



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

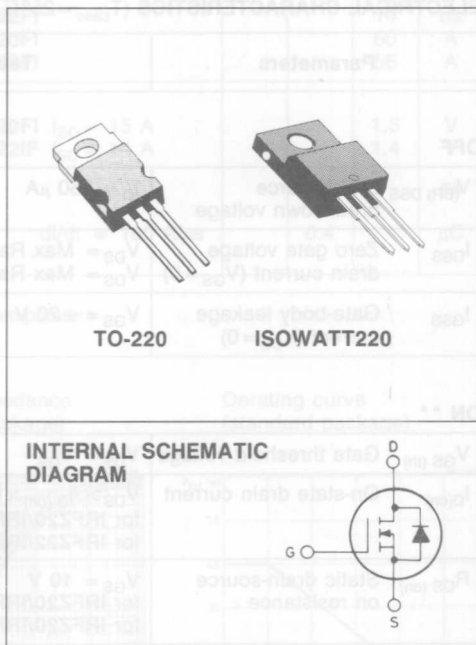
TYPE	V _{DSS}	R _{DS(on)}	I _D
IRFZ20	50 V	0.1 Ω	15 A
IRFZ20FI	50 V	0.1 Ω	12.5 A
IRFZ22	50 V	0.12 Ω	14 A
IRFZ20FI	50 V	0.12 Ω	12 A

- 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 K Ω)
V _{GS}	Gate-source voltage
I _{DM} (*)	Drain current (pulsed)
I _{DLM}	Drain inductive current, clamped (L = 100 μ H)
I _D	Drain current (cont.) at T _c = 25°C
I _D	Drain current (cont.) at T _c = 100°C
I _D ■	Drain current (cont.) at T _c = 25°C
I _D ■	Drain current (cont.) at T _c = 100°C
P _{tot} ■	Total dissipation at T _c < 25°C
■	Derating factor
T _{stg}	Storage temperature
T _j	Max. operating junction temperature

* T_j = 25°C to 125°C

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

■ See note on ISOWATT220 in this datasheet

IRF		
Z20	Z22	
Z20FI	Z22FI	
	50	V
	50	V
	± 20	V
60	56	A
60	56	A
Z20	Z22	
15	14	A
10	9	A
Z20FI	Z22FI	
12.5	12	A
7.5	7	A
TO-220	ISOWATT220	
40	30	W
0.32	0.24	W/°C
	-55 to 150	°C
	150	°C

THERMAL DATA *

TO-220 | ISOWATT220

$R_{thj - case}$	Thermal resistance junction-case	max	3.12	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 ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
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OFF

$V_{(BR) DSS}$	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 **

$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$	$I_D = 250 \mu\text{A}$	2	4	V
$I_{D(on)}$	On-state drain current	$V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max}}$ for IRFZ20/IRFZ20FI for IRFZ22/IRFZ22FI	$V_{GS} = 10 \text{ V}$	15 14		A A
$R_{DS(on)}$	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	$V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max}}$ $I_D = 9.0 \text{ A}$	5			mho
C_{iss}	Input capacitance	$V_{DS} = 25 \text{ V}$	$f = 1 \text{ MHz}$		850	pF
C_{oss}	Output capacitance	$V_{GS} = 0$			350	pF
C_{rss}	Reverse transfer capacitance				100	pF

SWITCHING

$t_d(on)$	Turn-on time	$V_{DD} = 25 \text{ V}$	$I_D = 9.0 \text{ A}$		30	ns
t_r	Rise time	$R_l = 50 \Omega$			90	ns
$t_d(off)$	Turn-off delay time	(see test circuit)			40	ns
t_f	Fall time				30	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

ELECTRICAL CHARACTERISTICS (Continued)

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

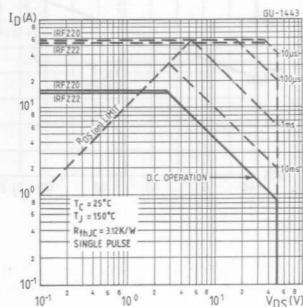
I_{SD}	Source-drain current	for IRFZ20/IRFZ20FI for IRFZ22/IRFZ22FI		15 14	ns ns
I_{SDM} (*)	Source-drain current (pulsed)	for IRFZ20/IRFZ20FI for IRFZ22/IRFZ22FI		60 56	A A
V_{SD}^{**}	Forward on voltage	$V_{GS} = 0$ for IRFZ20/IRFZ20FI $I_{SD} = 15$ A for IRFZ22/IRFZ22FI $I_{SD} = 14$ A		1.5 1.4	V V
t_{rr}	Reverse recovery time	$T_J = 150^\circ\text{C}$	100		ns
Q_{rr}	Reverse recovered charge	$I_{SD} = 15$ A $di/dt = 100$ A/ μs	0.4		μC

** Pulsed: Pulse duration ≤ 300 μs , duty cycle $\leq 1.5\%$

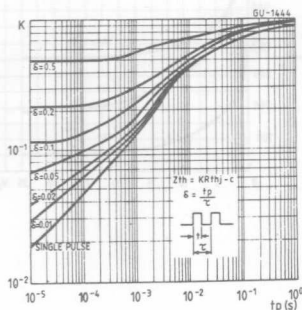
(*) Repetitive Rating: Pulse width limited by max junction temperature

■ See note on ISOWATT220 in this datasheet

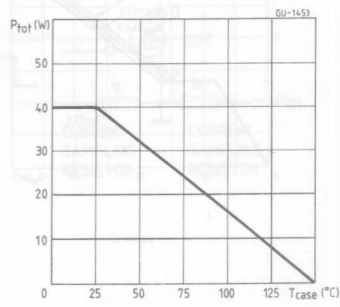
Safe operating areas
(standard package)



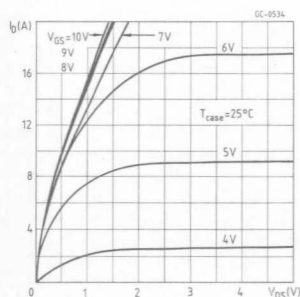
Thermal impedance
(standard package)



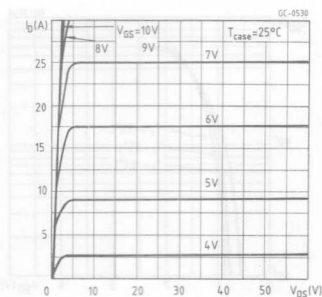
Derating curve
(standard package)



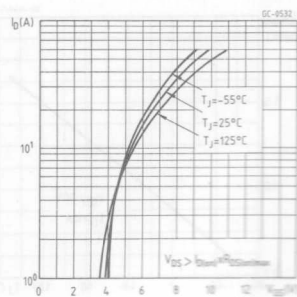
Output characteristics



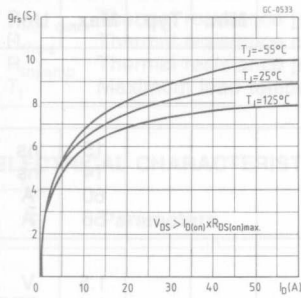
Output characteristics



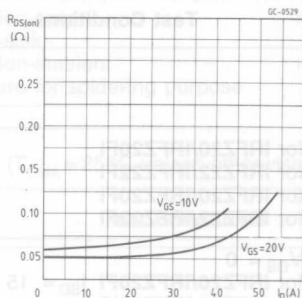
Transfer characteristics



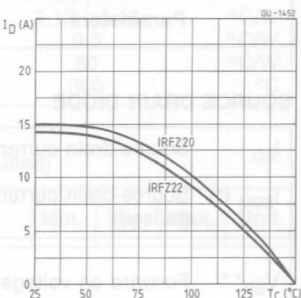
Transconductance



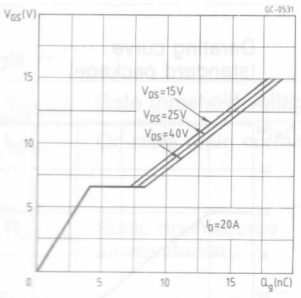
Static drain-source on resistance



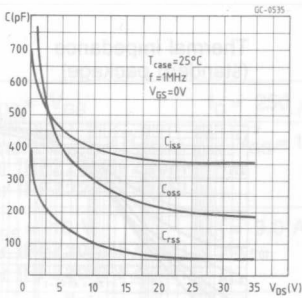
Maximum drain current vs temperature



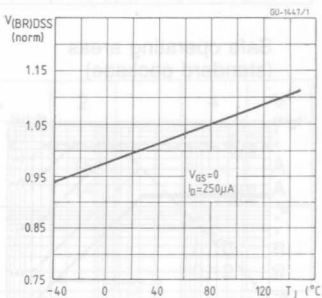
Gate charge vs gate-source voltage



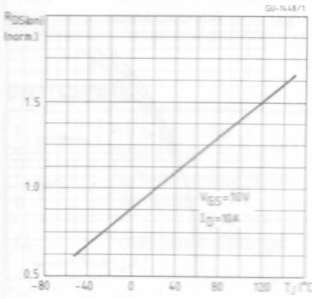
Capacitance variation



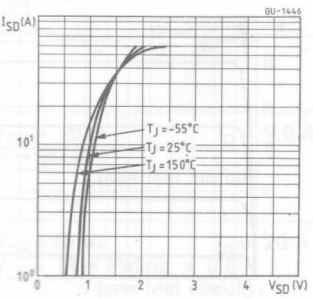
Normalized breakdown voltage vs temperature



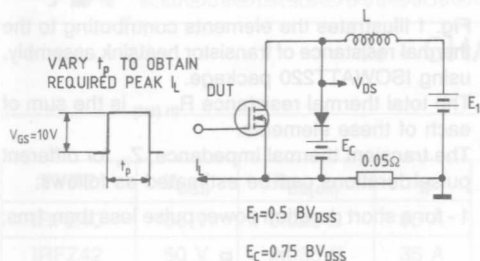
Normalized on resistance vs temperature



Source-drain diode forward characteristics

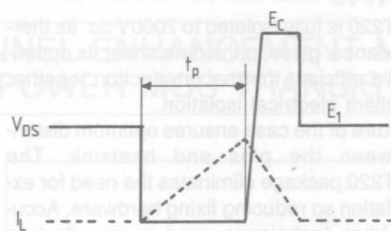


Clamped inductive test circuit



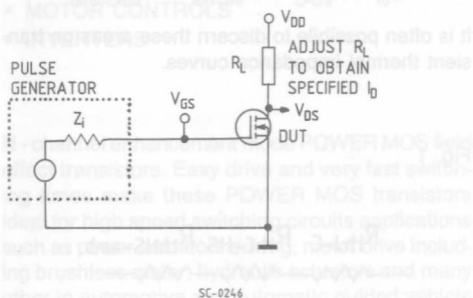
SC-0242

Clamped inductive waveforms



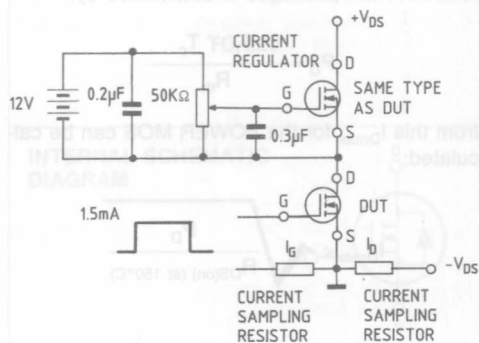
SC-0243

Switching times test circuit



SC-0246

Gate charge test circuit



SC-0244

ABSOLUTE MAXIMUM RATINGS



IRFZ40

IRFZ42



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:

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

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;
- 2 - for an intermediate power pulse of 5ms to 50ms;
- 3 - for long power pulses of the order of 500ms or greater;

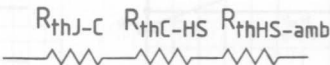
$$Z_{th} < R_{thJ-C}$$

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

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

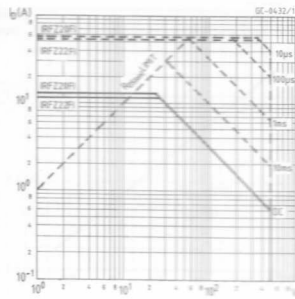
It is often possible to discern these areas on transient thermal impedance curves.

Fig. 1

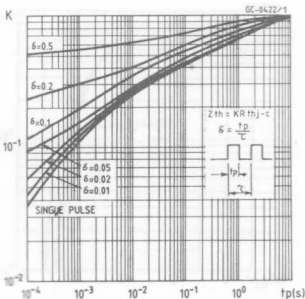


ISOWATT DATA

Safe operating areas



Thermal impedance



Derating curve

