SGS-THOMSON MICROELECTRONICS

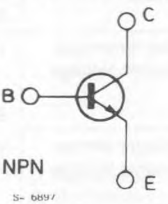
BUW90

NPN FAST SWITCHING POWER TRANSISTOR

- VERY LOW SATURATION VOLTAGE AND HIGH GAIN FOR REDUCED LOAD OPERATION
- TURN-ON AND TURN-OFF TAIL SPECIFICATIONS
- TURN-ON di_C/dt FOR BETTER RECTIFIER CHOICE
- SWITCHING TIMES SPECIFIED WITH AND WITHOUT NEGATIVE BASE DRIVE
- FAST SWITCHING TIMES
- LOW SWITCHING LOSSES
- LOW ON-STATE VOLTAGE DROP
- BASE CURRENT REQUIREMENTS

TO-218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CEV}	Collector-emitter Voltage (V_{BE} = – 1.5 V)	250	V
V_{CEO}	Collector-emitter Voltage (I_B = 0)	125	V
V_{EBO}	Emitter-base Voltage (I_C = 0)	7	V
I_C	Collector Current	20	A
I_{CM}	Collector Peak Current	30	A
I_B	Base Current	4	A
I_{BM}	Base Peak Current	6	A
P_{base}	Reverse Bias Base Power Dissipation (B.E. junction in avalance)	1	W
P_{tot}	Total Dissipation at T_c < 25 °C	125	W
T_{stg}	Storage Temperature	– 65 to 175	°C
T_j	Max. Operating Junction Temperature	175	°C

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.2	°C/W

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

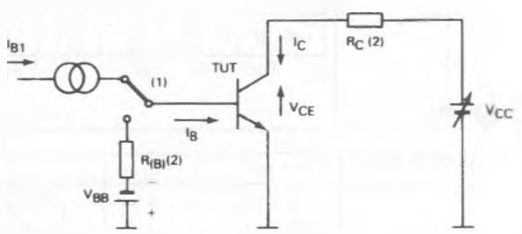
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector Cutoff Current (R_{BE} = 10 Ω)	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ T_c = 100 °C			1 5	mA mA
I_{CEV}	Collector Cutoff Current	$V_{CE} = V_{CEV}$ V_{BE} = − 1.5 V $V_{CE} = V_{CEV}$ V_{BE} = − 1.5 V T_c = 100 °C			1 5	mA mA
I_{EBO}	Emitter Cutoff Current (I_C = 0)	V_{EB} = 5 V			1	mA
$V_{CEO(sus)}$*	Collector Emitter Sustaining Voltage	I_C = 0.2 A L = 25 mH	125			V
V_{EBO}	Emitter-base Voltage (I_C = 0)	I_E = 50 mA	7			V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 5.5 A I_B = 0.35 A I_C = 11 A I_B = 1.1 A I_C = 5.5 A I_B = 0.35 A T_j = 100 °C I_C = 11 A I_B = 1.1 A T_j = 100 °C		0.5 0.65 0.5 0.8	0.8 0.9 0.9 1.2	V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 11 A I_B = 1.1 A I_C = 11 A I_B = 1.1 A T_j = 100 °C		1.3 1.35	1.6 1.7	V V
di_c/dt	Rate of Rise of on State Collector Current	V_{CC} = 100 V R_C = 0 I_{B1} = 1.65 A T_j = 25 °C T_j = 100 °C See fig. 2	 35 30	 45 40		 A/µs A/µs
$V_{CE(2µs)}$	Collector-emitter Dynamic Voltage	V_{CC} = 100 V R_C = 9 Ω I_{B1} = 1.1 A T_j = 25 °C T_j = 100 °C See fig. 2		 2 2.6	 2.5 4	 V V
$V_{CE(4µs)}$	Collector-emitter Dynamic Voltage	V_{CC} = 100 V R_C = 9 Ω I_{B1} = 1.1 A T_j = 25 °C T_j = 100 °C See fig. 2		 1.1 1.6	 2 2.5	 V V

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
	RESISTIVE LOAD					µs
t_r	Rise Time	V_{CC} = 100 V I_C = 15 A		0.4	1	µs
t_s	Storage Time	V_{BB} = – 5 V I_{B1} = 1.8 A		0.6	1	µs
t_f	Fall Time	R_B = 1.3 Ω t_p = 30 µs		0.14	0.3	
	INDUCTIVE LOAD					µs
t_s	Storage Time	V_{CC} = 100 V I_C = 11 A I_B = 1.1 A		0.75	1.4	µs
t_f	Fall Time	V_{BB} = – 5 V V_{clamp} = 125 V		0.08	0.2	µs
t_t	Tail Time in Turn-on	L_C = 0.25 mH R_B = 2.3 Ω		0.02	0.05	µs
t_c	Crossover Time	see fig. 3		0.15	0.3	
t_s	Storage Time	V_{CC} = 100 V I_C = 11 A I_B = 1.1 A		0.95	1.7	µs
t_f	Fall Time	V_{BB} = – 5 V V_{clamp} = 125 V		0.14	0.3	µs
t_t	Tail Time in Turn-on	L_C = 0.25 mH R_B = 2.3 Ω		0.04	0.1	µs
t_c	Crossover Time	see fig. 3 T_j = 100 °C		0.3	0.5	µs
t_s	Storage Time	V_{CC} = 100 V I_C = 11 A I_B = 1.1 A		1.8		µs
t_f	Fall Time	V_{BB} = 0 V_{clamp} = 125 V		0.7		µs
t_t	Tail Time in Turn-on	L_C = 0.25 mH R_B = 4.7 Ω		0.2		µs
		see fig. 3				
t_s	Storage Time	V_{CC} = 100 V I_C = 11 A I_B = 1.1 A		2.5		µs
t_f	Fall Time	V_{BB} = 0 V_{clamp} = 125 V		1		µs
t_t	Tail Time in Turn-on	L_C = 0.25 mH R_B = 4.7 Ω		0.4		µs
		see fig. 3 T_j = 100 °C				

* Pulsed : Pulse duration = 300 µs, duty cycle = 2 %.

Figure 1 : Switching Times Test Circuit (resistive load).



(1) Fast electronic switch
(2) Non-inductive resistor

Figure 2 : Turn-on Switching Waveforms.

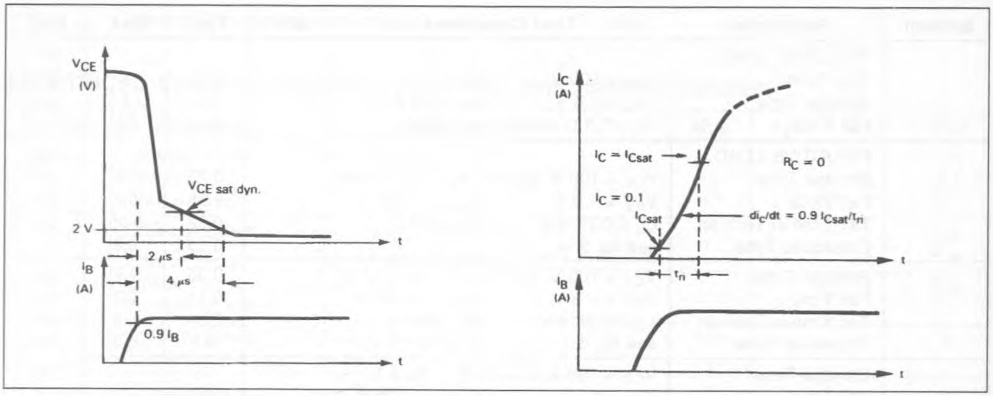


Figure 3a : Turn-off Switching Test Circuit.

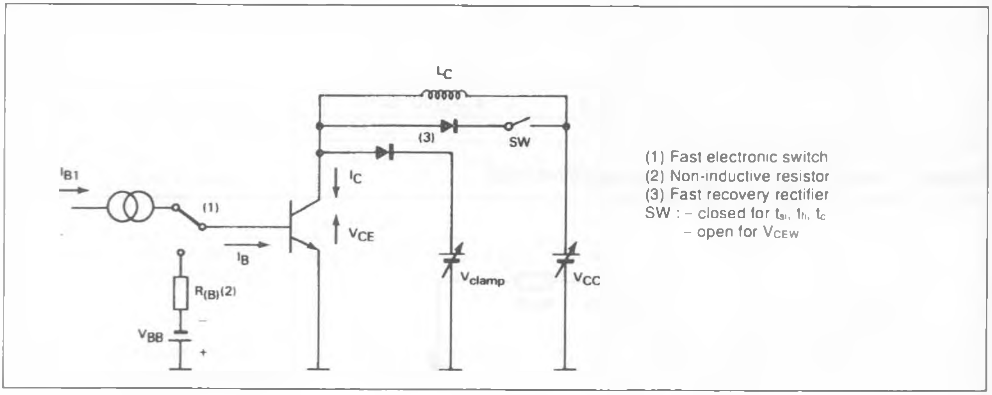
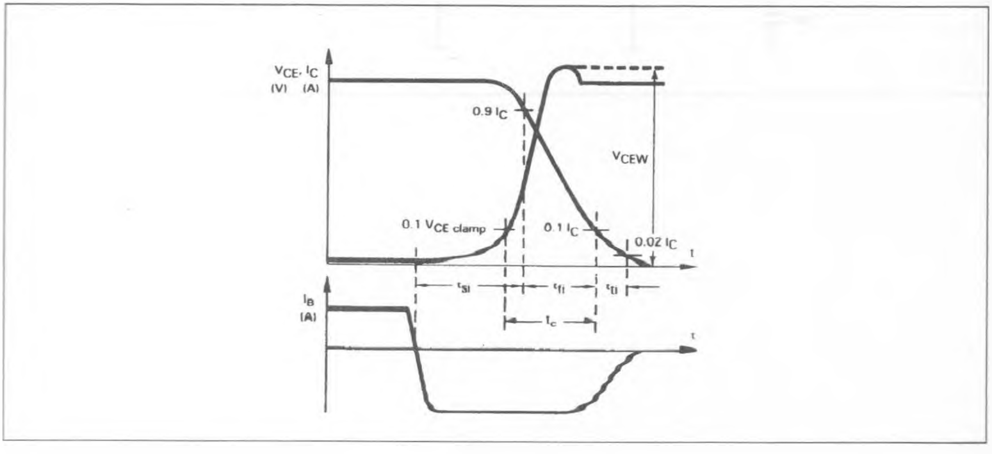
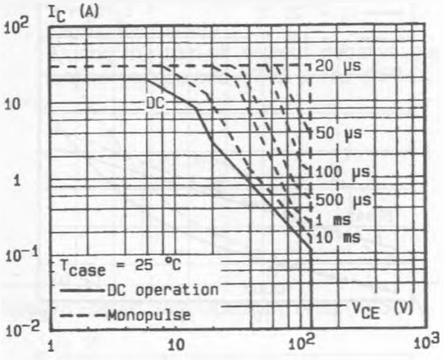


Figure 3b : Turn-off Switching Waveforms (inductive load).

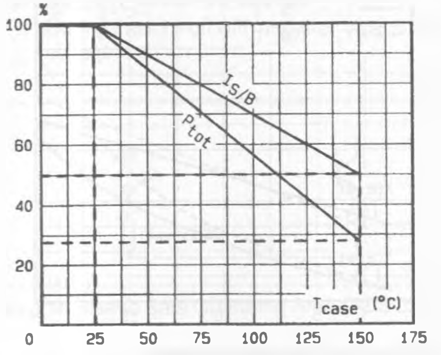


SGS-THOMSON MICROELECTRONICS

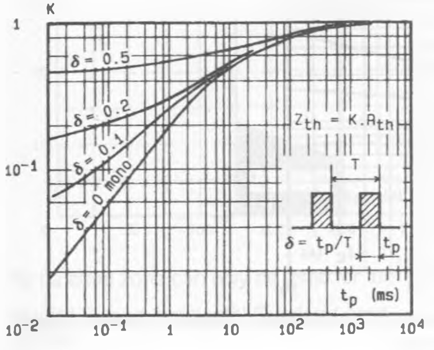
DC and AC Pulse Area.



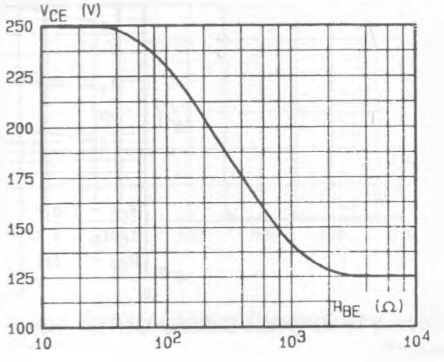
Power and $I_{S/B}$ Derating versus Case Temperature.



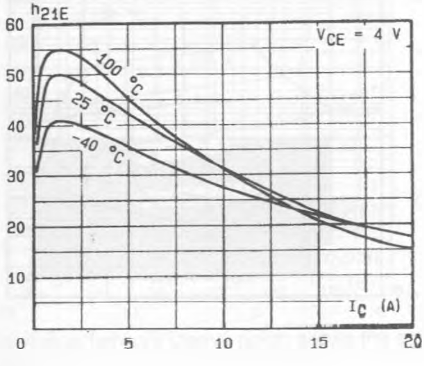
Transient Thermal Response.



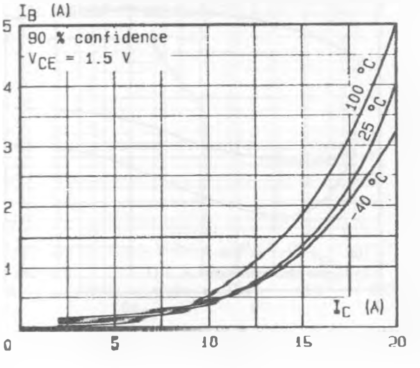
Collector-emitter Voltage versus Base-emitter Resistance.



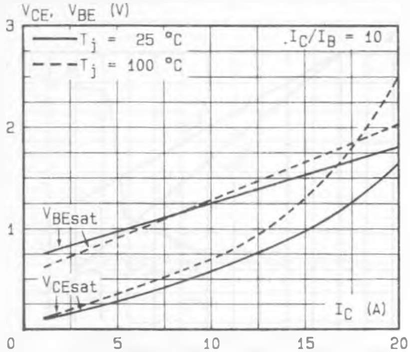
DC Current Gain.



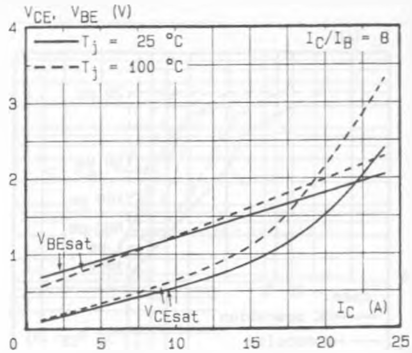
Minimum Base Current to Saturate the Transistor.



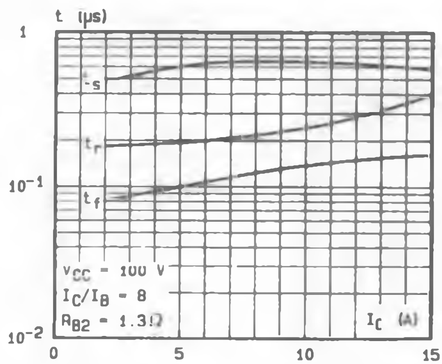
Saturation Voltage.



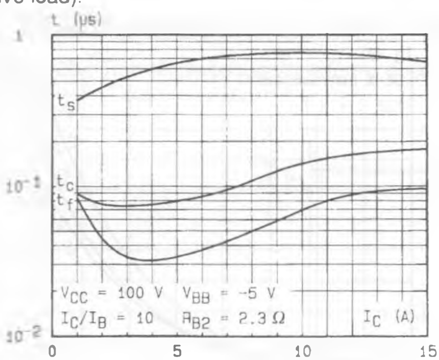
Saturation Voltage.



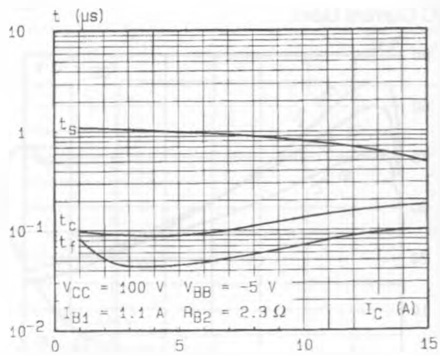
Switching Times versus Collector



Switching Times versus Collector Current (inductive load).



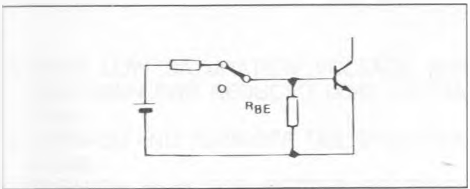
Switching Times versus Collector Current (inductive load).



SWITCHING OPERATING AND OVERLOAD AREAS

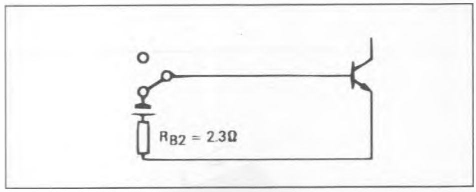
TRANSISTOR FORWARD BIASED

- During the turn-on
- During the turn-off without negative base-emitter voltage and 4.7 $\Omega \leq R_{BE} \leq 50\ \Omega$.

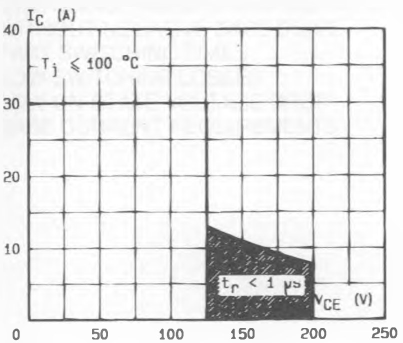


TRANSISTOR REVERSE BIASED

- During the turn-off with negative base-emitter voltage.

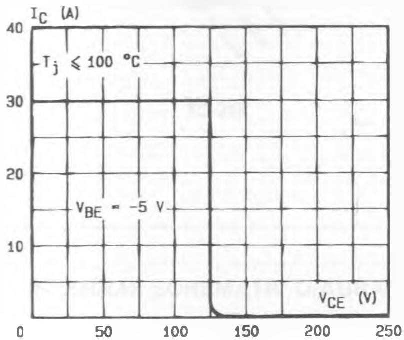


Forward Biased Safe Operating Area (FBSOA).

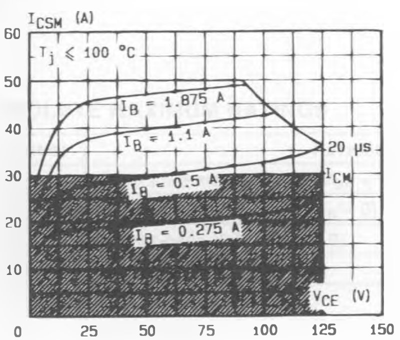


The hatched zone can only be used for turn-on.

Reverse Biaesd Safe Operating Area (RBSOA).

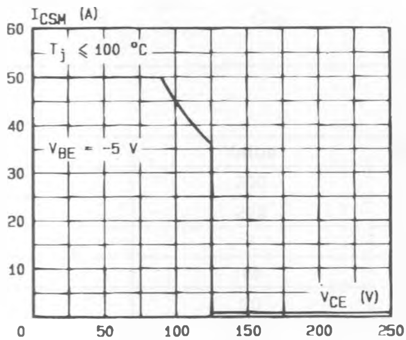


Forward Biased Accidental Overload Area (FBADA).



The Kellog network (heavy point) allows the calculation of the maximum value of the short-circuit for a given base current I_B.
(90 % confidence).

Reverse Biased Accidental Overload Area (RBADA).



After the accidental overload current the RBAOA has to be used for the turn-off.

High accidental surge currents ($I > I_{CM}$) are allowed if they are non repetitive and applied less than 3000 times during the component life.