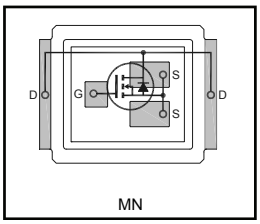
DirectFET® Power MOSFET②

**Typical values (unless otherwise specified)**

| $V_{DSS}$ | $V_{GS}$ | $R_{DS(on)}$ |
|---|---|---|
| 100V min | ±20V max | 5.3mΩ @ 10V |
| $Q_{g\ tot}$ | $Q_{gd}$ | $V_{gs(th)}$ |
| 36nC | 13nC | 2.9V |

### Applications and Benefits

- Ideal for High Performance Isolated Converter Primary Switch
- Optimized for Synchronous Rectification
- RoHS Compliant, Halogen Free ②
- Lead-Free (Qualified up to 260°C Reflow) ①
- Low Conduction Losses
- High Cdv/dt Immunity
- Low Profile (<0.7mm)
- Dual Sided Cooling Compatible ①
- Compatible with existing Surface Mount Techniques ①
- Industrial Qualified



MN


DirectFET™ ISOMETRIC

Applicable DirectFET® Outline and Substrate Outline ①

| | | | | MN | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

### Description

The IRF7171MTRPbF combines the latest HEXFET® Power MOSFET Silicon technology with the advanced DirectFET® packaging to achieve the lowest on-state resistance in a package that has a footprint smaller than a D2PAK and only 0.7 mm profile. The DirectFET® package is compatible with existing layout geometries used in power applications, PCB assembly equipment and vapor phase, infra-red or convection soldering techniques, when application note AN-1035 is followed regarding the manufacturing methods and processes. The DirectFET® package allows dual sided cooling to maximize thermal transfer in power systems.
The IRF7171MTRPbF is optimized for high frequency switching and synchronous rectification applications. The reduced total losses in the device coupled with the high level of thermal performance enables high efficiency and low temperatures, which are key for system reliability improvements, and makes this device ideal for high performance power converters.

### Ordering Information

| Base part number | Package Type | Standard Pack | | Orderable Part Number |
|---|---|---|---|---|
| | | Form | Quantity | |
| IRF7171MTRPbF | DirectFET® Medium Can | Tape and Reel | 4800 | IRF7171MTRPbF |

### Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V (Silicon Limited)④ | 93 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V (Silicon Limited)④ | 59 | |
| $I_D$ @ $T_A$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V (Silicon Limited)③ | 15 | |
| $I_{DM}$ | Pulsed Drain Current⑤ | 330 | |
| $E_{AS}$ | Single Pulse Avalanche Energy ⑥ | 86 | mJ |
| $I_{AR}$ | Avalanche Current ⑥ | 56 | A |

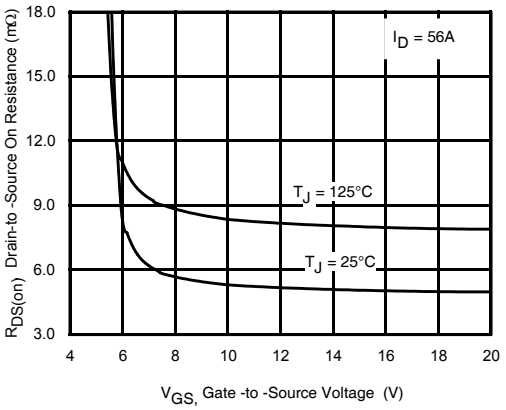



**Fig 1.** Typical On-Resistance vs. Gate Voltage

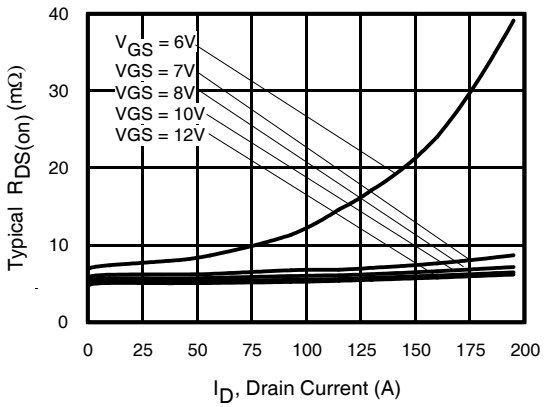



**Fig 2.** Typical On-Resistance vs. Drain Current

Notes
① Click on this section to link to the appropriate technical paper.
② Click on this section to link to the DirectFET® Website.
③ Surface mounted on 1 in. square Cu board, steady state.
④ TC measured with thermocouple mounted to top (Drain) of part.
⑤ Repetitive rating; pulse width limited by max. junction temperature.
⑥ Starting $T_J$ = 25°C, L = 55µH, $R_G$ = 50Ω, $I_{AS}$ = 56A.

**Static @ $T_J$ = 25°C (unless otherwise specified)**

| | Parameter | Min. | Typ. | Max. | Units | 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 | — | 40 | — | mV/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 5.3 | 6.5 | mΩ | $V_{GS}$ = 10V, $I_D$ = 56A ⑦ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | — | 3.6 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 150µA |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Temp. Coefficient | — | -6.2 | — | mV/°C | |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | 1 | µA | $V_{DS}$ = 80 V, $V_{GS}$ = 0V |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS}$ = -20V |
| gfs | Forward Transconductance | 80 | — | — | S | $V_{DS}$ = 10V, $I_D$ =56A |
| $Q_g$ | Total Gate Charge | — | 36 | 54 | nC | $V_{DS}$ = 50V<br>$V_{GS}$ = 10V<br>$I_D$ = 56A<br>See Fig.8 |
| $Q_{gs1}$ | Pre– Vth Gate-to-Source Charge | — | 6.9 | — | | |
| $Q_{gs2}$ | Post– Vth Gate-to-Source Charge | — | 2.4 | — | | |
| $Q_{gd}$ | Gate-to-Drain Charge | — | 13 | — | | |
| $Q_{godr}$ | Gate Charge Overdrive | — | 13.7 | — | | |
| $Q_{sw}$ | Switch Charge ($Q_{gs2}$ + $Q_{gd}$) | — | 15.4 | — | | |
| $Q_{oss}$ | Output Charge | — | 120 | — | nC | $V_{DS}$ = 50V, $V_{GS}$ = 0V |
| $R_G$ | Gate Resistance | — | 1.0 | — | Ω | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 9.3 | — | ns | $V_{DD}$ = 50V, $V_{GS}$ = 10V⑦<br>$I_D$ = 56A<br>$R_G$= 1.8Ω |
| $t_r$ | Rise Time | — | 27 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 15 | — | | |
| $t_f$ | Fall Time | — | 20 | — | | |
| $C_{iss}$ | Input Capacitance | — | 2160 | — | pF | $V_{GS}$ = 0V<br>$V_{DS}$ = 50V<br>$f$ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | — | 970 | — | | |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 60 | — | | |
| $C_{oss}$ | Output Capacitance | — | 4660 | — | | $V_{GS}$ = 0V, $V_{DS}$ = 1.0V, $f$ =1.0MHz |
| $C_{oss}$ | Output Capacitance | — | 580 | — | | $V_{GS}$ = 0V, $V_{DS}$ = 80V, $f$ =1.0MHz |

**Diode Characteristics**

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 95 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ⑤ | — | — | 330 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.3 | V | $T_J$ = 25°C, $I_S$ = 56A, $V_{GS}$ = 0V ⑦ |
| $t_{rr}$ | Reverse Recovery Time | — | 66 | — | ns | $T_J$ = 25°C, $I_F$ = 56A, $V_{DD}$ = 50V |
| $Q_{rr}$ | Reverse Recovery Charge | — | 126 | — | nC | di/dt = 100A/µs ⑦ |

Notes:
⑤ Repetitive rating; pulse width limited by max. junction temperature.
⑦ Pulse width ≤ 400µs; duty cycle ≤ 2%

**Absolute Maximum Ratings**

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $P_D$ @$T_C$ = 25°C | Power Dissipation ④ | 104 | W |
| $P_D$ @$T_C$ = 100°C | Power Dissipation ④ | 42 | |
| $P_D$ @$T_A$ = 25°C | Power Dissipation ③ | 2.8 | |
| $T_P$ | Peak Soldering Temperature | 270 | °C |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | |

**Thermal Resistance**

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-Ambient ③ | ––– | 45 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient ⑧ | 12.5 | ––– | |
| $R_{\theta JA}$ | Junction-to-Ambient ⑨ | 20 | ––– | |
| $R_{\theta JC}$ | Junction-to-Can ④⑩ | ––– | 1.2 | |
| $R_{\theta JA\text{-}PCB}$ | Junction-to-PCB Mounted | 1.0 | ––– | |

**Notes:**

③ Surface mounted on 1 in. square Cu board, steady state.
④ $T_C$ measured with thermocouple in contact with top (Drain) of part.
⑧ Used double sided cooling, mounting pad with large heat sink.
⑨ Mounted on minimum footprint full size board with metalized back and with small clip heat sink.
⑩ $R_\theta$ is measured at $T_J$ of approximately 90°C.

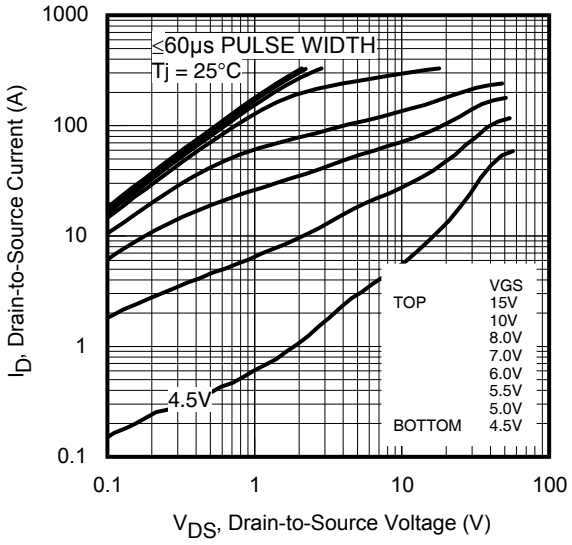



**Fig 3.** Typical Output Characteristics

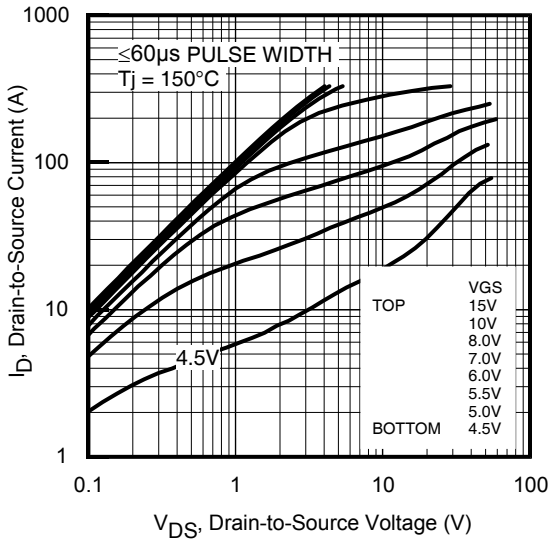



**Fig 4.** Typical Output Characteristics

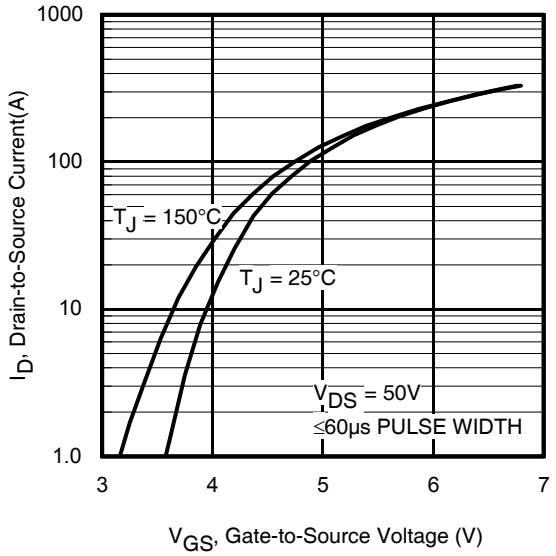



**Fig 5.** Typical Transfer Characteristics

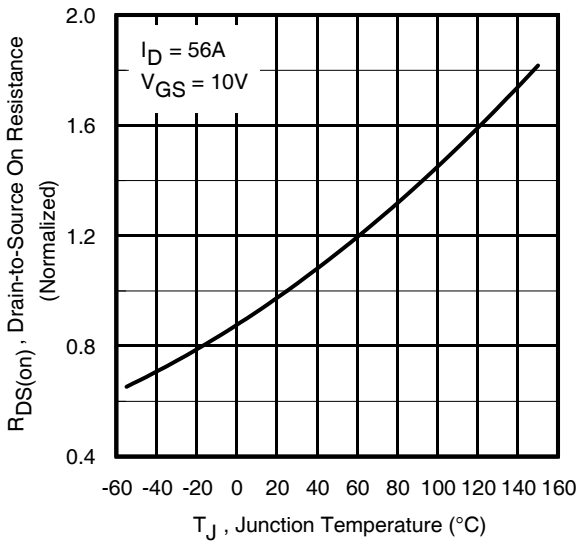



**Fig 6.** Normalized On-Resistance vs. Temperature

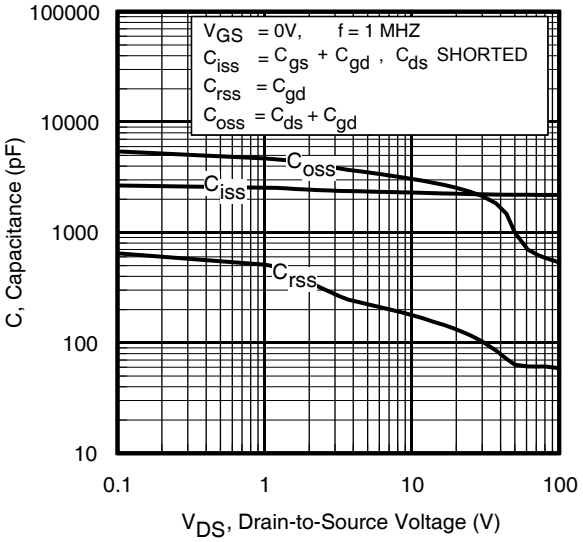



**Fig 7.** Typical Capacitance vs. Drain-to-Source Voltage

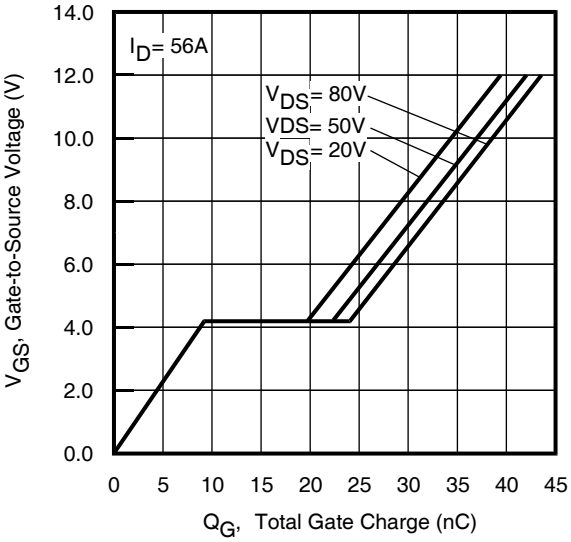



**Fig 8.** Typical Gate Charge vs. Gate-to-Source Voltage

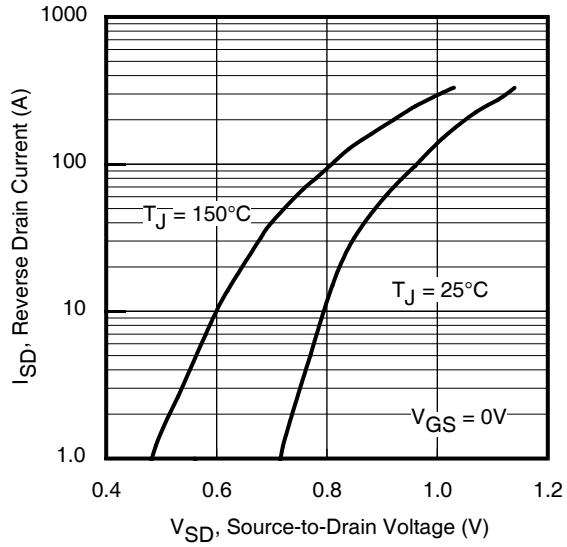



**Fig 9.** Typical Source-Drain Diode Forward Voltage

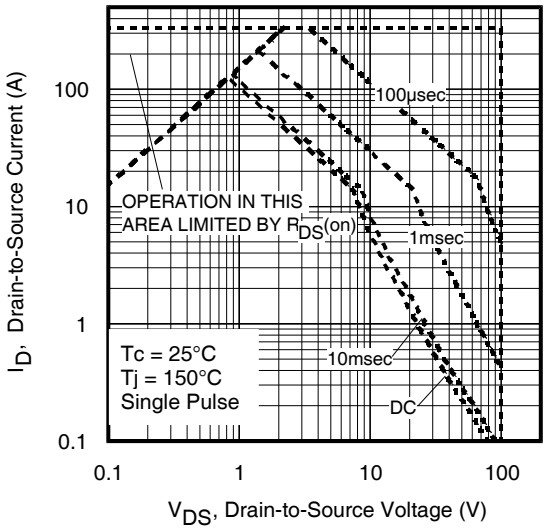



**Fig 10.** Maximum Safe Operating Area

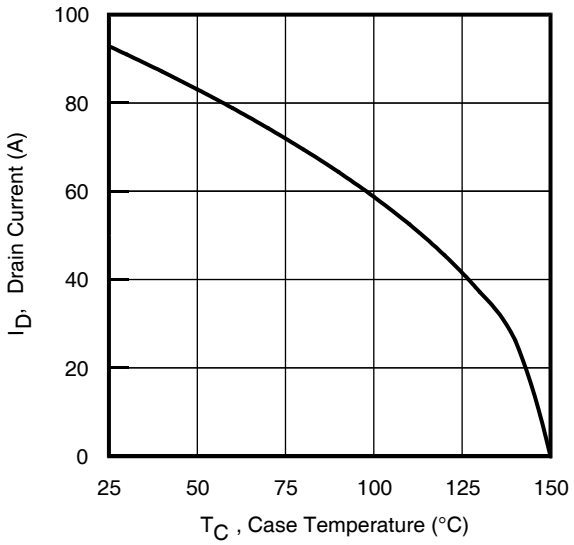



**Fig 11.** Maximum Drain Current vs. Case Temperature

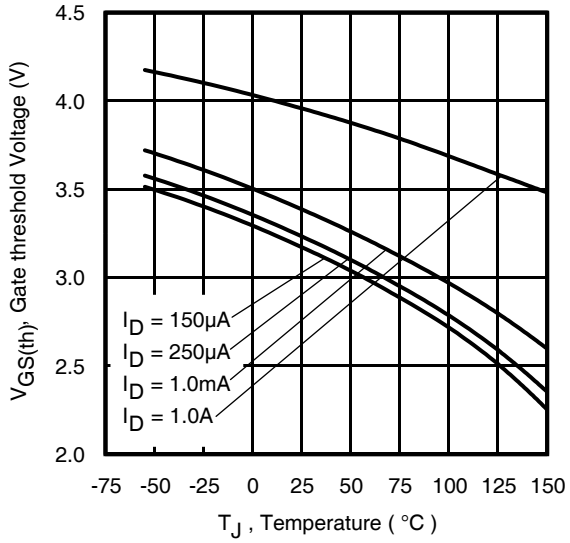



**Fig 12.** Typical Threshold Voltage vs. Junction Temperature

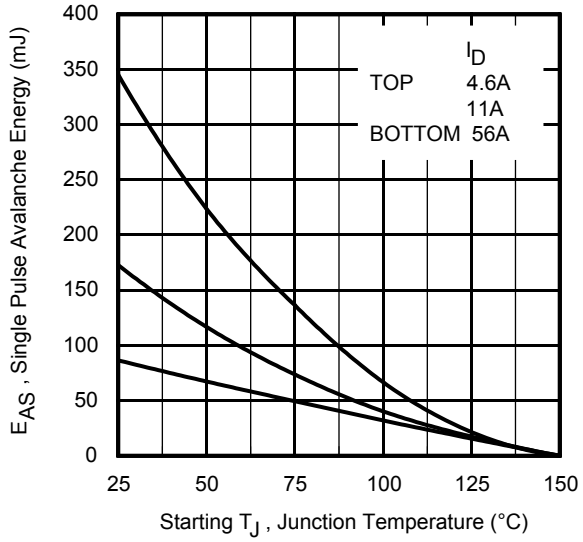



**Fig 13.** Maximum Avalanche Energy vs. Drain Current

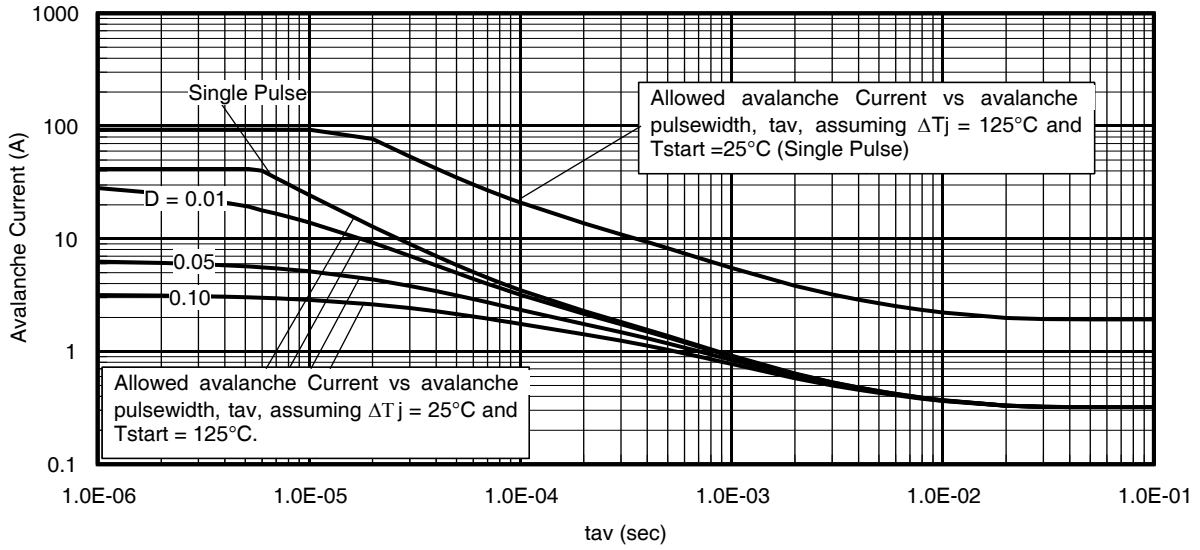



**Fig 14.** Typical Avalanche Current vs. Pulse Width

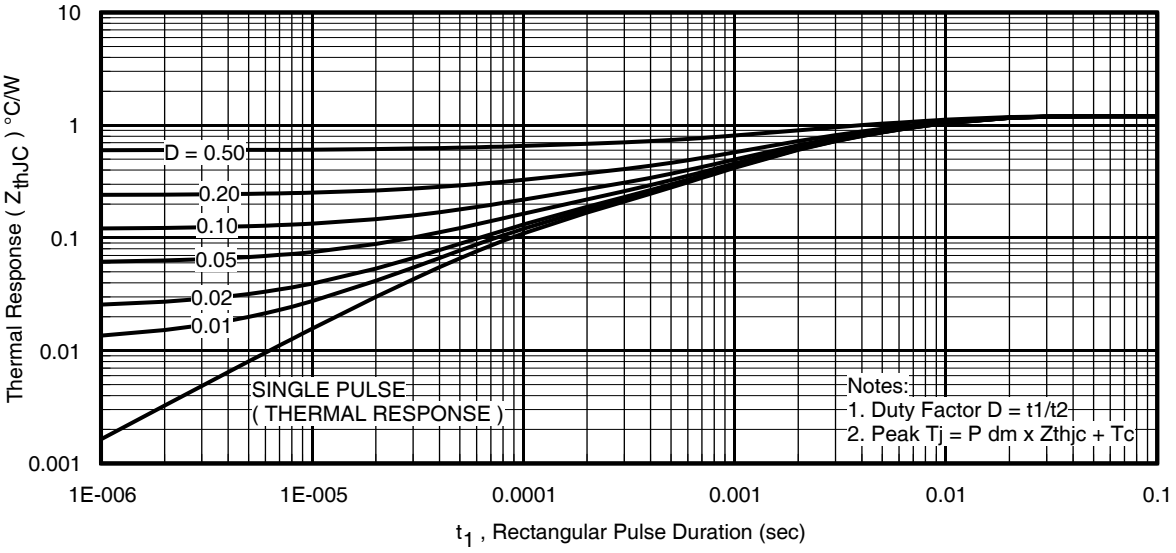
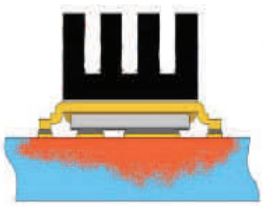
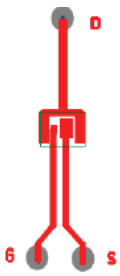



**Fig 15**. Maximum Effective Transient Thermal Impedance, Junction-to-Case

**Notes:**

③ Surface mounted on 1 in. square Cu board, steady state.
④ $T_C$ measured with thermocouple incontact with top (Drain) of part.
⑤ Repetitive rating; pulse width limited by max. junction temperature.
⑧ Used double sided cooling, mounting pad with large heatsink.
⑨ Mounted on minimum footprint full size board with metalized back and with small clip heatsink.
⑩ $R_\theta$ is measured at $T_J$ of approximately 90°C.




③ Surface mounted on 1 in. square Cu board (still air).

⑨ Mounted on minimum footprint full size board with metalized back and with small clip heatsink (still air)

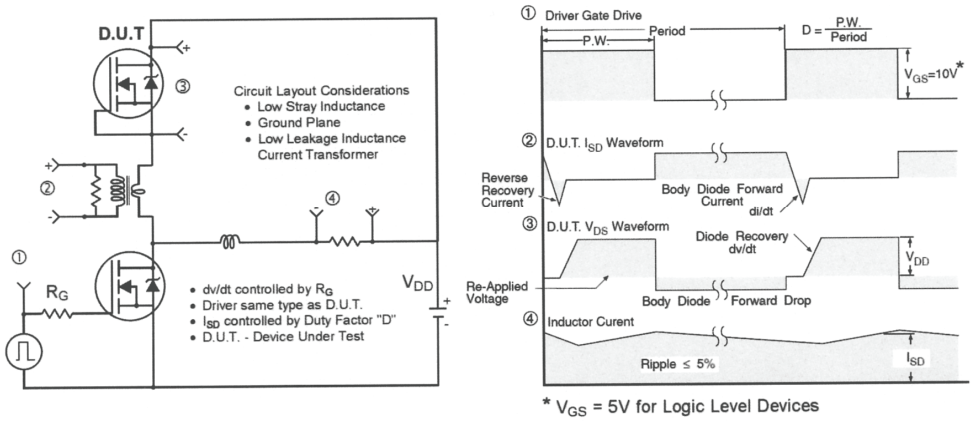



**Fig 16.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

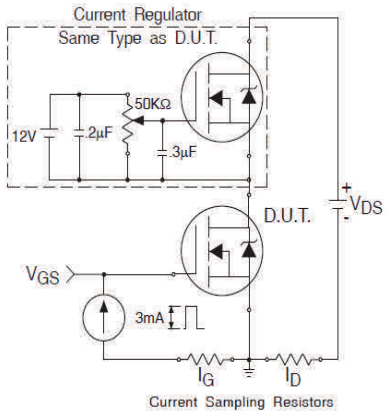



**Fig 17a.** Gate Charge Test Circuit

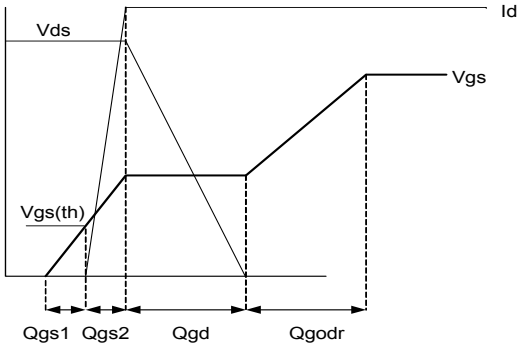



**Fig 17b.** Gate Charge Waveform

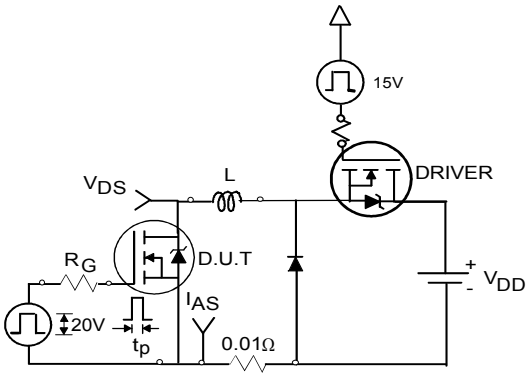



**Fig 18a.** Unclamped Inductive Test Circuit

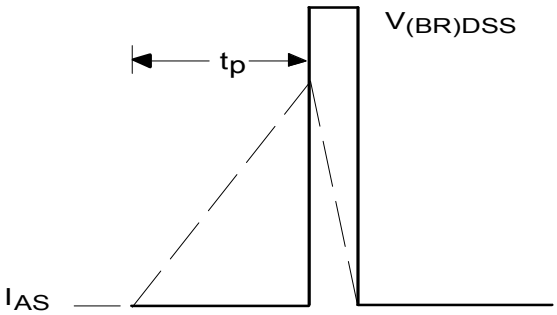



**Fig 18b.** Unclamped Inductive Waveforms

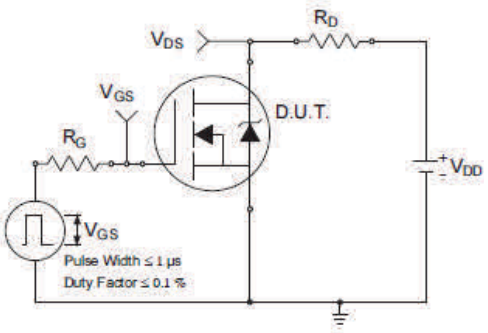



**Fig 19a.** Switching Time Test Circuit

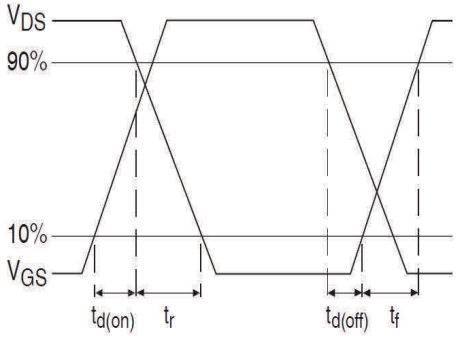
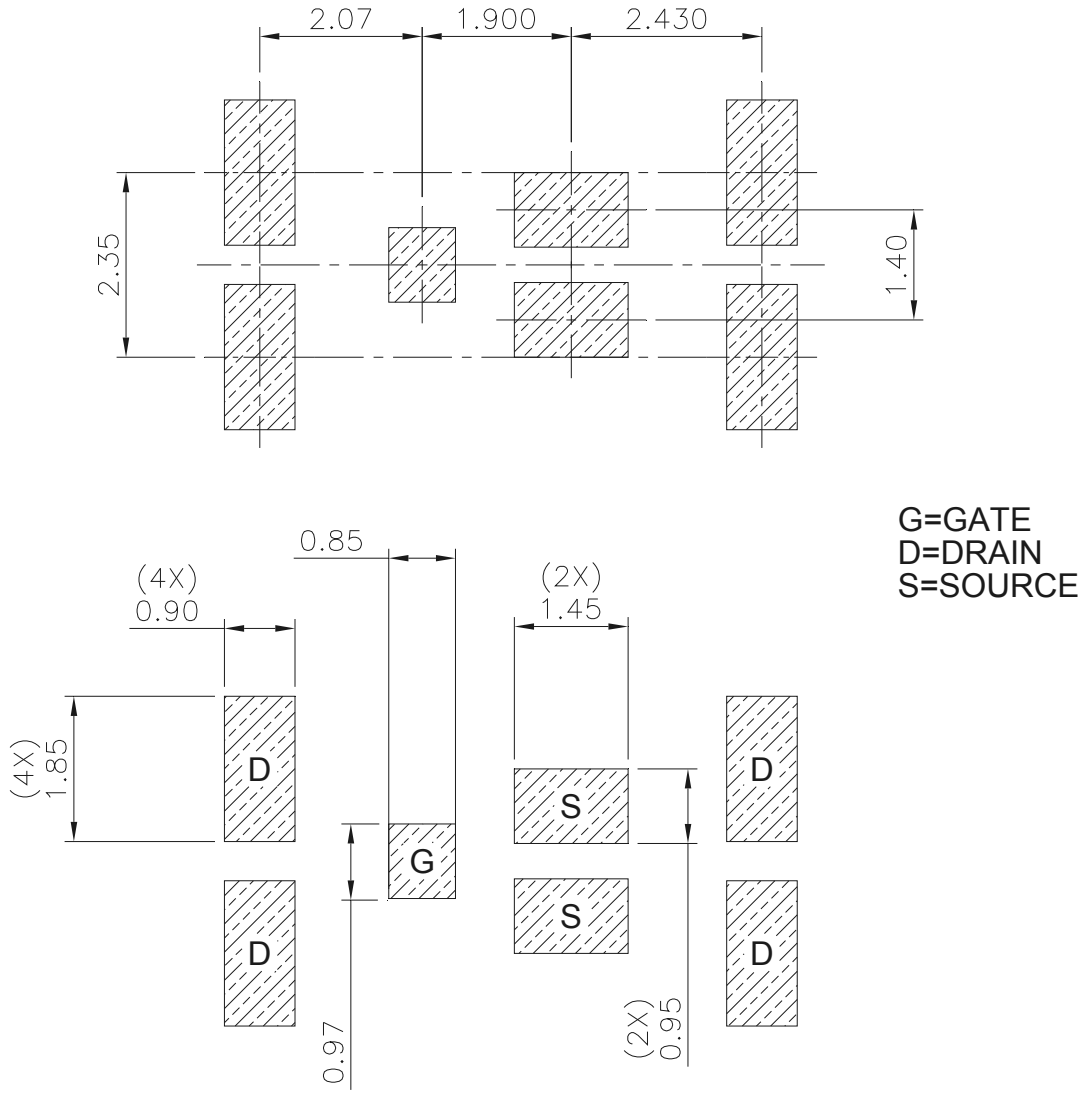



**Fig 19b.** Switching Time Waveforms

**DirectFET®Board Footprint, MN Outline**

Please see DirectFET® application note AN-1035 for all details regarding the assembly of DirectFET®.
This includes all recommendations for stencil and substrate designs.

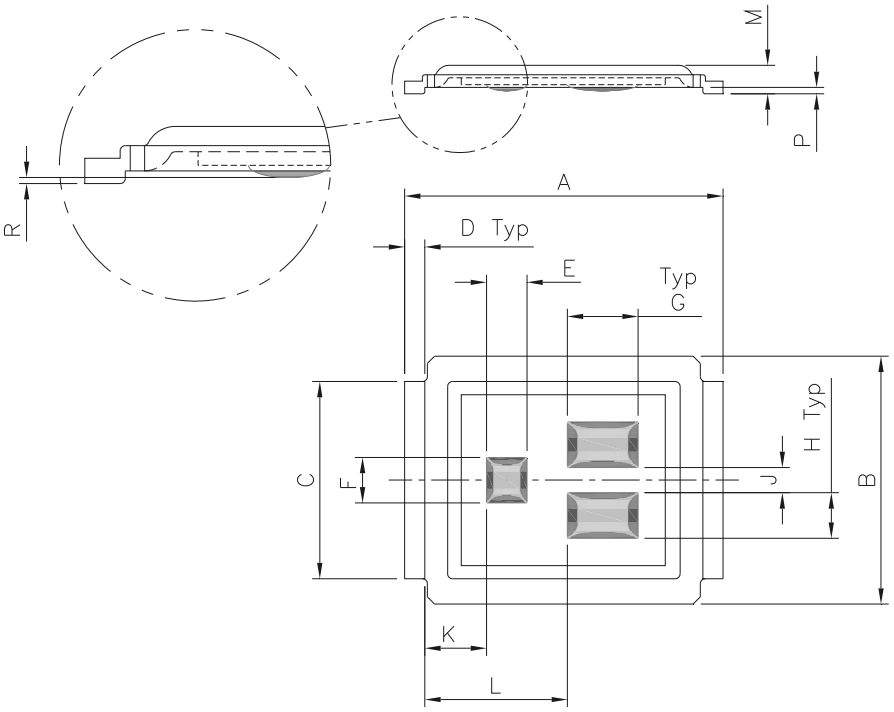



Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

**DirectFET® Outline Dimension, MN Outline**
**(Medium Size Can, N-Designation).**

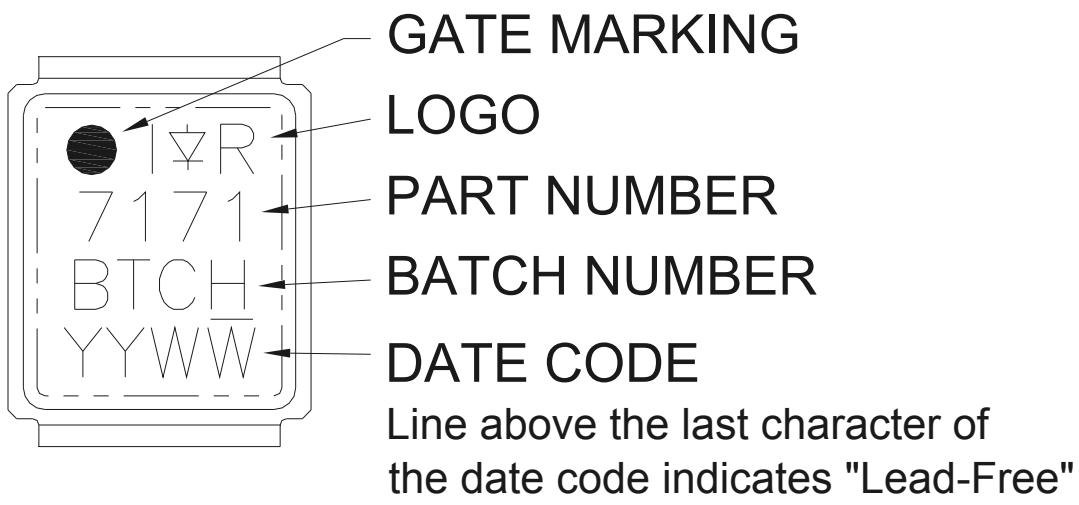
Please see DirectFET® application note AN-1035 for all details regarding the assembly of DirectFET®.
This includes all recommendations for stencil and substrate designs.




| DIMENSIONS | | | | |
|---|---|---|---|---|
| | METRIC | | IMPERIAL | |
| CODE | MIN | MAX | MIN | MAX |
| A | 6.25 | 6.35 | 0.246 | 0.250 |
| B | 4.80 | 5.05 | 0.189 | 0.199 |
| C | 3.85 | 3.95 | 0.152 | 0.156 |
| D | 0.35 | 0.45 | 0.014 | 0.018 |
| E | 0.78 | 0.82 | 0.031 | 0.032 |
| F | 0.88 | 0.92 | 0.035 | 0.036 |
| G | 1.38 | 1.42 | 0.054 | 0.056 |
| H | 0.88 | 0.92 | 0.035 | 0.036 |
| J | 0.48 | 0.52 | 0.019 | 0.020 |
| K | 1.17 | 1.27 | 0.046 | 0.050 |
| L | 2.77 | 2.87 | 0.109 | 0.113 |
| M | 0.535 | 0.595 | 0.021 | 0.023 |
| R | 0.02 | 0.08 | 0.0008 | 0.0031 |
| P | 0.08 | 0.17 | 0.003 | 0.007 |

Dimensions are shown in
millimeters (inches)

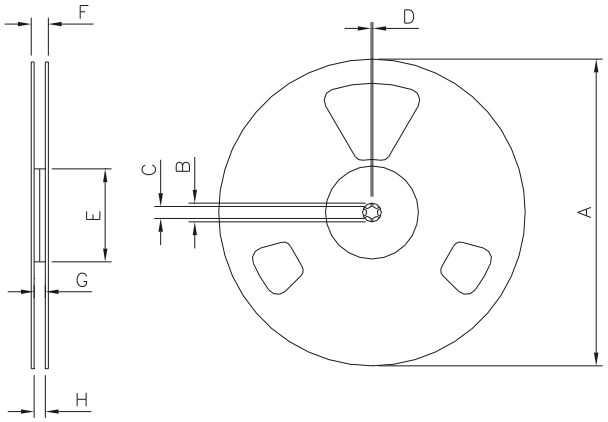
**DirectFET® Part Marking**




Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

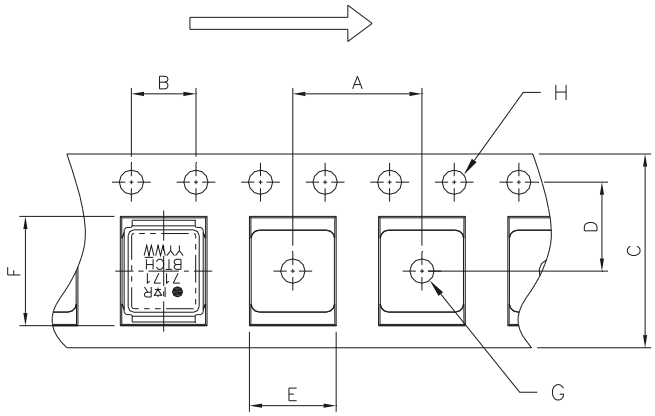
**DirectFET® Tape & Reel Dimension (Showing component orientation).**




NOTE: Controlling dimensions in mm
Std reel quantity is 4800 parts. (ordered as IRF7171MTRPBF). For 1000 parts on 7" reel, order IRF7171MTR1PBF

| REEL DIMENSIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| STANDARD OPTION **(QTY 4800)** | | | | | TR1 OPTION **(QTY 1000)** | | | |
| | METRIC | | IMPERIAL | | METRIC | | IMPERIAL | |
| CODE | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| A | 330.0 | N.C | 12.992 | N.C | 177.77 | N.C | 6.9 | N.C |
| B | 20.2 | N.C | 0.795 | N.C | 19.06 | N.C | 0.75 | N.C |
| C | 12.8 | 13.2 | 0.504 | 0.520 | 13.5 | 12.8 | 0.53 | 0.50 |
| D | 1.5 | N.C | 0.059 | N.C | 1.5 | N.C | 0.059 | N.C |
| E | 100.0 | N.C | 3.937 | N.C | 58.72 | N.C | 2.31 | N.C |
| F | N.C | 18.4 | N.C | 0.724 | N.C | 13.50 | N.C | 0.53 |
| G | 12.4 | 14.4 | 0.488 | 0.567 | 11.9 | 12.01 | 0.47 | N.C |
| H | 11.9 | 15.4 | 0.469 | 0.606 | 11.9 | 12.01 | 0.47 | N.C |

LOADED TAPE FEED DIRECTION




NOTE: CONTROLLING DIMENSIONS IN MM

| DIMENSIONS | | | | |
|---|---|---|---|---|
| | METRIC | | IMPERIAL | |
| CODE | MIN | MAX | MIN | MAX |
| A | 7.90 | 8.10 | 0.311 | 0.319 |
| B | 3.90 | 4.10 | 0.154 | 0.161 |
| C | 11.90 | 12.30 | 0.469 | 0.484 |
| D | 5.45 | 5.55 | 0.215 | 0.219 |
| E | 5.10 | 5.30 | 0.201 | 0.209 |
| F | 6.50 | 6.70 | 0.256 | 0.264 |
| G | 1.50 | N.C | 0.059 | N.C |
| H | 1.50 | 1.60 | 0.059 | 0.063 |

Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

**Qualification Information**†

| | | |
|---|---|---|
| **Qualification Level** | Industrial†† * | |
| **Moisture Sensitivity Level** | DirectFET® Medium Can | MSL1<br>(per JEDEC J-STD-020D†††) |
| **RoHS Compliant** | Yes | |

† Qualification standards can be found at International Rectifier's web site http://www.irf.com/product-info/reliability

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information: http://www.irf.com/whoto-call/salesrep/

††† Applicable version of JEDEC standard at the time of product release.

* Industrial qualification standards except autoclave test conditions.

## Revision History

| Date | Comment |
|---|---|
| 12/3/2014 | • Updated $R_{\theta JA}$ from "60°C/W" to "45°C/W" on page 3.<br>• Updated $I_D$ @ $T_A$ and $P_D$ @$T_A$ based on $R_{\theta JA}$ corrected on page 1 & page 3. |
| 3/25/2015 | • Added "FastIRFET" on page 1. |

International
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