

HIGH INJECTION N-CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS (IGBT)

PRELIMINARY DATA

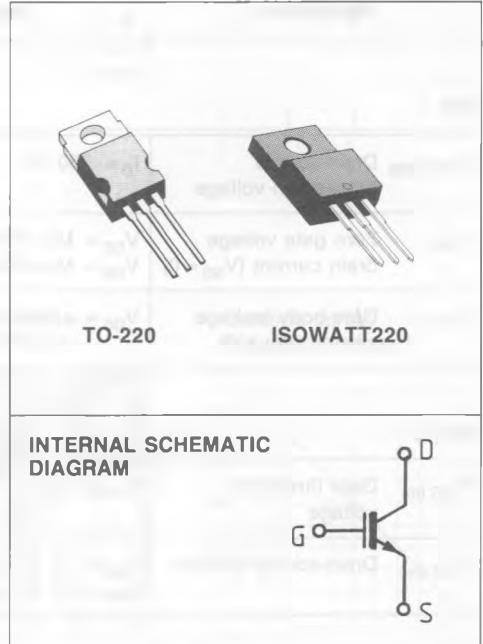
TYPE	V _{DSS}	I _D
STH10N50	500 V	10 A
STH10N50FI	500 V	10 A

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE
- HIGH CURRENT CAPABILITY
- FAST TURN-OFF: $t_f < 1.5 \mu\text{s}$

APPLICATIONS:

- MOTOR CONTROL

N - channel High Injection POWER MOS transistors (IGBT) which feature a high impedance insulated gate input and a low on-resistance characteristic of bipolar transistors. This low resistance is achieved by conductivity modulation of the drain. These devices are particularly suited to switching motor control applications in consumer equipment such as washing machines and tumble dryers and industrial equipment motor control.


ABSOLUTE MAXIMUM RATINGS

V _{DS}	Drain-source voltage (V _{GS} = 0)	500	V
V _{GS}	Gate-source voltage	±20	V
I _D (*)	Drain current (contin.) at T _c = 25°C	10	A
I _{DM}	Drain current (pulsed)	30	A
P _{tot}	Total dissipation at T _c < 25°C	STH10N50 100	STH10N50FI 35
	Derating factor	0.8	0.28
T _{stg}	Storage temperature	- 65 to 150	
T _j	Max. operating junction temperature	150	

(*) Pulse width limited by safe operating area

THERMAL DATA
TO-220 | ISOWATT220

$R_{thj-case}$ Thermal resistance junction-case	max	1.25	3.57	°C/W
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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	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	500			V
I_{DSS} Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_j = 125^\circ\text{C}$			250 1000	μA μA
I_{GSS} Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\ \text{V}$			± 100	nA

ON (*)

$V_{GS(th)}$ Gate threshold voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2		4	V
$V_{DS(on)}$ Drain-source voltage	$V_{GS} = 15\ \text{V}$ $I_D = 10\ \text{A}$ $V_{GS} = 15\ \text{V}$ $I_D = 10\ \text{A}$ $T_j = 100^\circ\text{C}$			2.7 2.7	V V

DYNAMIC

g_{fs} Forward transconductance	$V_{DS} = 20\ \text{V}$ $I_D = 10\ \text{A}$	2.5			mho
C_{iss} Input capacitance	$V_{DS} = 25\ \text{V}$ $f = 1\ \text{MHz}$ $V_{GS} = 0$		850	950	pF
C_{oss} Output capacitance			90	140	pF
C_{rss} Reverse transfer capacitance			40	80	pF

SWITCHING

RESISTIVE LOAD						
$t_{d(on)}$ Turn-on delay time	$V_{DD} = 400\ \text{V}$ $I_D = 10\ \text{A}$ $V_g = 15\ \text{V}$ $R_g = 100\ \Omega$			100	150	ns
t_r Rise time				700	1000	ns
$t_{d(off)}$ Turn-off delay time				500	700	ns
t_f Fall time				800	1500	ns

ELECTRICAL CHARACTERISTICS (Continued)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
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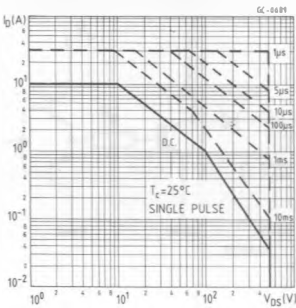
SWITCHING (continued)

INDUCTIVE LOAD		$V_{DS\ clamp} = 350\ V$ $V_g = 15\ V$ $L = 180\ \mu H$	$I_D = 10\ A$ $R_g = 100\ \Omega$ $T_j = 100^\circ C$	0.7	1.2	μS
$t_d\ (off)$	Turn-off delay time					
t_f	Fall time					
t_{cross}	Crossover time					
E_{off}	Turn-off losses					
				1.1	1.5	μS
				1.7	2	μS
				4		mJ

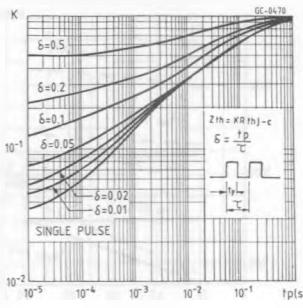
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1,5%

(■) See note on ISOWATT220 in this datasheet

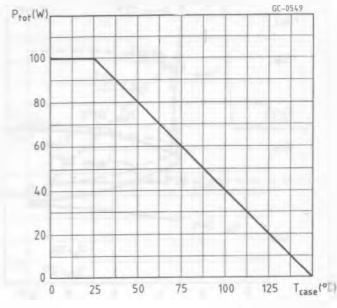
Safe operating areas (standard package)



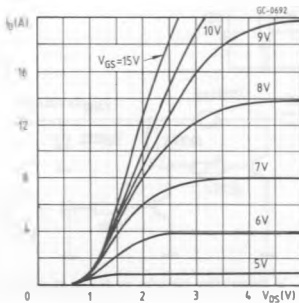
Thermal impedance (standard package)



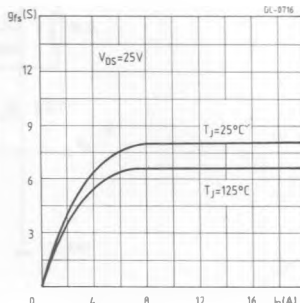
Derating curve (standard package)



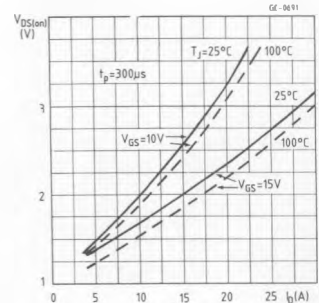
Output characteristics



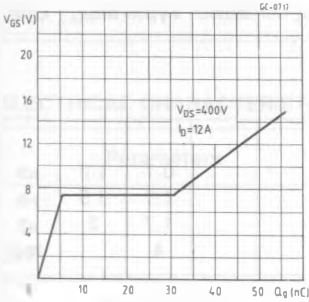
Transconductance



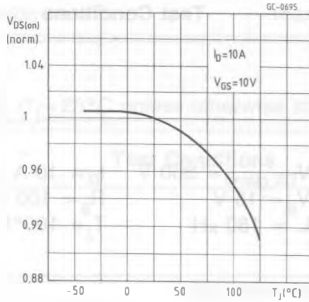
Static drain-source on voltage



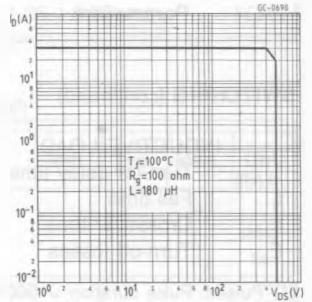
Gate charge vs gate-source voltage



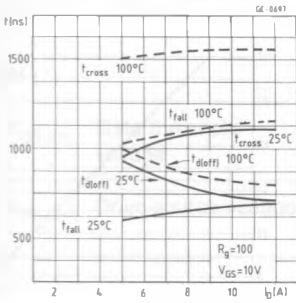
Normalized on voltage vs temperature



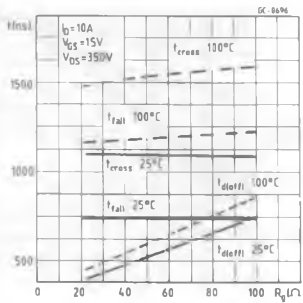
Reverse biased SOA



Switching times inductive load vs drain current

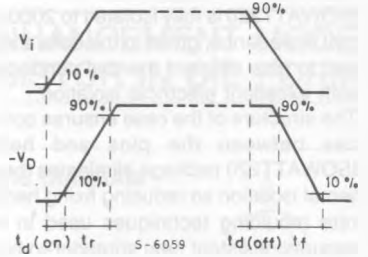
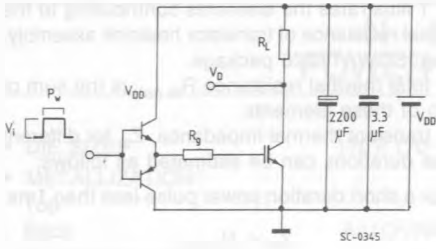


Switching times inductive load vs Rg



Switching times test circuit for resistive load .

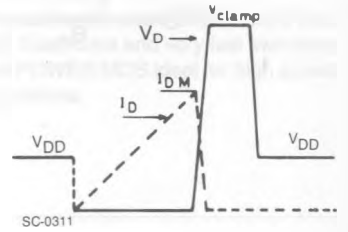
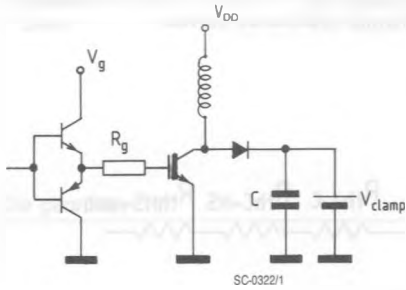
Switching time waveforms for resistive load



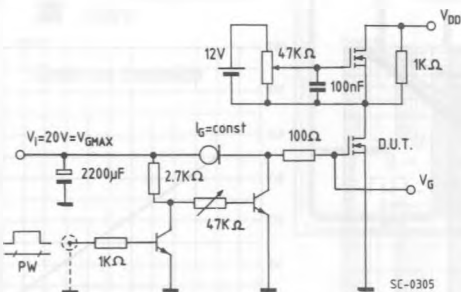
Pulse width $\leq 100 \mu\text{s}$
 Duty cycle $\leq 2\%$

Clamped inductive load and RBSOA test circuit

Clamped inductive waveforms



Gate charge test circuit



PW adjusted to obtain required V_G

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:

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

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:

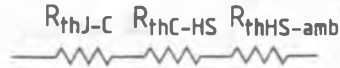
$$Z_{th} = R_{thJ-C}$$

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

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

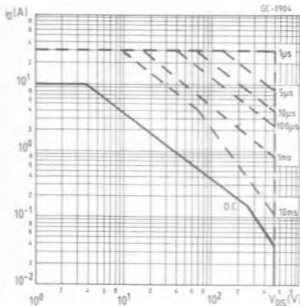
It is often possible to discern these areas on transient thermal impedance curves.

Fig. 1

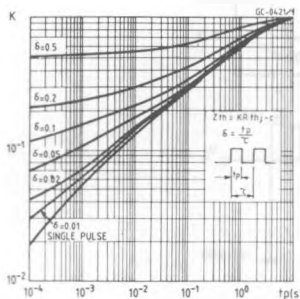


ISOWATT DATA

Safe operating areas



Thermal impedance



Derating curve

