SGS-THOMSON
MICROELECTRONICS

S G S-THOMSON

IRF 730/FI-731/FI
IRF 732/FI-733/FI

N - CHANNEL ENHANCEMENT MODE
POWER MOS TRANSISTORS

| TYPE	V_{DSS}	$R_{DS(on)}$	I_D ■
IRF730	400 V	1.0 Ω	5.5 A
IRF730FI	400 V	1.0 Ω	3.5 A
IRF731	350 V	1.0 Ω	5.5 A
IRF731FI	350 V	1.0 Ω	3.5 A
IRF732	400 V	1.5 Ω	4.5 A
IRF732FI	400 V	1.5 Ω	3.0 A
IRF733	350 V	1.5 Ω	4.5 A
IRF733FI	350 V	1.5 Ω	3.0 A

- HIGH VOLTAGE - FOR ELECTRONIC LAMP BALLAST
- 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 DC switch, constant current source, ultrasonic equipment and electronic ballast for fluorescent lamps.

TO-220   ISOWATT220

INTERNAL SCHEMATIC DIAGRAM

ABSOLUTE MAXIMUM RATINGS

		TO-220 ISOWATT220	IRF				
			730 730FI	731 731FI	732 732FI	733 733FI	
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)		20	20	16	16	A
I_{DLM}	Drain inductive current, clamped (L= 100 μH)		20	20	16	16	A
			730	731	732	733	
I_D	Drain current (cont.) at $T_c=$ 25°C		5.5	5.5	4.5	4.5	A
I_D	Drain current (cont.) at $T_c=$ 100°C		3.5	3.5	3	3	A
			730FI	731FI	732FI	733FI	
I_D ■	Drain current (cont.) at $T_c=$ 25°C		3.5	3.5	3	3	A
I_D ■	Drain current (cont.) at $T_c=$ 100°C		2	2	1.8	1.8	A
			TO-220		ISOWATT220		
P_{tot} ■	Total dissipation at $T_c <25°C$		74		35		W
■	Derating factor		0.59		0.28		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.

June 1988

1/6

THERMAL DATA *

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal resistance junction-case	max	1.69	3.57	°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 **IRF730/732/730FI/732FI** for **IRF731/733/731FI/733FI**	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 **IRF730/731/730FI/731FI** for **IRF732/733/732FI/733FI**	5.5 4.5			A A
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10$ V $I_D = 3.0$ A for **IRF730/731/730FI/731FI** for **IRF732/733/732FI/733FI**			1.0 1.5	Ω Ω

DYNAMIC

g_{fs} **	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 3.0$ A	2.9			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$			800 300 80	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 $I_D = 3.0$ A $R_l = 15$ Ω (see test circuit)			30 35 55 35	ns ns ns ns
Q_g	Total Gate Charge	$V_{GS} = 10$ V $I_D = 5.5$ A V_{DS} = Max Rating × 0.8 (see test circuit)			35	nC

ELECTRICAL CHARACTERISTICS (Continued)

Parameters		Test Conditions		Min.	Typ.	Max.	Unit

SOURCE DRAIN DIODE

|	Parameters	Test Conditions		Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (•)	Source-drain current Source-drain current (pulsed)					5.5 20	A A
V_{SD}	Forward on voltage	$I_{SD} = 5.5$ A	$V_{GS} = 0$			1.6	V
t_{rr}	Reverse recovery time	$T_j = 150°C$			600		ns
Q_{rr}	Reverse recovered charge	$I_{SD} = 5.5$ A	$di/dt = 100$ A/μs		4		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)
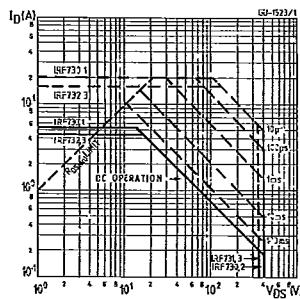
Thermal impedance (standard package)
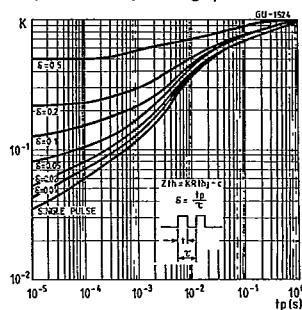
Derating curve (standard package)
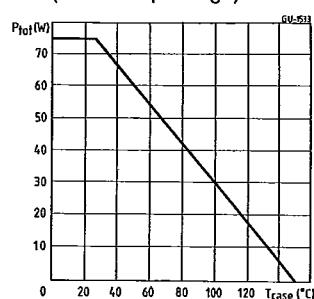
Output characteristics
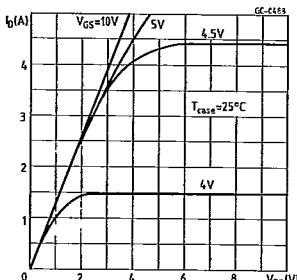
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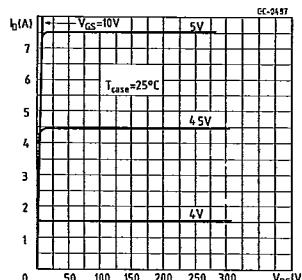
### Transfer characteristics
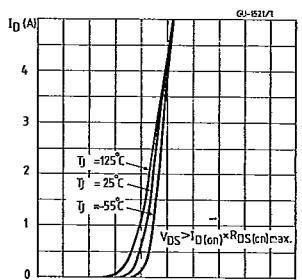
## Transconductance
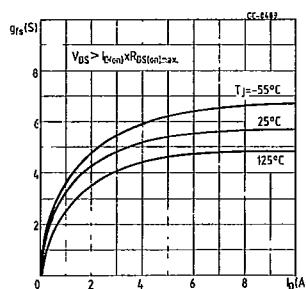
## Static drain-source on resistance
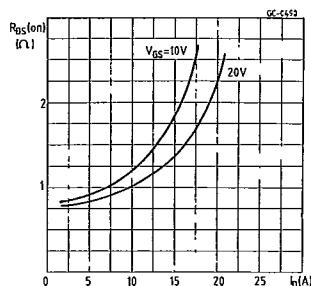

Maximum drain current vs temperature
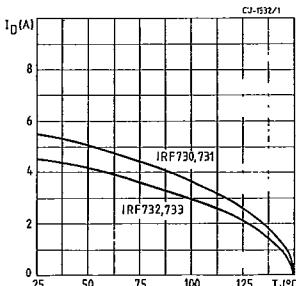
## Gate charge vs gate-source voltage
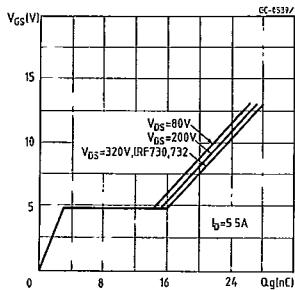
## Capacitance variation
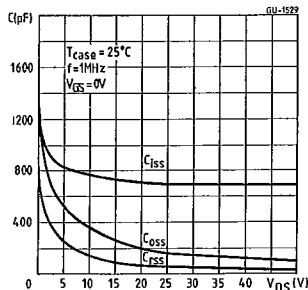
Normalized breakdown voltage vs temperature
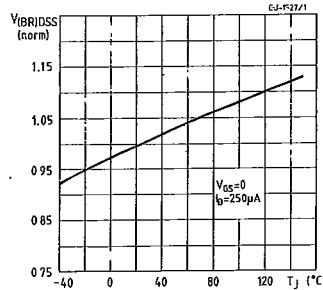
## Normalized on resistance vs temperature
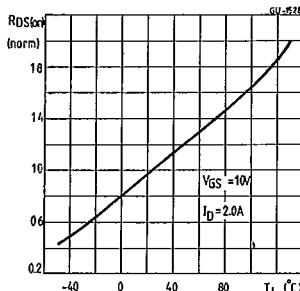
Source-drain diode forward characteristics


4/6
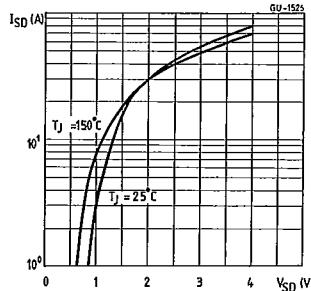
Clamped inductive test circuit

VARY t_p TO OBTAIN
REQUIRED PEAK I_L DUT

$V_{GS}=10V$

$E_1=0.5 \; BV_{DSS}$

$E_C=0.75 \; BV_{DSS}$

SC-0242

Clamped inductive waveforms
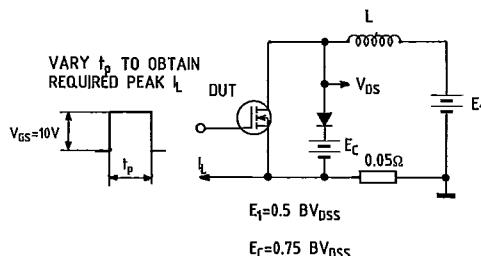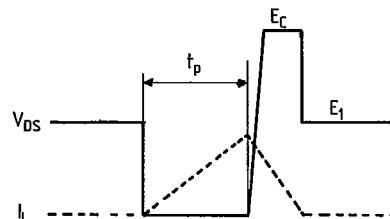
SC-0243

Switching times test circuit

PULSE
GENERATOR

ADJUST R_L
TO OBTAIN
SPECIFIED I_D
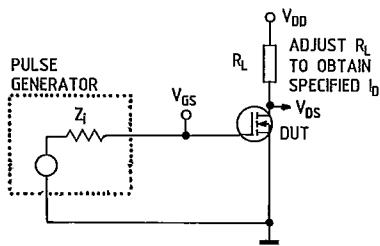
SC-0246

Gate charge test circuit

CURRENT
REGULATOR

SAME TYPE
AS DUT

12V   0.2μF   50KΩ

0.3μF

1.5mA

DUT

I_G I_D

CURRENT
SAMPLING
RESISTOR

CURRENT
SAMPLING
RESISTOR
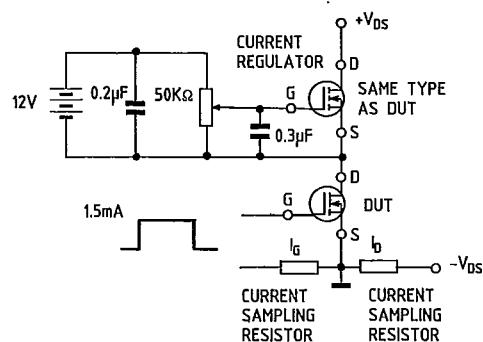
SC-0244

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 $R_{th \text{ (tot)}}$ 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

$$R_{thJ-C} \quad R_{thC-HS} \quad R_{thHS-amb}$$
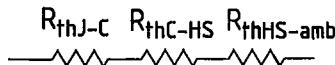
ISOWATT DATA
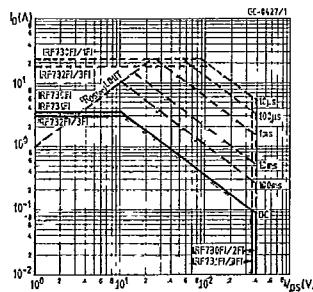
Safe operating areas   Thermal impedance   Derating curve

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