IOR HiRel
An Infineon Technologies Company

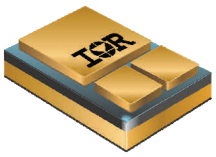
# IRF5NJ9540

## HEXFET® POWER MOSFET SURFACE MOUNT (SMD-0.5)

## 100V, P-CHANNEL

### Product Summary

| Part Number | $BV_{DSS}$ | RDS(on) | $I_D$ |
|---|---|---|---|
| IRF5NJ9540 | -100V | 0.117Ω | -18A |



SMD-0.5

### Description

Fifth Generation HEXFET® power MOSFETs from IR HiRel utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon unit area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient device for use in a wide variety of applications.

These devices are well-suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high-energy pulse circuits.

### Features

- Low RDS(on)
- Avalanche Energy Ratings
- Dynamic dv/dt Rating
- Simple Drive Requirements
- Hermetically Sealed
- Surface Mount
- Light Weight
- ESD Rating: Class 2 per MIL-STD-750, Method 1020

### Absolute Maximum Ratings — Pre-Irradiation

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $I_{D1}$ @ $V_{GS}$ = -10V, $T_C$ = 25°C | Continuous Drain Current | -18 | A |
| $I_{D2}$ @ $V_{GS}$ = -10V, $T_C$ = 100°C | Continuous Drain Current | -11 | |
| $I_{DM}$ @ $T_C$ = 25°C | Pulsed Drain Current ① | -72 | |
| $P_D$ @$T_C$ = 25°C | Maximum Power Dissipation | 75 | W |
| | Linear Derating Factor | 0.6 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 260 | mJ |
| $I_{AR}$ | Avalanche Current ① | -11 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | 7.5 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 4.1 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |
| | Package Mounting Surface Temp | 300 (for 5s) | |
| | Weight | 1.0 (Typical) | g |

For Footnotes, refer to the page 2.



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## Electrical Characteristics @ Tj = 25°C (Unless Otherwise Specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | -100 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = -250µA |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | -0.104 | —— | V/°C | Reference to 25°C, $I_D$ = -1.0mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | —— | —— | 0.117 | Ω | $V_{GS}$ = -10V, $I_{D2}$ = -11A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | -2.0 | —— | -4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| gfs | Forward Transconductance | 5.0 | —— | —— | S | $V_{DS}$ = -15V, $I_{D2}$ = -11A ④ |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | —— | —— | -25 | µA | $V_{DS}$ = -80V, $V_{GS}$ = 0V |
| | | —— | —— | -250 | | $V_{DS}$ = -80V,$V_{GS}$ = 0V,$T_J$ =125°C |
| $I_{GSS}$ | Gate-to-Source Leakage Forward | —— | —— | -100 | nA | $V_{GS}$ = -20V |
| | Gate-to-Source Leakage Reverse | —— | —— | 100 | | $V_{GS}$ = 20V |
| $Q_G$ | Total Gate Charge | —— | —— | 109 | nC | $I_{D2}$ = -11A |
| $Q_{GS}$ | Gate-to-Source Charge | —— | —— | 19 | | $V_{DS}$ = -80V |
| $Q_{GD}$ | Gate-to-Drain ('Miller') Charge | —— | —— | 53 | | $V_{GS}$ = -10V |
| $t_{d(on)}$ | Turn-On Delay Time | —— | —— | 29 | ns | $V_{DD}$ = -50V |
| $t_r$ | Rise Time | —— | —— | 135 | | $I_{D2}$ = -11A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | —— | 87 | | $R_G$ = 5.1Ω |
| $t_f$ | Fall Time | —— | —— | 84 | | $V_{GS}$ = -10V |
| Ls +$L_D$ | Total Inductance | —— | 4.0 | —— | nH | Measured from center of Drain pad to center of Source pad |
| $C_{iss}$ | Input Capacitance | —— | 1340 | —— | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 428 | —— | | $V_{DS}$ = -25V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 246 | —— | | $f$ = 1.0MHz |

## Source-Drain Diode Ratings and Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | —— | —— | -18 | A | |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | —— | —— | -72 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | -1.6 | V | $T_J$=25°C, $I_S$ = -18A, $V_{GS}$=0V④ |
| $t_{rr}$ | Reverse Recovery Time | —— | —— | 220 | ns | $T_J$=25°C, $I_F$ = -11A,$V_{DD}$ ≤ -50V |
| $Q_{rr}$ | Reverse Recovery Charge | —— | —— | 1200 | nC | di/dt = -100A/µs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$+$L_D$) | | | | |

## Thermal Resistance

| Symbol | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | —— | —— | 1.67 | °C/W |

**Footnotes:**

① Repetitive Rating; Pulse width limited by maximum junction temperature.

② $V_{DD}$ = -25V, starting $T_J$ = 25°C, L = 4.3mH, Peak $I_L$ = -11A, $V_{GS}$ = -10V, $R_G$ = 25Ω

③ $I_{SD}$ ≤ -11A, di/dt ≤ -360A/µs, $V_{DD}$ ≤ -100V, $T_J$ ≤ 150°C

④ Pulse width ≤ 300 µs; Duty Cycle ≤ 2%



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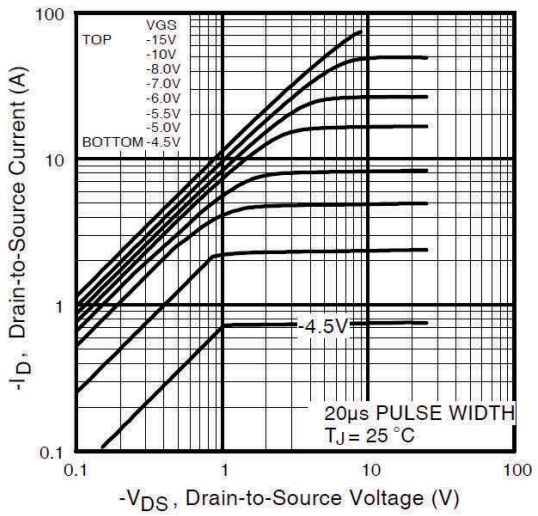


**Fig 1.** Typical Output Characteristics

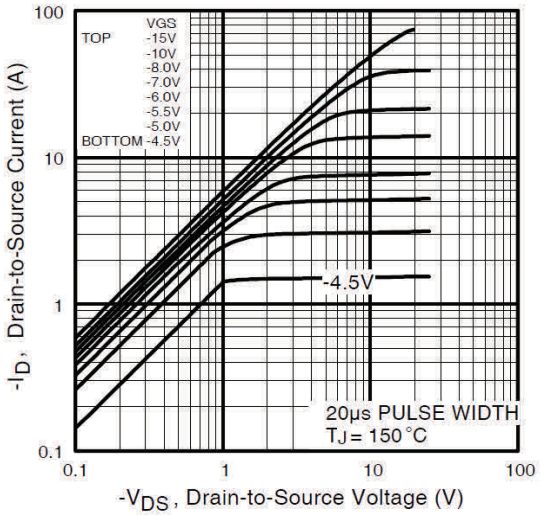


**Fig 2.** Typical Output Characteristics

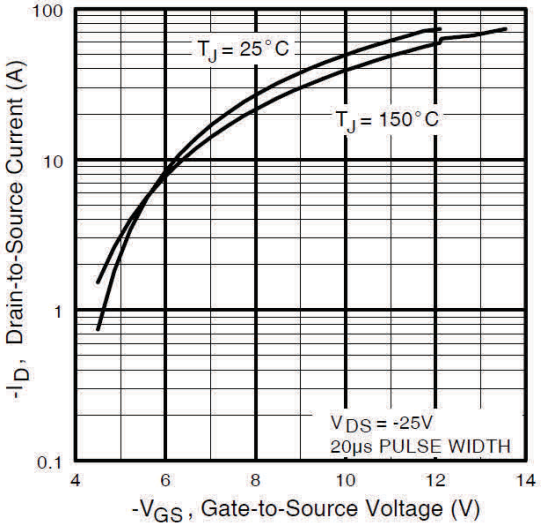


**Fig 3.** Typical Transfer Characteristics

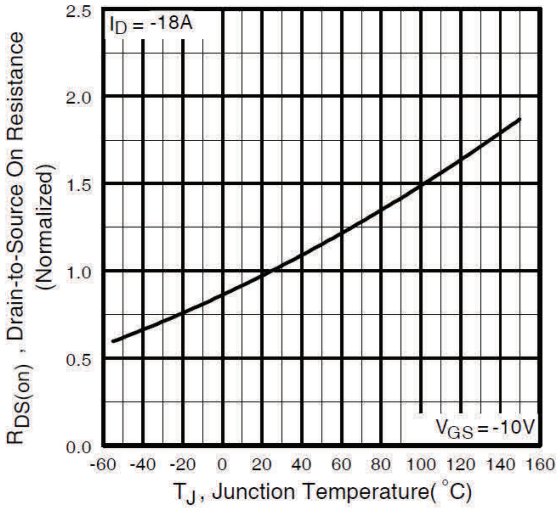


**Fig 4.** Normalized On-Resistance Vs.

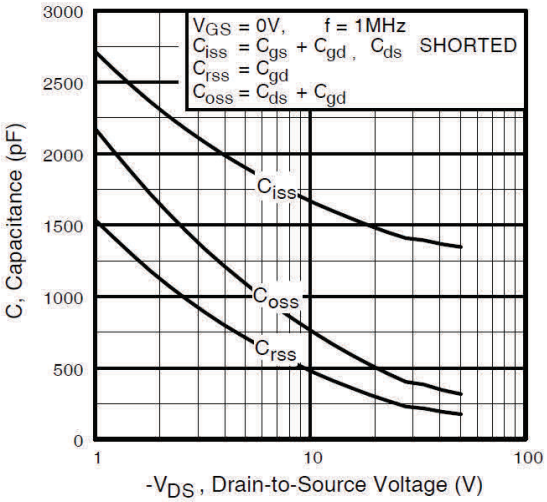


**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

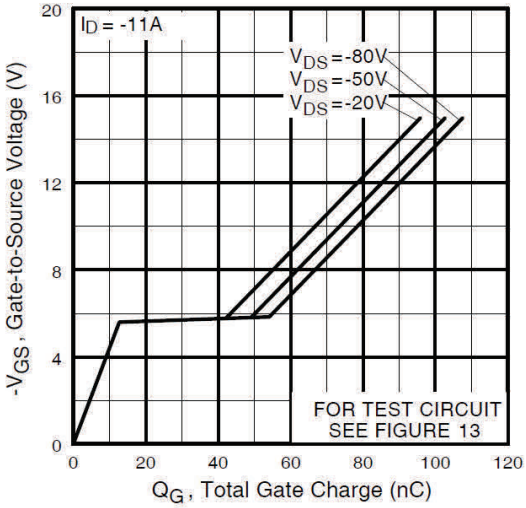


**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



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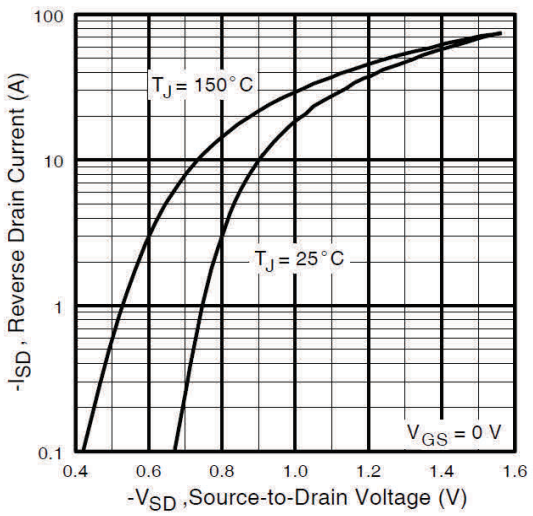


**Fig 7.** Typical Source-Drain Diode Forward Voltage

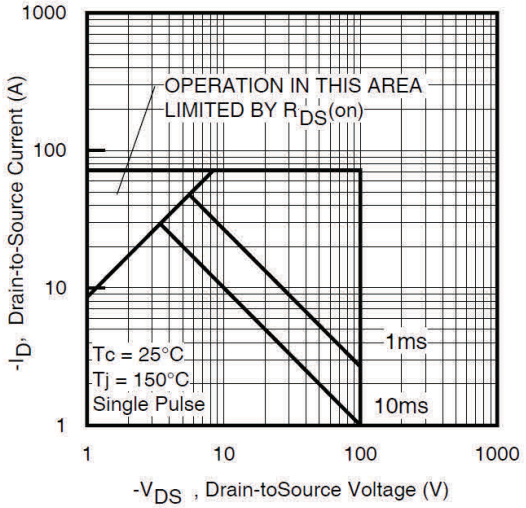


**Fig 8.** Maximum Safe Operating Area

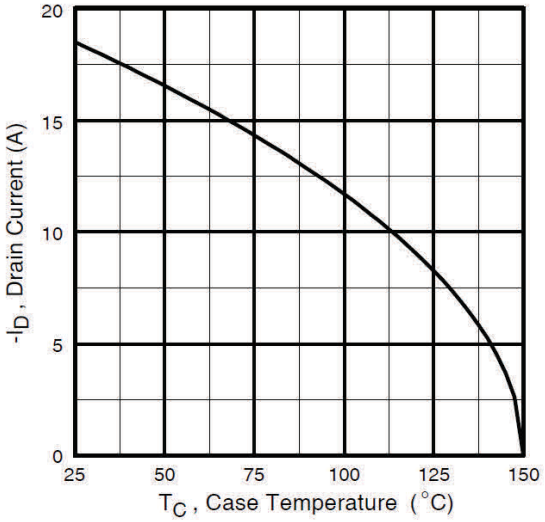


**Fig 9.** Maximum Drain Current Vs.Case Temperature

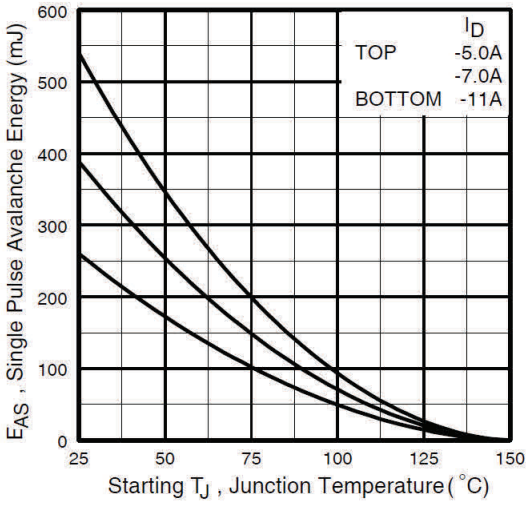


**Fig 10.** Maximum Avalanche Energy Vs. Drain Current

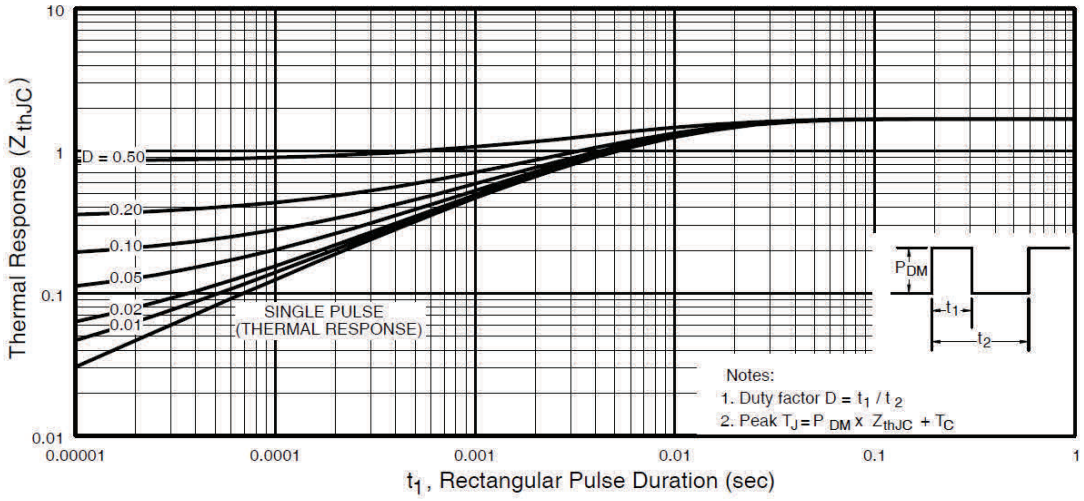


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



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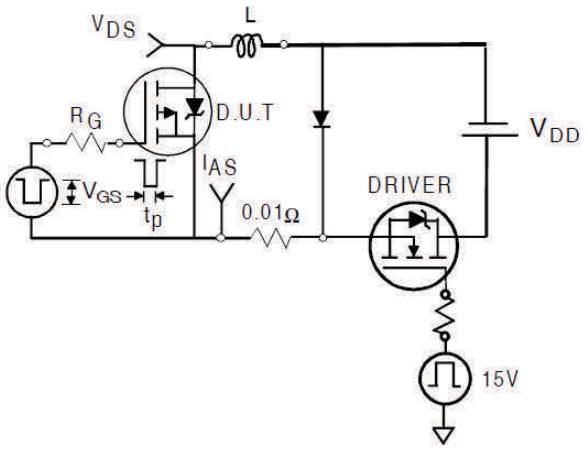


**Fig 12a.** Unclamped Inductive Test Circuit

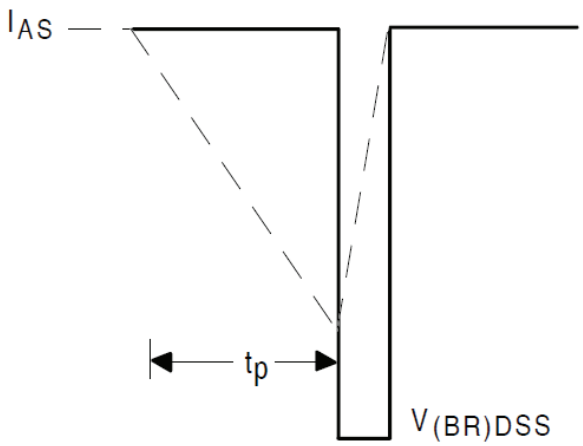


**Fig 12b.** Unclamped Inductive Waveforms

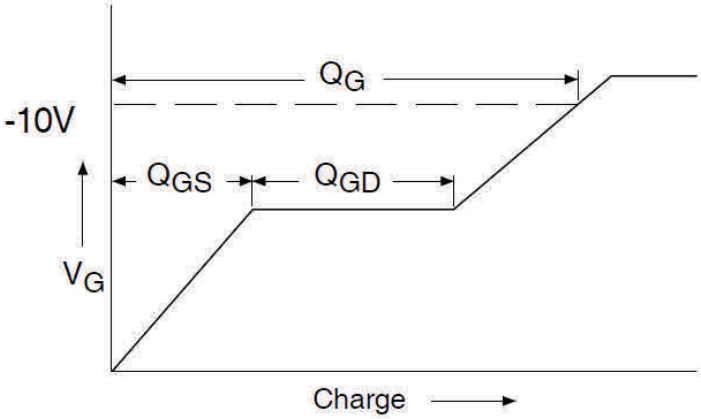


**Fig 13a.** Gate Charge Waveform

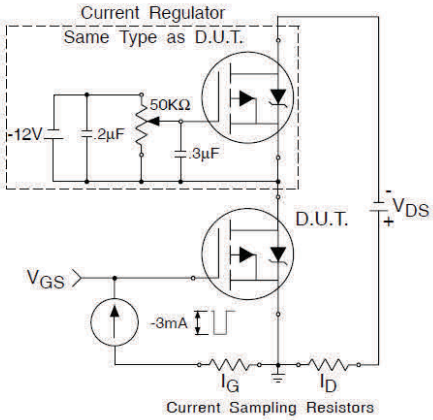


**Fig 13b.** Gate Charge Test Circuit

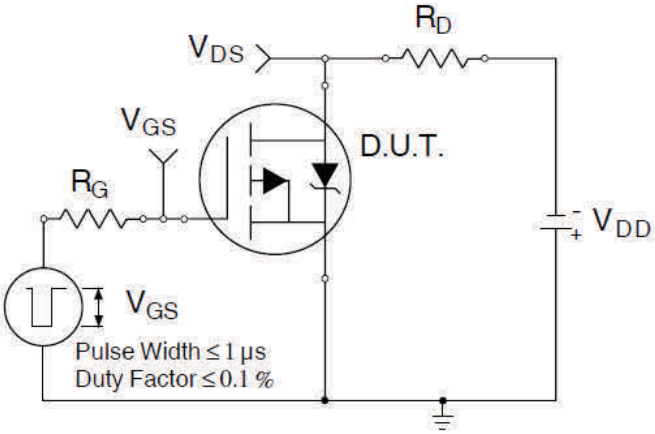


**Fig 14a.** Switching Time Test Circuit

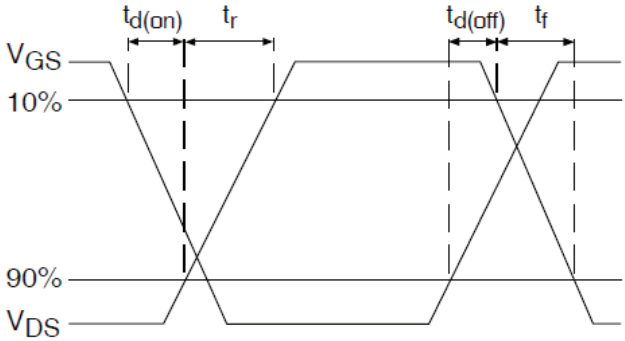


**Fig 14b.** Switching Time Waveforms



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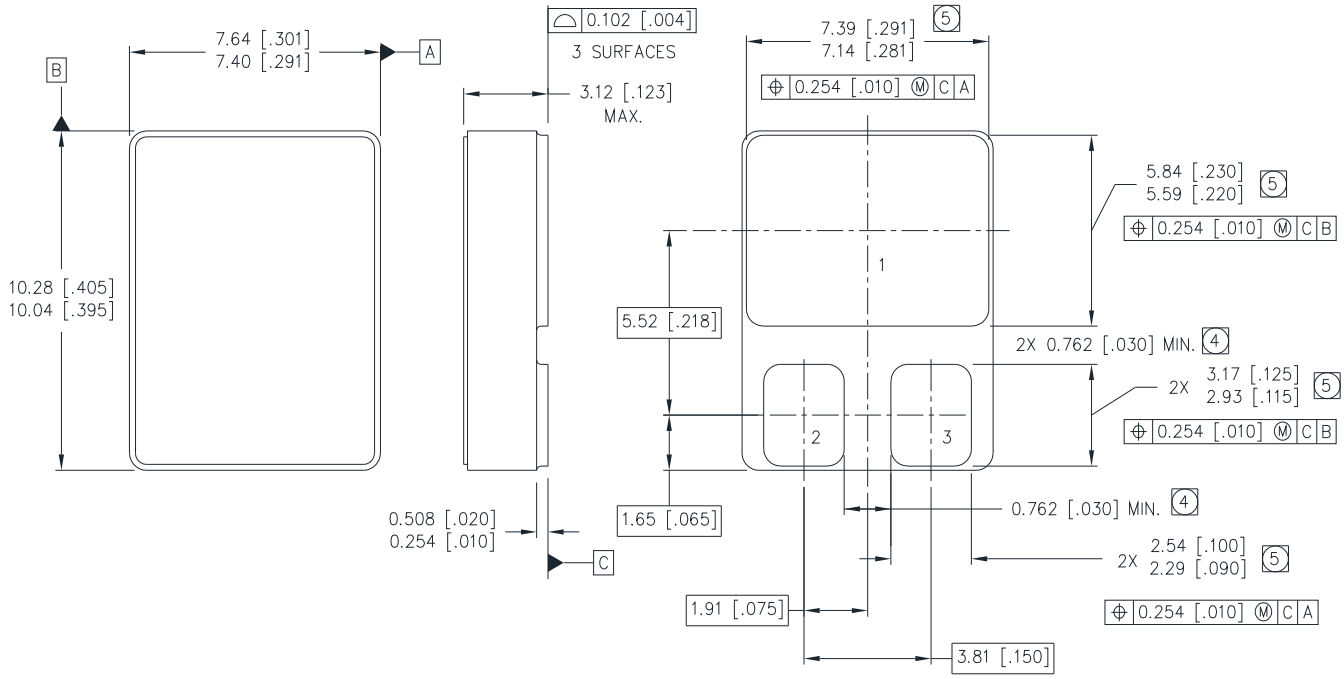
## Case Outline and Dimensions — SMD-0.5




NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. DIMENSION INCLUDES METALLIZATION FLASH.
5. DIMENSION DOES NOT INCLUDE METALLIZATION FLASH.

PAD ASSIGNMENTS

1 = DRAIN

2 = GATE

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