

# Plastic Medium-Power Complementary Silicon Transistors

... designed for general-purpose amplifier and low-speed switching applications.

- High DC Current Gain —  
 $h_{FE} = 2500$  (Typ) @  $I_C = 4.0$  Adc
- Collector Emitter Sustaining Voltage — @ 100 mAdc  
 $V_{CEO(sus)} = 80$  Vdc (Min) — BDX53B, 54B  
 $= 100$  Vdc (Min) — BDX53C, 54C
- Low Collector-Emitter Saturation Voltage —  
 $V_{CE(sat)} = 2.0$  Vdc (Max) @  $I_C = 3.0$  Adc  
 $= 4.0$  Vdc (Max) @  $I_C = 5.0$  Adc
- Monolithic Construction with Built-In Base-Emitter Shunt Resistors
- TO-220AB Compact Package

## MAXIMUM RATINGS

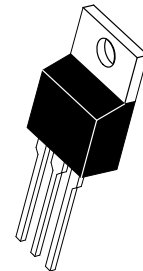
Rating	Symbol	BDX53B BDX54B	BDX53C BDX54C	Unit
Collector-Emitter Voltage	$V_{CEO}$	80	100	Vdc
Collector-Base Voltage	$V_{CB}$	80	100	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0		Vdc
Collector Current — Continuous Peak	$I_C$	8.0 12		Adc
Base Current	$I_B$	0.2		Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	60 0.48		Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150		$^\circ\text{C}$

## THERMAL CHARACTERISTICS

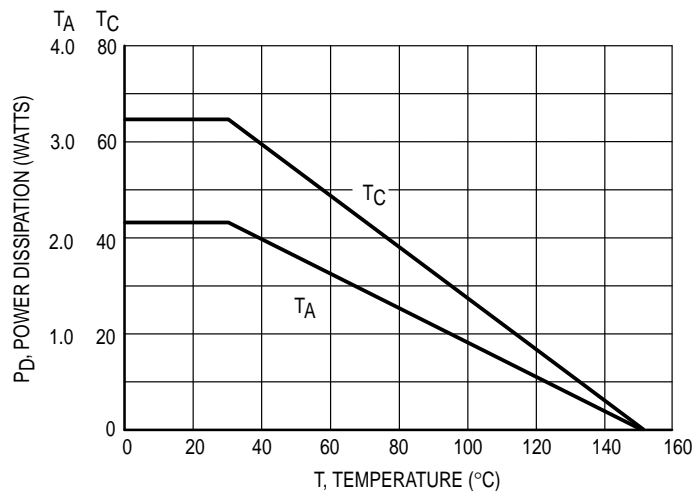
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	70	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	70	$^\circ\text{C/W}$

**NPN**  
**BDX53B**  
  
**BDX53C**  
**PNP**  
**BDX54B**  
  
**BDX54C**

**DARLINGTON**  
**8 AMPERE**  
**COMPLEMENTARY**  
**SILICON**  
**POWER TRANSISTORS**  
**80-100 VOLTS**  
**65 WATTS**



**CASE 221A-06**  
**TO-220AB**



**Figure 1. Power Derating**

# BDX53B BDX53C BDX54B BDX54C

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (1) ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )	$V_{CEO(sus)}$	80 100	— —	Vdc
Collector Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	— —	0.5 0.5	mAdc
Collector Cutoff Current ( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	— —	0.2 0.2	mAdc

## ON CHARACTERISTICS (1)

DC Current Gain ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )	$h_{FE}$	750	—	—
Collector–Emitter Saturation Voltage ( $I_C = 3.0\text{ Adc}$ , $I_B = 12\text{ mAdc}$ )	$V_{CE(sat)}$	— —	2.0 4.0	Vdc
Base–Emitter Saturation Voltage ( $I_C = 3.0\text{ Adc}$ , $I_C = 12\text{ mA}$ )	$V_{BE(sat)}$	—	2.5	Vdc

## DYNAMIC CHARACTERISTICS

Small–Signal Current Gain ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$h_{fe}$	4.0	—	—
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	$C_{ob}$	— —	300 200	pF

(1) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

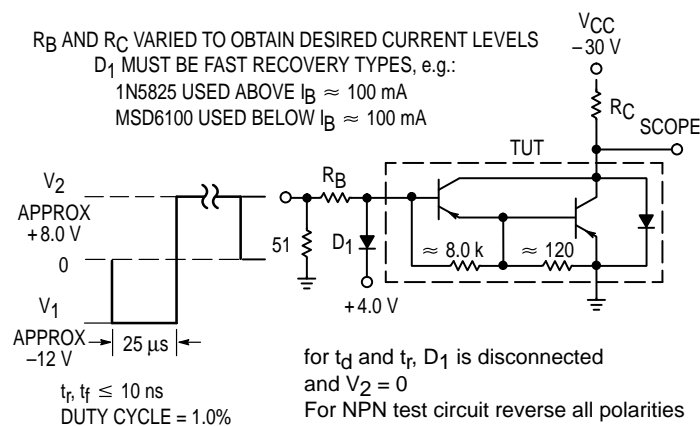


Figure 2. Switching Time Test Circuit

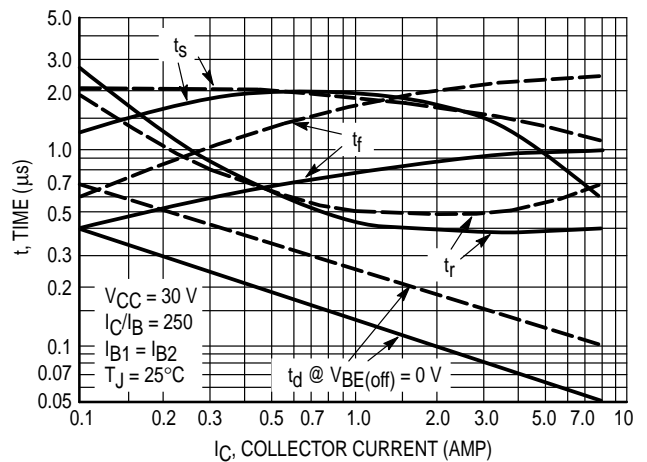


Figure 3. Switching Times

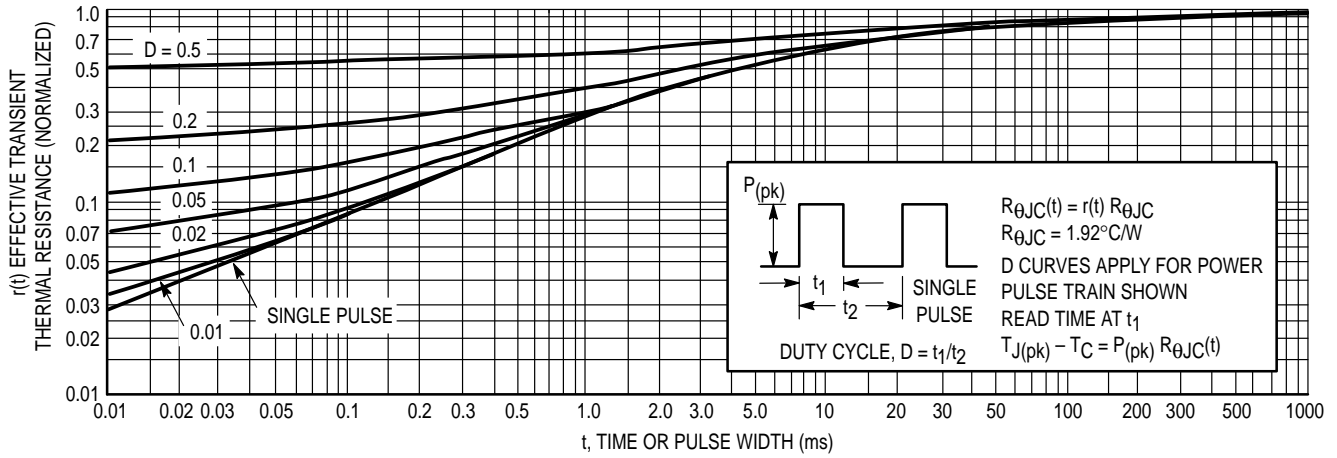


Figure 4. Thermal Response

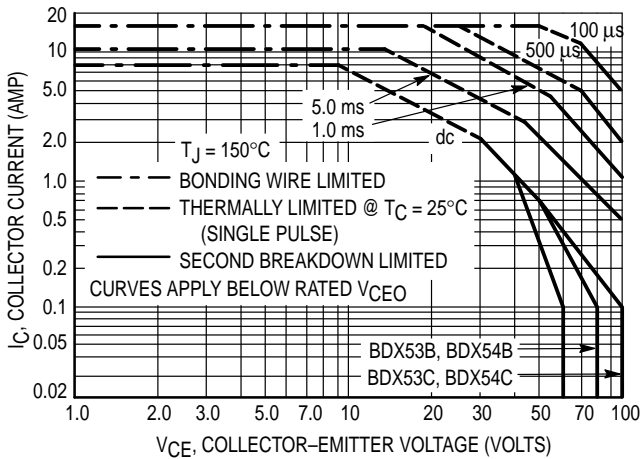


Figure 5. Active-Region Safe Operating Area

There are two limitations on the power handling ability of a transistor average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation, i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on  $T_{J(pk)} = 150^\circ C$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 150^\circ C$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

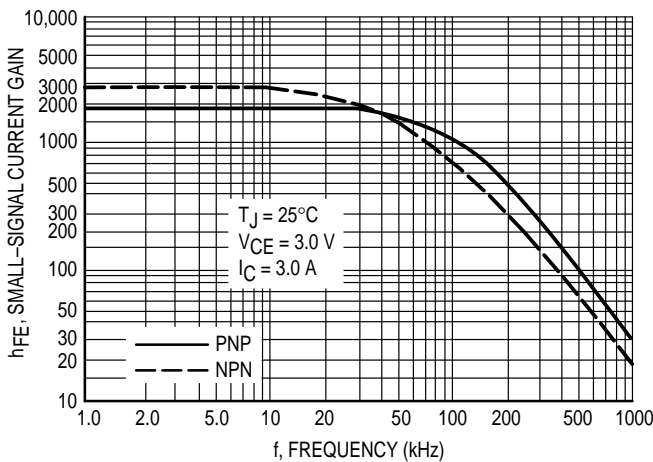


Figure 6. Small-Signal Current Gain

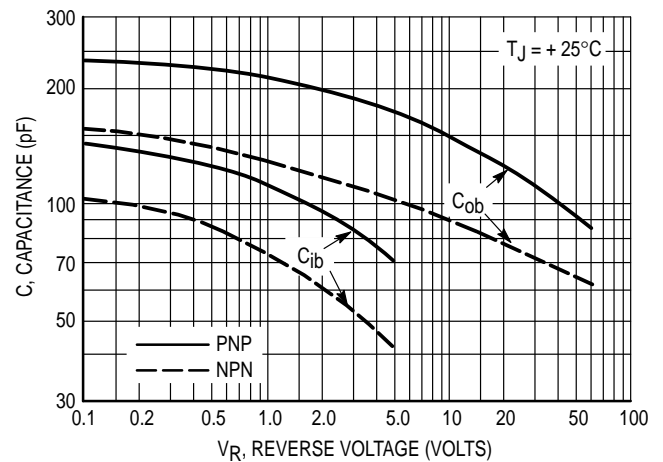
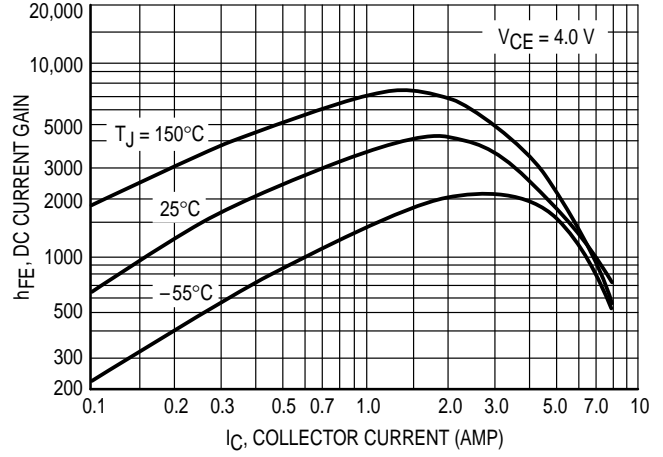
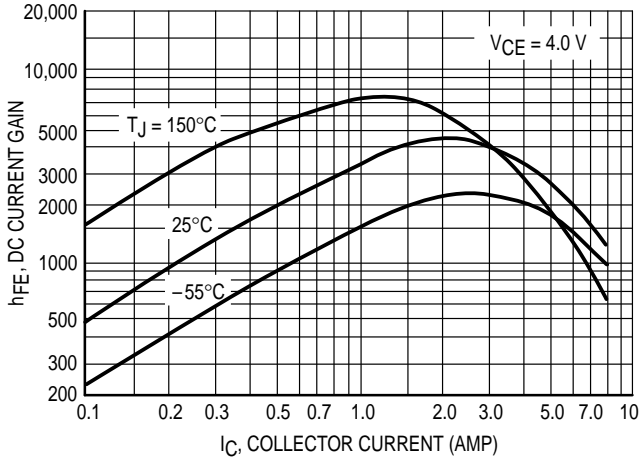


Figure 7. Capacitance

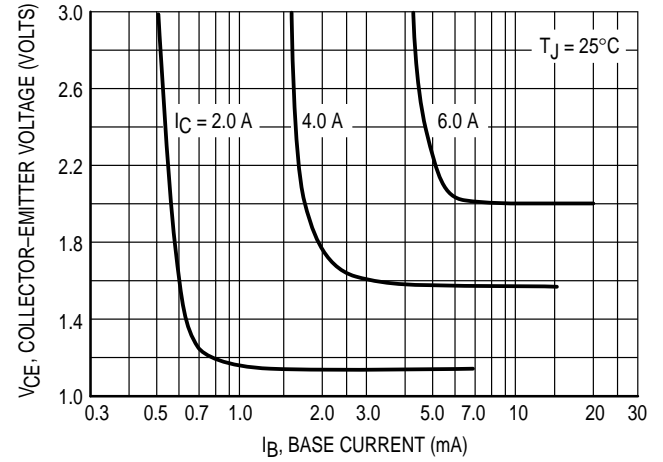
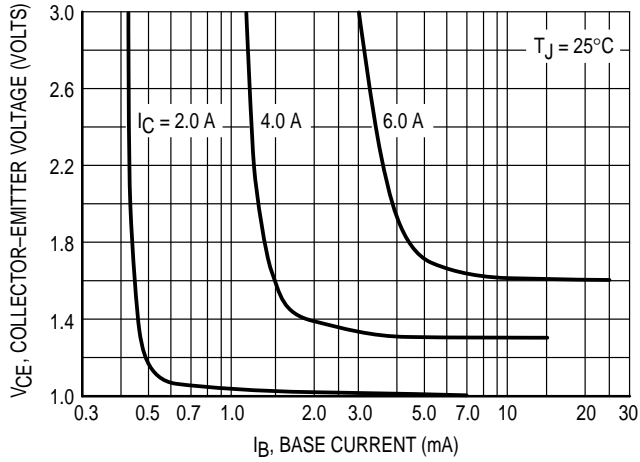
**BDX53B BDX53C BDX54B BDX54C**

**NPN  
BDX53B, 53C**

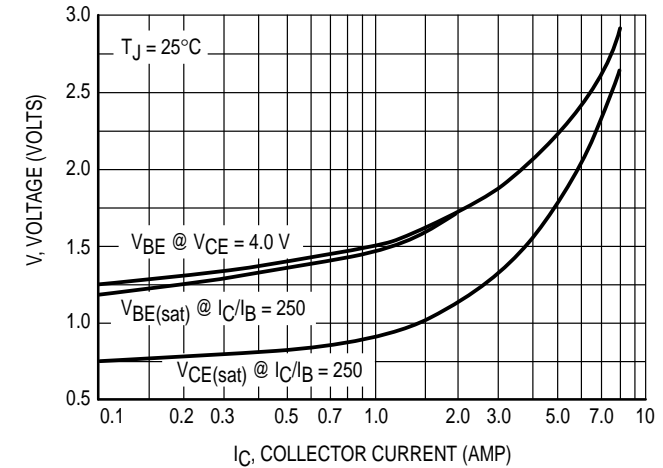
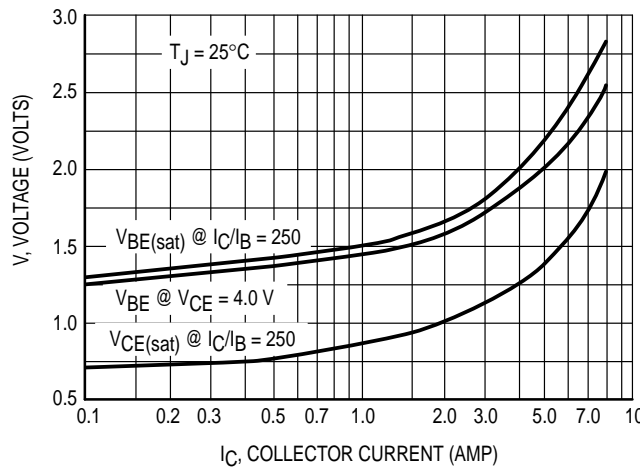
**PNP  
BDX54B, 54C**



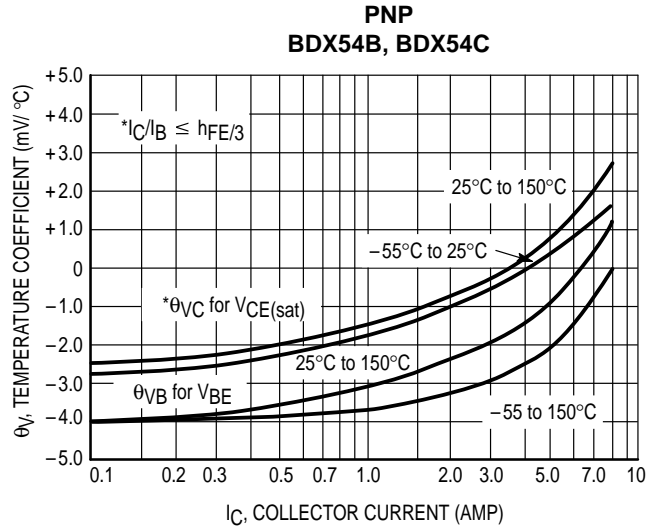
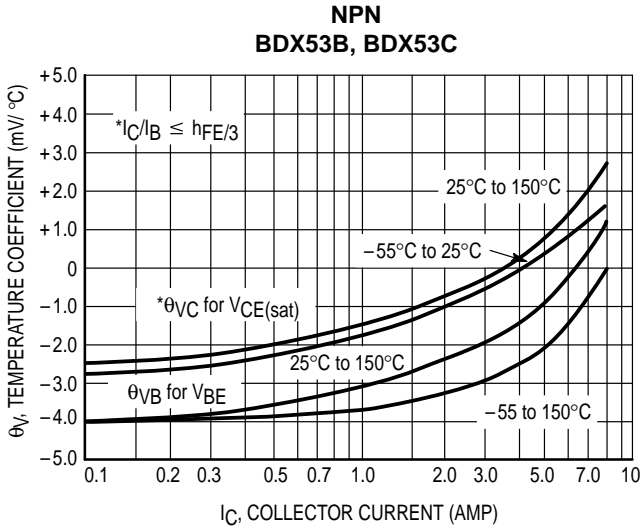
**Figure 8. DC Current Gain**



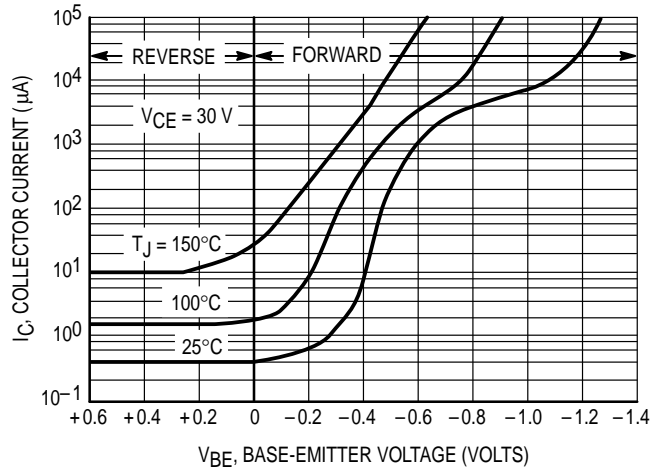
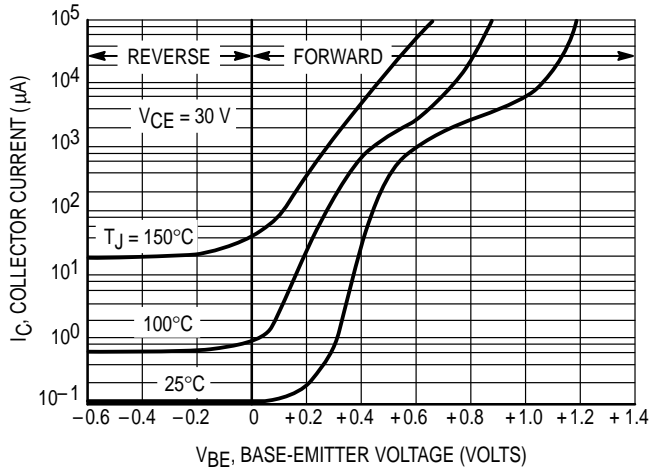
**Figure 9. Collector Saturation Region**



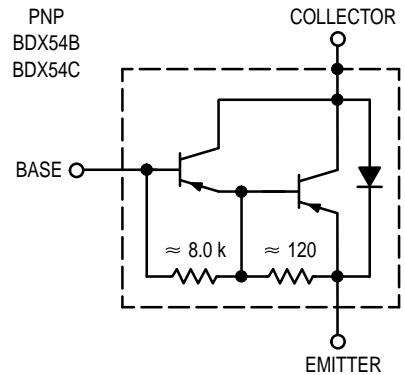
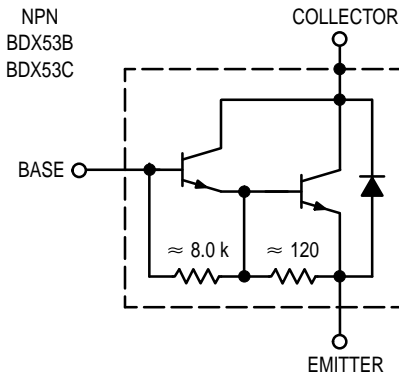
**Figure 10. "On" Voltages**



**Figure 11. Temperature Coefficients**

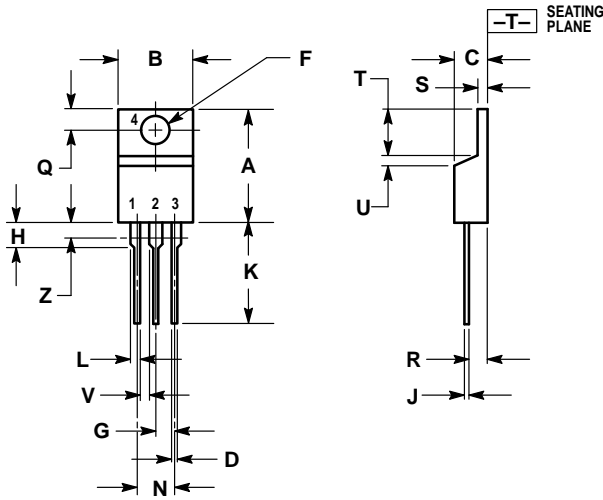


**Figure 12. Collector Cut-Off Region**



**Figure 13. Darlington Schematic**

PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

- STYLE 1:
1. BASE
  2. COLLECTOR
  3. EMITTER
  4. COLLECTOR

CASE 221A-06  
TO-220AB  
ISSUE Y

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How to reach us:  
USA/EUROPE: Motorola Literature Distribution;  
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,  
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

MFAX: RMFAX0@email.sps.mot.com - TOUCHTONE (602) 244-6609  
INTERNET: http://Design-NET.com

HONG KONG: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

