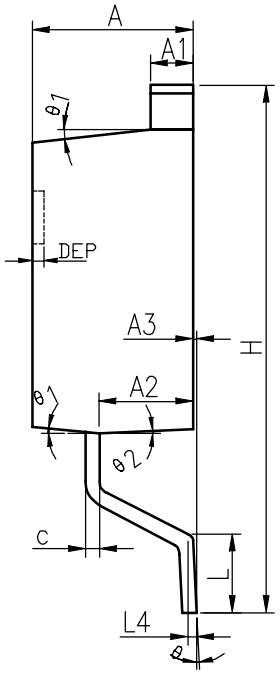


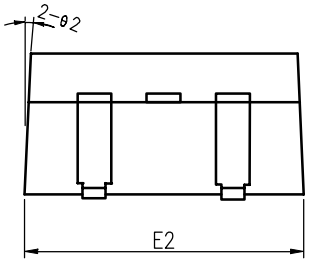


COMMON DIMENSIONS

| SYMBOL | MM | | | INCH | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 4.40 | 4.57 | 4.70 | 0.173 | 0.180 | 0.185 |
| A1 | 1.22 | 1.27 | 1.32 | 0.048 | 0.050 | 0.052 |
| A2 | 2.59 | 2.69 | 2.79 | 0.102 | 0.106 | 0.110 |
| A3 | 0.00 | 0.10 | 0.20 | 0.000 | 0.004 | 0.008 |
| b | 0.77 | 0.813 | 0.90 | 0.030 | 0.032 | 0.035 |
| b1 | 1.20 | 1.270 | 1.36 | 0.047 | 0.050 | 0.054 |
| c | 0.34 | 0.381 | 0.47 | 0.013 | 0.015 | 0.019 |
| D1 | 8.60 | 8.70 | 8.80 | 0.339 | 0.343 | 0.346 |
| E | 10.00 | 10.16 | 10.26 | 0.394 | 0.400 | 0.404 |
| E2 | 10.00 | 10.10 | 10.20 | 0.394 | 0.398 | 0.402 |
| e | | 2.54 BSC | | | 0.100 BSC | |
| H | 14.70 | 15.10 | 15.50 | 0.579 | 0.594 | 0.610 |
| H2 | 1.17 | 1.27 | 1.40 | 0.046 | 0.050 | 0.055 |
| L | 2.00 | 2.30 | 2.60 | 0.079 | 0.091 | 0.102 |
| L1 | 1.45 | 1.55 | 1.70 | 0.057 | 0.061 | 0.067 |
| L2 | | 2.50 REF | | | 0.098 REF | |
| L4 | | 0.25 BSC | | | 0.010 BSC | |
| | 0° | 5° | 8° | 0° | 5° | 8° |
| 1 | 5° | 7° | 9° | 5° | 7° | 9° |
| 2 | 1° | 3° | 5° | 1° | 3° | 5° |
| ΦP1 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| DEP | 0.05 | 0.10 | 0.20 | 0.002 | 0.004 | 0.008 |

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### Keep safety first in your circuit designs!

1. MOS-TECH Semiconductor Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.