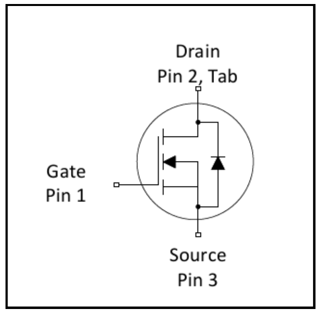
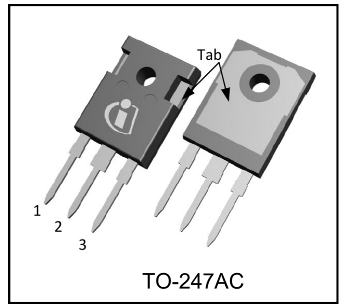
# IRFP4229PbF

## PDP SWITCH

| Key Parameters | | |
|---|---|---|
| $V_{DS}$ max | 250 | V |
| $V_{DS\ (Avalanche)}$ typ. | 300 | V |
| $R_{DS(ON)}$ typ. @ 10V | 38 | mΩ |
| $I_{RP}$ max @ $T_C$= 100°C | 87 | A |
| $T_J$ max | 175 | °C |




### Features

- Advanced Process Technology
- Key Parameters Optimized for PDP Sustain, Energy Recovery and Pass Switch Applications
- Low $E_{PULSE}$ Rating to Reduce Power Dissipation in PDP Sustain, Energy Recovery and Pass Switch Applications
- Low $Q_G$ for Fast Response
- High Repetitive Peak Current Capability for Reliable Operation
- Short Fall & Rise Times for Fast Switching
- 175°C Operating Junction Temperature for Improved Ruggedness
- Repetitive Avalanche Capability for Robustness and Reliability

### Description

This HEXFET® Power MOSFET is specifically designed for Sustain; Energy Recovery & Pass switch applications in Plasma Display Panels. This MOSFET utilizes the latest processing techniques to achieve low on-resistance per silicon area and low $E_{PULSE}$ rating. Additional features of this MOSFET are 175°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for PDP driving applications

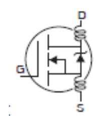
### Absolute Maximum Ratings

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $V_{GS}$ | Gate-to-Source Voltage | ± 30 | V |
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 44 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 31 | |
| $I_{DM}$ | Pulsed Drain Current ① | 180 | |
| $I_{RP}$ @ $T_C$ = 100°C | Repetitive Peak Current ⑤ | 87 | |
| $P_D$ @$T_C$ = 25°C | Maximum Power Dissipation | 310 | W |
| $P_D$ @$T_C$ = 100°C | Maximum Power Dissipation | 150 | |
| | Linear Derating Factor | 2.0 | W/°C |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -40 to + 175 | °C |
| | Soldering Temperature, for 10 seconds (1.6mm from case) | 300 | |
| | Mounting torque, 6-32 or M3 screw | 10 lbf•in (1.1N•m) | |

### Thermal Resistance

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case ④ | — | 0.49 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient ④ | — | 40 | |

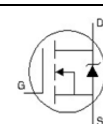
### Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 250 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | 210 | —— | mV/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | —— | 38 | 46 | mΩ | $V_{GS}$ = 10V, $I_D$ = 26A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 3.0 | —— | 5.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Temp. Coefficient | —— | -14 | —— | mV/°C | |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | 20 | μA | $V_{DS}$ = 250V, $V_{GS}$ = 0V |
| | | —— | —— | 1.0 | mA | $V_{DS}$ = 250V, $V_{GS}$ = 0V, $T_J$ =125°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | —— | —— | 100 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | —— | —— | -100 | | $V_{GS}$ = -20V |
| gfs | Forward Trans conductance | 83 | —— | —— | S | $V_{DS}$ = 25V, $I_D$ = 26A |
| $Q_g$ | Total Gate Charge | —— | 72 | 110 | nC | $I_D$ = 26A, $V_{DS}$ = 125V ③ |
| $Q_{gd}$ | Gate-to-Drain Charge | —— | 26 | —— | | $V_{GS}$ = 10V |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 25 | —— | ns | $V_{DD}$ = 125V, $V_{GS}$ = 10V ③ |
| $t_r$ | Rise Time | —— | 27 | —— | | $I_D$ = 26A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 44 | —— | | $R_G$= 5.0Ω |
| $t_f$ | Fall Time | —— | 19 | —— | | See Fig. 22 |
| $t_{st}$ | Shoot Through Blocking Time | 100 | —— | —— | ns | $V_{DD}$ = 200V, $V_{GS}$ = 15V, $R_G$= 4.7Ω |
| $E_{PULSE}$ | Energy per Pulse | —— | 790 | —— | μJ | L = 220nH, C = 0.3μF, $V_{GS}$ = 15V<br>$V_{DD}$ = 200V, $R_G$= 4.7Ω, $T_J$ = 25°C |
| | | —— | 1390 | —— | | L = 220nH, C = 0.3μF, $V_{GS}$ = 15V<br>$V_{DD}$ = 200V, $R_G$= 4.7Ω, $T_J$ = 100°C |
| $C_{iss}$ | Input Capacitance | —— | 4560 | —— | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 390 | —— | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 100 | —— | | *f* = 1.0MHz |
| $C_{oss}$ eff. | Effective Output Capacitance | —— | 290 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 200V |
| $L_D$ | Internal Drain Inductance | —— | 5.0 | —— | nH | Between lead,<br>6mm (0.25in.)<br>from package<br>and center of die contact  |
| $L_S$ | Internal Source Inductance | —— | 13 | —— | | |

### Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | —— | 300 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy ① | —— | 31 | |
| $V_{DS(Avalanche)}$ | Repetitive Avalanche Voltage ① | 300 | —— | V |
| $I_{AS}$ | Avalanche Current ② | —— | 26 | A |

### Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ @ $T_C$ = 25°C | Continuous Source Current<br>(Body Diode) | —— | —— | 44 | A | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode) ① | —— | —— | 180 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | 1.3 | V | $T_J$ = 25°C, $I_S$ = 26A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | —— | 190 | 290 | ns | $T_J$ = 25°C, $I_F$ = 26A, $V_{DD}$ = 50V |
| $Q_{rr}$ | Reverse Recovery Charge | —— | 840 | 1260 | nC | di/dt = 100A/μs ③ |

**Notes:**
① Repetitive rating; pulse width limited by max. junction temperature.
② starting $T_J$ = 25°C, L = 0.85mH, $R_G$ = 25Ω, $I_{AS}$ = 26A.
③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
④ $R_\theta$ is measured at $T_J$ of approximately 90°C.
⑤ Half sine wave with duty cycle = 0.25, ton=1μsec.

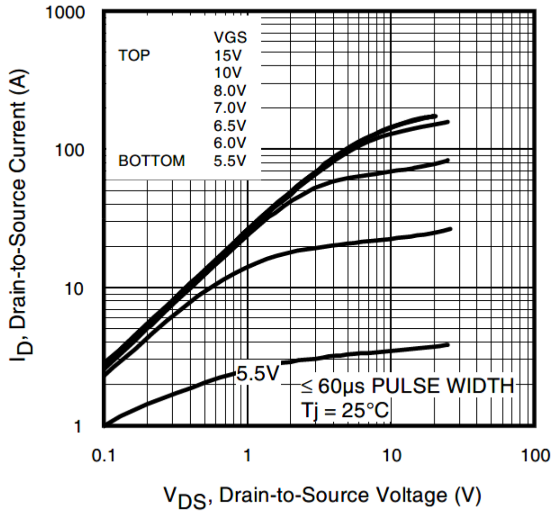



**Fig. 1.** Typical Output Characteristics

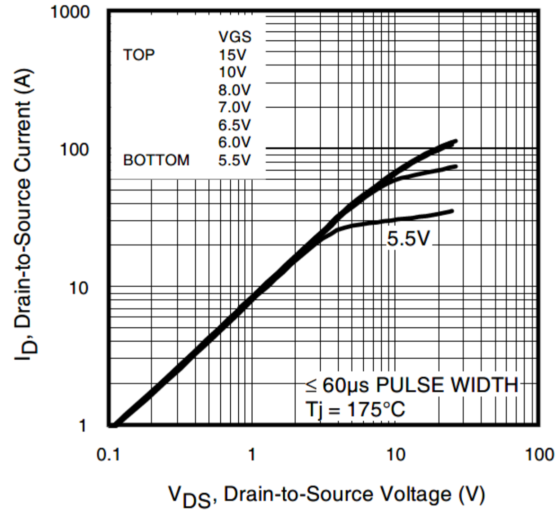



**Fig. 2.** Typical Output Characteristics

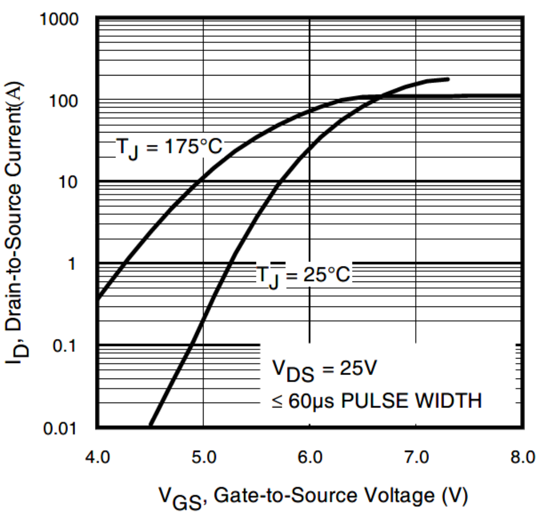



**Fig. 3.** Typical Transfer Characteristics

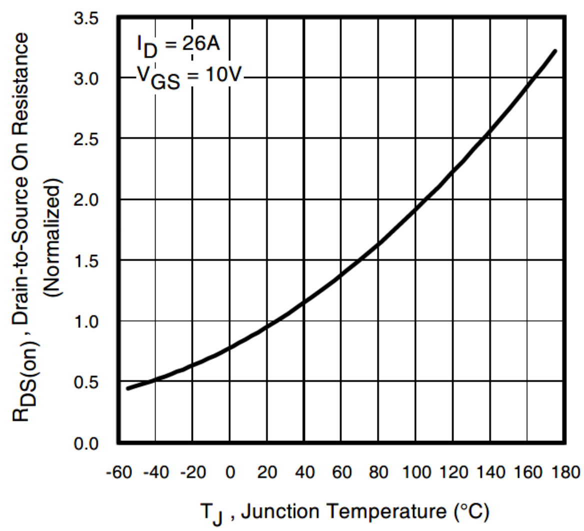



**Fig. 4.** Normalized On-Resistance vs. Temperature

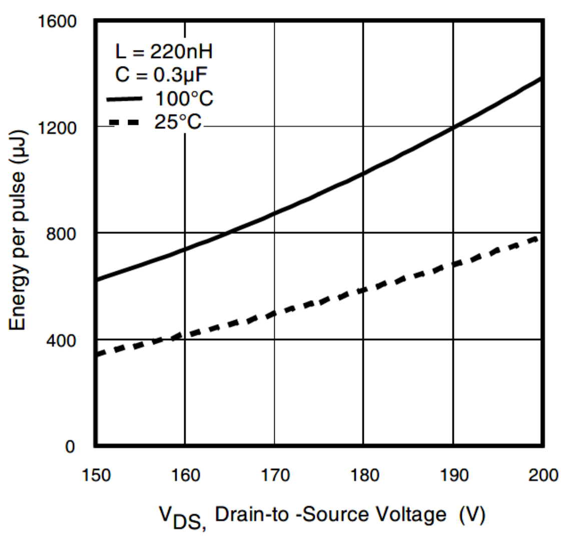



**Fig 5.** Typical $E_{PULSE}$ vs. Drain-to-Source Voltage

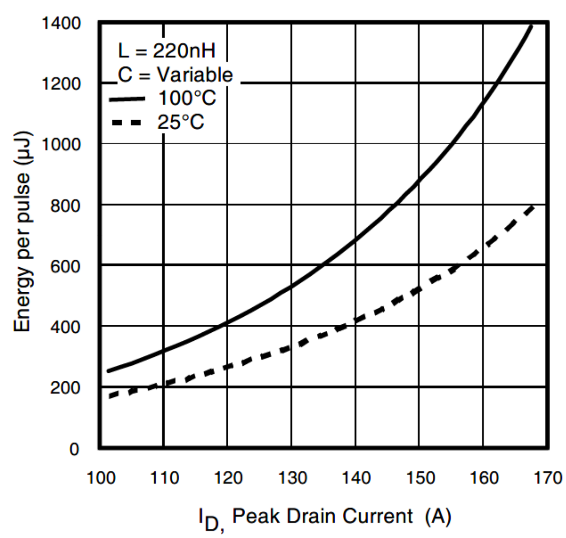



**Fig 6.** Typical $E_{PULSE}$ vs. Drain Current

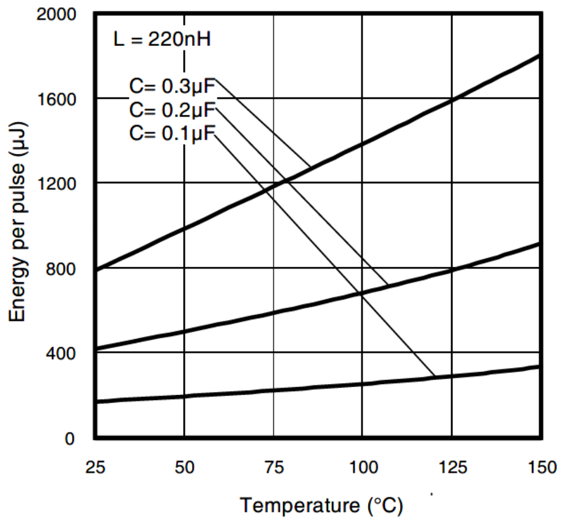



**Fig. 7.** Typical $E_{PULSE}$ vs. Temperature

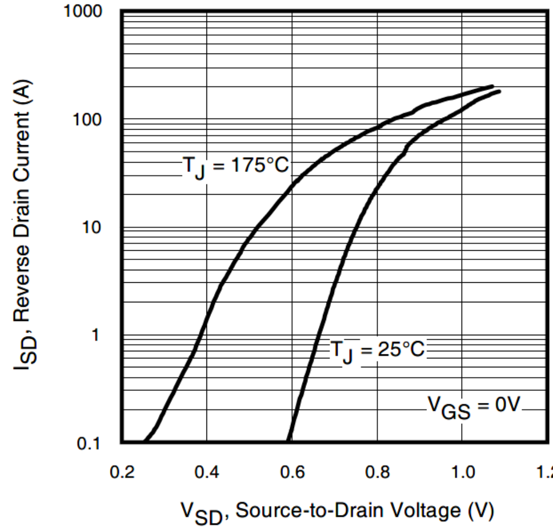



**Fig 8.** Typical Source-Drain Diode Forward Voltage

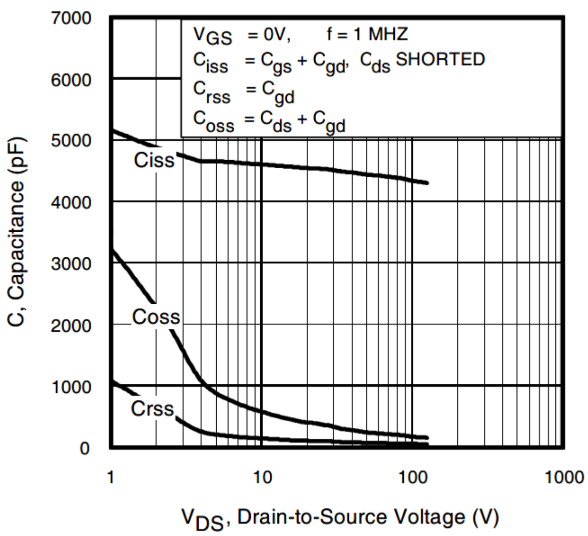



**Fig 9.** Typical Capacitance vs.Drain-to-Source Voltage

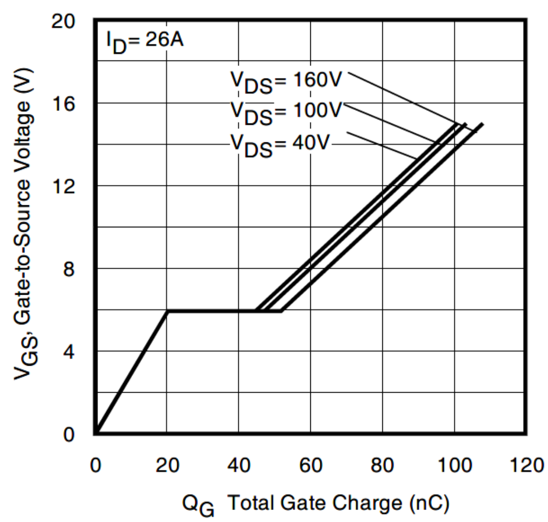



**Fig 10.** Typical Gate Charge vs. Gate-to-Source Voltage

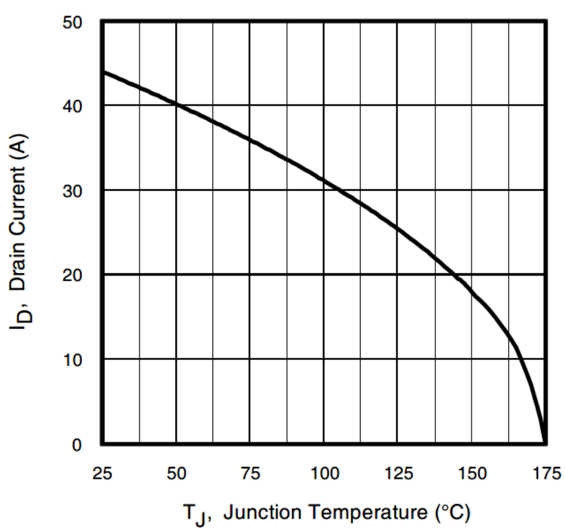



**Fig 11.** Maximum Drain Current vs. Case Temperature

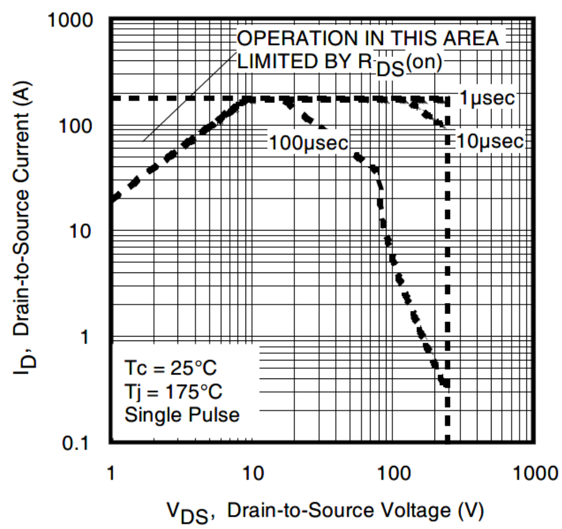



**Fig 12.** Maximum Safe Operating Area

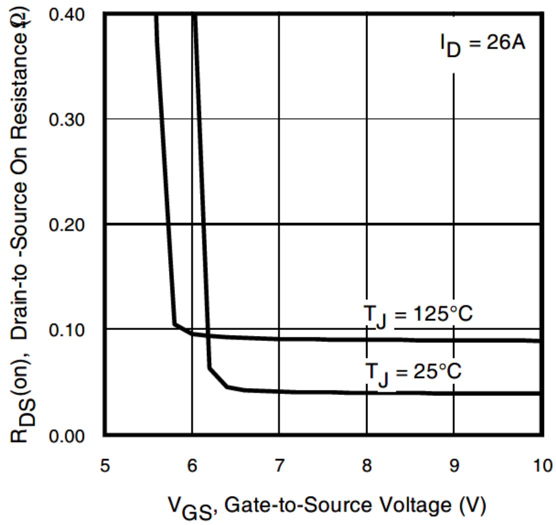



**Fig. 13.** On-Resistance Vs. Gate Voltage

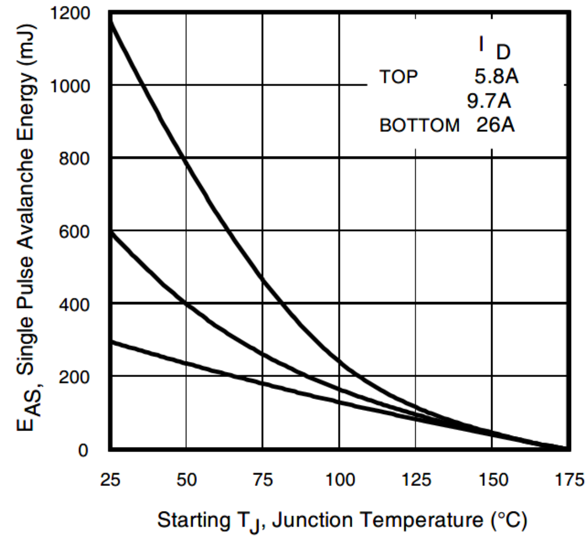



**Fig. 14.** Maximum Avalanche Energy Vs. Temperature

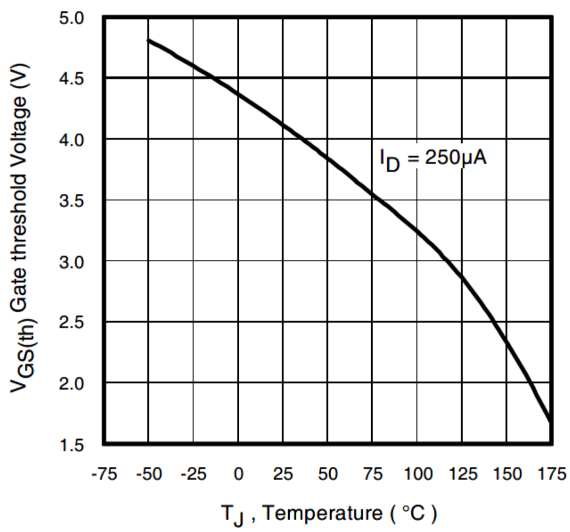



**Fig. 15.** Threshold Voltage vs. Temperature

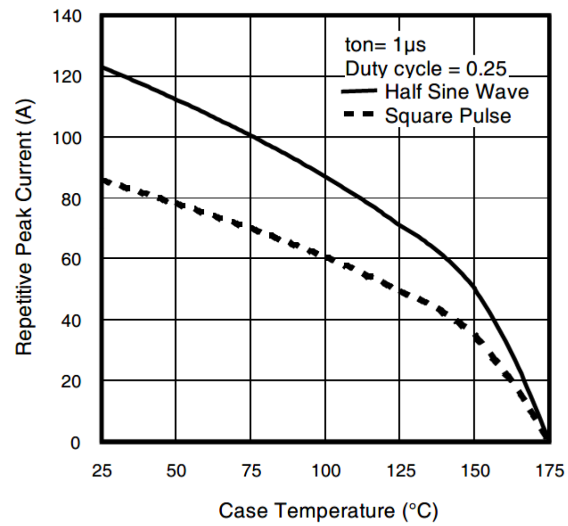
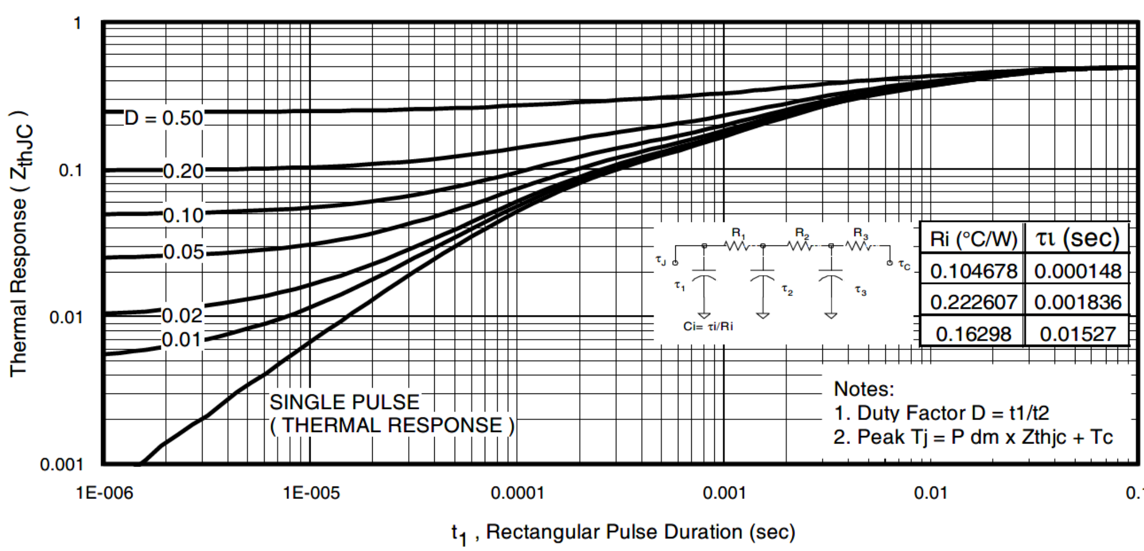
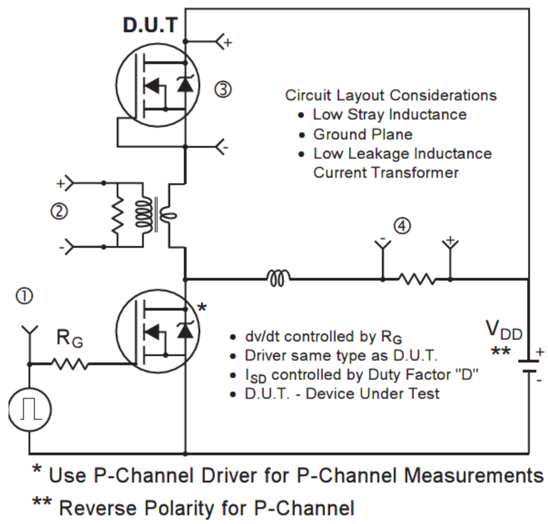



**Fig. 16.** Typical Repetitive peak Current vs. Case temperature




| Ri (°C/W) | τι (sec) |
|---|---|
| 0.104678 | 0.000148 |
| 0.222607 | 0.001836 |
| 0.16298 | 0.01527 |

**Fig 17.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



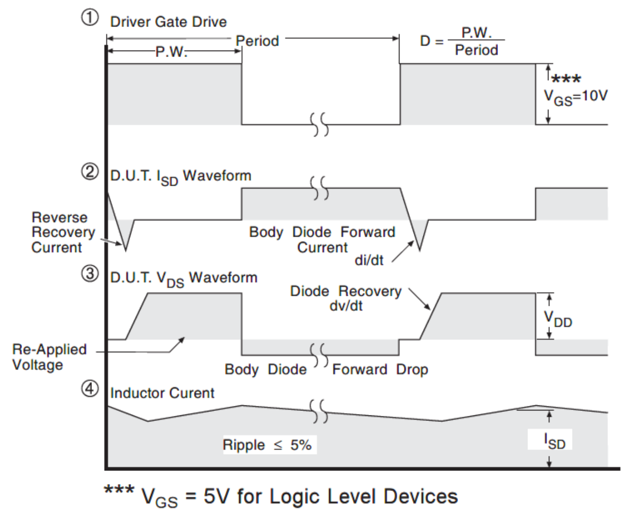




**Fig 18.** Diode Reverse Recovery Test Circuit for N-Channel HEXFET® Power MOSFETs

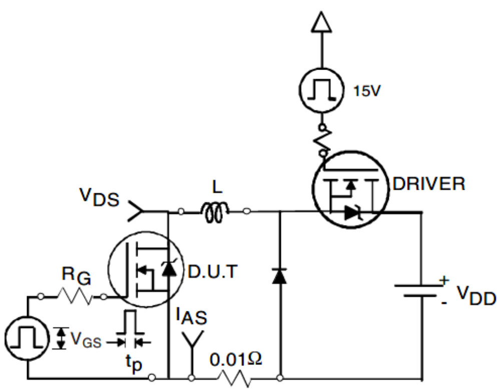



**Fig 19a.** Unclamped Inductive Test Circuit

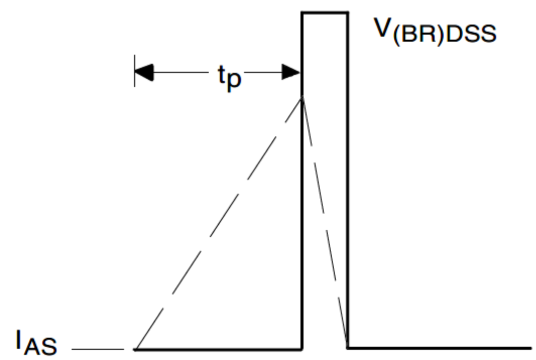



**Fig 19b.** Unclamped Inductive Waveforms

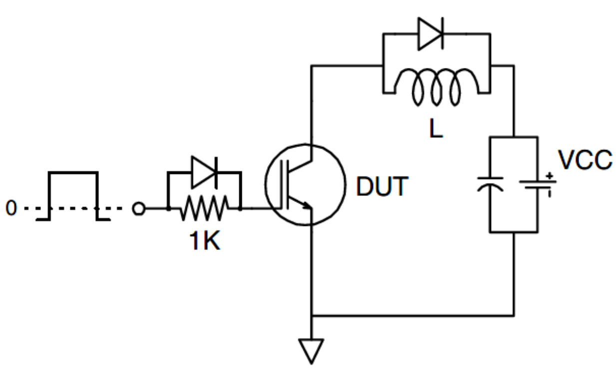



**Fig 20a.** Gate Charge Test Circuit

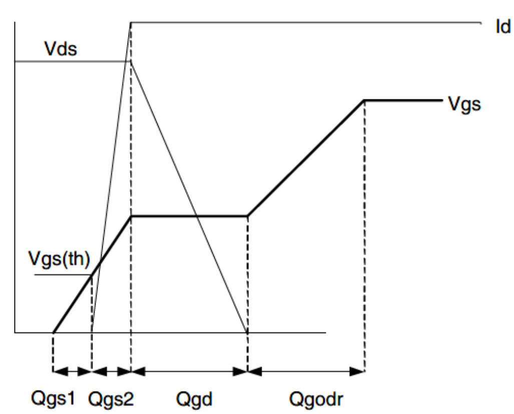



**Fig 20b.** Gate Charge Waveform

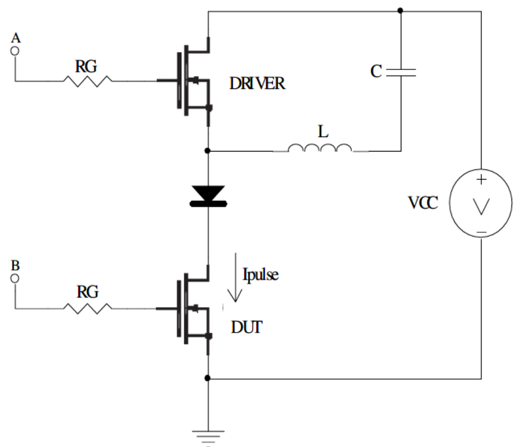



**Fig 21a.** $t_{st}$ and $E_{PULSE}$ Test Circuit

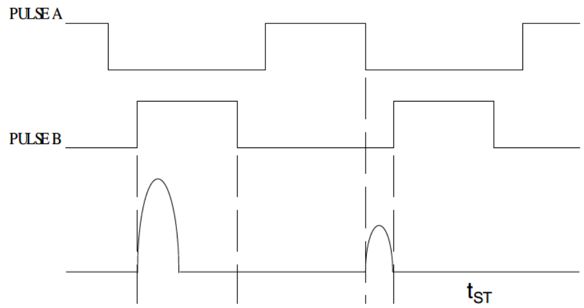



**Fig 21b.** $t_{st}$ Test Waveforms

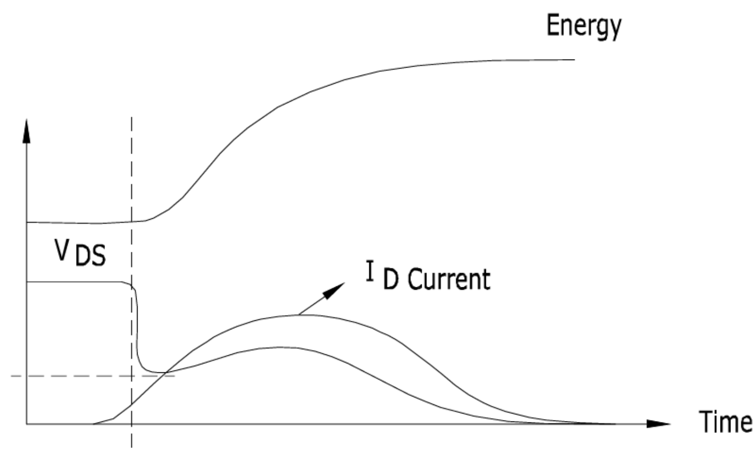



**Fig 21c.** $E_{PULSE}$ Test Waveforms

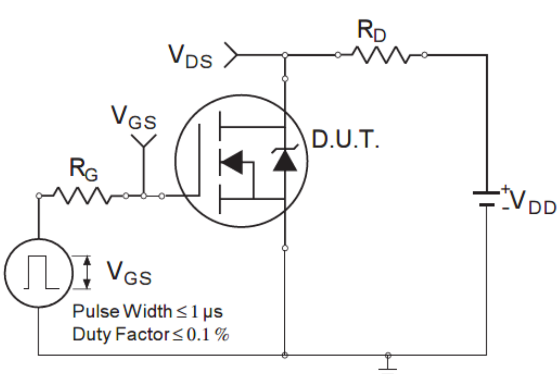



**Fig 22a.** Switching Time Test Circuit

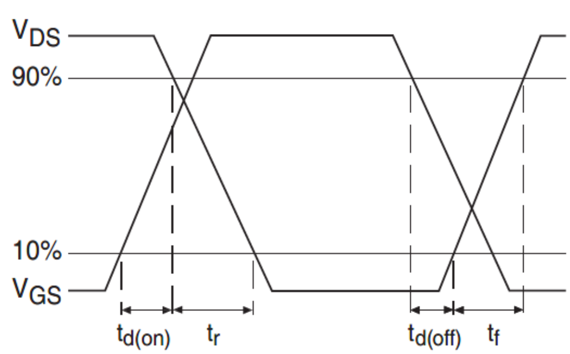
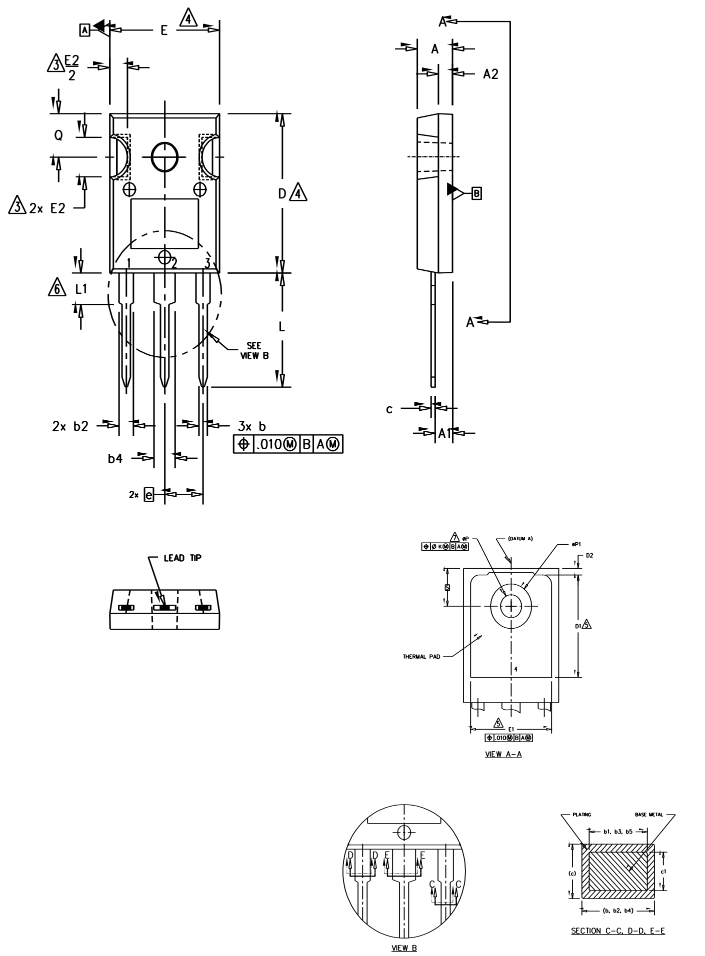



**Fig 22b.** Switching Time Waveforms

**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 | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | INCHES | | MILLIMETERS | | |
| | 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 | .530 | - | 13.46 | - | |
| E2 | .178 | .216 | 4.52 | 5.49 | |
| e | .215 BSC | | 5.46 BSC | | |
| øk | .010 | | 0.25 | | |
| 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 | |
| Q | .209 | .224 | 5.31 | 5.69 | |
| S | .217 BSC | | 5.51 BSC | | |

LEAD ASSIGNMENTS

HEXFET

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

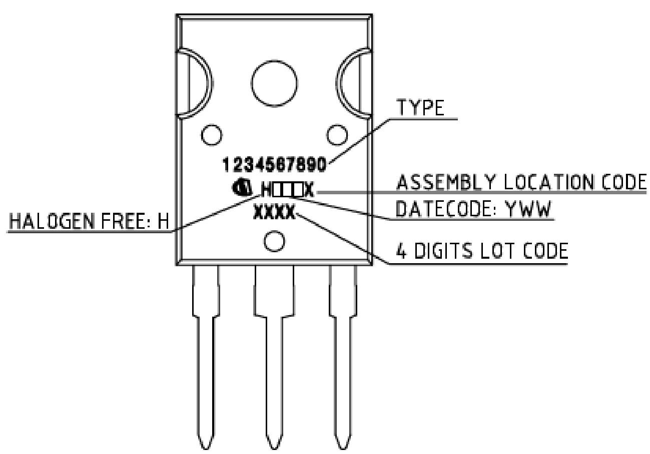
IGBTs, CoPACK

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

DIODES

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

**TO-247AC Part Marking Information**




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

### Revision History

| Date | Rev. | Comments |
|---|---|---|
| 2013-09-06 | 2.0 | • Final data sheet |
| 2024-12-05 | 2.1 | • Update datasheet to Infineon format<br>• Updated Part marking –page 8<br>• Added disclaimer on last page. |

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