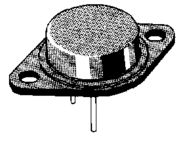
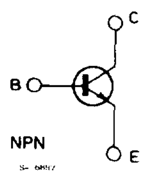
FAST SWITCHING POWER TRANSISTOR

- FAST SWITCHING TIMES
- LOW SWITCHING LOSSES
- VERY LOW SATURATION VOLTAGE AND HIGH GAIN FOR REDUCED LOAD OPERATION



TO-3

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CEV}	Collector-emitter Voltage (V_{BE} = – 1.5V)	350	V
V_{CEO}	Collector-emitter Voltage (I_B = 0)	250	V
V_{EBO}	Emitter-base Voltage (I_C = 0)	7	V
I_C	Collector Current	40	A
I_{CM}	Collector Peak Current	60	A
I_B	Base Current	7	A
I_{BM}	Base Peak Current	12	A
P_{base}	Reverse Bias Base Dissipation (B.E. junction in avalanche)	2	W
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 CHARACTERISITCS (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 4	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 = 25 mH	250			V
V_{EBO}	Emitter-base Voltage (I_C = 0)	I_E = 50mA	7			V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 8A I_B = 0.53A I_C = 16A I_B = 1.6A I_C = 24A I_B = 3A I_C = 8A I_B = 0.53A T_j = 100°C I_C = 16A I_B = 1.6A T_j = 100°C I_C = 24A I_B = 3A T_j = 100°C		0.35 0.45 0.6 0.35 0.6 0.9	0.9 0.9 1.2 1.2 1.5 1.9	V V V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 16A I_B = 1.6A I_C = 24A I_B = 3A I_C = 16A I_B = 1.6A T_j = 100°C I_C = 24A I_B = 3A T_j = 100°C		0.9 1.2 1 1.2	1.3 1.5 1.3 1.5	V V V V
di_c/dt	Rated of Rise of On-state Collector Current	V_{CC} = 200V R_C = 0 I_{B1} = 2.4A T_j = 25°C See fig. 2 T_j = 100°C	 50 45	 130 120		 A/µs A/µs
$V_{CE(2µs)}$	Collector Emitter Dynamic Voltage	V_{CC} = 200V I_{B1} = 1.6A R_C = 13Ω T_j = 25°C See fig. 2 T_j = 100°C		 1.8 2/8	 3 6	 V V
$V_{CE(4µs)}$	Collector Emitter Dynamic Voltage	V_{CC} = 200V I_{B1} = 1.6A R_C = 13Ω T_j = 25°C See fig. 2 T_j = 100°C		 1.1 1.5	 1.7 2.5	 V V

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

ELECTRICAL CHARACTERISTICS (continued)

RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_r	Rise Time	V_{CC} = 200V I_C = 24A V_{BB} = – 5V I_{B1} = 3A R_{B2} = 0.83Ω t_p = 30µs See fig. 1		0.3	0.6	µs
t_s	Storage Time			1.2	1.8	µs
t_f	Fall Time			0.15	0.35	µs

INDUCTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_s	Storage Time	V_{CC} = 200V V_{clamp} = 250V I_C = 16A I_B = 1.6A V_{BB} = – 5V R_{B2} = 1.6Ω L_C = 0.63mH See fig. 3		1.2	2	µs
t_f	Fall Time			0.08	0.2	µs
t_t	Tail Time in Turn-on			0.03	0.12	µs
t_c	Crossover Time			0.15	0.35	µs
t_s	Storage Time	V_{CC} = 200V V_{clamp} = 250V I_C = 16A I_B = 1.6A V_{BB} = – 5V R_{B2} = 3.3Ω L_C = 0.63mH T_j = 100°C See fig. 3		1.8	2.5	µs
t_f	Fall Time			0.2	0.4	µs
t_t	Tail Time in Turn-on			0.08	0.2	µs
t_c	Crossover Time			0.3	0.7	µs
t_s	Storage Time	V_{CC} = 200V V_{clamp} = 250V I_C = 16A I_B = 1.6A V_{BB} = 0 R_{B2} = 3.3Ω L_C = 0.63mH See fig. 3		3		µs
t_f	Fall Time			0.6		µs
t_t	Tail Time in Turn-on			0.2		µs
t_s	Storage Time	V_{CC} = 200V V_{clamp} = 250V I_C = 16A I_B = 1.6A V_{BB} = 0 R_{B2} = 3.3Ω L_C = 0.63mH T_j = 100°C See fig. 3		5		µs
t_f	Fall Time			1		µs
t_t	Tail Time in Turn-on			0.45		µs

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

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

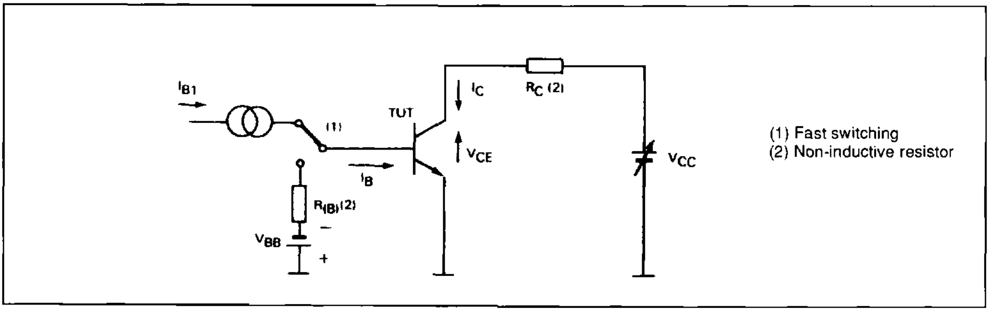


Figure 2 : Turn-on Switching Waveforms.

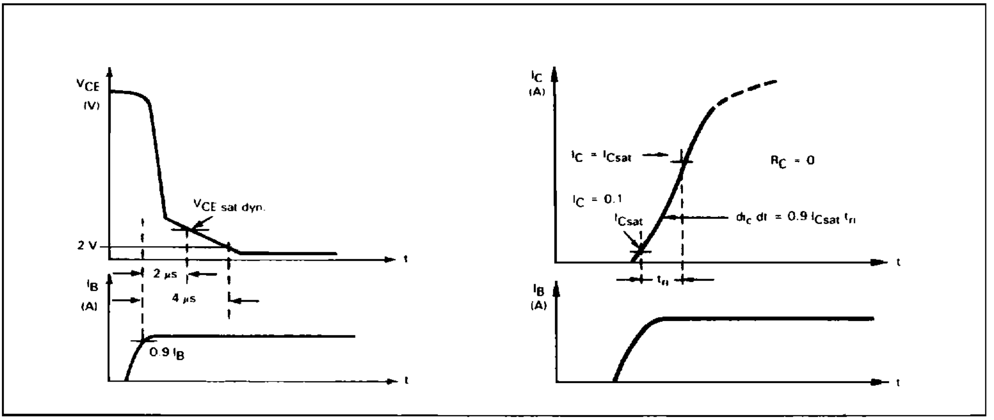


Figure 3a : Turn-on Switching Test Circuit.

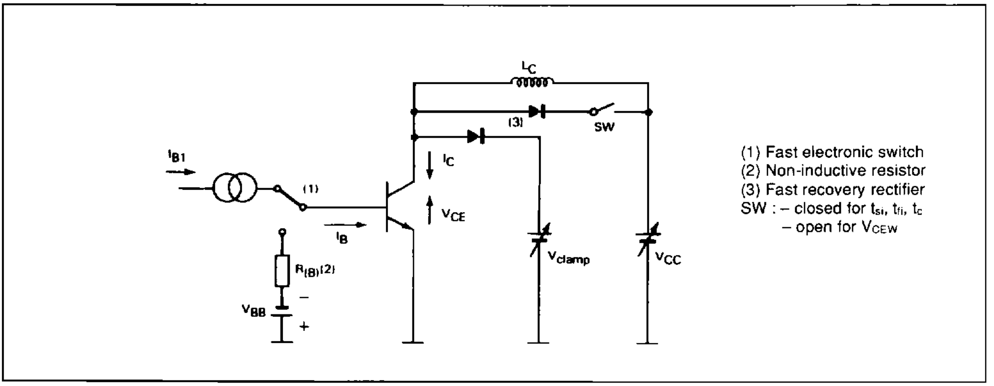
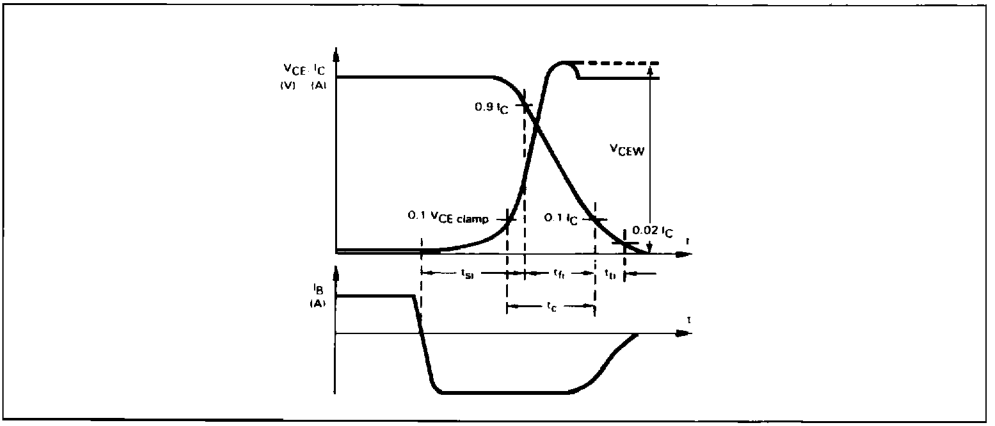
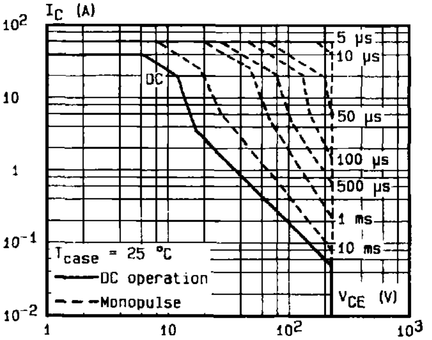


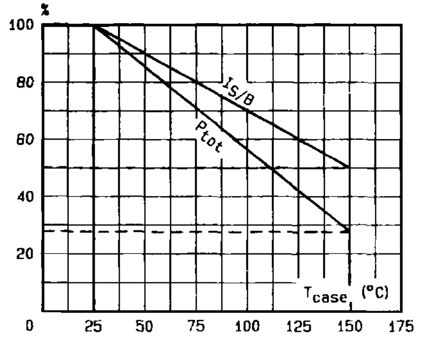
Figure 3b : Turn-off Switching Waveforms (inductive load).



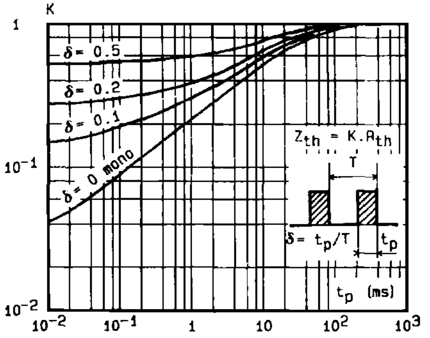
DC and AC Pulse Area.



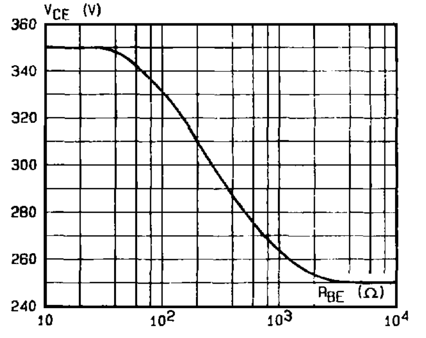
Power and $I_{S/B}$ Derating versus Case Temperature.



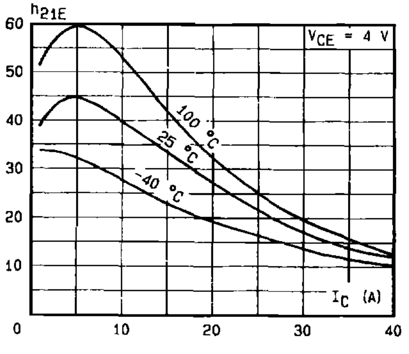
Transient Thermal Response.



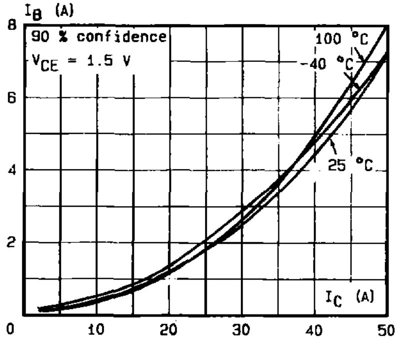
Collector-emitter Voltage versus Base-emitter Resistance.



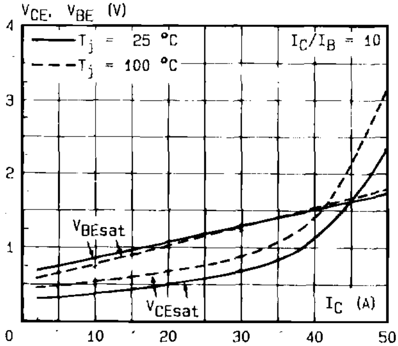
DC Current Gain.



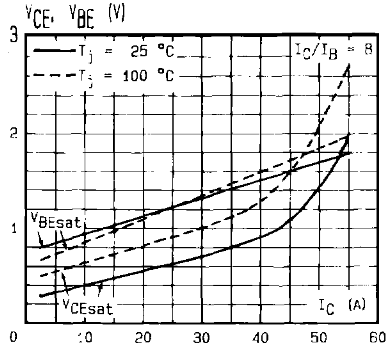
Minimum Base Current to saturate the Transistor.



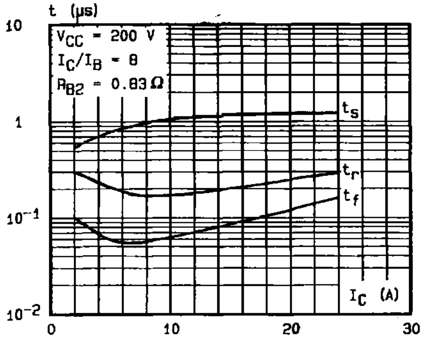
Saturation Voltage.



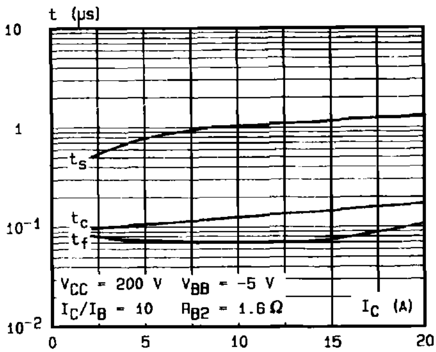
Saturation Voltage.



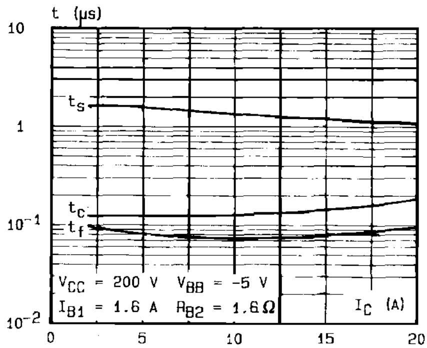
Switching Times versus Collector Current (resistive load).



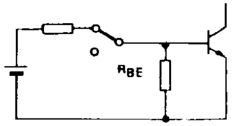
Switching Times versus Collector Current (inductive load).



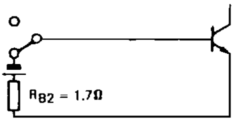
Switching Times versus Collector Current (inductive load).



SWITCHING OPERATING AND OVERLOAD AREAS

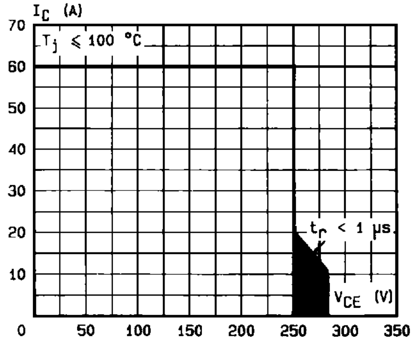


Transistor Forward Biased
- During the turn on
- During the turn off without negative base-emitter voltage and 3.3Ω ≤ R_{BE} ≤ 50 Ω



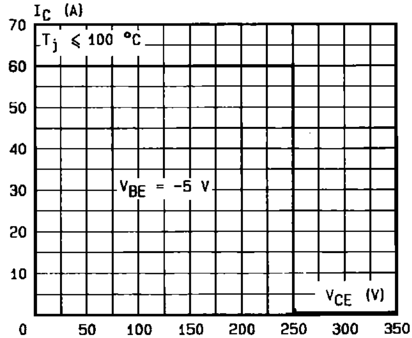
Transistor Reverse Biased
- During the turn off with negative base emitter voltage

Forward Biased Safe Operating Area (FBSOA).

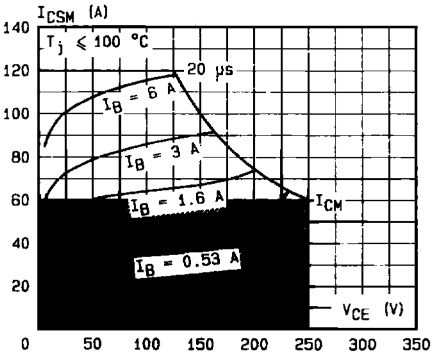


The hatched zone can only be used for turn-on

Reverse Biased Safe Operating Area (RBSOA).

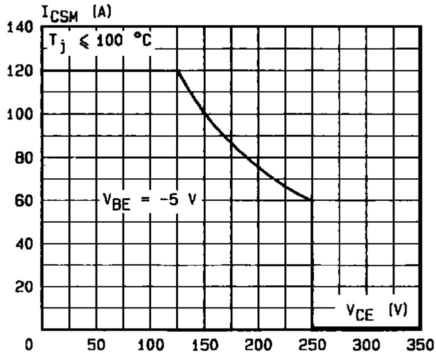


Forward Biased Accidental Overload Area (FBAOA).



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.