SGS-THOMSON
MICROELECTRONICS

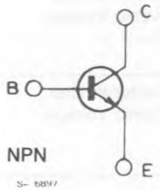
BUW50

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} = – 1.5V)	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	25	A
I_{CM}	Collector Peak Current	50	A
I_B	Base Current	6	A
I_{BM}	Base Peak Current	12	A
P_{base}	Reverse Bias Base Power Dissipation (B.E. junction in avalance)	2	W
P_{tot}	Total Dissipation at T_c < 25°C	150	W
T_{stg}	Storage Temperature	– 65 to + 175	°C
TJ	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	125			V
V_{EBO}	Emitter-base Voltage (I_C = 0)	I_E = 5A	7			V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 10A I_B = 0.5A I_C = 20A I_B = 2A I_C = 10A I_B = 0.5A T_j = 100°C I_C = 20A I_B = 2A T_j = 100°C		0.4 0.6 0.5 0.75	0.8 0.9 0.9 1.5	V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 20A I_B = 2A I_C = 20A I_B = 2A T_j = 100°C		1.25 1.25	1.6 1.7	V V
di_C/dt	Rate of Rise of on State Collector Current	V_{CC} = 100V R_C = 0 I_{B1} = 3A T_j = 25°C T_j = 100°C See fig. 2	 50 45	 100 85		 A/μs A/μs
$V_{CE(2μs)}$	Collector-emitter Dynamic Voltage	V_{CC} = 100V R_C = 5Ω I_{B1} = 2A T_j = 25°C T_j = 100°C See fig. 2		 1.4 2.1	 3 4	 V V
$V_{CE(4μs)}$	Collector-emitter Dynamic Voltage	V_{CC} = 100V R_C = 5Ω I_{B1} = 2A T_j = 25°C T_j = 100°C See fig. 2		 1.1 1.5	 2 2.5	 V V

ELECTRICAL CHARACTERISTICS (continued)

RESISTIVE LOAD

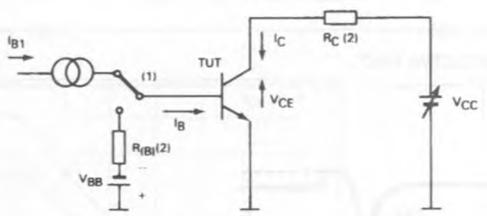
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
t_r	Rise Time	V_{CC} = 100V	I_C = 24A		0.33	0.6	µs
t_s	Storage Time	V_{BB} = – 5V	I_{B1} = 3A		0.75	1.2	µs
t_f	Fall Time	R_B = 0.83Ω	t_p = 30µs		0.15	0.3	µs

INDUCTIVE LOAD

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
t_s	Storage Time	V_{CC} = 100V I_C = 20A	I_B = 2A		0.85	1.4	µs
t_f	Fall Time	V_{BB} = – 5V	V_{clamp} = 125V		0.09	0.2	µs
t_t	Tail Time in Turn-on	L_C = 0.25mH	R_B = 1.3Ω		0.04	0.05	µs
t_c	Crossover Time	see fig. 3			0.16	0.3	µs
t_s	Storage Time	V_{CC} = 100V I_C = 20A	I_B = 2A		1.2	1.7	µs
t_f	Fall Time	V_{BB} = – 5V	V_{clamp} = 125V		0.17	0.3	µs
t_t	Tail Time in Turn-on	L_C = 0.25mH	R_B = 1.3Ω		0.07	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} = 100V I_C = 20A	I_B = 2A		2.1		µs
t_f	Fall Time	V_{BB} = 0	V_{clamp} = 125V		0.7		µs
t_t	Tail Time in Turn-on	L_C = 0.25mH	R_B = 4.7Ω		0.28		µs
		see fig. 3					
t_s	Storage Time	V_{CC} = 100V I_C = 20A	I_B = 2A		3.2		µs
t_f	Fall Time	V_{BB} = 0	V_{clamp} = 125V		1.2		µs
t_t	Tail Time in Turn-on	L_C = 0.25mH	R_B = 4.7Ω		0.55		µs
		see fig. 3	T_j = 100°C				

* Pulsed : Pulse duration = 300µs, 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.

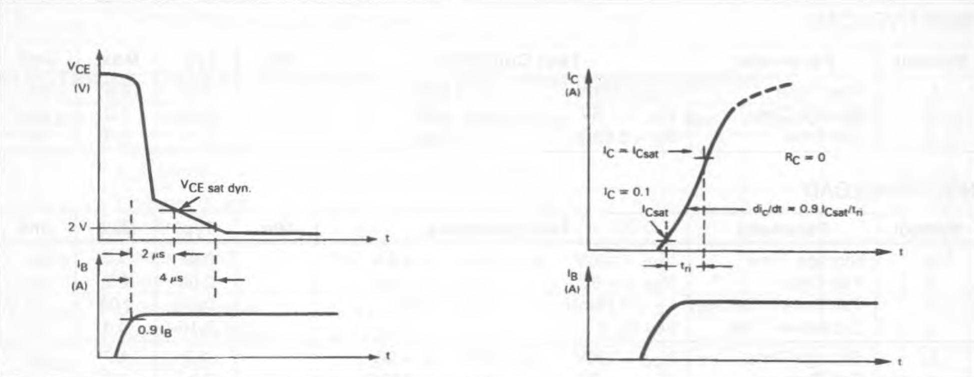


Figure 3a : Turn-off Switching Test Circuit.

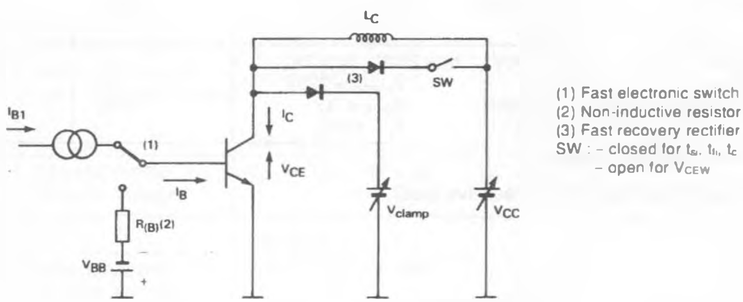
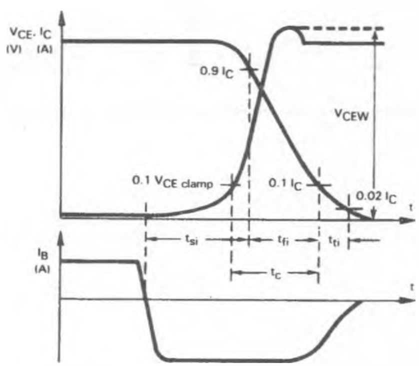
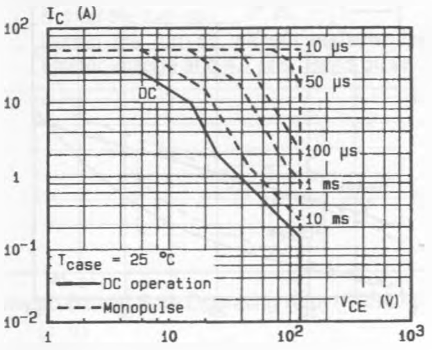


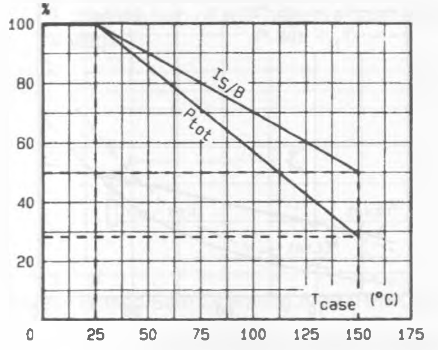
Figure 3b : Turn-off Switching Waveforms (inductive load).



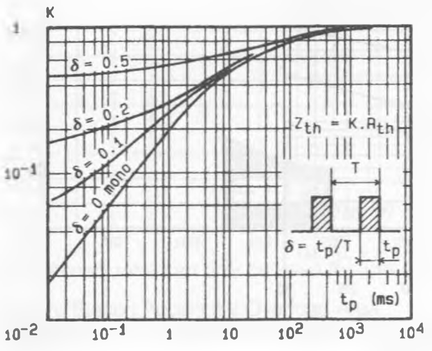
DC and AC Pulse Area.



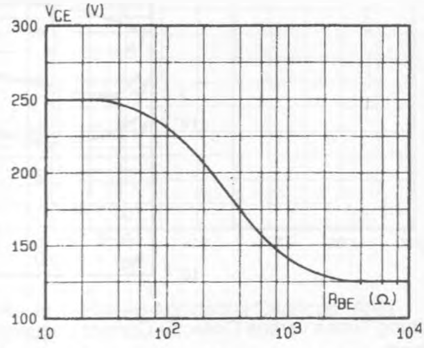
Power and $I_{S/B}$ Derating versus Case Temperature.



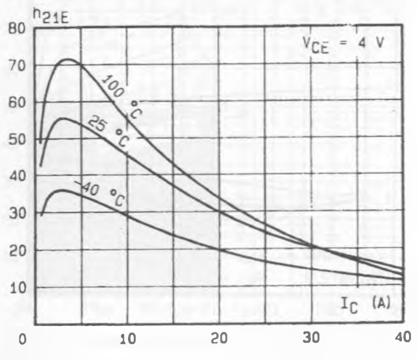
Transient Thermal Response.



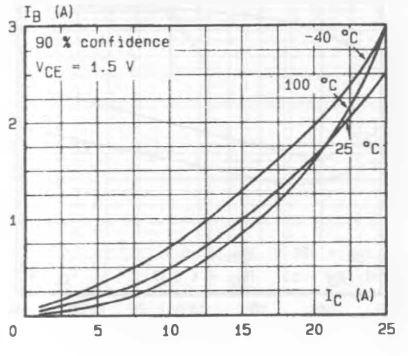
Collector-emitter Voltage versus Base-emitter Resistance.



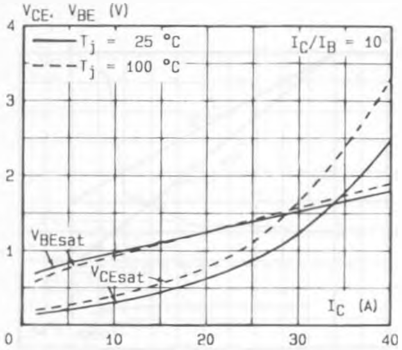
DC Current Gain.



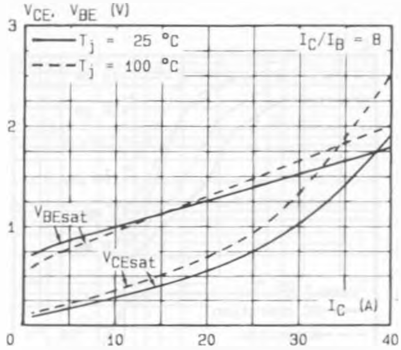
Minimum Base Current to Saturate the Transistor.



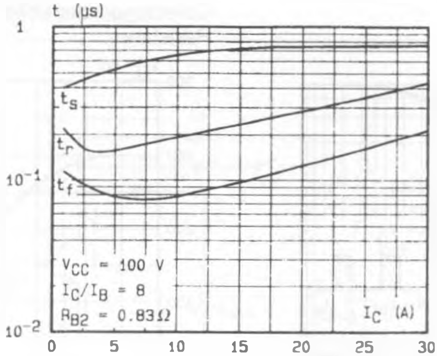
Saturation Voltage.



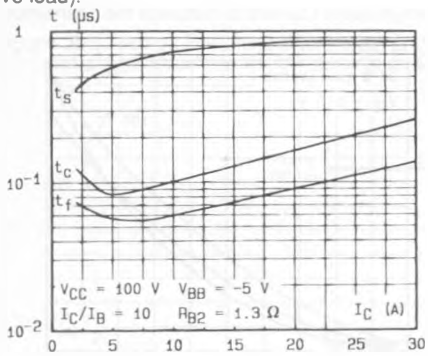
Saturation Voltage.



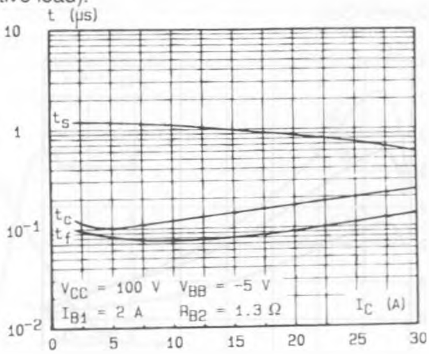
Switching Times versus Collector.



Switching Times versus Collector Current (inductive load).



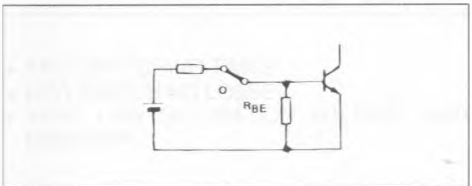
Switching Times versus Collector Current (inductive load).



SWITCHING OPERATING AND OVERLOAD AREAS

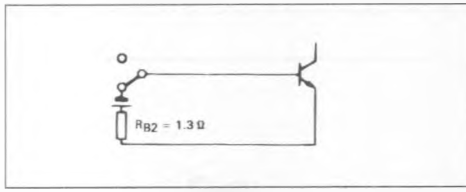
TRANSISTOR FORWARD BIASED

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

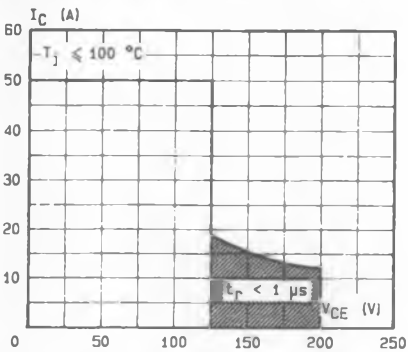


TRANSISTOR REVERSE BIASED

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

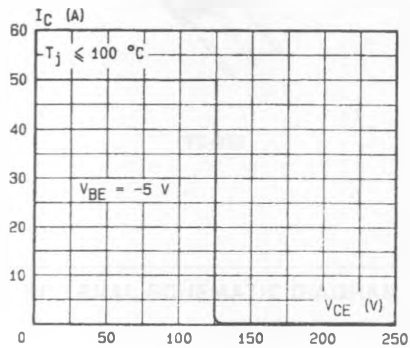


Forward Biased Safe Operating Area (FBSOA).

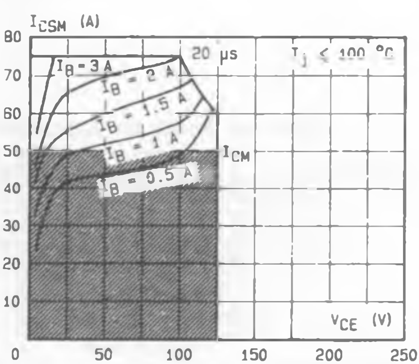


The hatched zone can only be used for turn-on.

Reverse Biased Safe Operating Area (RBSOA).

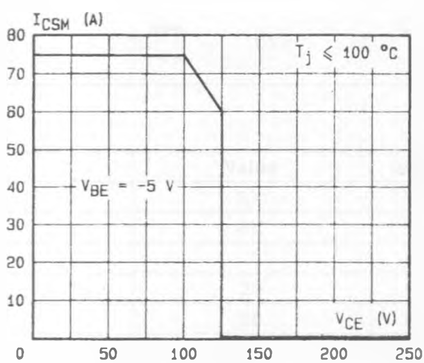


Forward Biased Accidental Overload Area (FBADA).



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.