SGS-THOMSON
MICROELECTRONICS

STHI10N50
STHI10N50FI

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

PRELIMINARY DATA

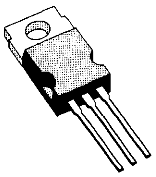
TYPE	V_{DSS}	I_D
STHI10N50	500 V	10 A
STHI10N50FI	500 V	10 A

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

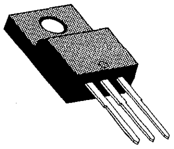
APPLICATIONS:

- 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.

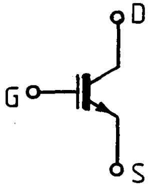


TO-220



ISOWATT220

INTERNAL SCHEMATIC DIAGRAM



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
		STHI10N50	**STHI10N50FI**	
P_{tot}	Total dissipation at $T_c<25°C$	100	35	W
	Derating factor	0.8	0.28	W/°C
T_{stg}	Storage temperature	−65 to 150		°C
T_j	Max. operating junction temperature	150		°C

(•) 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

ELECTRICAL CHARACTERISTICS ($T_j = 25$°C unless otherwise specified)

OFF

Parameters		Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu A$ $V_{GS} = 0$	500			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} =$ Max Rating $V_{DS} =$ Max Rating × 0.8 $T_j = 125$°C			250 1000	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20$ V			±100	nA

ON (*)

Parameters		Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS\ (th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu A$	2		4	V
$V_{DS\ (on)}$	Drain-source voltage	$V_{GS} = 15$ V $I_D = 10$ A $V_{GS} = 15$ V $I_D = 10$ A $T_j = 100$°C			2.7 2.7	V V

DYNAMIC

Parameters		Test Conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward transconductance	$V_{DS} = 20$ V $I_D = 10$ A	2.5			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$		850 90 40	950 140 80	pF pF pF

SWITCHING

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

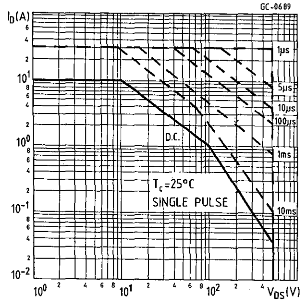
ELECTRICAL CHARACTERISTICS (Continued)

SWITCHING (continued)

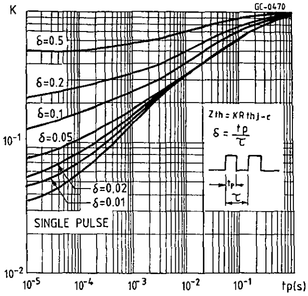
Parameters		Test Conditions	Min.	Typ.	Max.	Unit
INDUCTIVE LOAD						
$t_{d\ (off)}$	Turn-off delay time	$V_{DS\ clamp}$ = 350 V I_D = 10 A V_g = 15 V R_g = 100 Ω L = 180 μH T_j = 100°C		0.7	1.2	μs
t_f	Fall time			1.1	1.5	μs
t_{cross}	Crossover time			1.7	2	μs
E_{off}	Turn-off losses			4		mJ

(*) Pulsed: Pulse duration = 300 μs, duty cycle 1,5%
(■) See note on ISOWATT220 in this datasheet

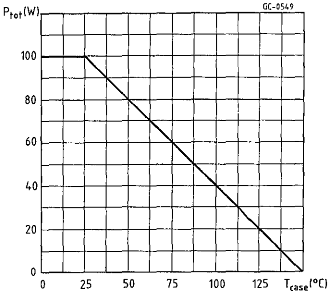
Safe operating areas (standard package)



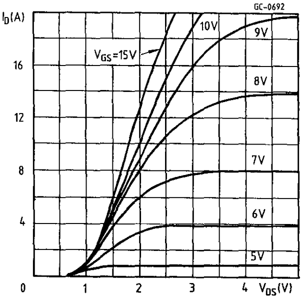
Thermal impedance (standard package)



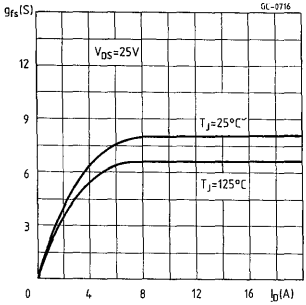
Derating curve (standard package)



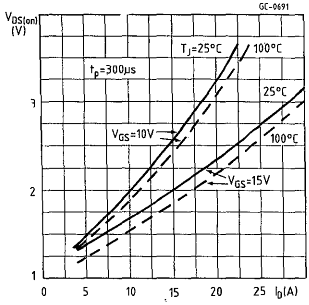
Output characteristics



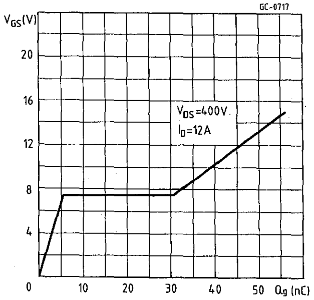
Transconductance



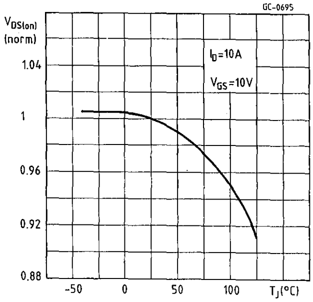
Static drain-souce on voltage



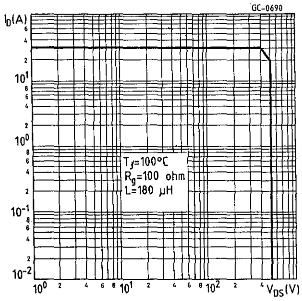
Gate charge vs gate-source voltage



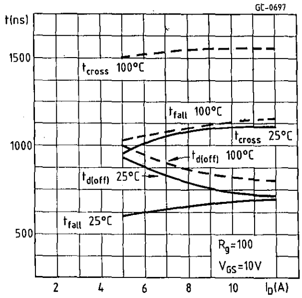
Normalized on voltage vs temperature



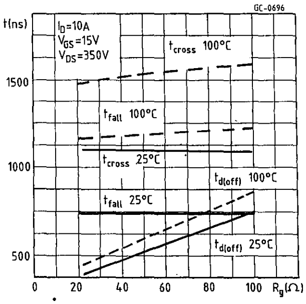
Reverse biased SOA



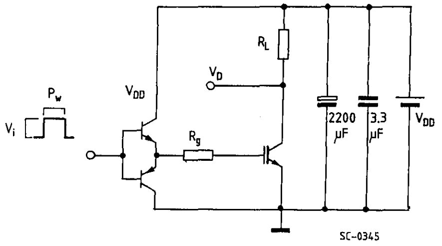
Switching times inductive load vs drain current



Switching times inductive load vs Rg

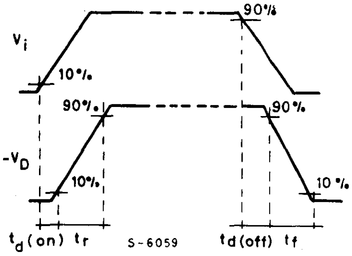


Switching times test circuit for resistive load

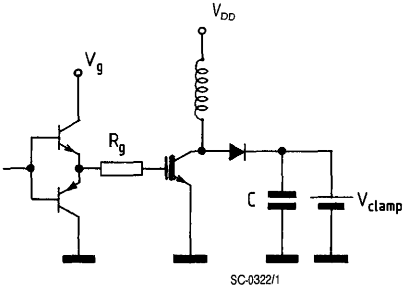


Pulse width ⩽ 100 µs
Duty cycle ⩽ 2%

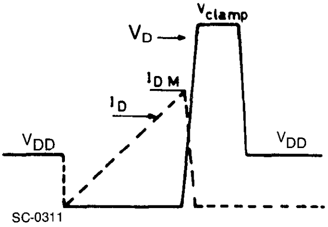
Switching time waveforms for resistive load



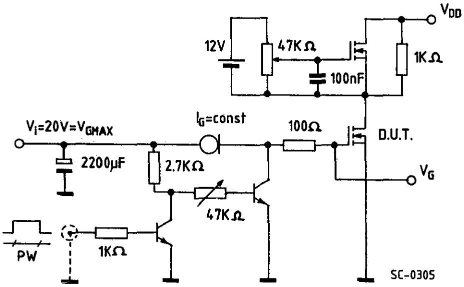
Clamped inductive load and RBSOA test circuit



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 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:

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

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;

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

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

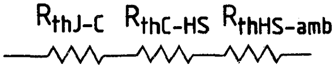
$$Z_{th} = R_{thJ\text{-}C}$$

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

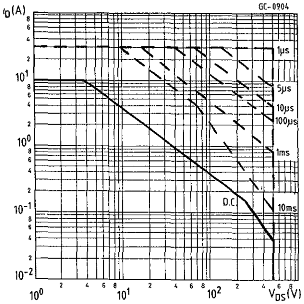
$$Z_{th} = R_{thJ\text{-}C} + R_{thC\text{-}HS} + R_{thHS\text{-}amb}$$

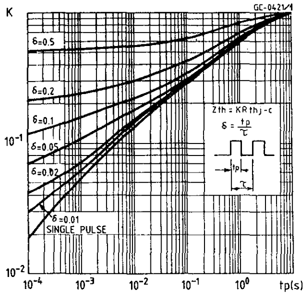
It is often possibile to discern these areas on transient thermal impedance curves.

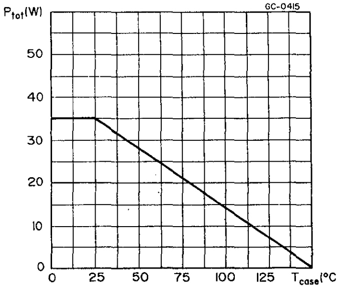
Fig. 1



ISOWATT DATA


Safe operating areas


Thermal impedance


Derating curve