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Bulletin E2794

International Rectifier IRFK2D450, IRFK2F450

Isolated Base Power HEX-pak™ Assembly - Half Bridge Configuration

- High Current Capability.
- UL recognised E78996.
- Electrically Isolated Base Plate.
- Easy Assembly into Equipment.

Description

The HEX-pak™ utilises the well-proven HEXFET™ die, combining low on-state resistance with high transconductance. These superior technology die are assembled by state of the art techniques into the TO-240 package, featuring 2.5kV rms isolation and solid M5 screw connections. The small footprint means the package is highly suited to power applications where space is a premium. Available in two versions, IRFK.D... for fast switching and IRFK.F... for oscillation sensitive applications.

$$V_{DS} = 500V$$
$$R_{DS(on)} = 200m\Omega$$
$$I_D = 22A$$

Absolute Maximum Rating

	Parameter	Max.	Units
$I_D @ T_C=25^\circ C$	Continuous Drain Current	22	A
$I_D @ T_C=100^\circ C$	Continuous Drain Current	14	A
I_{DM}	Pulse Drain Current	88	A ①
$P_D @ T_C=25^\circ C$	Maximum Power Dissipation	500	W
V_{GS}	Gate-to-Source Voltage	20	V
V_{INS}	R.M.S. Isolation Voltage, circuit to base	2.5	kV
T_J	Operating Junction Temperature Range	-40 to 150	°C
T_{STG}	Storage Temperature Range	-40 to 150	°C

Thermal and Mechanical Specifications

	Parameter	Min.	Typ.	Max.	Units
R_{thJC}	Junction-to-Case	-	-	0.25	K/W ②
R_{thCS}	Case-to-Sink, smooth & greased surface	-	0.1	-	K/W
T	Mounting Torque +10%				③
	HEXpak to Heatsink	-	5	-	Nm
	Busbar to HEXpak	-	3	-	Nm
wt	Approximate Weight	-	140	-	g
		-	5	-	oz

Notes:

① Repetitive Rating: Pulse width limited by maximum junction temperature see figure 8.

② - Per Module.

③ A mounting compound is recommended and the torque should be rechecked after a period of three hours to allow for the spread of the compound.



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Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (Unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
B_{VDSS}	Drain-to-Source Breakdown voltage	500	-	-	V	$V_{GS}=0V, I_D=1.0mA$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	-	160	200	m Ω	$V_{GS}=10V, I_D=14A$
$I_{D(on)}$	On-State Drain Current	22	-	-	A	$V_{DS} > I_{D(on)} \times R_{DS(on)} \text{max}, V_{GS}=10V$
$V_{GS(th)}$	Gate Threshold Voltage	2.0	-	4.0	V	$V_{DS}=V_{GS}, I_D=1.0mA$
g_{fs}	Forward Transconductance ^④	16	26	-	S	$V_{DS} > 50V, I_D=14A$
I_{DSS}	Zero Gate Voltage Drain Current	-	-	0.5	mA	$V_{DS}=V_{DS} \text{max}, V_{GS}=0V$
		-	-	2.0	mA	$V_{GS}=10V, T_C=125^\circ\text{C}, V_{DS}=V_{DS} \text{max} \times 0.8$
I_{GSS}	Gate-to-Source Leakage Forward	-	-	200	nA	$V_{GS}=20V$
I_{GSS}	Gate-to-Source Leakage Reverse	-	-	-200	nA	$V_{GS}=20V$
Q_g	Total Gate Charge	-	225	260	nC	$I_D=22A, V_{GS}=10V,$
Q_{gs}	Gate-to-Source Charge	-	22	34	nC	$V_{DS}=V_{DS} \text{max} \times 0.8$
Q_{gd}	Gate-to-Drain ("Miller") Charge	-	86	128	nC	
$t_{d(on)}$	Turn-on Delay Time	IRFK2D450 IRFK2F450	- 40	- 45	- ns	$V_{DD}=210V, I_D=14A,$
t_r	Rise Time	IRFK2D450 IRFK2F450	- 50	- 65	- ns	$V_{GS}=10V,$
$t_{d(off)}$	Turn-off Delay Time	IRFK2D450 IRFK2F450	- 190	- 250	- ns	$R_{SOURCE}=3.3\Omega$
t_f	Fall Time	IRFK2D450 IRFK2F450	- 40	- 65	- ns	
L_{DS}	Drain-to-Source Inductance	-	18	-	nH	
C_{iss}	Input Capacitance	-	5.5	-	nF	$V_{GS}=0V, V_{DS}=25V,$
C_{oss}	Output Capacitance	-	1.2	-	nF	$f=1.0MHz$
C_{rss}	Reverse Transfer Capacitance	-	0.35	-	nF	
	Linear Derating Factor	-	-	4	W/K	

Source-Drain Diode Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	-	-	22	A	
I_{SM}	Pulsed Source Current (Body Diode)	-	-	80	A	
V_{SD}	Diode Forward Voltage	-	-	1.4	V	$V_{GS}=0V, I_S=22A, T_C=25^\circ\text{C}$
t_{rr}	Reverse Recovery Time	280	580	1200	ns	$di/dt=200A/\mu s, T_J=150^\circ\text{C}$
Q_{rr}	Reverse Recovered Charge	6.4	13.5	30.0	μC	$I_S=22A$

Notes:

④ - Pulse Width $\leq 300\mu s$; Duty cycle $\leq 2\%$.



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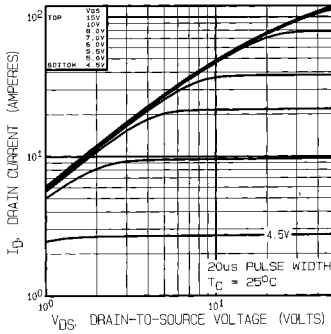


Fig 1. Typical Output Characteristics,
 $T_C=25^\circ\text{C}$

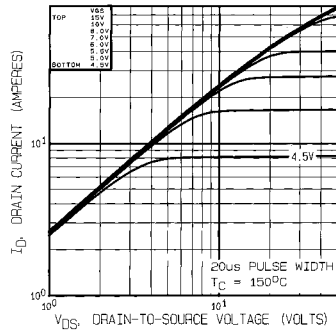


Fig 2. Typical Output Characteristics,
 $T_C=150^\circ\text{C}$

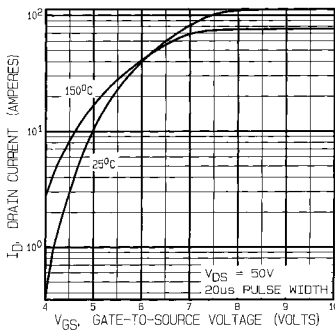


Fig 3. Typical Transfer Characteristics

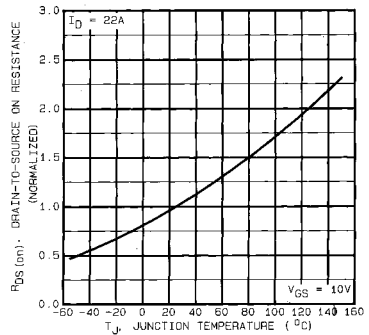


Fig 4. Normalized On-Resistance Vs.
Temperature

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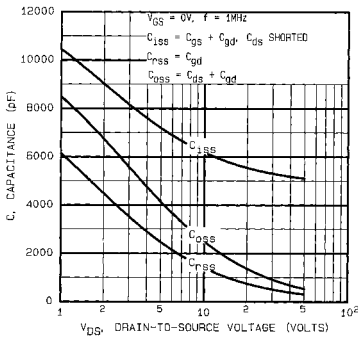


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

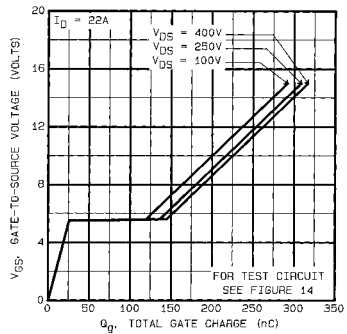


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

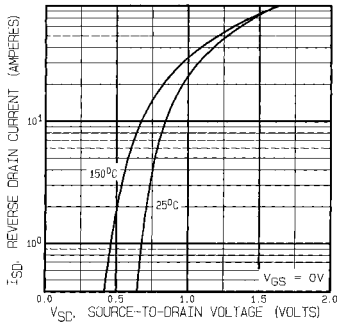


Fig 7. Typical Source-Drain Diode Forward Voltage

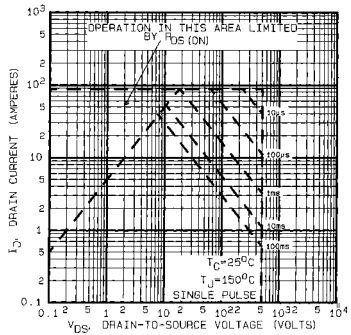


Fig 8. Maximum Safe Operating Area

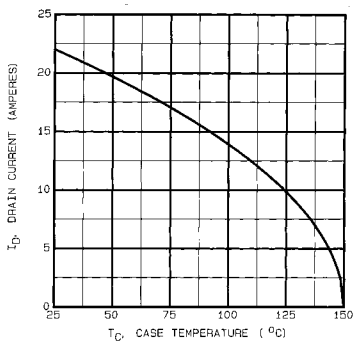


Fig 9. Maximum Drain Current Vs. Case Temperature

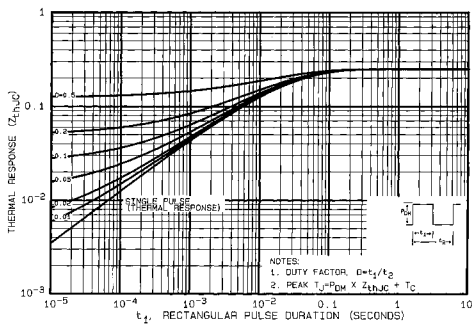


Fig 10. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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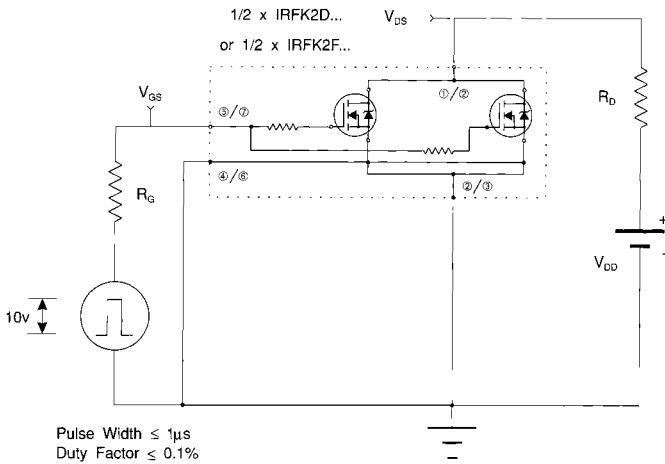


Fig 11a. Switching Time Test Circuit

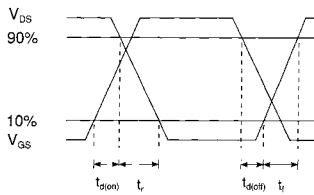
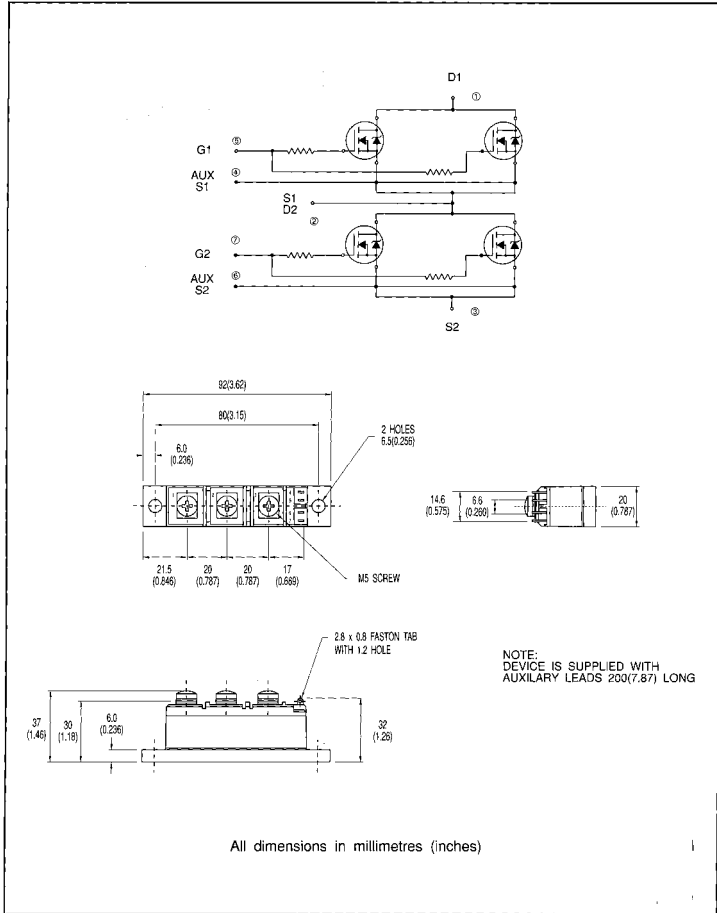


Fig 11b. Switching Time Waveforms



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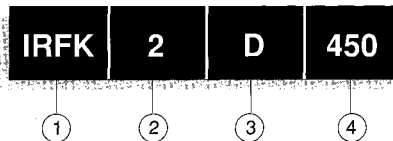
Circuit Configuration and Outline



IRFK2D450,IRFK2F450



Part Numbering



1. - HEX-pak Module.
2. - Number of arms of bridge.
3. - D - Fast switching.
- F - Oscillation resistant for sensitive applications.
4. - Voltage code:-
054 - 60V
150 - 100V
250 - 200V
350 - 400V
450 - 500V
C50 - 600V

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