SGS-THOMSON
MICROELECTRONICS

IRFP350FI

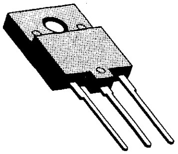
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
IRFP350FI	400 V	0.3 Ω	10 A

- HIGH VOLTAGE - FOR OFF-LINE SMPS
- HIGH CURRENT - FOR SMPS UPTO 350W
- ULTRA FAST SWITCHING - FOR OPERATION AT > 100KHz
- EASY DRIVE - REDUCES SIZE AND COST

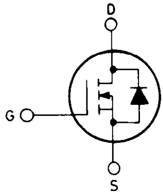
INDUSTRIAL APPLICATIONS:
- SWITCHING MODE POWER SUPPLIES
- MOTOR CONTROLS

N - channel enhancement mode POWER MOS field effect transistor. Fast switching and easy drive make this POWER MOS transistor ideal for high voltage switching applications include electronic welders, switched mode power supplies and sonar equipment.



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

V_{DS} *	Drain-source voltage ($V_{GS}=0$)	400	V
V_{DGR} *	Drain-gate voltage ($R_{GS}=20$ KΩ)	400	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (cont.) at $T_c=25°C$	10	A
I_D	Drain current (cont.) at $T_c=100°C$	6.3	A
I_{DM}(•)	Drain current (pulsed)	60	A
I_{DLM}	Drain inductive current, clamped (L= 100 μH)	60	A
P_{tot}	Total dissipation at T_c <25°C	70	W
	Derating factor	0.56	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

THERMAL DATA

$R_{thj\text{ - }case}$	Thermal resistance junction-case	max	1.78	°C/W
$R_{thc\text{-}s}$	Thermal resistance case-sink	typ	0.1	°C/W
$R_{thj\text{ - }amb}$	Thermal resistance junction-ambient	max	30	°C/W
T_l	Maximum lead temperature for soldering purpose		300	°C

ELECTRICAL CHARACTERISTICS ($T_j = 25°C$ unless otherwise specified)

Parameters		Test Conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu A$ $V_{GS} = 0$	400			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} =$ Max Rating $V_{DS} =$ Max Rating × 0.8 $T_j = 125°C$			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	$V_{DS} > I_{D\ (on)} \times R_{DS\ (on)\ max}$, $V_{GS} = 10\ V$	10			A
$R_{DS\ (on)}$	Static drain-source on resistance	$V_{GS} = 10\ V$ $I_D = 8.0\ A$			0.3	Ω
DYNAMIC						
g_{fs}**	Forward transconductance	$V_{DS} > I_{D\ (on)} \times R_{DS\ (on)\ max}$ $I_D = 8.0\ A$	8.0			mho
C_{iss}	Input capacitance				3000	pF
C_{oss}	Output capacitance	$V_{DS} = 25\ V$ $f = 1\ MHz$			600	pF
C_{rss}	Reverse transfer capacitance	$V_{GS} = 0$			200	pF
SWITCHING						
$t_{d\ (on)}$	Turn-on time	$V_{DD} = 180\ V$ $I_D = 8.0\ A$			35	ns
t_r	Rise time	$R_i = 4.7\ \Omega$			65	ns
$t_{d\ (off)}$	Turn-off delay time	(see test circuit)			150	ns
t_f	Fall time				75	ns
Q_g	Total Gate Charge	$V_{GS} = 10\ V$ $I_D = 18\ A$ $V_{DS} =$ Max Rating × 0.8 (see test circuit)			120	nC

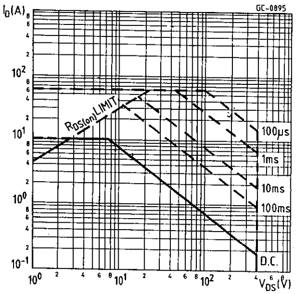
ELECTRICAL CHARACTERISTICS (Continued)

SOURCE DRAIN DIODE

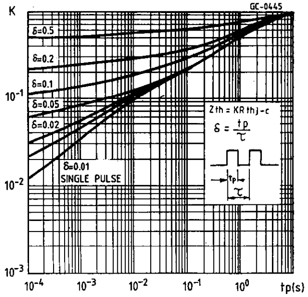
Parameters		Test Conditions		Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (•)	Source-drain current Source-drain current (pulsed)					10 60	A A
V_{SD}**	Forward on voltage	$I_{SD} = 15$ A	$V_{GS} = 0$			1.6	V
t_{rr} Q_{rr}	Reverse recovery time Reverse recovered charge	$T_j = 150°C$ $I_{SD} = 15$ A	 di/dt = 100 A/μs		1000 6.6		ns μC

** Pulsed: Pulse duration ⩽ 300 μs, duty cycle ⩽ 1.5%
(•) Repetitive Rating: Pulse width limited by max junction temperature

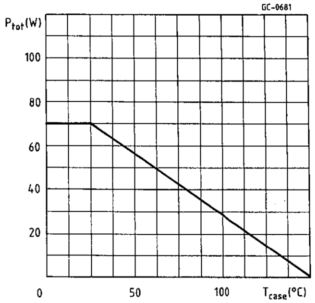
Safe operating areas



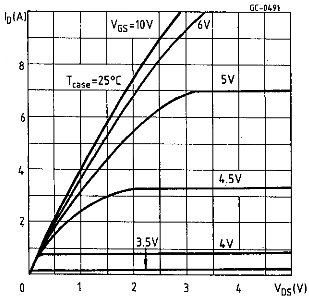
Thermal impedance



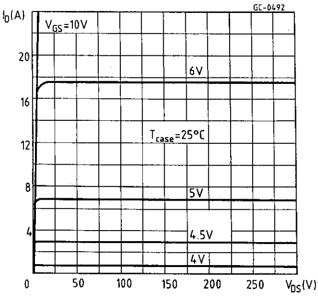
Derating curve



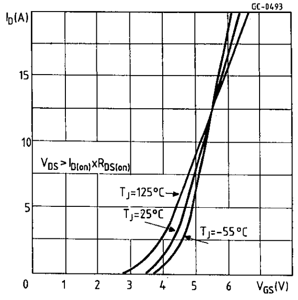
Output characteristics



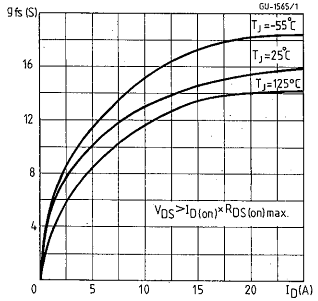
Output characteristics



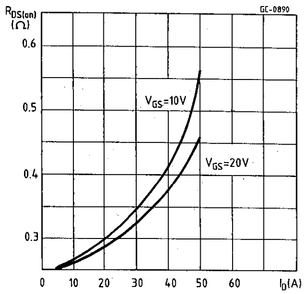
Transfer characteristics



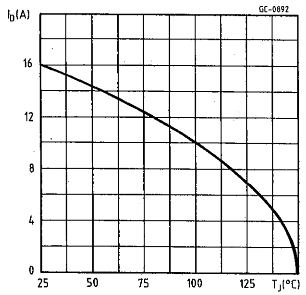
Transconductance



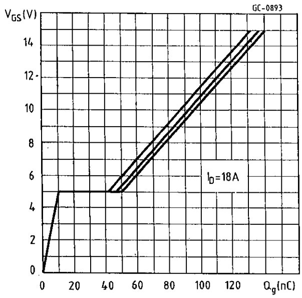
Static drain-source on resistance



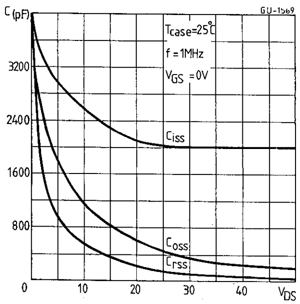
Maximum drain current vs temperature



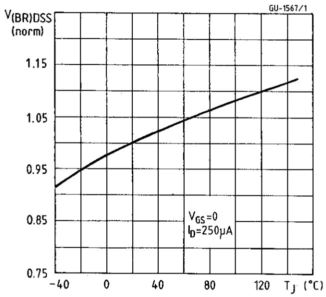
Gate charge vs gate-source voltage



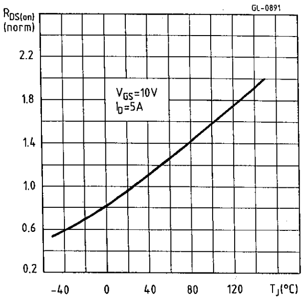
Capacitance variation



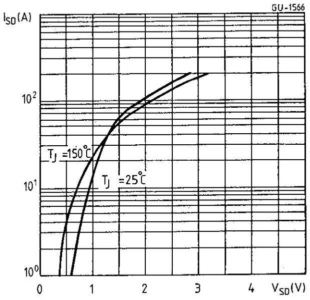
Normalized breakdown voltage vs temperature



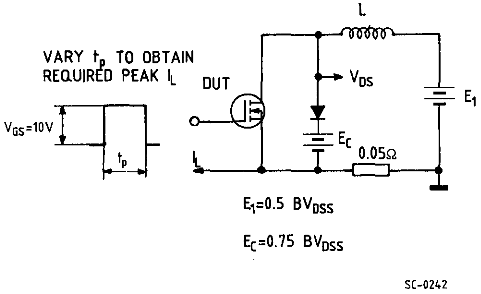
Normalized on resistance vs temperature



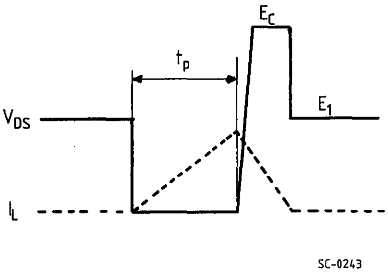
Source-drain diode forward characteristics



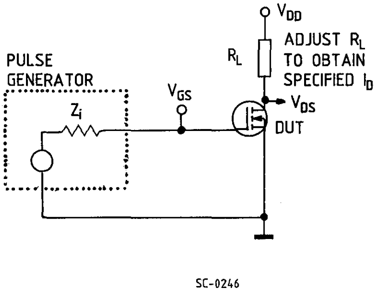
Clamped inductive test circuit



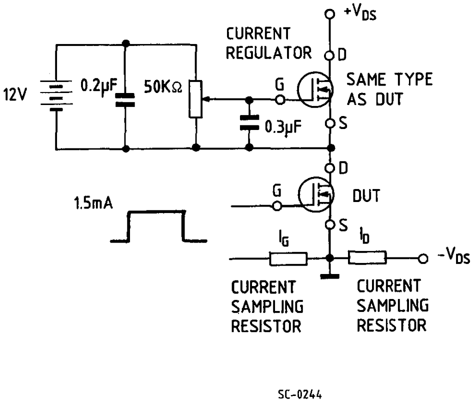
Clamped inductive waveforms



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:

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

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;

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

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

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

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

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

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

Fig. 1