Data Sheet No. PD-9.452B

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T-39-27

HEXPAK POWER MODULE
IRFK2D350
IRFK2D351

U.L. RECOGNIZED
File no E78996

Isolated Base Power HEXFET® Assembly
Half Bridge Configuration

400 Volt, 150 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:

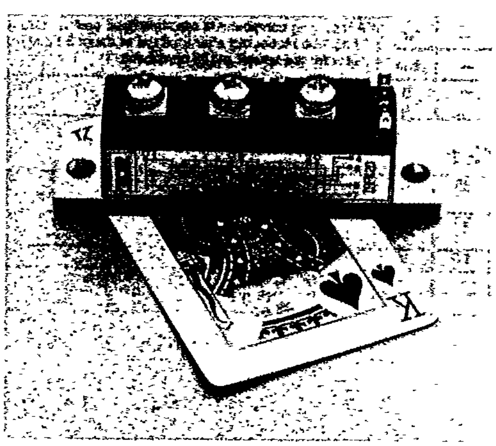
- High Current Capability
- Fast Switching
- Low Drive Current
- No Second Breakdown
- Ease of Paralleling
- Electrically Isolated Base Plate

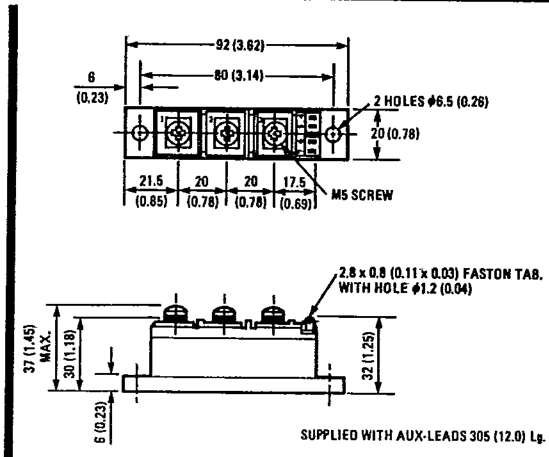
Product Summary

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRFK2D350	400V	150 mΩ	25A
IRFK2D351	350V	150 mΩ	25A

MODULE DEVICES

CASE STYLE AND DIMENSIONS





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

Absolute Maximum Ratings

Parameter		IRFK2D350	IRFK2D351	Units
V_{DS}	Drain-Source Voltage ①	400	350	V
V_{DGR}	Drain-Gate Voltage (R_{GS} = 10 kΩ) ①	400	350	V
I_D @ T_C = 25°C	Continuous Drain Current	25	25	A
I_D @ T_C = 100°C	Continuous Drain Current	16	16	A
I_{DM}	Pulsed Drain Current	95	95	A
V_{GS}	Gate-Source Voltage	20	20	V
P_D @ T_C = 25°C	Max. Power Dissipation	500	500	W
	Linear Derating Factor	4	4	W/K
I_{LM}	Inductive Current, Clamped	95	95	A
T_J T_{stg}	Operating Junction and Storage Temperature Range	−55 to 150		°C
di/dt	Max. Rate of Change of Current at Turn-Off	See Fig. 15		A/μs

Electrical Characteristics @ T_C = 25°C (Unless Otherwise Specified)

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain-Source Breakdown Voltage	IRFK2D350	400	—	—	V	V_{GS} = 0V, I_D = 500 μA
		IRFK2D351	350	—	—	V	
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	—	4.0	V	V_{DS} = V_{GS}, I_D = 500 μA
I_{GSS}	Gate-Source Leakage Forward	ALL	—	—	200	nA	V_{GS} = 20V
I_{GSS}	Gate-Source Leakage Reverse	ALL	—	—	−200	nA	V_{GS} = −20V
I_{DSS}	Zero Gate Voltage Drain Current	ALL	—	—	500	μA	V_{DS} = V_{DS} Max, V_{GS} = 0V
			—	—	2.0	mA	V_{DS} = V_{DS} Max. × 0.8, V_{GS} = 0V, T_C = 125°C
$R_{DS(on)}$	Static Drain-Source On-State Resistance	ALL	—	120	150	mΩ	V_{GS} = 10V, I_D = 16A
g_{fs}	Forward Transconductance	ALL	16	24	—	S(℧)	V_{DS} > $I_{D(on)}$ × $R_{DS(on)max.}$, I_D = 16A
C_{iss}	Input Capacitance	ALL	—	4000	6000	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0 MHz
C_{oss}	Output Capacitance	ALL	—	800	1200	pF	
C_{rss}	Reverse Transfer Capacitance	ALL	—	200	400	pF	
$t_{d(on)}$	Turn-On Delay Time	ALL	—	—	45	ns	V_{DD} = 180V, I_D = 16A, V_{GS} = 10V, R_{Source} = 3.3Ω
t_r	Rise Time	ALL	—	—	65	ns	
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	—	170	ns	
t_f	Fall Time	ALL	—	—	75	ns	
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	160	240	nC	V_{GS} = 10V, I_D = 36A, V_{DS} = 320V
Q_{gs}	Gate-Source Charge	ALL	—	75	—	nC	
Q_{gd}	Gate-Drain ("Miller") Charge	ALL	—	85	—	nC	
V_{INS}	R.M.S. Isolation Voltage	ALL	2.5	—	—	kV	Circuit to Base
L_{DS}	Drain-Source Inductance	ALL	—	18	—	nH	

Thermal and Mechanical Specifications

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
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 5	—	g oz	

Source-Drain Diode Ratings and Characteristics

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	ALL	—	—	25	A	
I_{SM}	Pulse Source Current (Body Diode)	ALL	—	—	95	A	
V_{SD}	Diode Forward Voltage	ALL	—	—	1.6	V	T_C = 25°C, I_S = 30A, V_{GS} = 0V
t_{rr}	Reverse Recovery Time	ALL	—	1000	—	ns	T_J = 150°C, I_F = 30A, di_F/dt = 100A/μs
Q_{RR}	Reverse Recovered Charge	ALL	—	13.2	—	μC	

① T_J = 25°C to 150°C

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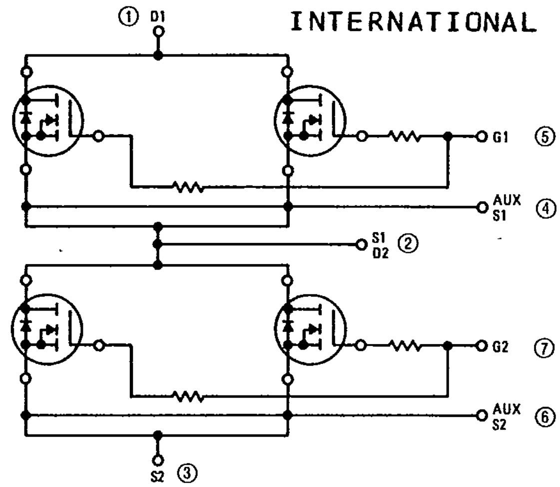

Fig. a — Circuit Configuration

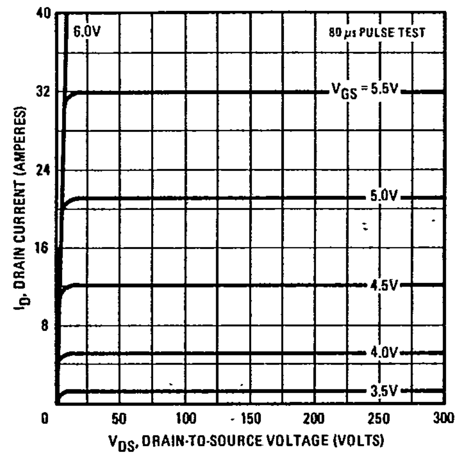

Fig. 1 — Typical Output Characteristics

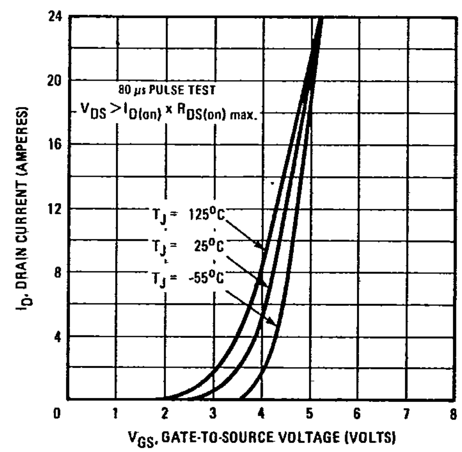

Fig. 2 — Typical Transfer Characteristics

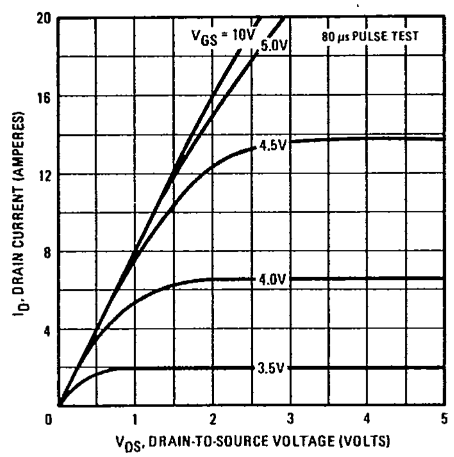

Fig. 3 — Typical Saturation Characteristics

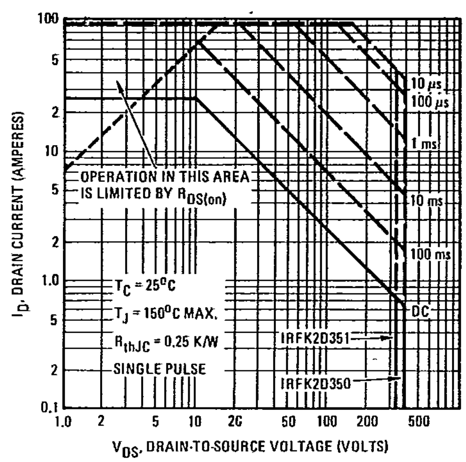

Fig. 4 — Maximum Safe Operating Area (Per Arm)

MODULE DEVICES

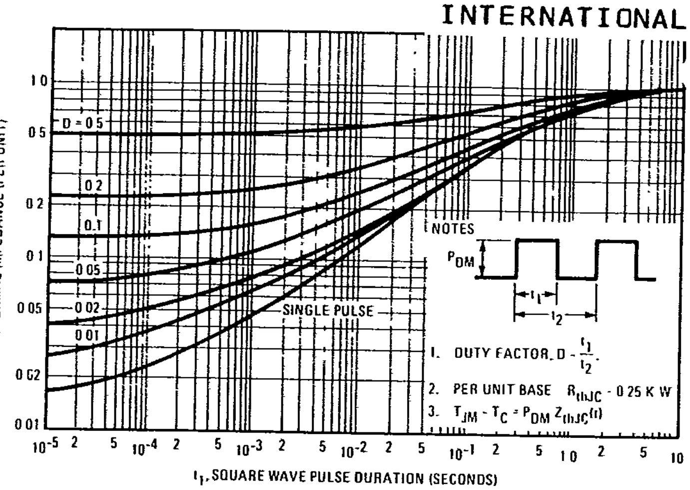

Fig. 5 — Maximum Effective Transient Thermal Impedance Junction-to-Case Vs. Pulse Duration

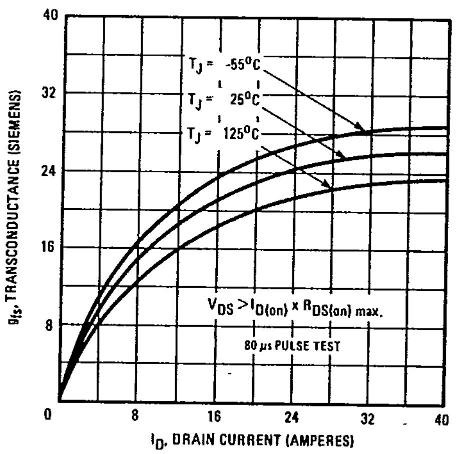

Fig. 6 — Typical Transconductance Vs. Drain Current

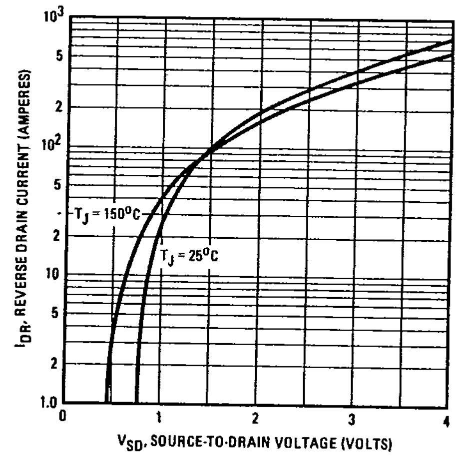

Fig. 7 — Typical Source-Drain Diode Forward Voltage

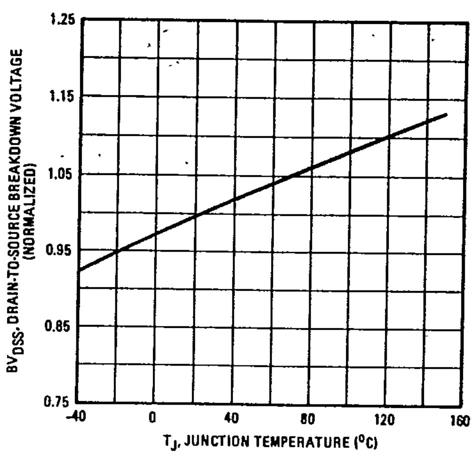

Fig. 8 — Breakdown Voltage Vs. Temperature

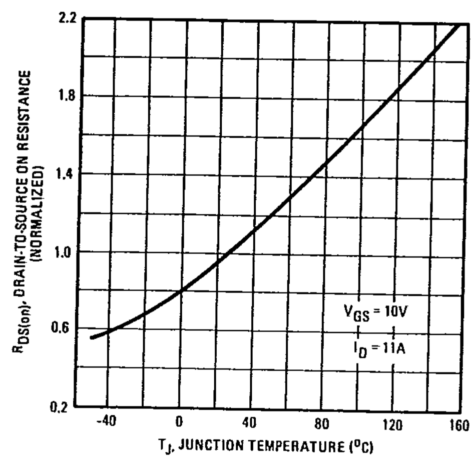

Fig. 9 — Normalized On-Resistance Vs. Temperature

IRFK2D350, IRFK2D351 Devices

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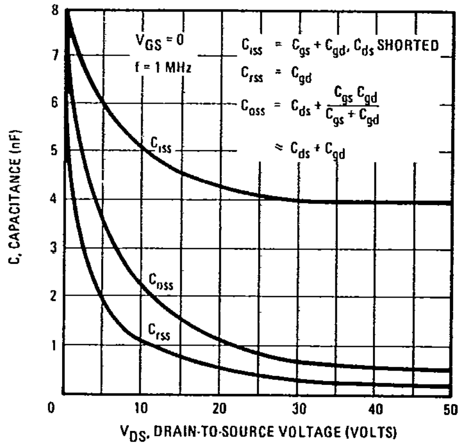

Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

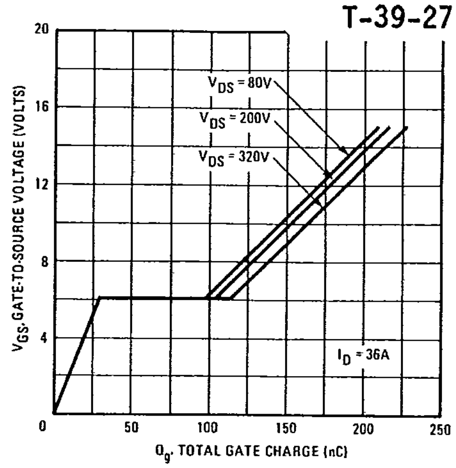

Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

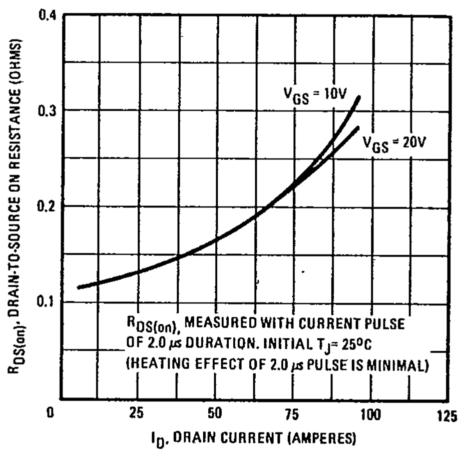

Fig. 12 — Typical On-Resistance Vs. Drain Current

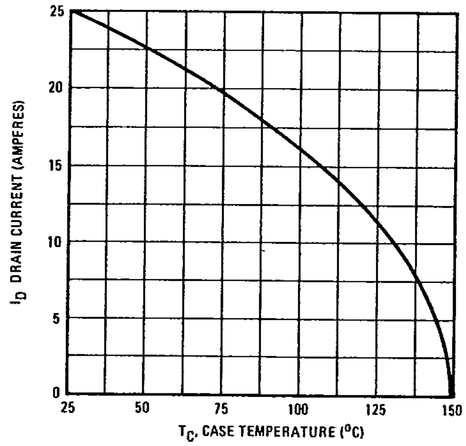

Fig. 13 — Maximum Drain Current Vs. Case Temperature

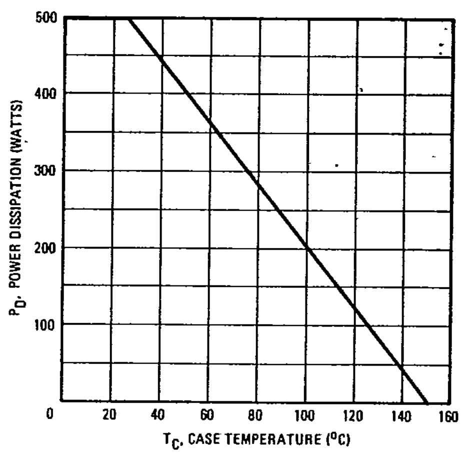

Fig. 14 — Power Vs. Temperature Derating Curve

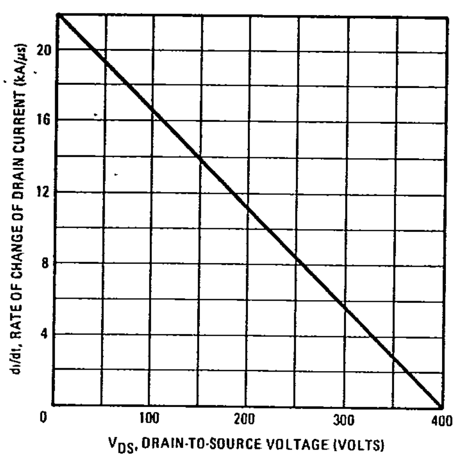

Fig. 15 — Maximum Rate of Change of Drain Current Vs. Drain-to-Source Voltage

MODULE DEVICES

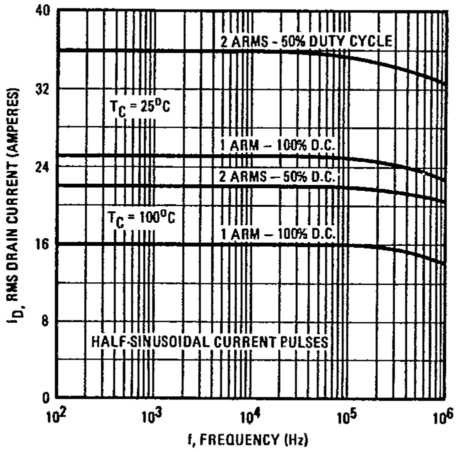

Fig. 16 — Maximum Continuous Drain Current Vs. Frequency Derating

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.

CAUTION

SENSITIVE ELECTRONIC DEVICES

DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC OR RADIOACTIVE FIELDS.

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. . . because your company cares.