

INTERNATIONAL RECTIFIER

T-39-27
INTERNATIONAL RECTIFIER **IR**



HEXPAK POWER MODULE

IRFK4H250

IRFK4H251

Isolated Base Power HEXFET® Parallel Assembly

200 Volt, 21 mΩ HEXPAK

The HEXFET® technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry and unique processing of the HEXFET design achieve very low on-state resistance combined with high transconductance and extreme device ruggedness.

The superior HEXFET technology has been coupled to the state of the art assembling techniques adopted for all International Rectifier isolated base modules. This multiple die package is ideally suited for high power applications where space saving and ease of assembling is important. Applications include uninterruptible power supplies, motor drive controls, switching power supplies, and high frequency welders.

Features:

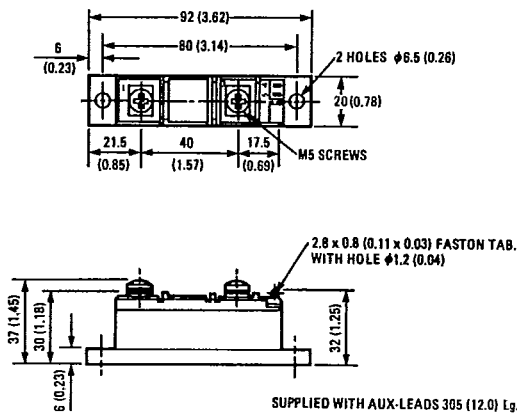
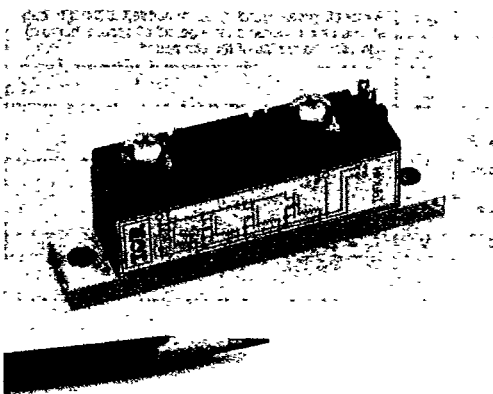
- High Current Capability
- Fast Switching
- Low Drive Current
- No Second Breakdown
- Ease of Paralleling
- Electrically Isolated Base Plate

Product Summary

Part Number	V _{DS}	R _{DS(on)}	I _D
IRFK4H250	200V	21 mΩ	108A
IRFK4H251	150V	21 mΩ	108A

MODULE
DEVICES

CASE STYLE AND DIMENSIONS



Similar to JEDEC Outline TO-240AA
 Dimensions in Millimeters (Inches)

Absolute Maximum Ratings

Parameter	IRFK4H250	IRFK4H251	Units
V_{DS} Drain-Source Voltage ①	200	150	V
V_{DGR} Drain-Gate Voltage ($R_{GS} = 10\text{ k}\Omega$) ①	200	150	V
I_D @ $T_C = 25^\circ\text{C}$ Continuous Drain Current	108	108	A
I_D @ $T_C = 100^\circ\text{C}$ Continuous Drain Current	68	68	A
I_{DM} Pulsed Drain Current	380	380	A
V_{GS} Gate-Source Voltage	20	20	V
P_D @ $T_C = 25^\circ\text{C}$ Max. Power Dissipation	500	500	W
Linear Derating Factor	4	4	W/K
I_{LM} Inductive Current, Clamped	380	380	A
T_J Operating Junction and Storage Temperature Range	-55 to 150		$^\circ\text{C}$
di/dt Max. Rate of Change of Current at Turn-Off	See Fig. 15		A/ μs

Electrical Characteristics @ $T_C = 25^\circ\text{C}$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS} Drain-Source Breakdown Voltage	IRFK4H150	200	—	—	V	$V_{GS} = 0\text{V}, I_D = 1.0\text{ mA}$
	IRFK4H151	150	—	—	V	
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 1.0\text{ mA}$
I_{GSS} Gate-Source Leakage Forward	ALL	—	—	400	nA	$V_{GS} = 20\text{V}$
I_{GSS} Gate-Source Leakage Reverse	ALL	—	—	-400	nA	$V_{GS} = -20\text{V}$
I_{DSS} Zero Gate Voltage Drain Current	ALL	—	—	1000	μA	$V_{DS} = V_{DS\text{ Max}}, V_{GS} = 0\text{V}$
		—	—	4.0	mA	$V_{DS} = V_{DS\text{ Max.}} \times 0.8, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$
$R_{DS(on)}$ Static Drain-Source On-State Resistance	ALL	—	18	21	m Ω	$V_{GS} = 10\text{V}, I_D = 64\text{A}$
g_{fs} Forward Transconductance	ALL	36	44	—	S(0)	$V_{DS} > I_{D(on)} \times R_{DS(on)max}, I_D = 64\text{A}$
C_{iss} Input Capacitance	ALL	—	8.0	12.0	nF	$V_{GS} = 0\text{V}, V_{DS} = 25\text{V}, f = 1.0\text{ MHz}$
C_{oss} Output Capacitance	ALL	—	4.0	6.0	nF	
C_{rss} Reverse Transfer Capacitance	ALL	—	1.4	2.0	nF	$V_{DD} = 95\text{V}, I_D = 40\text{A}, V_{GS} = 10\text{V}, R_{Source} = 3.3\Omega$
$t_{d(on)}$ Turn On Delay Time	ALL	—	—	45	ns	
t_r Rise Time	ALL	—	—	290	ns	
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	—	160	ns	
t_f Fall Time	ALL	—	—	140	ns	$V_{GS} = 10\text{V}, I_D = 152\text{A}, V_{DS} = V_{DS\text{ Max.}} \times 0.8$
Q_g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	320	480	nC	
Q_{gs} Gate-Source Charge	ALL	—	150	—	nC	
Q_{gd} Gate-Drain ("Miller") Charge	ALL	—	170	—	nC	
V_{INS} Isolation Voltage	ALL	2.5	—	—	kV	Circuit to Base
L_{DS} Drain-Source Inductance	ALL	—	18	—	nH	

Thermal and Mechanical Specifications

R_{thJC} Junction-to-Case	ALL	—	—	0.25	K/W	Per module
R_{thCS} Case-to-Sink	ALL	—	0.1	—	K/W	Mounting surface flat, smooth, and greased
T Mounting torque + 10% HEXPAK to heatsink	ALL	—	5	—	Nm	A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound.
Busbar to HEXPAK	ALL	—	3	—	Nm	
wt Approximate weight	ALL	—	140	—	g oz	

Source-Drain Diode Ratings and Characteristics

I_S Continuous Source Current (Body Diode)	ALL	—	—	108	A	$T_C = 25^\circ\text{C}, I_S = 120\text{A}, V_{GS} = 0\text{V}$
I_{SM} Pulse Source Current (Body Diode)	ALL	—	—	380	A	
V_{SD} Diode Forward Voltage	ALL	—	—	2.0	V	$T_J = 150^\circ\text{C}, I_F = 120\text{A}, di_{pk}/dt = 100\text{A}/\mu\text{s}$
t_{rr} Reverse Recovery Time	ALL	—	750	—	ns	
Q_{RR} Reverse Recovered Charge	ALL	—	19	—	μC	

① $T_J = 25^\circ\text{C}$ to 150°C

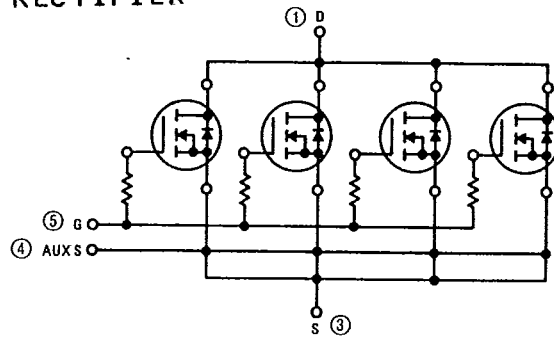


Fig. a - Circuit Configuration

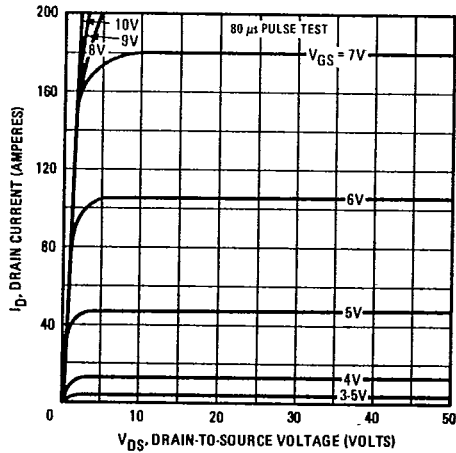


Fig. 1 - Typical Output Characteristics

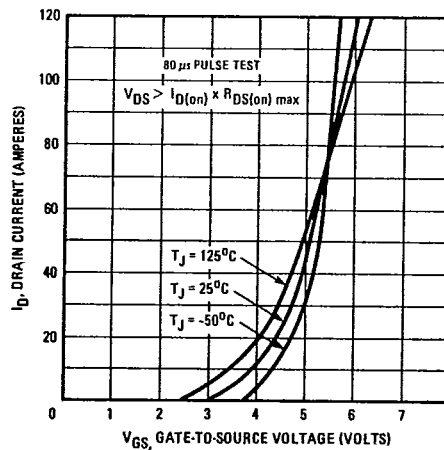


Fig. 2 - Typical Transfer Characteristics

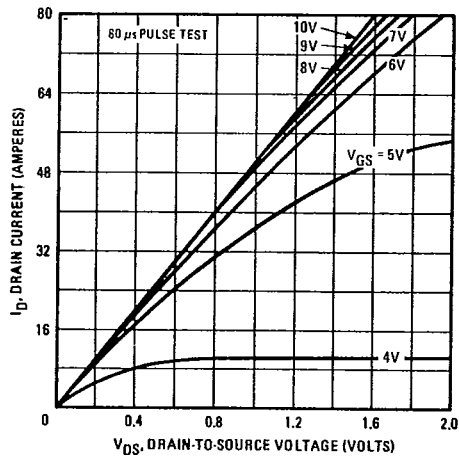


Fig. 3 - Typical Saturation Characteristics

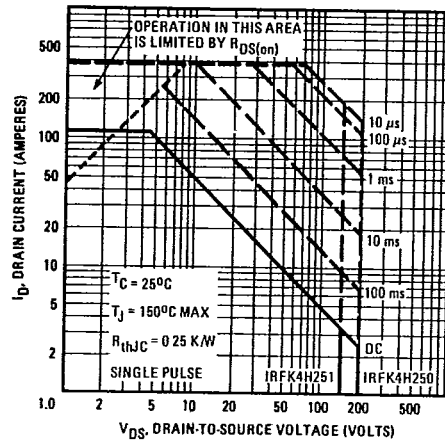


Fig. 4 - Maximum Safe Operating Area

MODULE
DEVICES

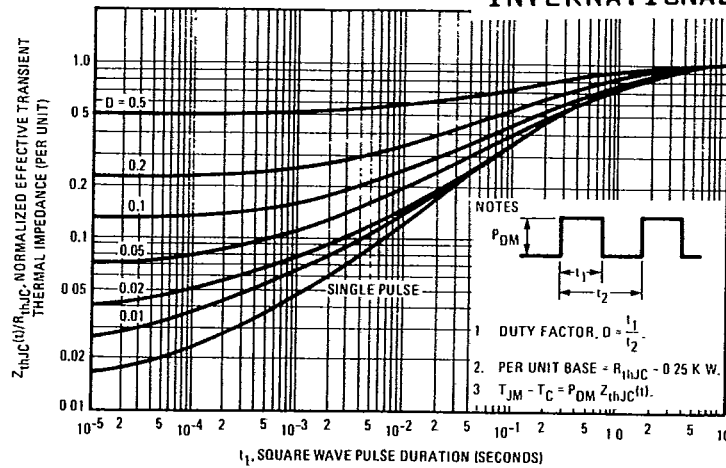


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

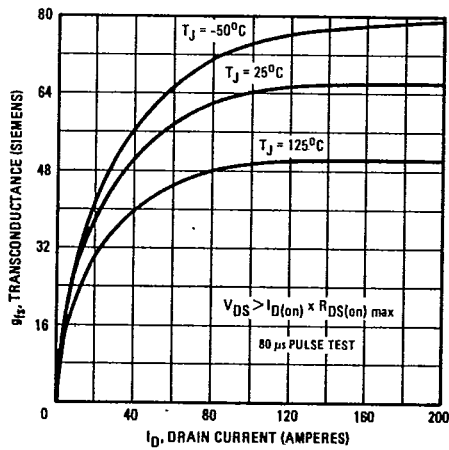


Fig. 6 — Typical Transconductance Vs. Drain Current

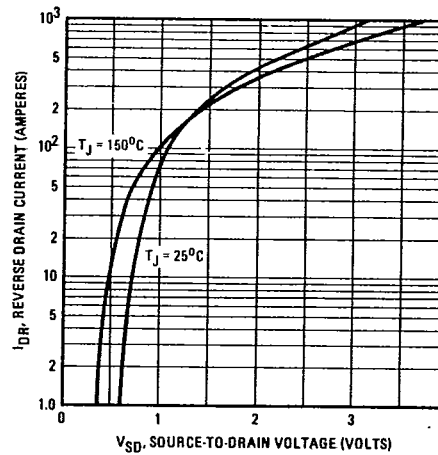


Fig. 7 — Typical Source-Drain Diode Forward Voltage

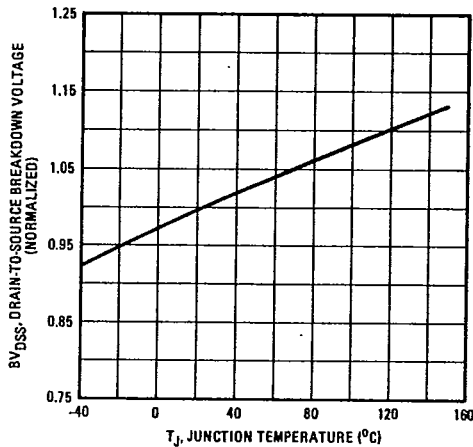


Fig. 8 — Breakdown Voltage Vs. Temperature

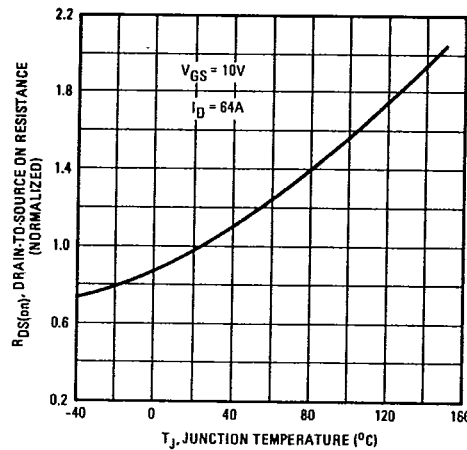


Fig. 9 — Normalized On-Resistance Vs. Temperature

INTERNATIONAL RECTIFIER

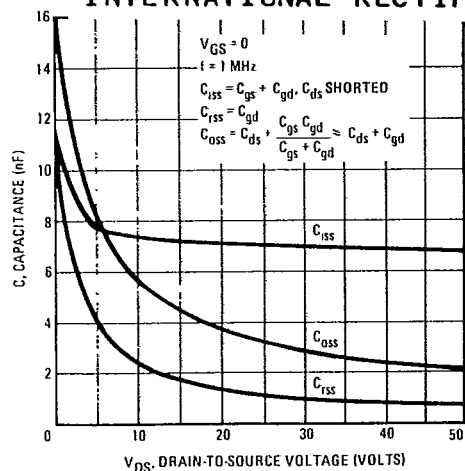


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

IRFK4H250, IRFK4H251 Devices

T-39-27

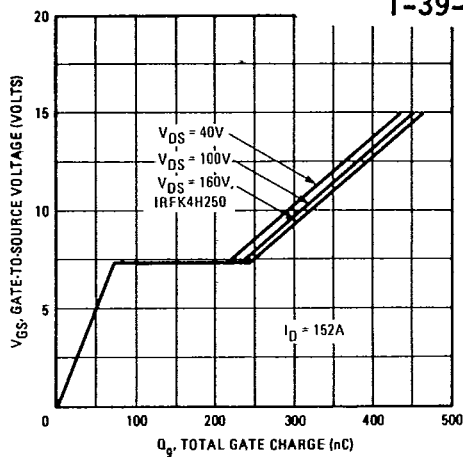


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

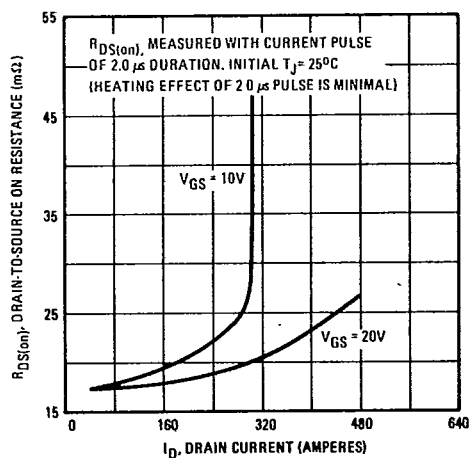


Fig. 12 — Typical On-Resistance Vs. Drain Current

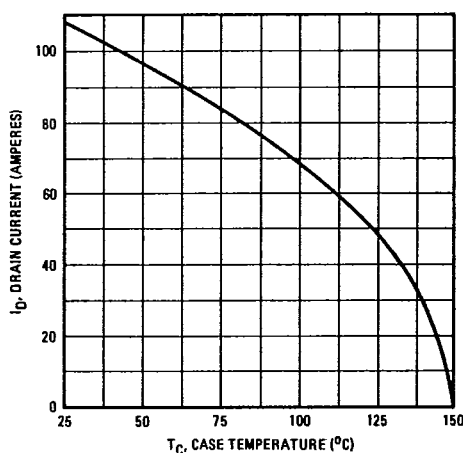


Fig. 13 — Maximum Drain Current Vs. Case Temperature

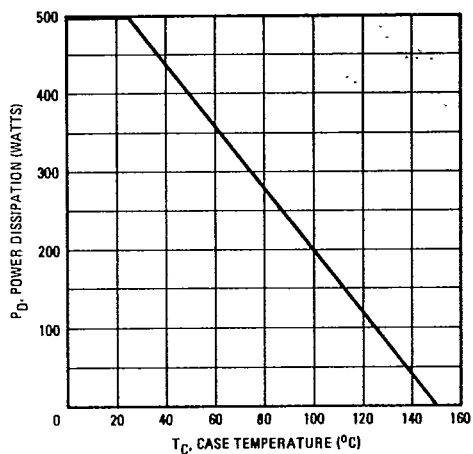


Fig. 14 — Power Vs. Temperature Derating Curve

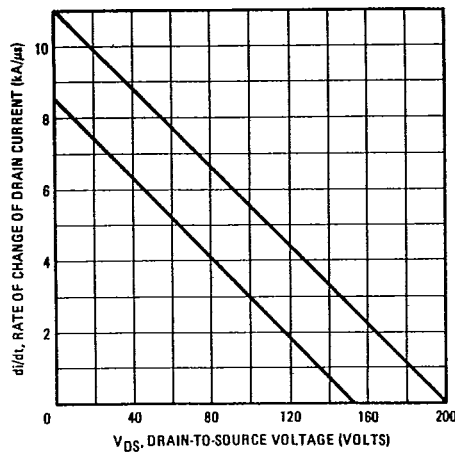
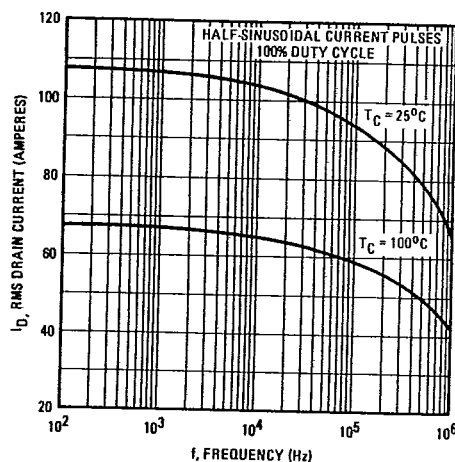


Fig. 15 — Maximum Rate of Change of Drain Current Vs. Drain-to-Source Voltage

MODULE
DEVICES



T-39-27

Fig. 16 — Maximum Continuous Drain Current Vs. Frequency Derating

The Do's and Don'ts of Using HEXPAK Power Modules

We can summarize some of the most common recommendations on using HEXPAK Power Modules as follows:

- a) Observe mounting recommendations for optimum thermal performance and enhanced reliability during operation.
- b) Keep the length of the leads to the auxiliary terminals as short as possible. **DO NOT USE THE SOURCE POWER CONNECTORS** for gate circuit return connections, **USE THE AUXILIARY SOURCE CONNECTOR.**
- c) Maintain turn-off drive circuit impedances as low as possible. It is even more desirable to use gate-source reverse biasing in high dv/dt environments.
- d) Use gate zener clamps.
- e) Pay attention to the di/dt vs V_{DS} curve in the data.
- f) Make due allowances for drain current in high frequency applications. Refer to Figure 16.
- g) Ensure good layout practice is adhered to in the design of the power circuit to minimize undesirable perturbations and interference.
- h) Always decouple the power circuit locally.
- i) Ensure turn-off snubbers are in close proximity with the power terminals.
- j) Do not use principles of false economy in selection of decoupling and snubber components.

Almost all of the precautions advised above are fundamental. Observation of these few precautions on the other hand will ensure long and trouble-free operation of the circuit. Of greater significance, adherence to these few precautions is rewarded by the enhanced design-in simplicity offered by these power modules.

