SGS-THOMSON MICROELECTRONICS

# STHI07N50
# STHI07N50FI

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

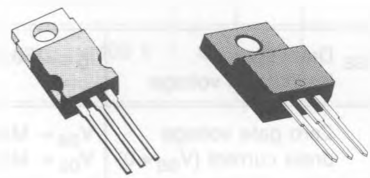
**PRELIMINARY DATA**

| TYPE | $V_{DSS}$ | $I_D$ |
|---|---|---|
| STHI07N50 | 500 V | 7 A |
| STHI07N50FI | 500 V | 7 A |

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE
- HIGH CURRENT CAPABILITY

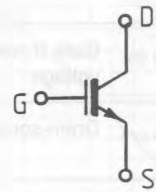
**APPLICATIONS:**
- AUTOMOTIVE IGNITION
- DRIVERS FOR SOLENOIDS AND RELAYS

N - channel High Injection POWER MOS transistors (IGBT) which features 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 automative ignition switching. They can also be used as drivers for solenoids and relays.



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 $T_c = 25°C$ | 7 | | A |
| $I_{DM}$ | Drain current (pulsed) | 20 | | A |
| | | **STHI07N50** | **STHI07N50FI** | |
| $P_{tot}$ | 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 | 3.6 | °C/W |

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

| Parameters | | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| **OFF** | | | | | | | |
| $V_{(BR)\,DSS}$ | 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<br>$V_{DS}$ = Max Rating × 0.8 | <br>$T_j = 125°C$ | | | 250<br>1000 | μA<br>μA |
| $I_{GSS}$ | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\ V$ | | | | ±100 | nA |
| **ON (*)** | | | | | | | |
| $V_{GS\,(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$ | $I_D = 250\ \mu A$ | 2 | | 4 | V |
| $V_{DS\,(on)}$ | Drain-source voltage | $V_{GS} = 10\ V$ | $I_D = 7\ A$ | | | 2.7 | V |
| **DYNAMIC** | | | | | | | |
| $g_{fs}$ | Forward transconductance | $V_{DS} = 20\ V$ | $I_D = 7\ A$ | 2.5 | | | mho |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS} = 25\ V$<br>$V_{GS} = 0$ | f = 1 MHz | | 850<br>90<br>40 | 950<br>140<br>80 | pF<br>pF<br>pF |
| **SWITCHING** | | | | | | | |
| $t_{d\,(on)}$<br>$t_r$<br>$t_{d\,(off)}$<br>$t_f$ | RESISTIVE LOAD<br>Turn-on delay time<br>Rise time<br>Turn-off delay time<br>Fall time | $V_{DD} = 400\ V$<br>$V_g = 10\ V$ | $I_D = 10\ A$<br>$R_g = 100\ \Omega$ | | 100<br>700<br>500<br>800 | 150<br>1000<br>700<br>1500 | ns<br>ns<br>ns<br>ns |

## ELECTRICAL CHARACTERISTICS (Continued)

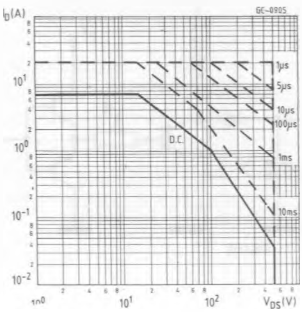
### SWITCHING (continued)

| Parameters | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| INDUCTIVE LOAD<br>$t_{d\,(off)}$ Turn-off delay time<br>$t_f$ Fall time | $V_{DD}$ = 12 V<br>$V_{DS\ clamp}$ = 350 V  $I_D$ = 7 A<br>$V_{GS}$ = 10 V  $R_g$ = 100 Ω<br>L = 10 mH  $T_j$ = 100°C | | 1<br>1.1 | 1.4<br>1.5 | μs<br>μs |
| USE TEST | $V_{CC}$ = 14 V  $V_{DS\ clamp}$ = 400 V<br>L = 7 mH | 6 | | | A |

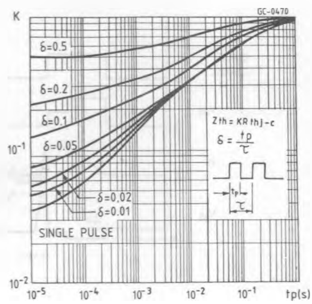
(*) Pulsed: Pulse duration = 300 μs, duty cycle 1,5%

■ See note on ISOWATT220 or this datasheet

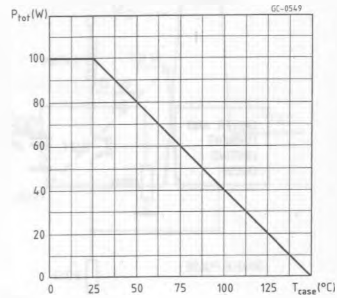
Safe operating areas (standard package)



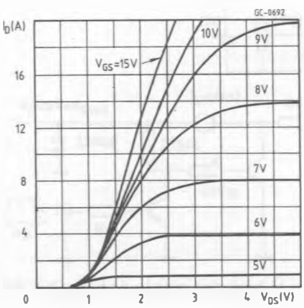

Thermal impedence (standard package)



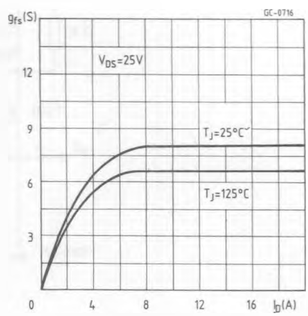

Derating curve (standard package)



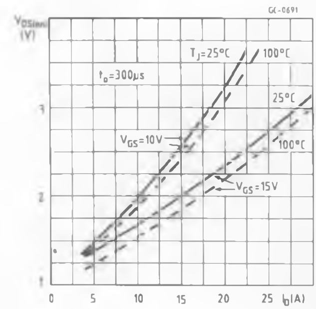

Output characteristics



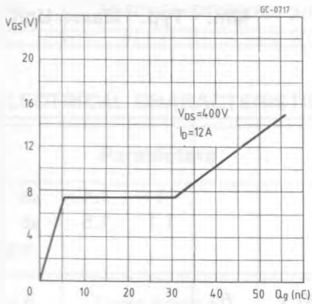

Transconductance



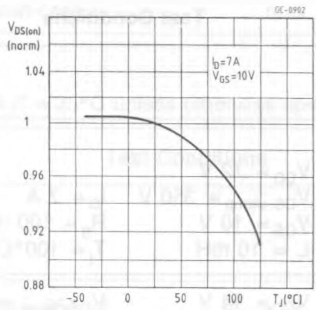

Static drain-souce on voltage



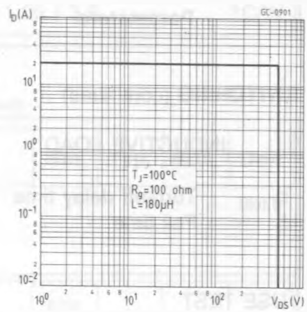
Gate charge vs gate-source voltage



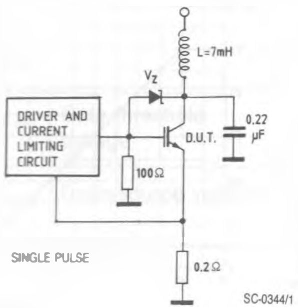

Normalized on voltage vs temperature



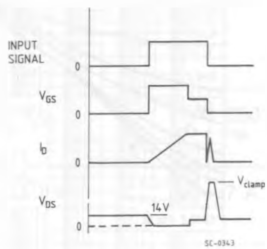

Reverse biased SOA



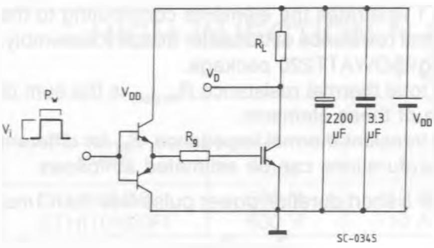

Functional test circuit




Functional test waveforms

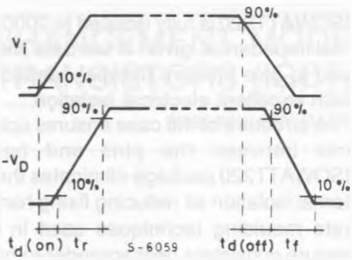


Switching times test circuit for resistive load

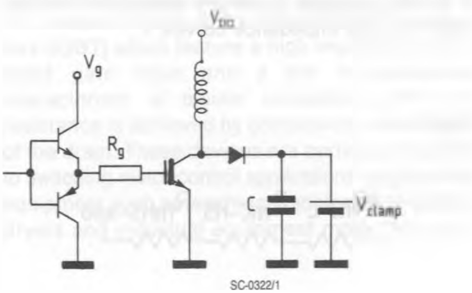



Pulse width ⩽ 100 µs
Duty cycle ⩽ 2%

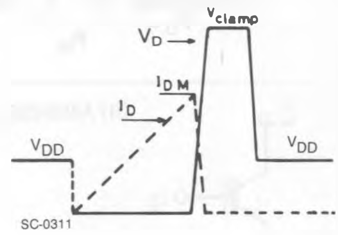
Switching time waveforms for resistive load



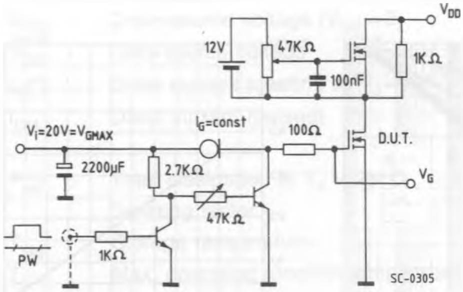

Clamped inductive load and RBSOA test circuit




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:

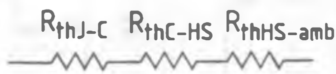
$$Z_{th} = R_{thJ\text{-}C}$$

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

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

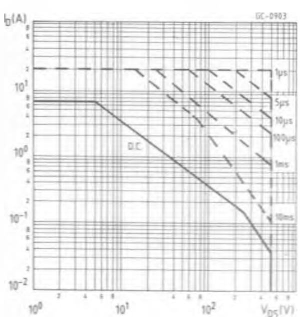
It is often possibile to discern these areas on transient thermal impedance curves.

Fig. 1

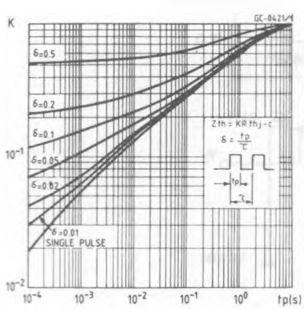



## ISOWATT DATA

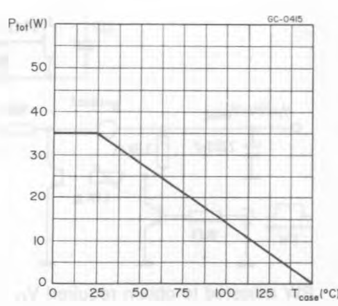
Safe operating areas




Thermal impedance




Derating curve





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