NEC
ELECTRON DEVICE

SILICON POWER TRANSISTOR
NTC1871A

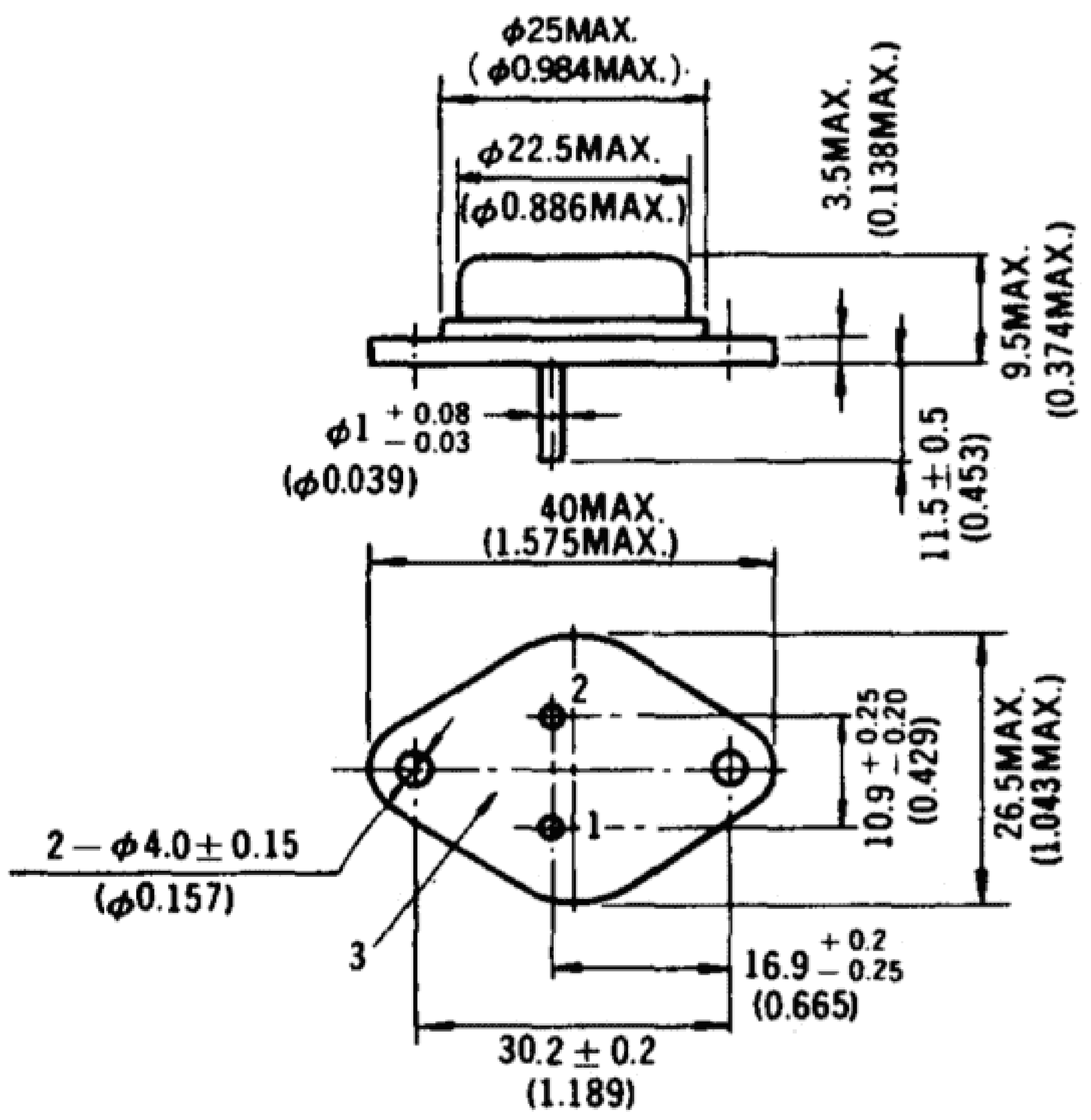
HIGH SPEED HIGH CURRENT SWITCHING
NPN SILICON TRIPLE DIFFUSED MESA TRANSISTOR

Industrial Use

DESCRIPTION

Suitable for switching regulator, DC-DC converter and ultrasonic appliance applications.

PACKAGE DIMENSIONS
in millimeters (inches)



1. Base
2. Emitter
3. Collector (Case)

EIAJ :TC-3,TB-3
JEDEC:TO-3
IEC :C14A,B18

FEATURES

- High speed switching.
- Low collector saturation voltage.
- Specified of reverse biased S.O.A. with inductive loads.

ABSOLUTE MAXIMUM RATINGS

Maximum Voltages and Currents (Ta = 25°C)			
Collector to Emitter Voltage	V_{CEX}	500	V
Collector to Emitter Sustaining Voltage	$V_{CEO(SUS)}$	400	V
Collector to Emitter Sustaining Voltage	$V_{CEX(SUS)}$	450	V
Emitter to Base Voltage	V_{EBO}	7.0	V
Continuous Collector Current	$I_{C(DC)}$	15	A
Peak Collector Current*	$I_{C(pulse)}$	30	A
Continuous Base Current	$I_{B(DC)}$	5.0	A
Peak Base Current*	$I_{B(pulse)}$	10	A
Maximum Power Dissipations			
Total Power Dissipation	$P_{T(Tc=25°C)}$	150	W
Total Power Dissipation	$P_{T(Tc=100°C)}$	86	W
Total Power Dissipation	$P_{T(Ta=25°C)}$	5	W
Maximum Temperatures			
Junction Temperature	T_j	200	°C
Storage Temperature	T_{stg}	-65 to +200	°C
Lead Temperature 1/8 inch from case for 10 seconds	T_L	260	°C
Thermal Resistances			
Junction to Case	$R_{th(j-c)}$	1.17	°C/W
Junction to Ambient	$R_{th(j-a)}$	35	°C/W

* Pulsed PW ≦ 300 μs, duty cycle ≦ 10%

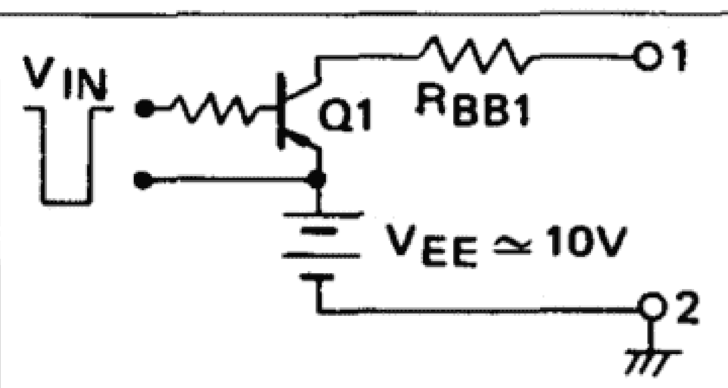
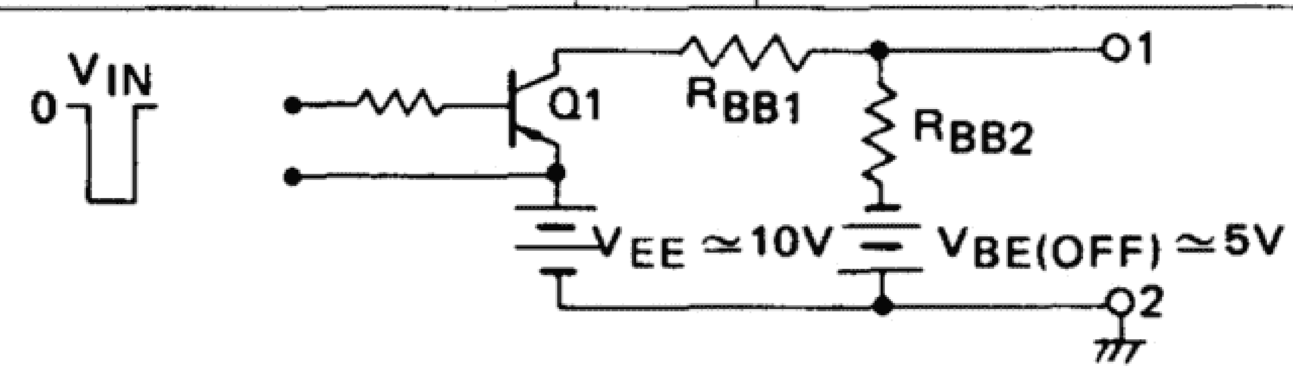
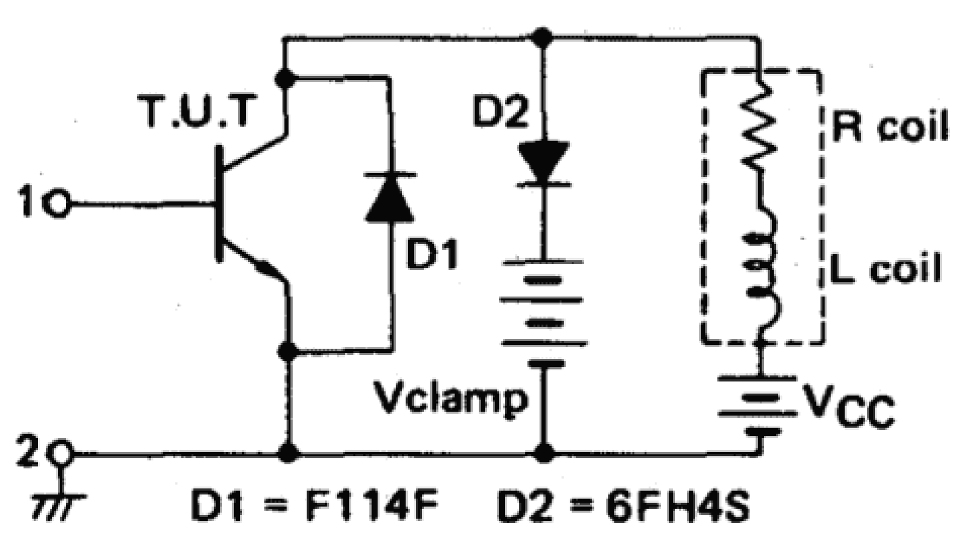
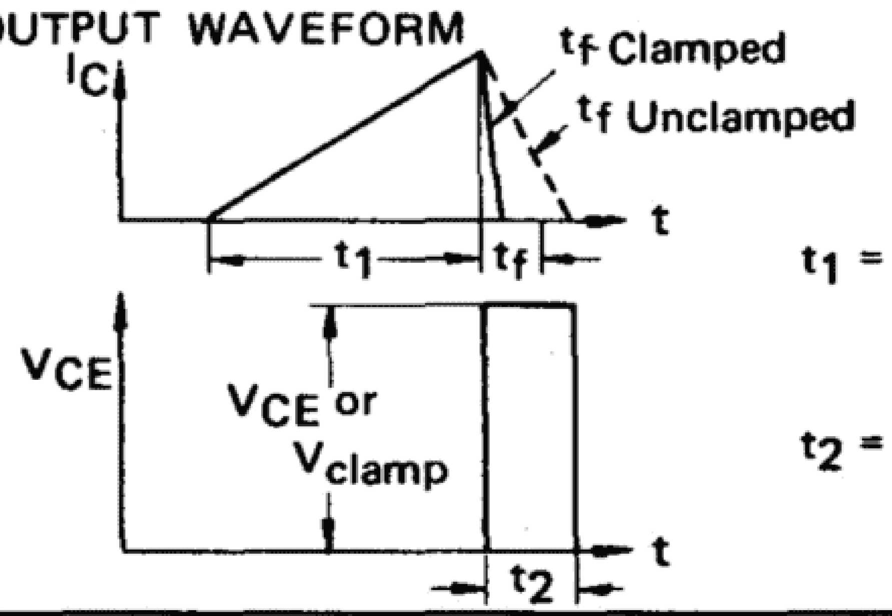
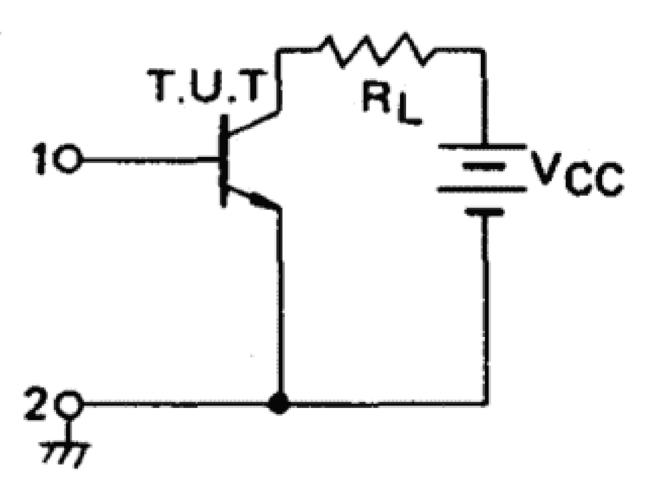
ELECTRICAL CHARACTERISTICS (Ta = 25°C unless otherwise noted)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Collector to Emitter Sustaining Voltage	$V_{CEO(SUS)}$	400			V	Table 1. I_C = 10A, I_{B1} = 2A, L = 50μH
	$V_{CEX(SUS)1}$	450			V	Table 1. I_C = 10A, I_{B1} = $-I_{B2}$ = 2A V_{clamp} = Rated V_{CEX}, Ta = 125°C
	$V_{CEX(SUS)2}$	400			V	Table 1. I_C = 20A, I_{B1} = 4A, I_{B2} = −2A V_{clamp} = Rated V_{CEX}, Ta = 125°C
Collector Cutoff Current	I_{CER}			2.0	mA	V_{CE} = 500V, R_{BE} = 50Ω, Ta = 125°C
	I_{CEX}			100	μA	V_{CE} = 500V, $V_{BE(OFF)}$ = −1.5V
	I_{CEX}			1.0	mA	V_{CE} = 500V, $V_{BE(OFF)}$ = −1.5V, Ta = 125°C
Emitter Cutoff Current	I_{EBO}			10	μA	V_{EB} = 7.0V, I_C = 0
Second Breakdown Collector Current	$I_{S/B}$	3.75			A	t = 1.0 s, V_{CE} = 40V, Tc = 25°C
Second Breakdown Energy	$E_{S/B}$	2.0			mJ	I_C = 10A, I_{B1} = 2.0A, $V_{BE(OFF)}$ = 5V
DC Current Gain	h_{FE1}	15		100		V_{CE} = 5V, I_C = 5A **
	h_{FE2}	10				V_{CE} = 5V, I_C = 10A **
Collector Saturation Voltage	$V_{CE(sat)}$			1.0	V	I_C = 10A, I_B = 2A **
	$V_{CE(sat)}$			1.5	V	I_C = 10A I_B = 2A, Ta = 125°C **
Base Saturation Voltage	$V_{BE(sat)}$			1.5	V	I_C = 10A, I_B = 2A **
	$V_{BE(sat)}$			1.5	V	I_C = 10A, I_B = 2A, Ta = 125°C **
Gain Bandwidth Product	f_T	10			MHz	V_{CE} = 10V, I_C = 500mA, f_o = 3.0 MHz, Tc = 25°C
Output Capacitance	C_{ob}			360	pF	V_{CB} = 10V, f_o = 1.0 MHz
Delay Time	t_d			0.1	μs	Resistive Load (Table 1.)
Rise Time	t_r			0.9	μs	
	t_r			2.7	μs	Ta = 125°C I_C = 10A, I_{B1} = $-I_{B2}$ = 2A
Storage Time	t_{stg}			2.0	μs	R_L = 15Ω, V_{CC} ≃ 150V
	t_{stg}			4.0	μs	Ta = 125°C PW ≃ 50μs, duty cycle ≦ 2%
Fall Time	t_f			0.7	μs	
	t_f			2.8	μs	Ta = 125°C

** PW ≦ 350 μs, duty cycle ≦ 2%

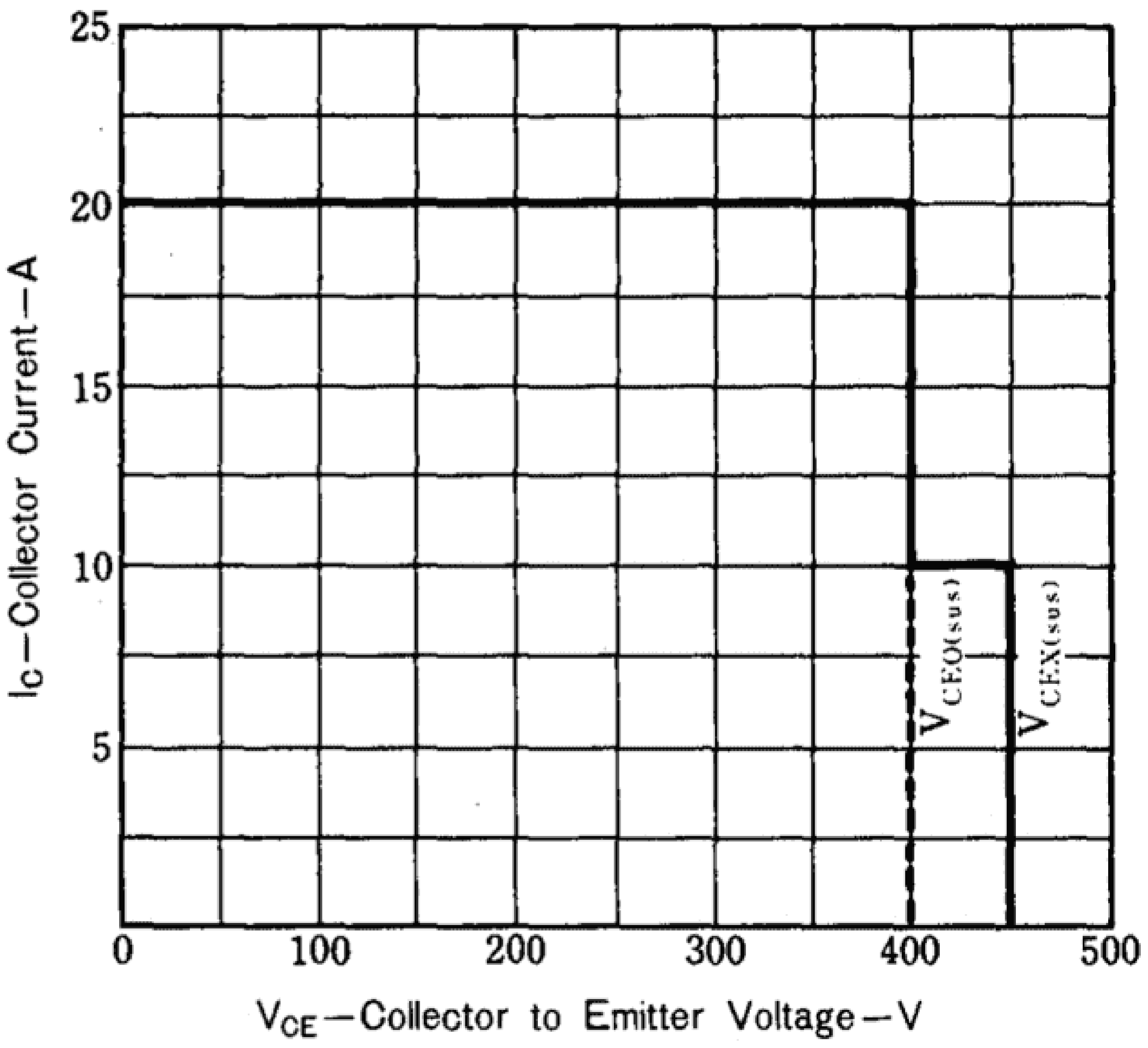
3

TABLE 1. – TEST CONDITIONS FOR DYNAMIC PERFORMANCE

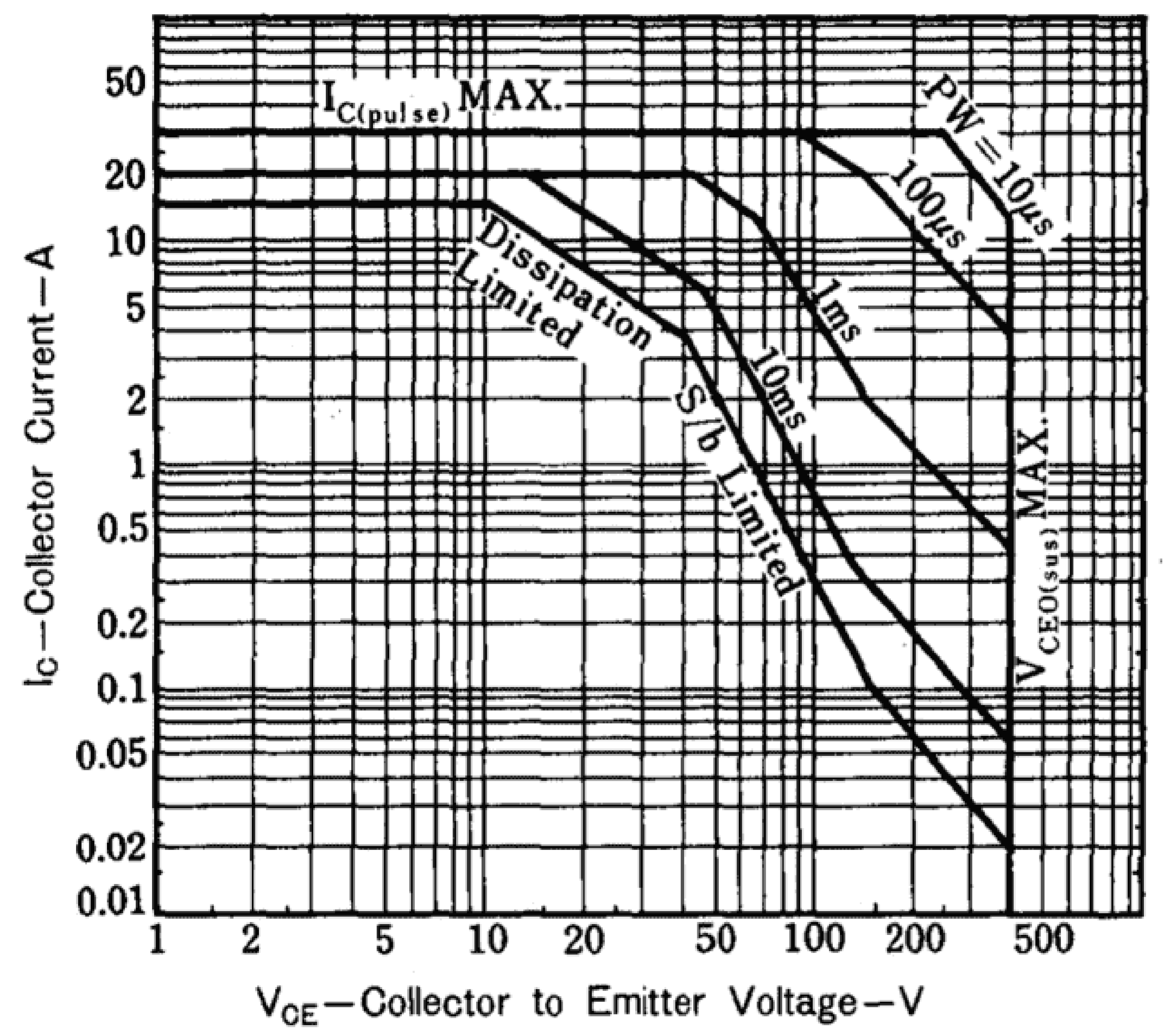
	V_{CEO} (SUS)	V_{CEX} (SUS)	$E_{S/B}$	RESISTIVE SWITCHING
INPUT CONDITIONS	 PW Varied to Attain I_C = 10A	 PW Varied to Attain I_C = 10A duty cycle ≦ 2% Q_1 = 2SA959		
CIRCUIT VALUES	L_{coil} = 50μH, V_{CC} = 10V R_{coil} = 0.05Ω V_{clamp} (Unclamped)	L_{coil} = 180 μH, V_{CC} = 20V R_{coil} = 0.05Ω V_{clamp} = Rated V_{CEX} Value	L_{coil} = 40 μH, V_{CC} = 10V R_{coil} = 0.05Ω, R_{BB2} = 50Ω V_{clamp} (Unclamped)	R_L = 15Ω, V_{CC} ≃ 150V
TEST CIRCUITS	INDUCTIVE TEST CIRCUIT  D1 = F114F D2 = 6FH4S	OUTPUT WAVEFORM 	t_1 Adjust to Obtain IC $t_1 = \frac{L_{coil}(I_{C\,pk})}{V_{CC}}$ $t_2 = \frac{L_{coil}(I_{C\,pk})}{V_{clamp}}$	RESISTIVE TEST CIRCUIT 

TYPICAL CHARACTERISTICS (Ta=25°C)

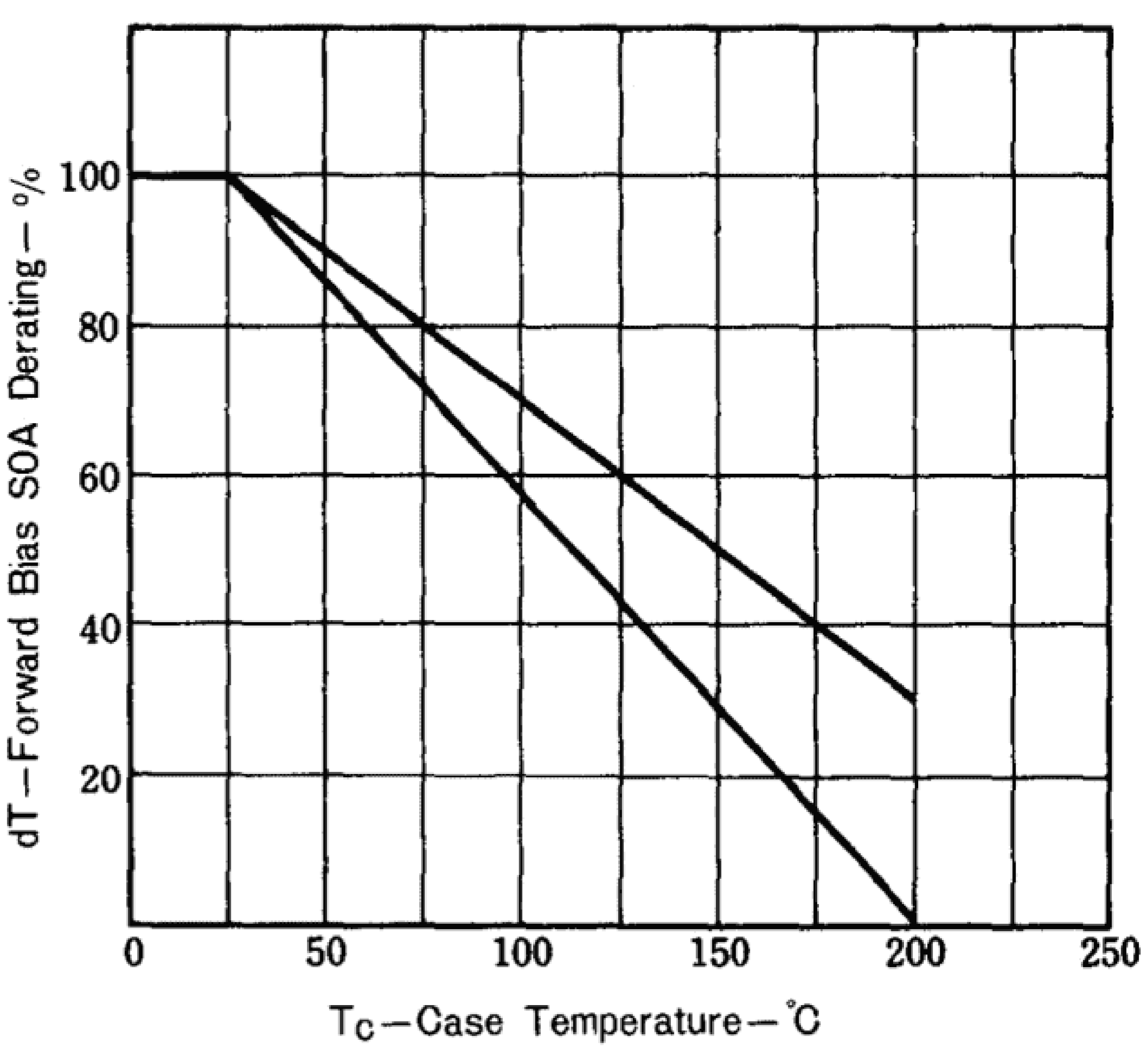
REVERSE BIAS SAFE OPERTING AREA



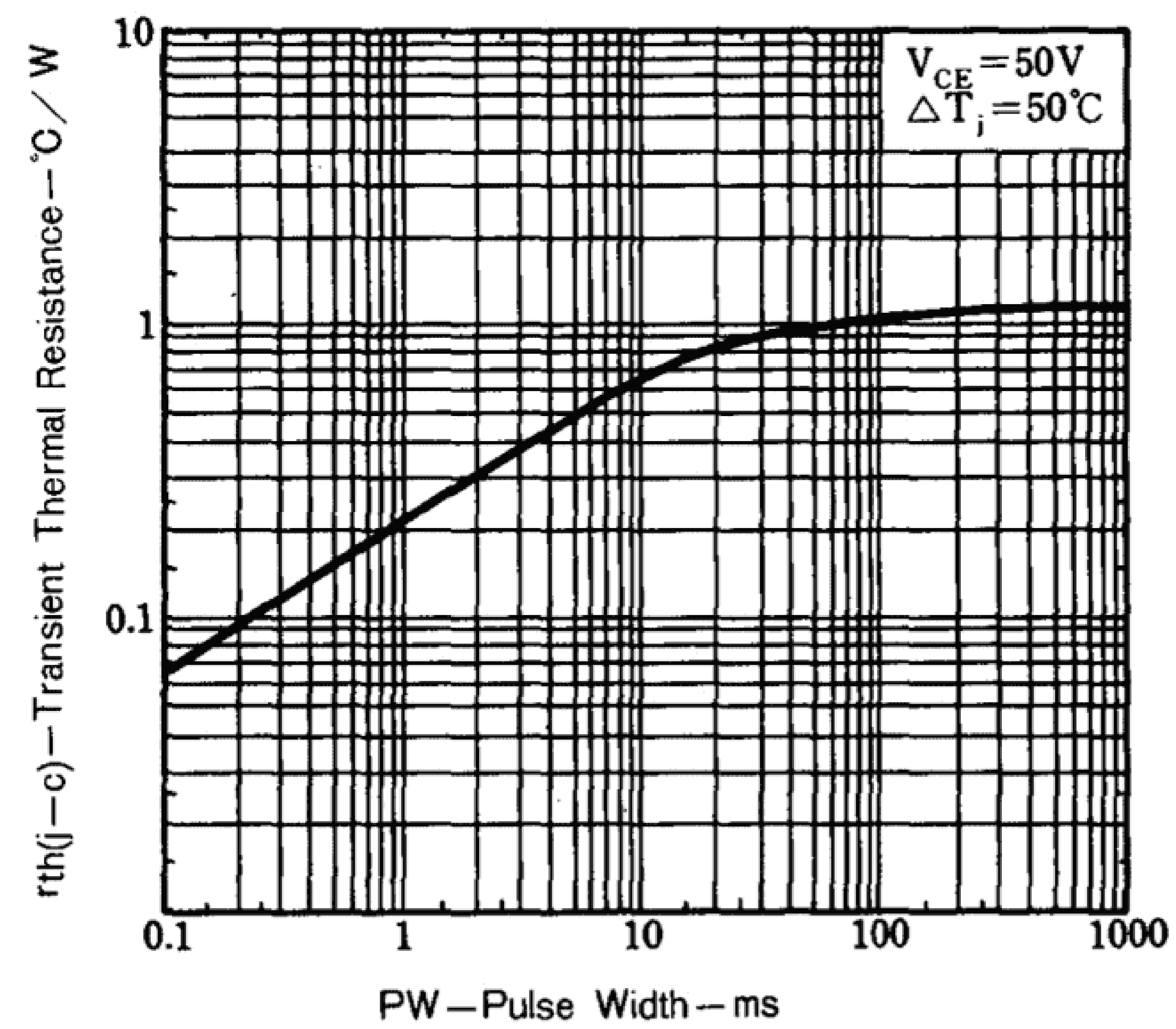
FORWARD BIAS SAFE OPERATING AREA



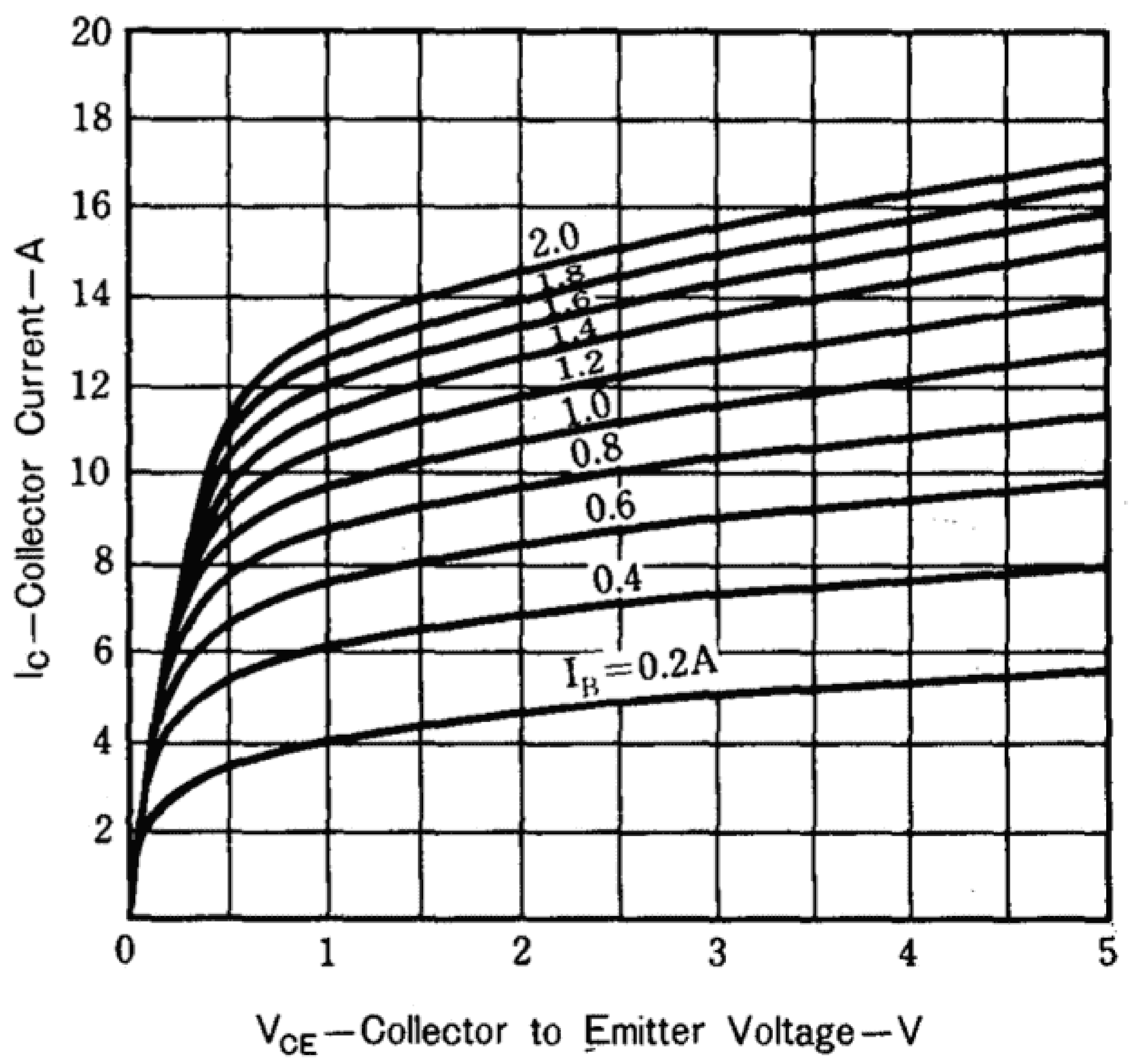
DERATING CURVE OF FORWARD BIAS SAFE OPERATING AREA



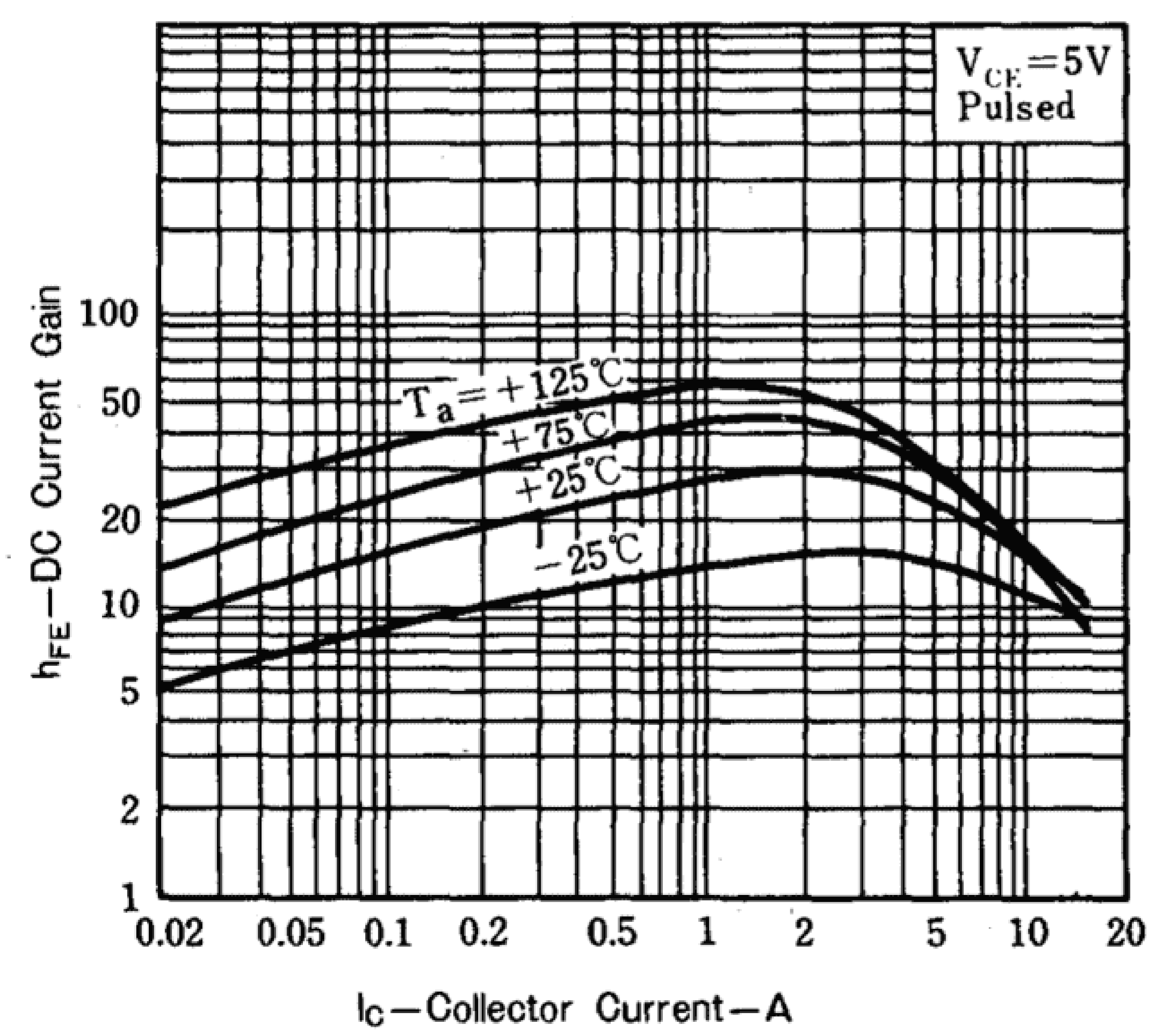
TRANSIENT THERMAL RESISTANCE



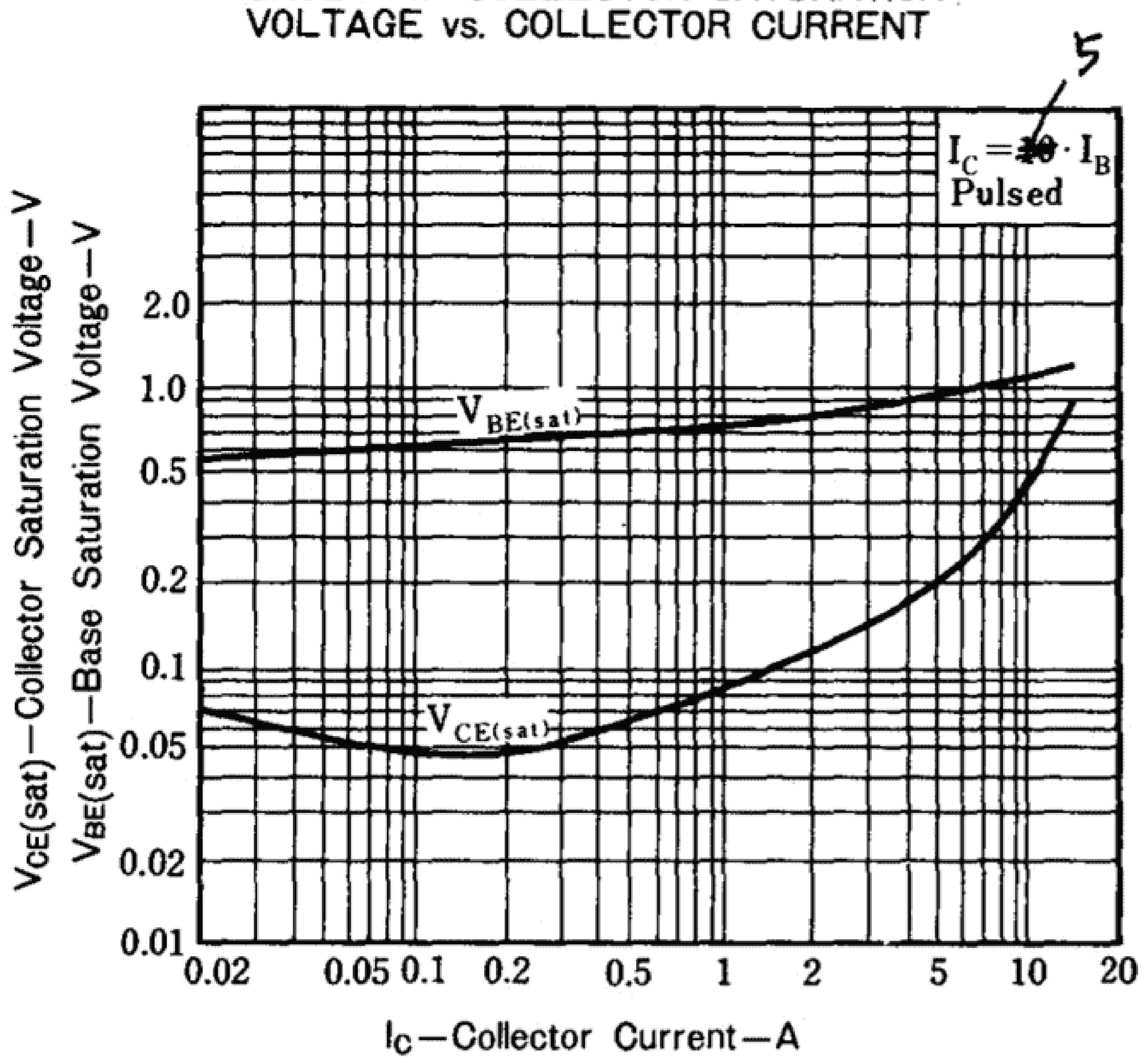
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



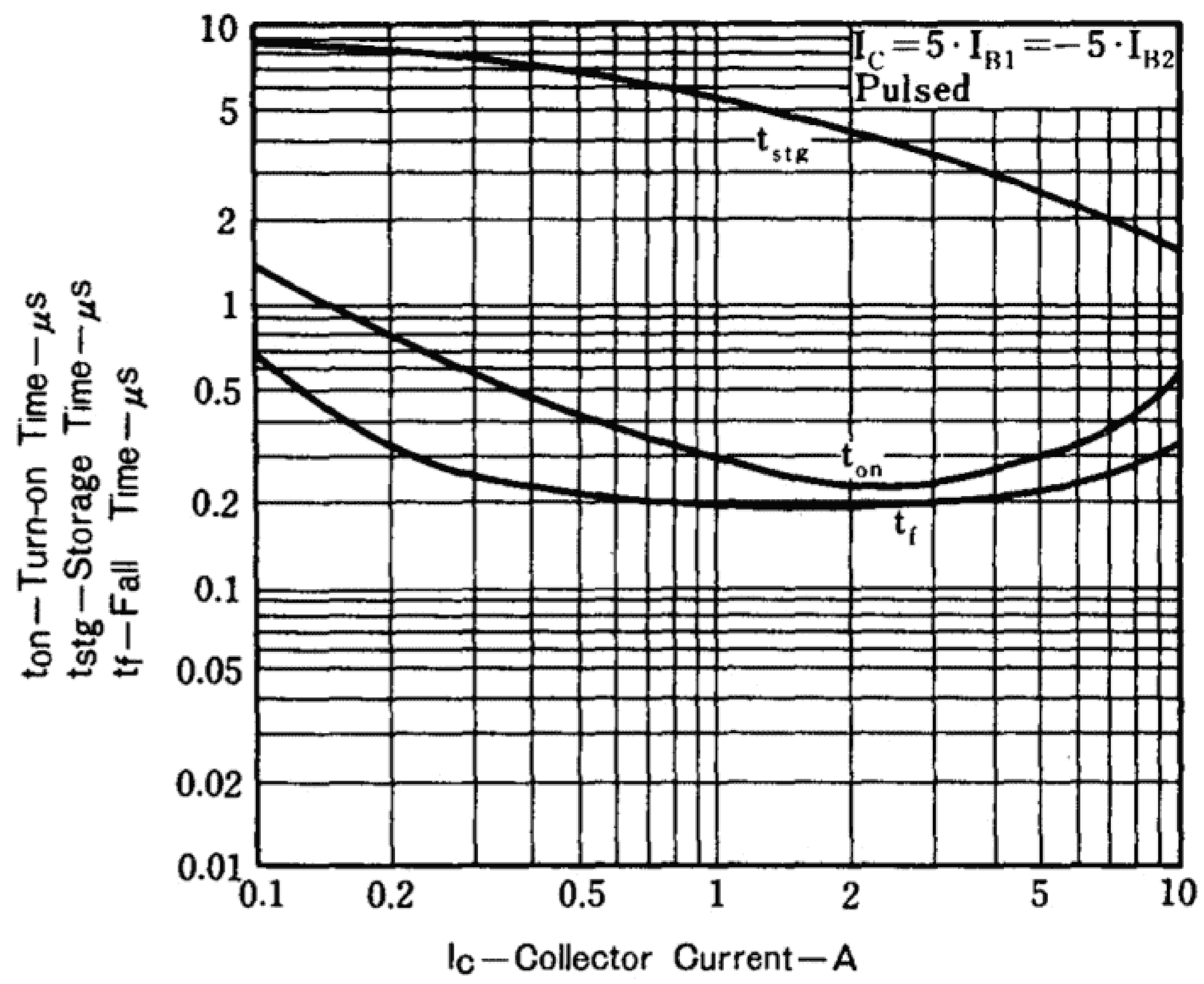
DC CURRENT GAIN vs. COLLECTOR CURRENT



BASE AND COLLECTOR SATURATION VOLTAGE vs. COLLECTOR CURRENT



TURN ON TIME, STORAGE TIME AND FALL TIME vs. COLLECTOR CURRENT



3