# IPB020NE7N3G-VB Datasheet

## N-Channel 80 V (D-S) MOSFET

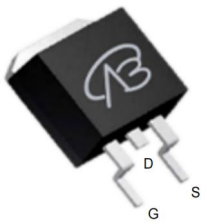
| PRODUCT SUMMARY | | | |
|---|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) MAX. | $I_D$ (A) | $Q_g$ (TYP.) |
| 80 | 0.0031 at $V_{GS}$ = 10 V | 230 | 94 |
| | 0.0035 at $V_{GS}$ = 7.5 V | 220 | |

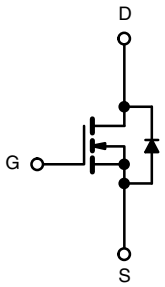
### FEATURES

- Trench power MOSFET
- Maximum 175 °C junction temperature
- Very low $Q_{gd}$ reduces power loss from passing through $V_{plateau}$
- 100 % $R_g$ and UIS tested

RoHS COMPLIANT
HALOGEN FREE

TO-263




N-Channel MOSFET

### APPLICATIONS

- Power supply
  - Secondary synchronous rectification
- DC/DC converter
- Power tools
- Motor drive switch
- DC/AC inverter
- Battery management

| ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25 °C, unless otherwise noted) | | | | |
|---|---|---|---|---|
| PARAMETER | | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | | $V_{DS}$ | 80 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | |
| Continuous Drain Current ($T_J$ = 150 °C) | $T_C$ = 25 °C | $I_D$ | 230 | A |
| | $T_C$ = 70 °C | | 138[d] | |
| Pulsed Drain Current (t = 100 µs) | | $I_{DM}$ | 690 | |
| Avalanche Current | | $I_{AS}$ | 70 | |
| Single Avalanche Energy [a] | L = 0.1 mH | $E_{AS}$ | 245 | mJ |
| Maximum Power Dissipation [a] | $T_C$ = 25 °C | $P_D$ | 375 [b] | W |
| | $T_C$ = 125 °C | | 125 [b] | |
| 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) | $R_{thJC}$ | 0.4 | |

**Notes**

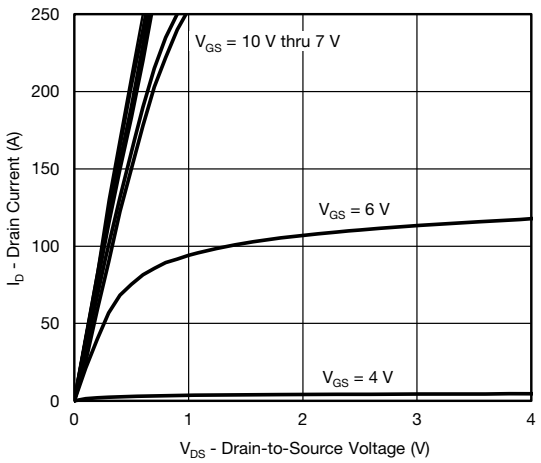
a. Duty cycle ≤ 1 %.
b. See SOA curve for voltage derating.
c. When mounted on 1" square PCB (FR4 material).
d. Package limited.

| **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 | 80 | - | - | 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, $V_{GS}$ = ± 20 V | - | - | ± 250 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 80 V, $V_{GS}$ = 0 V | - | - | 1 | µA |
| | | $V_{DS}$ = 80 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | - | - | 150 | |
| | | $V_{DS}$ = 80 V, $V_{GS}$ = 0 V, $T_J$ = 175 °C | - | - | 5 | mA |
| On-State Drain Current [a] | $I_{D(on)}$ | $V_{DS}$ ≥ 10 V, $V_{GS}$ = 10 V | 120 | - | - | A |
| Drain-Source On-State Resistance [a] | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 30 A | - | 0.0031 | - | Ω |
| | | $V_{GS}$ = 7.5 V, $I_D$ = 20 A | - | 0.0035 | - | |
| Forward Transconductance [a] | $g_{fs}$ | $V_{DS}$ = 15 V, $I_D$ = 30 A | - | 82 | - | S |
| **Dynamic [b]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 40 V, f = 1 MHz | - | 4100 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 110 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 348 | - | |
| Total Gate Charge [c] | $Q_g$ | $V_{DS}$ = 40 V, $V_{GS}$ = 10 V, $I_D$ = 20 A | - | 94 | 141 | nC |
| Gate-Source Charge [c] | $Q_{gs}$ | | - | 31 | - | |
| Gate-Drain Charge [c] | $Q_{gd}$ | | - | 10 | - | |
| Gate Resistance | $R_g$ | f = 1 MHz | 0.28 | 1.4 | 2.8 | Ω |
| Turn-On Delay Time [c] | $t_{d(on)}$ | $V_{DD}$ = 40 V, $R_L$ = 4 Ω<br>$I_D$ ≅ 10 A, $V_{GEN}$ = 10 V, $R_g$ = 1 Ω | - | 24 | 40 | ns |
| Rise Time [c] | $t_r$ | | - | 24 | 40 | |
| Turn-Off Delay Time [c] | $t_{d(off)}$ | | - | 34 | 60 | |
| Fall Time [c] | $t_f$ | | - | 14 | 28 | |
| **Drain-Source Body Diode Ratings and Characteristics [b]** ($T_C$ = 25 °C) | | | | | | |
| Pulsed Current (t = 100 µs) | $I_{SM}$ | | - | - | 690 | A |
| Forward Voltage [a] | $V_{SD}$ | $I_F$ = 10 A, $V_{GS}$ = 0 V | - | 0.8 | 1.5 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 34 A, di/dt = 100 A/µs | - | 126 | 190 | ns |
| Peak Reverse Recovery Charge | $I_{RM(REC)}$ | | - | 5 | 10 | A |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 0.315 | 0.475 | µC |

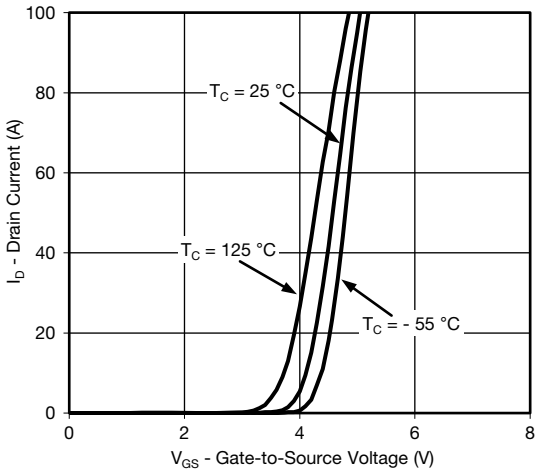
**Notes**

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

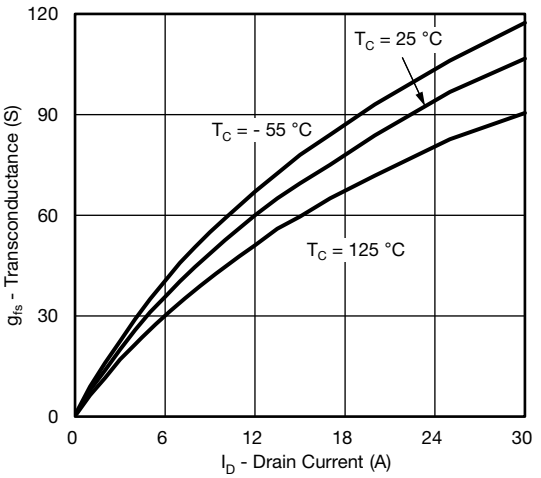
## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C, unless otherwise noted)



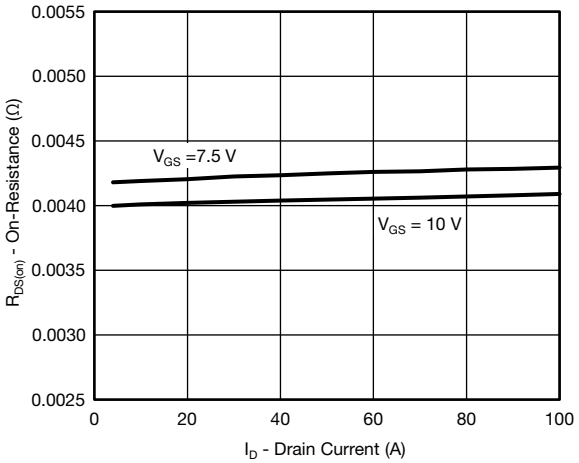

**Output Characteristics**



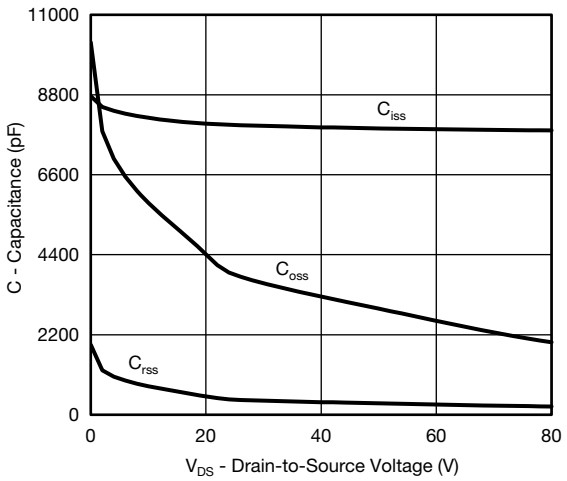

**Transfer Characteristics**



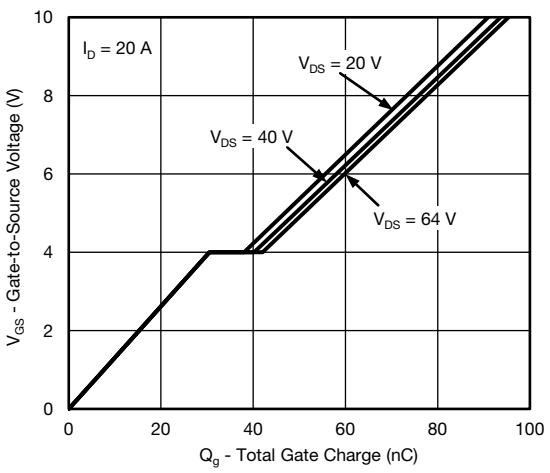

**Transconductance**




**On-Resistance vs. Drain Current**

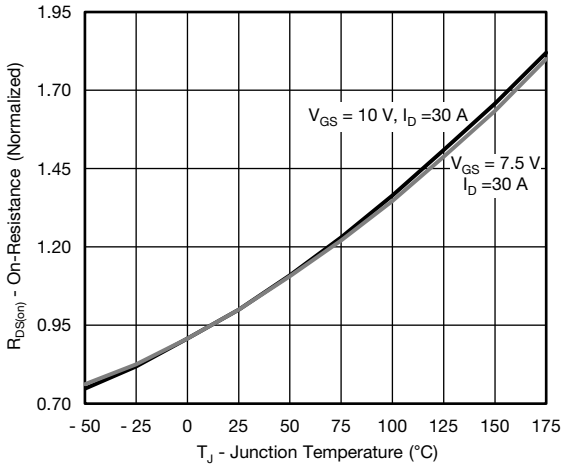



**Capacitance**

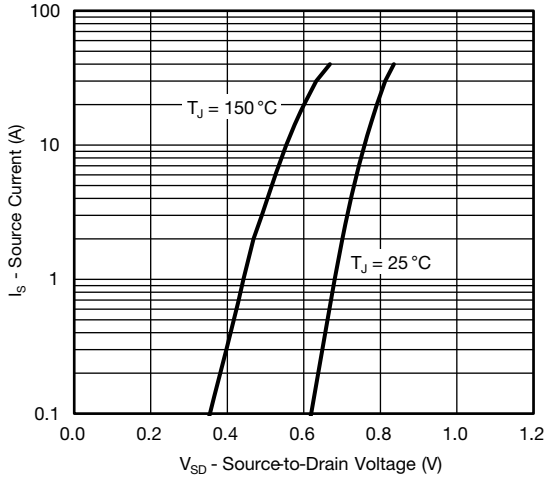



**Gate Charge**

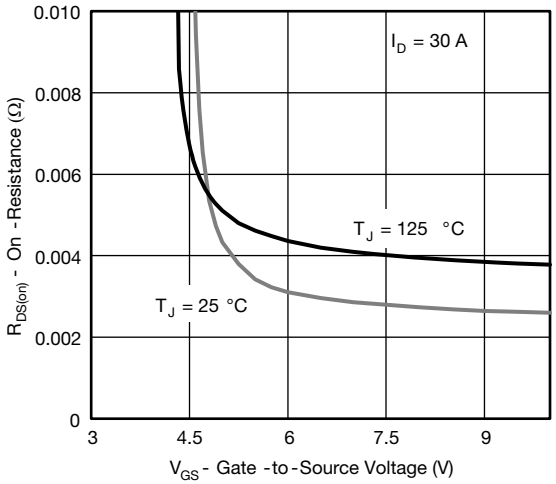
## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C, unless otherwise noted)



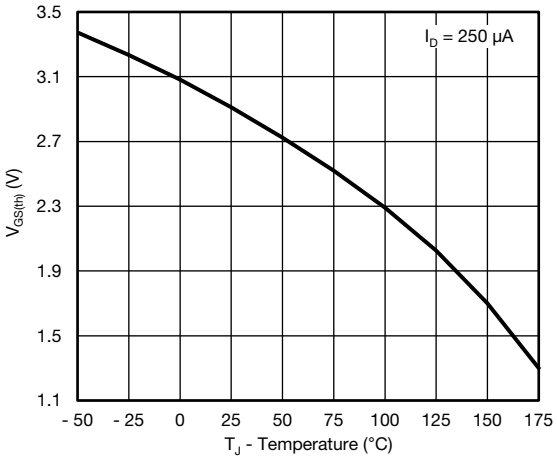

**On-Resistance vs. Junction Temperature**



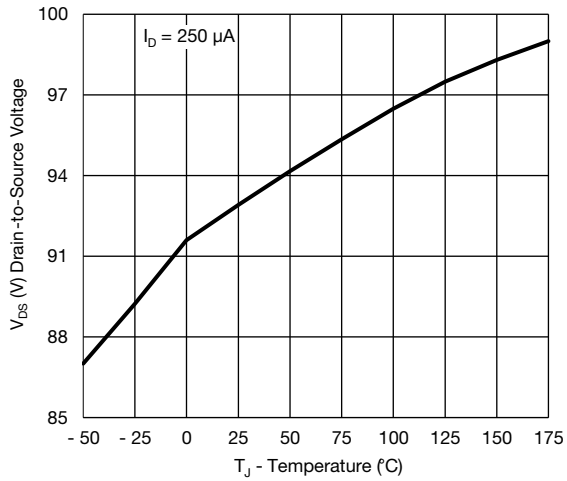

**Source Drain Diode Forward Voltage**



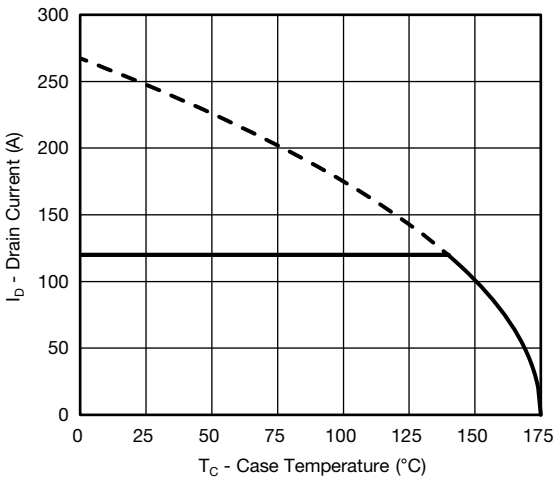

**On-Resistance vs. Gate-to-Source Voltage**




**Threshold Voltage**

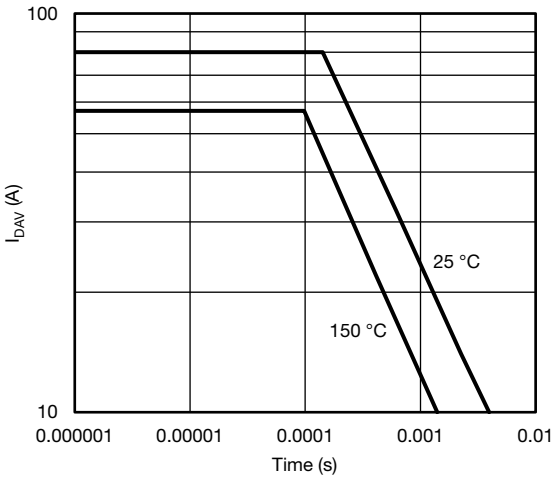



**Drain Source Breakdown vs. Junction Temperature**

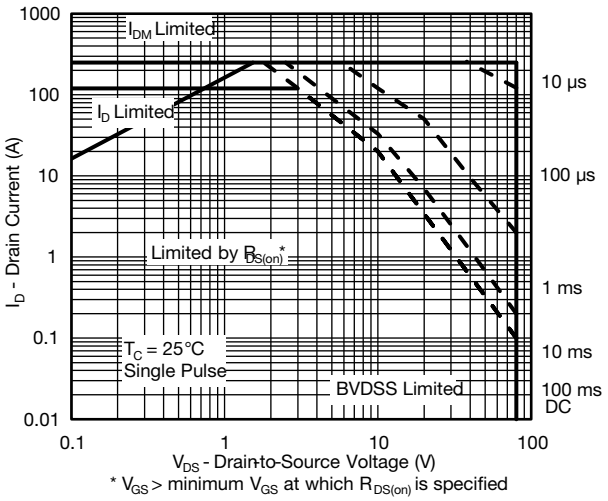



**Current De-rating**

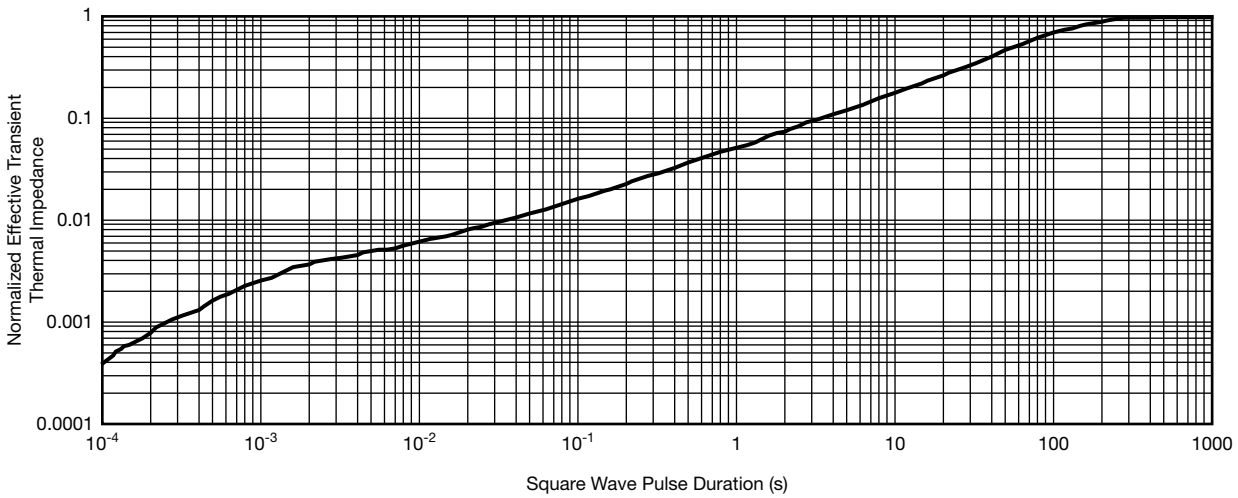
**THERMAL RATINGS** ($T_A$ = 25 °C, unless otherwise noted)




**Single Pulse Avalanche Current Capability vs. Time**

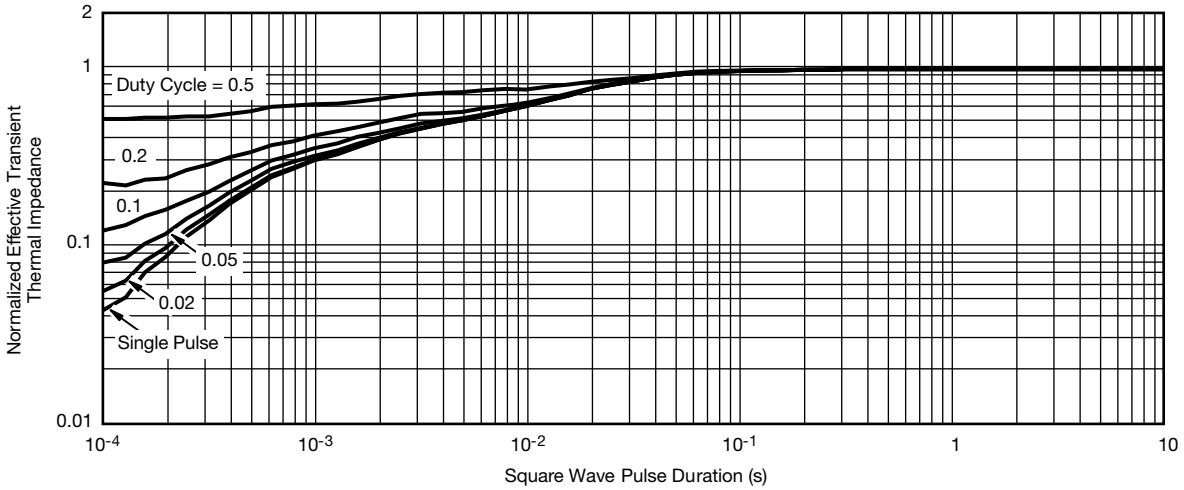



**Safe Operating Area**




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

**THERMAL RATINGS** ($T_A$ = 25 °C, unless otherwise noted)



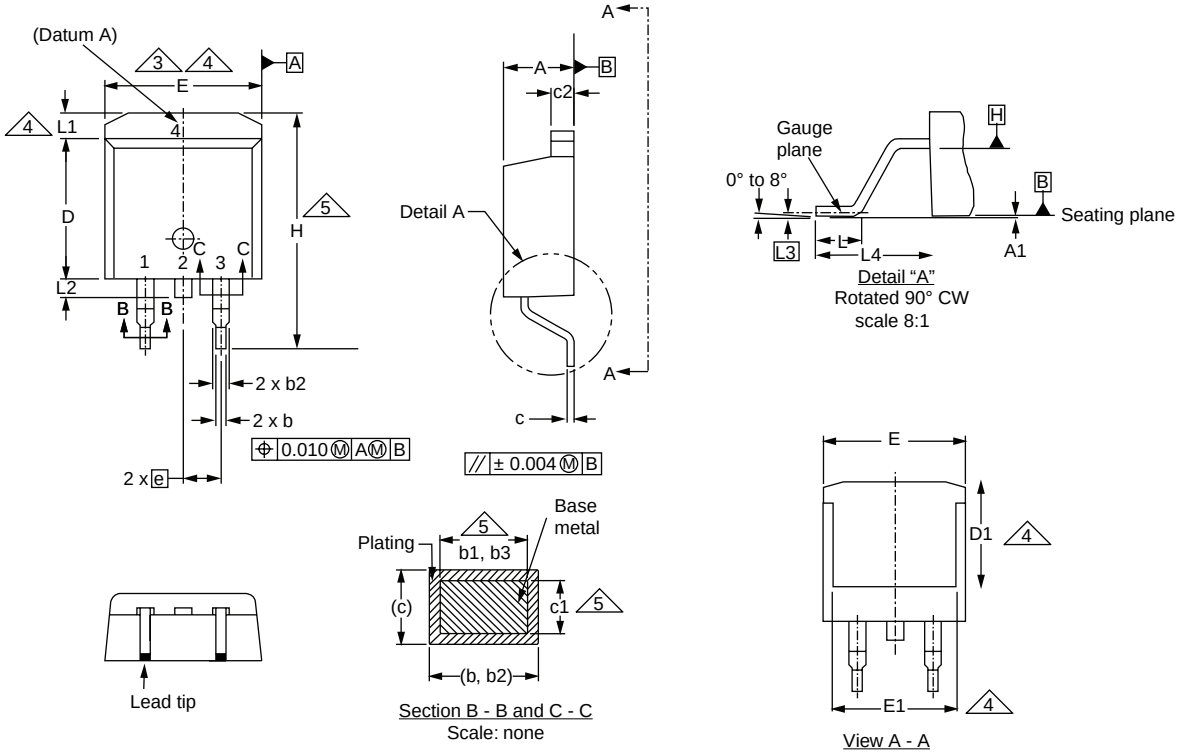

**Normalized Thermal Transient Impedance, Junction-to-Case**

**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction to Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction to Case (25 °C)

  are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

## TO-263AB




| | 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 |

**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.

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