SGS-THOMSON
MICROELECTRONICS

SGSF324/IF324
SGSF424/IF424

FASTSWITCH HOLLOW–EMITTER NPN TRANSISTORS

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

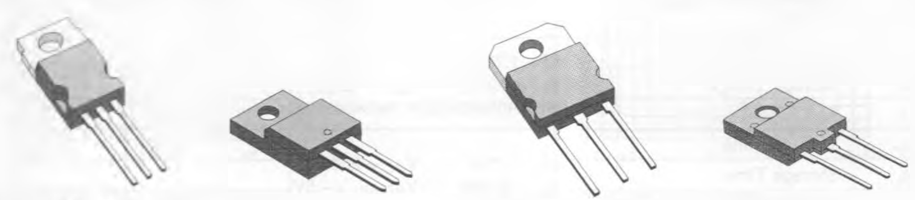
APPLICATIONS

- SMPS
- TV HORIZONTAL DEFLECTION

DESCRIPTION

Hollow emitter FASTSWITCH NPN power transistors have been especially designed for 220V (and 117V with input doubler) off-line switching power supply and colour CRT horizontal deflection applications. High voltage hollow emitter transistors can operate up to 50kHz with low cost drive circuits. These transistors can be used to advantage in off-line switching power supply applications where their high voltage rating is a benefit because a costly transformer clamp winding or over voltage snubbing can be omitted. These transistors are suitable for suitable for application in flyback and forward single transistor low power converters, 70W to 150W. 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-220, TO-218, ISOWATT220 and ISOWATT218 packages. The ISOWATT218 conforms to te creepage distance and isolation requirements of VDE, IEC, and UL specifications.



TO-220 ISOWATT220 TO-218 ISOWATT218

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGS				Unit
		F324	IF324	F424	IF424	
V_{CES}	Collector - Emitter Voltage (V_{BE} = 0)	1200				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	4				A
I_{CM}	Collector Peak Current (t_p < 5ms)	8				A
I_B	Base Current	3				A
I_{BM}	Base Peak Current (t_p < 5ms)	6				A
P_{tot}	Total Dissipation at T ≤ 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				
		F324	IF324	F424	IF424	
$R_{thj\text{-}case}$	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} = 1200V			200	µA
I_{CEO}	Collector Cutoff Current (I_B = 0)	V_{CE} = 380V V_{CE} = 600V			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	600			V
$V_{CE(sat)}$*	Collector Emitter Saturation Voltage	I_C = 1.75A I_B = 0.35A I_C = 1.25A I_B = 0.18A			1.5 1.5	V V
$V_{BE(sat)}$*	Base Emitter Saturation Voltage	I_C = 1.75A I_B = 0.35A I_C = 1.25A I_B = 0.18A			1.5 1.5	V V

RESISTIVE LOAD

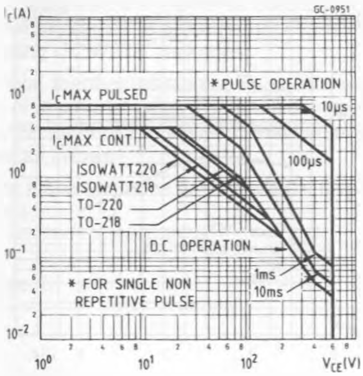
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on Time	I_C = 1.75A V_{CC} = 250V I_{B1} = 0.35A I_{B2} = − 2I_{B1}		0.6	1	µs
t_s	Storage Time			3	4.5	µs
t_f	Fall Time			0.2	0.35	µs
t_{on}	Turn-on Time	I_C = 1.75A V_{CC} = 250V I_{B1} = 0.35A I_{B2} = − 2I_{B1} with Antisaturation Network		0.6		µs
t_s	Storage Time			2		µs
t_f	Fall Time			0.16		µs
t_{on}	Turn-on Time	I_C = 1.75A V_{CC} = 250V I_{B1} = 0.35A $V_{BE(off)}$ = − 5V		0.6		µs
t_s	Storage Time			1		µs
t_f	Fall Time			0.5		µs

INDUCTIVE LOAD

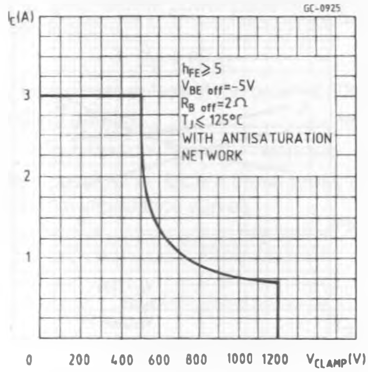
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_s	Storage Time	I_C = 1.75A h_{FE} = 5 V_{CL} = 450V $V_{BE(off)}$ = − 5V L = 300µH $R_{B(off)}$ = 2Ω		1.2	2.5	µs
t_f	Fall Time			0.1	0.2	µs
t_s	Storage Time	I_C = 1.75A h_{FE} = 5 V_{CL} = 450V $V_{BE(off)}$ = − 5V L = 300µH $R_{B(off)}$ = 2 Ω T_c = 100°C			3.7	µs
t_f	Fall Time				0.3	µs

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

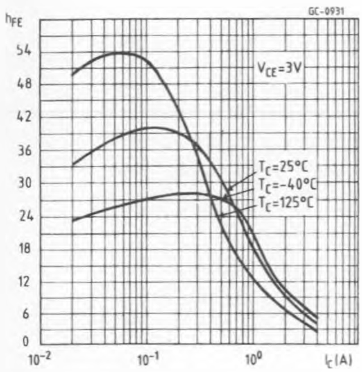
Operating Areas



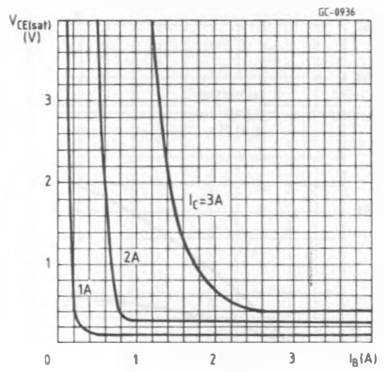
Reverse Biased Safe Operating Area



Current Gain



Collector-emitter Saturation Voltage



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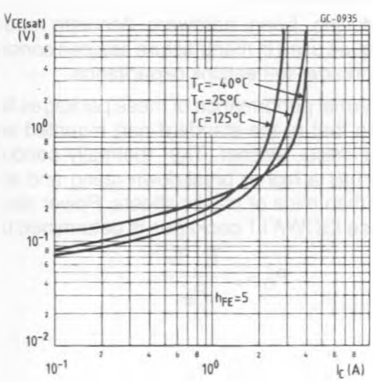
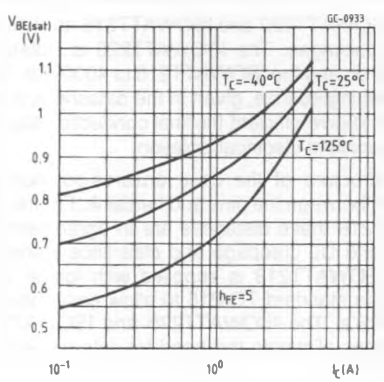
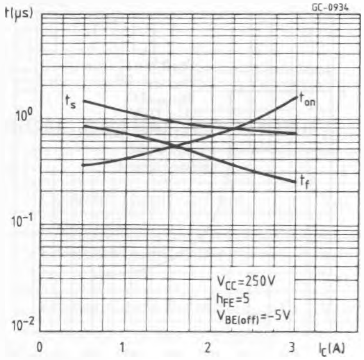


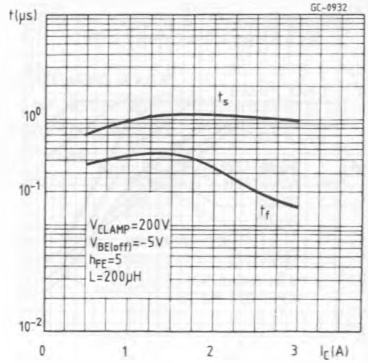
Base-emitter Saturation Voltage



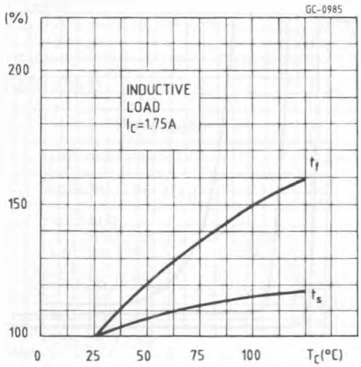
Resistive Load Switching Times



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 :

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

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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.