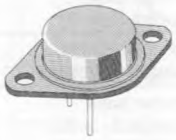
SGS-THOMSON MICROELECTRONICS

BUT90

FAST SWITCHING POWER TRANSISTOR

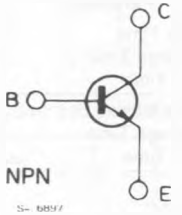
DESCRIPTION

High current, high speed transistor suited for power conversion applications high efficiency converters motors controls.



TO-3

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CEV}	Collector-emitter Voltage (V_{BE} = – 1.5V)	200	V
V_{CEO}	Collector-emitter Voltage (I_B = 0)	125	V
V_{EBO}	Emitter-base Voltage (I_C = 0)	10	V
I_C	Collector Current	50	A
I_{CM}	Collector Peak Current	120	A
I_B	Base Current	12	A
I_{BM}	Base Peak Current	32	A
P_{tot}	Total Dissipation at T_c < 25°C	250	W
T_{stg}	Storage Temperature	– 65 to 200	°C
T_j	Max. Operating Junction Temperature	200	°C

THERMAL DATA

$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	0.7	°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			0.4 4	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			0.2 2	mA mA
I_{EBO}	Emitter Cutoff Current (I_C = 0)	V_{EB} = 7V			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 = 50mA	10			V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 35A I_B = 1.75A I_C = 70A I_B = 7A I_C = 35A I_B = 1.75A T_j = 100°C I_C = 70A I_B = 7A T_j = 100°C		0.55 0.8 0.75 1.2	0.9 0.9 1.2 1.5	V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 35A I_B = 1.75A I_C = 70A I_B = 7A I_C = 35A I_B = 1.75A T_j = 100°C I_C = 70A I_B = 7A T_j = 100°C		1 1.45 1 1.65	1.3 1.8 1.4 2	V V V V

RESISTIVE LOAD

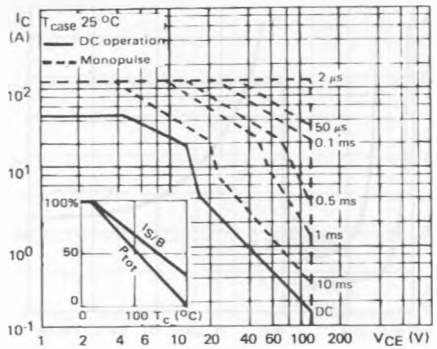
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_r t_s t_f	Rise Time Storage Time Fall Time	V_{CC} = 100V I_C = 70A I_{B1} = − I_{B2} = 7A t_p = 30µs		0.8 0.9 0.2	1.2 1.5 0.4	µs µs µs
t_r t_s t_f	Rise Time Storage Time Fall Time	V_{CC} = 100V I_C = 70A I_{B1} = − I_{B2} = 7A t_p = 30µs T_j = 100°C		1.1 1.2 0.3	1.6 2 0.6	µs µs µs

INDUCTIVE LOAD

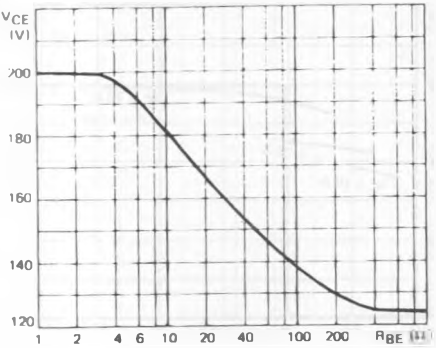
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_s t_f	Storage Time Fall Time	V_{CC} = 100V V_{clamp} = 125V I_C = 70A I_{B1} = − I_{B2} = 7A L_C = 70µH		1.25 0.16	2 0.3	µs µs
t_s t_f	Storage Time Fall Time	V_{CC} = 100V V_{clamp} = 125V I_C = 70A I_{B1} = − I_{B2} = 7A L_C = 70µH T_j = 100°C		1.5 0.25	2.3 0.5	µs µs

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

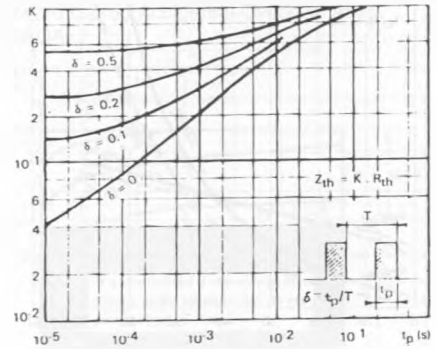
DC and Pulse Area.



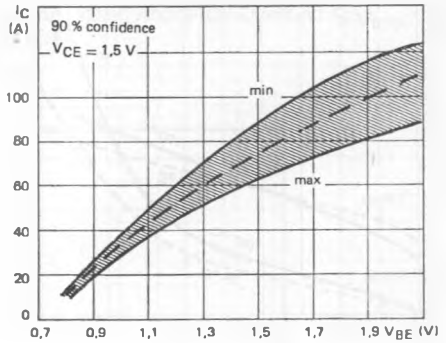
Collector-emitter vs. Base Emitter Resistance.



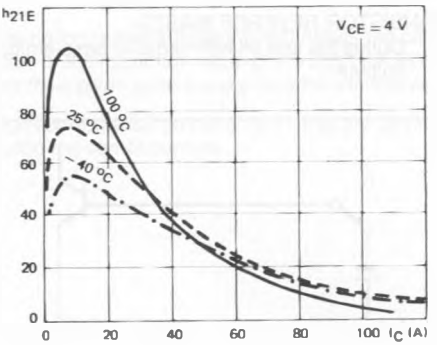
Transient Thermal Response.



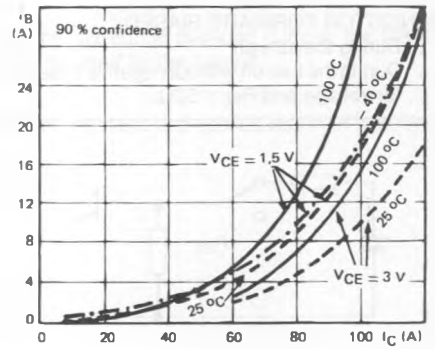
Collector-current Spread vs. Base-emitter Voltage.



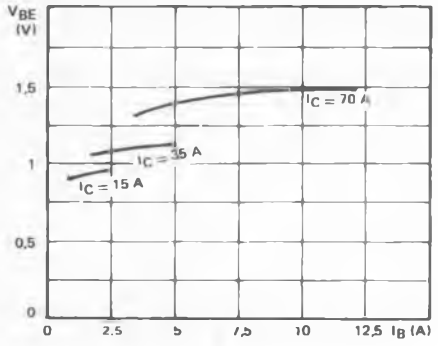
DC Current Gain.



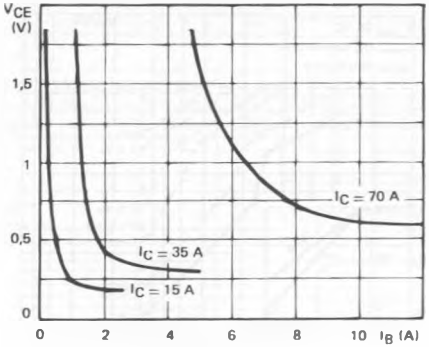
Minimum Base Current to saturate the Transistor.



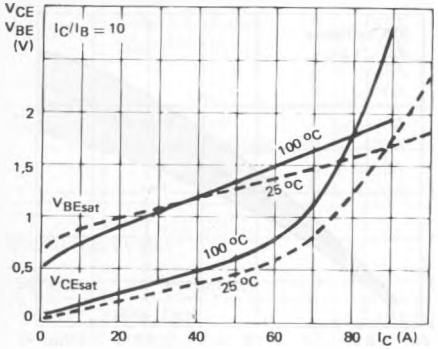
Base Characteristics.



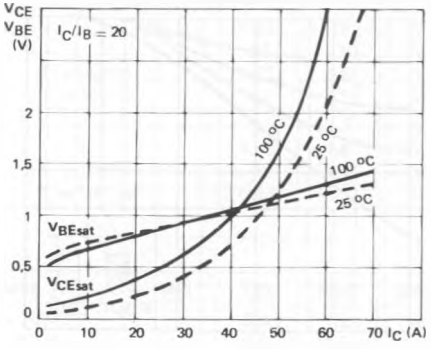
Collector Saturation Region.



Saturation Voltage Low Gain.



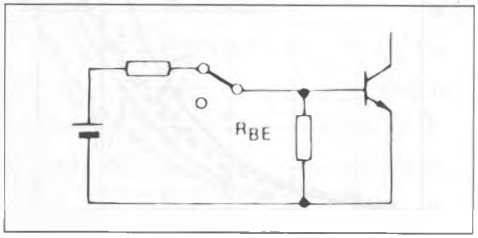
Saturation Voltage High Gain.



SWITCHING OPERATING AND OVERLOAD AREAS

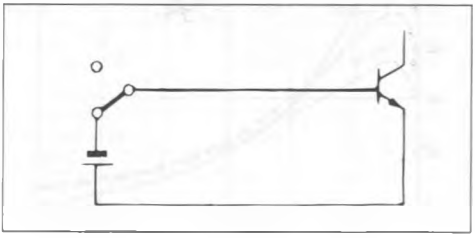
TRANSISTOR FORWARD BIASED

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

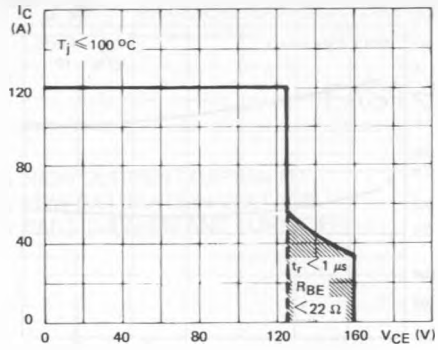


TRANSISTOR REVERSE BIASED

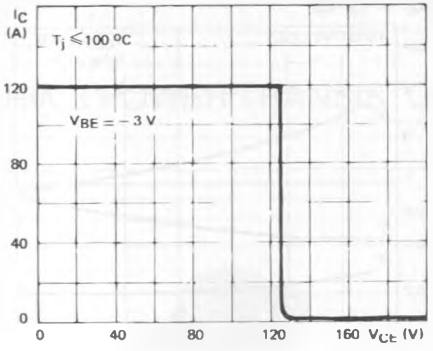
- During the turn off with negative base-emitter voltage.



Forward biased Safe Operating Area (FBSOA).

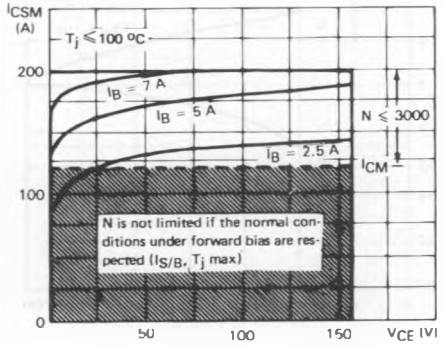


Reverse biased Safe Operating Area (RBSOA).

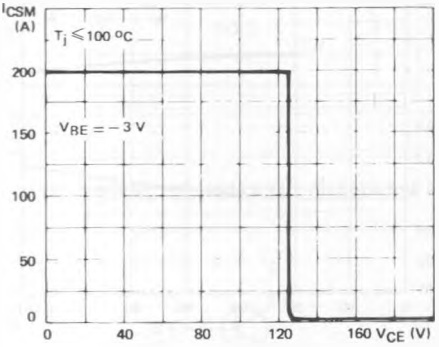


The hatched zone can only be used for turn on.

Forward biased Accidental Overload Area (FBAOA).



Reverse biased Accidental Overload Area (RBAOA).

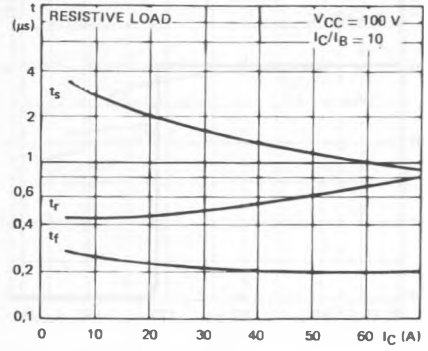


The Kellog network (heavy point) allows the calculation of the maximum value of the short-circuit current for a given base current I_B (90% confidence).

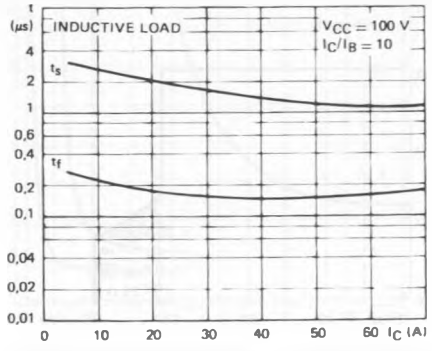
After the accidental overload current, the RBAOA has to be used for the turn off.

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

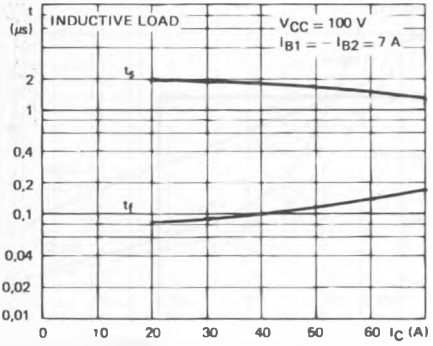
Switching Times vs. Collector Current (resistive load).



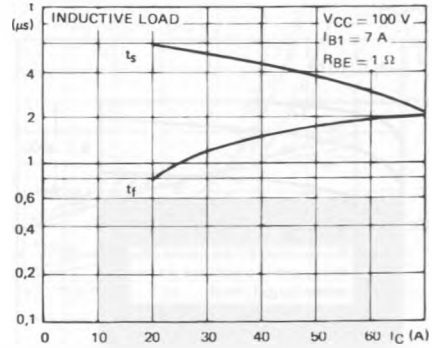
Switching Times vs. Collector Current (inductive load).



Inductive Load with Negative Base Drive.



Inductive Load without Negative Base Drive.



Switching Times vs. Junction Temperature.