# BBS3002-DL-1E-VB Datasheet

## P-Channel 60 V (D-S) MOSFET

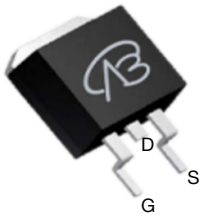
| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A) [d] |
| -60 | 0.0030 at $V_{GS}$ = -10V | -130 |
| | 0.0040 at $V_{GS}$ = -4.5V | |

### FEATURES

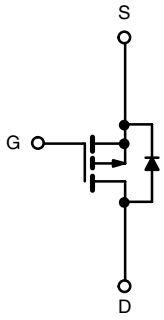
- Trench power MOSFET
- Package with low thermal resistance

RoHS COMPLIANT

**TO-263**




Top View




P-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25 °C, unless otherwise noted) | | | | |
|---|---|---|---|---|
| PARAMETER | | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | | $V_{DS}$ | -60 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | |
| Continuous Drain Current [d] ($T_J$ = 175 °C) | $T_C$ = 25 °C | $I_D$ | -130 | A |
| | $T_C$ = 125 °C | | -78 | |
| Pulsed Drain Current | | $I_{DM}$ | -390 | |
| Avalanche Current | L = 0.1 mH | $I_{AS}$ | -65 | |
| Single Pulse Avalanche Energy [a] | | $E_{AS}$ | 281 | mJ |
| Power Dissipation | $T_C$ = 25 °C [c] | $P_D$ | 375 | W |
| | $T_A$ = 25 °C [b] | | 3.75 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55 to +175 | °C |

| THERMAL RESISTANCE RATINGS | | | | |
|---|---|---|---|---|
| PARAMETER | | SYMBOL | TYPICAL | UNIT |
| Junction-to-Ambient | PCB mount [b] | $R_{thJA}$ | 40 | °C/W |
| Junction-to-Case | | $R_{thJC}$ | 0.4 | |

**Notes**

a. Duty cycle ≤ 1 %.
b. When mounted on 1" square PCB (FR4 material).
c. See SOA curve for voltage derating.
d. Limited by package.

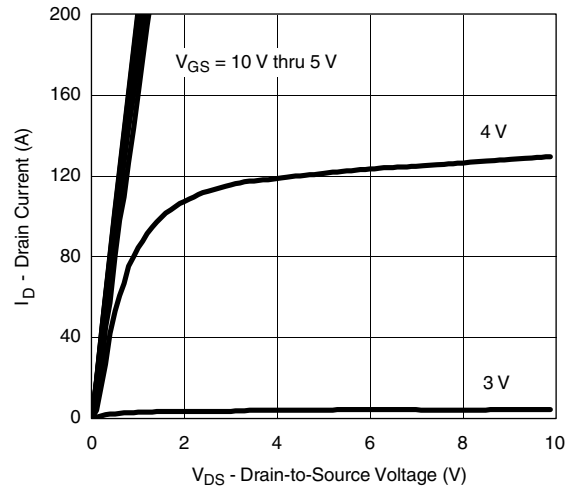
| **SPECIFICATIONS** ($T_J$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = -250 µA | -60 | - | - | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = -250 µA | - | -3.5 | - | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = -60 V, $V_{GS}$ = 0 V | - | - | -1 | µA |
| | | $V_{DS}$ = -60 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | - | - | -50 | |
| | | $V_{DS}$ = -60 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 | -120 | - | - | A |
| Drain-Source On-State Resistance [a] | $R_{DS(on)}$ | $V_{GS}$ = -10 V, $I_D$ = -30 A | - | 0.0030 | - | Ω |
| | | $V_{GS}$ = -10 V, $I_D$ = -30 A, $T_J$ = 125 °C | - | 0.0040 | - | |
| | | $V_{GS}$ = -10 V, $I_D$ = -30 A, $T_J$ = 175 °C | - | 0.0060 | - | |
| | | $V_{GS}$ = -4.5 V, $I_D$ = -20 A | - | 0.0040 | - | |
| Forward Transconductance [a] | $g_{fs}$ | $V_{DS}$ = -15 V, $I_D$ = -50 A | 20 | - | - | S |
| **Dynamic [b]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = -25 V, f = 1 MHz | - | 18000 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 1200 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 900 | - | |
| Total Gate Charge [c] | $Q_g$ | $V_{DS}$ = -30 V, $V_{GS}$ = -10 V, $I_D$ = -110 A | - | 230 | 345 | nC |
| Gate-Source Charge [c] | $Q_{gs}$ | | - | 50 | - | |
| Gate-Drain Charge [c] | $Q_{gd}$ | | - | 60 | - | |
| Gate Resistance | $R_g$ | f = 1 MHz | - | 3 | - | Ω |
| Turn-On Delay Time [c] | $t_{d(on)}$ | $V_{DD}$ = -30 V, $R_L$ = 0.27 Ω<br>$I_D \cong$ -110 A, $V_{GEN}$ = -10 V, $R_g$ = 1 Ω | - | 20 | 30 | ns |
| Rise Time [c] | $t_r$ | | - | 25 | 40 | |
| Turn-Off Delay Time [c] | $t_{d(off)}$ | | - | 110 | 200 | |
| Fall Time [c] | $t_f$ | | - | 50 | 100 | |
| **Drain-Source Body Diode Characteristics** ($T_C$ = 25 °C [b]) | | | | | | |
| Continuous Current | $I_S$ | | - | - | -130 | A |
| Pulsed Current | $I_{SM}$ | | - | - | -390 | |
| Forward Voltage [a] | $V_{SD}$ | $I_F$ = -85 A, $V_{GS}$ = 0 V | - | -1 | -1.5 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = -85 A, dI/dt = 100 A/µs | - | 91 | 137 | ns |
| Peak Reverse Recovery Charge | $I_{RM(REC)}$ | | - | -6 | -9 | A |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 0.21 | 0.44 | µC |

**Notes**

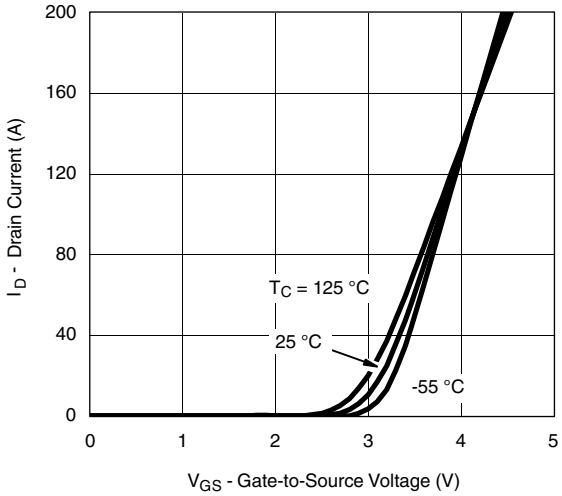
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

*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.*

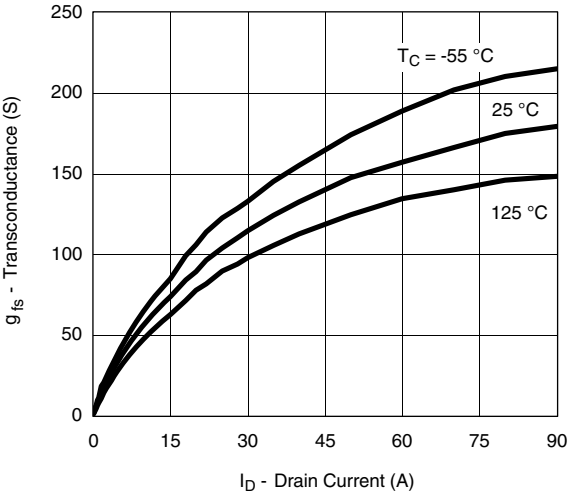
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



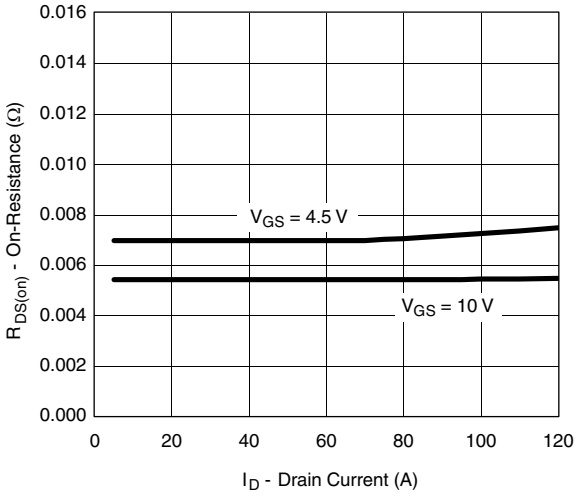

**Output Characteristics**



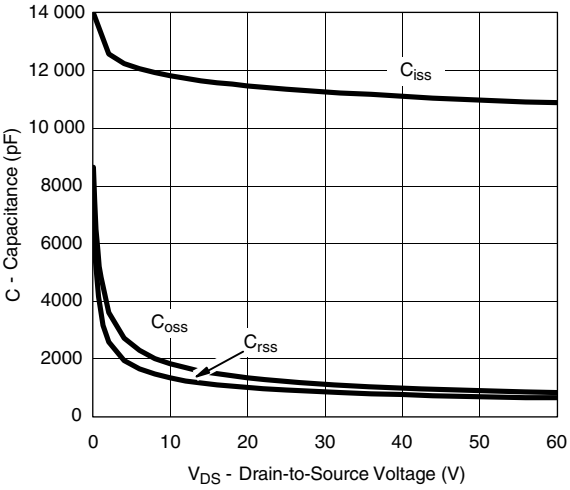

**Transfer Characteristics**



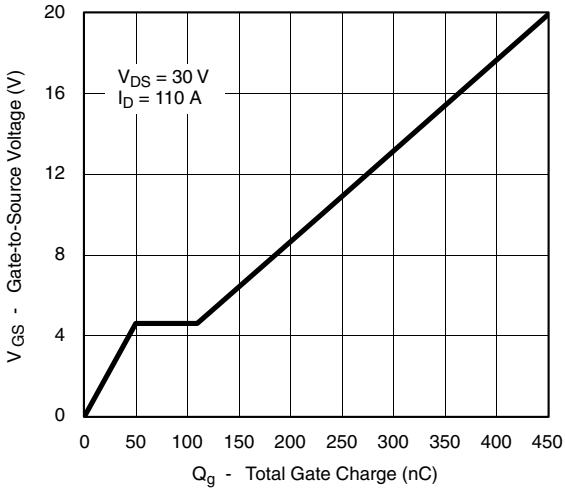

**Transconductance**




**On-Resistance vs. Drain Current**

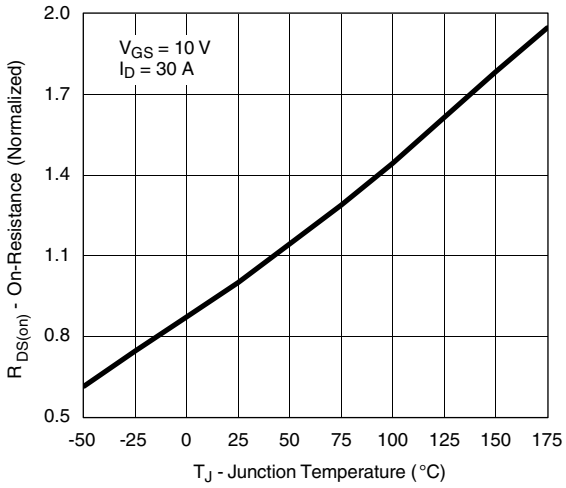



**Capacitance**

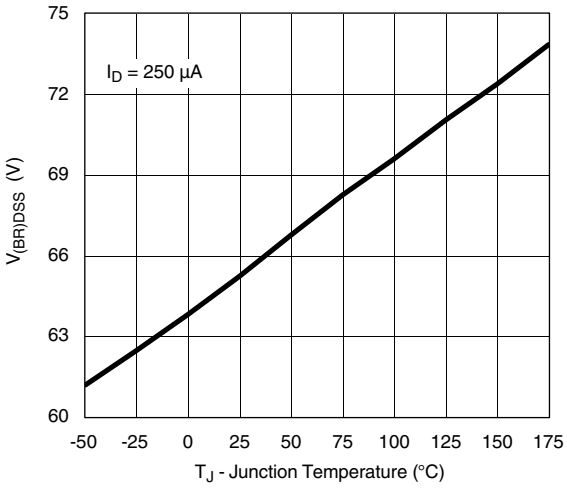



**Gate Charge**

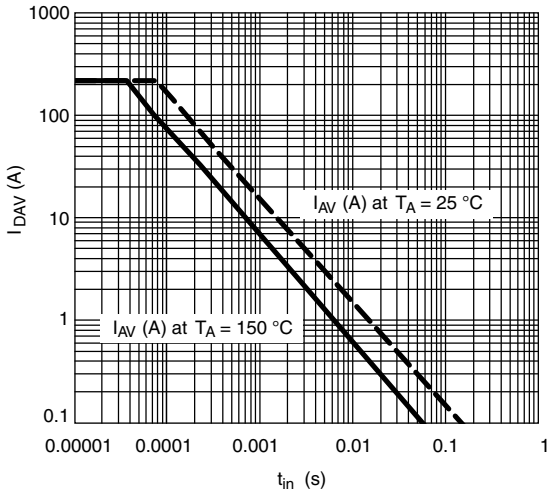
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



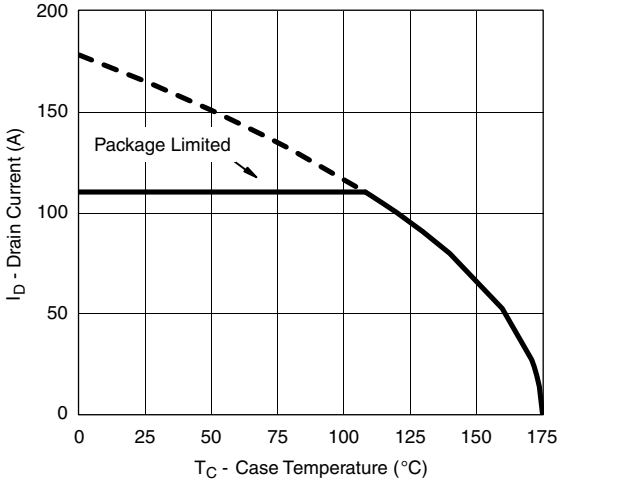

**On-Resistance vs. Junction Temperature**



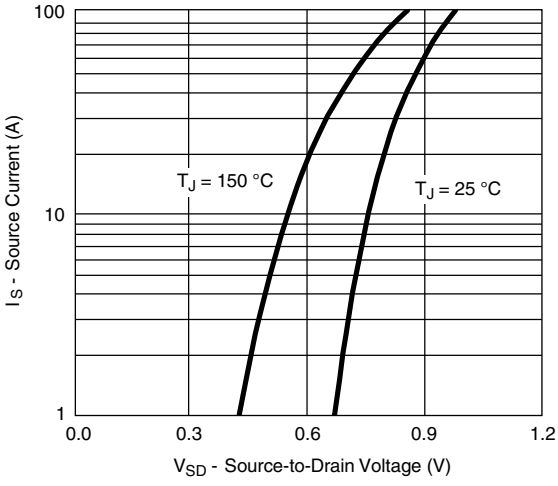

**Drain Source Breakdown vs. Junction Temperature**



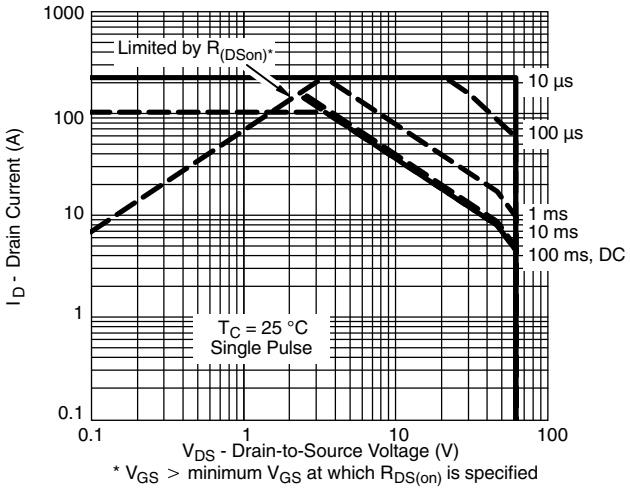

**Avalanche Current vs. Time**




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

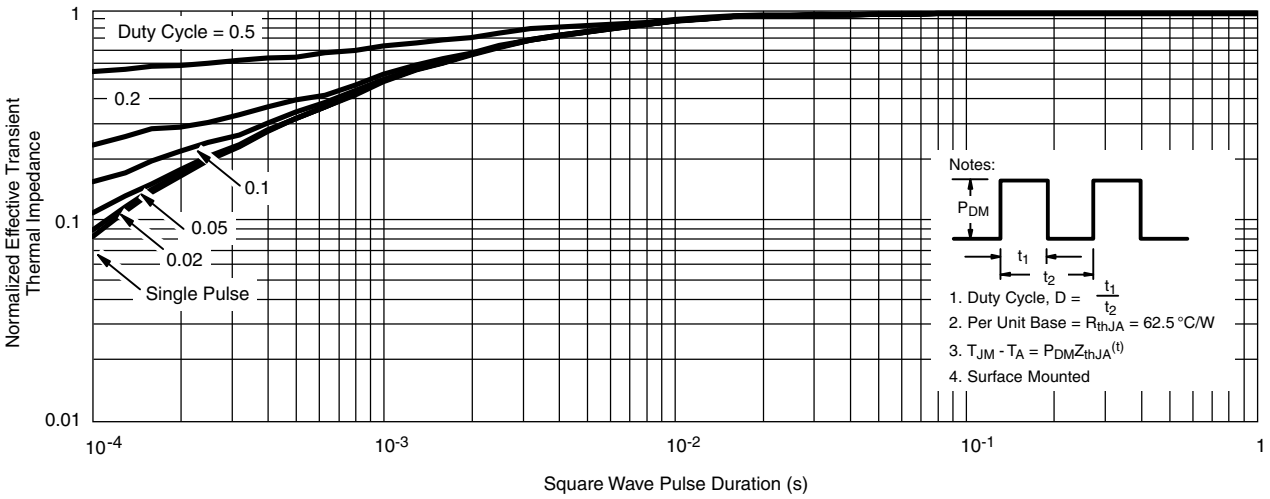



**Source-Drain Diode Forward Voltage**



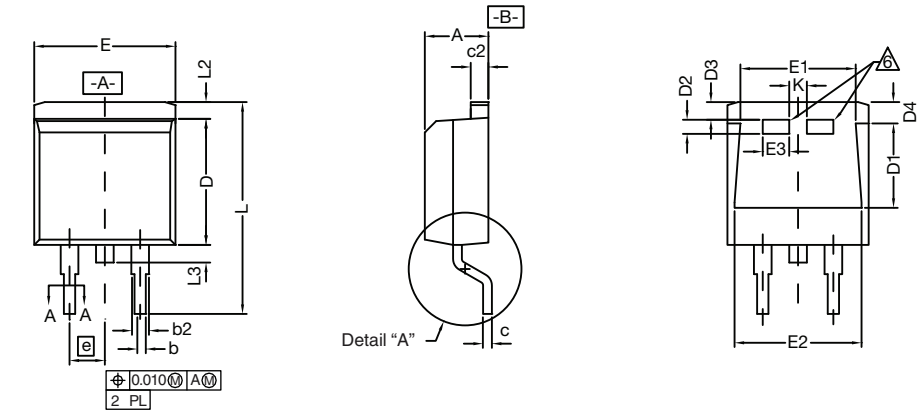

**Safe Operating Area**

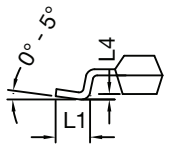
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



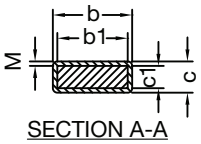

**Normalized Thermal Transient Impedance, Junction-to-Case**

# TO-263 ($D^2$PAK): 3-LEAD




DETAIL A (ROTATED 90°)



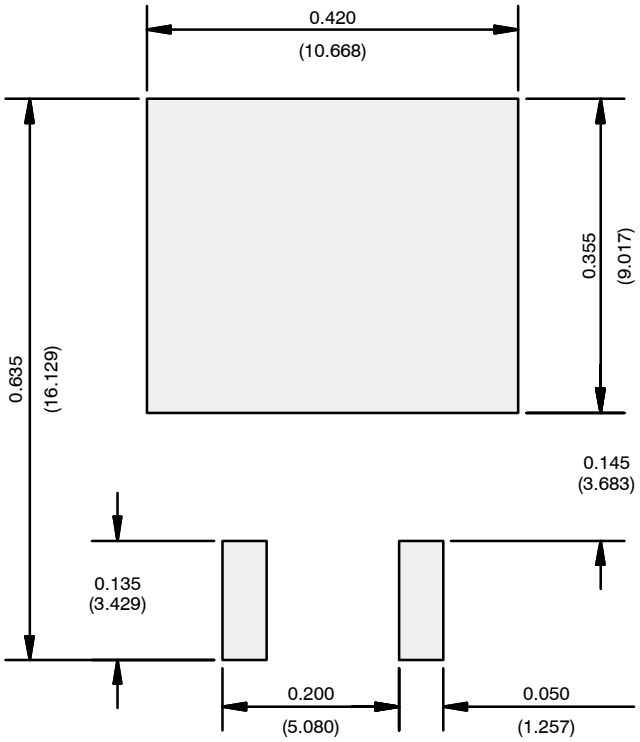

SECTION A-A

| DIM. | | INCHES | | MILLIMETERS | |
|---|---|---|---|---|---|
| | | MIN. | MAX. | MIN. | MAX. |
| A | | 0.160 | 0.190 | 4.064 | 4.826 |
| b | | 0.020 | 0.039 | 0.508 | 0.990 |
| b1 | | 0.020 | 0.035 | 0.508 | 0.889 |
| b2 | | 0.045 | 0.055 | 1.143 | 1.397 |
| c* | Thin lead | 0.013 | 0.018 | 0.330 | 0.457 |
| | Thick lead | 0.023 | 0.028 | 0.584 | 0.711 |
| c1 | Thin lead | 0.013 | 0.017 | 0.330 | 0.431 |
| | Thick lead | 0.023 | 0.027 | 0.584 | 0.685 |
| c2 | | 0.045 | 0.055 | 1.143 | 1.397 |
| D | | 0.340 | 0.380 | 8.636 | 9.652 |
| D1 | | 0.220 | 0.240 | 5.588 | 6.096 |
| D2 | | 0.038 | 0.042 | 0.965 | 1.067 |
| D3 | | 0.045 | 0.055 | 1.143 | 1.397 |
| D4 | | 0.044 | 0.052 | 1.118 | 1.321 |
| E | | 0.380 | 0.410 | 9.652 | 10.414 |
| E1 | | 0.245 | - | 6.223 | - |
| E2 | | 0.355 | 0.375 | 9.017 | 9.525 |
| E3 | | 0.072 | 0.078 | 1.829 | 1.981 |
| e | | 0.100 BSC | | 2.54 BSC | |
| K | | 0.045 | 0.055 | 1.143 | 1.397 |
| L | | 0.575 | 0.625 | 14.605 | 15.875 |
| L1 | | 0.090 | 0.110 | 2.286 | 2.794 |
| L2 | | 0.040 | 0.055 | 1.016 | 1.397 |
| L3 | | 0.050 | 0.070 | 1.270 | 1.778 |
| L4 | | 0.010 BSC | | 0.254 BSC | |
| M | | - | 0.002 | - | 0.050 |

**Notes**

1. Plane B includes maximum features of heat sink tab and plastic.
2. No more than 25 % of L1 can fall above seating plane by max. 8 mils.
3. Pin-to-pin coplanarity max. 4 mils.
4. *: Thin lead is for SUB, SYB.
   Thick lead is for SUM, SYM, SQM.
5. Use inches as the primary measurement.
6. This feature is for thick lead.

## RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead




Recommended Minimum Pads
Dimensions in Inches/(mm)

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