



S G S-THOMSON

IRFZ20/FI

IRFZ22/FI

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRFZ20	50 V	0.1 Ω	15 A
IRFZ20FI	50 V	0.1 Ω	12.5 A
IRFZ22	50 V	0.12 Ω	14 A
IRFZ22FI	50 V	0.12 Ω	12 A

- N-CHANNEL POWER MOS TRANSISTORS
- VERY LOW R_{DS (on)}
- LOW DRIVE ENERGY FOR EASY DRIVE
- COST EFFECTIVE

INDUSTRIAL APPLICATIONS:

- AUTOMOTIVE POWER ACTUATORS
- MOTOR CONTROLS
- INVERTERS

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 circuits applications such as power actuators driving, motor drive including brushless motors, hydraulic actuator and many other in automotive and automatic guided vehicle applications. They also find use DC/DC converters and uninterruptible power supplies

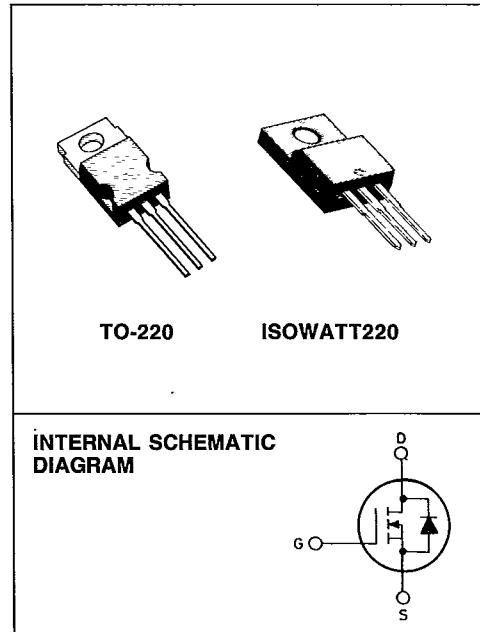
ABSOLUTE MAXIMUM RATINGS

V _{DS} *	Drain-source voltage (V _{GS} = 0)		
V _{DGR} *	Drain-gate voltage (R _{GS} = 20 kΩ)	50	V
V _{GS}	Gate-source voltage	50	V
I _{DM} (•)	Drain current (pulsed)	±20	V
I _{DLM}	Drain inductive current, clamped (L = 100 μH)	60	A
I _D	Drain current (cont.) at T _c = 25°C	60	A
I _D	Drain current (cont.) at T _c = 100°C	60	A
I _D ■	Drain current (cont.) at T _c = 25°C	Z20	Z22
I _D ■	Drain current (cont.) at T _c = 100°C	15	56
P _{tot} ■	Total dissipation at T _c < 25°C	10	14
T _{stg}	Derating factor	Z20FI	Z22
T _J	Storage temperature	12.5	12
	Max. operating junction temperature	7.5	7

* T_c = 25°C to 125°C

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

■ See note on ISOWATT220 in this datasheet



	IRF	Z20 Z20FI	Z22 Z22FI	
V _{DS} *	50	50	56	V
V _{DGR} *	50	50	56	V
V _{GS}	±20			V
I _{DM} (•)	60	60	56	A
I _{DLM}	60	60	56	A
I _D	Z20	Z22		
I _D	15	10	9	A
I _D ■	Z20FI	Z22	Z22FI	
I _D ■	12.5	12	12	A
P _{tot} ■	7.5	7	7	A
T _{stg}	TO-220	TO-220	ISOWATT220	
T _J	40	30	30	W
	0.32	0.24	0.24	W/°C
		-55 to 150	150	°C
				°C

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THERMAL DATA

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ISOWATT220

$R_{thj\text{-case}}$	Thermal resistance junction-case	max	3.12	4.16	$^{\circ}\text{C}/\text{W}$
$R_{thc\text{-s}}$	Thermal resistance case-sink	typ	0.5	$^{\circ}\text{C}/\text{W}$	$^{\circ}\text{C}/\text{W}$
$R_{thj\text{-amb}}$	Thermal resistance junction-ambient	max	80	$^{\circ}\text{C}/\text{W}$	$^{\circ}\text{C}/\text{W}$
T_I	Maximum lead temperature for soldering purpose		300		$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS ($T_{\text{case}} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
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OFF

$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$I_D = 250 \mu\text{A}$	$V_{GS} = 0$	50			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$	$T_c = 125^{\circ}\text{C}$		250 1000	μA μA	
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20 \text{ V}$			± 500	nA	

ON **

$V_{GS\text{(th)}}$	Gate threshold voltage	$V_{DS} = V_{GS}$	$I_D = 250 \mu\text{A}$	2		4	V
$I_{D\text{(on)}}$	On-state drain current	$V_{DS} > I_{D\text{(on)}} \times R_{DS\text{(on)}}$ max for IRFZ20/IRFZ20FI for IRFZ22/IRFZ22FI	$V_{GS} = 10 \text{ V}$	15 14			A A
$R_{DS\text{(on)}}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}$ for IRFZ20/IRFZ20FI for IRFZ22/IRFZ22FI	$I_D = 9.0 \text{ A}$		0.10 0.12	Ω Ω	

DYNAMIC

g_{fs}^{**}	Forward transconductance	$V_{DS} > I_{D\text{(on)}} \times R_{DS\text{(on)}}$ max $I_D = 9.0 \text{ A}$	5			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25 \text{ V}$ $V_{GS} = 0$	f = 1 MHz		850 350 100	pF pF pF

SWITCHING

$t_d\text{(on)}$ t_r $t_d\text{(off)}$ t_f	Turn-on time Rise time Turn-off delay time Fall time	$V_{DD} = 25 \text{ V}$ $R_i = 50 \Omega$ (see test circuit)	$I_D = 9.0 \text{ A}$	30 90 40 30	ns ns ns ns	
Q_g	Total Gate Charge	$V_{GS} = 10 \text{ V}$ $V_{DS} = \text{Max Rating} \times 0.8$ (see test circuit)	$I_D = 20 \text{ A}$		17	nC

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ELECTRICAL CHARACTERISTICS (Continued)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
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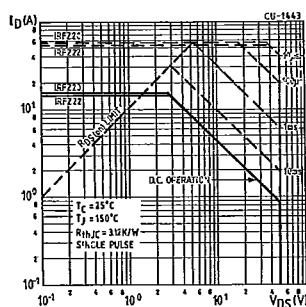
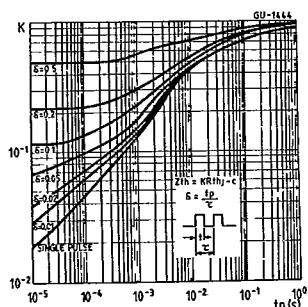
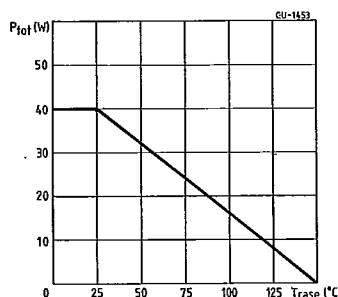
SOURCE DRAIN DIODE

I _{SD}	Source-drain current	for IRFZ20/IRFZ20FI		15	ns
I _{SDM} (*)	Source-drain current (pulsed)	for IRFZ22/IRFZ22FI		14	ns
V _{SD} **	Forward on voltage	for IRFZ20/IRFZ20FI I _{SD} = 15 A for IRFZ22/IRFZ22FI I _{SD} = 14 A		60	A
t _{rr}	Reverse recovery time	T _j = 150°C		56	A
Q _{rr}	Reverse recovered charge	I _{SD} = 15 A di/dt = 100 A/μs	100		ns
			0.4		μC

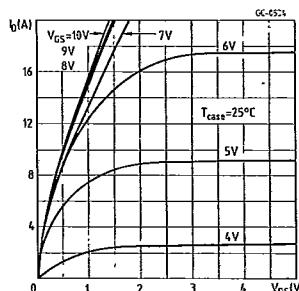
** Pulsed: Pulse duration $\leq 300 \mu\text{s}$, duty cycle $\leq 1.5\%$

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

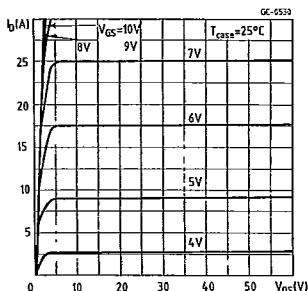
■ See note on ISOWATT220 in this datasheet

Safe operating areas
(standard package)Thermal impedance
(standard package)Derating curve
(standard package)

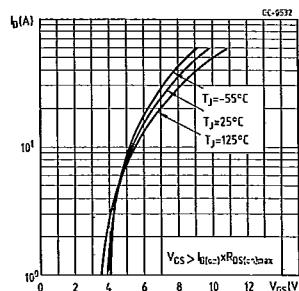
Output characteristics



Output characteristics

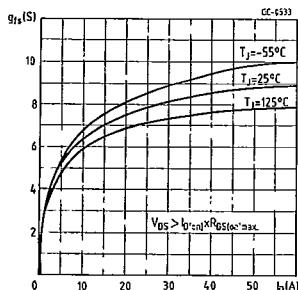


Transfer characteristics

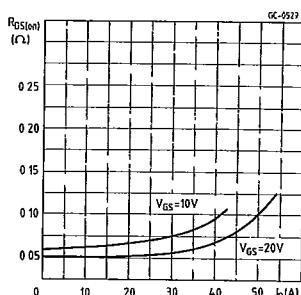


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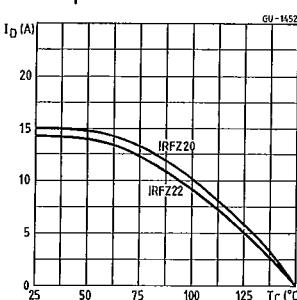
Transconductance



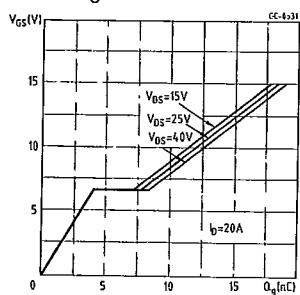
Static drain-source on resistance



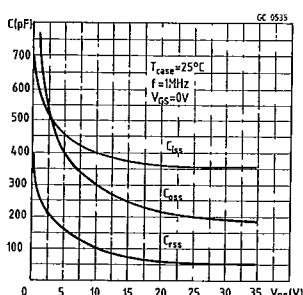
Maximum drain current vs temperature



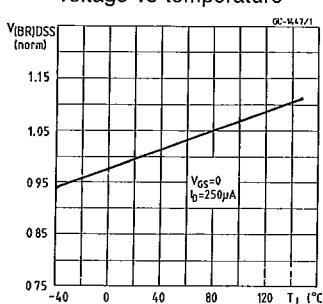
Gate charge vs gate-source voltage



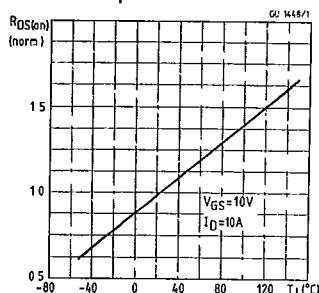
Capacitance variation



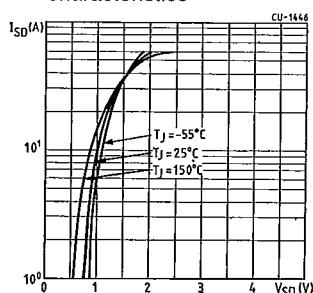
Normalized breakdown voltage vs temperature



Normalized on resistance vs temperature



Source-drain diode forward characteristics

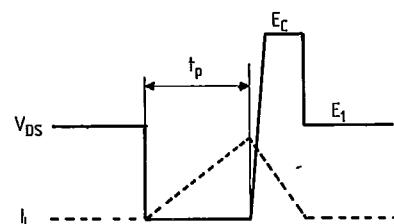
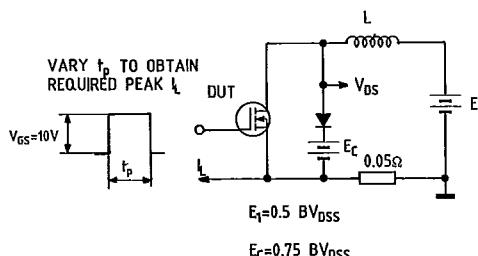


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Clamped inductive test circuit

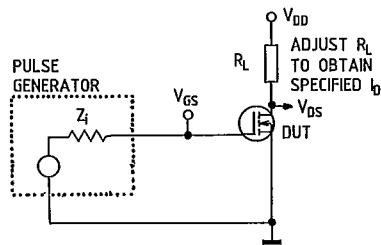
Clamped inductive waveforms



SC-0243

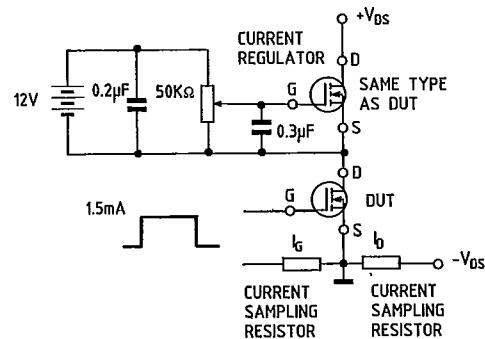
SC-0242

Switching times test circuit



SC-0246

Gate charge test circuit



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:

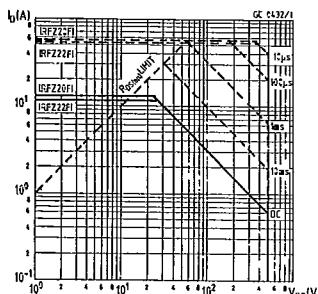
$$P_D = \frac{T_J - T_c}{R_{th}}$$

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

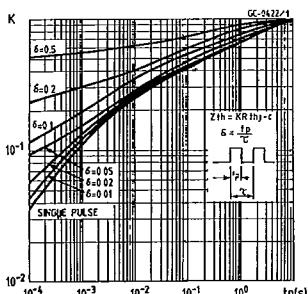
$$I_{Dmax} \leq \sqrt{\frac{P_D}{R_{DS(on)} \text{ (at } 150^\circ\text{C)}}}$$

ISOWATT DATA

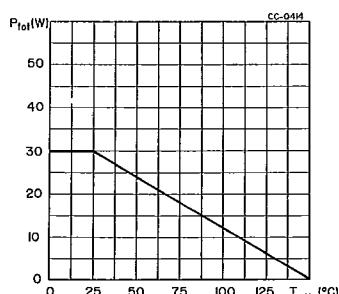
Safe operating areas



Thermal impedance



Derating curve



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 possible to discern these areas on transient thermal impedance curves.

Fig. 1

