SGS-THOMSON
MICROELECTRONICS

# SGSF465
# SGSIF465/F565



## FASTSWITCH HOLLOW–EMITTER NPN TRANSISTORS

- HIGH SWITCHING SPEED NPN POWER TRANSISTORS
- HOLLOW EMITTER FOR FAST SWITCHING
- HIGH VOLTAGE FOR OFF-LINE APPLICATIONS
- 50kHz SWITCHING SPEED WITH EASY DRIVE CIRCUITS
- LOW COST DRIVE CIRCUITS
- LOW DYNAMIC SATURATION

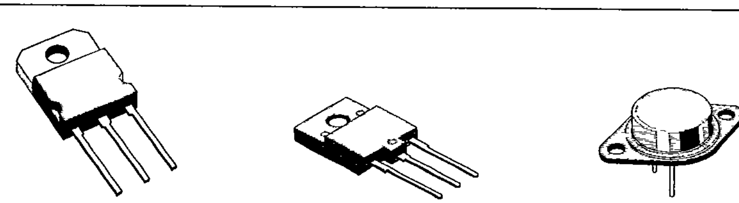
### APPLICATIONS

- SMPS
- TV HORIZONTAL DEFLECTION

### DESCRIPTION

These hollow emitter FASTSWITCH NPN power transistors are specially designed for 220V (and 117V with input doubler) off-line switching power supply and colour CRT deflection applications. Hollow emitter transistors can be used to advantage in off-line switching power supply applications where their high voltage rating is a benefit in forward and flyback medium power converters because a costly transformer clamp winding or over voltage snubbers can be omitted. High voltage hollow emitter transistors can operate up to 50kHz with simple drive circuits which help to simplify design and improve reliability. When used in conjunction with a low voltage Power MOSFET in emitter switch configuration in flyback and forward converters, they can operate at up to 100kHz.

These hollow emitter FASTSWITCH transistors are available in TO-218 and fully isolated TO-218 packages. The ISOWATT218 conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications. Additionally these FASTSWITCH transistors are available in metal TO-3 packages.



TO-218 ISOWATT218 TO-3

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | SGS F465 | SGS IF465 | SGS F565 | Unit |
|---|---|---|---|---|---|
| $V_{CES}$ | Collector - Emitter Voltage ($V_{BE}$ = 0) | 1300 | | | V |
| $V_{CEO}$ | Collector - Emitter Voltage ($I_B$ = 0) | 600 | | | V |
| $V_{EBO}$ | Emitter - Base Voltage ($I_C$ = 0) | 7 | | | V |
| $I_C$ | Collector Current | 10 | | | A |
| $I_{CM}$ | Collector Peak Current ($t_p$ < 5ms) | 15 | | | A |
| $I_B$ | Base Current | 7 | | | A |
| $I_{BM}$ | Base Peak Current ($t_p$ < 5ms) | 12 | | | A |
| $P_{tot}$ | Total Dissipation at T ≤ 25°C | 125 | 65 | 150 | W |
| $T_{stg}$ | Storage Temperature – 65 to | 150 | 150 | 175 | °C |
| $T_j$ | Junction Temperature | 150 | 150 | 175 | °C |

## THERMAL DATA

| | | SGS F465 | SGS IF465 | SGS F565 | |
|---|---|---|---|---|---|
| $R_{thj-case}$ | Thermal Resistance Junction-case Max | 1 | 1.92 | 1 | °C/W |

T-33-13

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25°C unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CES}$ | Collector Cutoff Current ($V_{BE}$ = 0) | $V_{CE}$ = 1300V | | | 200 | µA |
| $I_{CEO}$ | Collector Cutoff Current ($I_B$ = 0) | $V_{CE}$ = 380V<br>$V_{CE}$ = 600V | | | 200<br>2 | µA<br>mA |
| $I_{EBO}$ | Emitter Cutoff Current ($I_C$ = 0) | $V_{EB}$ = 7V | | | 1 | mA |
| $V_{CEO\ (sus)}$* | Collector Emitter Sustaining Voltage | $I_C$ = 0.1A | 600 | | | V |
| $V_{CE\ (sat)}$* | Collector Emitter Saturation Voltage | $I_C$ = 5A $I_B$ = 1A<br>$I_C$ = 3A $I_B$ = 0.4A | | | 1.5<br>1.5 | V<br>V |
| $V_{BE\ (sat)}$* | Base Emitter Saturation Voltage | $I_C$ = 5A $I_B$ = 1A<br>$I_C$ = 3A $I_B$ = 0.4A | | | 1.5<br>1.5 | V<br>V |

RESISTIVE LOAD

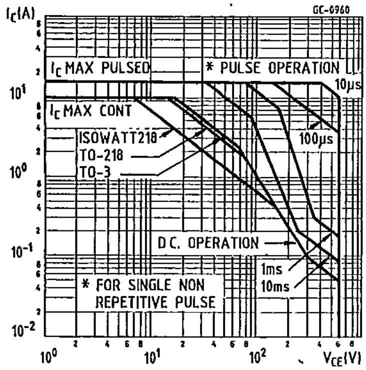
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{on}$ | Turn-on Time | $I_C$ = 5A $V_{CC}$ = 250V<br>$I_{B1}$ = 1A $I_{B2}$ = − 2$I_{B1}$ | | 0.6 | 1.2 | µs |
| $t_s$ | Storage Time | | | 2.45 | 3.5 | µs |
| $t_f$ | Fall Time | | | 0.12 | 0.4 | µs |
| $t_{on}$ | Turn-on Time | $I_C$ = 5A $V_{CC}$ = 250V<br>$I_{B1}$ = 1A $I_{B2}$ = − 2$I_{B1}$<br>With Antisaturation Network | | 0.6 | | µs |
| $t_s$ | Storage Time | | | 1.7 | | µs |
| $t_f$ | Fall Time | | | 0.12 | | µs |
| $t_{on}$ | Turn-on Time | $I_C$ = 5A $V_{CC}$ = 250V<br>$I_{B1}$ = 1A $V_{BE(off)}$ = − 5V | | 0.6 | | µs |
| $t_s$ | Storage Time | | | 1.3 | | µs |
| $t_f$ | Fall Time | | | 0.2 | | µs |

INDUCTIVE LOAD

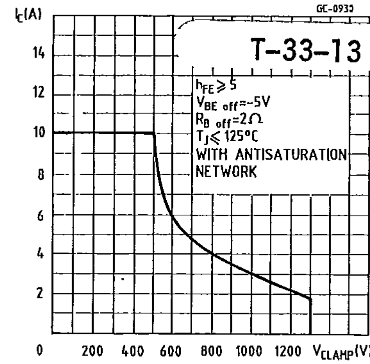
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_s$ | Storage Time | $I_C$ = 5A $h_{FE}$ = 5<br>$V_{CL}$ = 450V $V_{BE(off)}$ = − 5V<br>L = 300µH $R_{B(off)}$ = 0.8Ω | | 1.4 | 2.8 | µs |
| $t_f$ | Fall Time | | | 0.1 | 0.2 | µs |
| $t_s$ | Storage Time | $I_C$ = 5A $h_{FE}$ = 5<br>$V_{CL}$ = 450V $V_{BE(off)}$ = − 5V<br>L = 300µH $R_{B(off)}$ = 0.8Ω<br>$T_C$ = 100°C | | | 4 | µs |
| $t_f$ | Fall Time | | | | 0.3 | µs |

* Pulsed : Pulse duration = 300µs, duty cycle = 1.5%

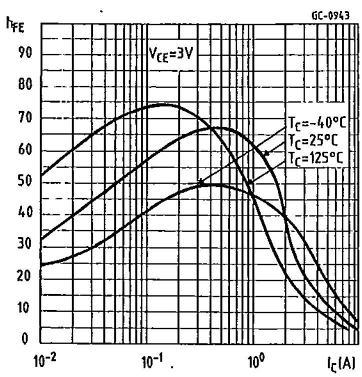
Safe Operating Areas



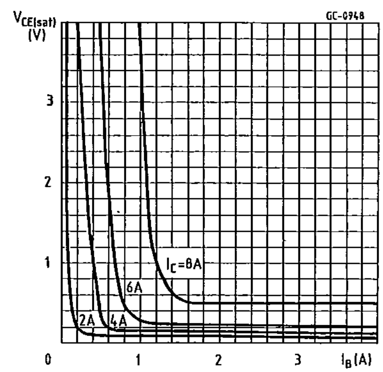

Reverse Biased Safe Operating Area



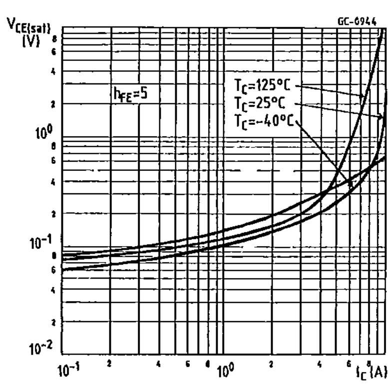

DC Current Gain



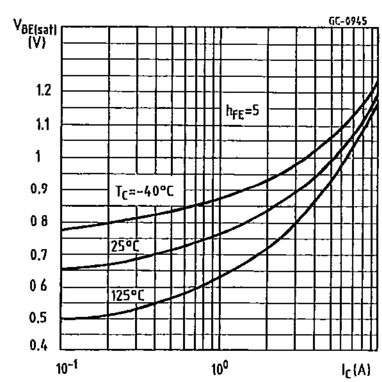

Collector-emitter Saturation Voltage



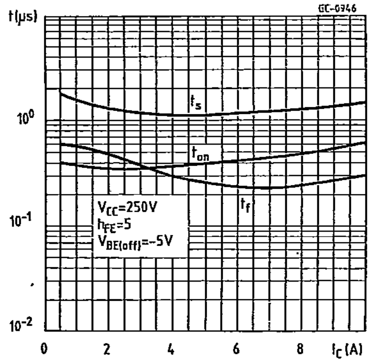

Collector-emitter Saturation Voltage



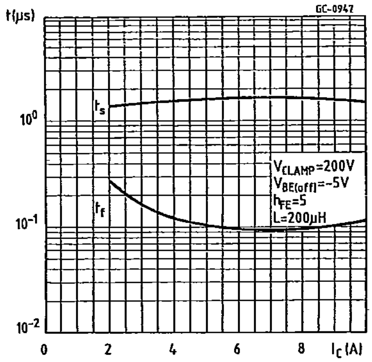

Base-emitter Saturation Voltage



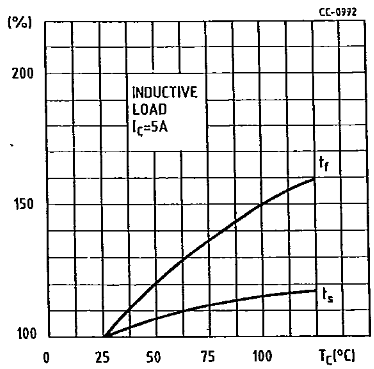
Resistive Load Switching Times




Inductive Load Switching Times




Switching Times Percentance Variation




## ISOWATT218 PACKAGE CHARACTERISTICS AND APPLICATION

ISOWATT218 is fully isolated to 4000V 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. These distances are in agreement with VDE and UL creepage and clearance standards. The ISOWATT218 package eliminates the need for external isolation so reducing fixing hardware.

The package is supplied with leads longer than the standard TO-218 to allow easy mounting on pcbs. Accurate moulding techniques used in manufacture assures consistent heat spreader-to-heatsink capacitance.

ISOWATT218 thermal performance is equivalent to 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 ISOWATT218 packages is determined by :

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

## THERMAL IMPEDANCE OF ISOWATT218 PACKAGE

Fig. 1 illustrates the elements contributing to the thermal resistance of a transistor heatsink assembly, using ISOWATT218 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 of less than 1ms :

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

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

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

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

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

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

**Figure 1.**