

# High Voltage Transistors

## MAXIMUM RATINGS

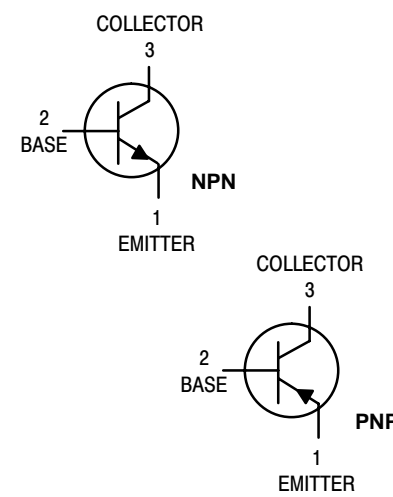
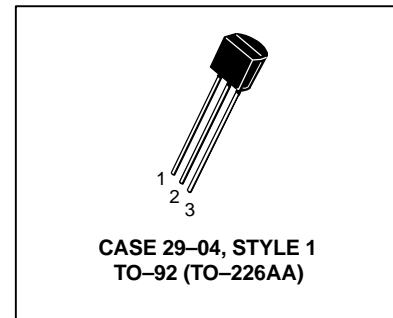
Rating	Symbol	2N6515	2N6517 2N6520	Unit
Collector–Emitter Voltage	$V_{CEO}$	250	350	Vdc
Collector–Base Voltage	$V_{CBO}$	250	350	Vdc
Emitter–Base Voltage 2N6515, 2N6516, 2N6517 2N6519, 2N6520	$V_{EBO}$	6.0 5.0		Vdc
Base Current	$I_B$	250		mAdc
Collector Current – Continuous	$I_C$	500		mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0		mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 12		Watts 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	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

**NPN**  
**2N6515**  
**2N6517**  
**PNP**  
**2N6520**

Voltage and current are negative  
for PNP transistors



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

Characteristic	Symbol	Min	Max	Unit
----------------	--------	-----	-----	------

## OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage <sup>(1)</sup> ( $I_C = 1.0 \text{ mAdc}, I_B = 0$ )	$V_{(BR)CEO}$	250 350	– –	Vdc
Collector–Base Breakdown Voltage ( $I_C = 100 \mu\text{Adc}, I_E = 0$ )	$V_{(BR)CBO}$	250 350	– –	Vdc
Emitter–Base Breakdown Voltage ( $I_E = 10 \mu\text{Adc}, I_C = 0$ )	$V_{(BR)EBO}$	6.0 5.0	– –	Vdc

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

# NPN 2N6515 2N6517 PNP 2N6520

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b> (Continued)				
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(1)

DC Current Gain ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )  ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )  ( $I_C = 30\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )  ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )  ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	2N6515 2N6517, 2N6520  2N6515 2N6517, 2N6520  2N6515 2N6517, 2N6520  2N6515 2N6517, 2N6520  2N6515 2N6517, 2N6520	$h_{FE}$	35 20  50 30  50 30  45 20  25 15	– – – 300 200  – –  – –	–
Collector–Emitter Saturation Voltage ( $I_C = 10\text{ mAdc}$ , $I_B = 1.0\text{ mAdc}$ ) ( $I_C = 20\text{ mAdc}$ , $I_B = 2.0\text{ mAdc}$ ) ( $I_C = 30\text{ mAdc}$ , $I_B = 3.0\text{ mAdc}$ ) ( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ )		$V_{CE(sat)}$	– – – –	0.30 0.35 0.50 1.0	Vdc
Base–Emitter Saturation Voltage ( $I_C = 10\text{ mAdc}$ , $I_B = 1.0\text{ mAdc}$ ) ( $I_C = 20\text{ mAdc}$ , $I_B = 2.0\text{ mAdc}$ ) ( $I_C = 30\text{ mAdc}$ , $I_B = 3.0\text{ mAdc}$ )		$V_{BE(sat)}$	– – –	0.75 0.85 0.90	Vdc
Base–Emitter On Voltage ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )		$V_{BE(on)}$	–	2.0	Vdc

## SMALL–SIGNAL CHARACTERISTICS

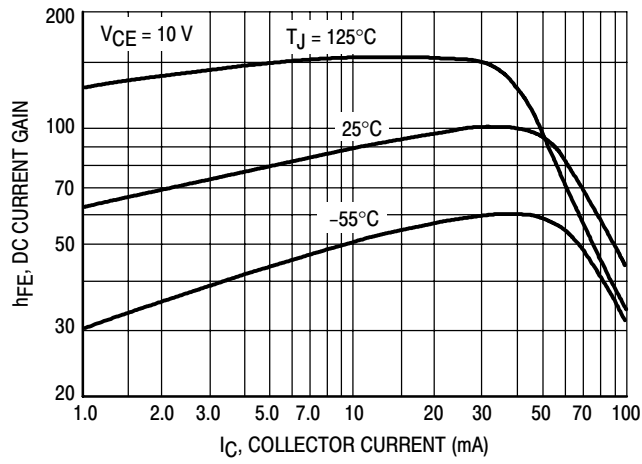
Current–Gain – Bandwidth Product(1) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 20\text{ MHz}$ )		$f_T$	40	200	MHz
Collector–Base Capacitance ( $V_{CB} = 20\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )		$C_{cb}$	–	6.0	pF
Emitter–Base Capacitance ( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	2N6515, 2N6517 2N6520	$C_{eb}$	– –	80 100	pF

## SWITCHING CHARACTERISTICS

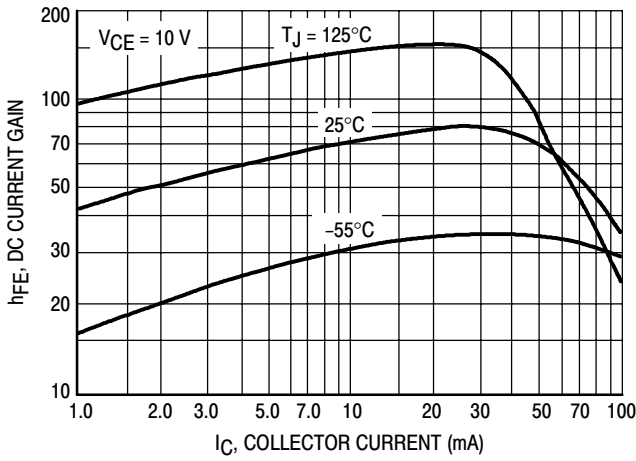
Turn–On Time ( $V_{CC} = 100\text{ Vdc}$ , $V_{BE(off)} = 2.0\text{ Vdc}$ , $I_C = 50\text{ mAdc}$ , $I_{B1} = 10\text{ mAdc}$ )	$t_{on}$	–	200	$\mu\text{s}$
Turn–Off Time ( $V_{CC} = 100\text{ Vdc}$ , $I_C = 50\text{ mAdc}$ , $I_{B1} = I_{B2} = 10\text{ mAdc}$ )	$t_{off}$	–	3.5	$\mu\text{s}$

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

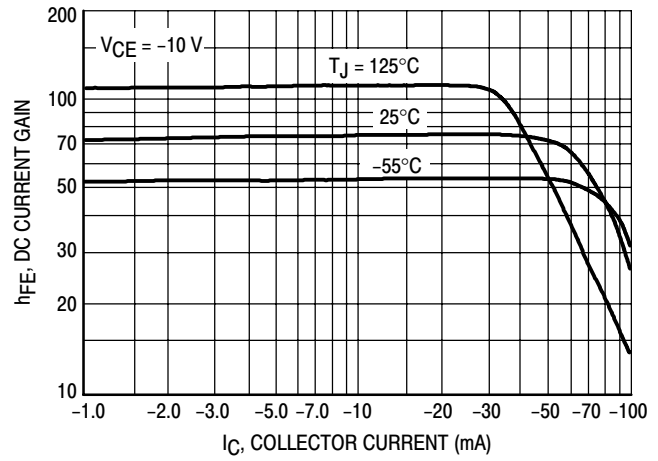
# NPN 2N6515 2N6517 PNP 2N6520



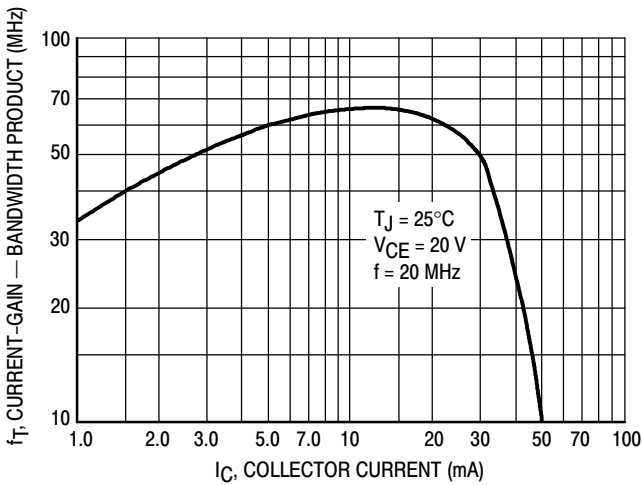
**Figure 1. DC Current Gain – NPN 2N6515**



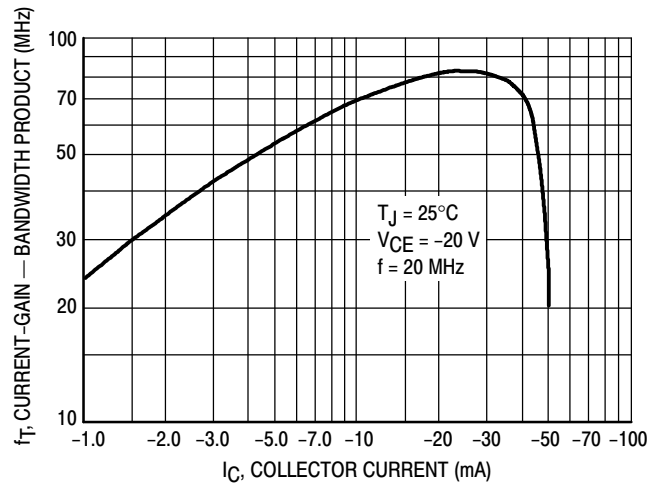
**Figure 2. DC Current Gain – NPN 2N6517**



**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

## NPN

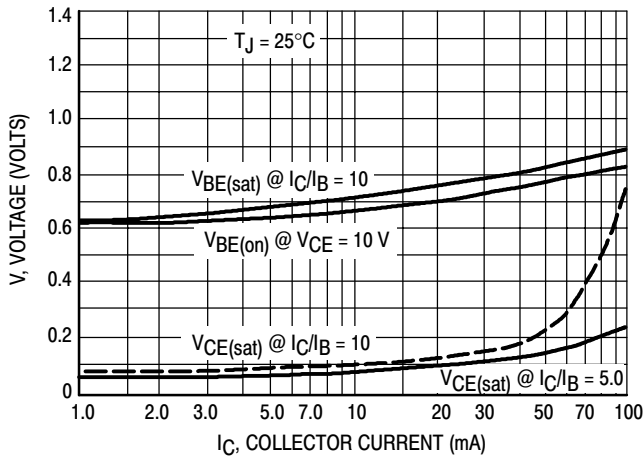


Figure 6. "On" Voltages – NPN 2N6515, 2N6517

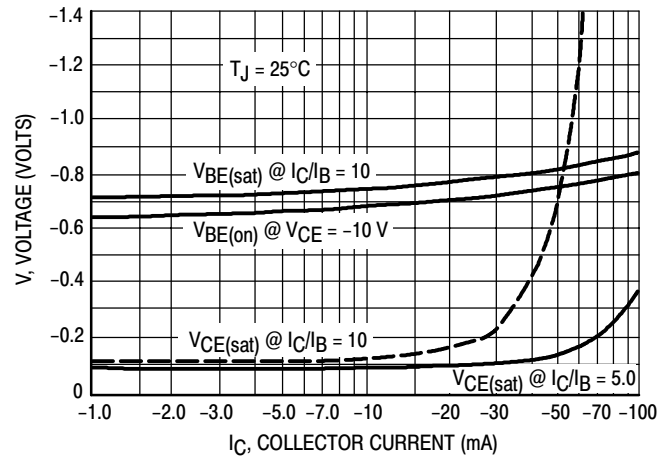


Figure 7. "On" Voltages – PNP 2N6520

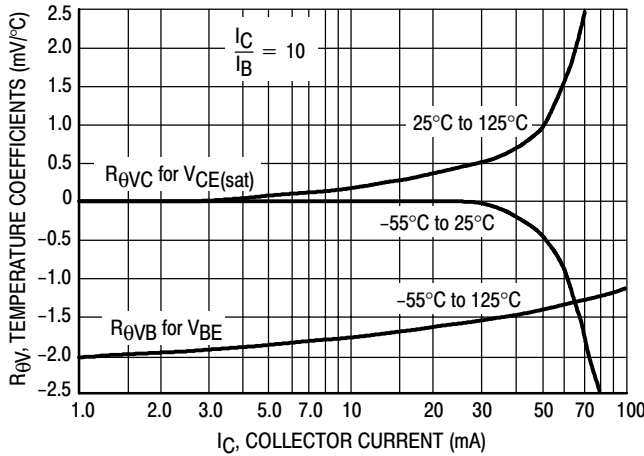


Figure 8. Temperature Coefficients – NPN 2N6515, 2N6517

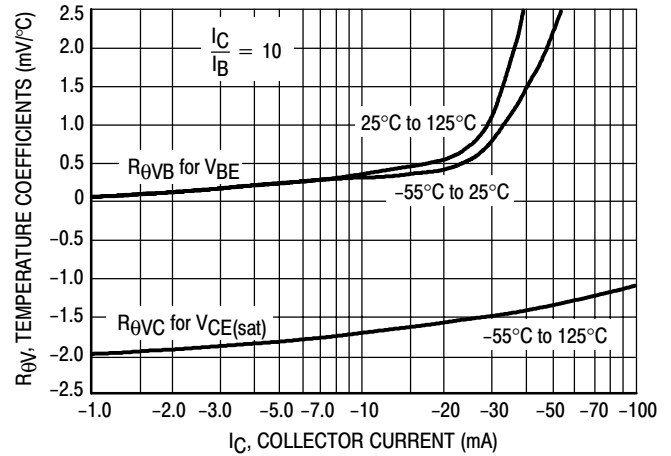


Figure 9. Temperature Coefficients – PNP 2N6520

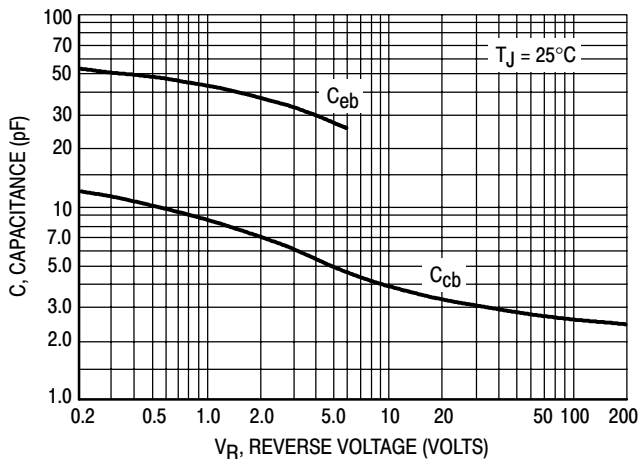


Figure 10. Capacitance – NPN 2N6515, 2N6517

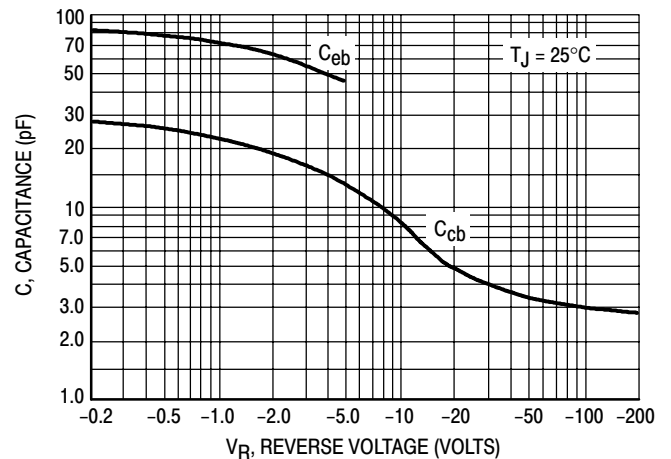


Figure 11. Capacitance – PNP 2N6520

# NPN 2N6515 2N6517 PNP 2N6520

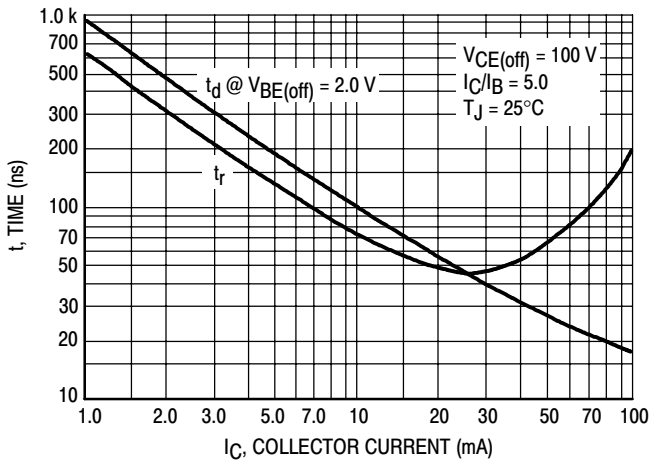


Figure 12. Turn-On Time – NPN 2N6515, 2N6517

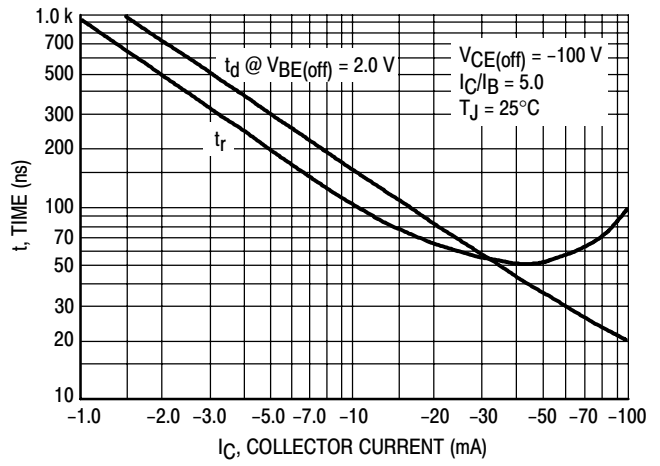


Figure 13. Turn-On Time – PNP 2N6520

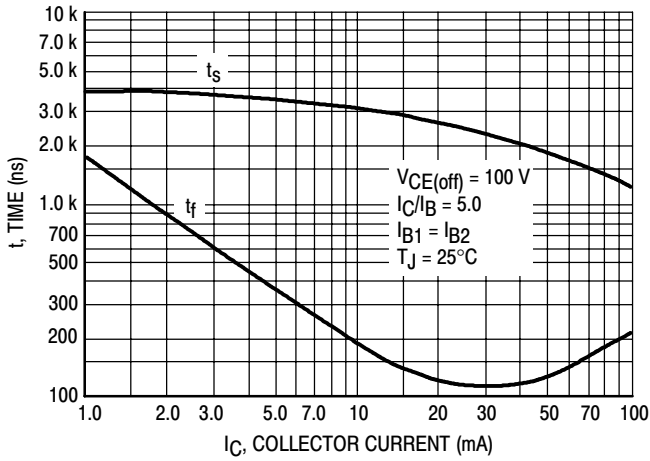


Figure 14. Turn-Off Time – NPN 2N6515, 2N6517

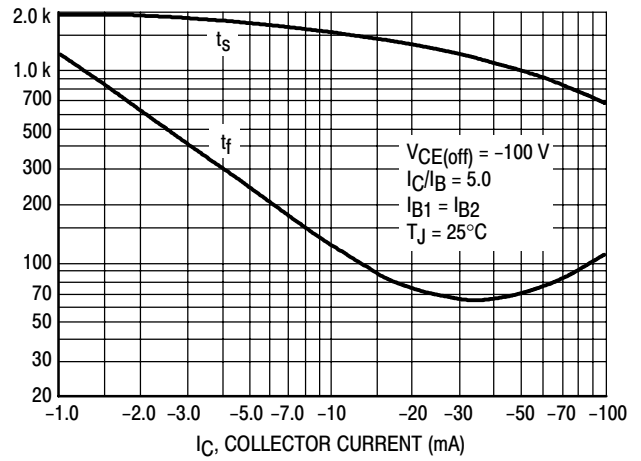


Figure 15. Turn-Off Time – PNP 2N6520

# NPN 2N6515 2N6517 PNP 2N6520

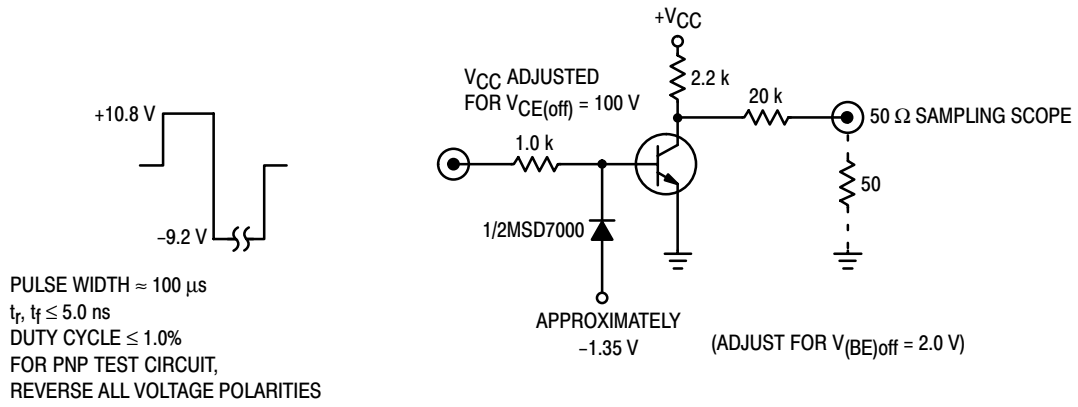


Figure 16. Switching Time Test Circuit

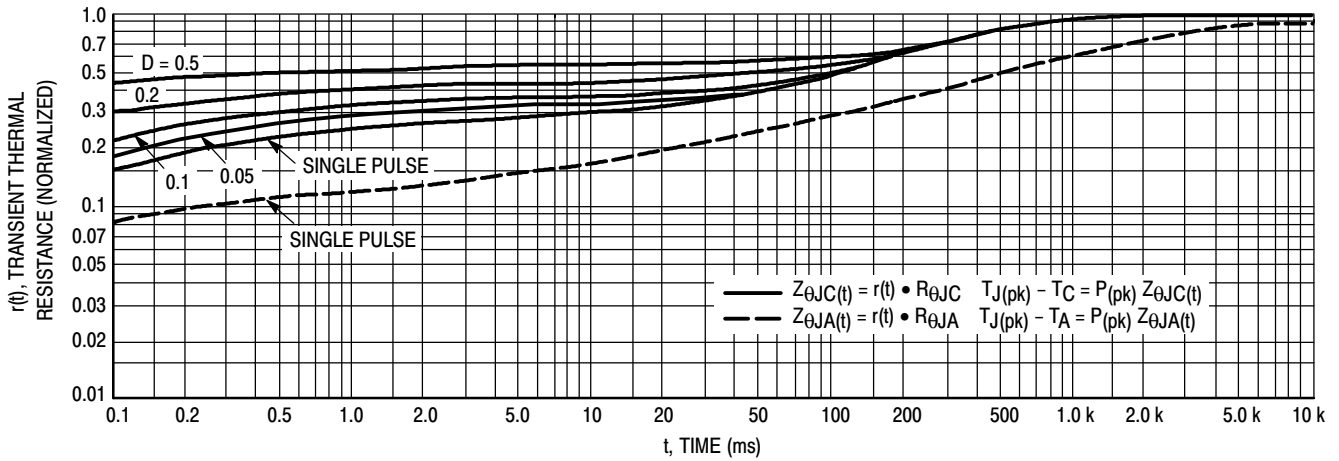


Figure 17. Thermal Response

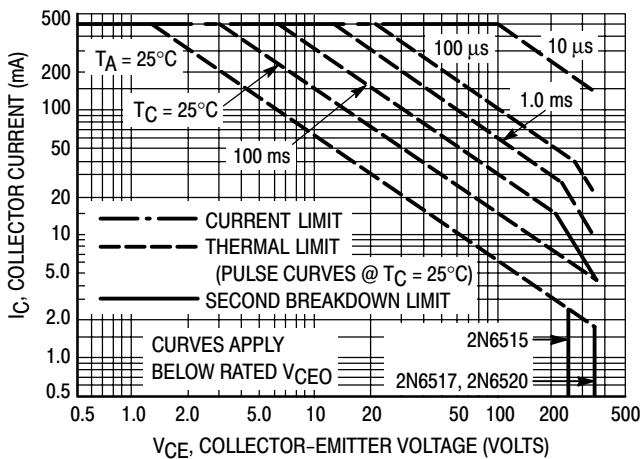
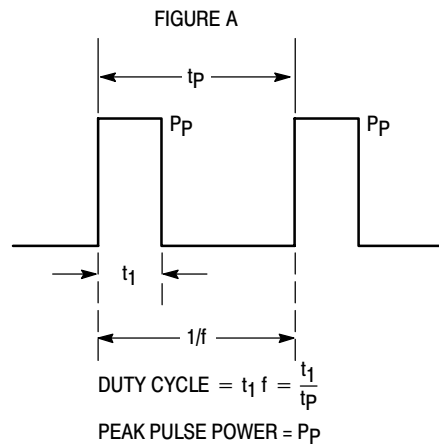


Figure 18. Active Region Safe Operating Area

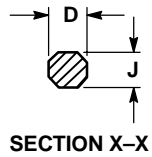
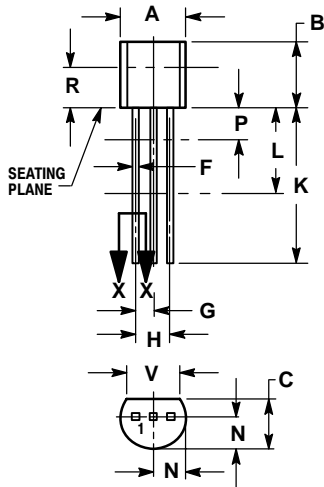


Design Note: Use of Transient Thermal Resistance Data

# NPN 2N6515 2N6517 PNP 2N6520

## PACKAGE DIMENSIONS

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.

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	0.022	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:

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

**ON Semiconductor** and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## **PUBLICATION ORDERING INFORMATION**

### **Literature Fulfillment:**

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** ONlit@hibbertco.com

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**JAPAN:** ON Semiconductor, Japan Customer Focus Center  
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031  
**Phone:** 81-3-5740-2700  
**Email:** r14525@onsemi.com

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.