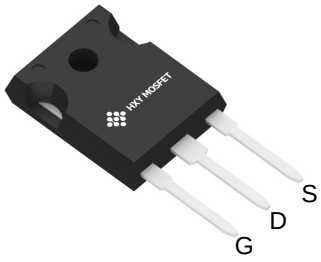
## Description

The HIRP450PBF uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

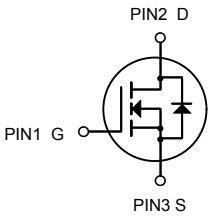



TO-247S

## General Features

$V_{DS}$ = 500V $I_D$ = 14A

$R_{DS(ON)}$ < 0.5Ω@ $V_{GS}$=10V




N-Channel MOSFET

## Application

Battery protection

Load switch

Uninterruptible power supply

## Package Marking and Ordering Information

| Product ID | Pack | Brand | Qty(PCS) |
|---|---|---|---|
| HIRFP450PBF | TO-247S | HXY MOSFET | 30 |

## Absolute Maximum Ratings Tc=25℃ unless otherwise noted

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 500 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 14 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 8.7 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 56 | A |
| EAS | Single Pulse Avalanche Energy[3] | 760 | mJ |
| $I_{AS}$ | Avalanche Current | 8.7 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 190 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |
| $R_{thJA}$ | Maximum Junction-to-Ambient | 40 | ℃/W |
| $R_{thJC}$ | Maximum Junction-to-Case (Drain) | 0.65 | ℃/W |

## Electrical Characteristics (TA=25℃unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 500 | - | - | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D$ = 1 mA | - | 0.63 | - | V/°C |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2.0 | - | 4.0 | V |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = ± 20 V | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 500 V, $V_{GS}$ = 0 V | - | - | 25 | µA |
| | | $V_{DS}$ = 400 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V; $I_D$ = 8.4A[b] | - | 0.43 | 0.5 | Ω |
| Forward Transconductance | $g_{fs}$ | $V_{DS}$ = 50 V, $I_D$ = 8.4 A[b] | 9.3 | - | - | S |
| **Dynamic** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1.0 MHz, see fig. 5 | - | 2600 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 720 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 340 | - | |
| Total Gate Charge | $Q_g$ | $V_{GS}$ = 10 V; $I_D$ = 14 A, $V_{DS}$ = 400 V, see fig. 6 and 13[b] | - | - | 150 | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | - | 20 | |
| Gate-Drain Charge | $Q_{gd}$ | | - | - | 80 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 250 V, $I_D$ = 14 A, $R_G$ = 6.2 Ω, $R_D$ = 17 Ω, see fig. 10[b] | - | 17 | - | ns |
| Rise Time | $t_r$ | | - | 47 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 92 | - | |
| Fall Time | $t_f$ | | - | 44 | - | |
| Internal Drain Inductance | $L_D$ | Between lead, 6 mm (0.25") from package and center of die contact  | - | 5.0 | - | nH |
| Internal Source Inductance | $L_S$ | | - | 13 | - | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 14 | A |
| Pulsed Diode Forward Current[a] | $I_{SM}$ | | - | - | 56 | |
| Body Diode Voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 14 A, $V_{GS}$ = 0 V[b] | - | - | 1.4 | V |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = 14 A, dI/dt = 100 A/µs[b] | - | 540 | 810 | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 4.8 | 7.2 | µC |
| Forward Turn-On Time | $t_{on}$ | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$) | | | | |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

b. Pulse width ≤ 300 µs; duty cycle ≤ 2 %.

## Typical Characteristics Ta = 25 °C, unless otherwise noted

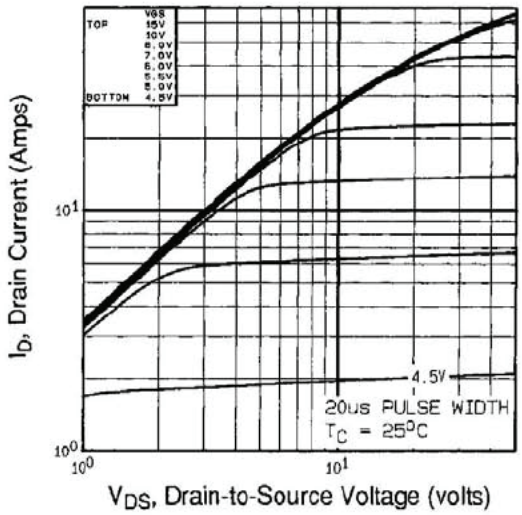



**Fig. 1 - Typical Output Characteristics, $T_C$ = 25 °C**

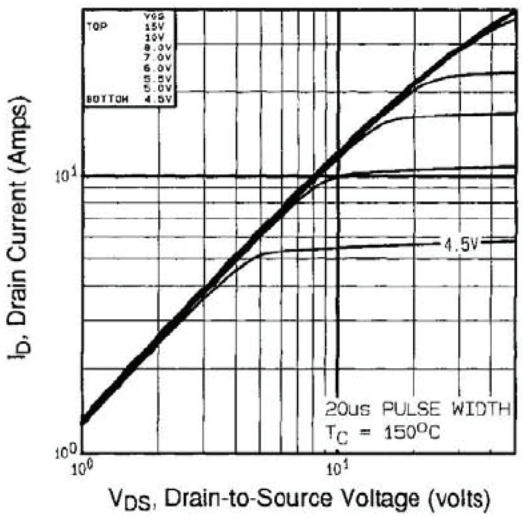



**Fig. 2 - Typical Output Characteristics, $T_C$ = 150 °C**

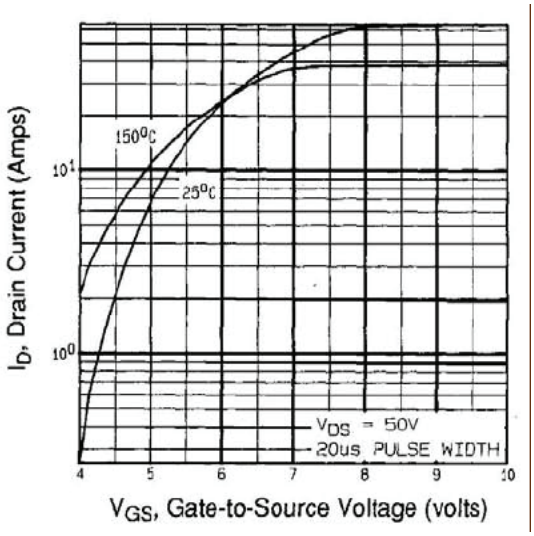



**Fig. 3 - Typical Transfer Characteristics**

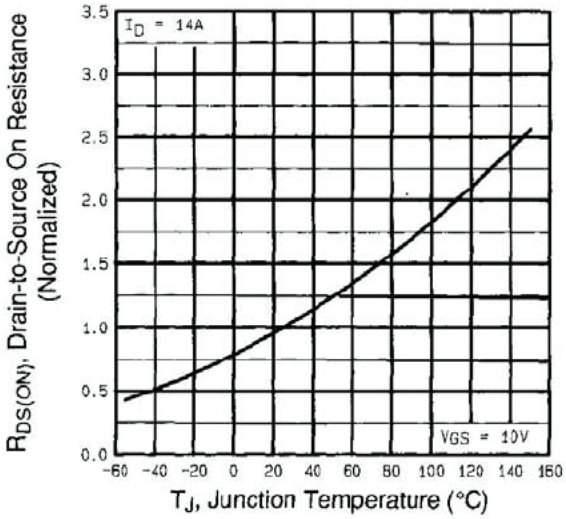



**Fig. 4 - Normalized On-Resistance vs. Temperature**

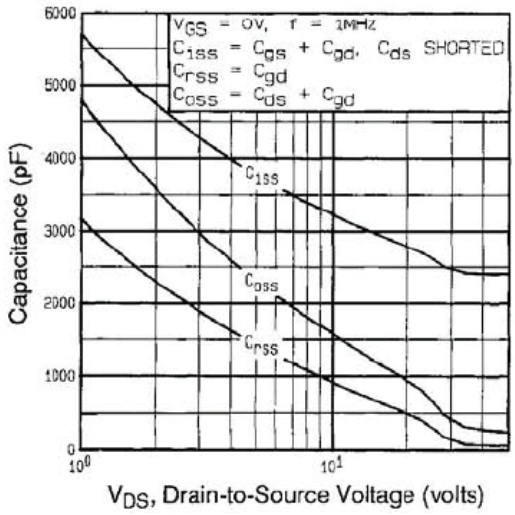



**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**

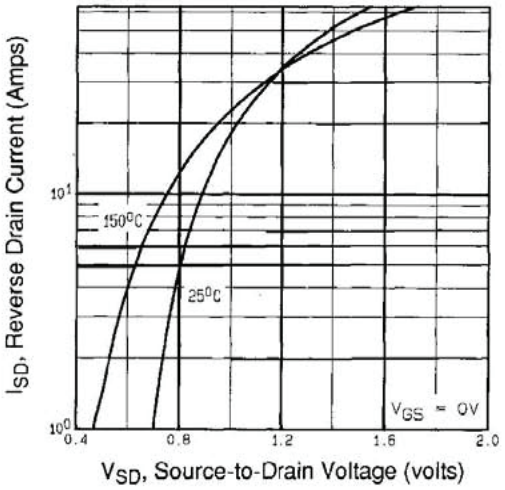



**Fig. 7 - Typical Source-Drain Diode Forward Voltage**

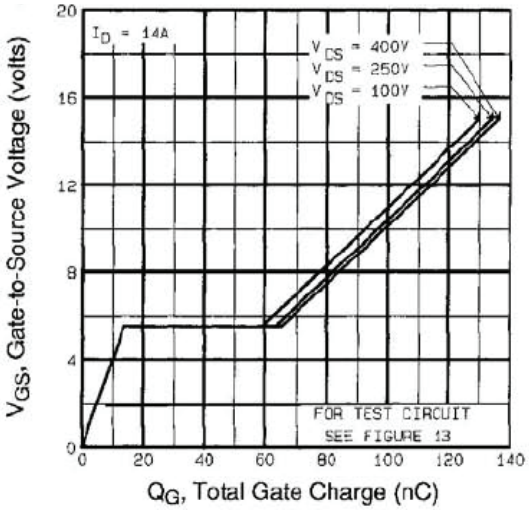



**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**

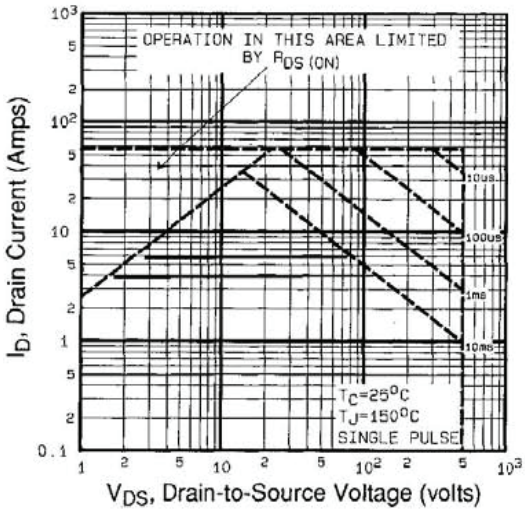



**Fig. 8 - Maximum Safe Operating Area**

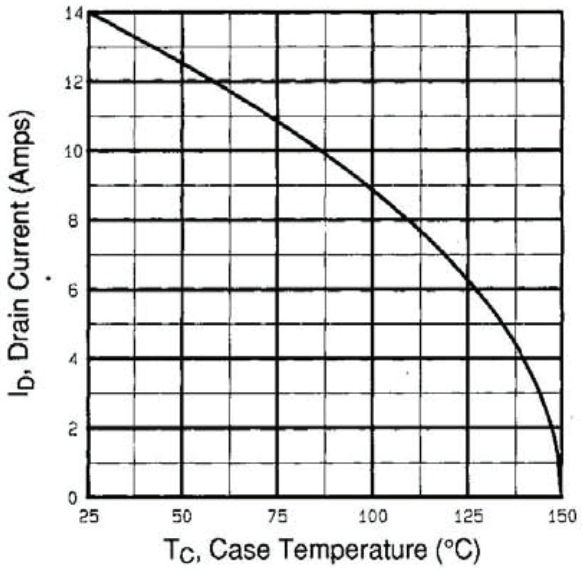



**Fig. 9 - Maximum Drain Current vs. Case Temperature**

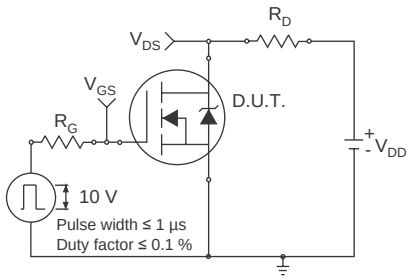



**Fig. 10a - Switching Time Test Circuit**

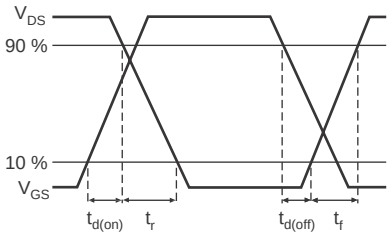



**Fig. 10b - Switching Time Waveforms**

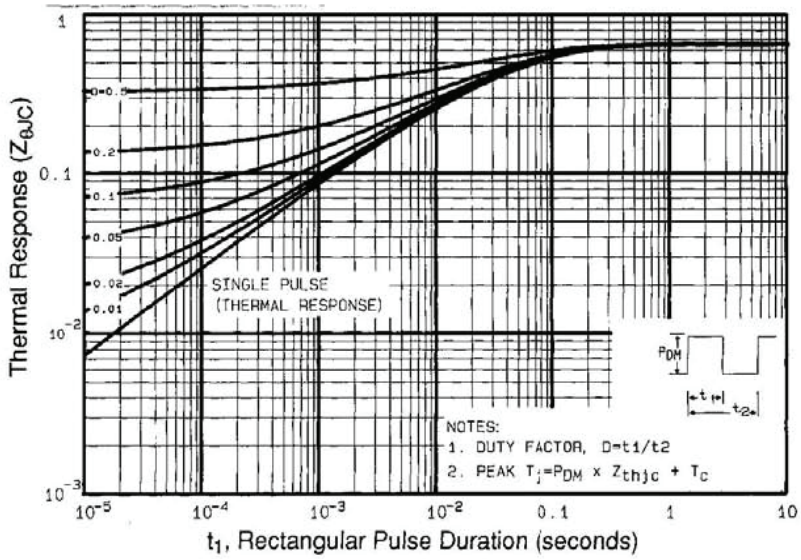



**Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**

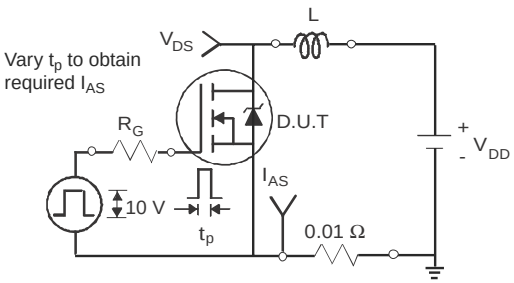



**Fig. 12a - Unclamped Inductive Test Circuit**

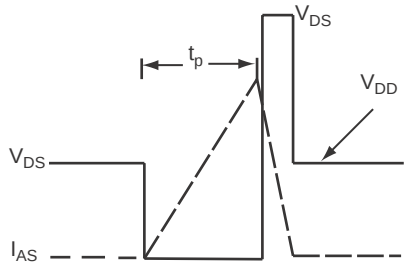



**Fig. 12b - Unclamped Inductive Waveforms**

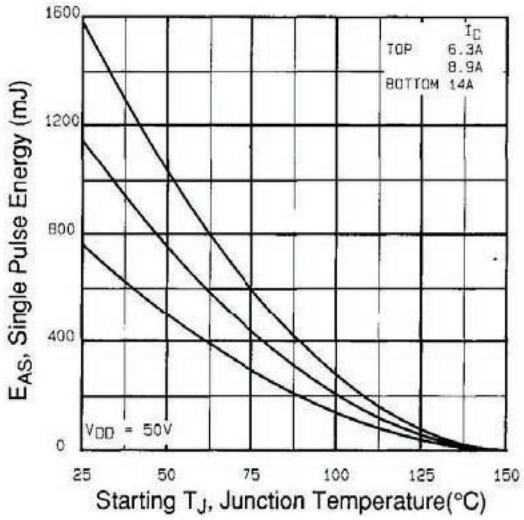



**Fig. 12c - Maximum Avalanche Energy vs. Drain Current**

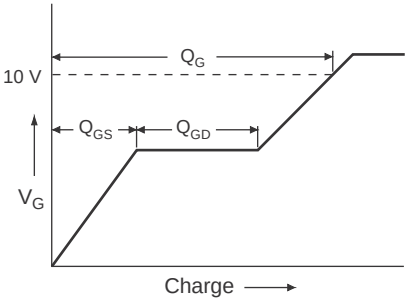



**Fig. 13a - Basic Gate Charge Waveform**

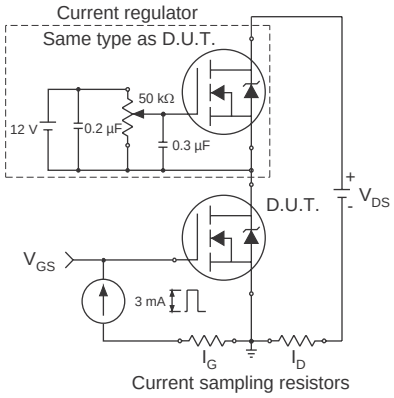
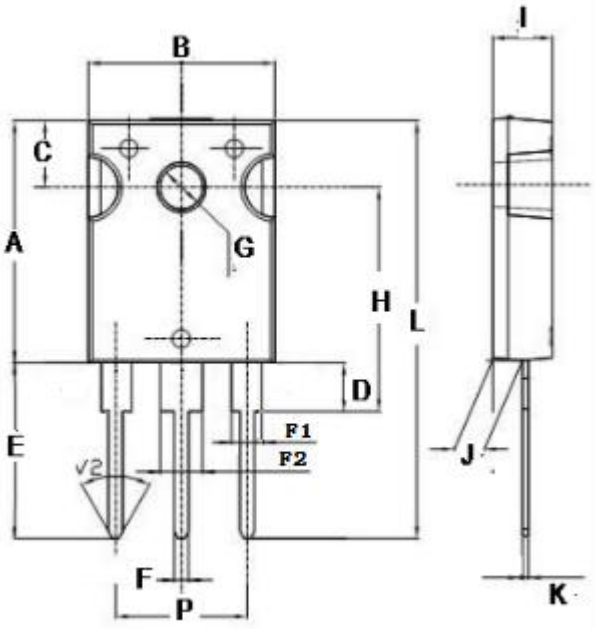



**Fig. 13b - Gate Charge Test Circuit**

## TO-247S Package Information




| Dim | Min | Max |
|---|---|---|
| A | 20.0 | 22.0 |
| B | 15.5 | 16.0 |
| C | 5.7 | 6.3 |
| D | 4.0 | 4.4 |
| E | 19.0 | 21.0 |
| F | 1.1 | 1.3 |
| G | 3.5 | 3.8 |
| H | 18.3 | 20.2 |
| I | 4.9 | 5.2 |
| J | 2.3 | 2.5 |
| K | 0.55 | 0.65 |
| L | 39.0 | 42.0 |
| P | 10.7 | 10.9 |
| F1 | 1.9 | 2.1 |
| F2 | 2.9 | 3.1 |
| mm | | |

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