SGS-THOMSON
MICROELECTRONICS

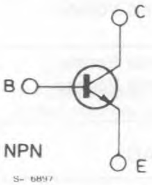
BUW89

FAST SWITCHING POWER TRANSISTOR

- FAST SWITCHING TIMES
- LOW SWITCHING LOSSES
- VERY LOW SATURATION VOLTAGE AND HIGH GAIN

TO-218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CEV}	Collector-emitter Voltage (V_{BE} = – 1.5V)	160	V
V_{CEO}	Collector-emitter Voltage (I_B = 0)	90	V
V_{EBO}	Emitter-base Voltage (I_C = 0)	7	V
I_C	Collector Current	25	A
I_{CM}	Collector Peak Current	45	A
I_B	Base Current	6	A
I_{BM}	Base Peak Current	9	A
P_{base}	Reverse Bias Base Power Dissipation (B.E. junction in avalanche)	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	°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} = 10Ω)	$V_{CE} = V_{CEV}$ $V_{CE} = V_{CEV}$ T_c = 100°C			1 5	mA mA
I_{CEV}	Collector Cutoff Current	$V_{CE} = V_{CEV}$ V_{BE} = – 1.5V $V_{CE} = V_{CEV}$ V_{BE} = – 1.5V T_c = 100°C			1 5	mA mA
I_{EBO}	Emitter Cutoff Current (I_C = 0)	V_{EB} = 5V			1	mA
$V_{CEO(sus)}$*	Collector Emitter Sustaining Voltage	I_C = 0.2A L = 25mH	90			V
V_{EBO}	Emitter-base Voltage (I_C = 0)	I_E = 50mA	7			V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 7.5A I_B = 0.375A I_C = 15A I_B = 1.5A I_C = 7.5A I_B = 0.375A T_j = 100°C I_C = 15A I_B = 1.5A T_j = 100°C		0.5 0.65 0.5 0.8	0.8 0.9 0.9 1.5	V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 15A I_B = 1.5A I_C = 15A I_B = 1.5A T_j = 100°C		1.4 1.45	1.7 1.8	V V
di_C/dt	Rated of Rise of on-state Collector Current	V_{CC} = 72V R_C = 0 I_{B1} = 2.25A T_j = 25°C See fig. 2 T_j = 100°C	 35 30	 50 45		 A/µs A/µs
$V_{CE(2\mu s)}$	Collector Emitter Dynamic Voltage	V_{CC} = 72V R_C = 4.8Ω I_{B1} = 1.5A T_j = 25°C See fig. 2 T_j = 100°C		 1.7 2	 2.5 4	 V V
$V_{CE(4\mu s)}$	Collector Emitter Dynamic Voltage	V_{CC} = 72V R_C = 4.8Ω I_{B1} = 1.5A T_j = 25°C See fig. 2 T_j = 100°C		 1 1.5	 2 3	 V V

RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_r t_s t_f	Rise Time Storage Time Fall Time	V_{CC} = 72V I_C = 20A V_{BB} = – 5V I_{B1} = 2.5A R_{B2} = 1Ω t_p = 30µs See fig. 1		0.55 0.55 0.12	1.1 1 0.25	µs µs µs

ELECTRICAL CHARACTERISTICS (continued)

INDUCTIVE LOAD

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
t_s t_f t_t t_c	Storage Time Fall Time Tail Time in Turn-on Crossover Time	V_{CC} = 72V I_C = 15A V_{BB} = – 5V L_C = 0.25mH	V_{clamp} = 90V I_S = 1.5A R_{B2} = 1.7Ω See fig. 3		0.75 0.09 0.03 0.14	1.2 0.2 0.05 0.3	µs µs µs µs
t_s t_f t_t t_c	Storage Time Fall Time Tail Time in Turn-on Crossover Time	V_{CC} = 72V I_C = 15A V_{BB} = – 5V L_C = 0.25mH See fig. 3	V_{clamp} = 90V I_B = 1.5A R_{B2} = 1.7Ω T_j = 100°C		0.95 0.15 0.06 0.3	1.7 0.3 0.1 0.5	µs µs µs µs
t_s t_f t_t	Storage Time Fall Time Tail Time in Turn-on	V_{CC} = 72V I_C = 15A V_{BB} = 0 L_C = 0.25mH	V_{clamp} = 90V I_B = 1.5A R_{B2} = 3.9Ω See fig. 3		1.4 0.7 0.22		µs µs µs
t_s t_f t_t	Storage Time Fall Time Tail Time in Turn-on	V_{CC} = 72V I_C = 15A V_{BB} = 0 L_C = 0.25mH See fig. 3	V_{clamp} = 90V I_B = 1.5A R_{B2} = 3.9Ω T_j = 100°C		1.85 1 0.44		µs µs µs

* Pulsed test t_p < 300 µs δ < 2 %.

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

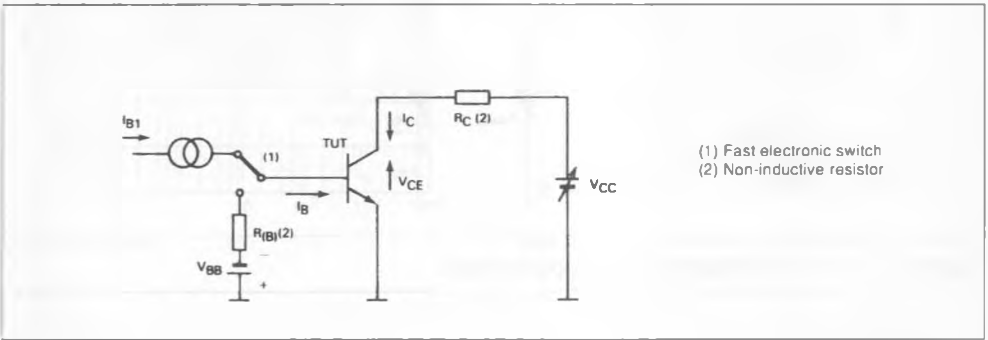


Figure 2 : Turn-on Switching Waveforms.

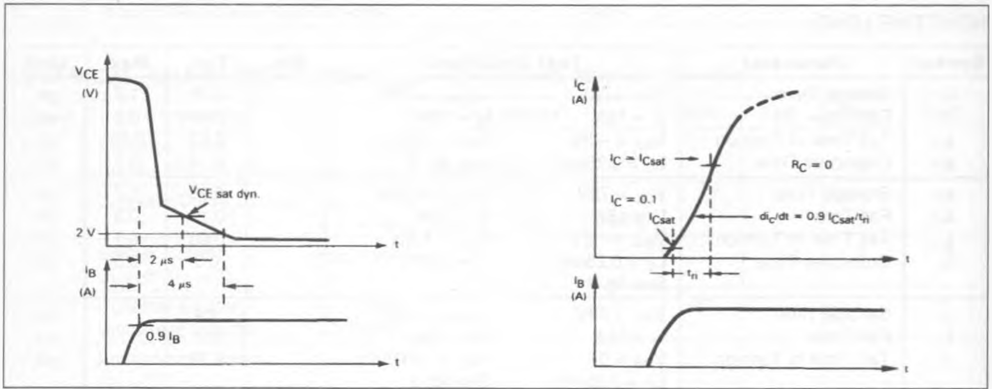


Figure 3a : Turn-off Switching Test Circuit.

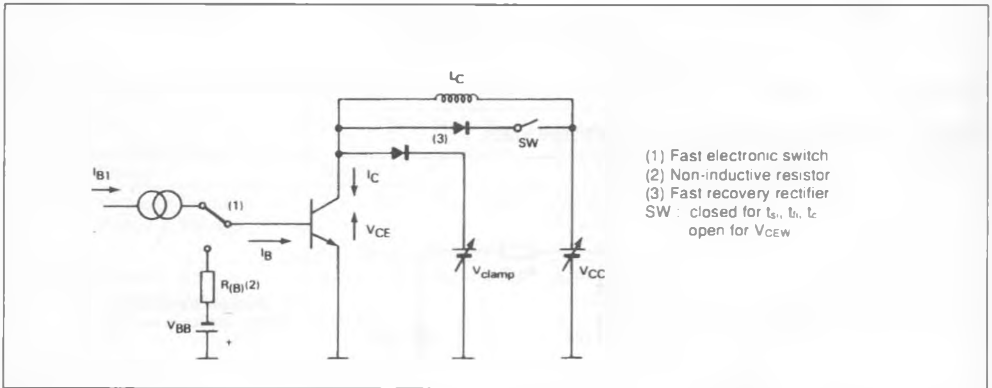
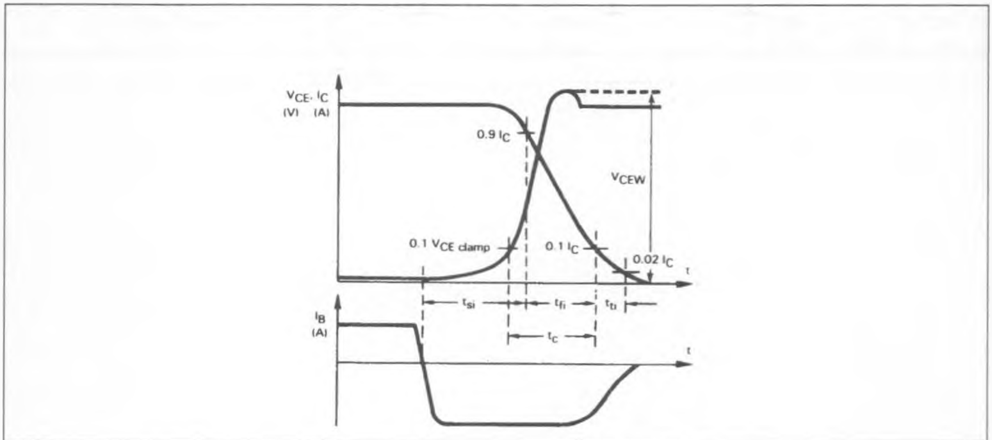
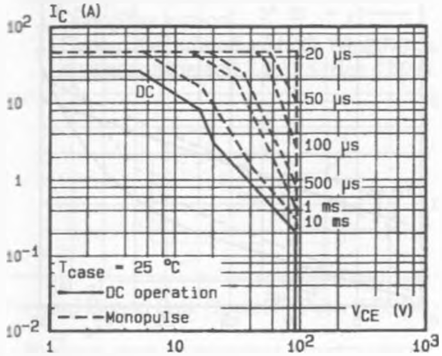


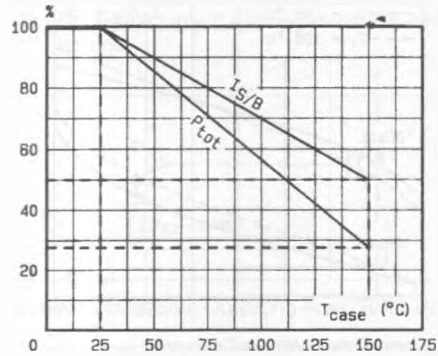
Figure 3b : Turn-off Switching Waveforms (inductive load).



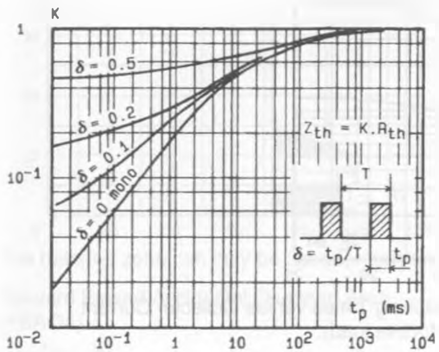
DC and AC Pulse Area.



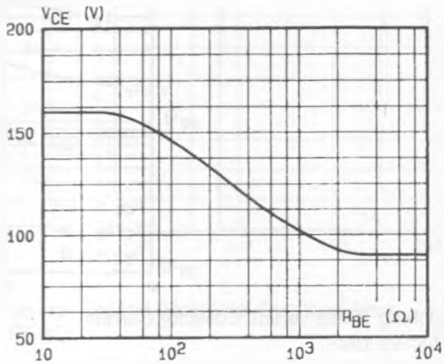
Power and $I_{S/B}$ Derating versus Case Temperature.



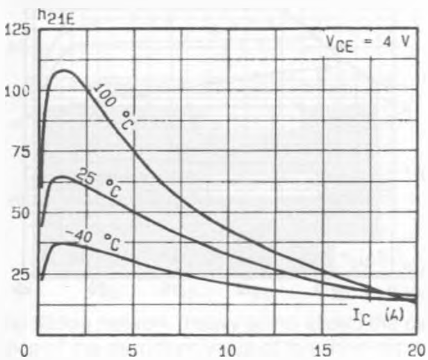
Transient Thermal Response.



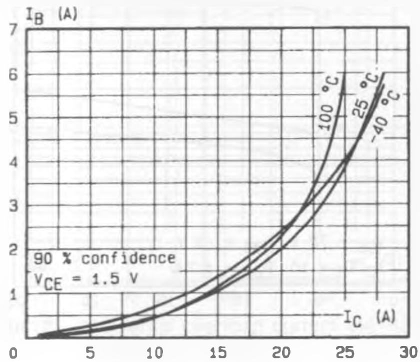
Collector-emitter Voltage versus Base-emitter Resistance.



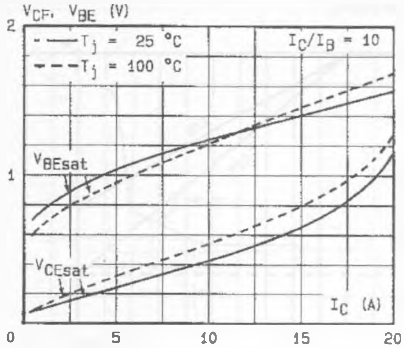
DC Current Gain.



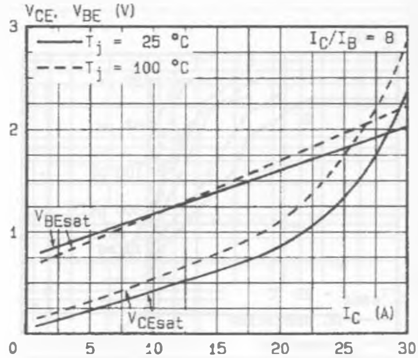
Minimum Base Current to Saturate the Transistor.



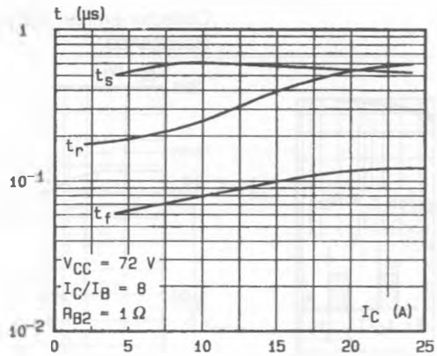
Saturation Voltage.



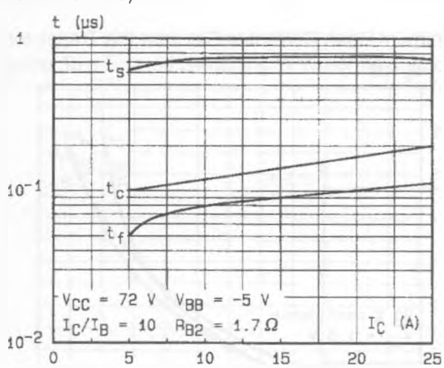
Saturation Voltage.



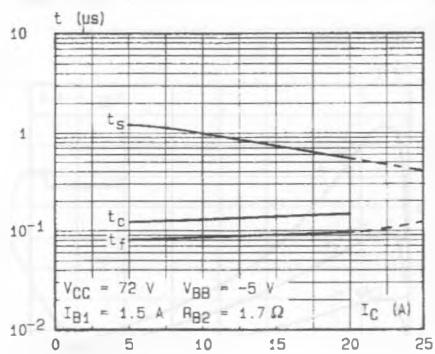
Switching Times Versus Collector



Switching Times versus Collector Current (inductive load).



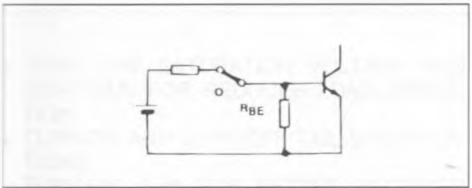
Switching Times versus Collector Current (inductive load).



SWITCHING OPERATING AND OVERLOAD AREAS

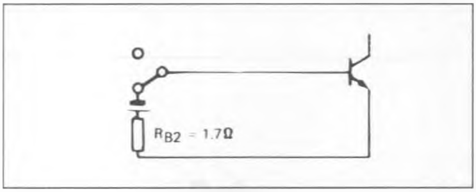
TRANSISTOR FORWARD BIASED

- During the turn-on
- During the turn-off without negative base-emitter voltage and 3.9 $\Omega \leq R_{BE} \leq 50\ \Omega$.

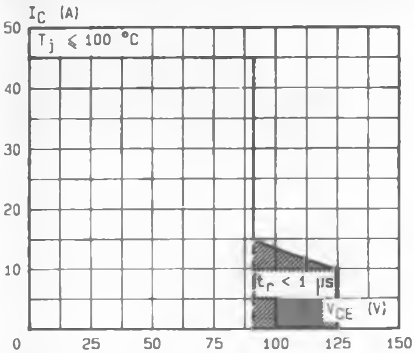


TRANSISTOR REVERSE BIASED

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

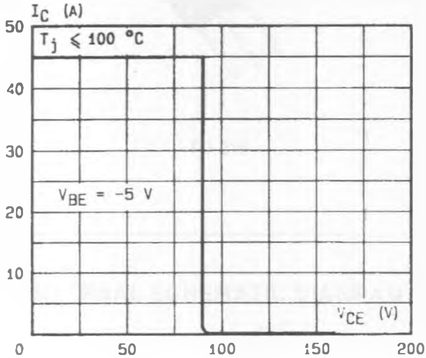


Forward Biased Safe Operating Area (FBSOA).

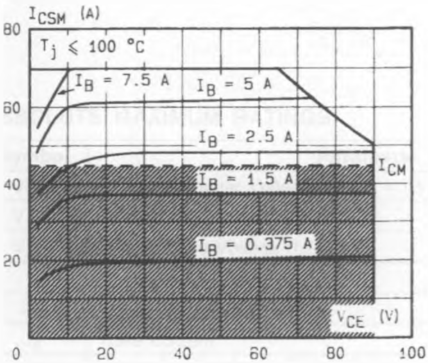


The hatched zone can only be used for turn-on.

Reverse Biased Safe Operating Area (RBSOA).

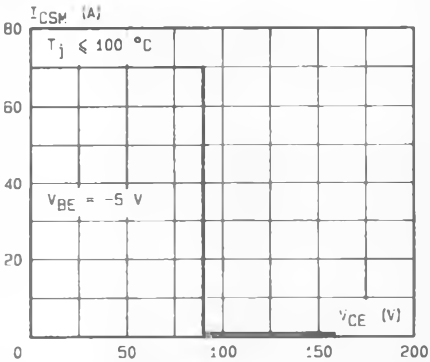


Forward Biased Accidental Overload Area (FBAOA).



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 (RBAOA).



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.