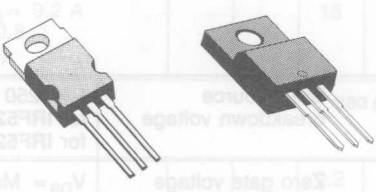
SGS-THOMSON MICROELECTRONICS

IRF 520/FI-521/FI
IRF 522/FI-523/FI

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V_{DSS}	$R_{DS(on)}$	I_D ■
IRF520	100 V	0.27 Ω	9.2 A
IRF520FI	100 V	0.27 Ω	7 A
IRF521	80 V	0.27 Ω	9.2 A
IRF521FI	80 V	0.27 Ω	7 A
IRF522	100 V	0.36 Ω	8 A
IRF522FI	100 V	0.36 Ω	6 A
IRF523	80 V	0.36 Ω	8 A
IRF523FI	80 V	0.36 Ω	6 A



TO-220 ISOWATT220

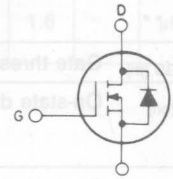
- 80-100 VOLTS - FOR DC/DC CONVERTERS
- HIGH CURRENT
- RATED FOR UNCLAMPED INDUCTIVE SWITCHING (ENERGY TEST) ◆
- ULTRA FAST SWITCHING
- EASY DRIVE - FOR REDUCED COST AND SIZE

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.

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

		IRF				
	TO-220	520	521	522	523	
	ISOWATT220	520FI	521FI	522FI	523FI	
V_{DS} *	Drain-source voltage ($V_{GS} = 0$)	100	80	100	80	V
V_{DGR} *	Drain-gate voltage ($R_{GS} = 20$ KΩ)	100	80	100	80	V
V_{GS}	Gate-source voltage	±20				V
I_{DM} (•)	Drain current (pulsed)	37	37	32	32	A
		520	521	522	523	
I_D	Drain current (cont.) at T_c = 25°C	9.2	9.2	8	8	A
I_D	Drain current (cont.) at T_c = 100°C	6.5	6.5	5.6	5.6	A
		520FI	521FI	522FI	523FI	
I_D ■	Drain current (cont.) at T_c = 25°C	7	7	6	6	A
I_D ■	Drain current (cont.) at T_c = 100°C	4	4	3.5	3.5	A
		TO-220		ISOWATT220		
P_{tot} ■	Total dissipation at $T_c < 25°C$	60		30		W
■	Derating factor	0.48		0.24		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 ISOWATT220 on this datasheet.

◆ Introduced in 1988 week 44

THERMAL DATA ▪

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal resistance junction-case	max	2.08	4.16	°C/W
R_{thc-s}	Thermal resistance case-sink	typ	0.5		°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	max	80		°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 **IRF520/522/520FI/522FI** for **IRF521/523/521FI/523FI**	 100 80			 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			±500	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 **IRF520/521/520FI/521FI** for **IRF521/523/521FI/523FI**	 9.2 8			 A A
$R_{DS\,(on)}$	Static drain-source on resistance	$V_{GS} = 10$ V $I_D = 5.6$ A for **IRF520/521/520FI/521FI** for **IRF522/523/522FI/523FI**			 0.27 0.36	 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 **IRF520/521/520FI/521FI** for **IRF522/523/522FI/523FI**	 9.2 8			 A A
DYNAMIC						
g_{fs} **	Forward transconductance	$V_{DS} > I_{D\,(on)} \times R_{DS\,(on)\,max}$ $I_D = 5.6$ A	2.7			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$			600 400 100	pF pF pF

ELECTRICAL CHARACTERISTICS (Continued)

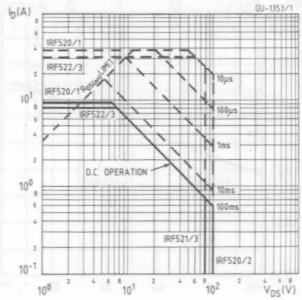
Parameters		Test Conditions	Min.	Typ.	Max.	Unit
SWITCHING						
$t_{d\ (on)}$ t_r $t_{d\ (off)}$ t_f	Turn-on time Rise time Turn-off delay time Fall time	V_{DD} = 40 V I_D = 4.0 A R_i = 50 Ω (see test circuit)			40 70 100 70	ns ns ns ns
Q_g	Total Gate Charge	V_{GS} = 15 V I_D = 9.2 A V_{DS} = Max Rating × 0.8 (see test circuit)			15	nC

SOURCE DRAIN DIODE

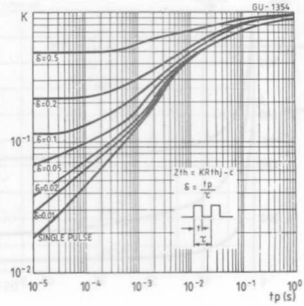
Parameters		Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (•)	Source-drain current Source-drain current (pulsed)				9.2 37	A A
V_{SD} **	Forward on voltage	I_{SD} = 9.2 A V_{GS} = 0			2.5	V
t_{rr}	Reverse recovery time	T_j = 150°C		280		ns
Q_{rr}	Reverse recovered charge	I_{SD} = 9.2 A di/dt = 100 A/μs		1.6		μC

** Pulsed: Pulse duration ⩽ 300 μs, duty cycle ⩽ 1.2%
(•) Repetitive Rating: Pulse width limited by max junction temperature
■ See note on ISOWATT220 in this datasheet

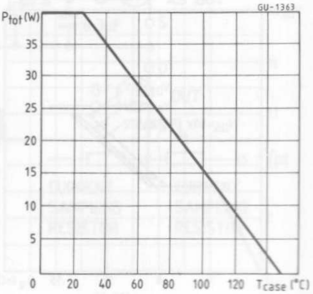
Safe operating areas (standard package)



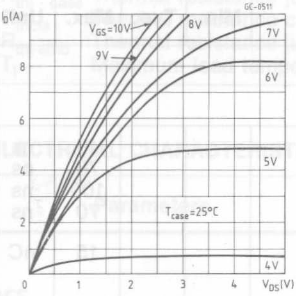
Thermal impedance (standard package)



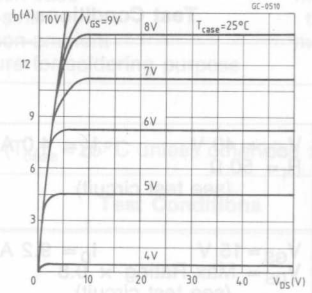
Derating curve (standard package)



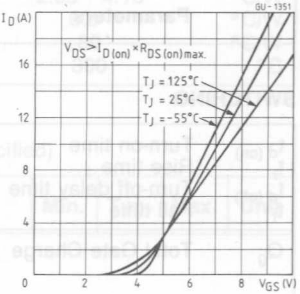
Output characteristics



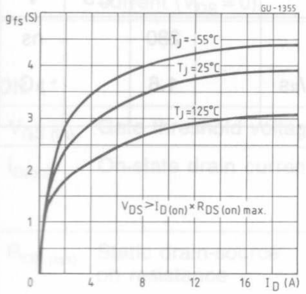
Output characteristics



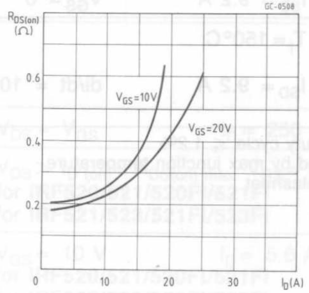
Transfer characteristics



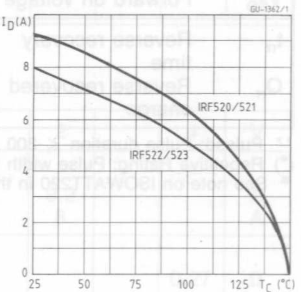
Transconductance



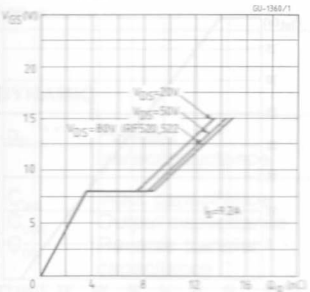
Static drain-source on resistance



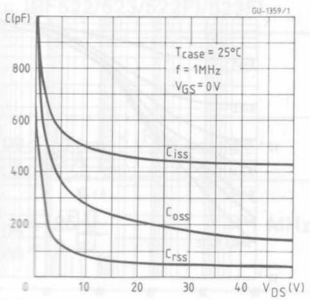
Maximum drain current vs temperature



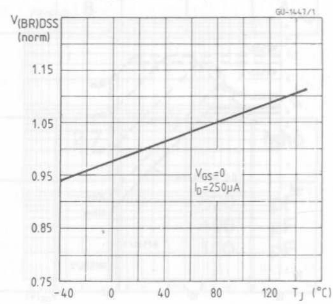
Gate charge vs gate-source voltage



Capacitance variation

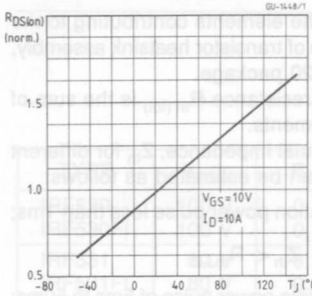


Normalized breakdown voltage vs temperature

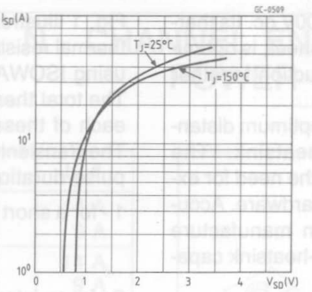


SGS-THOMSON MICROELECTRONICS

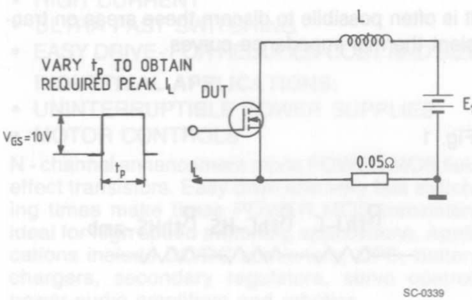
Normalized on resistance vs temperature



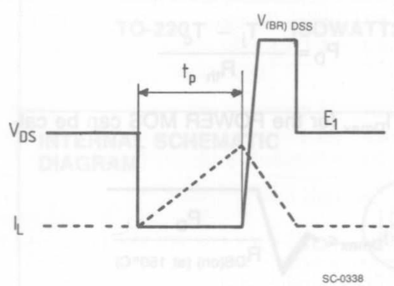
Source-drain diode forward characteristics



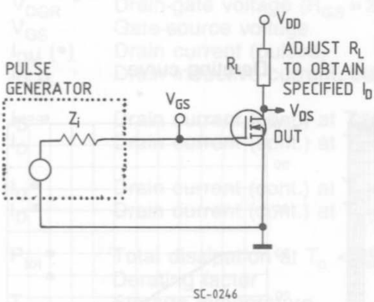
Unclamped inductive test circuit



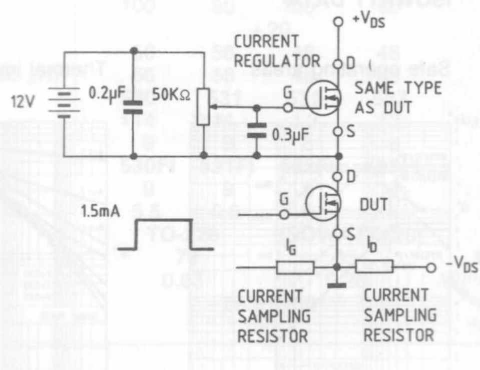
Unclamped inductive waveforms



Switching times test circuit



Gate charge test circuit



ISOWATT220 PACKAGE CHARACTERISTICS AND APPLICATION.

ISOWATT220 is fully isolated to 2000V 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. The ISOWATT220 package eliminates the need for external isolation so reducing fixing hardware. Accurate moulding techniques used in manufacture assure consistent heat spreader-to-heatsink capacitance.

ISOWATT220 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 ISOWATT220 packages is determined by:

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

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

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

THERMAL IMPEDANCE OF ISOWATT220 PACKAGE

Fig. 1 illustrates the elements contributing to the thermal resistance of transistor heatsink assembly, using ISOWATT220 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:

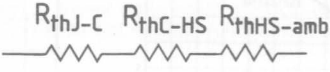
$$Z_{th} = R_{thJ\text{-}C}$$

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

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

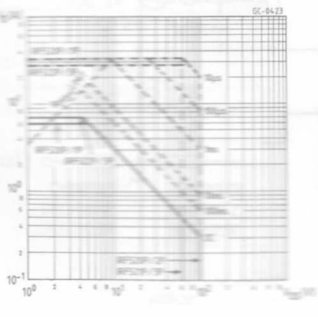
It is often possibile to discern these areas on transient thermal impedance curves.

Fig. 1

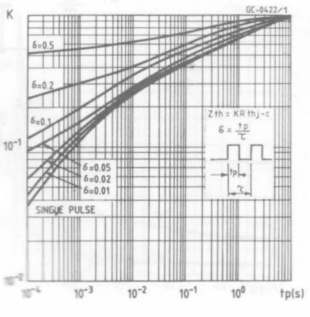


ISOWATT DATA

Safe operating areas



Thermal impedance



Derating curve