# VERY HIGH SPEED
# PNP POWER TRANSISTORS
## COMPLEMENTARY TO THE D44VH SERIES

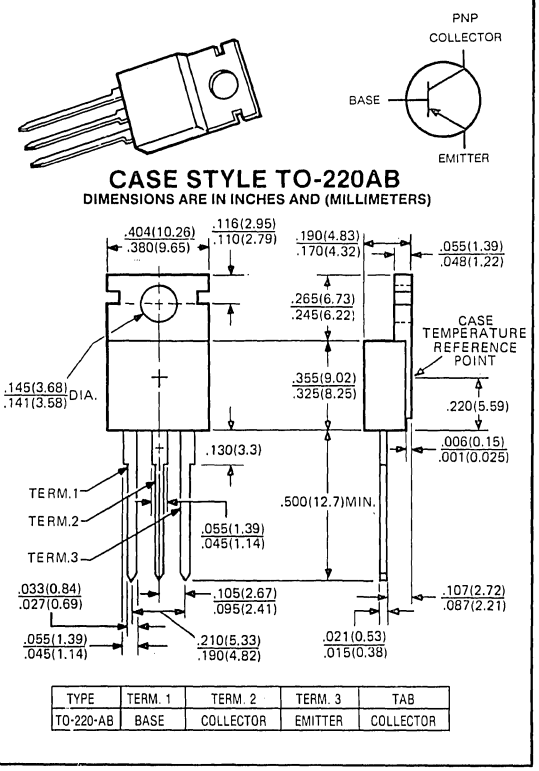
**D45VH Series**

**-30 - -80 VOLTS**
**-15 AMP, 83 WATTS**

The D45VH is a PNP power transistor especially designed for use in switching circuits such as switching regulators, high-frequency inverters/converters and other applications where very fast switching and low-saturation voltages are necessary. This device complements the D44VH NPN power transistor and is characterized with performance information which relates directly to switching.

**Features:**

- Fast Switching $t_s \leqslant 500$ ns resistive
  $t_f \leqslant 100$ ns
- Low $V_{CE(sat)} \leqslant 1.0V$ @ $I_C = 8A$




| TYPE | TERM. 1 | TERM. 2 | TERM. 3 | TAB |
|---|---|---|---|---|
| TO-220-AB | BASE | COLLECTOR | EMITTER | COLLECTOR |

## maximum ratings ($T_A = 25°C$) (unless otherwise specified)

| RATING | SYMBOL | D45VH1 | D45VH4 | D45VH7 | D45VH10 | UNITS |
|---|---|---|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO(sus)}$ | -30 | -45 | -60 | -80 | Volts |
| Collector-Emitter Voltage | $V_{CEX}$ | -40 | -55 | -70 | -90 | Volts |
| Collector-Emitter Voltage | $V_{CEV}$ | -50 | -70 | -80 | -100 | Volts |
| Emitter Base Voltage | $V_{EBO}$ | -7 | -7 | -7 | -7 | Volts |
| Collector Current — Continuous<br>Peak(1) | $I_C$<br>$I_{CM}$ | -15<br>-20 | -15<br>-20 | -15<br>-20 | -15<br>-20 | A |
| Base Current — Continuous<br>Peak(1) | $I_B$<br>$I_{BM}$ | -5<br>-10 | -5<br>-10 | -5<br>-10 | -5<br>-10 | A |
| Total Power Dissipation @ Tc = 25°C<br>@ Tc = 100°C<br>Derate above 25°C | $P_D$ | 83<br>33<br>.67 | 83<br>33<br>.67 | 83<br>33<br>.67 | 83<br>33<br>.67 | Watts<br><br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | -55 to +150 | -55 to +150 | -55 to +150 | °C |

## thermal characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.5 | 1.5 | 1.5 | 1.5 | °C/W |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 75 | 75 | 75 | 75 | °C/W |
| Maximum Lead Temperature for Soldering Purpose: ⅛" from Case for 5 Seconds | $T_L$ | 235 | 235 | 235 | 235 | °C |

(1) Pulse measurement condition PW ≤ 6.0 ms, see Figure 14.

## electrical characteristics ($T_C$ = 25° C) (unless otherwise specified)

| CHARACTERISTICS | SYMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|
| **off characteristics**[1] | | | | |
| Collector-Emitter Sustaining Voltage[1] ($I_C$ = 100mA, $I_B$ = 0) | $V_{CEO(sus)}$ | | | V |
| D45VH1 | | -30 | — | |
| D45VH4 | | -45 | — | |
| D45VH7 | | -60 | — | |
| D45VH10 | | -80 | — | |
| Collector-Emitter Voltage[2] ($I_C$ = 10A, $V_{CLAMP}$ = Rated $V_{CEX}$, $T_C$ = 100° C) | $V_{CEX}$ | | | V |
| D45VH1 | | -40 | — | |
| D45VH4 | | -55 | — | |
| D45VH7 | | -70 | — | |
| D45VH10 | | -90 | — | |
| Collector Cutoff Current | $I_{CEV}$ | | | μA |
| ($V_{CEV}$ = Rated Value, $V_{BE(off)}$ = 4.0V) | | — | -10 | |
| ($V_{CEV}$ = Rated Value, $V_{BE(off)}$ = 4.0V, $T_C$ = 100° C) | | — | -100 | |
| Collector Cutoff Current ($V_{CE}$ = Rated $V_{CEV}$, $R_{BE}$ = 50 Ω, $T_C$ = 100° C) | $I_{CER}$ | — | -100 | μA |
| Emitter Cutoff Current ($V_{EB}$ = -7V, $I_C$ = 0) | $I_{EBO}$ | — | -10 | μA |
| **second breakdown** | | | | |
| Second Breakdown with Base Forward Biased | $F_{BSOA}$ | SEE FIGURE 7 | | |
| Second Breakdown with Base Reverse Biased | $R_{BSOA}$ | SEE FIGURE 8 | | |
| **on characteristics**[1] | | | | |
| DC Current Gain | $h_{FE}$ | | | — |
| ($I_C$ = -2 A, $V_{CE}$ = -1V) | | 35 | — | |
| ($I_C$ = -4 A, $V_{CE}$ = -1V) | | 20 | — | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | | | V |
| ($I_C$ = -8A, $I_B$ = -0.8A) | | — | -1.0 | |
| ($I_C$ = -8A, $I_B$ = -0.8A, $T_C$ = 100° C) | | — | -1.1 | |
| ($I_C$ = -15A, $I_B$ = -3.0A, $T_C$ = 100° C) | | — | -1.5 | |
| Base-Emitter Saturation Voltage | $V_{BE(sat)}$ | | | V |
| ($I_C$ = -8A, $I_B$ = -0.8A) | | — | -1.4 | |
| ($I_C$ = -8A, $I_B$ = -0.8A, $T_C$ = 100° C) | | — | -1.4 | |

## dynamic characteristics

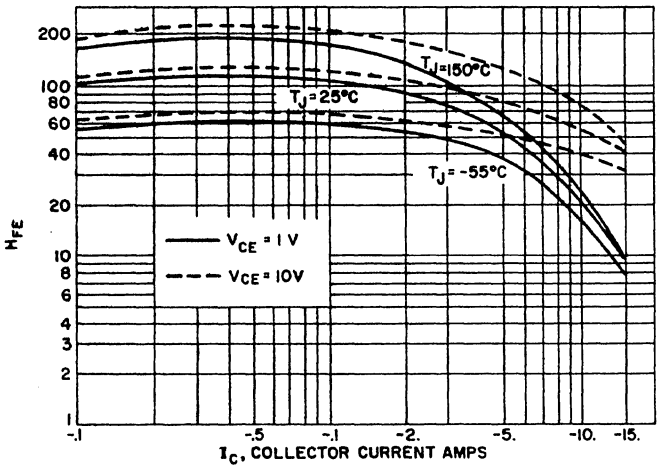
| | | Typical | |
|---|---|---|---|
| Current-Gain — Bandwidth Product ($I_C$ = -0.1A, $V_{CE}$ = -10V, $f_{test}$ = 1 MHz) | $f_T$ | 50 | MHz |
| Output Capacitance ($V_{CB}$ = -10V, $I_E$ = 0, $f_{test}$ = 1 MHz) | $C_{OB}$ | 275 | pF |

## switching characteristics

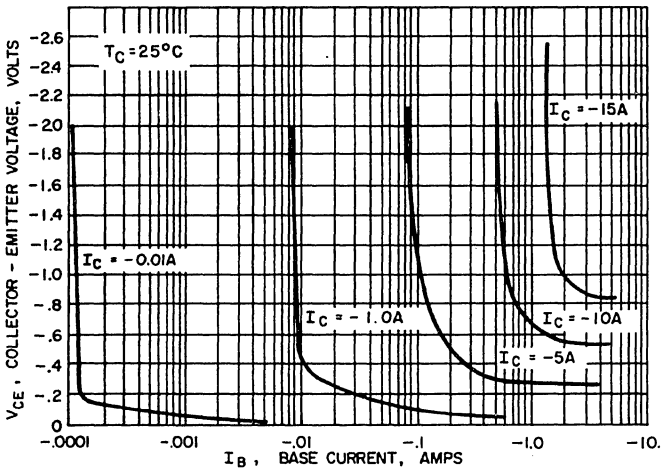
| | | | Maximum | | |
|---|---|---|---|---|---|
| Resistive Load (See Figure 16 for Test Circuit) | | $T_C$ | 25° C | 100° C | |
| Delay Time | $V_{CC}$ = -20V, $I_C$ = -8A | $t_d$ | 50 | — | nsec |
| Rise Time | $I_{B1}$ = $I_{B2}$ = -0.8A | $t_r$ | 250 | — | nsec |
| Storage Time | $t_p$ = 25 μsec | $t_s$ | 500 | — | nsec |
| Fall Time | | $t_f$ | 100 | — | nsec |
| Inductive Load, Clamped (See Figure 15 for Test Circuit) | | | | | |
| Storage Time | $V_{CC}$ = -20V, $I_C$ = -8A | $t_s$ | 500 | 600 | nsec |
| Fall Time | $V_{CLAMP}$ = Rated $V_{CEX}$ | $t_f$ | 300 | 400 | nsec |
| | $I_{B1}$ = 0.8A, $V_{BE(off)}$ = -5V | | Typical | | |
| Storage Time | L = 200 μh | $t_s$ | 200 | 320 | nsec |
| Fall Time | | $t_f$ | 160 | 180 | nsec |

(1) Pulse Duration = 300 μsec, Duty Factor ≤ 2%.
(2) See Figure 15 for Test Circuit.

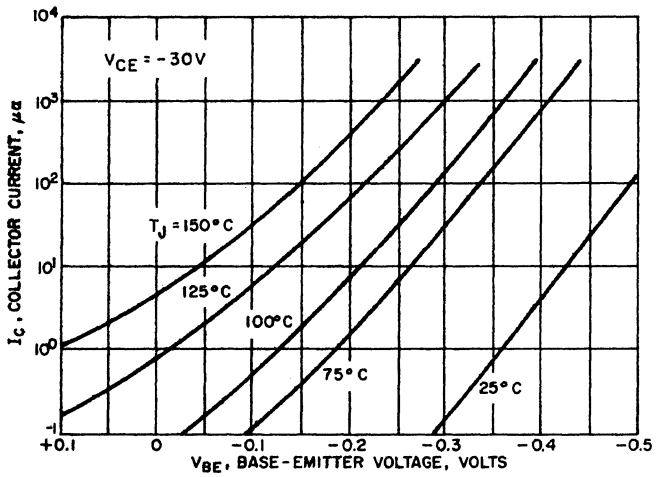
## TYPICAL DC CHARACTERISTICS



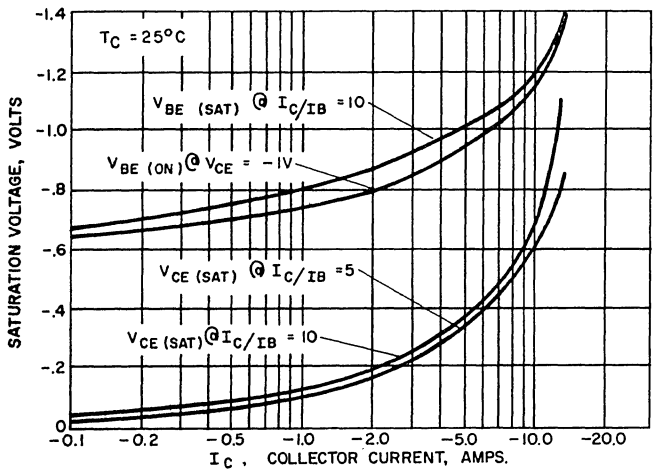

1. DC CURRENT GAIN



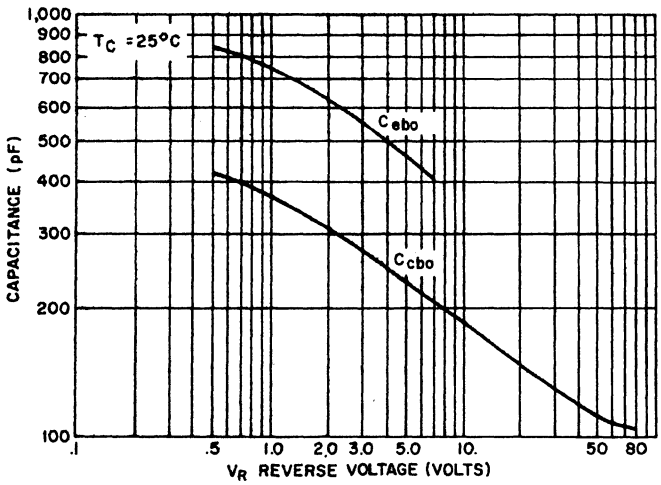

2. COLLECTOR SATURATION REGION



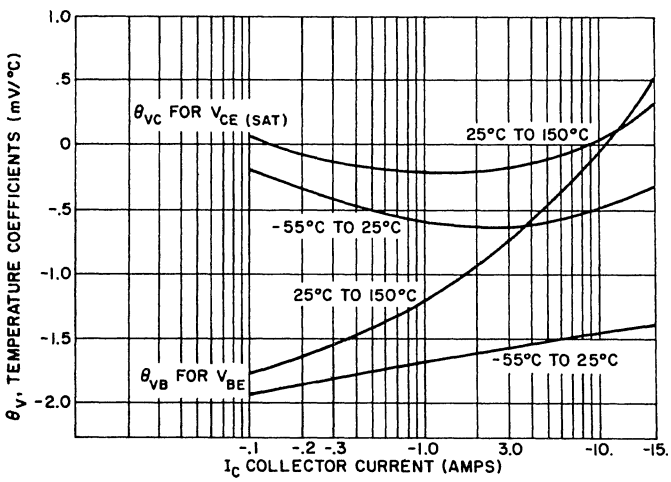

3. COLLECTOR CUTOFF REGION




4. SATURATION VOLTAGE

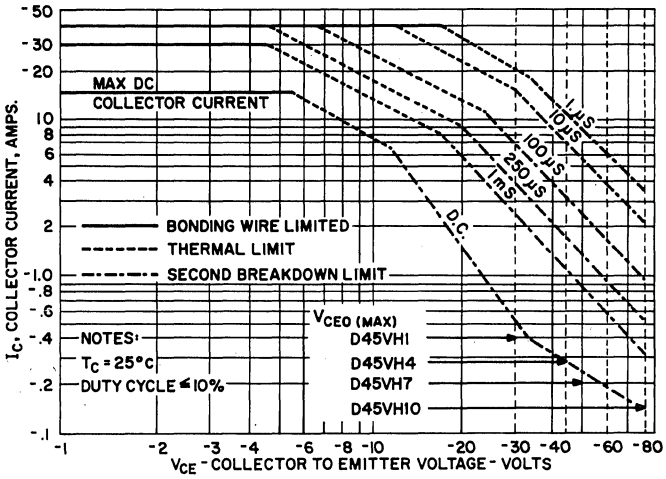



5. CAPACITANCE

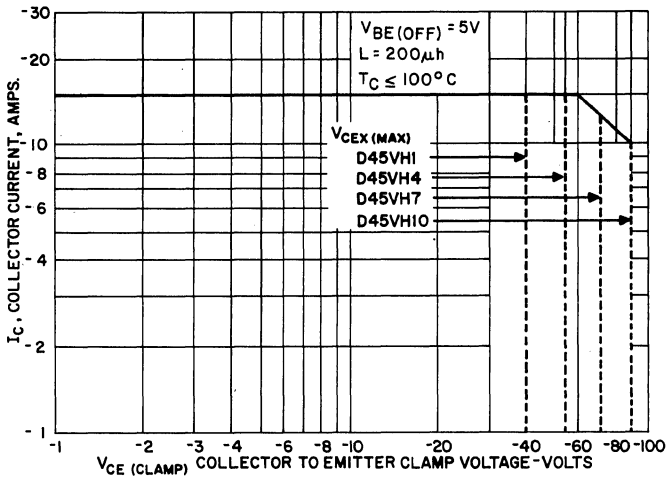



6. SATURATION VOLTAGE TEMPERATURE COEFFICIENTS

## SAFE OPERATING AREA

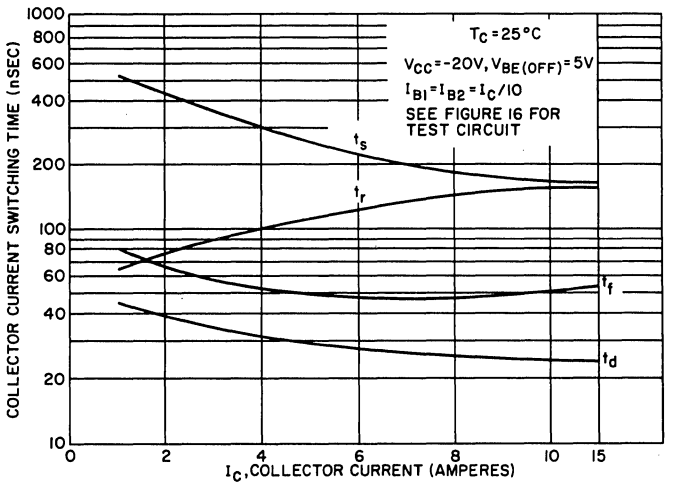



7. FORWARD BIAS SOA

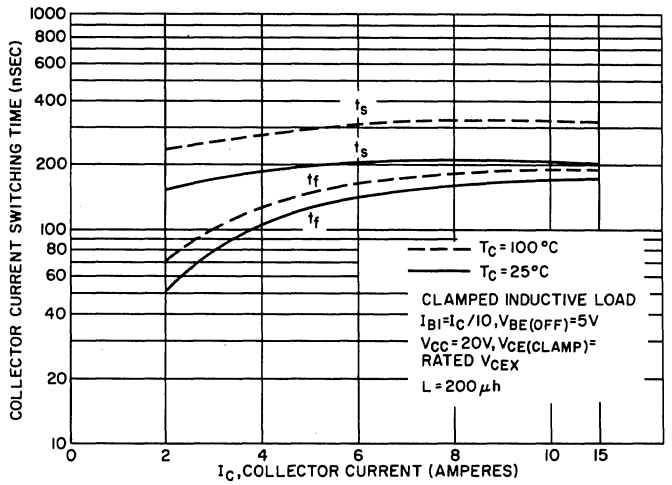



8. REVERSE BIAS SOA

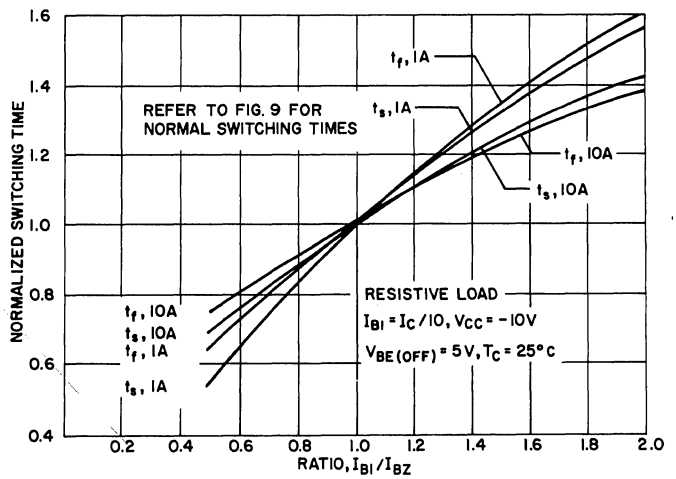
## TYPICAL SWITCHING CHARACTERISTICS



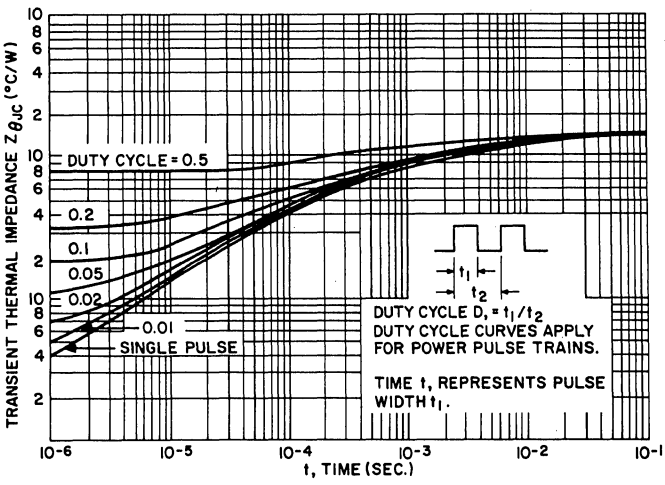

9. RESISTIVE SWITCHING TIME



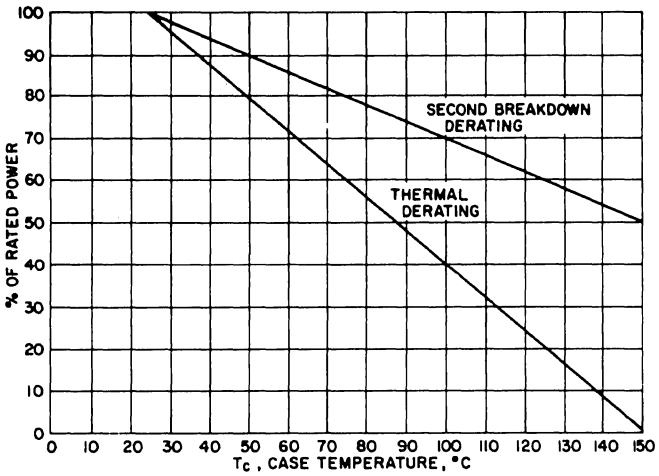

10. CLAMPED INDUCTIVE SWITCHING TIME



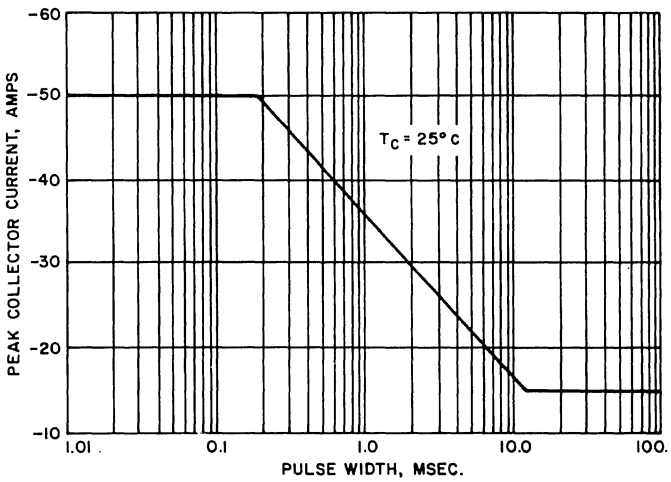

11. SWITCHING TIME VARIATION WITH $I_{B2}$




12. TRANSIENT THERMAL RESPONSE

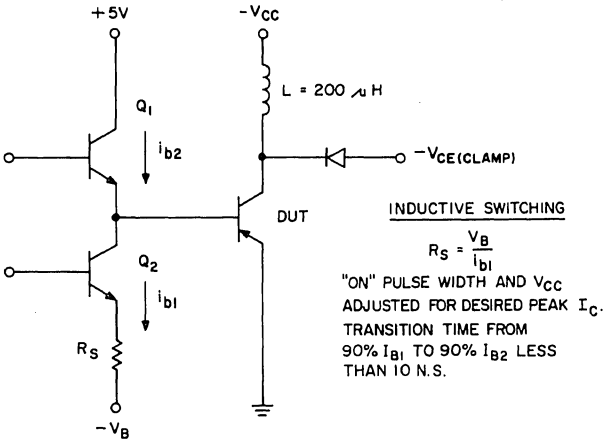



13. POWER DERATING FACTOR

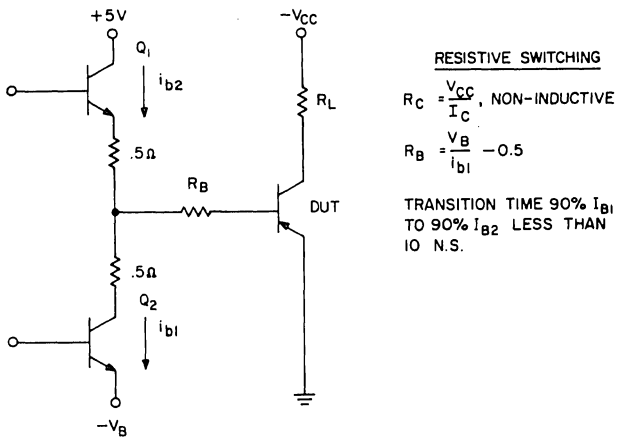



14. MAXIMUM SINGLE PULSE COLLECTOR CURRENT

## TEST CIRCUITS




15. INDUCTIVE SWITCHING AND $V_{CEX}$




16. RESISTIVE SWITCHING