# FDB33N25TM-VB Datasheet

## N-Channel 250 V (D-S) 175 °C MOSFET

| PRODUCT SUMMARY | | | |
|---|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A) | $Q_g$ (Typ) |
| 250 | 0.040 at $V_{GS}$ = 10 V | 60 | 95 |
| | 0.045 at $V_{GS}$ = 6 V | 55 | |

### FEATURES

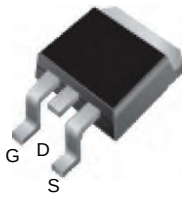
- Trench Power MOSFETS
- 175 °C Junction Temperature
- New Low Thermal Resistance Package
- Compliant to RoHS Directive 2002/95/EC

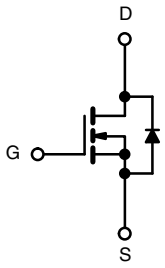
RoHS COMPLIANT

### APPLICATIONS

- Industrial

**D²PAK (TO-263)**




N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25 °C, unless otherwise noted) | | | | |
|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Limit** | **Unit** |
| Drain-Source Voltage | | $V_{DS}$ | 250 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 30 | |
| Continuous Drain Current ($T_J$ = 175 °C) | $T_C$ = 25 °C | $I_D$ | 60 | A |
| | $T_C$ = 125 °C | | 35 | |
| Pulsed Drain Current | | $I_{DM}$ | 200 | |
| Avalanche Current | | $I_{AR}$ | 35 | |
| Repetitive Avalanche Energy[a] | L = 0.1 mH | $E_{AR}$ | 61 | mJ |
| Maximum Power Dissipation[a] | $T_C$ = 25 °C | $P_D$ | 300[b] | W |
| | $T_A$ = 25 °C[c] | | 3.75 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 175 | °C |

| THERMAL RESISTANCE RATINGS | | | |
|---|---|---|---|
| **Parameter** | **Symbol** | **Limit** | **Unit** |
| Junction-to-Ambient (PCB Mount)[c] | $R_{thJA}$ | 40 | °C/W |
| Junction-to-Case (Drain) | $R_{thJC}$ | 0.5 | |

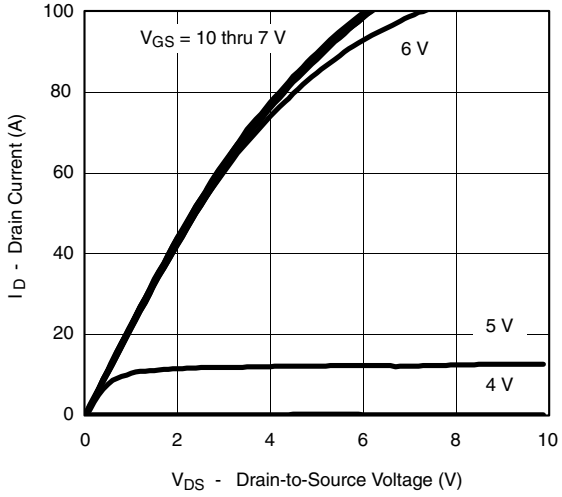
Notes:
a. Duty cycle ≤ 1 %.
b. See SOA curve for voltage derating.
c. When mounted on 1" square PCB (FR-4 material).

| **SPECIFICATIONS** ($T_J$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Min .** | **Typ.** | **Max.** | **Unit** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{DS}$ = 0 V, $I_D$ = 250 µA | 250 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2 | | 4 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 30 V | | | ± 250 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 250 V, $V_{GS}$ = 0 V | | | 1 | µA |
| | | $V_{DS}$ = 250 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | | | 50 | |
| | | $V_{DS}$ = 250 V, $V_{GS}$ = 0 V, $T_J$ = 175 °C | | | 250 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ ≥ 5 V, $V_{GS}$ = 10 V | 70 | | | A |
| Drain-Source On-State Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 30 A | | 0.040 | | Ω |
| | | $V_{GS}$ = 10 V, $I_D$ = 30 A, $T_J$ = 125 °C | | 0.091 | | |
| | | $V_{GS}$ = 10 V, $I_D$ = 30 A, $T_J$ = 175 °C | | 0.123 | | |
| | | $V_{GS}$ = 6 V, $I_D$ = 25 A | | 0.045 | | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 15 V, $I_D$ = 30 A | | 70 | | S |
| **Dynamic[b]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | | 5000 | | pF |
| Output Capacitance | $C_{oss}$ | | | 300 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 170 | | |
| Total Gate Charge[c] | $Q_g$ | $V_{DS}$ = 125 V, $V_{GS}$ = 10 V, $I_D$ = 45 A | | 95 | 140 | nC |
| Gate-Source Charge[c] | $Q_{gs}$ | | | 28 | | |
| Gate-Drain Charge[c] | $Q_{gd}$ | | | 34 | | |
| Gate Resistance | $R_g$ | f = 1 MHz | | 1.6 | | Ω |
| Turn-On Delay Time[c] | $t_{d(on)}$ | $V_{DD}$ = 100 V, $R_L$ = 2.78 Ω<br>$I_D$ ≅ 45 A, $V_{GEN}$ = 10 V, $R_g$ = 2.5 Ω | | 22 | 35 | ns |
| Rise Time[c] | $t_r$ | | | 220 | 330 | |
| Turn-Off Delay Time[c] | $t_{d(off)}$ | | | 40 | 60 | |
| Fall Time[c] | $t_f$ | | | 145 | 220 | |
| **Source-Drain Diode Ratings and Characteristics** ($T_C$ = 25 °C)[b] | | | | | | |
| Continuous Current | $I_S$ | | | | 45 | A |
| Pulsed Current | $I_{SM}$ | | | | 70 | |
| Forward Voltage[a] | $V_{SD}$ | $I_F$ = 45 A, $V_{GS}$ = 0 V | | 1 | 1.5 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 45 A, di/dt = 100 A/µs | | 150 | 225 | ns |
| Peak Reverse Recovery Current | $I_{RM(REC)}$ | | | 12 | 18 | A |
| Reverse Recovery Charge | $Q_{rr}$ | | | 0.9 | 2 | µC |

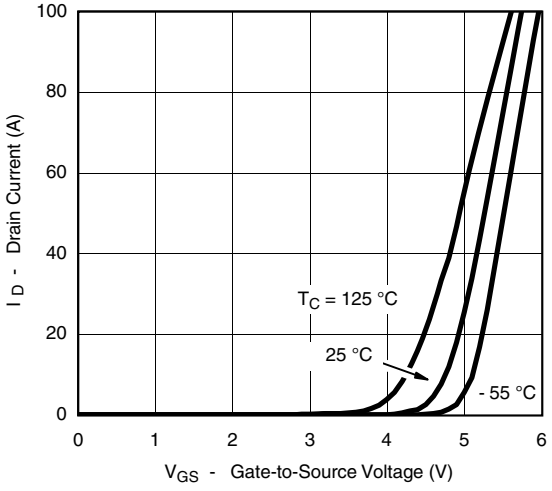
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

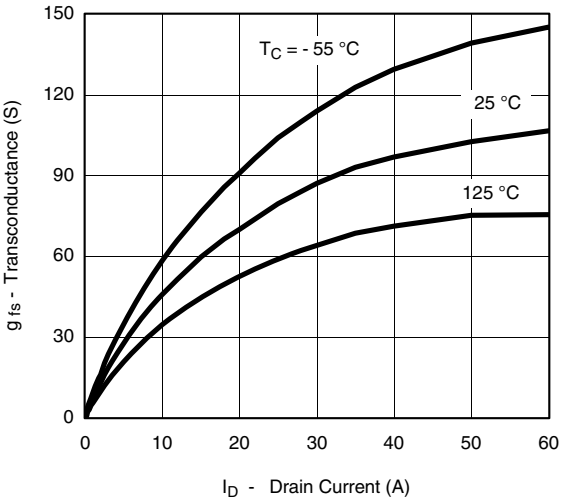
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



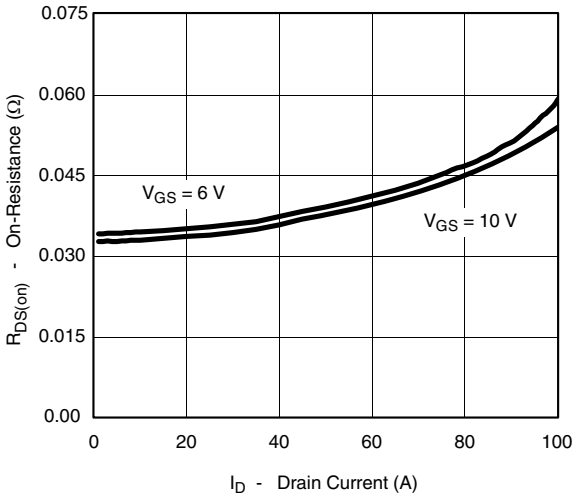

**Output Characteristics**



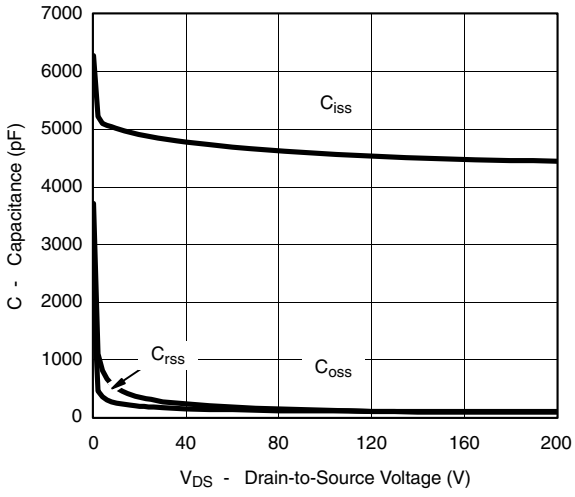

**Transfer Characteristics**



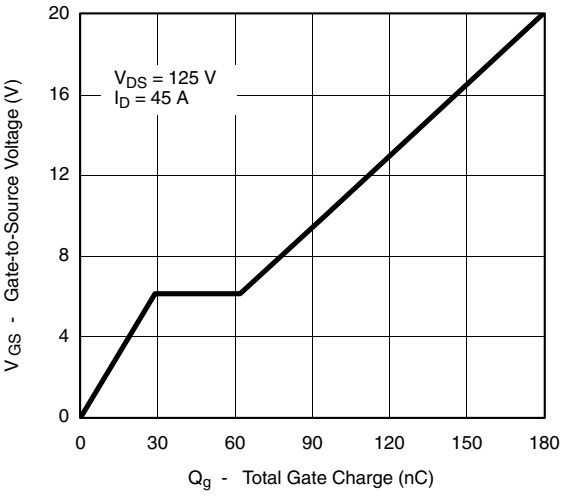

**Transconductance**




**On-Resistance vs. Drain Current**

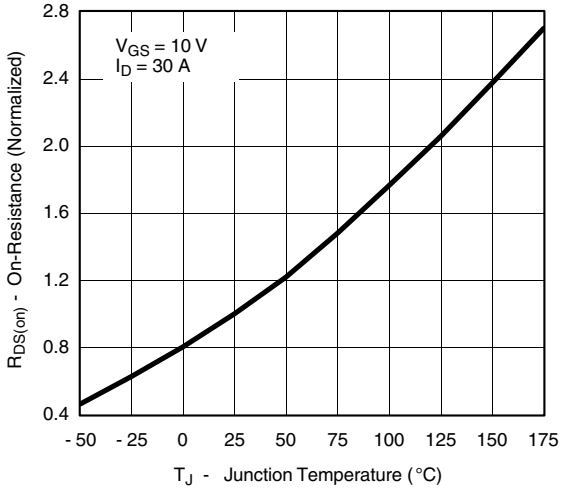



**Capacitance**

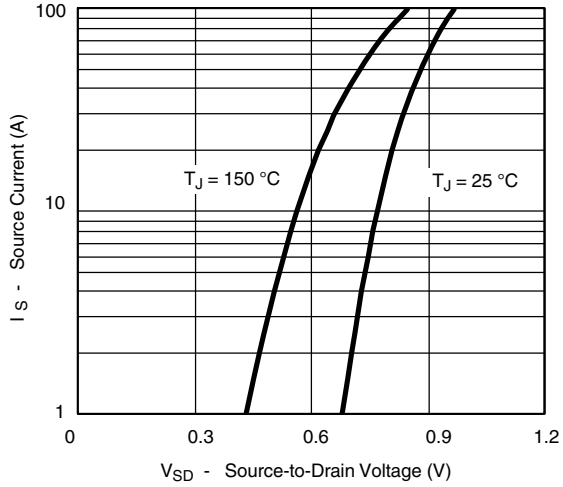



**Gate Charge**

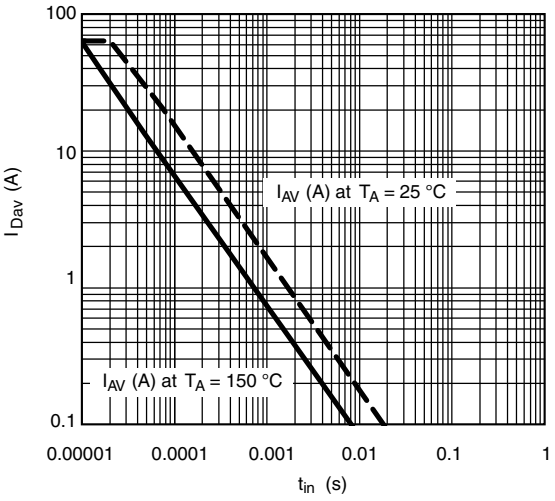
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



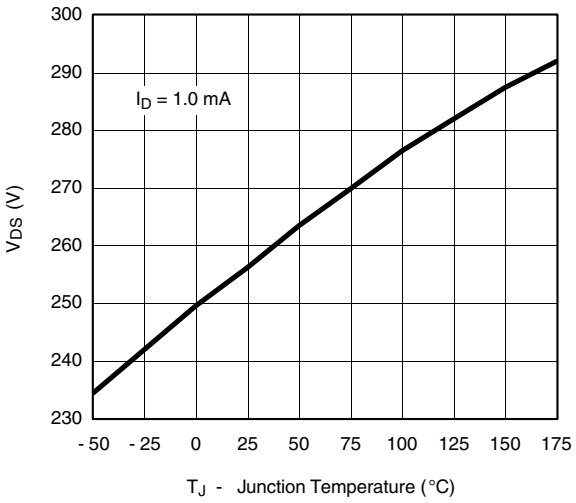

**On-Resistance vs. Junction Temperature**




**Source-Drain Diode Forward Voltage**

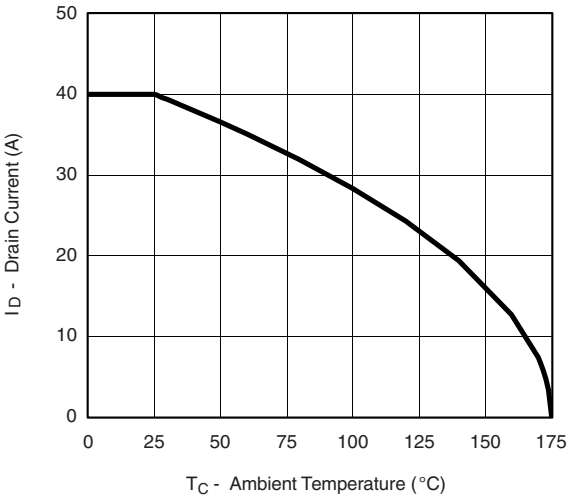



**Avalanche Current vs. Time**

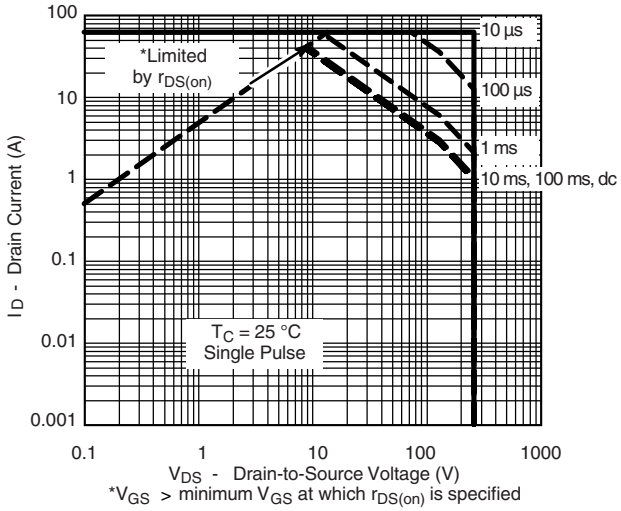



**Drain Source Breakdown vs. Junction Temperature**

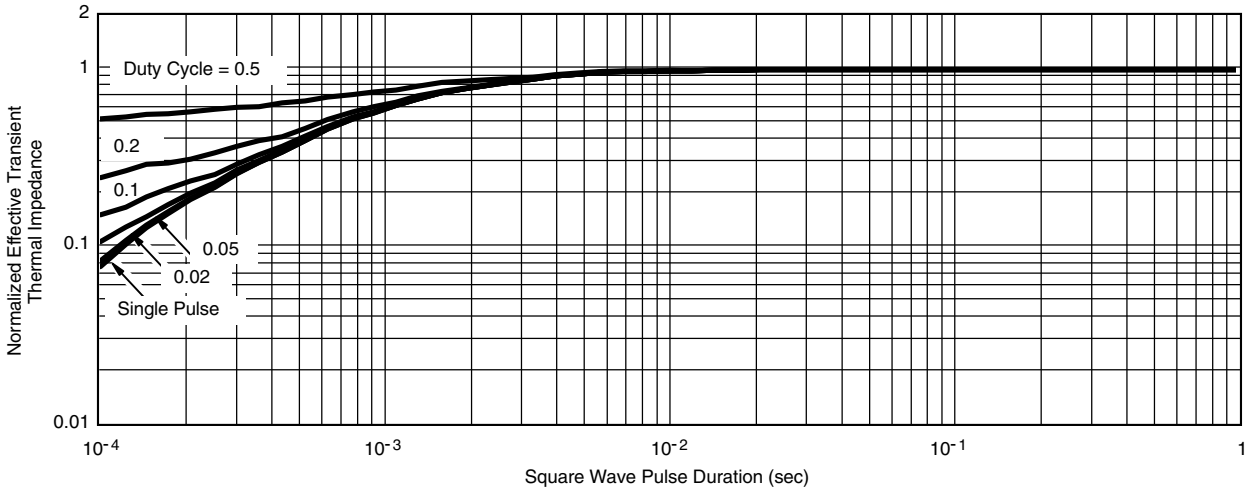
## THERMAL RATINGS




**Maximum Avalanche and Drain Current vs. Case Temperature**

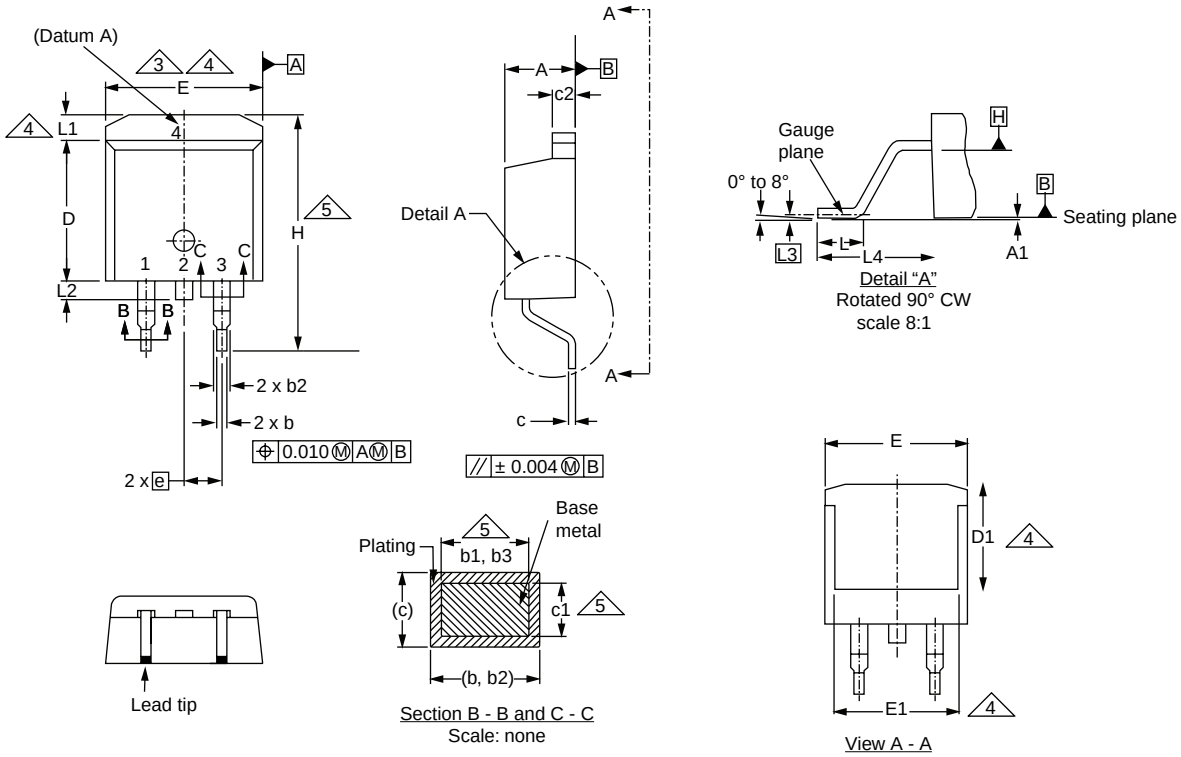



**Safe Operating Area, Case Temperature**




**Normalized Thermal Transient Impedance, Junction-to-Case**

## TO-263AB (HIGH VOLTAGE)




| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM. | MIN. | MAX. | MIN. | MAX. |
| A | 4.06 | 4.83 | 0.160 | 0.190 |
| A1 | 0.00 | 0.25 | 0.000 | 0.010 |
| b | 0.51 | 0.99 | 0.020 | 0.039 |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 |
| c | 0.38 | 0.74 | 0.015 | 0.029 |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 |
| D | 8.38 | 9.65 | 0.330 | 0.380 |

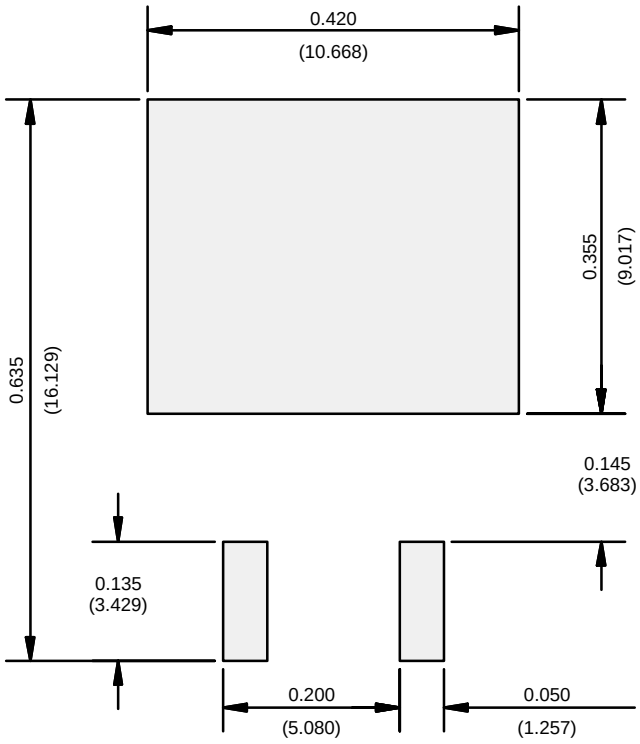
| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM. | MIN. | MAX. | MIN. | MAX. |
| D1 | 6.86 | - | 0.270 | - |
| E | 9.65 | 10.67 | 0.380 | 0.420 |
| E1 | 6.22 | - | 0.245 | - |
| e | 2.54 BSC | | 0.100 BSC | |
| H | 14.61 | 15.88 | 0.575 | 0.625 |
| L | 1.78 | 2.79 | 0.070 | 0.110 |
| L1 | - | 1.65 | - | 0.066 |
| L2 | - | 1.78 | - | 0.070 |
| L3 | 0.25 BSC | | 0.010 BSC | |
| L4 | 4.78 | 5.28 | 0.188 | 0.208 |

ECN: S-82110-Rev. A, 15-Sep-08
DWG: 5970

**Notes**

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

## RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead




Recommended Minimum Pads
Dimensions in Inches/(mm)

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