

NPN - 2N6515, 2N6517; PNP - 2N6520

High Voltage Transistors

NPN and PNP

Features

- Voltage and Current are Negative for PNP Transistors
- These are Pb-Free Devices*

MAXIMUM RATINGS

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

THERMAL CHARACTERISTICS

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

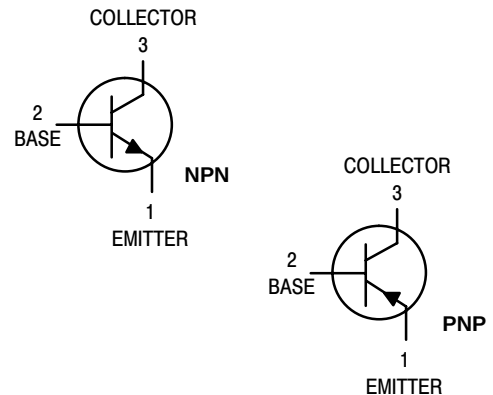
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

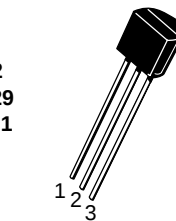


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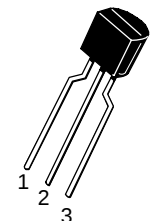
<http://onsemi.com>



TO-92
CASE 29
STYLE 1

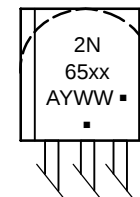


STRAIGHT LEAD
BULK PACK



BENT LEAD
TAPE & REEL
AMMO PACK

MARKING DIAGRAM



xx = 15, 17, or 20
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

NPN – 2N6515, 2N6517; PNP – 2N6520

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Breakdown Voltage (Note 1) ($I_C = 1.0\text{ mA}$, $I_E = 0$)	$V_{(BR)CEO}$	250 350	– –	Vdc
Collector–Base Breakdown Voltage ($I_C = 100\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	250 350	– –	Vdc
Emitter–Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	6.0 5.0	– –	Vdc
Collector Cutoff Current ($V_{CB} = 150\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 250\text{ Vdc}$, $I_E = 0$)	I_{CBO}	– –	50 50	nAdc
Emitter Cutoff Current ($V_{EB} = 5.0\text{ Vdc}$, $I_C = 0$) ($V_{EB} = 4.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	– –	50 50	nAdc

ON CHARACTERISTICS (Note 1)

DC Current Gain ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)	h_{FE}	35 20	– –	–
($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)		50 30	– –	
($I_C = 30\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)		50 30	300 200	
($I_C = 50\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)		45 20	220 200	
($I_C = 100\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)		25 15	– –	
Collector–Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) ($I_C = 20\text{ mA}$, $I_B = 2.0\text{ mA}$) ($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$) ($I_C = 50\text{ mA}$, $I_B = 5.0\text{ mA}$)	$V_{CE(sat)}$	– – – –	0.30 0.35 0.50 1.0	Vdc
Base–Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) ($I_C = 20\text{ mA}$, $I_B = 2.0\text{ mA}$) ($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$)	$V_{BE(sat)}$	– – –	0.75 0.85 0.90	Vdc
Base–Emitter On Voltage ($I_C = 100\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)	$V_{BE(on)}$	–	2.0	Vdc

SMALL–SIGNAL CHARACTERISTICS

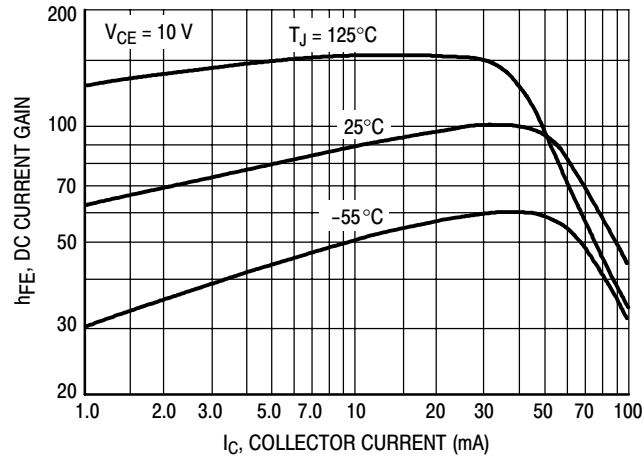
Current–Gain – Bandwidth Product (Note 1) ($I_C = 10\text{ mA}$, $V_{CE} = 20\text{ Vdc}$, $f = 20\text{ MHz}$)	f_T	40	200	MHz
Collector–Base Capacitance ($V_{CB} = 20\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{cb}	–	6.0	pF
Emitter–Base Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$)	C_{eb}	– –	80 100	pF

SWITCHING CHARACTERISTICS

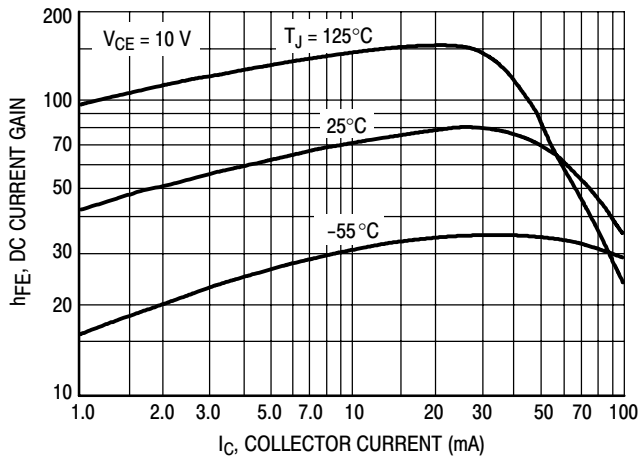
Turn–On Time ($V_{CC} = 100\text{ Vdc}$, $V_{BE(off)} = 2.0\text{ Vdc}$, $I_C = 50\text{ mA}$, $I_{B1} = 10\text{ mA}$)	t_{on}	–	200	μs
Turn–Off Time ($V_{CC} = 100\text{ Vdc}$, $I_C = 50\text{ mA}$, $I_{B1} = I_{B2} = 10\text{ mA}$)	t_{off}	–	3.5	μs

1. Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

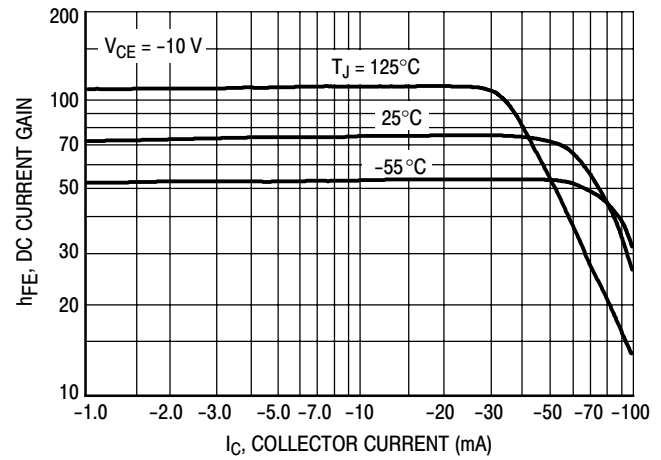
NPN – 2N6515, 2N6517; PNP – 2N6520



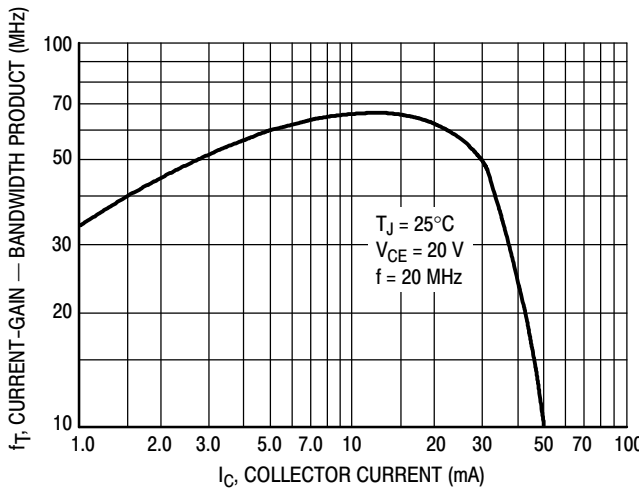
**Figure 1. DC Current Gain
NPN 2N6515**



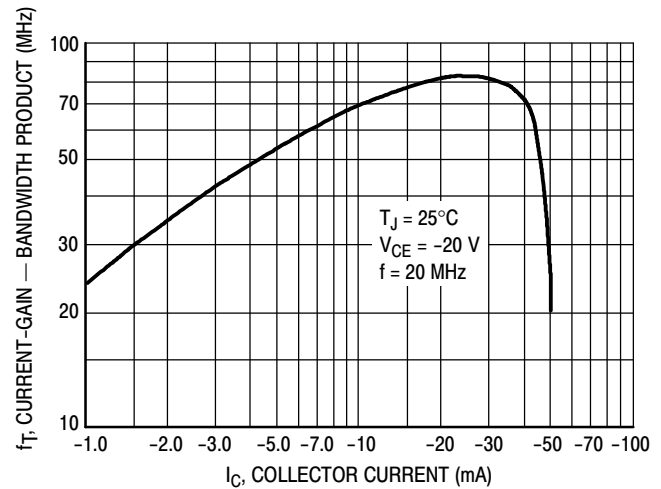
**Figure 2. DC Current Gain
NPN 2N6517**



**Figure 3. DC Current Gain
PNP 2N6520**

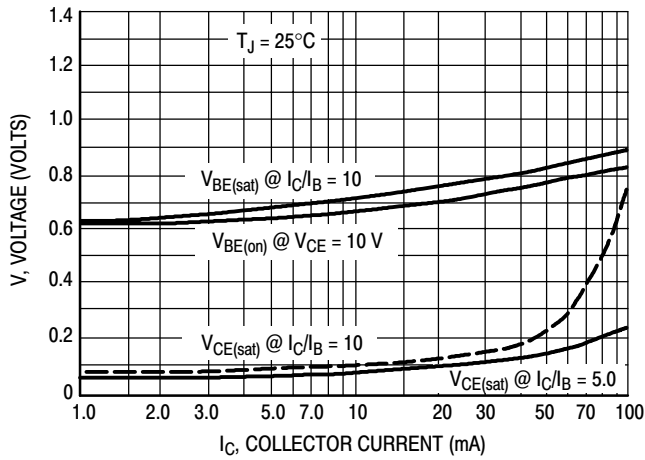


**Figure 4. Current-Gain – Bandwidth Product
NPN 2N6515, 2N6517**

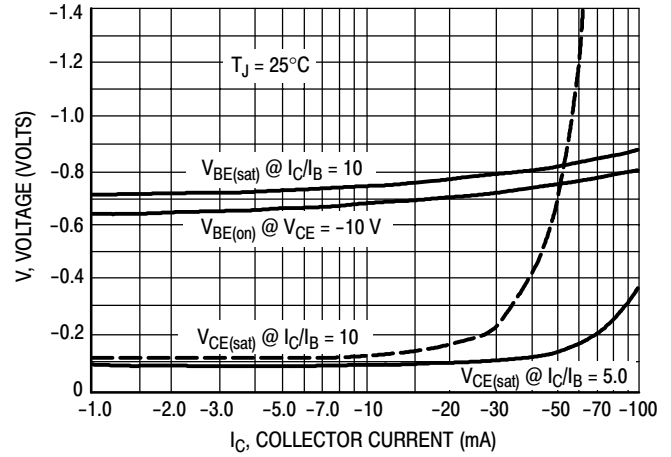


**Figure 5. Current-Gain – Bandwidth Product
PNP 2N6520**

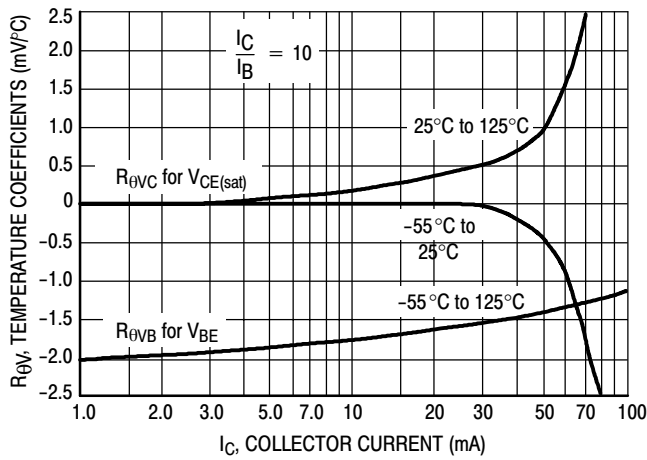
NPN – 2N6515, 2N6517; PNP – 2N6520



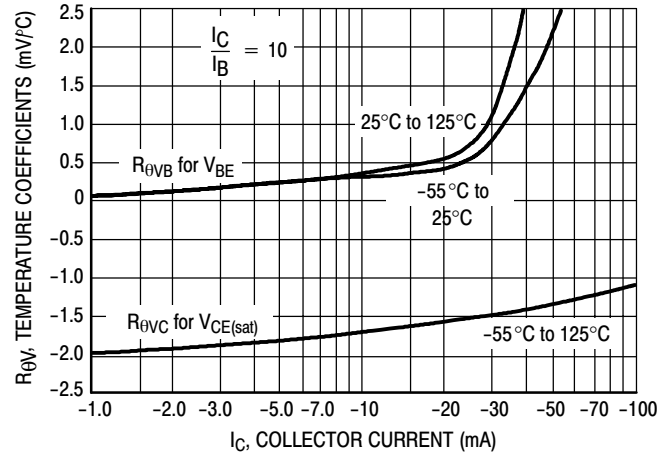
**Figure 6. "On" Voltages
NPN 2N6515, 2N6517**



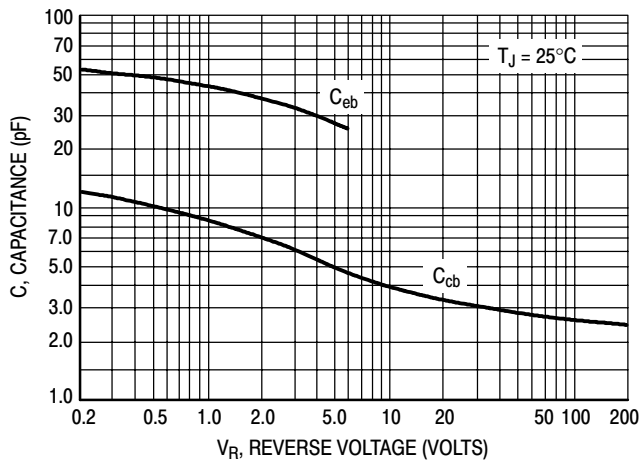
**Figure 7. "On" Voltages
PNP 2N6520**



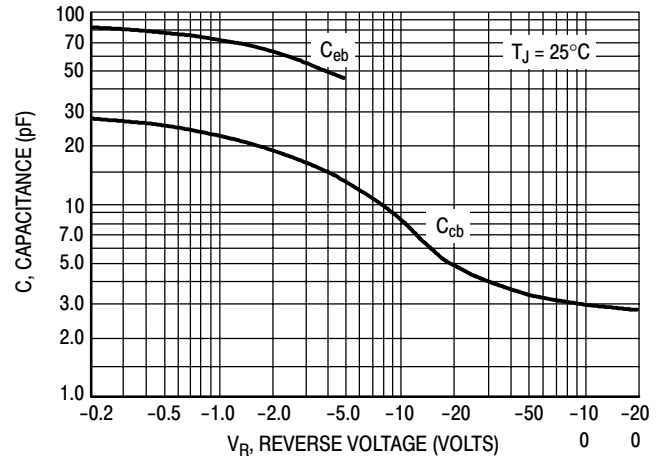
**Figure 8. Temperature Coefficients
NPN 2N6515, 2N6517**



**Figure 9. Temperature Coefficients
PNP 2N6520**



**Figure 10. Capacitance
NPN 2N6515, 2N6517**



**Figure 11. Capacitance
PNP 2N6520**

NPN – 2N6515, 2N6517; PNP – 2N6520

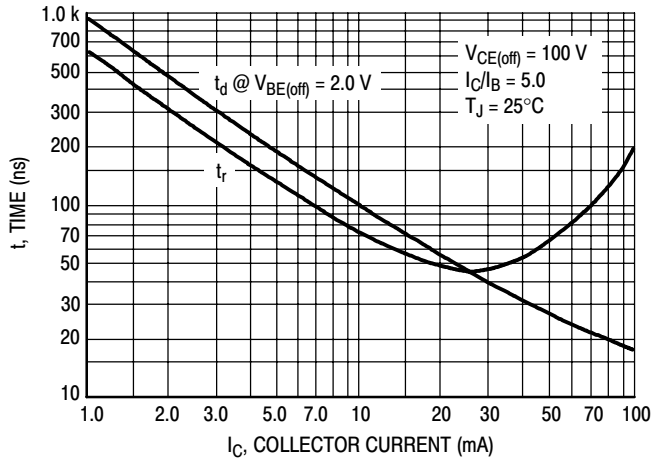


Figure 12. Turn-On Time
NPN 2N6515, 2N6517

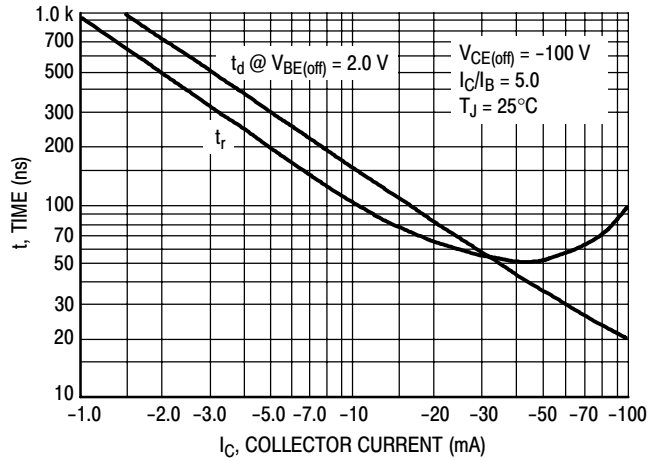


Figure 13. Turn-On Time
PNP 2N6520

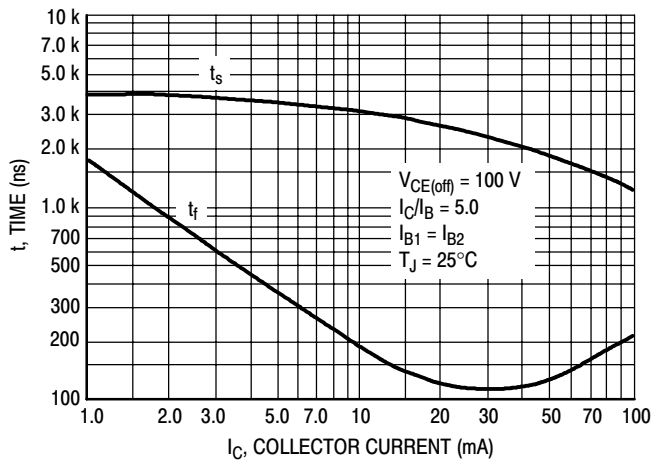


Figure 14. Turn-Off Time
NPN 2N6515, 2N6517

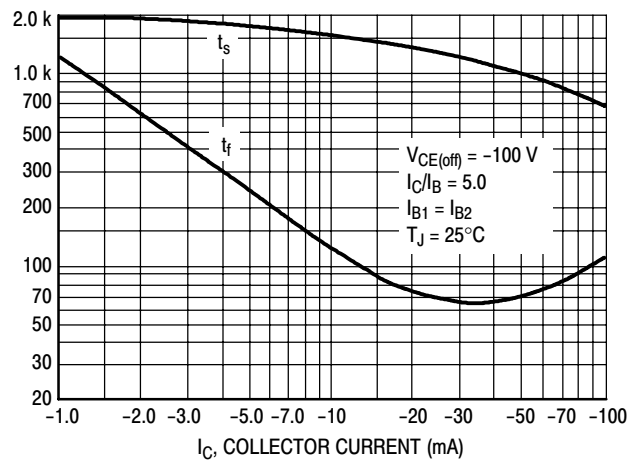


Figure 15. Turn-Off Time
PNP 2N6520

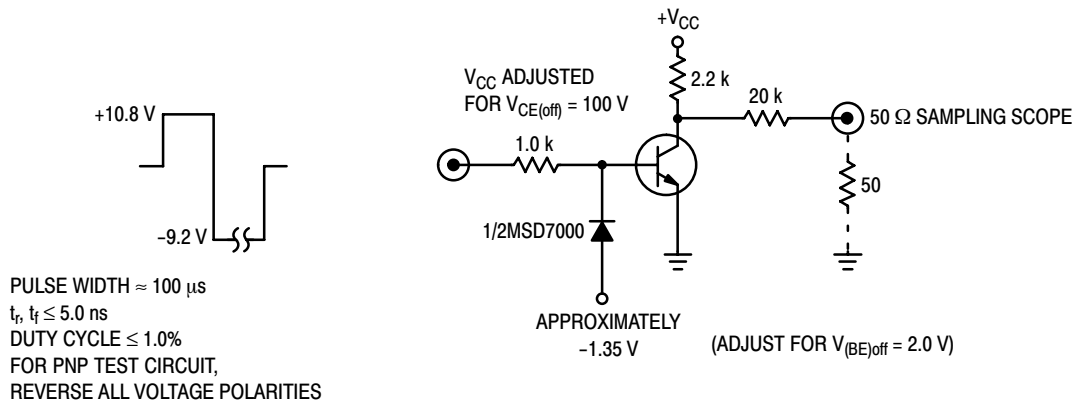


Figure 16. Switching Time Test Circuit

NPN – 2N6515, 2N6517; PNP – 2N6520

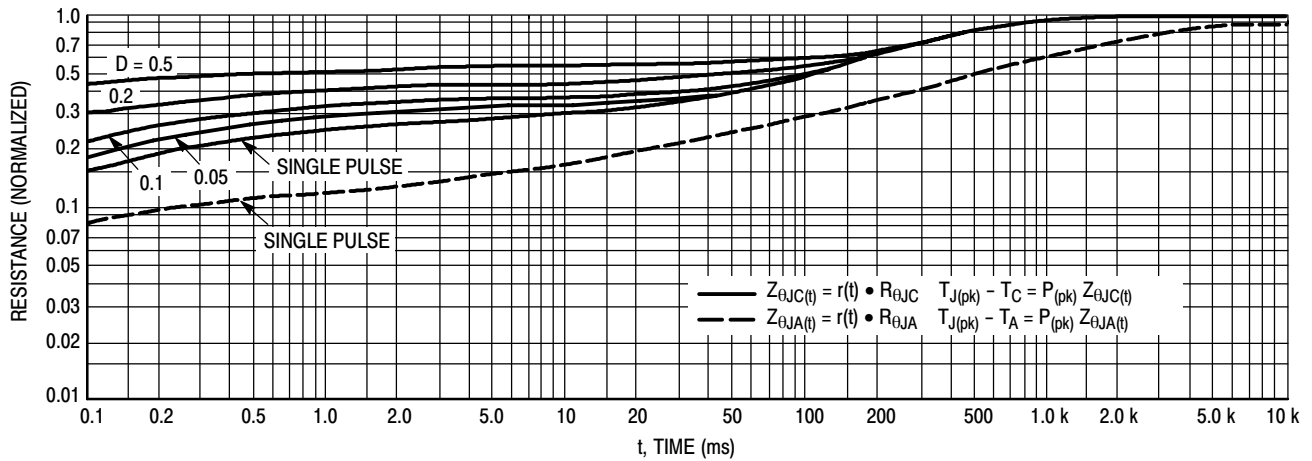


Figure 17. Thermal Response

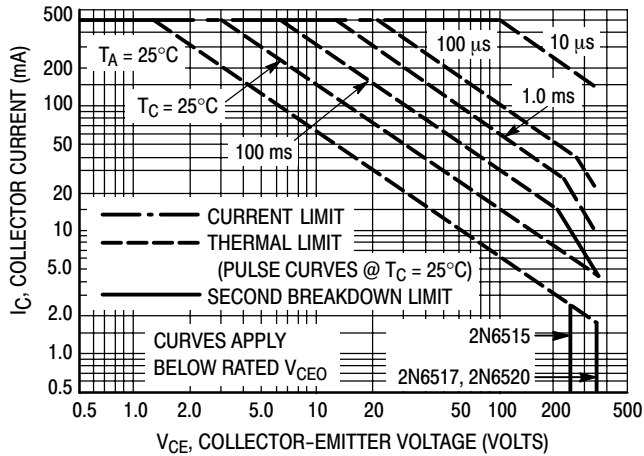
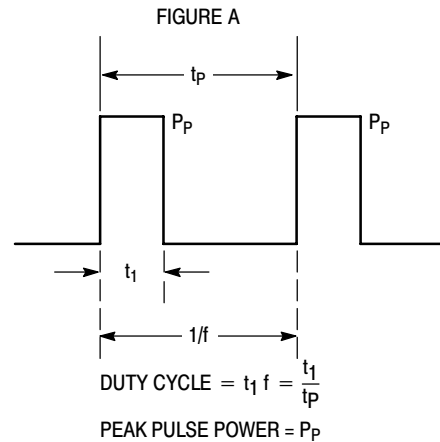


Figure 18. Active Region Safe Operating Area



Design Note: Use of Transient Thermal Resistance Data

ORDERING INFORMATION

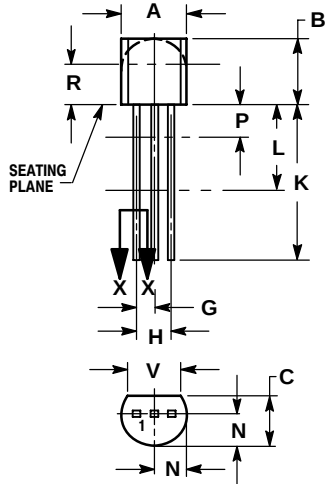
Device	Package	Shipping†
2N6515RLRMG	TO-92 (Pb-Free)	2000 Ammo Pack
2N6517G	TO-92 (Pb-Free)	5000 Unit / Bulk
2N6517RLRPG	TO-92 (Pb-Free)	2000 Ammo Pack
2N6520RLRAG	TO-92 (Pb-Free)	2000 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

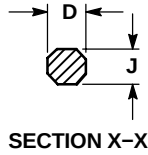
NPN – 2N6515, 2N6517; PNP – 2N6520

PACKAGE DIMENSIONS

TO-92 (TO-226) CASE 29-11 ISSUE AM



STRAIGHT LEAD
BULK PACK

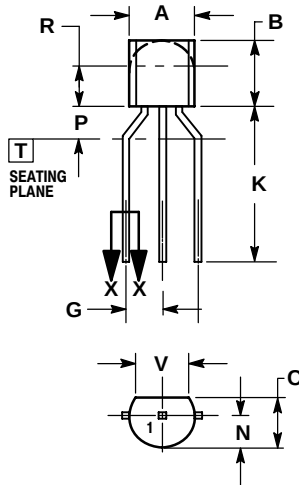


SECTION X-X

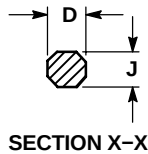
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	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	0.021	0.407	0.533
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	---



BENT LEAD
TAPE & REEL
AMMO PACK



SECTION X-X

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	MILLIMETERS	
	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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