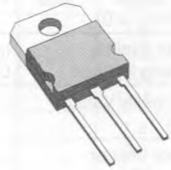
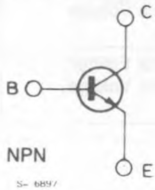
FAST SWITCHING POWER TRANSISTOR

- 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} = – 1.5 V)	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	20	A
I_{CM}	Collector Peak Current	30	A
I_B	Base Current	4	A
I_{BM}	Base Peak Current	6	A
P_{base}	Reverse Bias Base Power Dissipation (B.E. junction in avalanche)	1	W
P_{tot}	Total Dissipation at T_c < 25°C	150	W
T_{stg}	Storage Temperature	– 65 to 175	°C
T_j	Max. Operating Junction Temperature	175	°C

THERMAL DATA

$R_{thj\text{-}case}$	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			0.5 2.5	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			0.5 2	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	250			V
V_{EBO}	Emitter-base Voltage (I_C = 0)	I_E = 50mA	7			V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 4A I_B = 0.26A I_C = 8A I_B = 0.8A I_C = 4A I_B = 0.26A T_j = 100°C I_C = 8A I_B = 0.8A T_j = 100°C		0.35 0.45 0.35 0.6	0.8 0.9 0.9 1.5	V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 8A I_B = 0.8A I_C = 8A I_B = 0.8A T_j = 100°C		1 0.9	1.3 1.3	V V
di_C/dt	Rated of Rise of on-state Collector Current	V_{CC} = 200V R_C = 0 I_{B1} = 1.2A T_j = 25°C See fig. 2 T_j = 100°C	 30 25	 70 60		 A/µs A/µs
$V_{CE(2\mu s)}$	Collector Emitter Dynamic Voltage	V_{CC} = 200V R_C = 25Ω I_{B1} = 0.8A See fig. 2 T_j = 25°C T_j = 100°C		 1.8 2.8	 3 5	 V V
$V_{CE(4\mu s)}$	Collector Emitter Dynamic Voltage	V_{CC} = 200V R_C = 25Ω I_{B1} = 0.8A See fig. 2 T_j = 25°C T_j = 100°C		 1.1 1.5	 1.7 2.5	 V V

ELECTRICAL CHARACTERISTICS (continued)

RESISTIVE LOAD

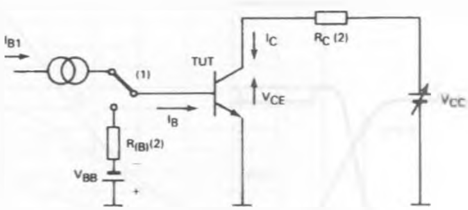
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
t_r t_s t_f	Rise Time Storage Time Fall Time	V_{CC} = 200V V_{BB} = – 5V R_{B2} = 1.7Ω See fig. 1	I_C = 12A I_{B1} = 1.5A t_p = 30μs		0.3 1 0.15	0.6 1.6 0.3	μs μs μs

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} = 200V I_C = 8A V_{BB} = – 5V L_C = 1.3mH	V_{clamp} = 250V I_B = 0.8A R_{B2} = 3.1Ω See fig. 3		1.2 0.08 0.03 0.15	1.8 0.2 0.12 0.35	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} = 200V I_C = 8A V_{BB} = – 5V L_C = 1.3mH See fig. 3	V_{clamp} = 250V I_B = 0.8A R_{B2} = 3.1Ω T_j = 100°C		1.8 0.2 0.08 0.35	2.4 0.4 0.2 0.7	μs μs μs μs
t_s t_f t_t	Storage Time Fall Time Tail Time in Turn-on	V_{CC} = 200V I_C = 8A V_{BB} = 0 L_C = 1.3mH	V_{clamp} = 250V I_B = 0.8A R_{B2} = 5.6Ω See fig. 3		2.8 0.5 0.15		μs μs μs
t_s t_f t_t	Storage Time Fall Time Tail Time in Turn-on	V_{CC} = 200V I_C = 8A V_{BB} = 0 L_C = 1.3mH See fig. 3	V_{clamp} = 250V I_B = 0.8A R_{B2} = 5.6Ω T_j = 100°C		4.5 0.8 0.4		μs μs μs

* Pulsed : Pulse duration = 300 ms, 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.

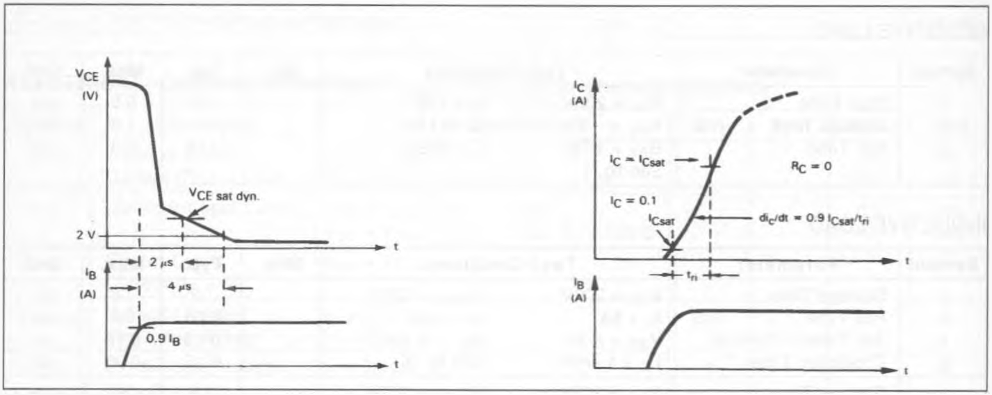


Figure 3a : Turn-off Switching Test Circuit.

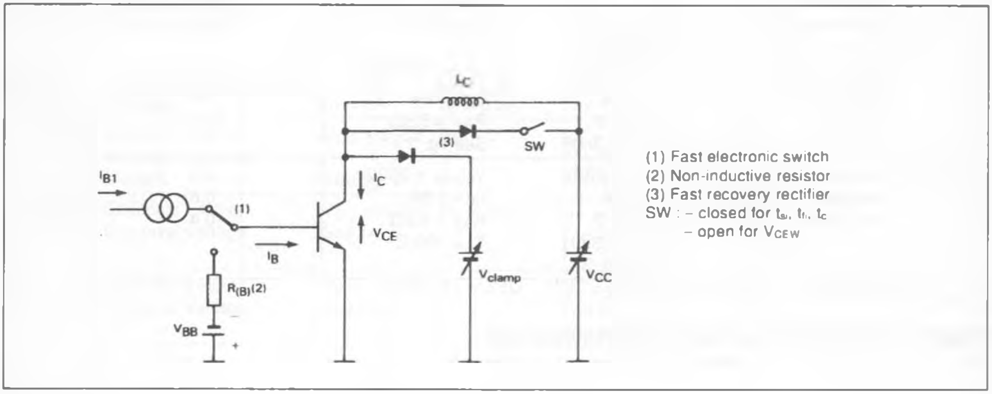
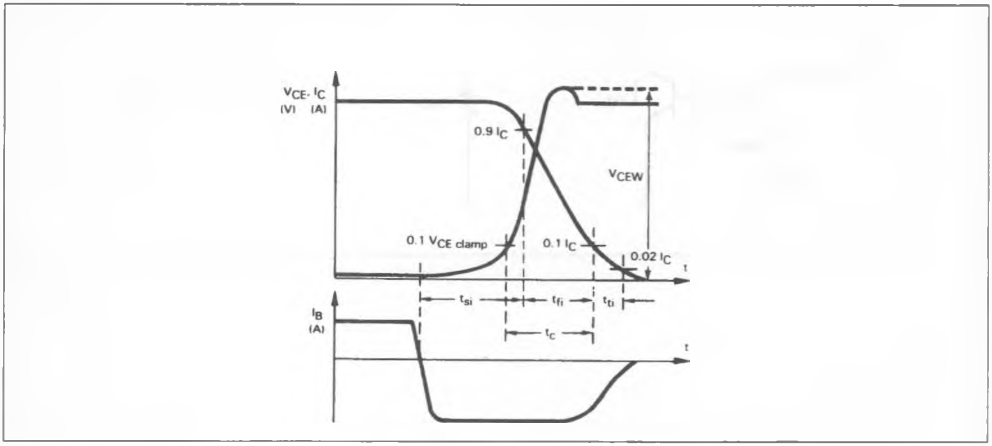
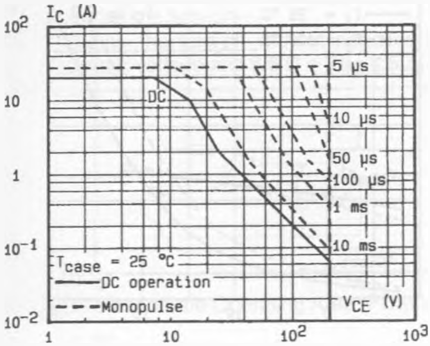


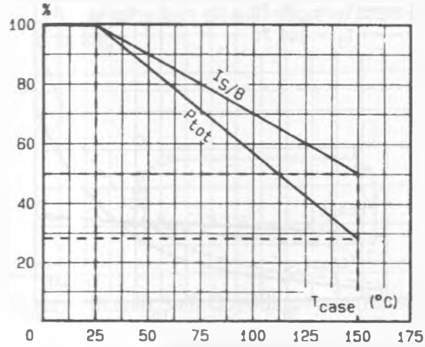
Figure 3b : Turn-off Switching Waveforms (inductive load).



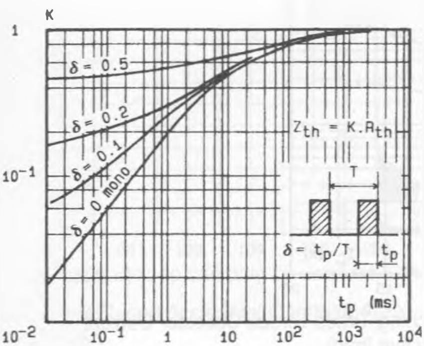
DC and AC Pulse Area.



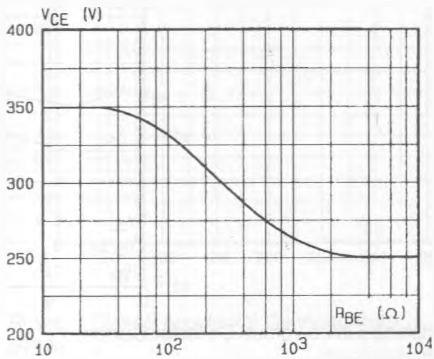
Power and $I_{S/B}$ Derating versus Case Temperature.



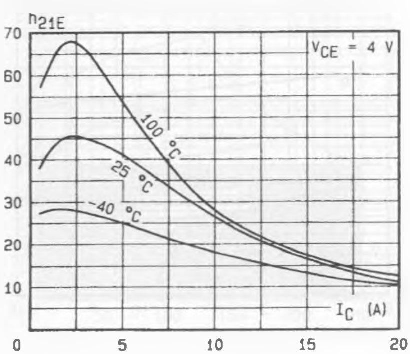
Transient Thermal Response.



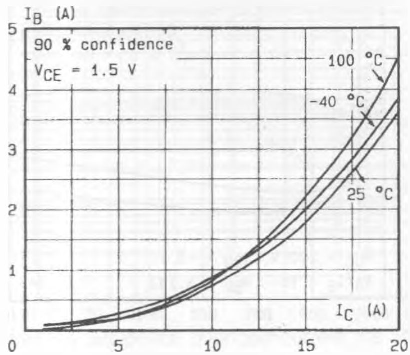
Collector-emitter Voltage versus Base-emitter Resistance.



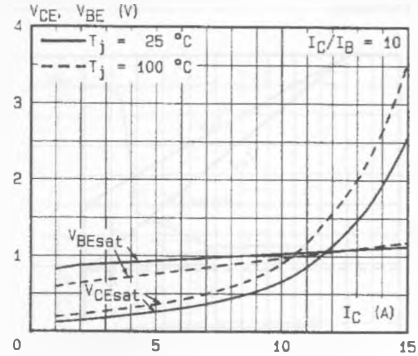
DC Current Gain.



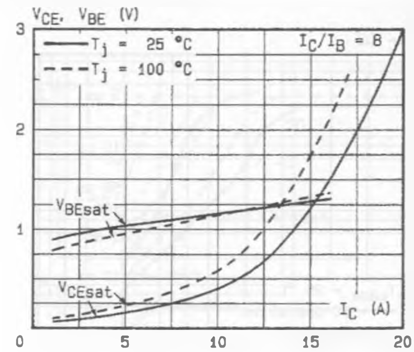
Minimum Base Current to Saturate the Transistor.



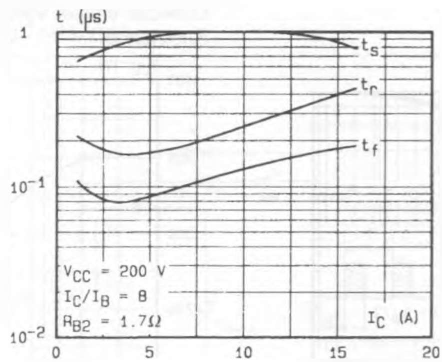
Saturation Voltage.



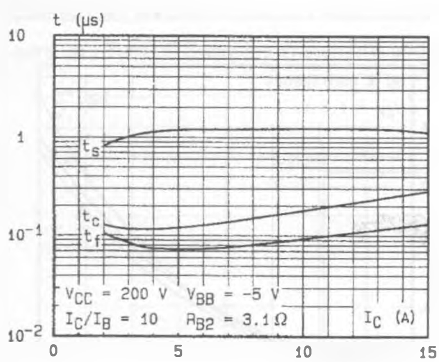
Saturation Voltage.



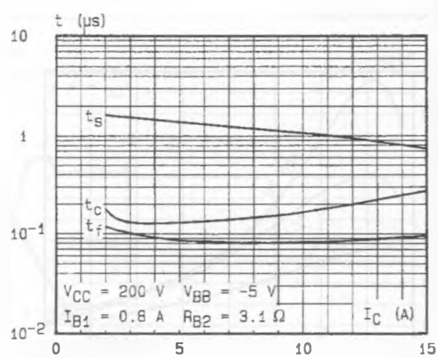
Switching Times versus Collector.



Switching Times versus Collector Current (inductive load).



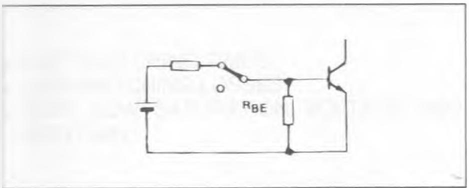
Switching Times versus Collector Current (inductive load).



SWITCHING OPERATING AND OVERLOAD AREAS

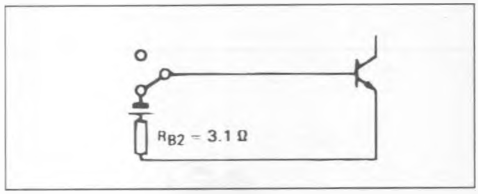
TRANSISTOR FORWARD BIASED

- During the turn-on
- During the turn-off without negative base-emitter voltage and 5.6 Ω ≤ R_{BE} ≤ 50 Ω.

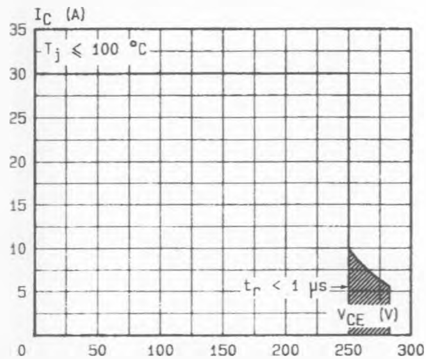


TRANSISTOR REVERSE BIASED

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

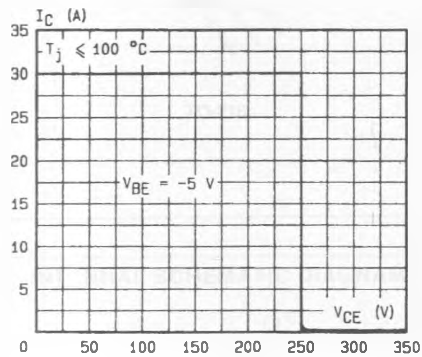


Forward Biased Safe Operating Area (FBSOA).

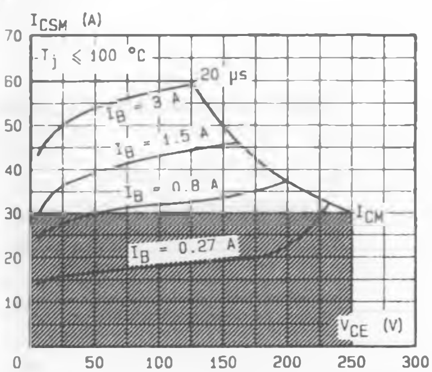


The hatched zone can only be used for turn-on.

Reverse Biased Safe Operating Area (RBSOA).

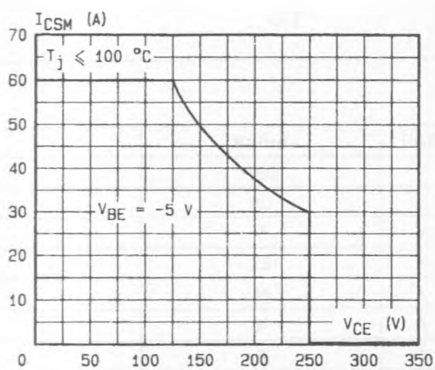


Forward Biased Accidental Overload Area (FBADA).



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.