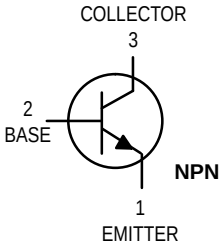
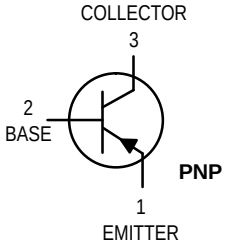
High Voltage Transistors

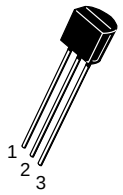




NPN
2N6515
thru 2N6517*
PNP
2N6519
2N6520*

Voltage and current are negative for PNP transistors

***Motorola Preferred Device**



CASE 29–04, STYLE 1
TO–92 (TO–226AA)

MAXIMUM RATINGS

Rating	Symbol	2N6515	2N6516 2N6519	2N6517 2N6520	Unit
Collector–Emitter Voltage	V_{CEO}	250	300	350	Vdc
Collector–Base Voltage	V_{CBO}	250	300	350	Vdc
Emitter–Base Voltage 2N6515, 2N6516, 2N6517 2N6519, 2N6520	V_{EBO}	6.0 5.0			Vdc
Base Current	I_B	250			mAdc
Collector Current — Continuous	I_C	500			mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0			mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12			Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–55 to +150			°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	°C/W

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Breakdown Voltage(1) (I_C = 1.0 mAdc, I_B = 0)	2N6515 2N6516, 2N6519 2N6517, 2N6520	$V_{(BR)CEO}$	250 300 350	— — —	Vdc
Collector–Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)	2N6515 2N6516, 2N6519 2N6517, 2N6520	$V_{(BR)CBO}$	250 300 350	— — —	Vdc
Emitter–Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	2N6515, 2N6516, 2N6517 2N6519, 2N6520	$V_{(BR)EBO}$	6.0 5.0	— —	Vdc

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

Preferred devices are Motorola recommended choices for future use and best overall value.

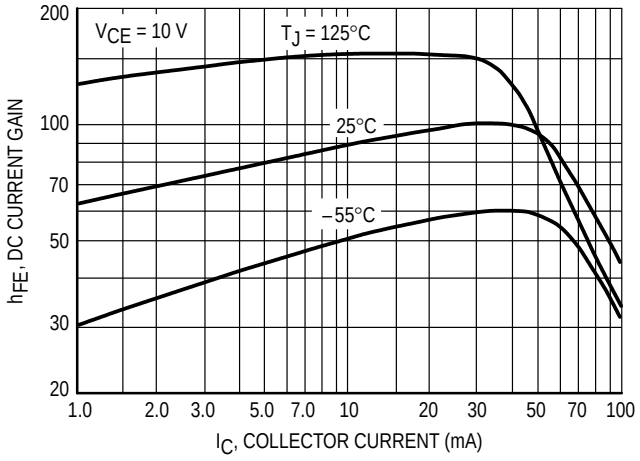
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS (Continued)					
Collector Cutoff Current		I_{CBO}			nAdc
(V_{CB} = 150 Vdc, I_E = 0)	2N6515		—	50	
(V_{CB} = 200 Vdc, I_E = 0)	2N6516, 2N6519		—	50	
(V_{CB} = 250 Vdc, I_E = 0)	2N6517, 2N6520		—	50	
Emitter Cutoff Current		I_{EBO}			nAdc
(V_{EB} = 5.0 Vdc, I_C = 0)	2N6515, 2N6516, 2N6517		—	50	
(V_{EB} = 4.0 Vdc, I_C = 0)	2N6519, 2N6520		—	50	
ON CHARACTERISTICS(1)					
DC Current Gain		h_{FE}			—
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc)	2N6515		35	—	
	2N6516, 2N6519		30	—	
	2N6517, 2N6520		20	—	
(I_C = 10 mAdc, V_{CE} = 10 Vdc)	2N6515		50	—	
	2N6516, 2N6519		45	—	
	2N6517, 2N6520		30	—	
(I_C = 30 mAdc, V_{CE} = 10 Vdc)	2N6515		50	300	
	2N6516, 2N6519		45	270	
	2N6517, 2N6520		30	200	
(I_C = 50 mAdc, V_{CE} = 10 Vdc)	2N6515		45	220	
	2N6516, 2N6519		40	200	
	2N6517, 2N6520		20	200	
(I_C = 100 mAdc, V_{CE} = 10 Vdc)	2N6515		25	—	
	2N6516, 2N6519		20	—	
	2N6517, 2N6520		15	—	
Collector–Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			—	0.30	
(I_C = 20 mAdc, I_B = 2.0 mAdc)			—	0.35	
(I_C = 30 mAdc, I_B = 3.0 mAdc)			—	0.50	
(I_C = 50 mAdc, I_B = 5.0 mAdc)			—	1.0	
Base–Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			—	0.75	
(I_C = 20 mAdc, I_B = 2.0 mAdc)			—	0.85	
(I_C = 30 mAdc, I_B = 3.0 mAdc)			—	0.90	
Base–Emitter On Voltage		$V_{BE(on)}$	—	2.0	Vdc
(I_C = 100 mAdc, V_{CE} = 10 Vdc)					
SMALL–SIGNAL CHARACTERISTICS					
Current–Gain — Bandwidth Product(1)		f_T	40	200	MHz
(I_C = 10 mAdc, V_{CE} = 20 Vdc, f = 20 MHz)					
Collector–Base Capacitance		C_{cb}	—	6.0	pF
(V_{CB} = 20 Vdc, I_E = 0, f = 1.0 MHz)					
Emitter–Base Capacitance		C_{eb}			pF
(V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	2N6515 thru 2N6517		—	80	
	2N6519, 2N6520		—	100	
SWITCHING CHARACTERISTICS					
Turn–On Time		t_{on}	—	200	μs
(V_{CC} = 100 Vdc, $V_{BE(off)}$ = 2.0 Vdc, I_C = 50 mAdc, I_{B1} = 10 mAdc)					
Turn–Off Time		t_{off}	—	3.5	μs
(V_{CC} = 100 Vdc, I_C = 50 mAdc, I_{B1} = I_{B2} = 10 mAdc)					

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

NPN

2N6515, 2N6516



PNP

2N6519

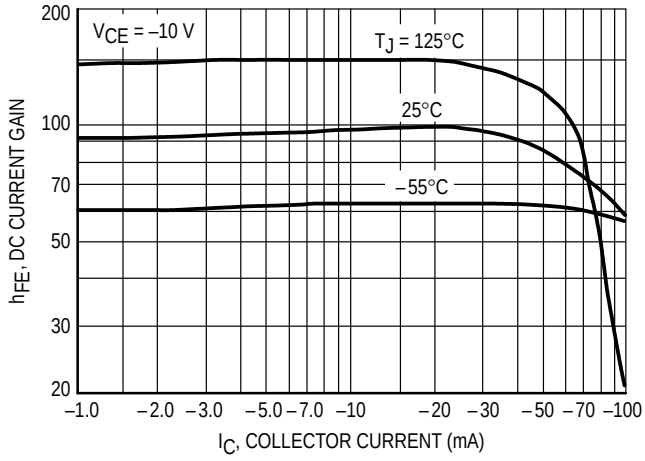
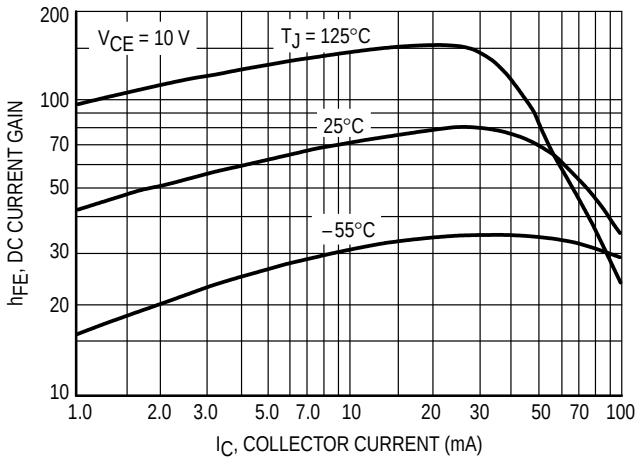


Figure 1. DC Current Gain

2N6517



2N6520

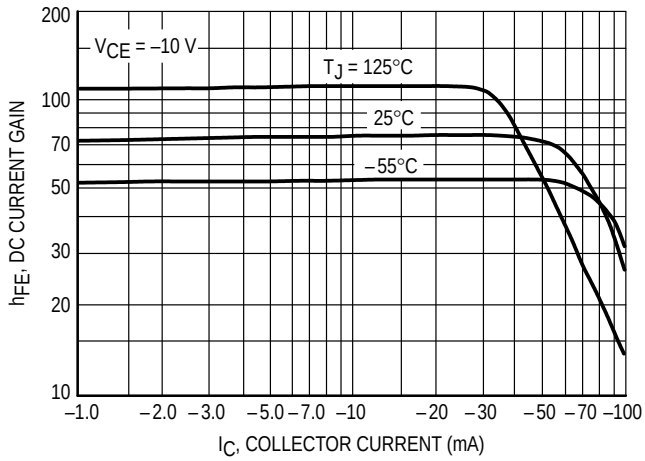
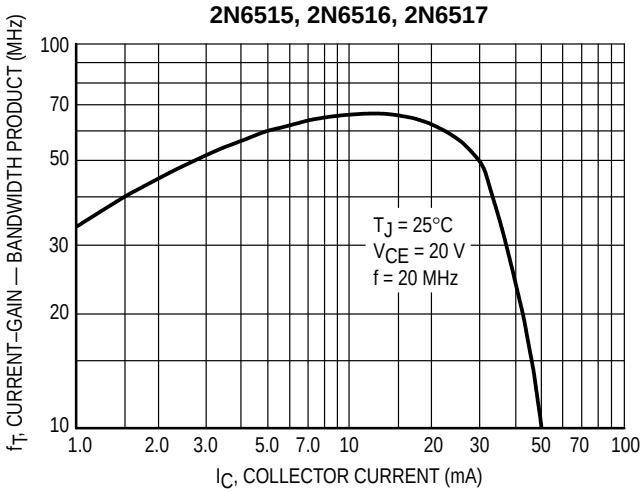


Figure 2. DC Current Gain

2N6515, 2N6516, 2N6517



2N6519, 2N6520

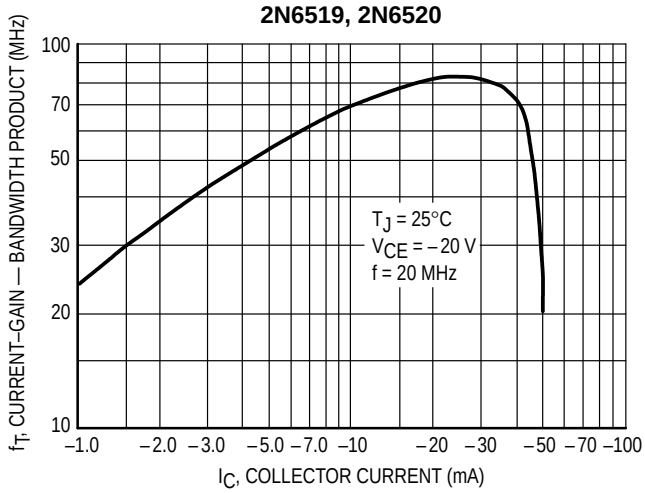
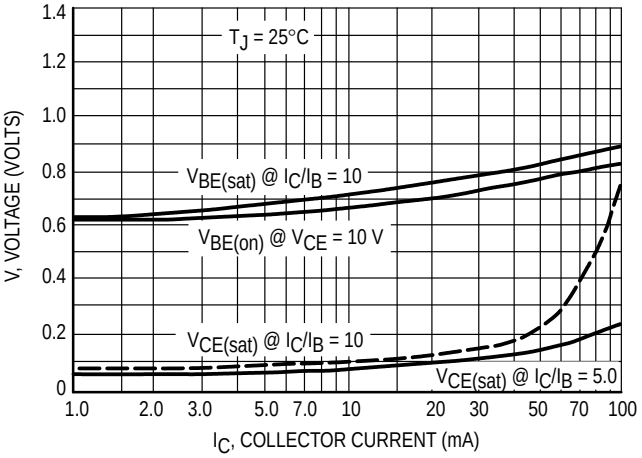


Figure 3. Current–Gain — Bandwidth Product

NPN

2N6515, 2N6516, 2N6517



PNP

2N6519, 2N6520

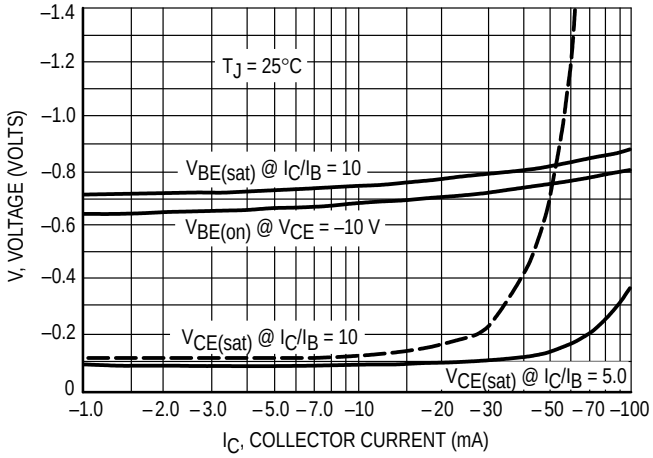
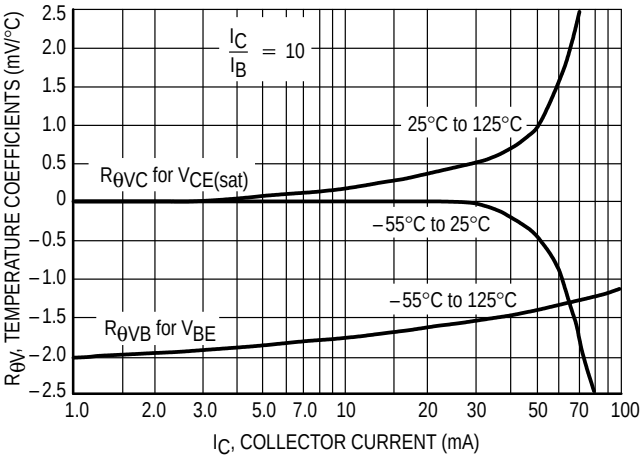


Figure 4. “On” Voltages

2N6515, 2N6516, 2N6517



2N6519, 2N6520

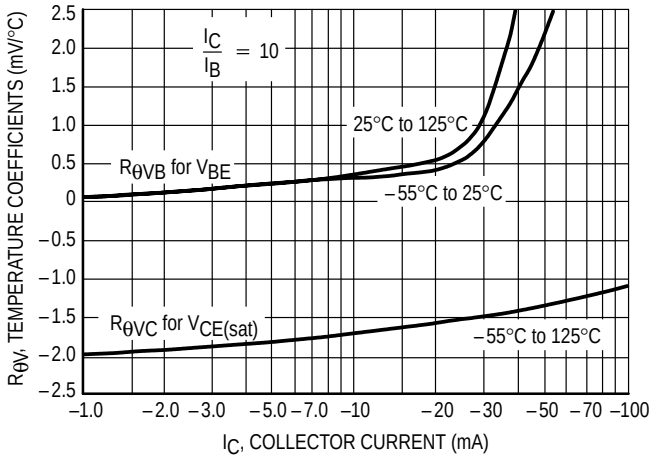
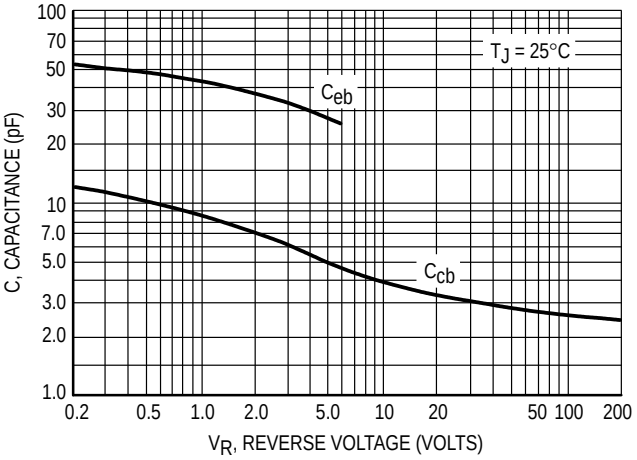


Figure 5. Temperature Coefficients

2N6515, 2N6516, 2N6517



2N6519, 2N6520

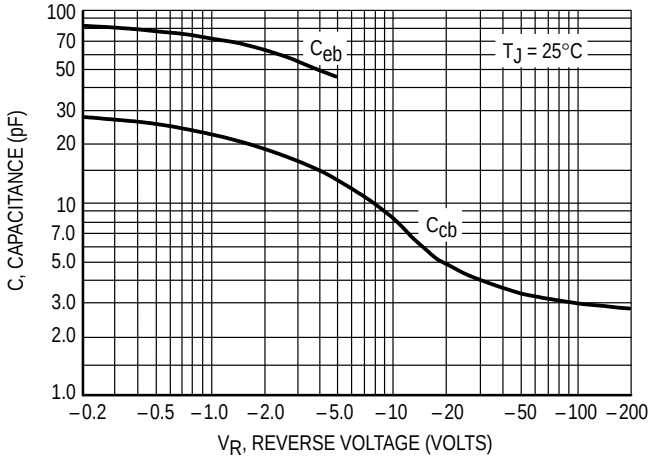
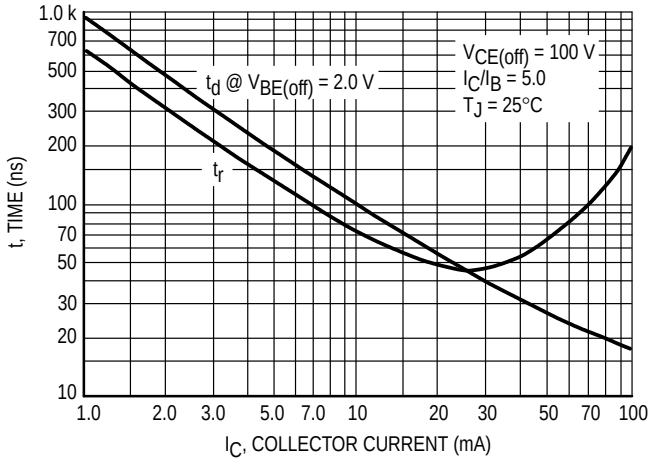


Figure 6. Capacitance

NPN

2N6515, 2N6516, 2N6517



PNP

2N6519, 2N6520

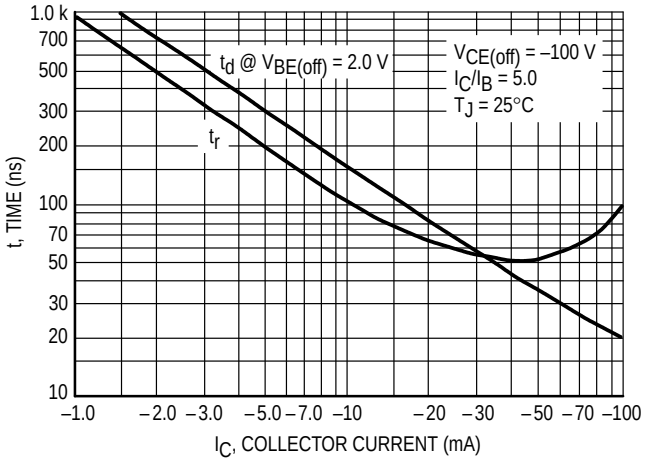
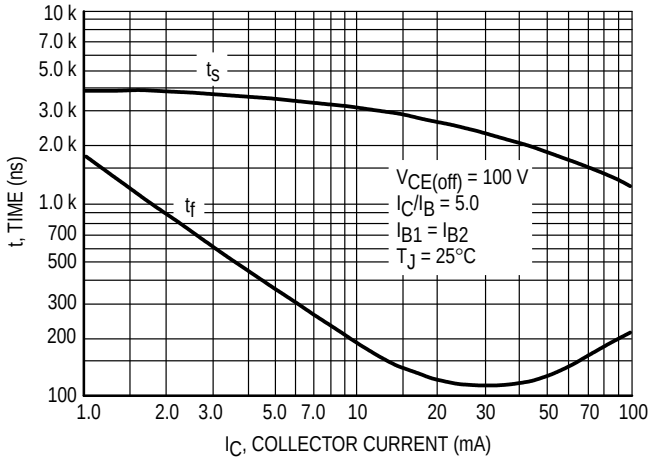


Figure 7. Turn–On Time

2N6515, 2N6516, 2N6517



2N6519, 2N6520

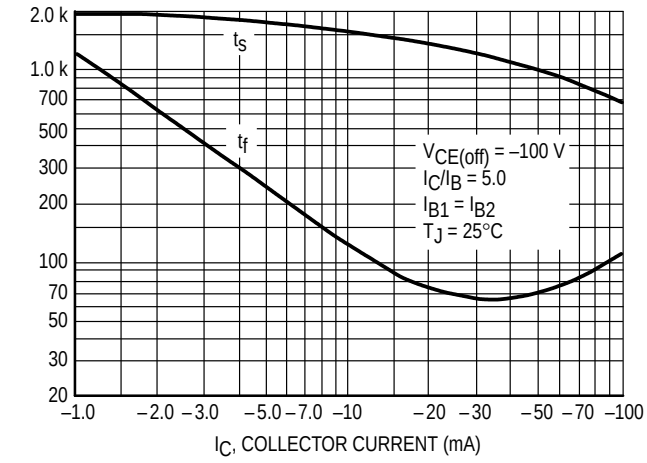


Figure 8. Turn–Off Time

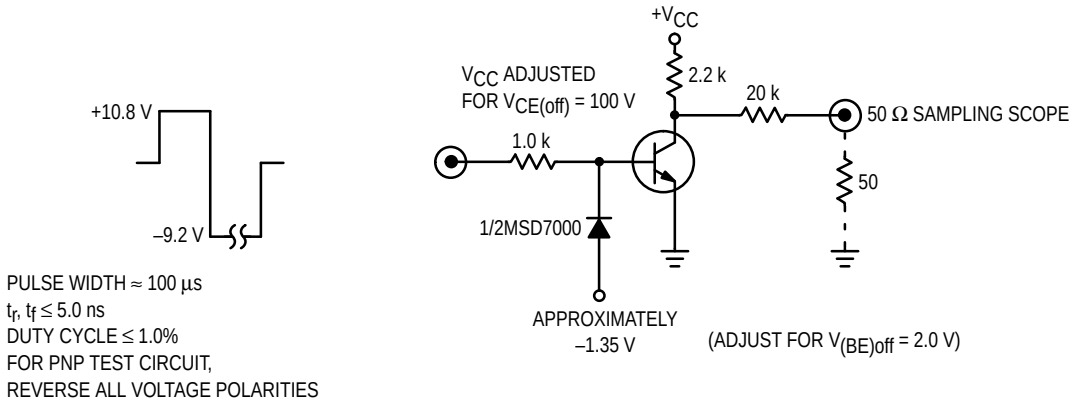


Figure 9. Switching Time Test Circuit

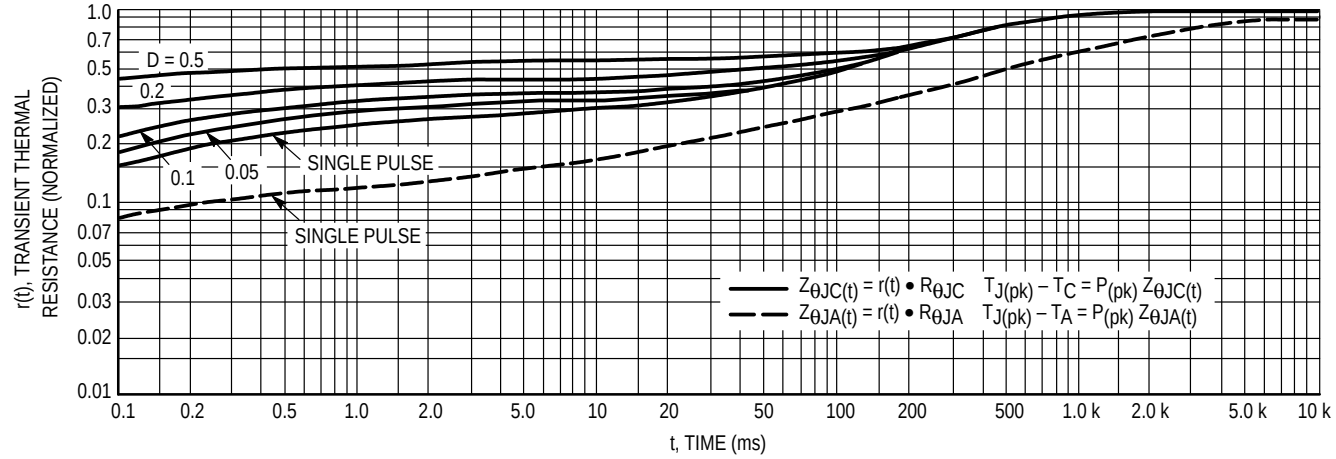


Figure 10. Thermal Response

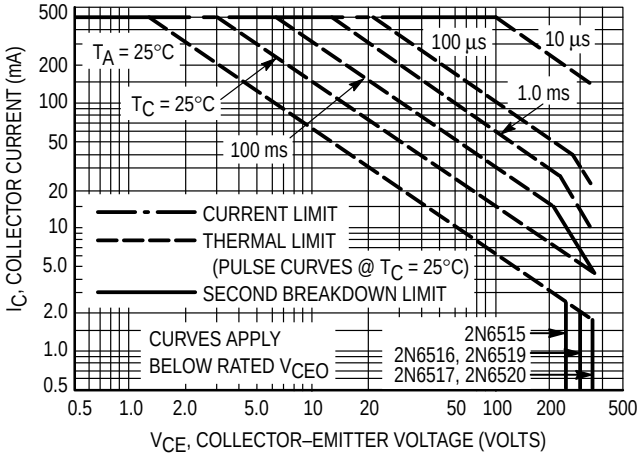
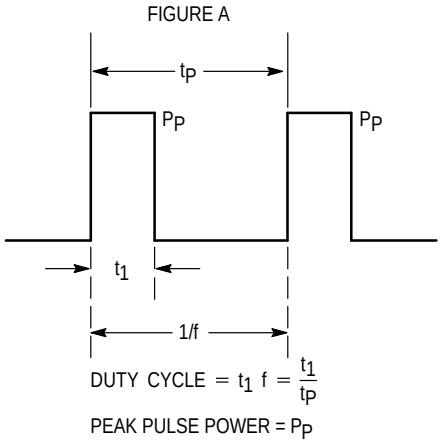
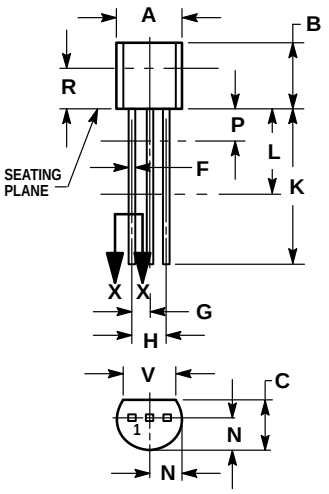


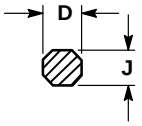
Figure 11. Active Region Safe Operating Area



Design Note: Use of Transient Thermal Resistance Data

PACKAGE DIMENSIONS





SECTION X–X

CASE 029–04
(TO–226AA)
ISSUE AD

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	—	12.70	—
L	0.250	—	6.35	—
N	0.080	0.105	2.04	2.66
P	—	0.100	—	2.54
R	0.115	—	2.93	—
V	0.135	—	3.43	—

STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

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51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298