

**International**  
**IR Rectifier**

# HEXFET® Power Module

**IRFT001 & IRFT002**  
**3-Phase Bridges**

## Description/Features

The IRFT series of HEXFET power modules are intended for use in driving sub-fractional horsepower dc brushless motors. These three-phase bridges are offered in voltages from 60 to 100V, with current ratings up to 6.0 amperes.

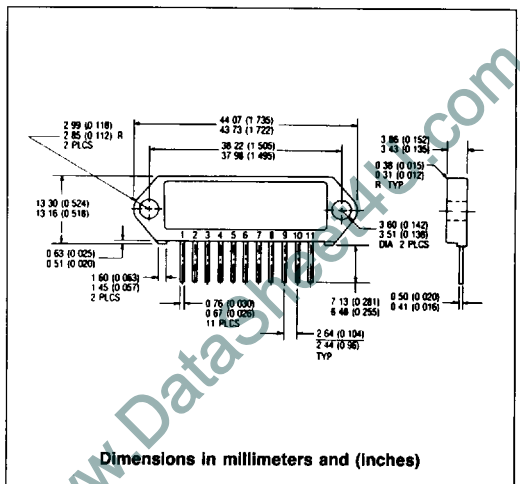
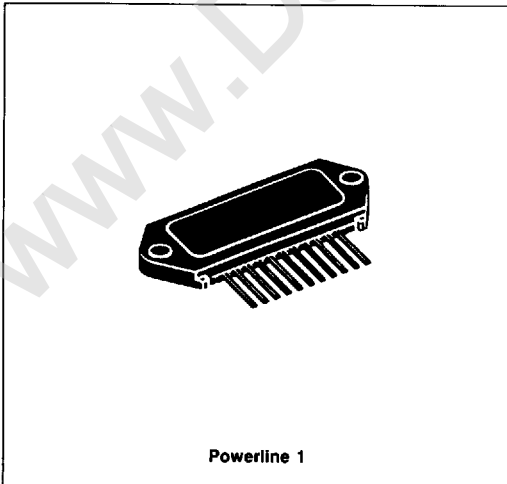
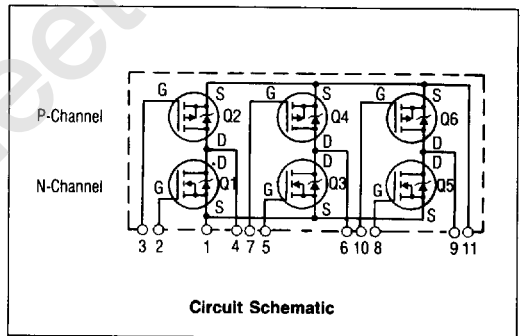
The IRFT series simplifies circuit design and construction by replacing six discrete devices with a single, electrically isolated and tested part. These modules minimize the space requirements of your power components while also providing thermal management and reduced assembly time and cost.

## Typical Applications:

- Disk and tape drives
- Small appliances
- Robotics
- Printers and plotters
- Process controls

## Product Summary

Part Number	V <sub>DS</sub>	R <sub>DS</sub> (on)		I <sub>D</sub>
		Low Side	High Side	
IRFT001	100V	0.27Ω	0.28Ω	3.9A
IRFT002	60V	0.10Ω	0.28Ω	6.0A



**Absolute Maximum Ratings**

Parameter	IRFT001	IRFT002	Units	Conditions/Notes
Breakdown Voltage	100	60	V	
Gate-to-Source Voltage	±20			
Continuous Current	3.9	6.0*	A	Any two complementary devices, T <sub>C</sub> = 25°C *Package limited
	3.5	6.0*		Any two complementary devices, T <sub>C</sub> = 45°C *Package limited
	2.5	4.6		Any two complementary devices, T <sub>C</sub> = 100°C
Operating & Storage Temperature	-40 to +150		°C	
Lead Temperature	300			1.6mm (0.063") from case for 10 sec
Mounting Torque	2.5 to 3.5		in * lb	For mounting & assy recommendations, see page 86
RMS Isolation Voltage	2500		V	Any pin to case

**HEXFET Electrical Characteristics @ T<sub>C</sub> = 25°C (Unless otherwise specified)**

Parameter	Type	IRFT001	IRFT002	Units	Conditions/Notes
BV <sub>DSS</sub> Min. Drain Source Breakdown	N-Channel	100	60	V	V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA, T <sub>J</sub> = 25°C to 150°C
	P-Channel	-100	-60		
V <sub>GS(th)</sub> Gate Threshold Voltage	N-Channel	2.0 to 4.0			V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA
	P-Channel	-2.0 to -4.0			
I <sub>GSS</sub> Max. Gate Source Leakage, Forward Voltage	N-Channel	500		nA	V <sub>GS</sub> = 20V
	P-Channel	-500			V <sub>GS</sub> = -20V
	N-Channel	-500			V <sub>GS</sub> = 20V
	P-Channel	500			
I <sub>DSS</sub> Max. Zero Gate Voltage Drain Current	N-Channel	250		μA	V <sub>DS</sub> = Max. Rating, V <sub>GS</sub> = 0V
	P-Channel	-250			
	N-Channel	1000			V <sub>DS</sub> = Max. Rating x 80%, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
	P-Channel	-1000			
R <sub>DS(on)</sub> Max. Static Drain-Source On-State Resistance of Die	N-Channel	0.27	0.10	Ω	V <sub>GS</sub> = 10V, Pulse Test: Pulse Width ≤ 300 μs, duty cycle ≤ 2%
	P-Channel	0.60	0.28		
R <sub>p</sub> Max. Resistance Contribution of Package		0.03			
g <sub>fs</sub> Min. Forward Transconductance	N-Channel	2.7	5.5	S(t)	V <sub>DS</sub> = 2 x V <sub>GS</sub> , I <sub>DS</sub> = Max. I <sub>D</sub> Rating @ 100°C
	P-Channel	0.9	2.9		

HEXFET Dynamic Characteristics @  $T_C = 25^\circ\text{C}$  (Unless otherwise specified)

Parameter	Type	IRFT001	IRFT002	Units	Conditions/Notes
$C_{iss}$ Typical Input Capacitance	N-Channel	350	640	pF	$V_{GS} = 0V, V_{DS} = 25V, f = 1.0 \text{ MHz}$
	P-Channel	300	570		
$C_{oss}$ Typical Output Capacitance	N-Channel	130	350		
	P-Channel	200	360		
$C_{rss}$ Typical Reverse Transfer Capacitance	N-Channel	24	51		
	P-Channel	50	65		
$t_{d(on)}$ Max. Turn-on Delay Time	N-Channel	13	13	nS	$V_{DD} = 50\%$ of Rated Value, $I_D = \text{Max. Cont. Rating}$ (MOSFET switching times are essentially independent of operating temperature).
	P-Channel	50	20		
$t_r$ Max. Rise Time	N-Channel	45	58		
	P-Channel	100	100		
$t_{d(off)}$ Max. Turn-off Delay Time	N-Channel	29	25		
	P-Channel	100	23		
$t_f$ Max. Fall Time	N-Channel	30	42		
	P-Channel	100	44		
$Q_g$ Max. Total Gate Charge	N-Channel	15	25	nC	$V_{GS} = 10V, I_D = \text{Max. Cont. Rating}, V_{DS} = \text{Max. Rating} \times 80\%$ . (Gate charge is essentially independent of operating temperature).
	P-Channel	22	19		
$Q_{gs}$ Typical Gate-to-Source Charge	N-Channel	2.2	3.9		
	P-Channel	9.0	4.1		
$Q_{gd}$ Typical Gate-to-Drain ("Miller") Charge	N-Channel	2.2	7.0		
	P-Channel	7.0	5.7		

Source-Drain Diode Electrical Characteristics @  $T_C = 25^\circ\text{C}$  (Unless otherwise specified)

Parameter	Type	IRFT001	IRFT002	Units	Conditions/Notes
$I_S$ Max. Continuous Source Current (Body Diode)		3.9	6.0*	A	*Package limited
$V_{SD}$ Max. Diode Forward Voltage	N-Channel	2.5	1.5	V	$V_{GS} = 0V, I_S = \text{Max. Rating}, T_J = 25^\circ\text{C}$
	P-Channel	-6.3	-6.3		
$t_{rr}$ Max. Reverse Recovery Time	N-Channel	240	180	nS	$I_F = I_S \text{ Max. Rating}, dI_F/dt = 100 \text{ A}/\mu\text{S}, T_J = 25^\circ\text{C}$
	P-Channel	230*	200		
$Q_{RR}$ Max. Reverse Recovery Charge	N-Channel	1.1	0.64	$\mu\text{C}$	
	P-Channel	1.3*	0.64		

**Thermal Characteristics**

Parameter	IRFT001	IRFT002	Units	Conditions/Notes
R <sub>thJC</sub> Max. Thermal Resistance Junction-to-Case	7.5	5.6	°C/W	Any one device
R <sub>thJA</sub> Typical Thermal Resistance Junction-to-Ambient	50	50		
P <sub>D</sub> Max. Power Dissipation	17	22	W	Any one device, T <sub>C</sub> = 25°C

For additional HEXFET characteristics, the electrical characteristic curves located from pages 67 to 85 can be referenced. This data represents the typical performance of each of the HEXFET die included in these power modules.

Parameter	Type	IRFT001	IRFT002	Units	Conditions/Notes
HEXFET Electrical Characteristic Curves	N-Channel	IRFC120 See page 74	IRFC024 See page 72	—	
	P-Channel	IRFC9120 See page 82	IRFC9024 See page 78		

These power modules can be manufactured in a variety of voltages and on-resistances along with substituted or additional components. For additional information on these semi-custom possibilities, refer to the Custom Capabilities section on page v.

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## Power Interface Products

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### Custom Packaging Capability

The Power Interface Products Group of International Rectifier has many years of design and manufacturing experience in custom packaging of power components. This expertise provides us with the flexibility necessary to meet your unique power application requirements.

#### *Design Expertise*

International Rectifier is dedicated to meeting the design needs of its customers. Computer-aided design and thermal analysis capabilities are utilized to minimize the time and cost for achieving the most complex and demanding design requirements. The combined experience of our development team offers design support and customer-responsiveness second to none.

#### *Advanced Manufacturing*

Our manufacturing facility houses a full compliment of automatic assembly and test equipment necessary to develop and produce power modules to meet virtually any application-specific packaging requirement. This facility also offers the flexibility to provide hybrid prototype quantities in a short cycle time and high volume capacity to meet most any production and delivery requirement. Dedicated thick-film or direct-bond processing, production tooling, automatic testing, lead form capabilities and a self-contained clean room provide the foundation for total and immediate responsiveness to product quality, reliability, performance and delivery.

#### *Technology Leadership*

International Rectifier's technological leadership in power semiconductors has, in turn, propelled its Power Interface Products Group to establish itself as an innovative leader in semiconductor packaging. Available at the forefront of our power hybrid expertise are both screen-printing thick film and direct-bond leadframe technologies. Ceramics or insulated metal substrates with integrated heatsink systems are also offered. Whatever the need, our power packaging capabilities can provide the most advanced integration for optimized performance in the required space.

#### *Total Accountability*

International Rectifier makes both the semiconductor die and the package. We have accurate control of wafer fab to correct and improve die-related problems. This means we take complete responsibility for the total solution with total commitment and total control. Three good reasons why International Rectifier is your best source for power module quality, reliability, cost, convenience, and performance.