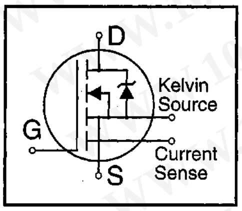
PD-9.733

International
IOR Rectifier

IRCP054

HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Current Sense
- Isolated Central Mounting Hole
- 175°C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements



V_{DSS} = 60V

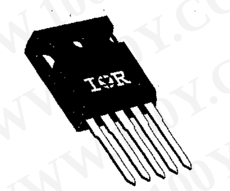
$R_{DS(on)}$ = 0.014Ω

I_D = 70*A

Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The HEXSense device provides an accurate fraction of the drain current through the additional two leads to be used for control or protection of the device. These devices exhibit similar electrical and thermal characteristics as their IRF-series equivalent part numbers. The provision of a kelvin source connection effectively eliminates problems of common source inductance when the HEXSense is used as a fast, high-current switch in non current-sensing applications.



TO-3P HexSense

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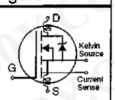
Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10 V	70*	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10 V	64	
I_{DM}	Pulsed Drain Current ①	360	
P_D @ T_C = 25°C	Power Dissipation	230	W
	Linear Derating Factor	1.5	W/°C
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS}	Single Pulse Avalanche Energy ②	640	mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.5	V/ns
T_J, T_{STG}	Operating Junction and Storage Temperature Range	-55 to +175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1 N•m)	

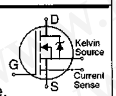
Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	0.65	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	40	

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

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	60	—	—	V	V_{GS}=0V, I_D= 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.056	—	V/°C	Reference to 25°C, I_D= 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.014	Ω	V_{GS}=10V, I_D=54A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	V_{DS}=V_{GS}, I_D= 250µA
g_{fs}	Forward Transconductance	25	—	—	S	V_{DS}=25V, I_D=54A ④
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	µA	V_{DS}=60V, V_{GS}=0V
		—	—	250		V_{DS}=48V, V_{GS}=0V, T_J=150°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS}=20V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS}=-20V
Q_g	Total Gate Charge	—	—	160	nC	I_D=64A
Q_{gs}	Gate-to-Source Charge	—	—	48		V_{DS}=48V
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	54		V_{GS}=10V See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	20	—	ns	V_{DD}=30V
t_r	Rise Time	—	160	—		I_D=64A
$t_{d(off)}$	Turn-Off Delay Time	—	83	—		R_G=6.2Ω
t_f	Fall Time	—	150	—		R_D=0.45Ω See Figure 10 ④
L_D	Internal Drain Inductance	—	5.0	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact 
L_S	Internal Source Inductance	—	13	—		
C_{iss}	Input Capacitance	—	4500	—	pF	V_{GS}=0V
C_{oss}	Output Capacitance	—	2000	—		V_{DS}= 25V
C_{rss}	Reverse Transfer Capacitance	—	300	—		f=1.0MHz See Figure 5
r	Current Sensing Ratio	2190	—	2430	—	I_D=90A, V_{GS}=10V
C_{oss}	Output Capacitance of Sensing Cells	—	9.0	—	pF	V_{GS}=0V, V_{DS}= 25V, f=1.0MHz

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	—	—	70*	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	360		
V_{SD}	Diode Forward Voltage	—	—	2.5	V	T_J=25°C, I_S=90A, V_{GS}=0V ④
t_{rr}	Reverse Recovery Time	—	270	540	ns	T_J=25°C, I_F=64A
Q_{rr}	Reverse Recovery Charge	—	1.1	2.2	µC	di/dt=100A/µs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is neglegible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)

② V_{DD}=25V, starting T_J=25°C, L=92µH R_G=25Ω, I_{AS}=90A (See Figure 12)

③ I_{SD}≤90A, di/dt≤300A/µs, V_{DD}≤$V_{(BR)DSS}$, T_J≤175°C

④ Pulse width ≤ 300 µs; duty cycle ≤2%.

* Current limited by the package, (Die Current =90A)

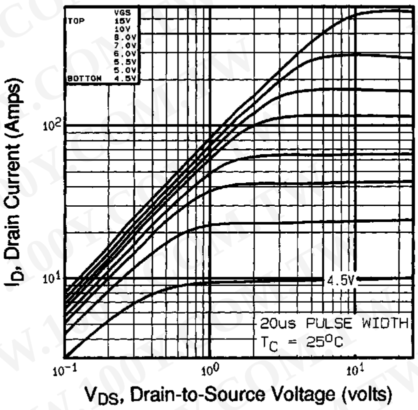


Fig 1. Typical Output Characteristics, T_C=25°C

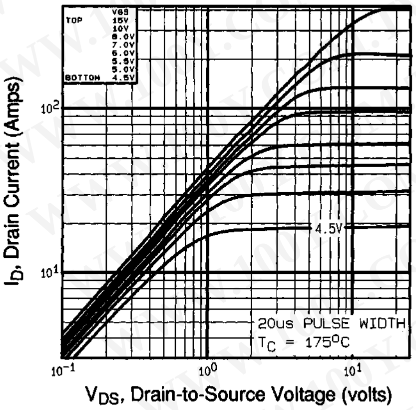


Fig 2. Typical Output Characteristics, T_C=175°C

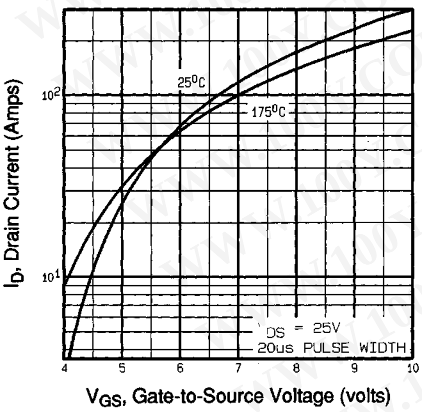


Fig 3. Typical Transfer Characteristics

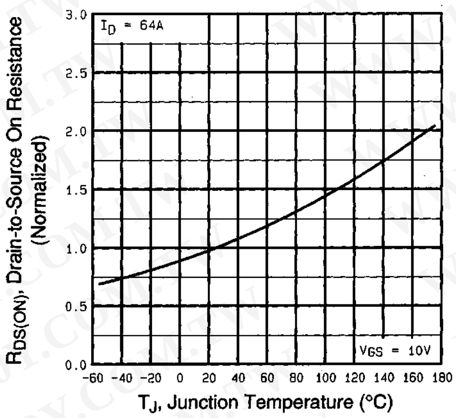


Fig 4. Normalized On-Resistance Vs. Temperature

DATA SHEETS

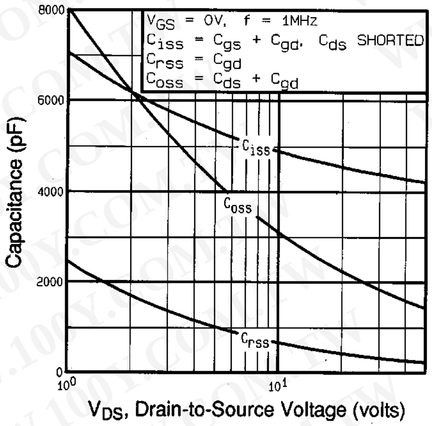


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

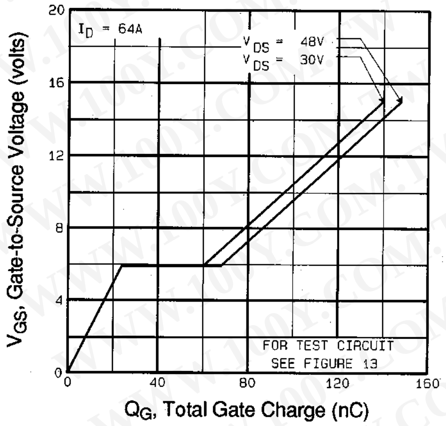


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

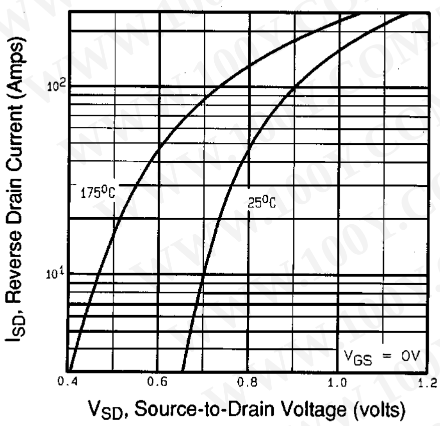


Fig 7. Typical Source-Drain Diode Forward Voltage

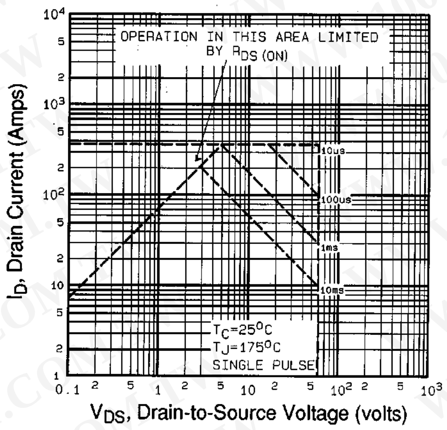


Fig 8. Maximum Safe Operating Area

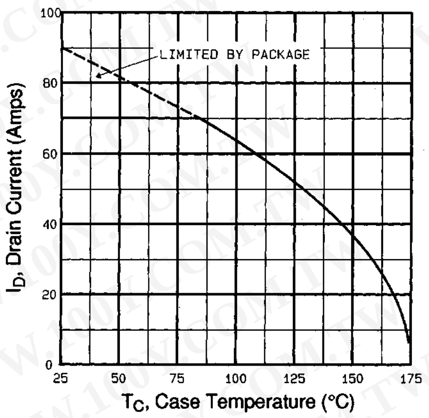


Fig 9. Maximum Drain Current Vs. Case Temperature

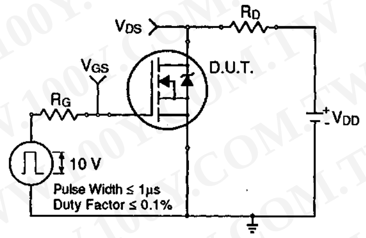


Fig 10a. Switching Time Test Circuit

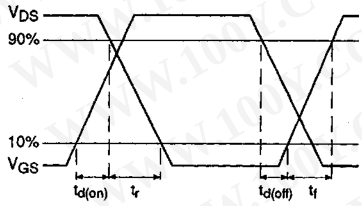


Fig 10b. Switching Time Waveforms

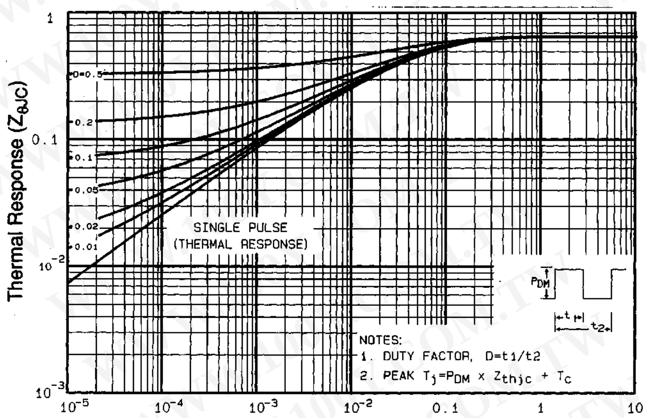


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

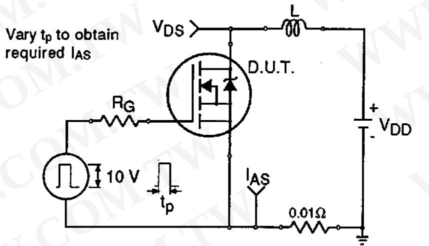


Fig 12a. Unclamped Inductive Test Circuit

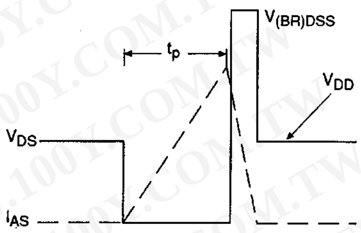


Fig 12b. Unclamped Inductive Waveforms

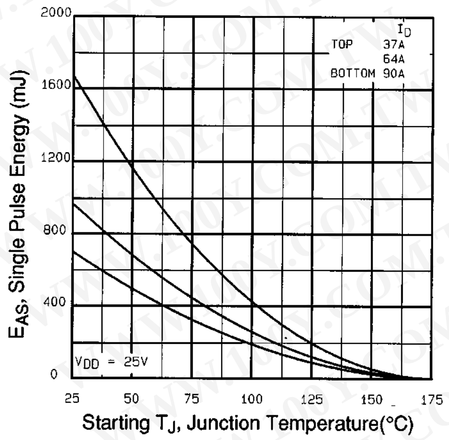


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

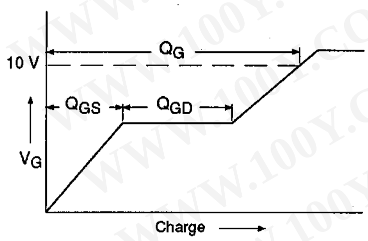


Fig 13a. Basic Gate Charge Waveform

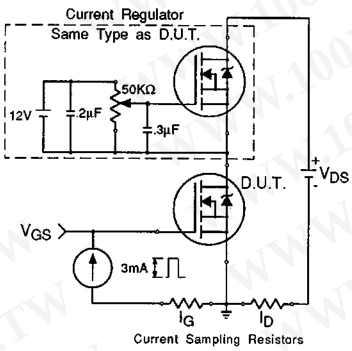


Fig 13b. Gate Charge Test Circuit

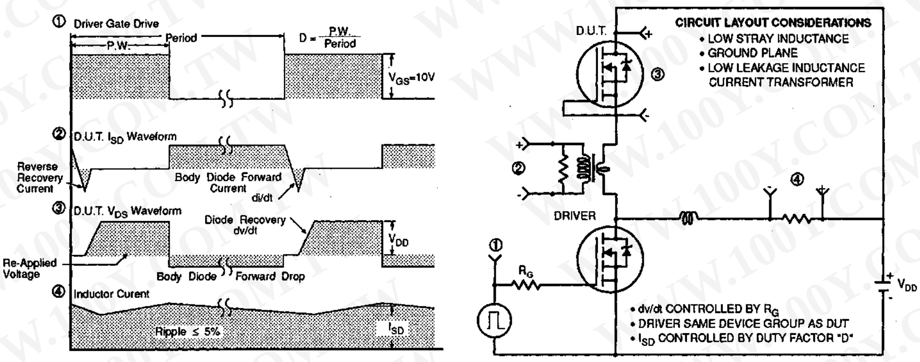


Fig 14. Peak Diode Recovery dv/dt Test Circuit

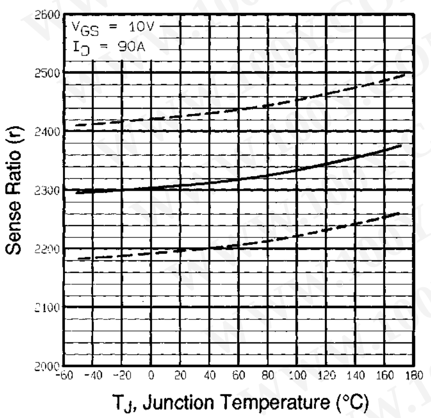


Fig 15. Typical HEXSense Ratio Vs. Junction Temperature

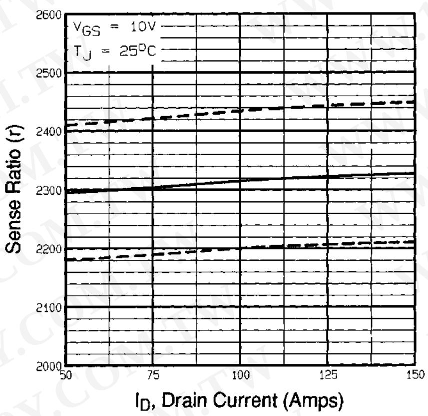


Fig 16. Typical HEXSense Ratio Vs. Drain Current

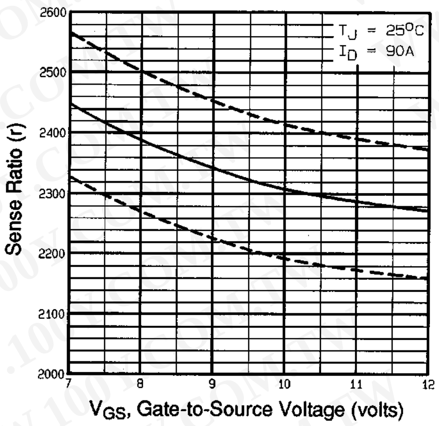


Fig 17. Typical HEXSense Ratio Vs. Gate Voltage

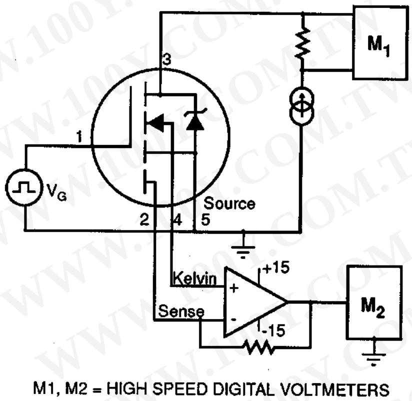


Fig 18. HEXSense Ratio Test Circuit

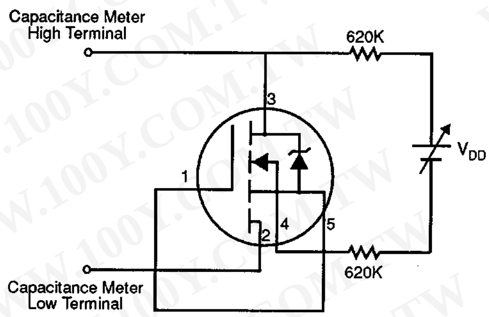


Fig 19. HEXSense Sensing Cell Output Capacitance Test Circuit

Appendix B: Package Outline Mechanical Drawing – See page 1512

Appendix C: Part Marking Information – See page 1517

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