

IRFI9540GPBF-VB Datasheet

P-Channel 100 V (D-S) MOSFET

PRODUCT SUMMARY

| V_{DS} (V) | $R_{DS(on)}$ (Ω) | I_D (A) | Q_g (Typ.) |
|--------------|-----------------------------|-----------|--------------|
| - 100 | 0.220 at $V_{GS} = - 10$ V | - 12 | 11.7 |
| | 0.230 at $V_{GS} = - 4.5$ V | - 10 | |

FEATURES

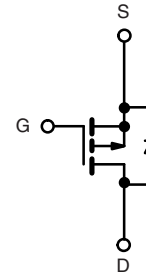
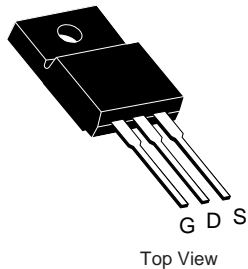
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



APPLICATIONS

- Power Switch
- DC/DC Converters

TO-220 FULLPAK



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_C = 25^\circ\text{C}$, unless otherwise noted

| Parameter | Symbol | Limit | Unit |
|--|----------------|---|------------------|
| Drain-Source Voltage | V_{DS} | - 100 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | |
| Continuous Drain Current ($T_J = 150^\circ\text{C}$) | I_D | $T_C = 25^\circ\text{C}$ - 12 | A |
| | | $T_C = 70^\circ\text{C}$ - 8.6 | |
| Pulsed Drain Current | I_{DM} | - 36 | |
| Avalanche Current | I_{AS} | - 18 | |
| Single Avalanche Energy ^a | E_{AS} | 16.2 | mJ |
| Maximum Power Dissipation ^a | P_D | $T_C = 25^\circ\text{C}$ 38.1 ^b | W |
| | | $T_A = 25^\circ\text{C}^c$ 2.5 | |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | - 55 to 150 | $^\circ\text{C}$ |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Limit | Unit |
|--|------------|-------|---------------------------|
| Junction-to-Ambient (PCB Mount) ^c | R_{thJA} | 50 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Case (Drain) | R_{thJC} | 3.9 | |

Notes:

a. Duty cycle $\leq 1\%$.

b. See SOA curve for voltage derating.

c. When Mounted on 1" square PCB (FR-4 material).

| SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted | | | | | | |
|---|---------------|---|-------|-------|-----------|---------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{DS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$ | - 100 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$ | - 1 | | - 2.5 | |
| Gate-Body Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 250 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = -100\text{ V}, V_{GS} = 0\text{ V}$ | | | - 1 | μA |
| | | $V_{DS} = -100\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$ | | | - 50 | |
| | | $V_{DS} = -100\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^{\circ}\text{C}$ | | | - 250 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \leq -10\text{ V}, V_{GS} = -10\text{ V}$ | - 15 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}, I_D = -3.6\text{ A}$ | | 0.220 | | Ω |
| | | $V_{GS} = -4.5\text{ V}, I_D = -3.4\text{ A}$ | | 0.230 | | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = -15\text{ V}, I_D = -3.6\text{ A}$ | | 12 | | S |
| Dynamic ^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = -50\text{ V}, f = 1\text{ MHz}$ | | 1055 | | pF |
| Output Capacitance | C_{oss} | | | 65 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 41 | | |
| Total Gate Charge ^c | Q_g | $V_{DS} = -50\text{ V}, V_{GS} = -10\text{ V}, I_D = -3.6\text{ A}$ | | 23.2 | 34.8 | nC |
| | | | | 11.7 | 17.6 | |
| | Q_{gs} | $V_{DS} = -50\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -3.6\text{ A}$ | | 3.5 | | |
| | | | | 4.8 | | |
| Gate-Drain Charge ^c | Q_{gd} | | | | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | 1.2 | 5.7 | 11.5 | Ω |
| Turn-On Delay Time ^c | $t_{d(on)}$ | $V_{DD} = -50\text{ V}, R_L = 17.2\text{ }\Omega$ $I_D \cong -2.9\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$ | | 7 | 14 | ns |
| Rise Time ^c | t_r | | | 12 | 18 | |
| Turn-Off Delay Time ^c | $t_{d(off)}$ | | | 33 | 50 | |
| Fall Time ^c | t_f | | | 9 | 18 | |
| | | | | | | |
| Drain-Source Body Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ ^b | | | | | | |
| Continuous Current | I_S | | | | - 8.8 | A |
| Pulsed Current | I_{SM} | | | | - 15 | |
| Forward Voltage ^a | V_{SD} | $I_F = -2.9\text{ A}, V_{GS} = 0\text{ V}$ | | - 0.8 | - 1.5 | V |
| Reverse Recovery Time | t_{rr} | $I_F = -2.9\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$ | | 50 | 75 | ns |
| Peak Reverse Recovery Current | $I_{RM(REC)}$ | | | - 4 | - 6 | A |
| Reverse Recovery Charge | Q_{rr} | | | 98 | 147 | nC |

Notes:

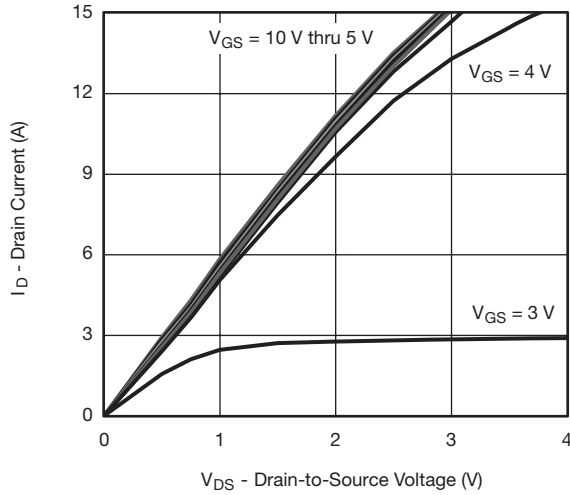
a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

b. Guaranteed by design, not subject to production testing.

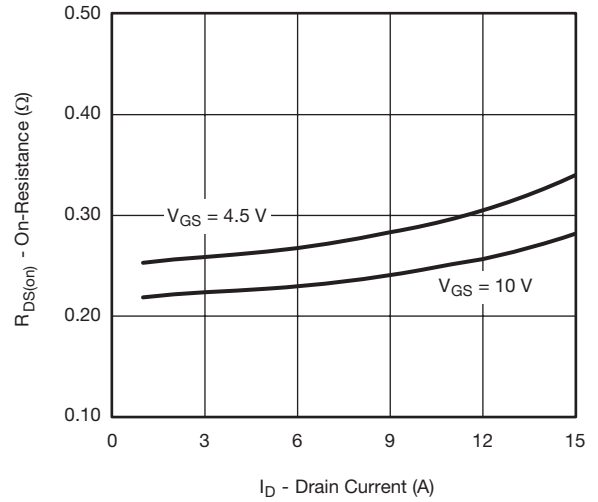
c. Independent of operating temperature.

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.

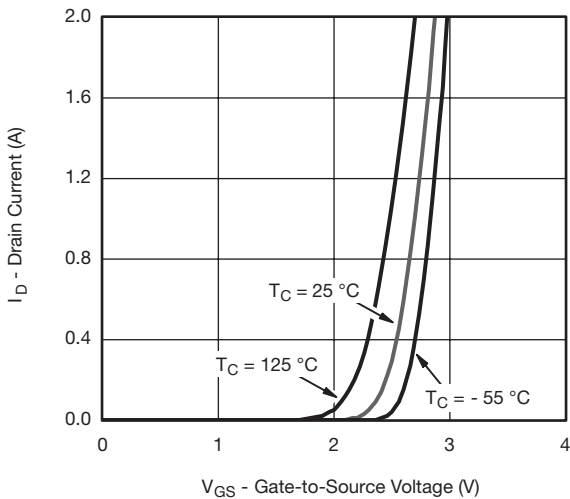
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



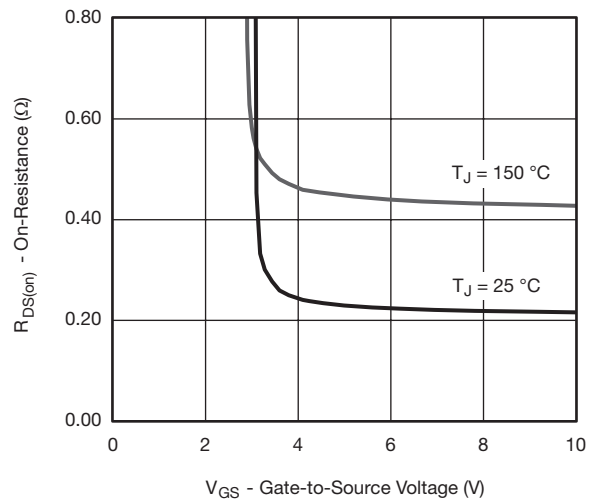
Output Characteristics



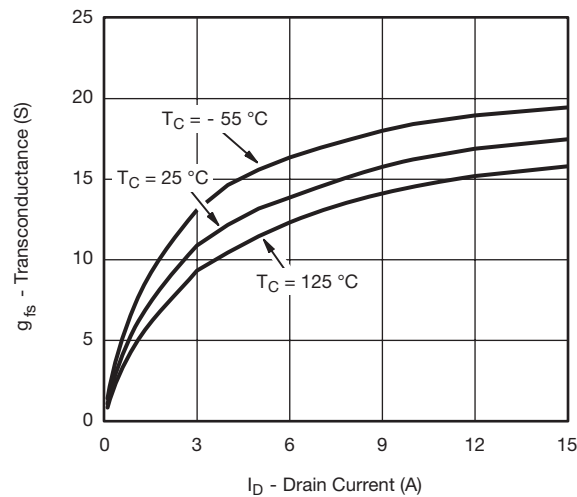
On-Resistance vs. Drain Current



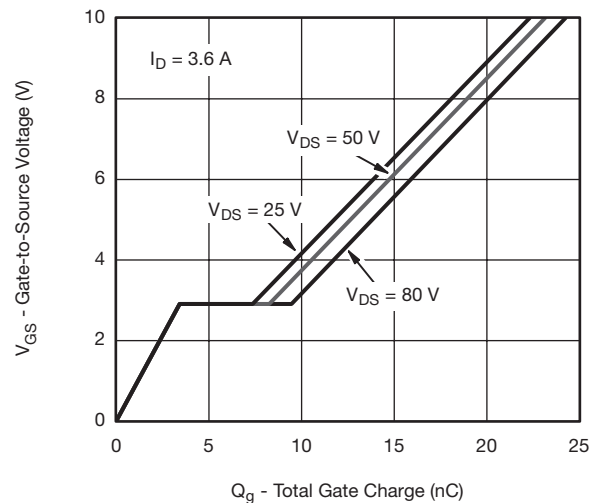
Transfer Characteristics



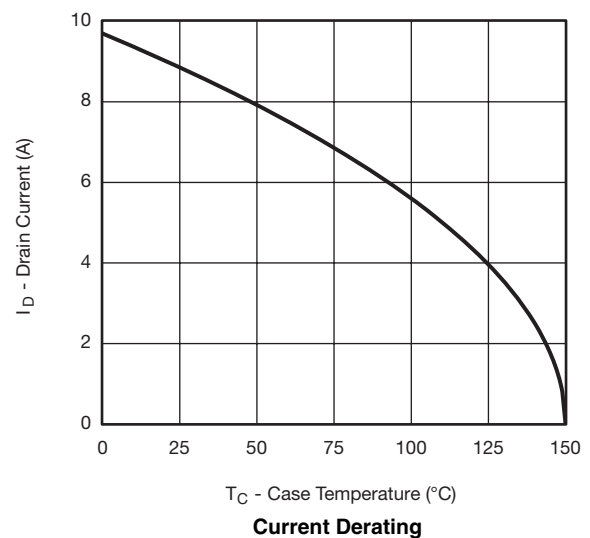
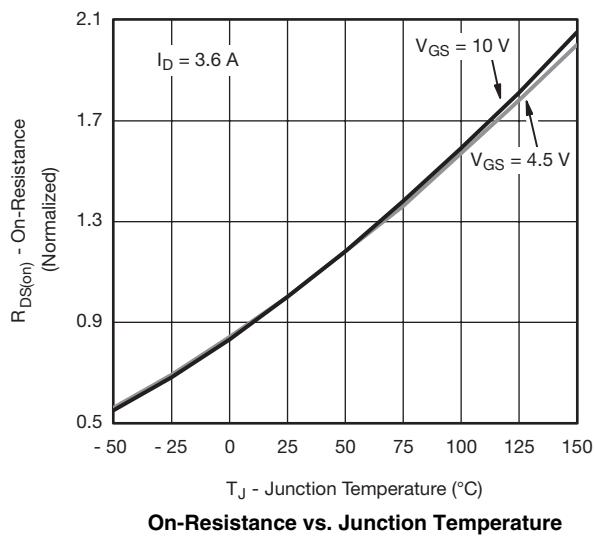
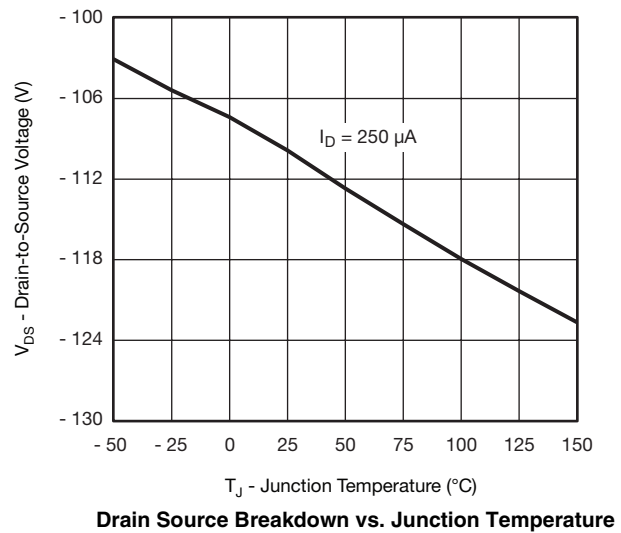
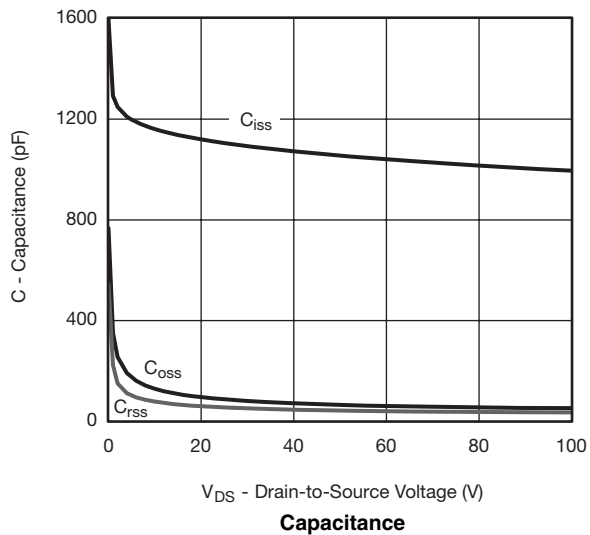
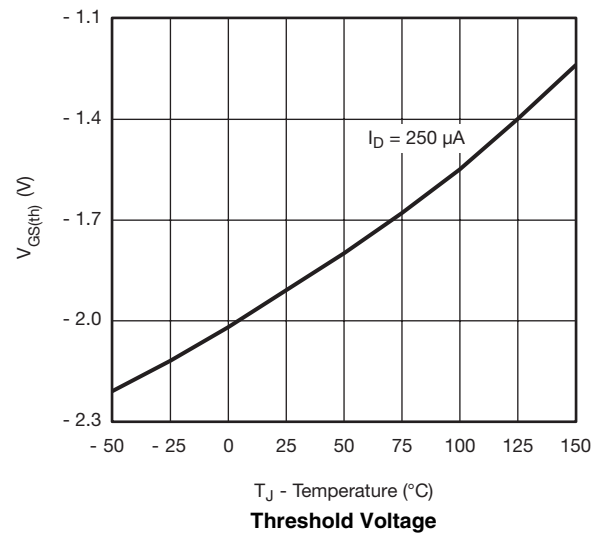
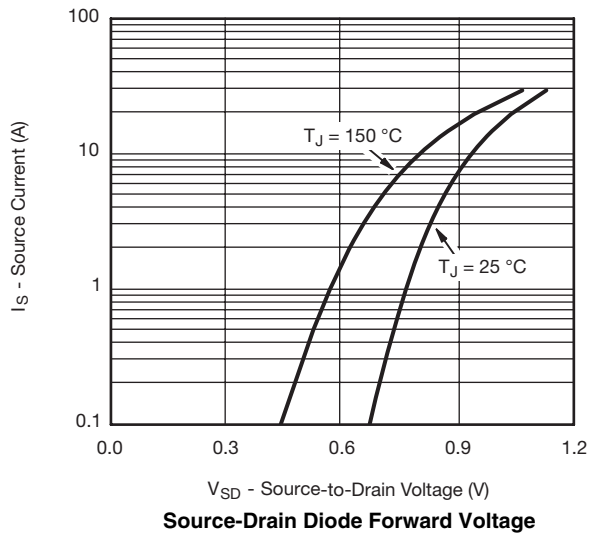
On-Resistance vs. Gate-to-Source Voltage



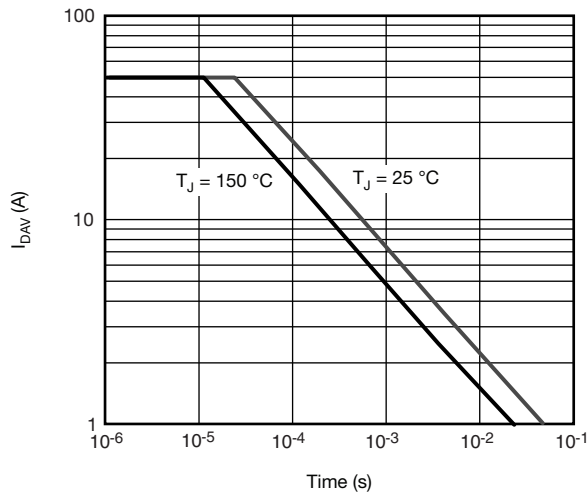
Transconductance



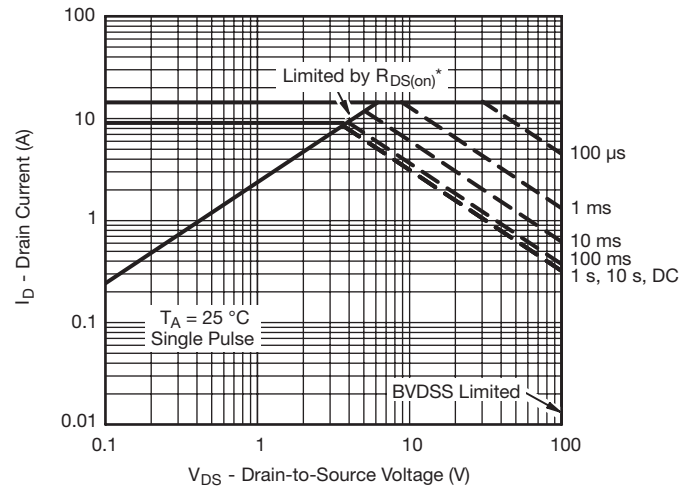
Gate Charge

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


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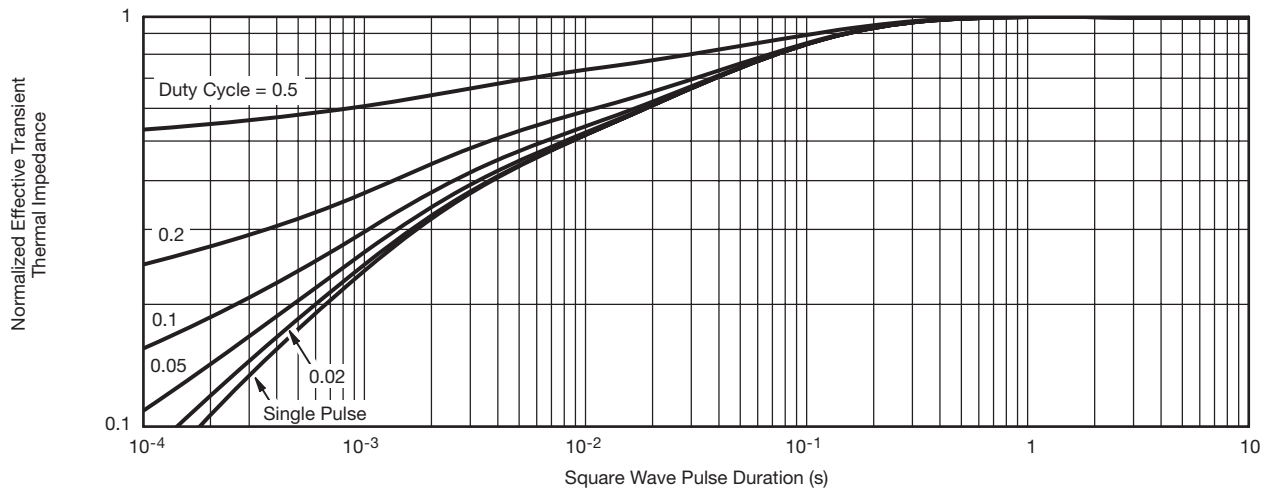


Single Pulse Avalanche Current Capability vs. Time

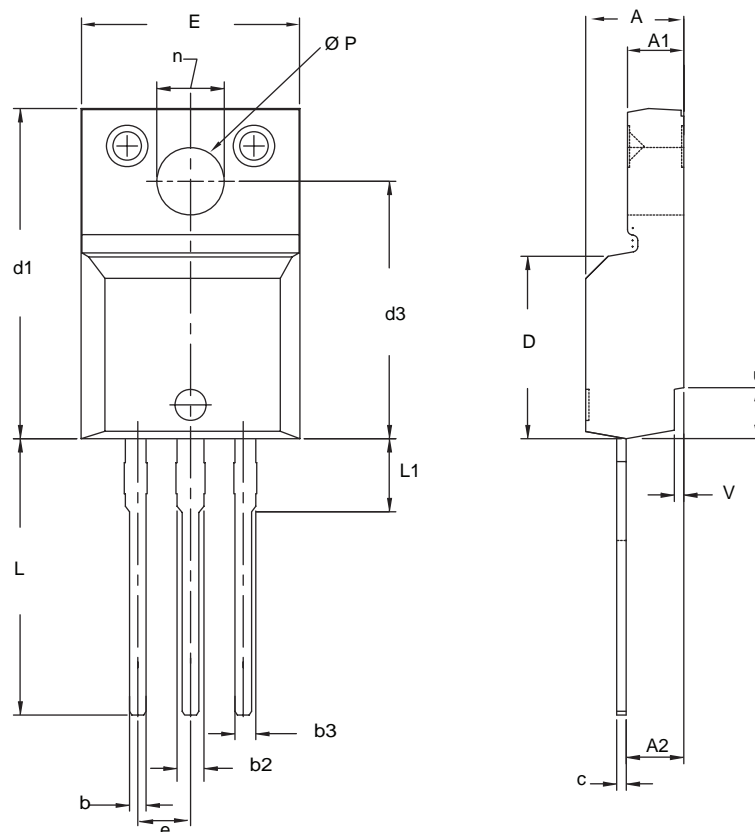


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

TO-220 FULLPAK

| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|--------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.570 | 4.830 | 0.180 | 0.190 |
| A1 | 2.570 | 2.830 | 0.101 | 0.111 |
| A2 | 2.510 | 2.850 | 0.099 | 0.112 |
| b | 0.622 | 0.890 | 0.024 | 0.035 |
| b2 | 1.229 | 1.400 | 0.048 | 0.055 |
| b3 | 1.229 | 1.400 | 0.048 | 0.055 |
| c | 0.440 | 0.629 | 0.017 | 0.025 |
| D | 8.650 | 9.800 | 0.341 | 0.386 |
| d1 | 15.88 | 16.120 | 0.622 | 0.635 |
| d3 | 12.300 | 12.920 | 0.484 | 0.509 |
| E | 10.360 | 10.630 | 0.408 | 0.419 |
| e | 2.54 BSC | | 0.100 BSC | |
| L | 13.200 | 13.730 | 0.520 | 0.541 |
| L1 | 3.100 | 3.500 | 0.122 | 0.138 |
| n | 6.050 | 6.150 | 0.238 | 0.242 |
| Ø P | 3.050 | 3.450 | 0.120 | 0.136 |
| u | 2.400 | 2.500 | 0.094 | 0.098 |
| v | 0.400 | 0.500 | 0.016 | 0.020 |

ECN: X09-0126-Rev. B, 26-Oct-09
 DWG: 5972

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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