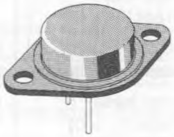
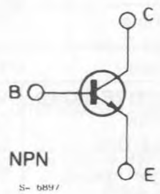
FAST SWITCHING POWER TRANSISTOR

- HIGH CURRENT CAPABILITY
- LOW SATURATION VOLTAGE
- FAST TURN-ON AND TURN-OFF



TO-3

INTERNAL SCHEMATIC DIAGRAM



DESCRIPTION

High current, high speed transistor suited for low voltage application.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CEV}	Collector-emitter Voltage (V_{BE} = – 1.5V)	300	V
V_{CEO}	Collector-emitter Voltage (I_B = 0)	200	V
V_{EBO}	Emitter-base Voltage (I_C = 0)	10	V
I_C	Collector Current	50	A
I_{CM}	Collector Peak Current	70	A
I_B	Base Current	10	A
I_{BM}	Base Peak Current	15	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

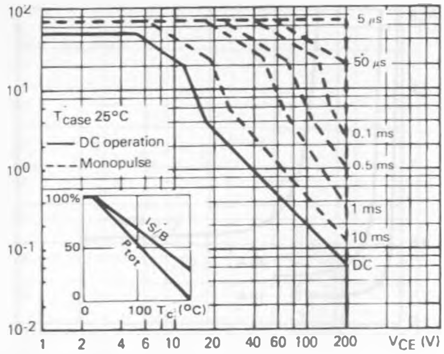
$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case Max	0.7	°C/W

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

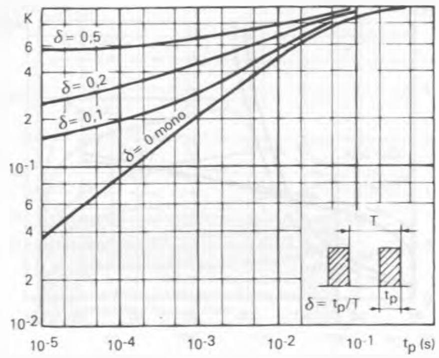
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector Cutoff Current (R_{BE} = 10Ω)	V_{CE} = V_{CEV} V_{CE} = V_{CEV} T_C = 100°C			0.4 4	mA mA
I_{CEV}	Collector Cutoff Current	V_{CE} = V_{CEV} V_{BE} = - 1.5V V_{CE} = V_{CEV} V_{BE} = - 1.5V T_C = 100°C			0.2 2	mA mA
I_{EBO}	Emitter Cutoff Current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEO(sus)}$*	Collector Emitter Sustaining Voltage	I_C = 0.2A L = 25mH	200			V
V_{EBO}	Emitter-base Voltage (I_C = 0)	I_E = 50mA	10			V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 20A I_B = 1A I_C = 40A I_B = 4A I_C = 20A I_B = 1A T_j = 100°C I_C = 40A I_B = 4A T_j = 100°C		0.55 0.7 0.7 0.95	0.9 1.2 1.2 1.8	V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 20A I_B = 1A I_C = 40A I_B = 4A I_C = 20A I_B = 1A T_j = 100°C I_C = 40A I_B = 4A T_j = 100°C		0.95 1.25 0.9 1.3	1.3 1.8 1.4 1.9	V V V V
 t_r t_s t_f	**RESISTIVE LOAD** Rise Time Storage Time Fall Time	V_{CC} = 150V I_C = 40A I_{B1} = − I_{B2} = 4A t_p = 30μs		0.5 0.65 0.15	0.8 1.2 0.3	μs μs μs
t_r t_s t_f	Rise Time Storage Time Fall Time	V_{CC} = 150V I_C = 40A I_{B1} = − I_{B2} = 4A t_p = 30μs T_j = 100°C		0.7 0.85 0.32	1.2 1.5 0.65	μs μs μs
 t_s t_f	**INDUCTIVE LOAD** Fall Time Storage Time	V_{CC} = 150V V_{clamp} = 200V I_C = 40A I_{B1} = − I_{B2} = 4A L_C = 70μH		0.7 0.08	1.5 0.2	μs μs
t_s t_f	Storage Time Fall Time	V_{CC} = 150V V_{clamp} = 200V I_C = 40A I_{B1} = − I_{B2} = 4A L_C = 70μH T_j = 100°C		1.1 0.18	1.8 0.4	μs μs

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

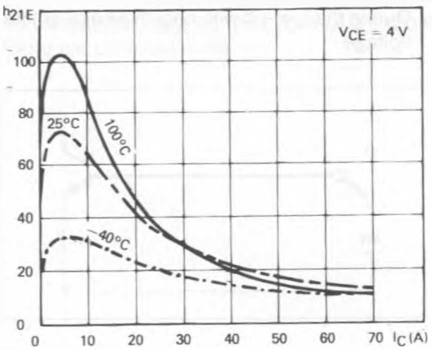
DC and AC Pulse Area.



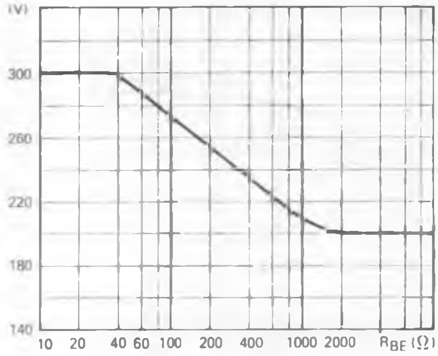
Transient Thermal Response.



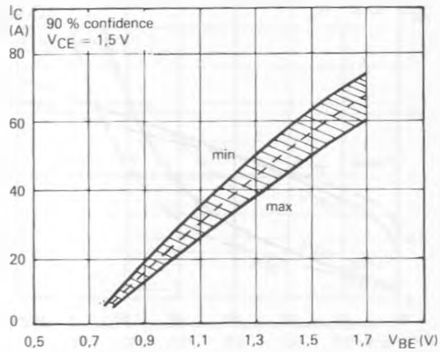
DC Current Gain.



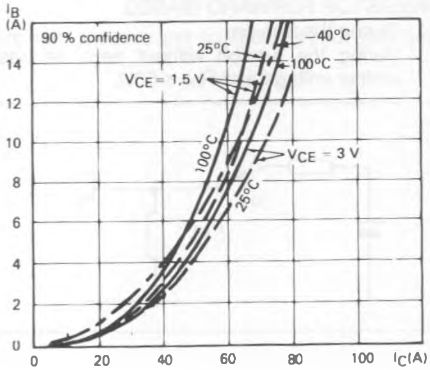
Collector-emitter vs. Base-emitter Resistance.



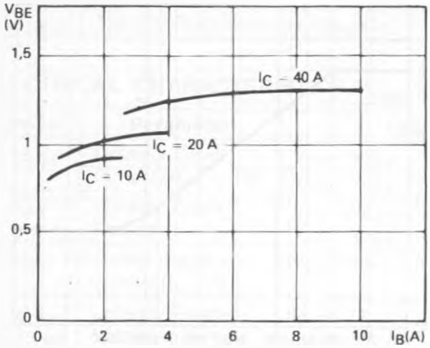
Collector Current Spread vs. Base-emitter Voltage.



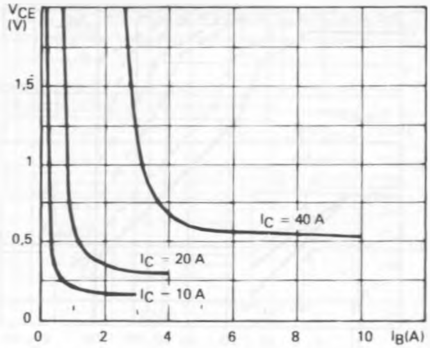
Minimum Base Current to saturate the Transistor.



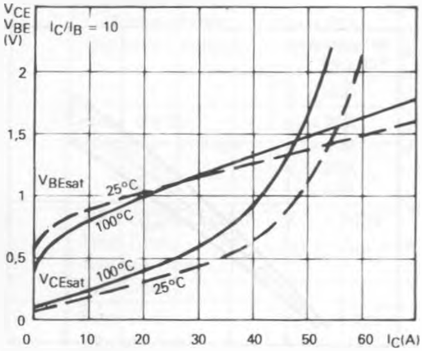
Base Characteristics.



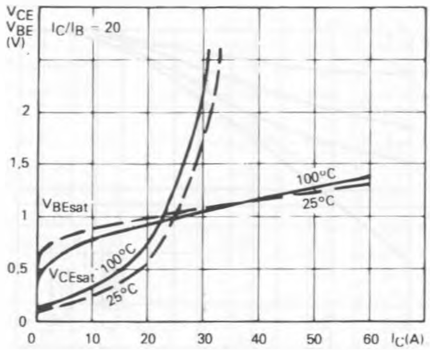
Collector Saturation Region.



Saturation Voltage Low Gain.



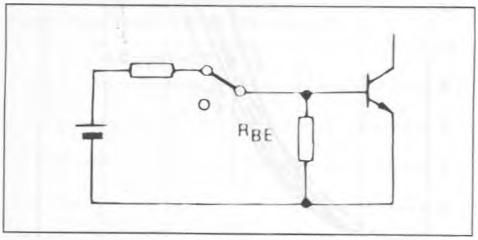
Saturation Voltage High Gain.



SWITCHING OPERATING AND OVERLOAD AREAS

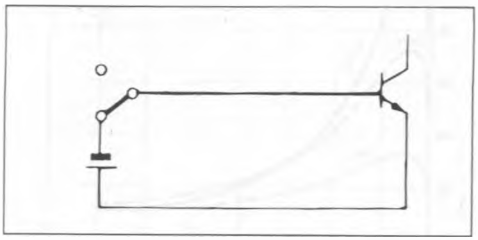
TRANSISTOR FORWARD BIASED

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

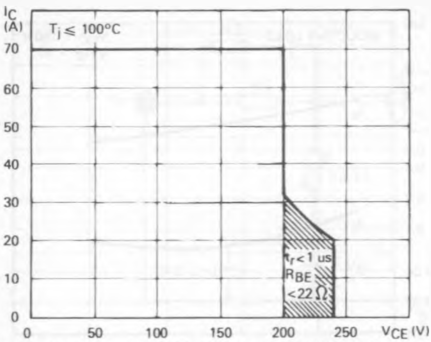


TRANSISTOR REVERSE BIASED

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

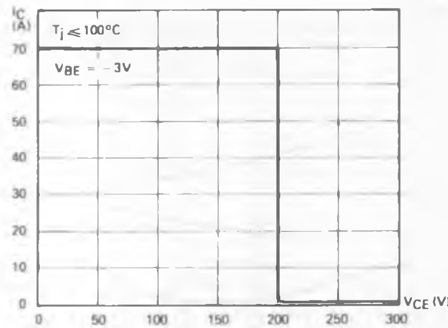


Forward biased Safe Operating Area (FBSOA).

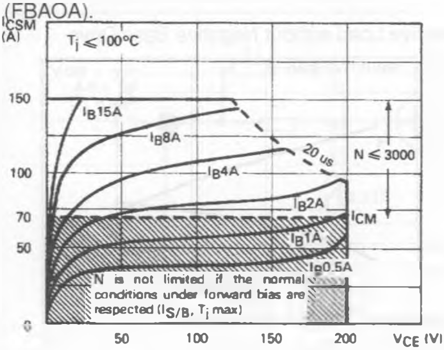


The hatched zone can only be used for turn-on.

Reverse biased Safe Operating Area (RBSOA).

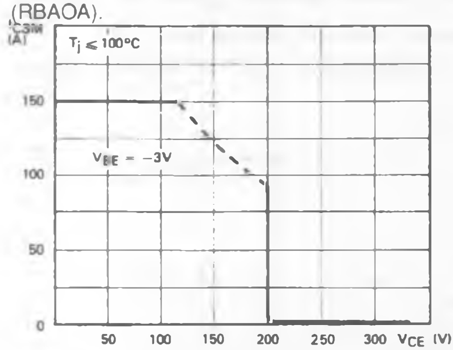


Forward biased Accidental Overload Area (FBAOA).



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

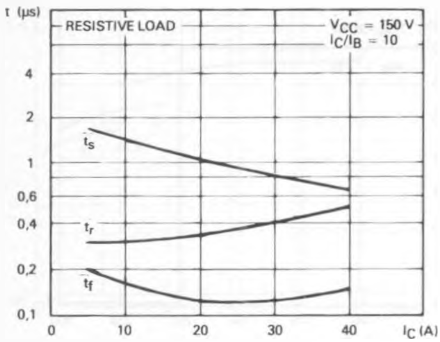
Reverse biased Accidental Overload Area (RBAOA).



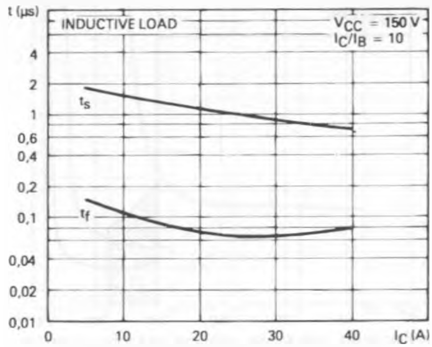
After the accidental overload current, the RBAOA has to be used for the turn-off.

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

Switching Times vs. Collector Current (resistive load).

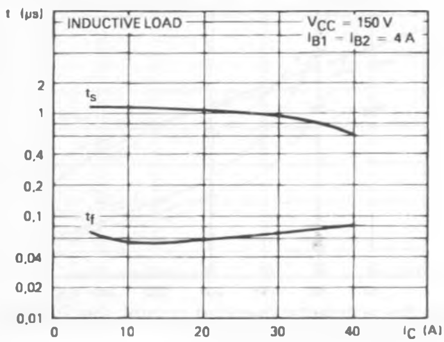


Switching Times vs. Collector Current (inductive load).

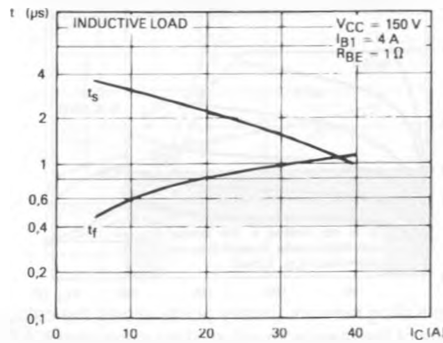


SWITCHING TIMES AT CONSTANT GAIN

Inductive Load with Negative Base Drive.

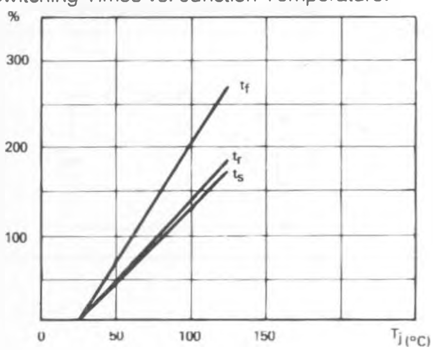


Inductive Load without Negative Base Drive.

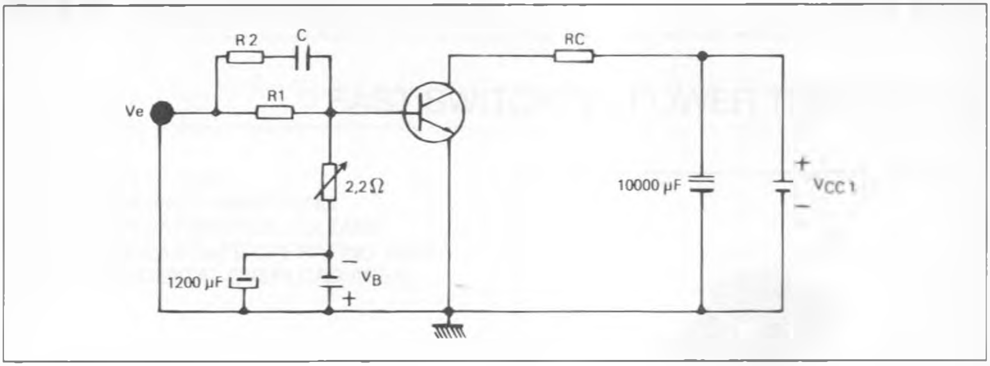


SWITCHING TIMES AT CONSTANT DRIVE

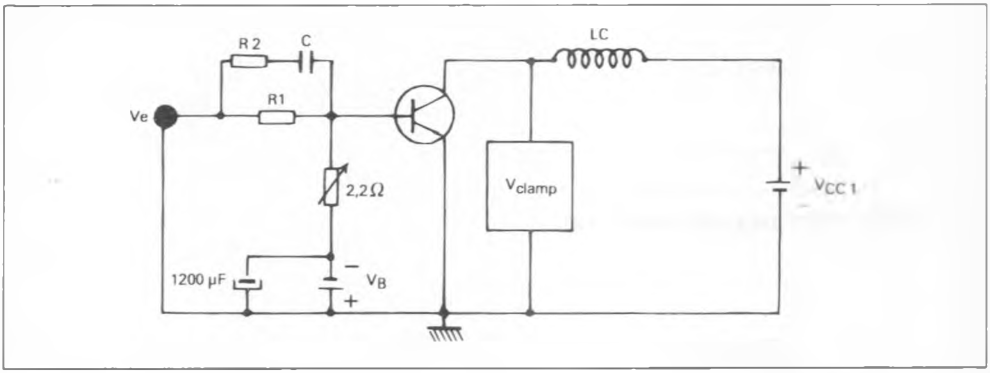
Switching Times vs. Junction Temperature.



SWITCHING ON RESISTIVE LOAD



SWITCHING ON INDUCTIVE LOAD



R_C = 37,5Ω
R1 = 2,2Ω
R2 = 3,3Ω
C = 60nF

Resistance non inductive

I_C = 40A
I_{B1} = − I_{B2} = 4A
V_{CC1} = 150V
$V_{CCclamp}$ = 200V
V_B = 6V
V_e = 25V
L_C = 190µH
D_1

$\frac{dI_{B1}}{dt} \geq 10A/\mu s$

$\frac{dI_{B2}}{dt} \geq 40A/\mu s$

Switching on resistive load

$t_p \approx 20\mu s$
$\delta \leq 1\%$

Switching on inductive load

$t_p \approx 50\mu s$
$\delta \leq 1\%$