SGS-THOMSON MICROELECTRONICS

IRF 720/FI-721/FI
IRF 722/FI-723/FI

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

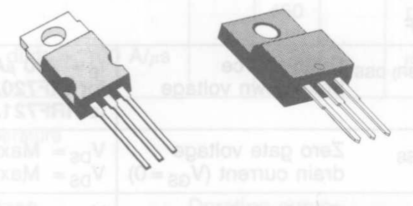
TYPE	V_{DSS}	$R_{DS(on)}$	I_D ■
IRF720	400 V	1.8 Ω	3.3 A
IRF720FI	400 V	1.8 Ω	2.5 A
IRF721	350 V	1.8 Ω	3.3 A
IRF721FI	350 V	1.8 Ω	2.5 A
IRF722	400 V	2.5 Ω	2.8 A
IRF722FI	400 V	2.5 Ω	2.0 A
IRF723	350 V	2.5 Ω	2.8 A
IRF723FI	350 V	2.5 Ω	2.0 A

- HIGH VOLTAGE - FOR OFF LINE APPLICATIONS
- ULTRA FAST SWITCHING
- EASY DRIVE - FOR REDUCED COST AND SIZE

INDUSTRIAL APPLICATIONS:

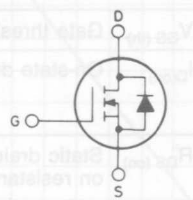
- ELECTRONIC LAMP BALLAST
- DC SWITCH

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 off-line use, constant current source, ultrasonic equipment and switching powers supplies start-up circuits.



TO-220 ISOWATT220

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-220 / ISOWATT220	IRF 720 / 720FI	721 / 721FI	722 / 722FI	723 / 723FI	
V_{DS} *	Drain-source voltage ($V_{GS} = 0$)	400	350	400	350	V
V_{DGR} *	Drain-gate voltage ($R_{GS} = 20$ KΩ)	400	350	400	350	V
V_{GS}	Gate-source voltage	± 20				V
I_{DM} (•)	Drain current (pulsed)	13	13	11	11	A
I_{DLM}	Drain inductive current, clamped ($L = 100\ \mu H$)	13	13	11	11	A
		720	721	722	723	
I_D	Drain current (cont.) at $T_c = 25°C$	3.3	3.3	2.8	2.8	A
I_D	Drain current (cont.) at $T_c = 100°C$	2.1	2.1	1.8	1.8	A
		720FI	721FI	722FI	723FI	
I_D ■	Drain current (cont.) at $T_c = 25°C$	2.5	2.5	2	2	A
I_D ■	Drain current (cont.) at $T_c = 100°C$	1.5	1.5	1.2	1.2	A
		TO-220		ISOWATT220		
P_{tot} ■	Total dissipation at $T_c < 25°C$	50		30		W
■	Derating factor	0.40		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.

THERMAL DATA ■

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal resistance junction-case	max	2.50	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 **IRF720/722/720FI/722FI** for **IRF721/723/721FI/723FI**	 400 350			 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 **IRF720/721/720FI/721FI** for **IRF722/723/722FI/723FI**	 3.3 2.8			 A A
$R_{DS\,(on)}$	Static drain-source on resistance	$V_{GS} = 10$ V $I_D = 1.8$ A for **IRF720/721/720FI/721FI** for **IRF722/723/722FI/723FI**			 1.8 2.5	 Ω Ω

DYNAMIC

g_{fs} **	Forward transconductance	$V_{DS} > I_{D\,(on)} \times R_{DS\,(on)\,max}$ $I_D = 1.8$ A	1.0			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25$ V f = 1 MHz $V_{GS} = 0$			600 200 40	pF pF pF

SWITCHING

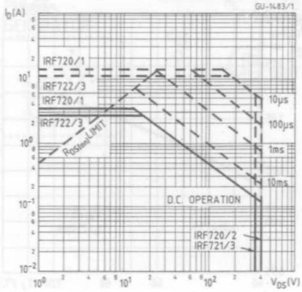
$t_{d\,(on)}$ t_r $t_{d\,(off)}$ t_f	Turn-on time Rise time Turn-off delay time Fall time	$V_{DD} = 175$ V $I_D = 1.5$ A $R_i = 50\ \Omega$ (see test circuit)			40 50 100 50	ns ns ns ns
Q_g	Total Gate Charge	$V_{GS} = 10$ V $I_D = 3.3$ A V_{DS} = Max Rating × 0.8 (see test circuit)			15	nC

ELECTRICAL CHARACTERISTICS (Continued)

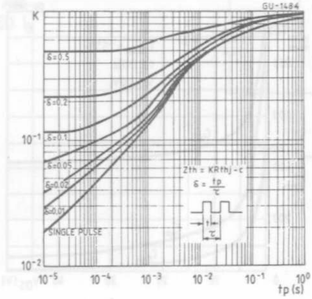
Parameters		Test Conditions	Min.	Typ.	Max.	Unit
SOURCE DRAIN DIODE						
I_{SD}	Source-drain current				3.3	A
I_{SDM} (•)	Source-drain current (pulsed)				13	A
V_{SD}	Forward on voltage	$I_{SD} = 3.3$ A $V_{GS} = 0$			1.6	V
t_{rr}	Reverse recovery time			450		ns
Q_{rr}	Reverse recovered charge	$I_{SD} = 3.3$ A di/dt = 100 A/μs		3.1		μC

** Pulsed: Pulse duration $\leqslant$ 300 μs, duty cycle $\leqslant$ 1.5%
(•) Repetitive Rating: Pulse width limited by max junction temperature
■ See note on ISOWATT220 in this datasheet

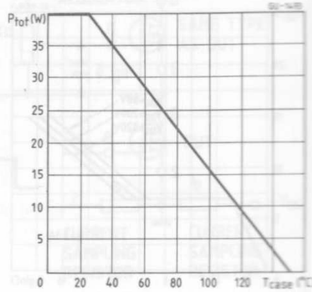
Safe operating areas (standard package)



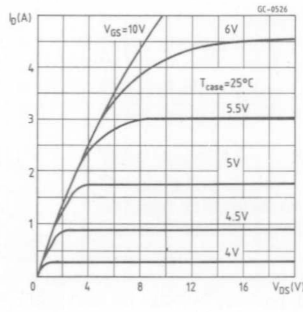
Thermal impedance (standard package)



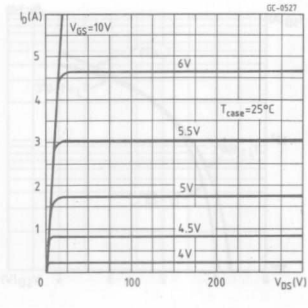
Derating curve (standard package)



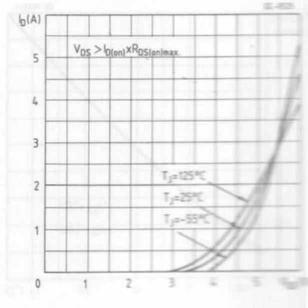
Output characteristics



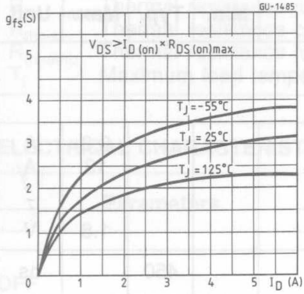
Output characteristics



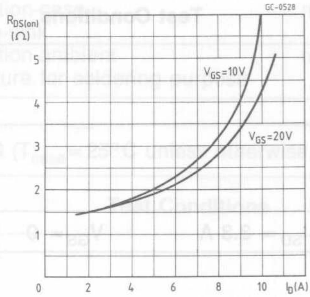
Transfer characteristics



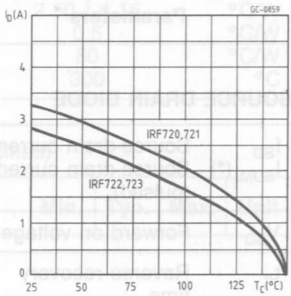
Transconductance



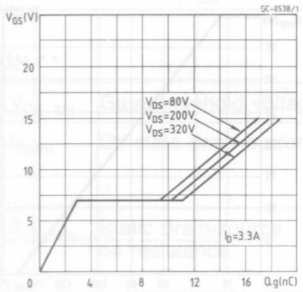
Static drain-source on resistance



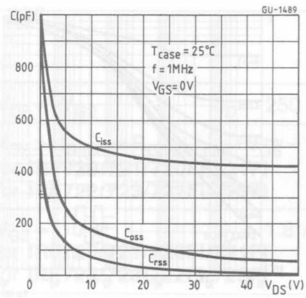
Maximum drain current vs temperature



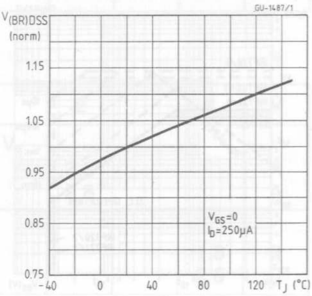
Gate charge vs gate-source voltage



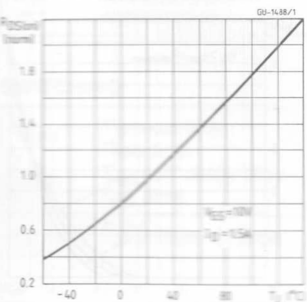
Capacitance variation



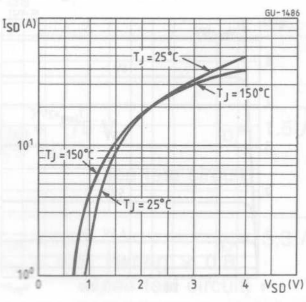
Normalized breakdown voltage vs temperature



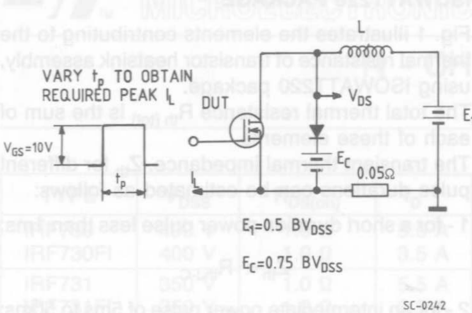
Normalized on resistance vs temperature



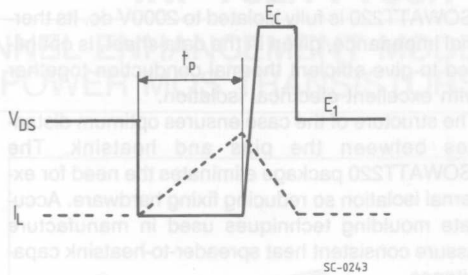
Source-drain diode forward characteristics



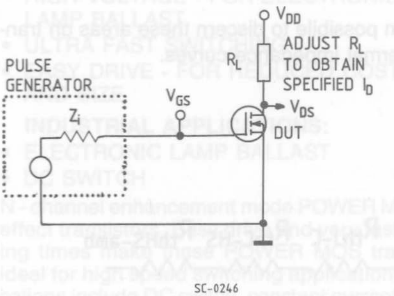
Clamped inductive test circuit



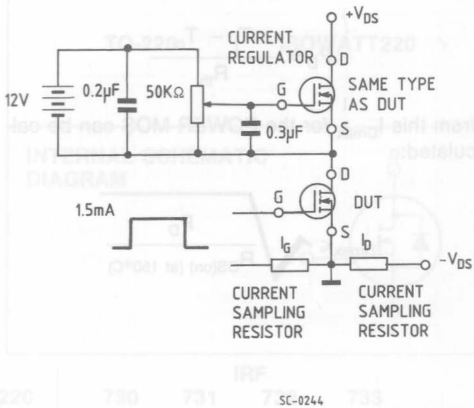
Clamped inductive waveforms



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:

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

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:

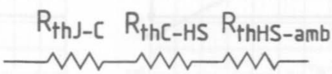
$$Z_{th} = R_{thJ\text{-}C}$$

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

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

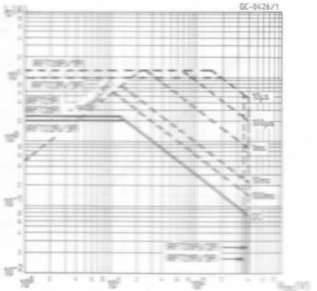
It is often possibile to discern these areas on transient thermal impedance curves.

Fig. 1

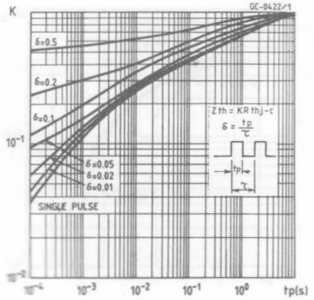


ISOWATT DATA

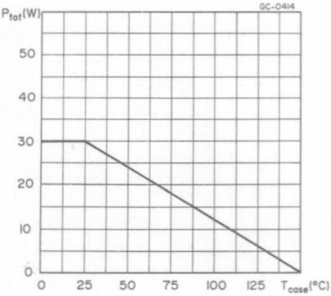
Safe operating areas



Thermal impedance



Derating curve



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