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SGS-THOMSON
MICROELECTRONICS

SGSF461
SGSIF461/F561

S G S-THOMSON 30E D

FASTSWITCH HOLLOW–EMITTER NPN TRANSISTORS

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

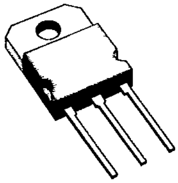
APPLICATIONS

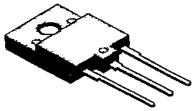
- SMPS

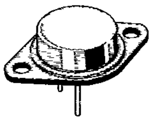
DESCRIPTION

Hollow emitter FASTSWITCH NPN power transistors are specially designed for 220V (and 117V with input doubler) off-line switching power supply applications. Hollow emitter transistors can operate up to 70kHz with simple drive circuits which helps to simplify designs and improve reliability. The superior switching performance reduces dissipation and consequently lowers the equipment operating temperature. These transistors are suitable for application in half bridge, push-pull and full bridge medium power transistor converters, 750W to 1500W. When used in conjunction with a low voltage Power MOSFET in emitter switch configuration, they can operate at up to 100kHz.

These hollow emitter FASTSWITCH transistors are available in TO-218 and the fully isolated ISOWATT218 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			Unit
		F461	IF461	F561	
V_{CES}	Collector - Emitter Voltage ($V_{BE} = 0$)	850			V
V_{CEO}	Collector - Emitter Voltage ($I_B = 0$)	400			V
V_{EBO}	Emitter - Base Voltage ($I_C = 0$)	7			V
I_C	Collector Current	15			A
I_{CM}	Collector Peak Current ($t_p < 5ms$)	25			A
I_B	Base Current	8			A
I_{BM}	Base Peak Current ($t_p < 5ms$)	15			A
P_{tot}	Total Dissipation at $T_c \leq 25°C$	125	65	150	W
T_{stg}	Storage Temperature – 65 to	150	150	175	°C
T_j	Junction Temperature	150	150	175	°C

February 1989

THERMAL DATA

		SGS			
		F461	IF461	F561	
$R_{thj\text{-}case}$	Thermal Resistance Junction-case Max	1	1.92	1	°C/W

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector Cutoff Current ($V_{BE} = 0$)	$V_{CE} = 700V$			200	µA
I_{CEO}	Collector Cutoff Current ($I_B = 0$)	$V_{CE} = 380V$ $V_{CE} = 400V$			200 2	µA mA
I_{EBO}	Emitter Cutoff Current ($I_C = 0$)	$V_{EB} = 7V$			1	mA
$V_{CEO\,(sus)}$*	Collector Emitter Sustaining Voltage	$I_C = 0.1A$	400			V
$V_{CE\,(sat)}$*	Collector Emitter Saturation Voltage	$I_C = 10A$ $I_B = 2A$ $I_C = 5.5A$ $I_B = 0.8A$			1.5 1.5	V V
$V_{BE\,(sat)}$*	Base Emitter Saturation Voltage	$I_C = 10A$ $I_B = 2A$ $I_C = 5.5A$ $I_B = 0.8A$			1.5 1.5	V V

RESISTIVE LOAD

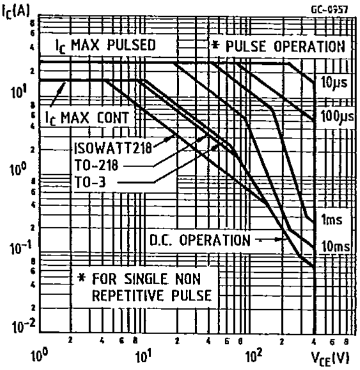
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on Time	$I_C = 10A$ $V_{CC} = 250V$ $I_{B1} = 2A$ $I_{B2} = -2I_{B1}$		1	1.7	µs
t_s	Storage Time			1.4	2.3	µs
t_f	Fall Time			0.25	0.5	µs
t_{on}	Turn-on Time	$I_C = 10A$ $V_{CC} = 250V$ $I_{B1} = 2A$ $I_{B2} = -2I_{B1}$ With Antisaturation Network		1		µs
t_s	Storage Time			1		µs
t_f	Fall Time			0.15		µs
t_{on}	Turn-on Time	$I_C = 10A$ $V_{CC} = 250V$ $I_{B1} = 2A$ $V_{BE(off)} = -5V$		1		µs
t_s	Storage Time			1		µs
t_f	Fall Time			0.06		µs

INDUCTIVE LOAD

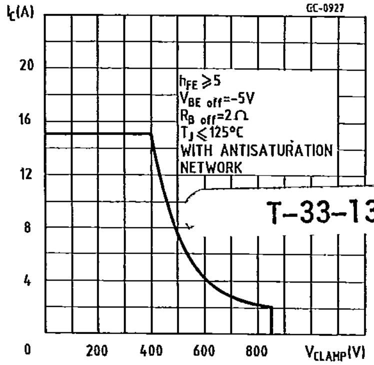
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_s	Storage Time	$I_C = 10A$ $h_{FE} = 5$ $V_{CL} = 350V$ $V_{BE(off)} = -5V$ $L = 300µH$ $R_{B(off)} = 1.2Ω$		1.4	2.8	µs
t_f	Fall Time			0.1	0.2	µs
t_s	Storage Time	$I_C = 10A$ $h_{FE} = 5$ $V_{CL} = 350V$ $V_{BE(off)} = -5V$ $L = 300µH$ $R_{B(off)} = 1.2Ω$ $T_c = 100°C$			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



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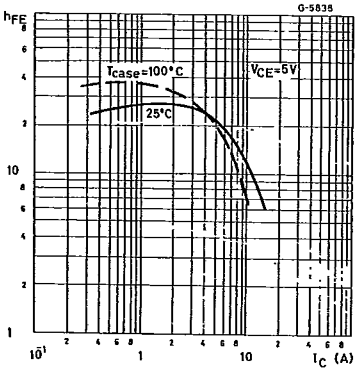
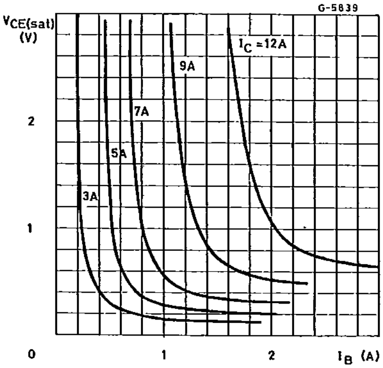
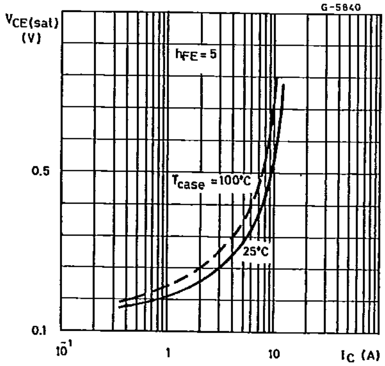
DC Current Gain



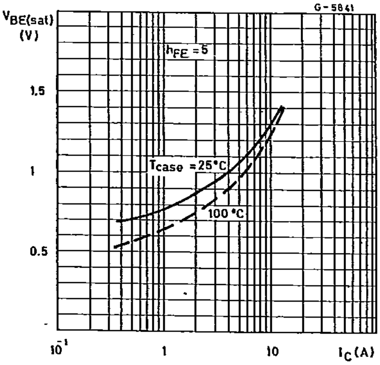
Collector-emitter Saturation Voltage



Collector-emitter Saturation Voltage



Base-emitter Saturation Voltage



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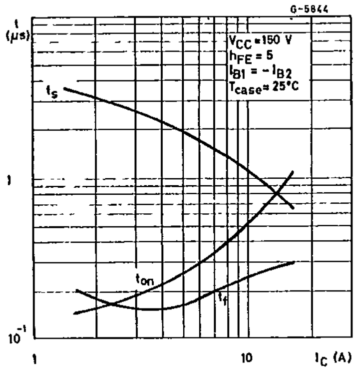
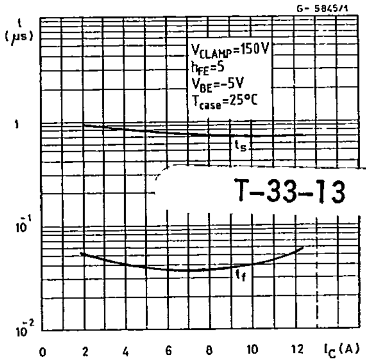
Resistive Load Switching Times



Inductive Load Switching Times



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Switching Times Percentance Variation

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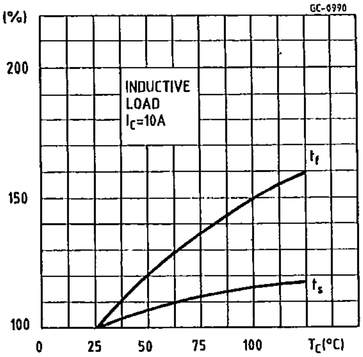

ISOWATT218 PACKAGE CHARACTERISTICS AND APPLICATION

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.