



# HIGH VOLTAGE/HIGH SPEED NPN POWER TRANSISTORS

## D44TD Series

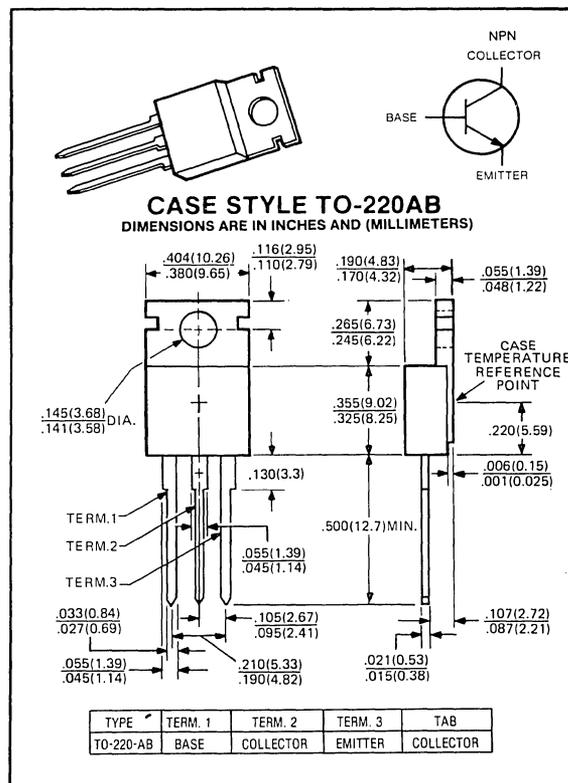
300-400 VOLTS  
2 AMP, 500 WATTS

The D44TD series of NPN Power Transistors is designed for use in switching applications requiring high-voltage capability, fast switching speeds and low-saturation voltages. They are particularly suited for off-line switching power supplies, solid-state lighting ballast, inverters, solenoid/relay drivers and deflection circuits.

### Features:

- Performance information tailored for switching applications
- 100°C maximum limits specified for:
  - Switching times
  - Saturation voltages
  - Leakage currents
- 300 to 400V V<sub>CEO(sus)</sub> in a TO-220AB Package
- Very fast turn-off, t<sub>f</sub> < 180 nsec (typ.) @ 1.5A

maximum ratings (T<sub>A</sub> = 25°C)  
(unless otherwise specified)



RATING	SYMBOL	D44TD3	D44TD4	D44TD5	UNITS
Collector-Emitter Voltage	V <sub>CEO</sub>	300	350	400	Volts
Collector-Emitter Voltage	V <sub>CEX</sub>	300	350	400	Volts
Collector-Emitter Voltage	V <sub>CEV</sub>	400	500	600	Volts
Emitter Base Voltage	V <sub>EBO</sub>	7	7	7	Volts
Collector Current — Continuous	I <sub>C</sub>	2	2	2	A
Peak <sup>(1)</sup>	I <sub>CM</sub>	4	4	4	
Base Current — Continuous	I <sub>B</sub>	.5	.5	.5	A
Peak <sup>(1)</sup>	I <sub>BM</sub>	1	1	1	
Total Power Dissipation @ T <sub>c</sub> = 25°C	P <sub>D</sub>	50	50	50	Watts
Derate above 25°C @ T <sub>c</sub> = 100°C		20	20	20	
		.4	.4	.4	W/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	-55 to +150	-55 to +150	°C

### thermal characteristics

Thermal Resistance, Junction to Case	R <sub>θJC</sub>	2.5	2.5	2.5	°C/W
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	75	75	75	°C/W
Maximum Lead Temperature for Soldering Purpose: 1/8" from Case for 5 Seconds	T <sub>L</sub>	260	260	260	°C

(1) Pulse condition, t<sub>p</sub> ≤ 5msec.

electrical characteristics ( $T_C = 25^\circ\text{C}$ ) (unless otherwise specified)

CHARACTERISTIC		SYMBOL	MIN	MAX	UNIT
Collector-Emitter Sustaining Voltage ( $I_C = 25\text{mA}$ , $I_B = 0$ )	D44TD3 D44TD4 D44TD5	$V_{CEO(sus)}$	300 350 400	— — —	Volts
Collector-Emitter Voltage ( $I_C = 2.0\text{mA}$ , $I_{B1} = I_{B2} = .4\text{A}$ ) ( $V_{BE} = -5\text{V}$ , $L = 200\ \mu\text{h}$ )	D44TD3 D44TD4 D44TD5	$V_{CEX}$	300 350 400	— — —	Volts
Collector Cutoff Current ( $V_{CEV} = \text{Rated Value}$ , $V_{BE(OFF)} = -1.5\text{V}$ ) ( $V_{CEV} = \text{Rated Value}$ , $V_{BE(OFF)} = -1.5\text{V}$ , $T_C = 100^\circ\text{C}$ )		$I_{CEV}$	— —	0.1 1.0	mA
Emitter Cutoff Current ( $V_{EB} = 7\text{V}$ , $I_C = 0$ )		$I_{EBO}$	—	1.0	mA

second breakdown

Second Breakdown with Base Forward Biased	FBSOA	SEE FIGURE 13
Clamped Inductive SOA with Base Reversed Bias	RBSOA	SEE FIGURE 14

on characteristics<sup>(1)</sup>

DC Current Gain ( $I_C = 1\text{A}$ , $V_{CE} = 2\text{V}$ ) ( $I_C = 2\text{A}$ , $V_{CE} = 3\text{V}$ )	$h_{FE}$	8 5	— —	—
Collector-Emitter Saturation Voltage ( $I_C = 1\text{A}$ , $I_B = .2\text{A}$ ) ( $I_C = 2\text{A}$ , $I_B = .4\text{A}$ ) ( $I_C = 1\text{A}$ , $I_B = .2\text{A}$ , $T_C = 100^\circ\text{C}$ )	$V_{CE(SAT)}$	— — —	0.6 1.0 1.0	Volts
Base-Emitter Saturation Voltage ( $I_C = 2\text{A}$ , $I_B = .4\text{A}$ ) ( $I_C = 2\text{A}$ , $I_B = .4\text{A}$ , $T_C = 100^\circ\text{C}$ )	$V_{BE(SAT)}$	— —	1.2 1.2	Volts

dynamic characteristics

Current Gain — Bandwidth Product ( $I_C = .25\text{A}$ , $V_{CE} = 10\text{V}$ , $f_{test} = 1.0\text{ MHz}$ )	$f_T$	15	50	MHz
Output Capacitance ( $V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	$C_{OB}$	10	25	pF

switching characteristics

		MAXIMUM			
Resistive Load (See Figure 17 for Test Circuit)		$T_C$	$25^\circ\text{C}$	$100^\circ\text{C}$	
Delay Time	$V_{CC} = 250\text{V}$ , $I_C = 1.5\text{A}$ $I_{B1} = I_{B2} = 0.3\text{A}$ , $t_p = 25\ \mu\text{sec}$	$t_d$	.06	.08	$\mu\text{s}$
Rise Time		$t_r$	0.6	0.8	$\mu\text{sec}$
Storage Time		$t_s$	2.5	3.0	$\mu\text{sec}$
Fall Time		$t_f$	0.5	0.8	$\mu\text{sec}$
Inductive Load, Clamped (See Figure 17 for Test Circuit)					
Storage Time	$V_{CLAMP} = 250\text{V}$ , $I_C = 1.5\text{A}$ , $I_{B1} = I_{B2} = 0.3\text{A}$ , $t_p = 25\ \mu\text{sec}$ $V_{BE(OFF)} = -5\text{V}$	$t_{sv}$	3.0	3.5	$\mu\text{s}$
Fall Time		$t_f$	0.3	0.6	$\mu\text{sec}$
		TYPICAL			
Storage Time	$L = 200\ \mu\text{h}$	$t_s$	2.1	2.6	$\mu\text{sec}$
Fall Time		$t_f$	0.18	0.23	$\mu\text{sec}$

(1) Pulse Duration =  $300\ \mu\text{s}$ , Duty Factor  $\leq 2\%$ . Do not measure on a curve tracer.

## TYPICAL DC CHARACTERISTICS

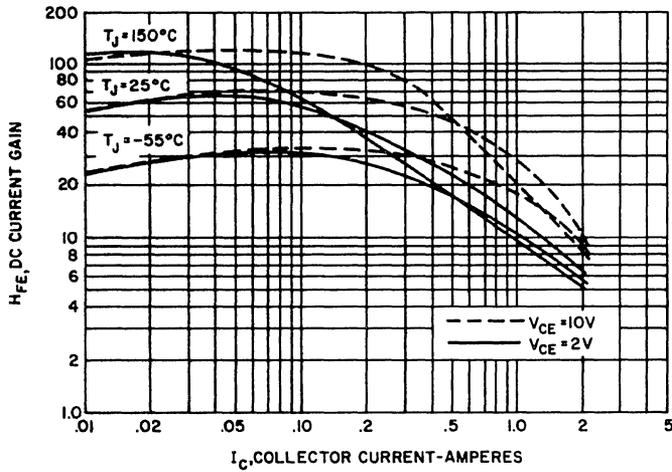


FIGURE 1. DC CURRENT GAIN

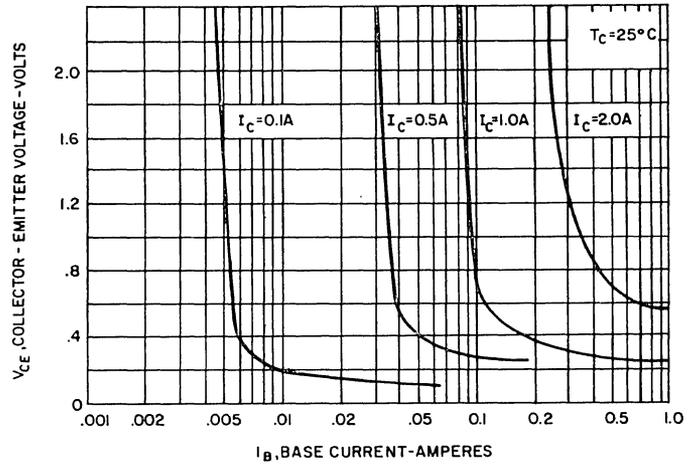


FIGURE 2. COLLECTOR SATURATION REGION

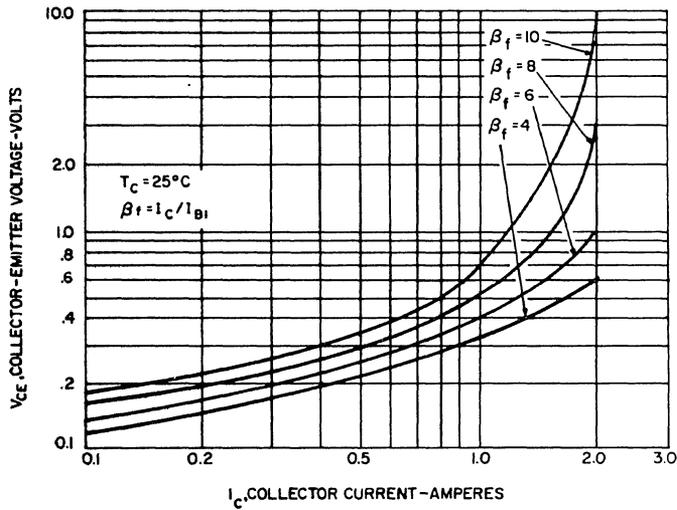


FIGURE 3.  $V_{CE(SAT)}$  VS.  $I_C$ ,  $T_C = 25^\circ\text{C}$

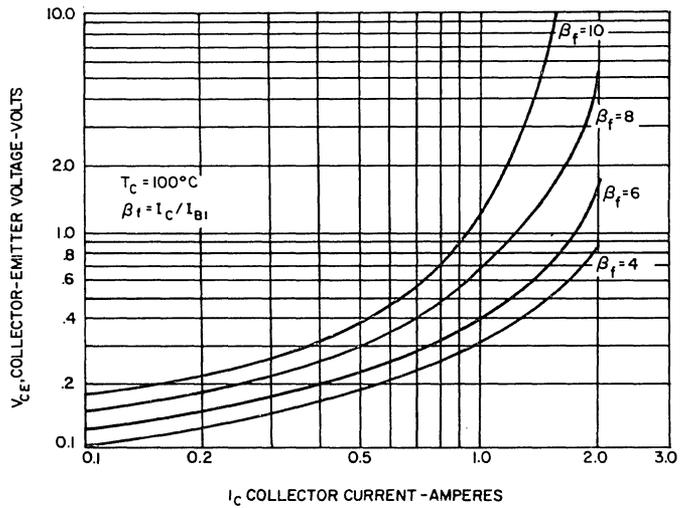


FIGURE 4.  $V_{CE(SAT)}$  VS.  $I_C$ ,  $T_C = 100^\circ\text{C}$

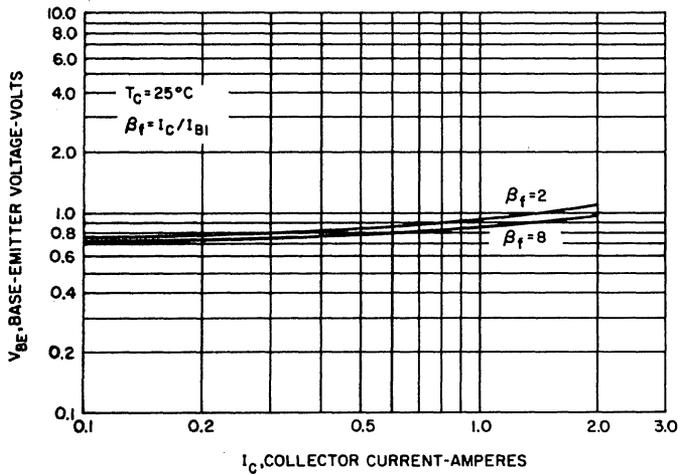


FIGURE 5.  $V_{BE(SAT)}$  VS.  $I_C$

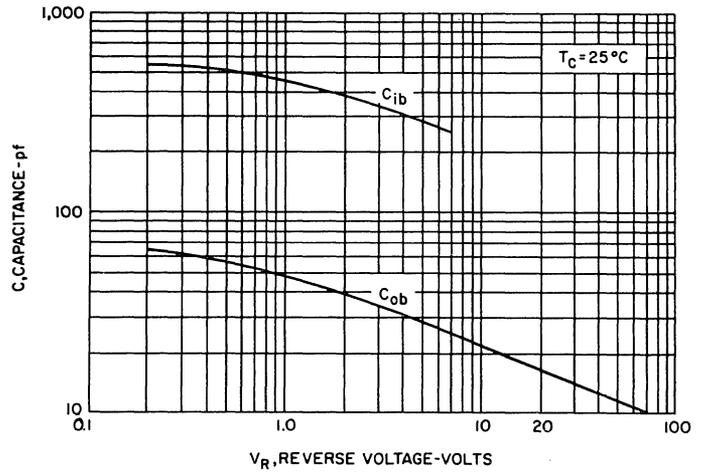
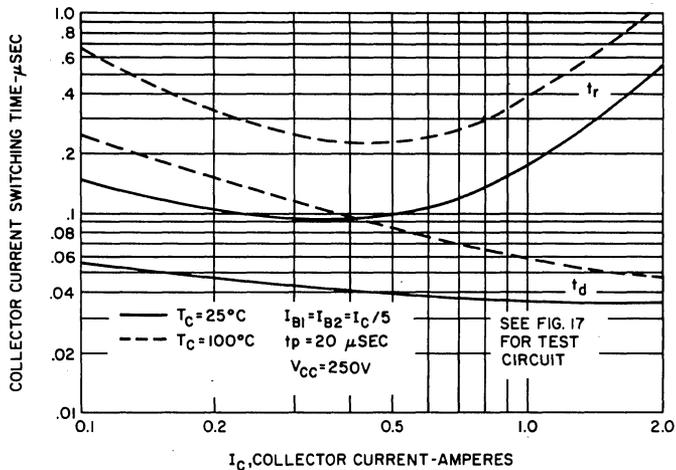
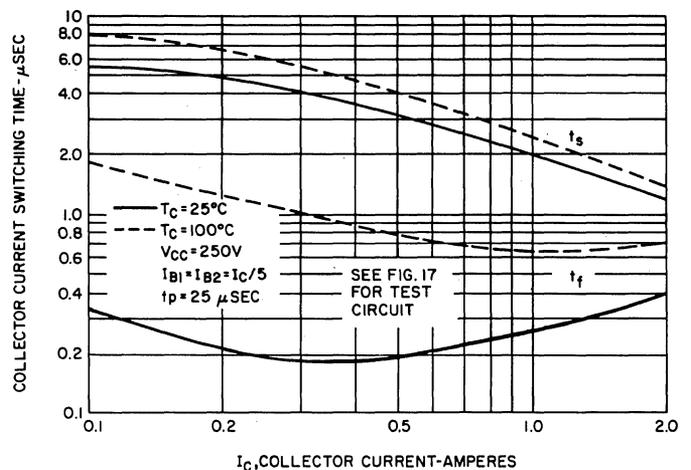


FIGURE 6. CAPACITANCE

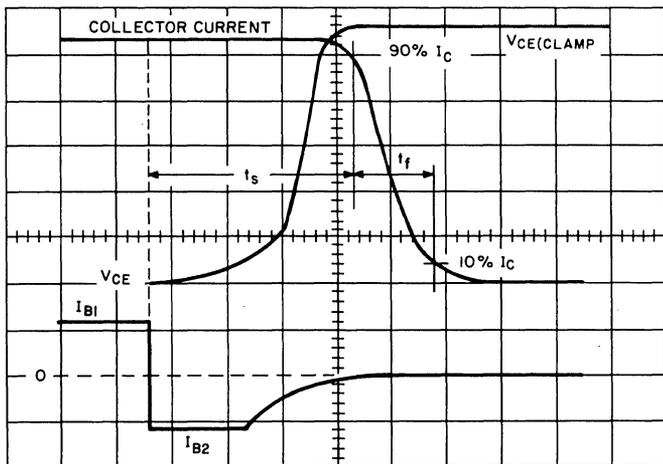
## TYPICAL SWITCHING CHARACTERISTICS



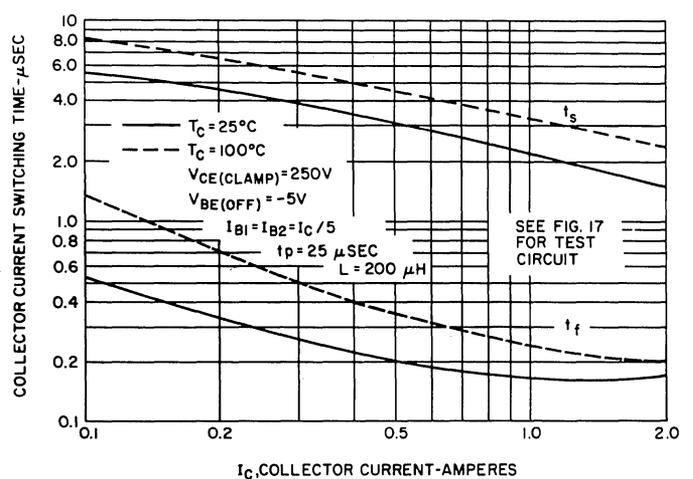
**FIGURE 7. TURN-ON TIME RESISTIVE LOAD**



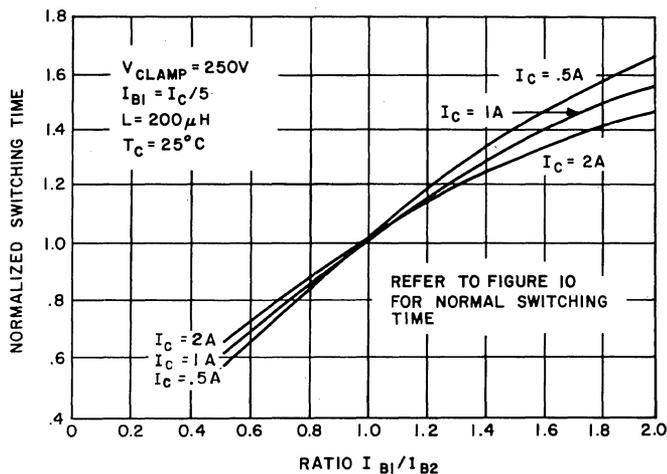
**FIGURE 8. TURN-OFF TIME RESISTIVE LOAD**



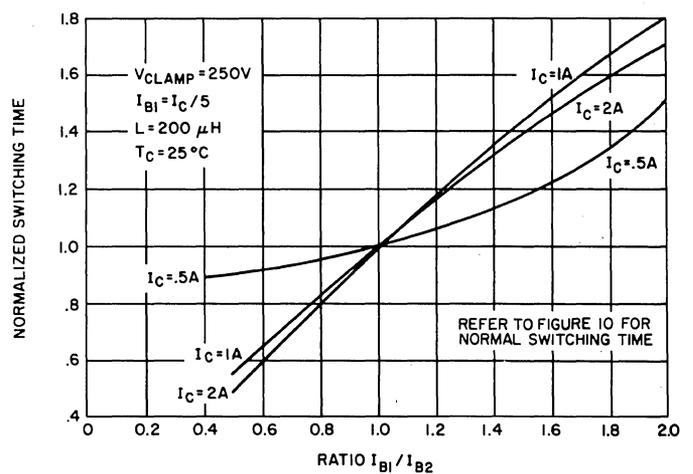
**FIGURE 9. INDUCTIVE TURN-OFF WAVEFORMS**



**FIGURE 10. CLAMPED INDUCTIVE TURN-OFF TIME**



**FIGURE 11. STORAGE TIME VARIATION WITH  $I_{B2}$**



**FIGURE 12. FALL TIME VARIATION WITH  $I_{B2}$**

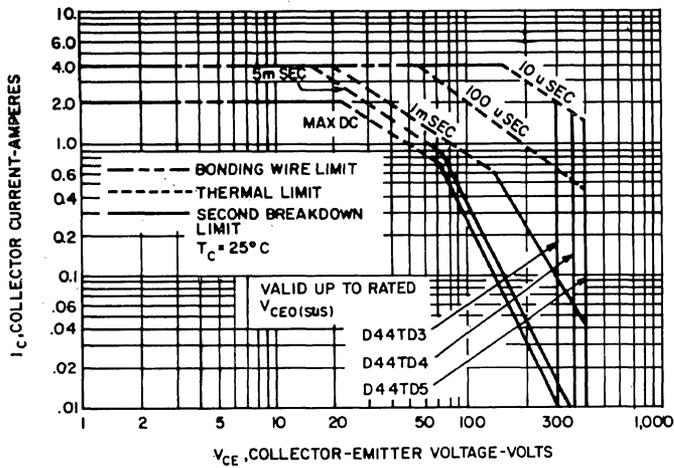


FIGURE 13. FORWARD BIAS SAFE OPERATING AREA

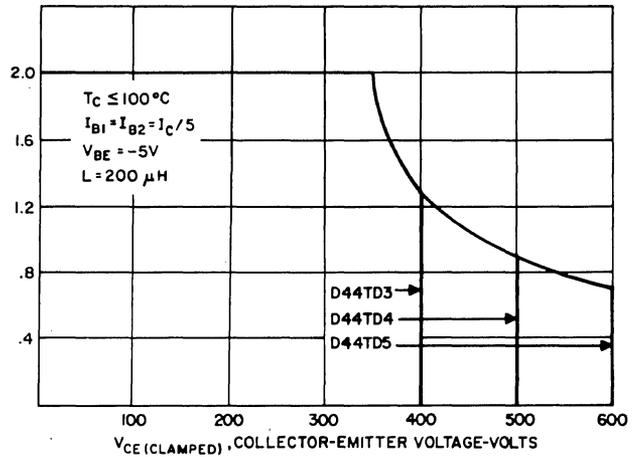


FIGURE 14. CLAMPED REVERSE BIAS SAFE OPERATING AREA

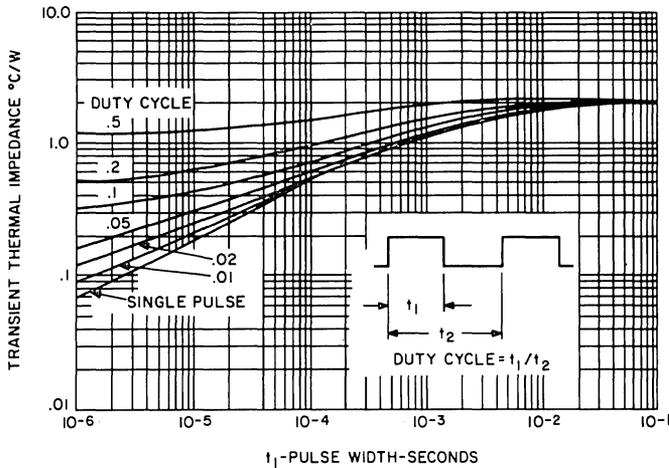


FIGURE 15. TRANSIENT THERMAL RESPONSE

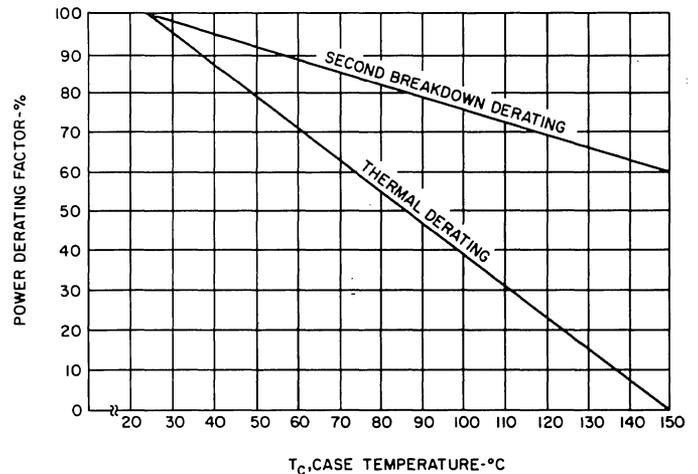


FIGURE 16. POWER DERATING CURVE

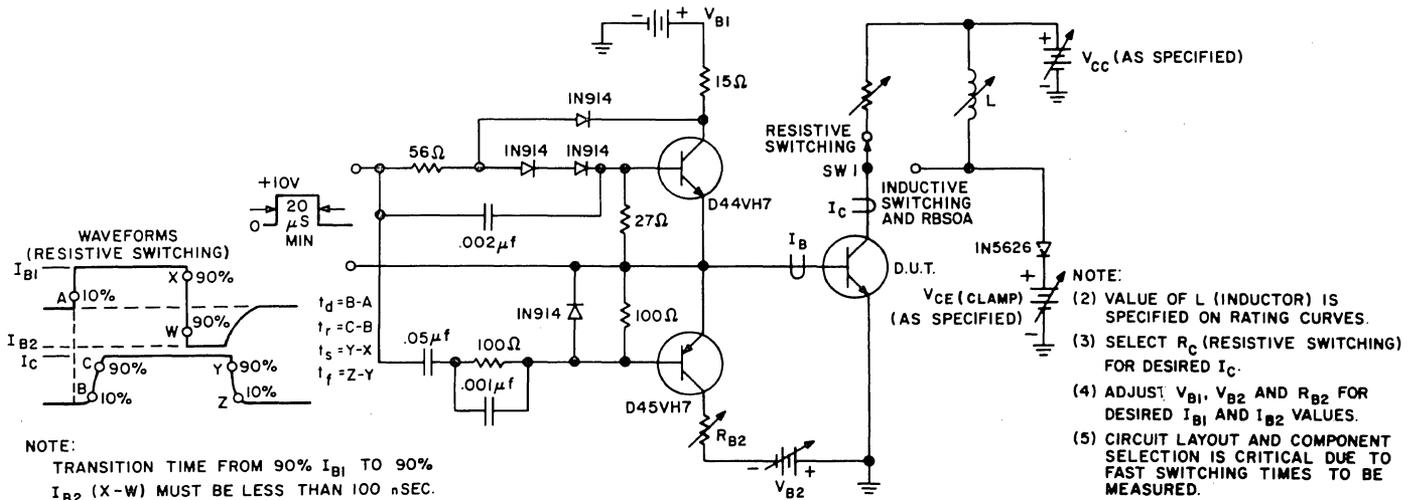


FIGURE 17. TEST CIRCUIT FOR SWITCHING TIMES AND RBSOA