

## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

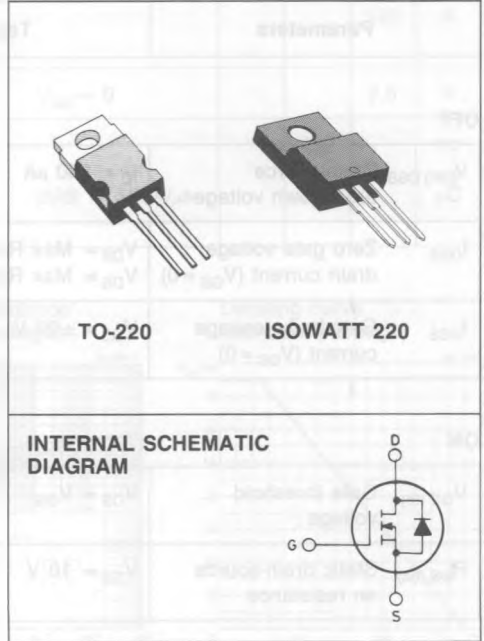
TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub> <sup>■</sup>
BUZ11S2	60 V	0.04 Ω	30 A
BUZ11S2FI	60 V	0.04 Ω	20 A

- VERY LOW ON-LOSSES
- LOW DRIVE ENERGY FOR EASY DRIVE
- HIGH TRANSCONDUCTANCE/C<sub>rSS</sub> RATIO

### INDUSTRIAL APPLICATIONS:

- AUTOMATIVE POWER ACTUATORS

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



### ABSOLUTE MAXIMUM RATINGS

V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> = 0)	60	V
V <sub>DGR</sub>	Drain-gate voltage (R <sub>GS</sub> = 20 KΩ)	60	V
V <sub>GS</sub>	Gate-source voltage	± 20	V
I <sub>DM</sub>	Drain current (pulsed) T <sub>c</sub> = 25°C	120	A
I <sub>D</sub> <sup>■</sup>	Drain current (continuous) T <sub>c</sub> = 30°C	30	A
P <sub>tot</sub> <sup>■</sup>	Total dissipation at T <sub>c</sub> < 25°C	75	W
T <sub>stg</sub>	Storage temperature	- 55 to 150	°C
T <sub>j</sub>	Max. operating junction temperature	150	°C
	DIN humidity category (DIN 40040)	E	
	IEC climatic category (DIN IEC 68-1)	55/150/56	

■ See note on ISOWATT 220 in this datasheet

**THERMAL DATA**
**TO-220 | ISOWATT220**

$R_{thj-case}$	Thermal resistance junction-case	max	1.67	3.57	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	max	75		°C/W

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

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
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**OFF**

$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$	$V_{GS} = 0$	60		V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$	$T_j = 125^\circ\text{C}$		250 1000	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\ \text{V}$			$\pm 100$	nA

**ON**

$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$	$I_D = 1\ \text{mA}$	2.1	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\ \text{V}$	$I_D = 15\ \text{A}$		0.04	$\Omega$

**DYNAMIC**

$g_{fs}$	Forward transconductance	$V_{DS} = 25\ \text{V}$	$I_D = 15\ \text{A}$	4		mho
$C_{iss}$	Input capacitance	$V_{DS} = 25\ \text{V}$ $V_{GS} = 0$	$f = 1\ \text{MHz}$		2000	pF
$C_{oss}$	Output capacitance				1100	pF
$C_{rss}$	Reverse transfer capacitance				400	pF

**SWITCHING**

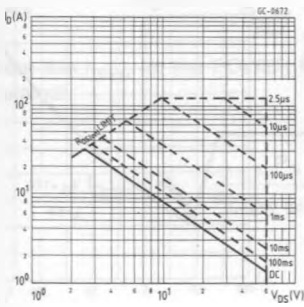
$t_{d(on)}$	Turn-on time	$V_{DD} = 30\ \text{V}$ $R_{GS} = 50\ \Omega$	$I_D = 3\ \text{A}$ $V_{GS} = 10\ \text{V}$		45	ns
$t_r$	Rise time				110	ns
$t_{d(off)}$	Turn-off delay time				230	ns
$t_f$	Fall time				170	ns

■ See note on ISOWATT 220 in this datasheet

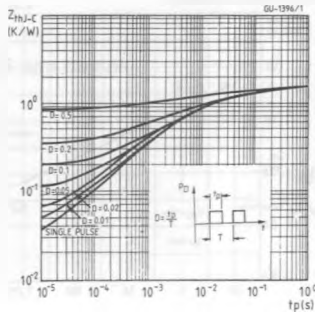
ELECTRICAL CHARACTERISTICS (Continued)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}$	Source-drain current Source-drain current (pulsed)	$T_c = 25^\circ\text{C}$		30 120	A A
$V_{SD}$	Forward on voltage	$I_{SD} = 60\text{ A}$	$V_{GS} = 0$	2.6	V
$t_{rr}$	Reverse recovery time			200	ns
$Q_{rr}$	Reverse recovered charge	$I_{SD} = 30\text{ A}$	$di/dt = 100\text{ A}/\mu\text{s}$	0.25	$\mu\text{C}$

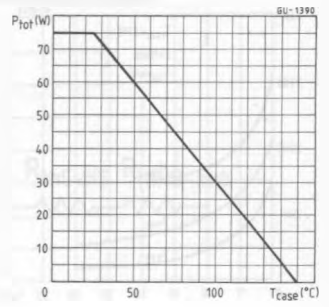
Safe operating areas  
(standard package)



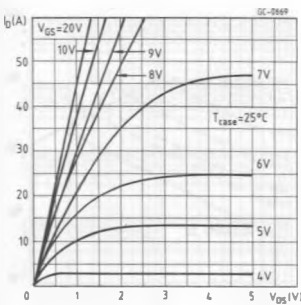
Thermal impedance  
(standard package)



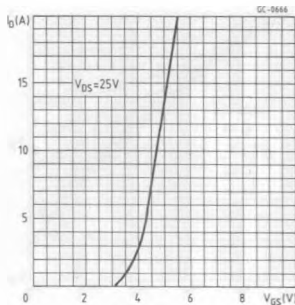
Derating curve  
(standard package)



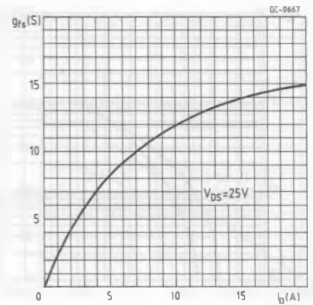
Output characteristics



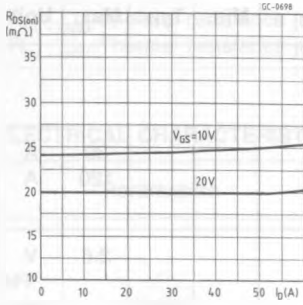
Transfer characteristics



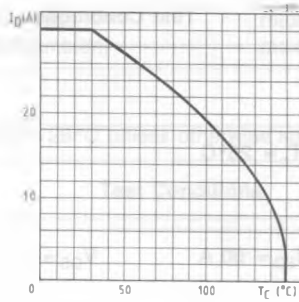
Transconductance



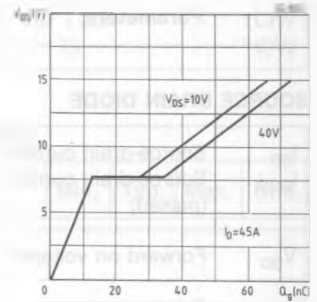
**Static drain-source on resistance**



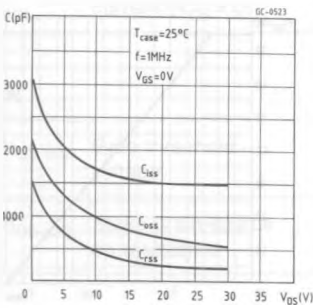
**Maximum drain current vs temperature**



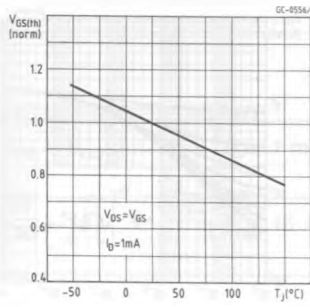
**Gate charge vs gate-source voltage**



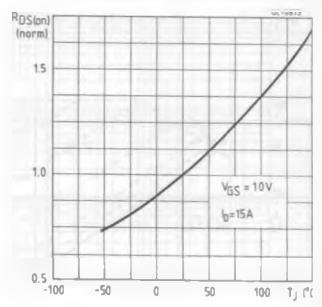
**Capacitance variation**



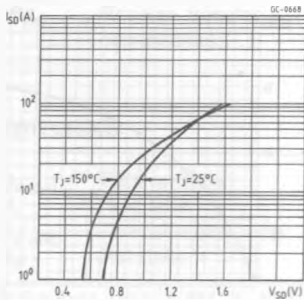
**Gate threshold voltage vs temperature**



**Drain-source on resistance vs temperature**



**Source-drain diode forward characteristics**



**ISOWATT220 PACKAGE CHARACTERISTICS AND APPLICATION.**

ISOWATT220 is fully isolated to 2000V dc. Its thermal impedance, given in the data sheet, is optimized 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;

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

2 - for an intermediate power pulse of 5ms to 50ms:

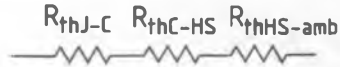
$$Z_{th} = R_{thJ-C}$$

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

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

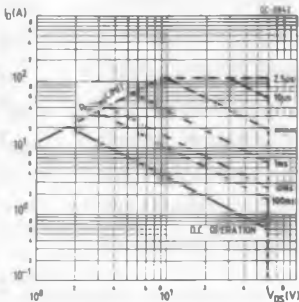
It is often possible to discern these areas on transient thermal impedance curves.

Fig. 1

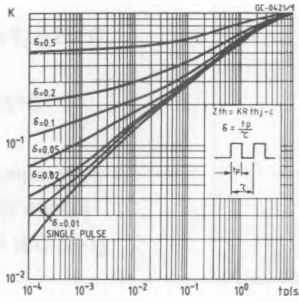


**ISOWATT DATA**

Safe operating areas



Thermal impedance



Derating curve

