



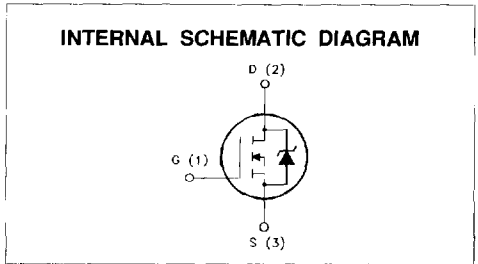
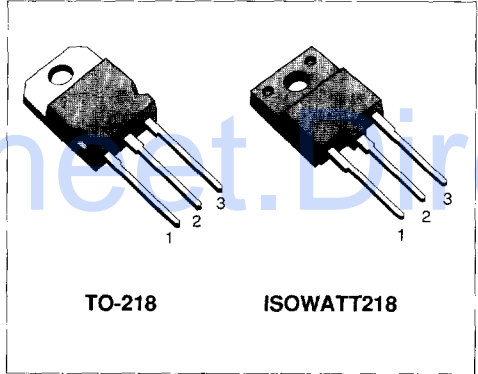
**N - CHANNEL ENHANCEMENT MODE  
POWER MOS TRANSISTORS**

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRFP450	500 V	0.4 Ω	14 A
IRFP450FI	500 V	0.4 Ω	9 A
IRFP451	450 V	0.4 Ω	14 A
IRFP451FI	450 V	0.4 Ω	9 A

- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

**APPLICATIONS**

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value				Unit
		IRFP				
		450	451	450FI	451FI	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500	450	500	450	V
V <sub>DGR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	500	450	500	450	V
V <sub>GS</sub>	Gate-source Voltage	± 20				V
I <sub>D</sub>	Drain Current (cont.) at T <sub>c</sub> = 25 °C	14	14	9	9	A
I <sub>D</sub>	Drain Current (cont.) at T <sub>c</sub> = 100 °C	8.8	8.8	5.6	5.6	A
I <sub>DM</sub> (*)	Drain Current (pulsed)	56	56	56	56	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	180		70		W
	Derating Factor	1.44		0.56		W/°C
T <sub>stg</sub>	Storage Temperature	-65 to 150				°C
T <sub>j</sub>	Max. Operating Junction Temperature	150				°C

(\*) Pulse width limited by safe operating area

**THERMAL DATA**

			TO-218	ISOWATT218	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max		30	°C/W
$R_{thc-s}$	Thermal Resistance Case-sink	Typ		0.1	°C/W
$T_l$	Maximum Lead Temperature For Soldering Purpose			300	°C

**AVALANCHE CHARACTERISTICS**

Symbol	Parameter	Max Value	Unit
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$ )	14	A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	760	mJ
$E_{AR}$	Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$ )	18	mJ
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive ( $T_c = 100\text{ }^\circ\text{C}$ , pulse width limited by $T_j$ max, $\delta < 1\%$ )	8	A

**ELECTRICAL CHARACTERISTICS** ( $T_{case} = 25\text{ }^\circ\text{C}$  unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$ for <b>IRFP450/450FI</b> for <b>IRFP451/451FI</b>	500 450			V V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 7.9\text{ A}$			0.4	$\Omega$
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	14			A

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 7.9\text{ A}$	6			S
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$			3000	pF
$C_{oss}$	Output Capacitance				400	pF
$C_{rss}$	Reverse Transfer Capacitance				200	pF

**ELECTRICAL CHARACTERISTICS** (continued)  
**SWITCHING RESISTIVE LOAD**

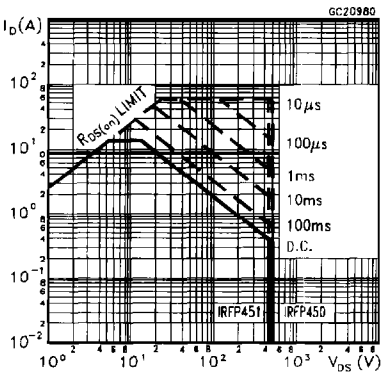
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 210\text{ V}$ $I_D = 7\text{ A}$			70	ns
$t_r$	Rise Time	$R_i = 4.7\ \Omega$			80	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)			155	ns
$t_f$	Fall Time				55	ns
$Q_g$	Total Gate Charge	$I_D = 13\text{ A}$ $V_{GS} = 10\text{ V}$ $V_{DD} = \text{Max Rating} \times 0.8$ (see test circuit)		145	170	nC

**SOURCE DRAIN DIODE**

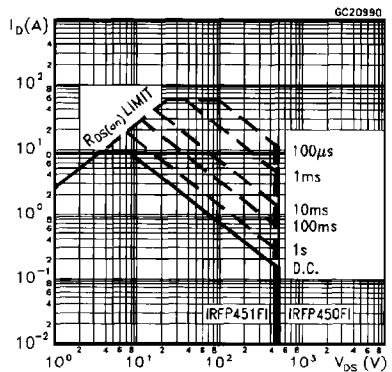
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				14	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				56	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 14\text{ A}$ $V_{GS} = 0$			1.4	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 14\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		700		ns
$Q_{rr}$	Reverse Recovery Charge			15.8		$\mu\text{C}$

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %  
 (•) Pulse width limited by safe operating area

Safe Operating Area for TO-218 Package



Safe Operating Area for ISOWATT218 Package



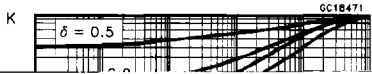
# IRFP 450/FI - 451/FI - 452/FI - 453/FI

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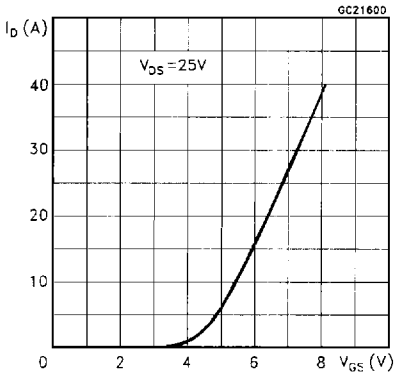
Thermal Impedance for TO-218 Package



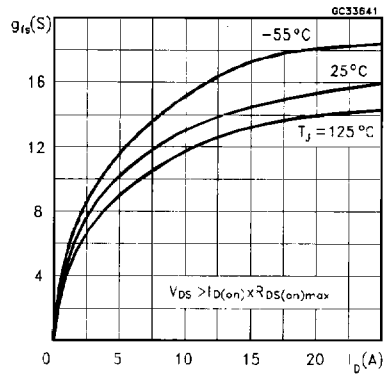
Thermal Impedance for ISOWATT218 Package



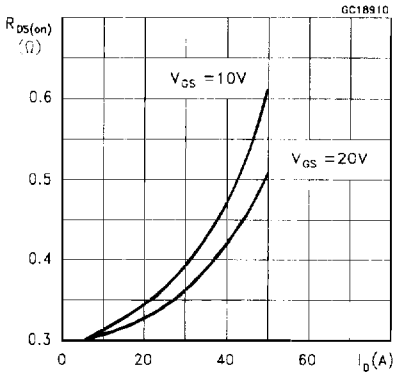
Transfer Characteristics



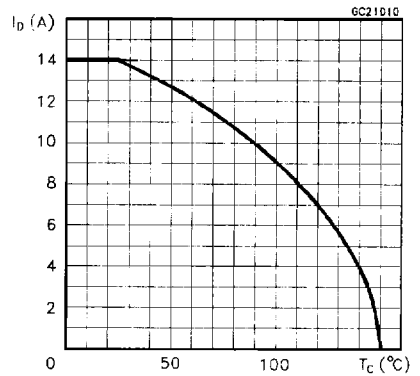
Transconductance



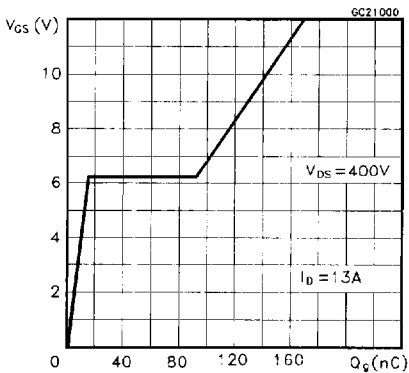
Static Drain-source On Resistance



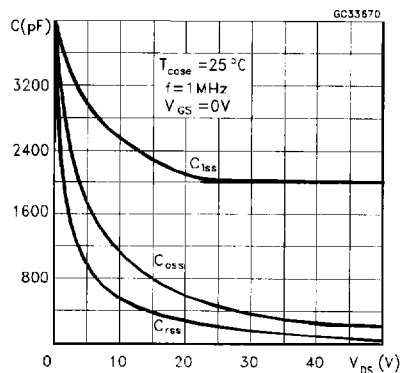
Maximum Drain Current vs Temperature



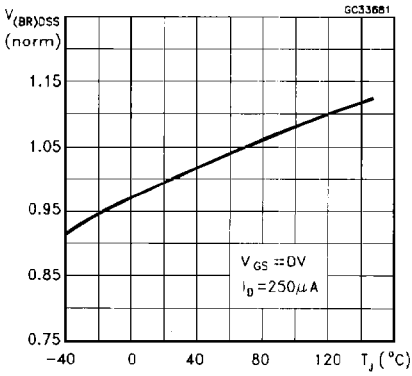
Gate Charge vs Gate-source Voltage



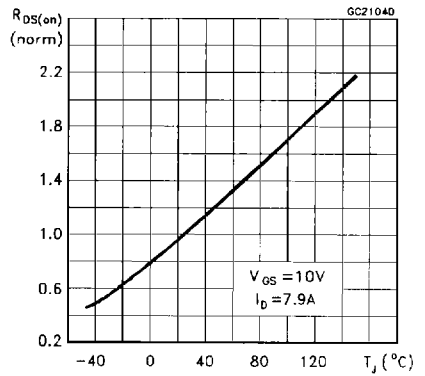
Capacitance Variations



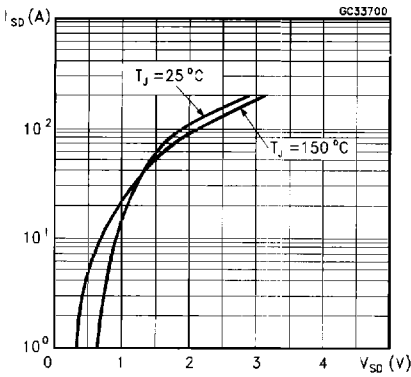
Normalized Breakdown Voltage vs Temperature



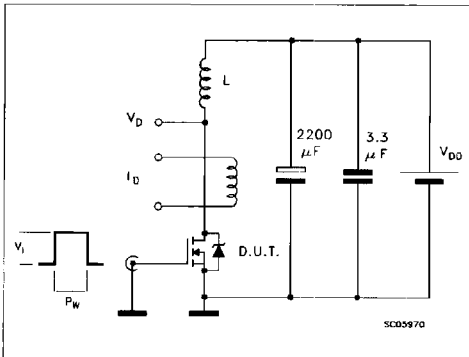
Normalized On Resistance vs Temperature



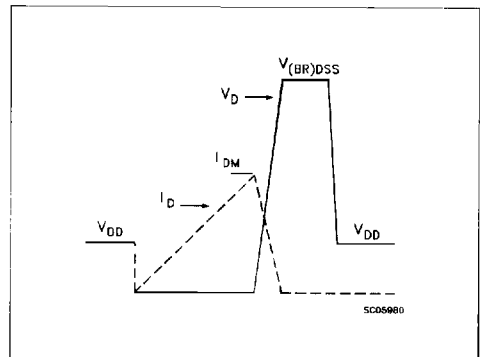
Source-drain Diode Forward Characteristics



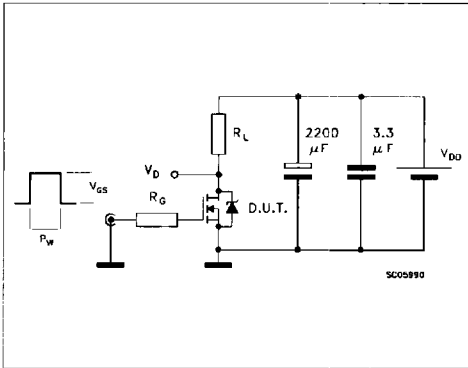
Unclamped Inductive Load Test Circuit



Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit

