

IRFP2907PbF

HEXFET® Power MOSFET

Typical Applications

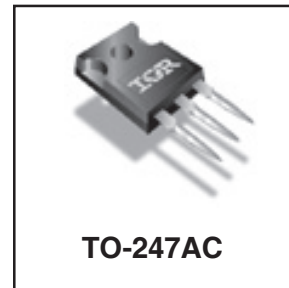
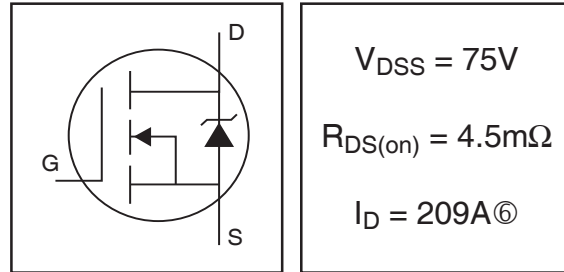
- Telecom applications requiring soft start

Benefits

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free

Description

This Stripe Planar design of HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this HEXFET power MOSFET are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These benefits combine to make this design an extremely efficient and reliable device for use in a wide variety of applications.



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---------------------------|--|--------------------------|-------|
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 209 [Ⓞ] | A |
| $I_D @ T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 148 [Ⓞ] | |
| I_{DM} | Pulsed Drain Current [Ⓛ] | 840 | |
| $P_D @ T_C = 25^\circ C$ | Power Dissipation | 470 | W |
| | Linear Derating Factor | 3.1 | W/°C |
| V_{GS} | Gate-to-Source Voltage | ± 20 | V |
| E_{AS} | Single Pulse Avalanche Energy [Ⓜ] | 1970 | mJ |
| I_{AR} | Avalanche Current | See Fig.12a, 12b, 15, 16 | A |
| E_{AR} | Repetitive Avalanche Energy [Ⓜ] | | mJ |
| dv/dt | Peak Diode Recovery dv/dt [Ⓜ] | 5.0 | V/ns |
| T_J | Operating Junction and | -55 to + 175 | °C |
| T_{STG} | Storage Temperature Range | | |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case) | |
| | Mounting Torque, 6-32 or M3 screw | 10 lbf•in (1.1N•m) | |

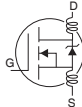
Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case | — | 0.32 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 40 | |

IRFP2907PbF

International
IR Rectifier

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--|--------------------------------------|------|-------|------|-------|--|
| V _{(BR)DSS} | Drain-to-Source Breakdown Voltage | 75 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| ΔV _{(BR)DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | — | 0.085 | — | V/°C | Reference to 25°C, I _D = 1mA |
| R _{DS(on)} | Static Drain-to-Source On-Resistance | — | 3.6 | 4.5 | mΩ | V _{GS} = 10V, I _D = 125A ④ |
| V _{GS(th)} | Gate Threshold Voltage | 2.0 | — | 4.0 | V | V _{DS} = 10V, I _D = 250μA |
| g _{fs} | Forward Transconductance | 130 | — | — | S | V _{DS} = 25V, I _D = 125A |
| I _{DSS} | Drain-to-Source Leakage Current | — | — | 20 | μA | V _{DS} = 75V, V _{GS} = 0V |
| | | — | — | 250 | | V _{DS} = 60V, V _{GS} = 0V, T _J = 150°C |
| I _{GSS} | Gate-to-Source Forward Leakage | — | — | 200 | nA | V _{GS} = 20V |
| | Gate-to-Source Reverse Leakage | — | — | -200 | | V _{GS} = -20V |
| Q _g | Total Gate Charge | — | 410 | 620 | nC | I _D = 125A |
| Q _{gs} | Gate-to-Source Charge | — | 92 | 140 | | V _{DS} = 60V |
| Q _{gd} | Gate-to-Drain ("Miller") Charge | — | 140 | 210 | | V _{GS} = 10V ④ |
| t _{d(on)} | Turn-On Delay Time | — | 23 | — | ns | V _{DD} = 38V |
| t _r | Rise Time | — | 190 | — | | I _D = 125A |
| t _{d(off)} | Turn-Off Delay Time | — | 130 | — | | R _G = 1.2Ω |
| t _f | Fall Time | — | 130 | — | | V _{GS} = 10V ④ |
| L _D | Internal Drain Inductance | — | 5.0 | — | nH | Between lead, 6mm (0.25in.) from package and center of die contact |
| L _S | Internal Source Inductance | — | 13 | — | |  |
| C _{iss} | Input Capacitance | — | 13000 | — | pF | V _{GS} = 0V |
| C _{oss} | Output Capacitance | — | 2100 | — | | V _{DS} = 25V |
| C _{rss} | Reverse Transfer Capacitance | — | 500 | — | | f = 1.0MHz, See Fig. 5 |
| C _{oss} | Output Capacitance | — | 9780 | — | | V _{GS} = 0V, V _{DS} = 1.0V, f = 1.0MHz |
| C _{oss} | Output Capacitance | — | 1360 | — | | V _{GS} = 0V, V _{DS} = 60V, f = 1.0MHz |
| C _{oss eff.} | Effective Output Capacitance ⑤ | — | 2320 | — | | V _{GS} = 0V, V _{DS} = 0V to 60V |

Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|---|--|------|------|-------|---|
| I _S | Continuous Source Current (Body Diode) | — | — | 209⑥ | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | 840 | | |
| V _{SD} | Diode Forward Voltage | — | — | 1.3 | V | T _J = 25°C, I _S = 125A, V _{GS} = 0V ④ |
| t _{rr} | Reverse Recovery Time | — | 140 | 210 | ns | T _J = 25°C, I _F = 125A |
| Q _{rr} | Reverse Recovery Charge | — | 880 | 1320 | 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) | | | | |

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② Starting T_J = 25°C, L = 0.25mH
R_G = 25Ω, I_{AS} = 125A. (See Figure 12).
- ③ I_{SD} ≤ 125A, di/dt ≤ 260A/μs, V_{DD} ≤ V_{(BR)DSS},
T_J ≤ 175°C
- ④ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ⑤ C_{oss eff.} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 90A.
- ⑦ Limited by T_{Jmax}, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.

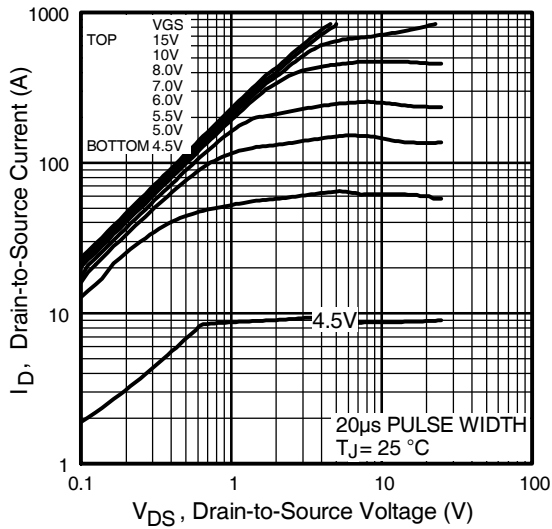


Fig 1. Typical Output Characteristics

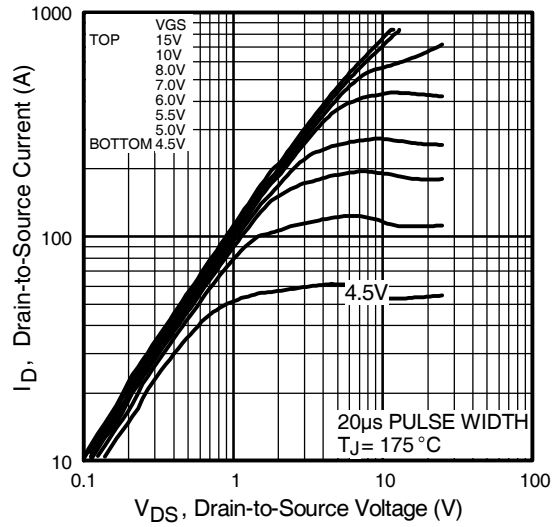


Fig 2. Typical Output Characteristics

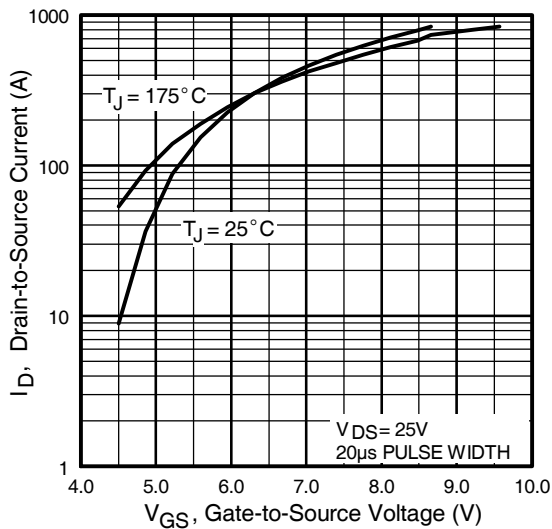


Fig 3. Typical Transfer Characteristics

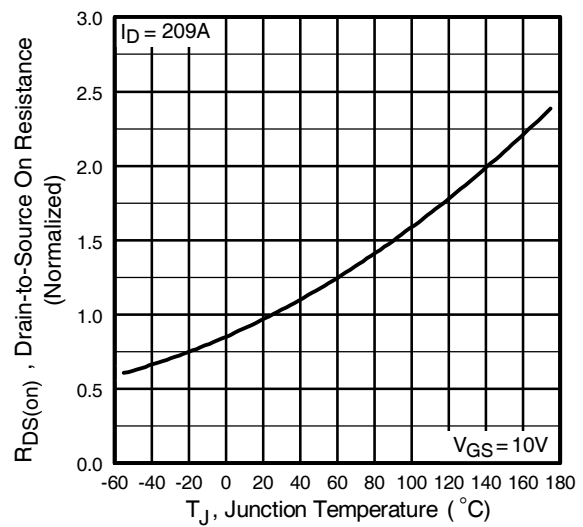


Fig 4. Normalized On-Resistance Vs. Temperature

IRFP2907PbF

International
IR Rectifier

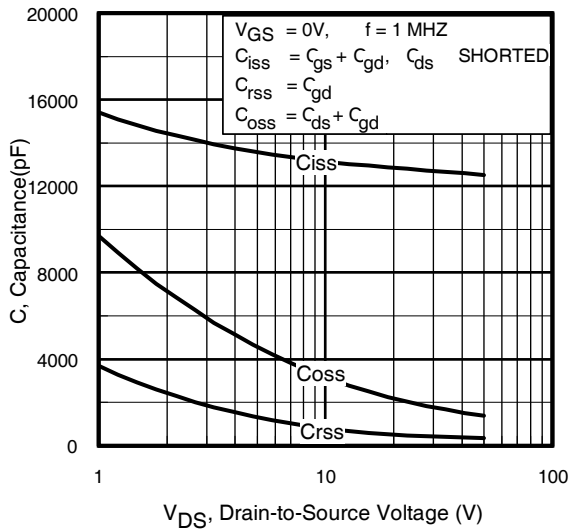


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

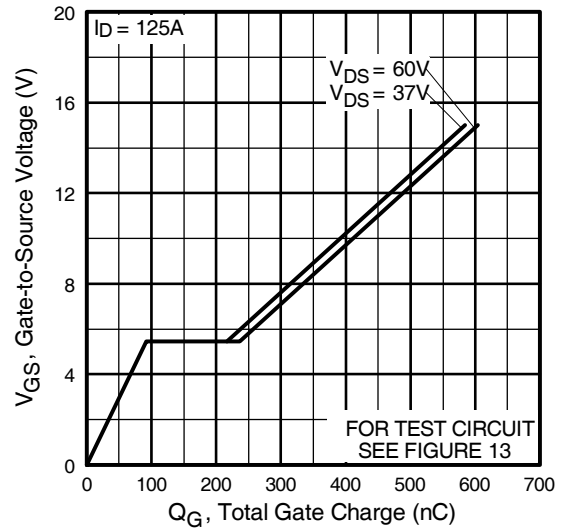


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

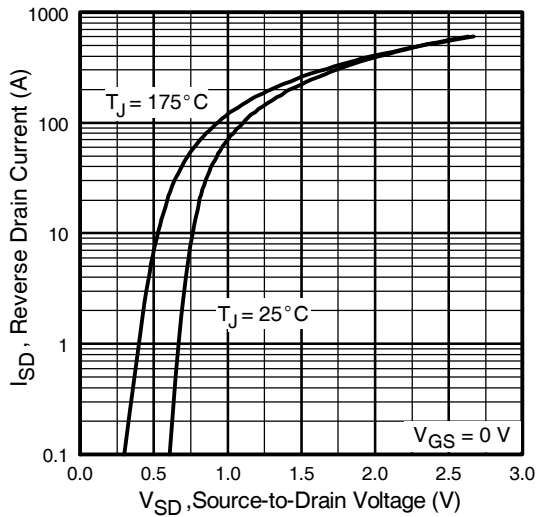


Fig 7. Typical Source-Drain Diode Forward Voltage

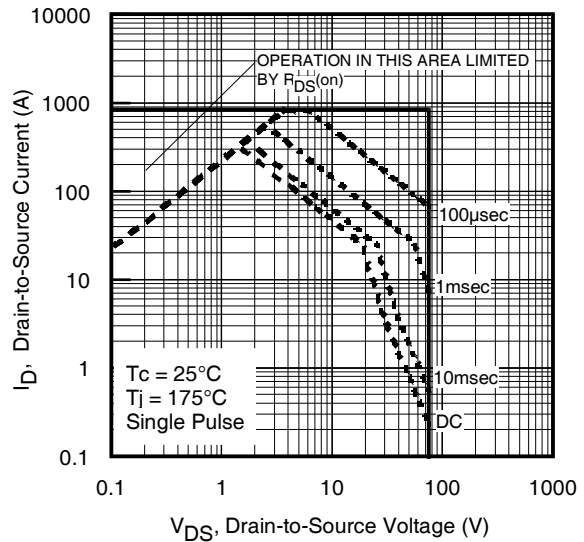


Fig 8. Maximum Safe Operating Area

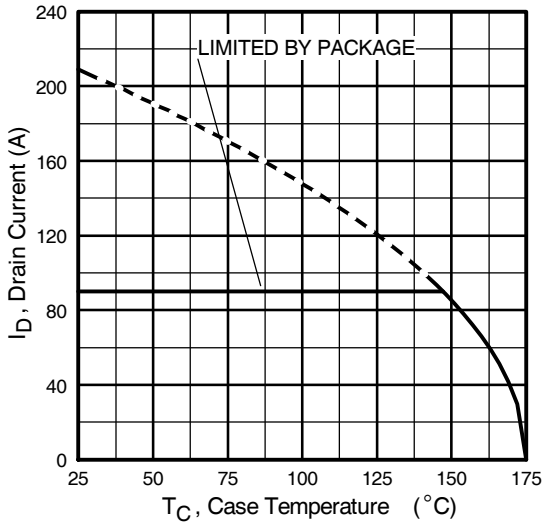


Fig 9. Maximum Drain Current Vs. Case Temperature

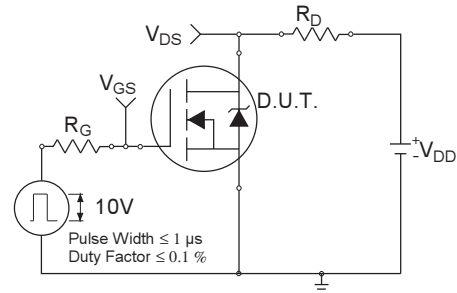


Fig 10a. Switching Time Test Circuit

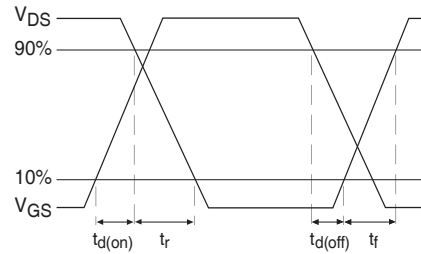


Fig 10b. Switching Time Waveforms

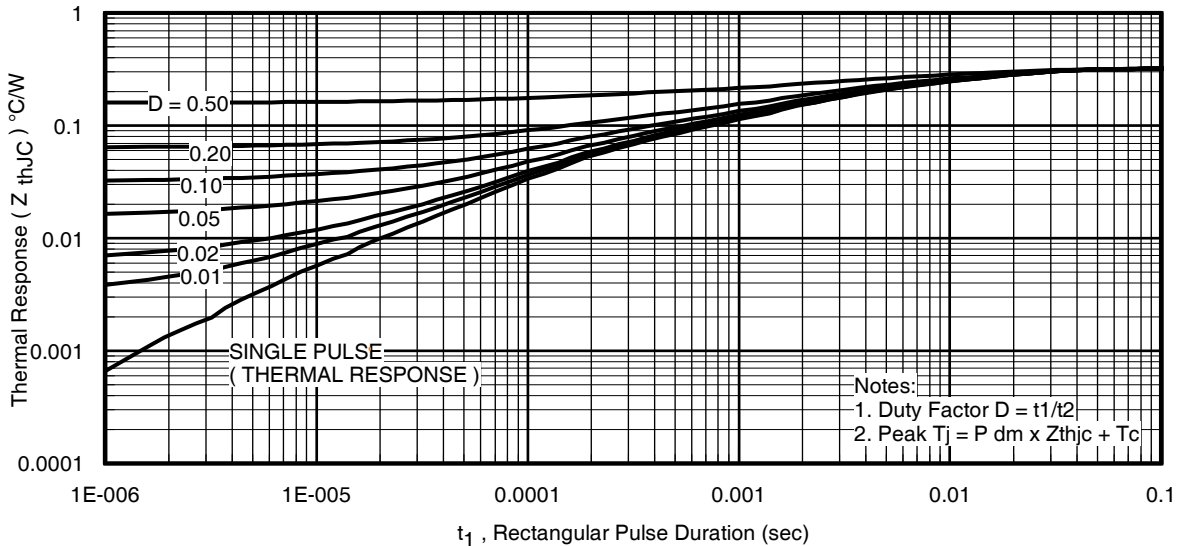


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

IRFP2907PbF

International
IR Rectifier

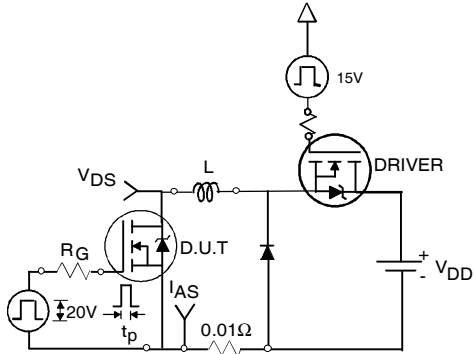


Fig 12a. Unclamped Inductive Test Circuit



Fig 12b. Unclamped Inductive Waveforms

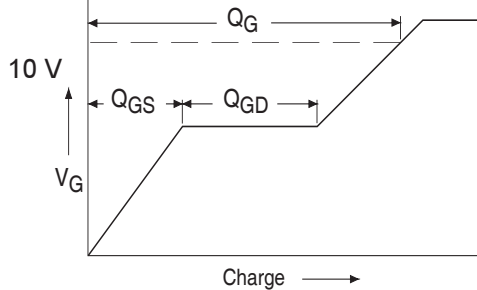


Fig 13a. Basic Gate Charge Waveform

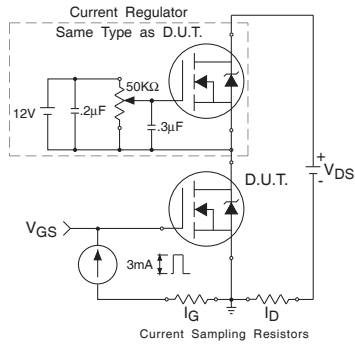


Fig 13b. Gate Charge Test Circuit

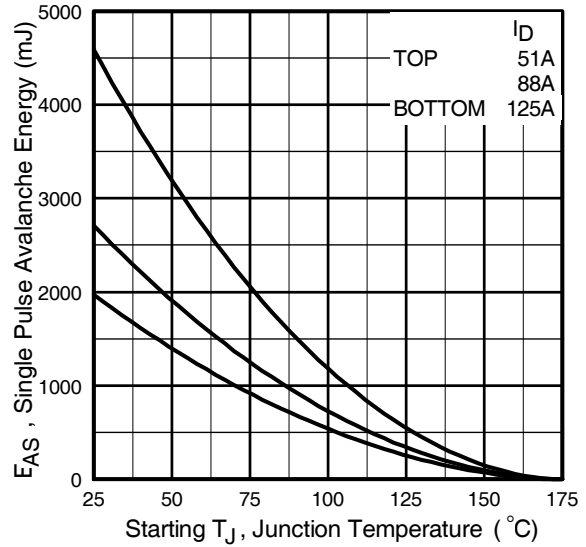


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

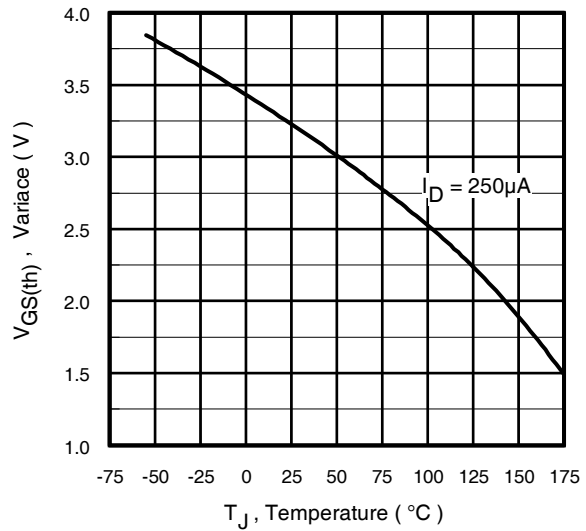


Fig 14. Threshold Voltage Vs. Temperature

www.irf.com

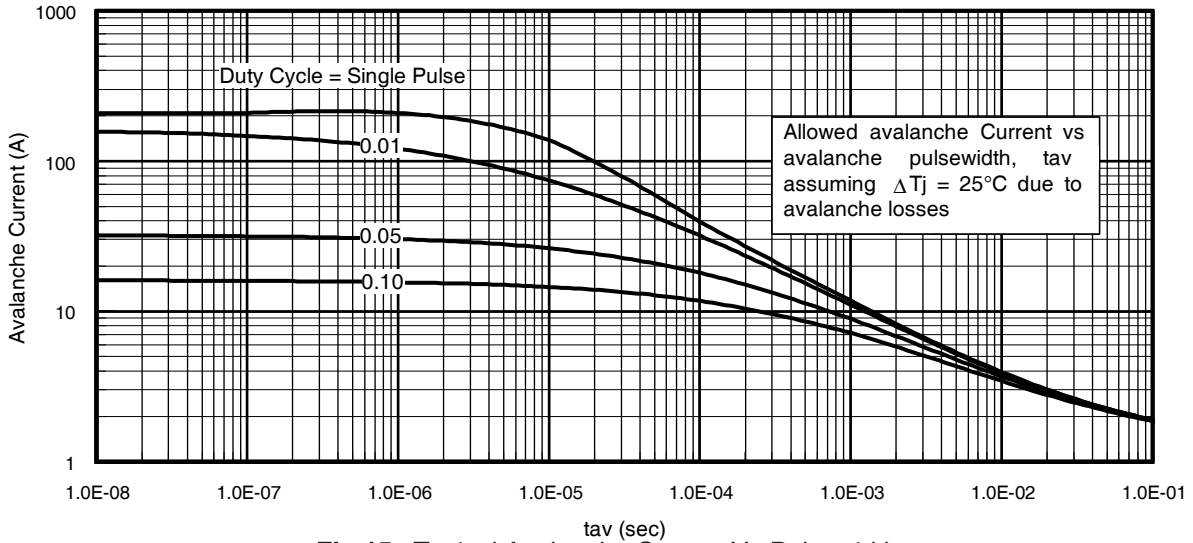


Fig 15. Typical Avalanche Current Vs.Pulsewidth

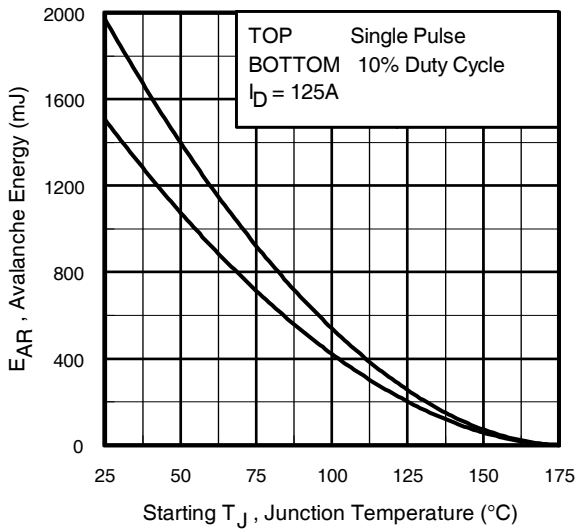


Fig 16. Maximum Avalanche Energy Vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 15, 16:
(For further info, see AN-1005 at www.irf.com)

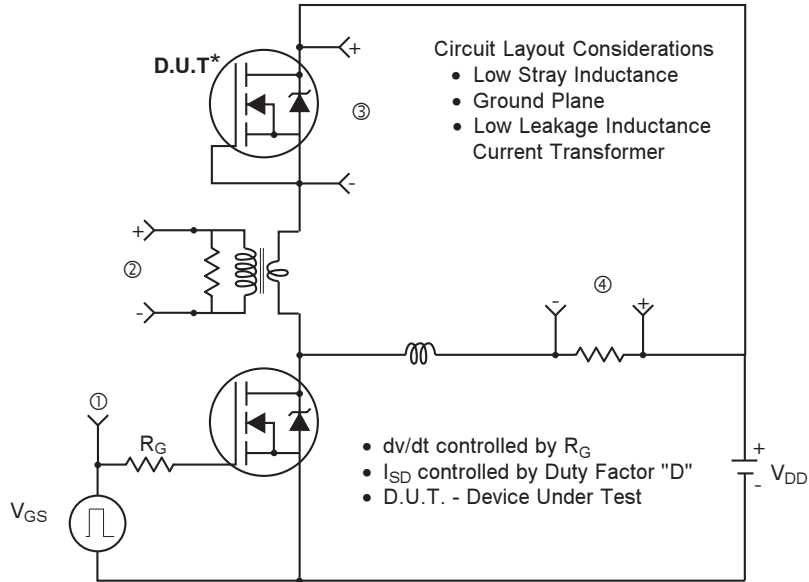
1. Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4. $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 15, 16).
 t_{av} = Average time in avalanche.
 D = Duty cycle in avalanche = $t_{av} \cdot f$
 $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see figure 11)

$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

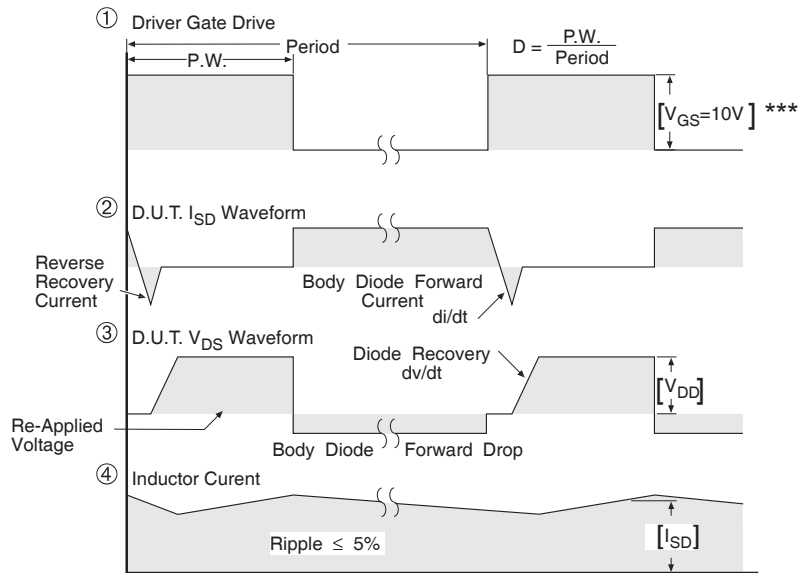
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

Peak Diode Recovery dv/dt Test Circuit



* Reverse Polarity of D.U.T for P-Channel

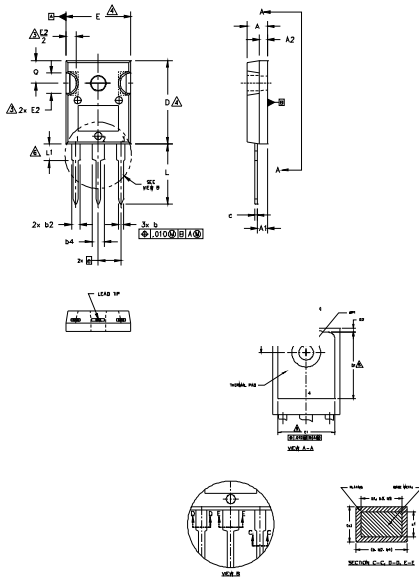


*** $V_{GS} = 5.0V$ for Logic Level and 3V Drive Devices

Fig 17. For N-channel HEXFET® power MOSFETs

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



- NOTES:
1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
 2. DIMENSIONS ARE SHOWN IN INCHES.
 3. CONTOUR OF SLOT OPTIONAL.
 4. DIMENSION D & E DO NOT INCLUDE MOLD FLASH, MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 5. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
 6. LEAD FINISH UNCONTROLLED IN L1.
 7. ØP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
 8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AC .

| SYMBOL | INCHES | | MILLIMETERS | | NOTES |
|--------|----------|------|-------------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | .183 | .209 | 4.65 | 5.31 | |
| A1 | .087 | .102 | 2.21 | 2.59 | |
| A2 | .059 | .098 | 1.50 | 2.49 | |
| b | .039 | .055 | 0.99 | 1.40 | |
| b1 | .039 | .053 | 0.99 | 1.35 | |
| b2 | .065 | .094 | 1.65 | 2.39 | |
| b3 | .065 | .092 | 1.65 | 2.34 | |
| b4 | .102 | .135 | 2.59 | 3.43 | |
| b5 | .102 | .133 | 2.59 | 3.38 | |
| c | .015 | .035 | 0.38 | 0.89 | |
| c1 | .015 | .033 | 0.38 | 0.84 | |
| D | .776 | .815 | 19.71 | 20.70 | 4 |
| D1 | .515 | - | 13.08 | - | 5 |
| D2 | .020 | .053 | 0.51 | 1.35 | |
| E | .602 | .625 | 15.29 | 15.87 | 4 |
| E1 | .630 | - | 13.46 | - | |
| E2 | .178 | .216 | 4.52 | 5.49 | |
| e | .215 BSC | | 5.46 BSC | | |
| Øk | Ø10 | | Ø25 | | |
| L | .559 | .634 | 14.20 | 16.10 | |
| L1 | .146 | .169 | 3.71 | 4.29 | |
| ØP | .140 | .144 | 3.56 | 3.66 | |
| ØP1 | - | .291 | - | 7.39 | |
| Ø | .209 | .224 | 5.31 | 5.69 | |
| S | .217 BSC | | 5.51 BSC | | |

LEAD ASSIGNMENTS

HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

IGBTs, COPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

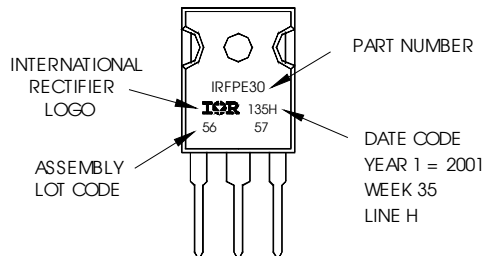
DIODES

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30
 WITH ASSEMBLY
 LOT CODE 5657
 ASSEMBLED ON WW 35, 2001
 IN THE ASSEMBLY LINE "H"

Note: "P" in assembly line position
 indicates "Lead-Free"



TO-247AC package is not recommended for Surface Mount Application.

Notes:

1. For an Automotive Qualified version of this part please see <http://www.irf.com/product-info/automotive/>
2. For the most current drawing please refer to IR website at <http://www.irf.com/package/>

Data and specifications subject to change without notice.

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.