SGS-THOMSON
MICROELECTRONICS

SGSF323/IF323
SGSF423/IF423

FASTSWITCH HOLLOW–EMITTER NPN TRANSISTORS

- HIGH SWITCHING SPEED NPN POWER TRANSISTORS
- HOLLOW EMITTER TECHNOLOGY
- FOR FAST SWITCHING
- HIGH VOLTAGE FOR OFF-LINE APPLICATIONS
- 70kHz SWITCHING SPEED
- LOW COST DRIVE CIRCUITS
- LOW DYNAMIC SATURATION

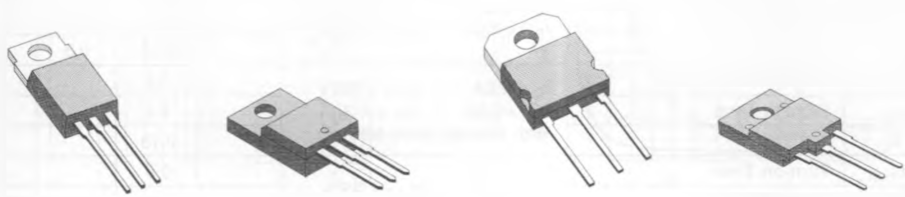
APPLICATIONS

- SMPS

DESCRIPTION

Hollow emitter FASTSWITCH NPN power transistors have been specifically designed for 220V (and 117V with input doubler) off-line switching power supply applications. Hollow emitter transistors can operate up to 70kHz with low cost drive circuits. These devices are suitable for flyback and forward low power converters (100W to 250W) where normal high voltage peaks, associated with single transistor design, are limited by a transformer clamp winding or over voltage snubbing at 1000V. When used in conjunction with a low voltage Power MOSFET in emitter switch configuration, they can operate at up to 100kHz.

Hollow emitter FASTSWITCH transistors are available in TO-220, TO-218, ISOWATT220 and ISOWATT218 packages. The ISOWATT218 conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.



TO-220 ISOWATT220 TO-218 ISOWATT218

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGS				Unit
		F323	IF323	F423	IF423	
V_{CES}	Collector - Emitter Voltage (V_{BE} = 0)	1000				V
V_{CEO}	Collector - Emitter Voltage (I_B = 0)	450				V
V_{EBO}	Emitter - Base Voltage (I_C = 0)	7				V
I_C	Collector Current	5				A
I_{CM}	Collector Peak Current (t_p < 5ms)	10				A
I_B	Base Current	3				A
I_{BM}	Base Peak Current (t_p < 5ms)	6				A
P_{tot}	Total Dissipation at $T_c \leq 25°C$	70	35	80	45	W
T_{stg}	Storage Temperature – 65 to	150	150	150	150	°C
T_j	Junction Temperature	150	150	150	150	°C

THERMAL DATA

		SGS				
		F323	IF323	F423	IF423	
$R_{thj-case}$	Thermal Resistance Junction-case Max	1.78	3.57	1.56	2.78	°C/W

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} = 1000V			200	µA
I_{CEO}	Collector Cutoff Current (I_B = 0)	V_{CE} = 380V V_{CE} = 450V			200 2	µA 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	450			V
$V_{CE(sat)}$*	Collector Emitter Saturation Voltage	I_C = 2.5A I_B = 0.5A I_C = 1.75A I_B = 0.25A			1.5 1.5	V V
$V_{BE(sat)}$*	Base Emitter Saturation Voltage	I_C = 2.5A I_B = 0.5A I_C = 1.75A I_B = 0.25A			1.5 1.5	V V

RESISTIVE LOAD

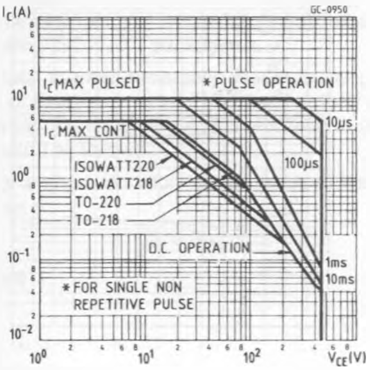
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on Time	I_C = 2.5A V_{CC} = 250V I_{B1} = 0.5A I_{B2} = – 2I_{B1}		0.5	1	µs
t_s	Storage Time			1.5	2.5	µs
t_f	Fall Time			0.18	0.3	µs
t_{on}	Turn-on Time	I_C = 2.5A V_{CC} = 250V I_{B1} = 0.5A I_{B2} = – 2I_{B1} With Antisaturation Network		0.5		µs
t_s	Storage Time			1.1		µs
t_f	Fall Time			0.13		µs
t_{on}	Turn-on Time	I_C = 2.5A V_{CC} = 250V I_{B1} = 0.5A $V_{BE(off)}$ = – 5V		0.5		µs
t_s	Storage Time			1.1		µs
t_f	Fall Time			0.13		µs

INDUCTIVE LOAD

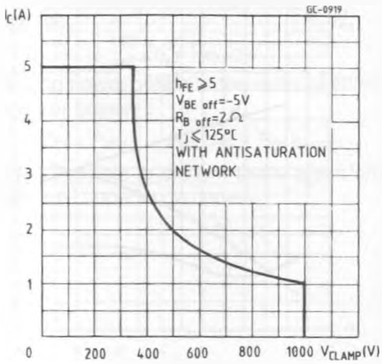
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_s	Storage Time	I_C = 2.5A h_{FE} = 5 V_{CL} = 350V $V_{BE(off)}$ = – 5V L = 300µH $R_{B(off)}$ = 2Ω		1	2	µs
t_f	Fall Time			0.1	0.2	µs
t_s	Storage Time	I_C = 2.5A h_{FE} = 5 V_{CL} = 350V $V_{BE(off)}$ = – 5V L = 300µH $R_{B(off)}$ = 2Ω T_c = 100°C			3	µs
t_f	Fall Time				0.3	µs

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

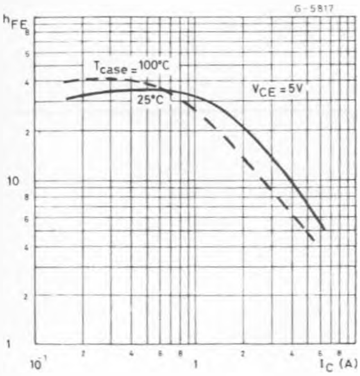
Safe Operating Areas



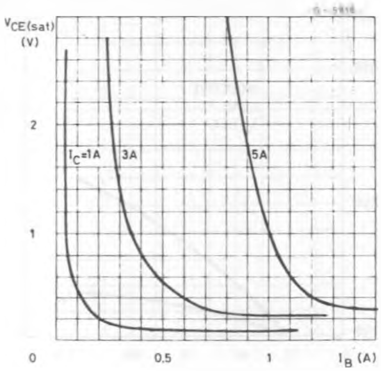
Reverse Biased Safe Operating Area



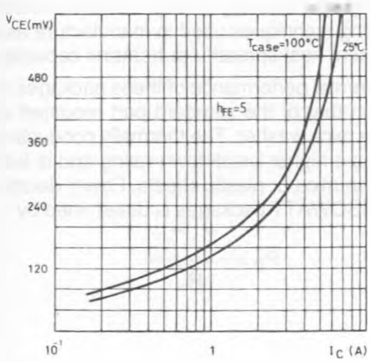
DC Current Gain



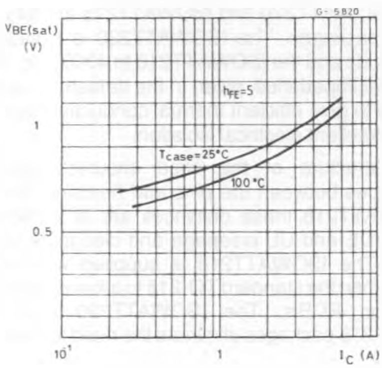
Collector-emitter Saturation Voltage



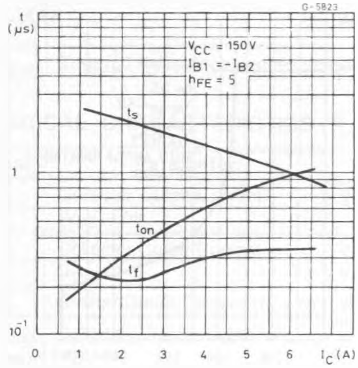
Collector-emitter Saturation Voltage



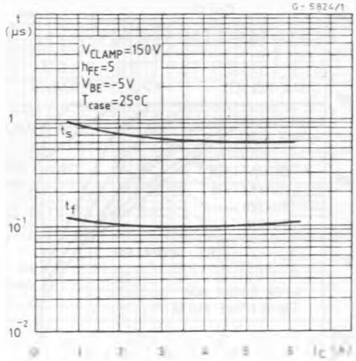
Base-emitter Saturation Voltage



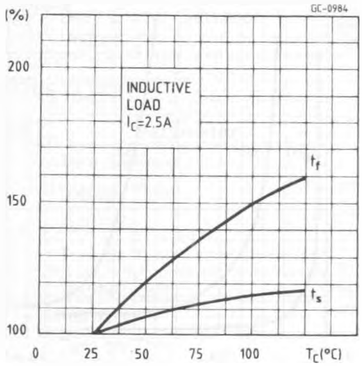
Resistive Load Switching Times



Inductive Load Switching Times



Switching Times Percentance Variation



ISOWATT PACKAGES CHARACTERISTICS AND APPLICATION

The ISOWATT220 and ISOWATT218 are fully isolated packages. The ISOWATT220 is isolated to 2000V dc and the ISOWATT218 to 4000V dc. Their thermal impedence, given in the datasheet, 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. For the ISOWATT218 these distances are in agreement with VDE and UL creepage and clearance standards. The ISOWATT218 is supplied with longer leads than the standard TO-218 to allow easy mounting on PCB's. The ISOWATT220 and ISOWATT218 packages eliminate the need for external isolation so reducing fixing hardware. Accurate moulding techniques used in manufacture assures consistent heat spreader-to-heatsink capacitance.

The thermal performance of these packages 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 these ISOWATT packages is determined by :

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

THERMAL IMPEDANCE OF ISOWATT PACKAGES

Fig. 1 illustrates the elements contributing to the thermal resistance of a transistor heatsink assembly, using ISOWATT packages.

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 :

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

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

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

3 - For long power pulses of the order of 500ms seconds 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.

Figure 1.