SGS-THOMSON MICROELECTRONICS

IRFP 150/FI-151/FI IRFP 152/FI-153/FI

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

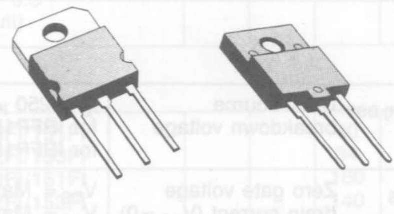
TYPE	V_{DSS}	$R_{DS(on)}$	I_D ■
IRFP150	100 V	0.055 Ω	40 A
IRFP150FI	100 V	0.055 Ω	26 A
IRFP151	60 V	0.055 Ω	40 A
IRFP151FI	60 V	0.055 Ω	26 A
IRFP152	100 V	0.08 Ω	34 A
IRFP152FI	100 V	0.08 Ω	21 A
IRFP153	60 V	0.08 Ω	34 A
IRFP153FI	60 V	0.08 Ω	21 A

- 60 - 100 V FOR DC/DC CONVERTERS
- HIGH CURRENT
- RATED FOR UNCLAMPED INDUCTIVE SWITCHING (ENERGY TEST) ◆
- ULTRA FAST SWITCHING
- EASY DRIVE - FOR REDUCES COST AND SIZE

INDUSTRIAL APPLICATIONS:

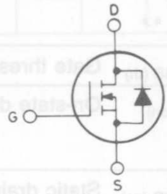
- UNINTERRUPTIBLE POWER SUPPLIES
- MOTOR CONTROLS

N - channel enhancement mode POWER MOS field effect transistors. Easy drive and very fast switching times make these POWER MOS transistors ideal for high speed switching applications. Applications include DC/DC converters, UPS, battery chargers, secondary regulators, servo control, power audio amplifiers and robotics.



TO-218 ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-218 / ISOWATT218	IRFP 150 / 150FI	151 / 151FI	152 / 152FI	153 / 153FI	
V_{DS} *	Drain-source voltage ($V_{GS}=0$)	100	60	100	60	V
V_{DGR} *	Drain-gate voltage ($R_{GS}=20$ KΩ)	100	60	100	60	V
V_{GS}	Gate-source voltage	± 20				V
I_{DM} (•)	Drain current (pulsed)	160	160	140	140	A
		150	**151**	**152**	**153**	
I_D	Drain current (cont.) at $T_c = 25°C$	40	40	34	34	A
I_D	Drain current (cont.) at $T_c = 100°C$	26	26	22	22	A
		150FI	**151FI**	**152FI**	**153FI**	
I_D■	Drain current (cont.) at $T_c = 25°C$	26	26	21	21	A
I_D■	Drain current (cont.) at $T_c = 100°C$	16	16	13	13	A
		TO-218		**ISOWATT218**		
P_{tot}■	Total dissipation at $T_c < 25°C$	150		65		W
	Derating factor	1.2		0.52		W/°C
T_{stg}	Storage temperature	– 55 to 150				°C
T_j	Max. operating junction temperature	150				°C

* T_j = 25°C to 125°C

(•) Repetitive Rating: Pulse width limited by max junction temperature.

■ See note on ISOWATT218 on this datasheet.

◆ Introduced in 1988 week 44

THERMAL DATA ▪

			TO-218	ISOWATT218	
$R_{thj-case}$	Thermal resistance junction-case	max	0.83	1.92	°C/W
R_{thc-s}	Thermal resistance case-sink	typ	0.1		°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	max	30		°C/W
T_l	Maximum lead temperature for soldering purpose		300		°C

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\,DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu A$ $V_{GS} = 0$ for **IRFP150/152/150FI/152FI** for **IRFP151/153/151FI/153FI**	 100 60			 V V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	V_{DS} = Max Rating V_{DS} = Max Rating x 0.8 $T_c = 125°C$			250 1000	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\ V$			±100	nA
ON **						
$V_{GS\,(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu A$	2		4	V
$I_{D(on)}$	On-state drain current	$V_{DS} > I_{D\,(on)} \times R_{DS(on)\,max}$ $V_{GS} = 10\ V$ for **IRFP150/151/150FI/151FI** for **IRFP152/153/152FI/153FI**	 40 34			 A A
$R_{DS\,(on)}$	Static drain-source on resistance	$V_{GS} = 10\ V$ $I_D = 22\ A$ for **IRFP150/151/150FI/151FI** for **IRFP152/153/152FI/153FI**			 0.055 0.08	 Ω Ω
ENERGY TEST						
I_{UIS}	Unclamped inductive switching current (single pulse)	$V_{DD} = 30\ V$ $L = 100\ \mu H$ starting $T_j = 25°C$ for **IRFP150/151/150FI/151FI** for **IRFP152/153/152FI/153FI**	 40 34			 A A
DYNAMIC						
g_{fs} **	Forward transconductance	$V_{DS} > I_{D\,(on)} \times R_{DS\,(on)\,max}$ $I_D = 22\ A$	13			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\ V$ $f = 1\ MHz$ $V_{GS} = 0$			3000 1500 500	pF pF pF

ELECTRICAL CHARACTERISTICS (Continued)

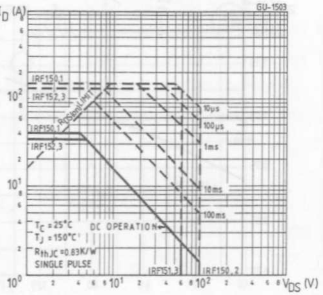
Parameters		Test Conditions		Min.	Typ.	Max.	Unit
SWITCHING							
$t_{d\ (on)}$ t_r $t_{d\ (off)}$ t_f	Turn-on time Rise time Turn-off delay time Fall time	V_{DD} = 24 V R_i = 4.7 Ω (see test circuit)	I_D = 20 A			35 100 125 100	ns ns ns ns
Q_g	Total Gate Charge	V_{GS} = 10 V V_{DS} = Max Rating × 0.8 (see test circuit)	I_D = 50 A			110	nC
SOURCE DRAIN DIODE							
I_{SD}	Source-drain current	for **IRFP150/151/150FI/151FI** for **IRFP152/153/152FI/153FI**				40 34	A A
I_{SDM} (•)	Source-drain current (pulsed)	for **IRFP150/151/150FI/151FI** for **IRFP152/153/152FI/153FI**				160 140	A A
V_{SD} **	Forward on voltage	I_{SD} = 40 A	V_{GS} = 0			2.5	V
t_{rr}	Reverse recovery time	T_j = 150°C			600		ns
Q_{rr}	Reverse recovered charge	I_{SD} = 40 A	di/dt = 100 A/μs		3.3		μC

** Pulsed: Pulse duration ≤ 300 μs, duty cycle ≤ 1.5%

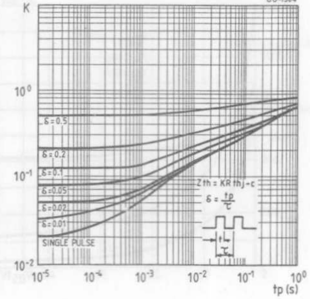
(•) Repetitive Rating: Pulse width limited by max junction temperature

■ See note on ISOWATT220 in this datasheet

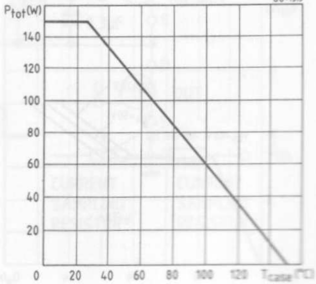
Safe operating areas (standard package)



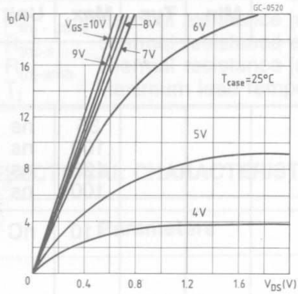
Thermal impedance (standard package)



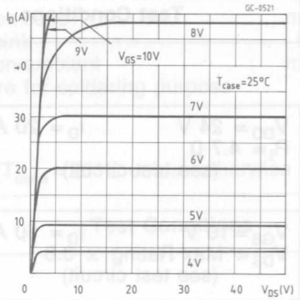
Derating curve (standard package)



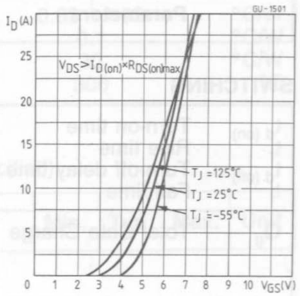
Output characteristics



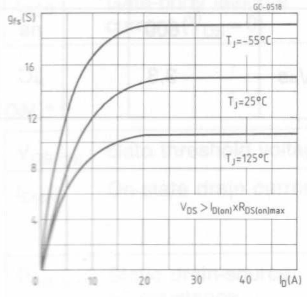
Output characteristics



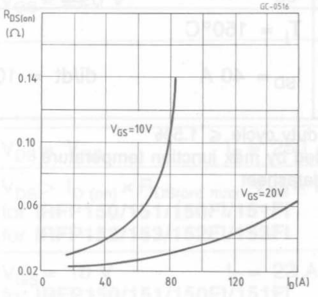
Transfer characteristics



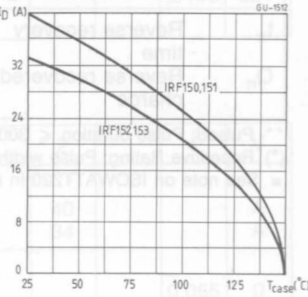
Transconductance



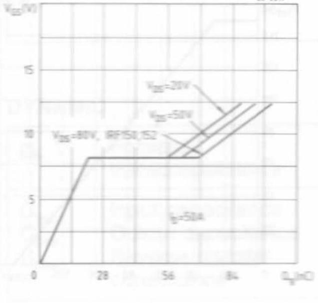
Static drain-source on resistance



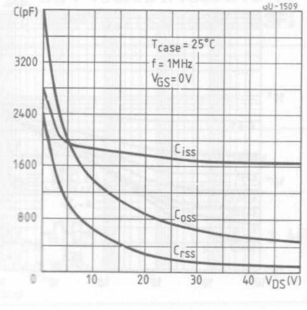
Maximum drain current vs temperature



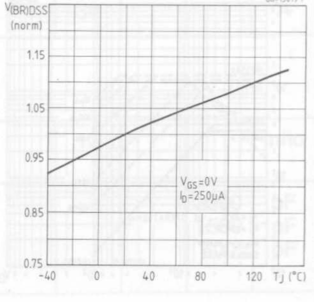
Gate charge vs gate-source voltage



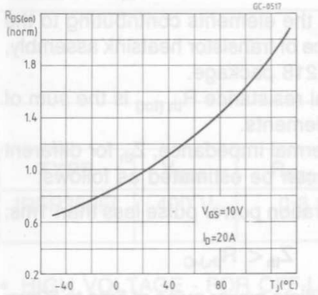
Capacitance variation



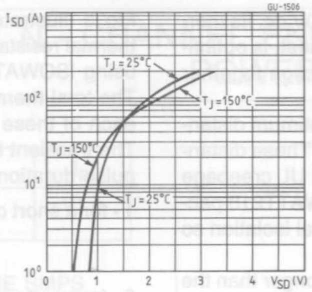
Normalized breakdown voltage vs temperature



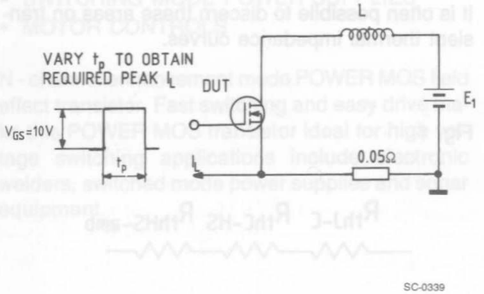
Normalized on resistance vs temperature



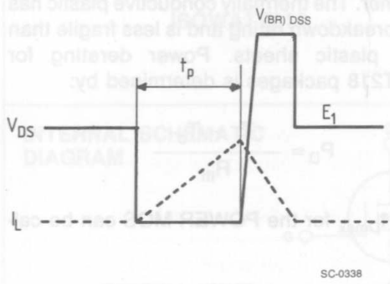
Source-drain diode forward characteristics



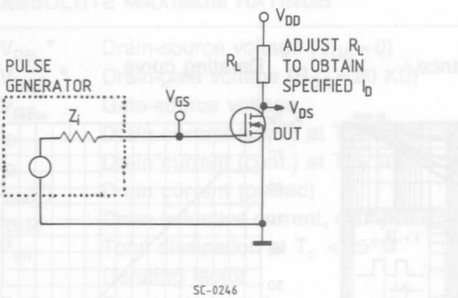
Unclamped inductive test circuit



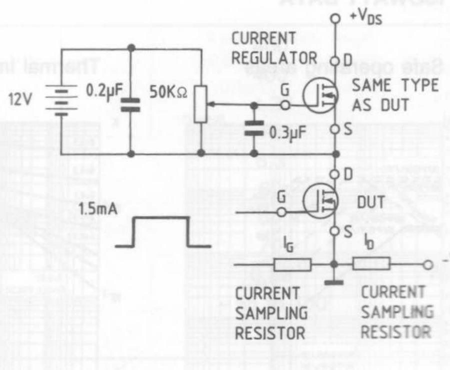
Unclamped inductive waveforms



Switching times test circuit



Gate charge test circuit



ISOWATT218 PACKAGE CHARACTERISTICS AND APPLICATION.

ISOWATT218 is fully isolated to 4000V dc. Its thermal impedance, given in the data sheet, is optimised to give efficient thermal conduction together with excellent electrical isolation.
The structure of the case ensures optimum distances between the pins and heatsink. These distances are in agreement with VDE and UL creepage and clearance standards. The ISOWATT218 package eliminates the need for external isolation so reducing fixing hardware.
The package is supplied with leads longer than the standard TO-218 to allow easy mounting on pcbs.
Accurate moulding techniques used in manufacture assures consistent heat spreader-to-heatsink capacitance
ISOWATT218 thermal performance is better than that of the standard part, mounted with a 0.1mm mica washer. The thermally conductive plastic has a higher breakdown rating and is less fragile than mica or plastic sheets. Power derating for ISOWATT218 packages is determined by:

$$P_D = \frac{T_j - T_c}{R_{th}}$$

from this I_{Dmax} for the POWER MOS can be calculated:

$$I_{Dmax} \leq \sqrt{\frac{P_D}{R_{DS(on)}\ (\text{at } 150°C)}}$$

THERMAL IMPEDANCE OF ISOWATT218 PACKAGE

Fig. 1 illustrates the elements contributing to the thermal resistance of transistor heatsink assembly, using ISOWATT218 package.
The total thermal resistance $R_{th\ (tot)}$ is the sum of each of these elements.
The transient thermal impedance, Z_{th} for different pulse durations can be estimated as follows:

1 - for a short duration power pulse less than 1ms;

$$Z_{th} < R_{thJ\text{-}C}$$

2 - for an intermediate power pulse of 5ms to 50ms:

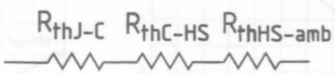
$$Z_{th} = R_{thJ\text{-}C}$$

3 - for long power pulses of the order of 500ms or greater:

$$Z_{th} = R_{thJ\text{-}C} + R_{thC\text{-}HS} + R_{thHS\text{-}amb}$$

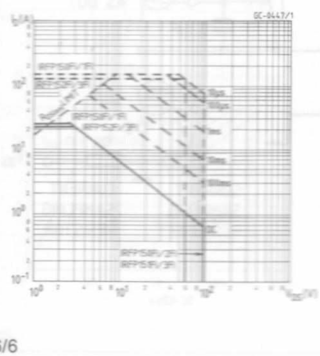
It is often possibile to discern these areas on transient thermal impedance curves.

Fig. 1

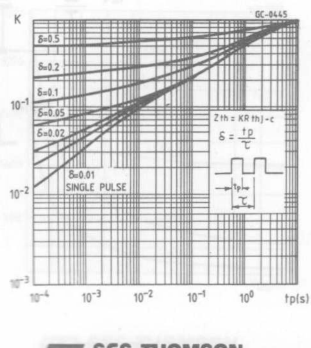


ISOWATT DATA

Safe operating areas



Thermal impedance



Derating curve