

NST3946DXV6T1G, NST3946DXV6T5G

Complementary General Purpose Transistor

The NST3946DXV6T1 device is a spin-off of our popular SOT-23/SOT-323 three-leaded device. It is designed for general purpose amplifier applications and is housed in the SOT-563 six-leaded surface mount package. By putting two discrete devices in one package, this device is ideal for low-power surface mount applications where board space is at a premium.

- h_{FE} , 100–300
- Low $V_{CE(sat)}$, ≤ 0.4 V
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Table 1. MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector – Emitter Voltage (NPN) (PNP)	V_{CEO}	40 –40	Vdc
Collector – Base Voltage (NPN) (PNP)	V_{CBO}	60 –40	Vdc
Emitter – Base Voltage (NPN) (PNP)	V_{EBO}	6.0 –5.0	Vdc
Collector Current – Continuous (NPN) (PNP)	I_C	200 –200	mAdc
Electrostatic Discharge	ESD	HBM>16000, MM>2000	V

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.

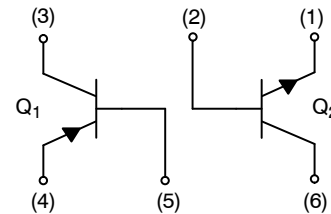


ON Semiconductor®

<http://onsemi.com>



**SOT-563
CASE 463A**



NST3946DXV6T1*

*Q1 PNP
Q2 NPN

MARKING DIAGRAM



46 = Specific Device Code
M = Date Code
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NST3946DXV6T1G	SOT-563 (Pb-Free)	4,000/Tape & Reel
NST3946DXV6T5G	SOT-563 (Pb-Free)	8,000/Tape & Reel

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

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Table 2. THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)		Symbol	Max	Unit
Total Device Dissipation Derate above 25°C	$T_A = 25^\circ\text{C}$	P_D	357 (Note 1) 2.9 (Note 1)	mW mW/°C
Thermal Resistance Junction-to-Ambient		$R_{\theta JA}$	350 (Note 1)	°C/W
Characteristic (Both Junctions Heated)		Symbol	Max	Unit
Total Device Dissipation Derate above 25°C	$T_A = 25^\circ\text{C}$	P_D	500 (Note 1) 4.0 (Note 1)	mW mW/°C
Thermal Resistance Junction-to-Ambient		$R_{\theta JA}$	250 (Note 1)	°C/W
Junction and Storage Temperature Range		T_J, T_{stg}	55 to +150	°C

1. FR-4 @ Minimum Pad

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

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector – Emitter Breakdown Voltage (Note 2) ($I_C = 1.0\text{ mAdc}, I_B = 0$) ($I_C = -1.0\text{ mAdc}, I_B = 0$)	(NPN) (PNP)	$V_{(BR)CEO}$	40 -40	- -	Vdc
Collector – Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{Adc}, I_E = 0$) ($I_C = -10\text{ }\mu\text{Adc}, I_E = 0$)	(NPN) (PNP)	$V_{(BR)CBO}$	60 -40	- -	Vdc
Emitter – Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{Adc}, I_C = 0$) ($I_E = -10\text{ }\mu\text{Adc}, I_C = 0$)	(NPN) (PNP)	$V_{(BR)EBO}$	6.0 -5.0	- -	Vdc
Base Cutoff Current ($V_{CE} = 30\text{ Vdc}, V_{EB} = 3.0\text{ Vdc}$) ($V_{CE} = -30\text{ Vdc}, V_{EB} = -3.0\text{ Vdc}$)	(NPN) (PNP)	I_{BL}	- -	50 -50	nAdc
Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}, V_{EB} = 3.0\text{ Vdc}$) ($V_{CE} = -30\text{ Vdc}, V_{EB} = -3.0\text{ Vdc}$)	(NPN) (PNP)	I_{CEX}	- -	50 -50	nAdc

ON CHARACTERISTICS (Note 2)

DC Current Gain ($I_C = 0.1\text{ mAdc}, V_{CE} = 1.0\text{ Vdc}$) ($I_C = 1.0\text{ mAdc}, V_{CE} = 1.0\text{ Vdc}$) ($I_C = 10\text{ mAdc}, V_{CE} = 1.0\text{ Vdc}$) ($I_C = 50\text{ mAdc}, V_{CE} = 1.0\text{ Vdc}$) ($I_C = 100\text{ mAdc}, V_{CE} = 1.0\text{ Vdc}$) ($I_C = -0.1\text{ mAdc}, V_{CE} = -1.0\text{ Vdc}$) ($I_C = -1.0\text{ mAdc}, V_{CE} = -1.0\text{ Vdc}$) ($I_C = -10\text{ mAdc}, V_{CE} = -1.0\text{ Vdc}$) ($I_C = -50\text{ mAdc}, V_{CE} = -1.0\text{ Vdc}$) ($I_C = -100\text{ mAdc}, V_{CE} = -1.0\text{ Vdc}$)	(NPN) (PNP)	h_{FE}	40 70 100 60 30 60 80 100 60 30	- - 300 - - - - 300 - -	-
Collector – Emitter Saturation Voltage ($I_C = 10\text{ mAdc}, I_B = 1.0\text{ mAdc}$) ($I_C = 50\text{ mAdc}, I_B = 5.0\text{ mAdc}$) ($I_C = -10\text{ mAdc}, I_B = -1.0\text{ mAdc}$) ($I_C = -50\text{ mAdc}, I_B = -5.0\text{ mAdc}$)	(NPN) (PNP)	$V_{CE(sat)}$	- - - -	0.2 0.3 -0.25 -0.4	Vdc
Base – Emitter Saturation Voltage ($I_C = 10\text{ mAdc}, I_B = 1.0\text{ mAdc}$) ($I_C = 50\text{ mAdc}, I_B = 5.0\text{ mAdc}$) ($I_C = -10\text{ mAdc}, I_B = -1.0\text{ mAdc}$) ($I_C = -50\text{ mAdc}, I_B = -5.0\text{ mAdc}$)	(NPN) (PNP)	$V_{BE(sat)}$	0.65 - -0.65 -	0.85 0.95 -0.85 -0.95	Vdc

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

Characteristic	Symbol	Min	Max	Unit
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain – Bandwidth Product (I _C = 10 mAdc, V _{CE} = 20 Vdc, f = 100 MHz) (I _C = -10 mAdc, V _{CE} = -20 Vdc, f = 100 MHz)	f _T (NPN) (PNP)	300 250	– –	MHz
Output Capacitance (V _{CB} = 5.0 Vdc, I _E = 0, f = 1.0 MHz) (V _{CB} = -5.0 Vdc, I _E = 0, f = 1.0 MHz)	C _{obo} (NPN) (PNP)	– –	4.0 4.5	pF
Input Capacitance (V _{EB} = 0.5 Vdc, I _C = 0, f = 1.0 MHz) (V _{EB} = -0.5 Vdc, I _C = 0, f = 1.0 MHz)	C _{ibo} (NPN) (PNP)	– –	8.0 10.0	pF
Input Impedance (V _{CE} = 10 Vdc, I _C = 1.0 mAdc, f = 1.0 kHz) (V _{CE} = -10 Vdc, I _C = -1.0 mAdc, f = 1.0 kHz)	h _{ie} (NPN) (PNP)	1.0 2.0	10 12	k Ω
Voltage Feedback Ratio (V _{CE} = 10 Vdc, I _C = 1.0 mAdc, f = 1.0 kHz) (V _{CE} = -10 Vdc, I _C = -1.0 mAdc, f = 1.0 kHz)	h _{re} (NPN) (PNP)	0.5 0.1	8.0 10	X 10 ⁻⁴
Small-Signal Current Gain (V _{CE} = 10 Vdc, I _C = 1.0 mAdc, f = 1.0 kHz) (V _{CE} = -10 Vdc, I _C = -1.0 mAdc, f = 1.0 kHz)	h _{fe} (NPN) (PNP)	100 100	400 400	–
Output Admittance (V _{CE} = 10 Vdc, I _C = 1.0 mAdc, f = 1.0 kHz) (V _{CE} = -10 Vdc, I _C = -1.0 mAdc, f = 1.0 kHz)	h _{oe} (NPN) (PNP)	1.0 3.0	40 60	μmhos
Noise Figure (V _{CE} = 5.0 Vdc, I _C = 100 μAdc, R _S = 1.0 k Ω, f = 1.0 kHz) (V _{CE} = -5.0 Vdc, I _C = -100 μAdc, R _S = 1.0 k Ω, f = 1.0 kHz)	NF (NPN) (PNP)	– –	5.0 4.0	dB

SWITCHING CHARACTERISTICS

Delay Time (V _{CC} = 3.0 Vdc, V _{BE} = -0.5 Vdc) (V _{CC} = -3.0 Vdc, V _{BE} = 0.5 Vdc)	t _d (NPN) (PNP)	– –	35 35	ns
Rise Time (I _C = 10 mAdc, I _{B1} = 1.0 mAdc) (I _C = -10 mAdc, I _{B1} = -1.0 mAdc)	t _r (NPN) (PNP)	– –	35 35	
Storage Time (V _{CC} = 3.0 Vdc, I _C = 10 mAdc) (V _{CC} = -3.0 Vdc, I _C = -10 mAdc)	t _s (NPN) (PNP)	– –	200 225	ns
Fall Time (I _{B1} = I _{B2} = 1.0 mAdc) (I _{B1} = I _{B2} = -1.0 mAdc)	t _f (NPN) (PNP)	– –	50 75	

2. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

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(NPN)

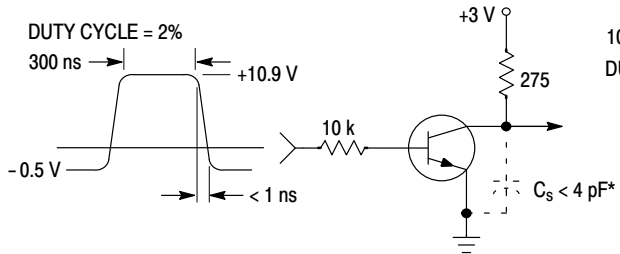


Figure 1. Delay and Rise Time Equivalent Test Circuit

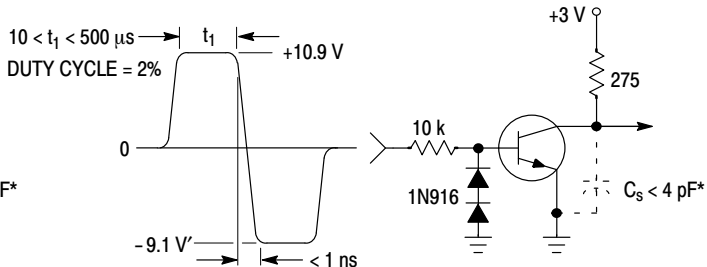


Figure 2. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

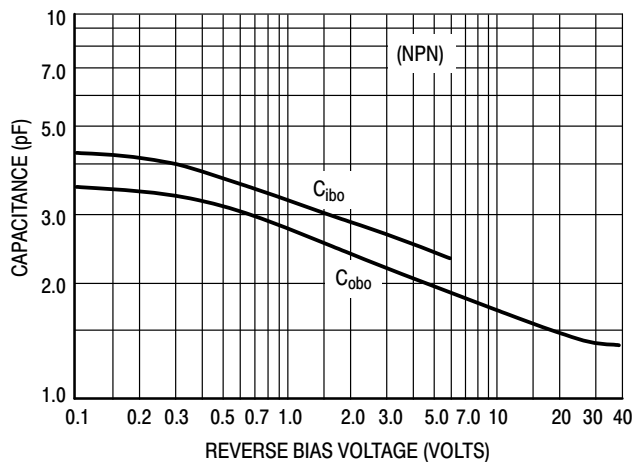


Figure 3. Capacitance

NST3946DXV6T1G, NST3946DXV6T5G

(NPN)

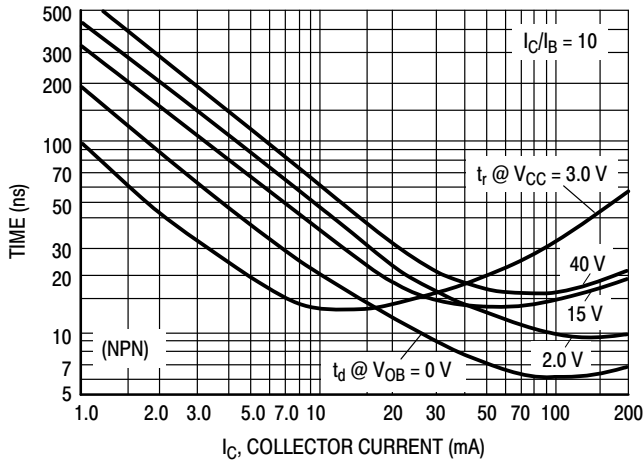


Figure 4. Turn-On Time

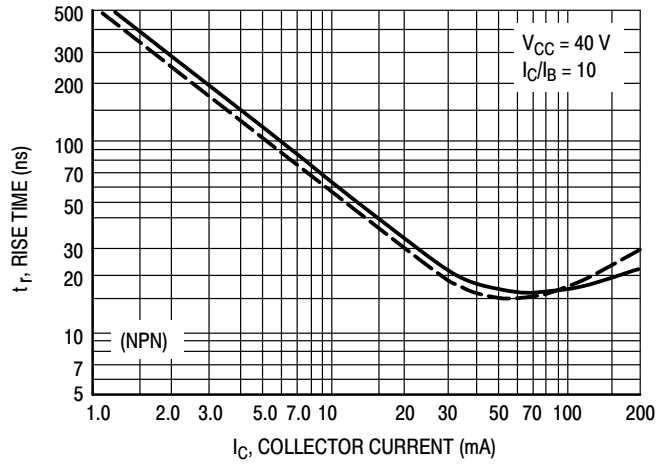


Figure 5. Rise Time

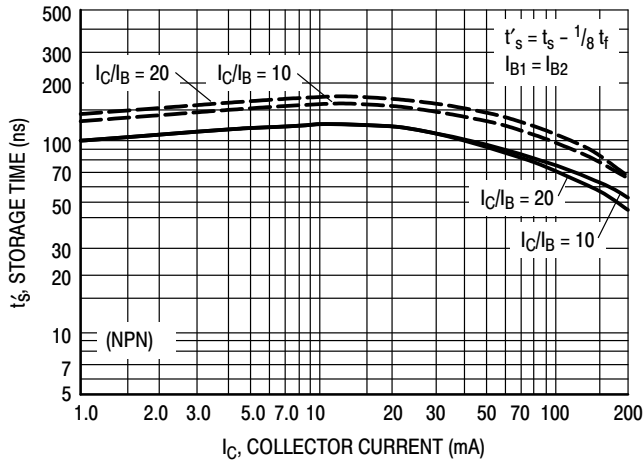


Figure 6. Storage Time

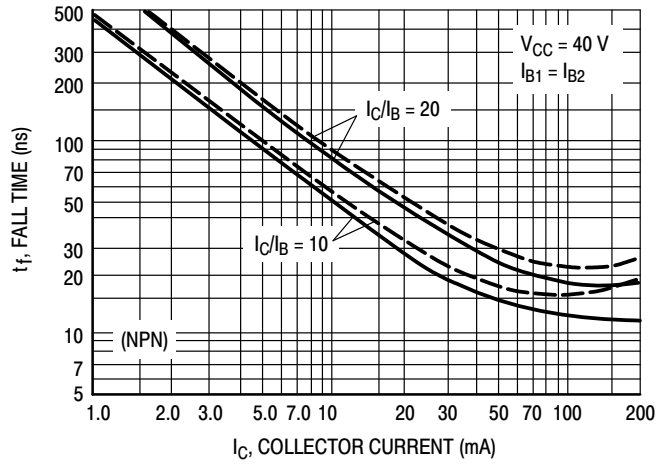


Figure 7. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

($V_{CE} = 5.0 \text{ Vdc}$, $T_A = 25^\circ\text{C}$, Bandwidth = 1.0 Hz)

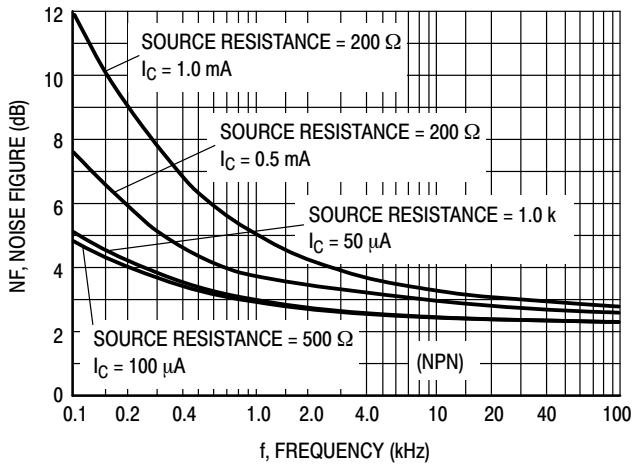


Figure 8. Noise Figure

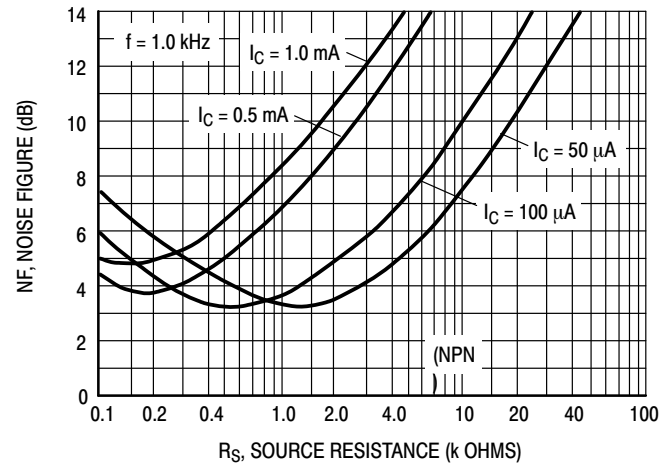


Figure 9. Noise Figure

NST3946DXV6T1G, NST3946DXV6T5G

(NPN)

h PARAMETERS

($V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$, $T_A = 25^\circ\text{C}$)

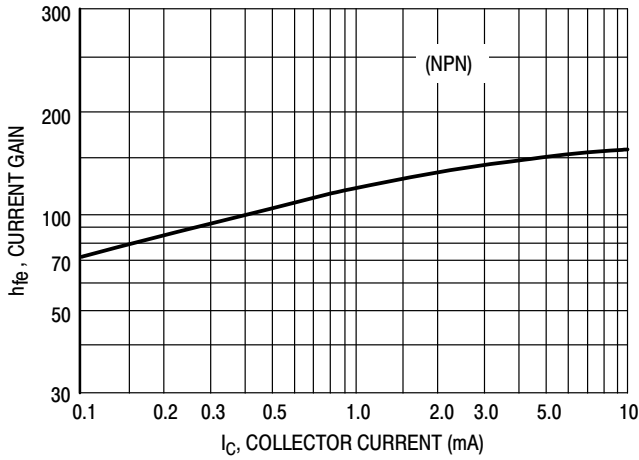


Figure 10. Current Gain

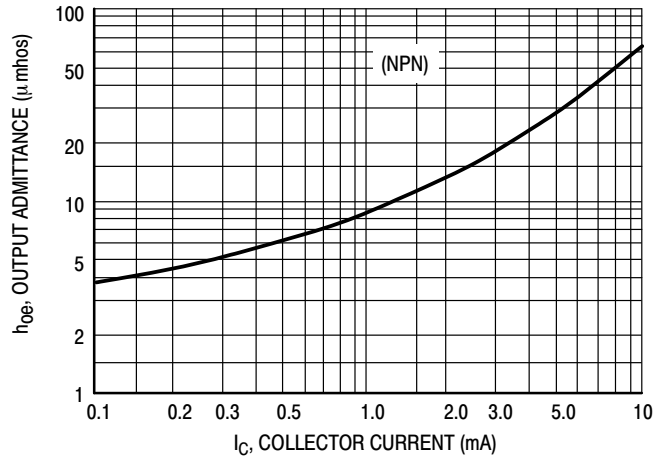


Figure 11. Output Admittance

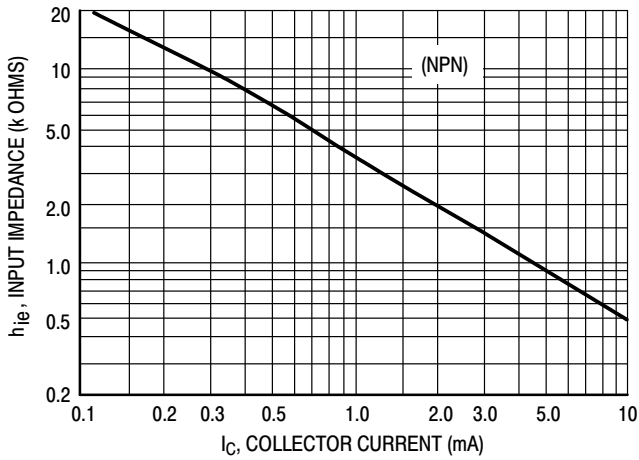


Figure 12. Input Impedance

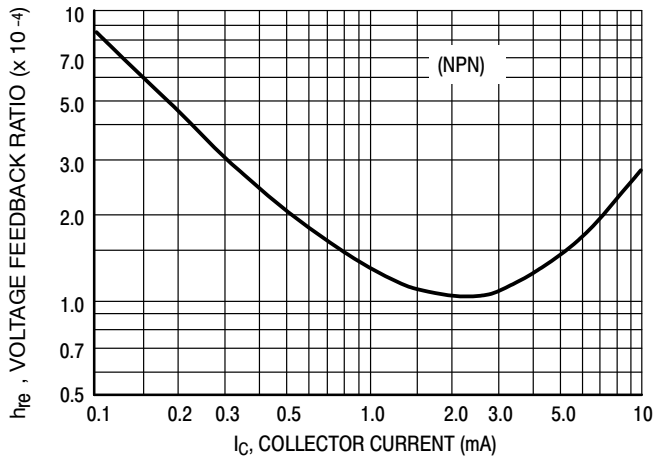


Figure 13. Voltage Feedback Ratio

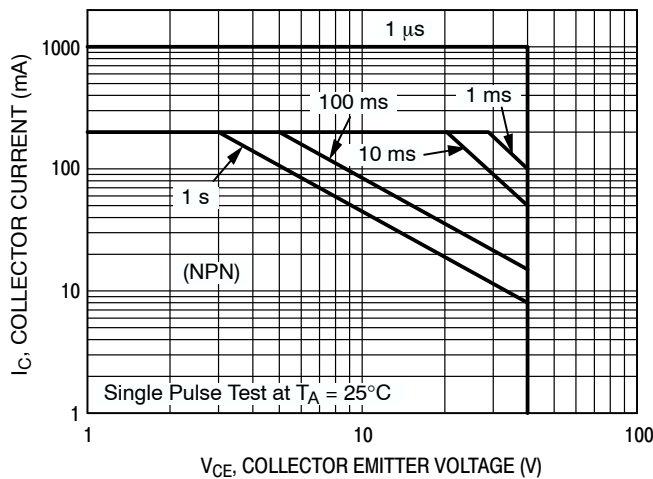


Figure 14. Safe Operating Area

NST3946DXV6T1G, NST3946DXV6T5G

(NPN)

TYPICAL STATIC CHARACTERISTICS

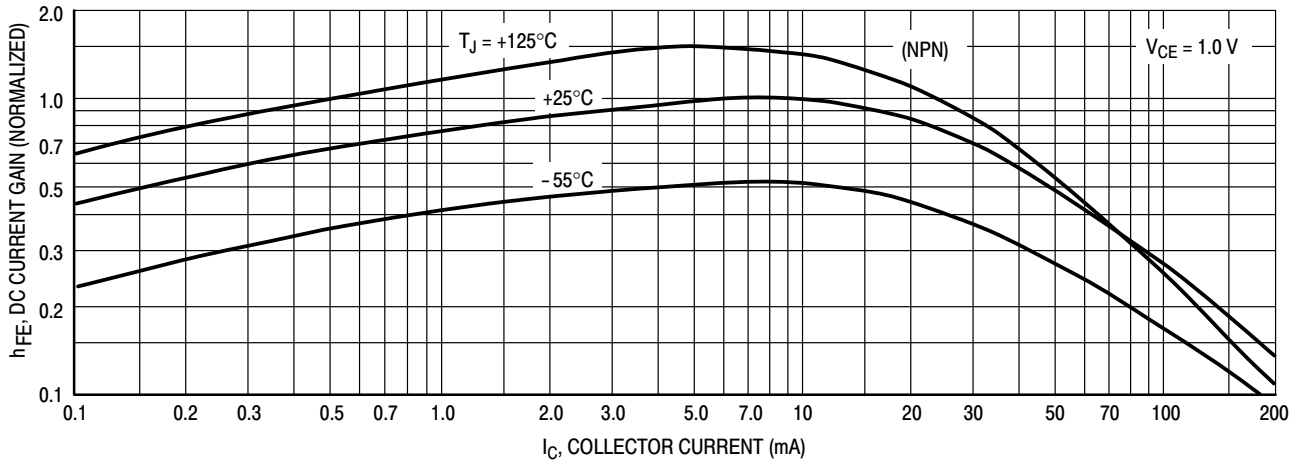


Figure 15. DC Current Gain

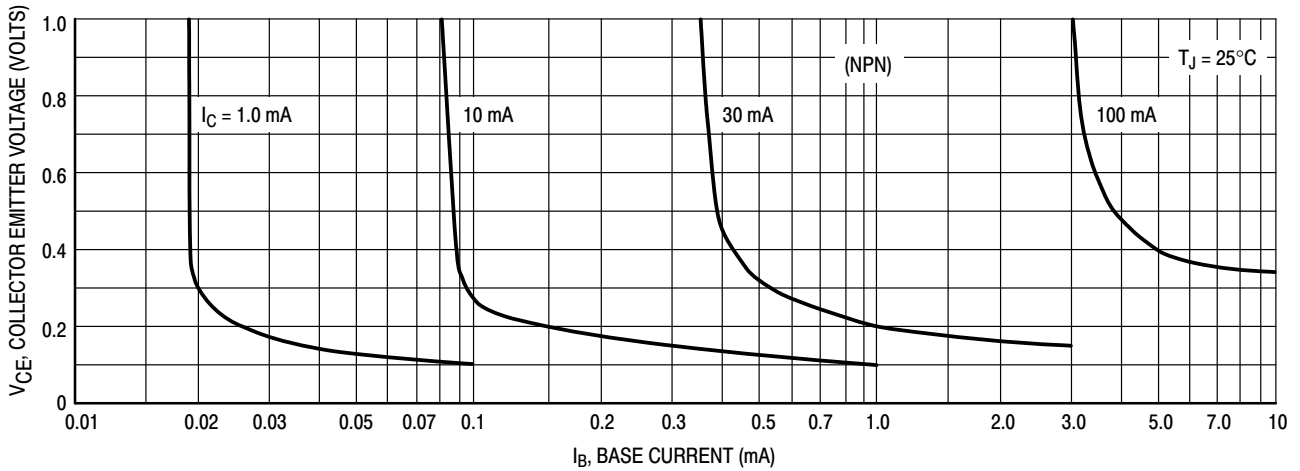


Figure 16. Collector Saturation Region

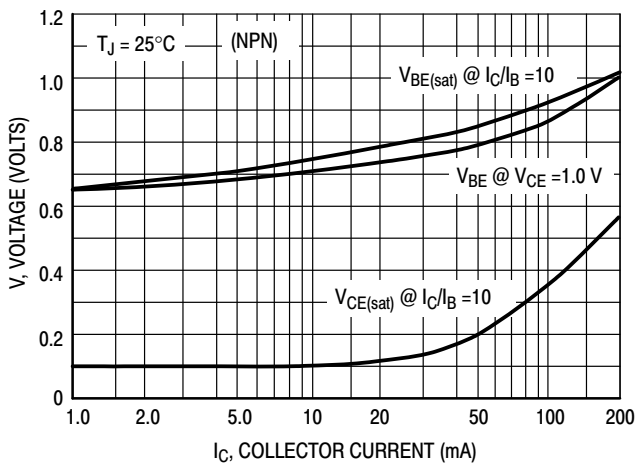


Figure 17. "ON" Voltages

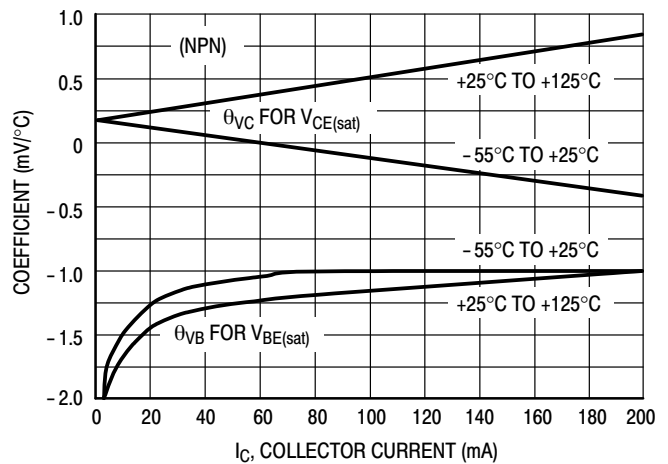


Figure 18. Temperature Coefficients

NST3946DXV6T1G, NST3946DXV6T5G

(PNP)

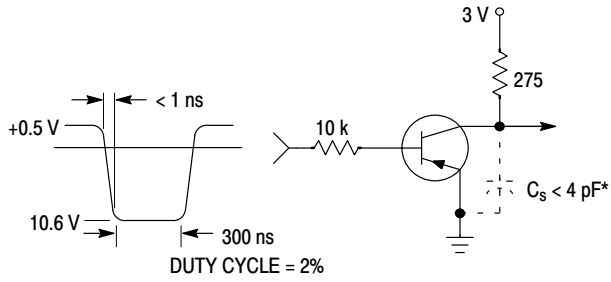


Figure 19. Delay and Rise Time Equivalent Test Circuit

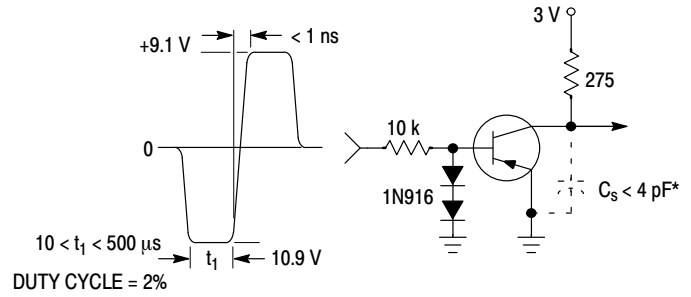


Figure 20. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

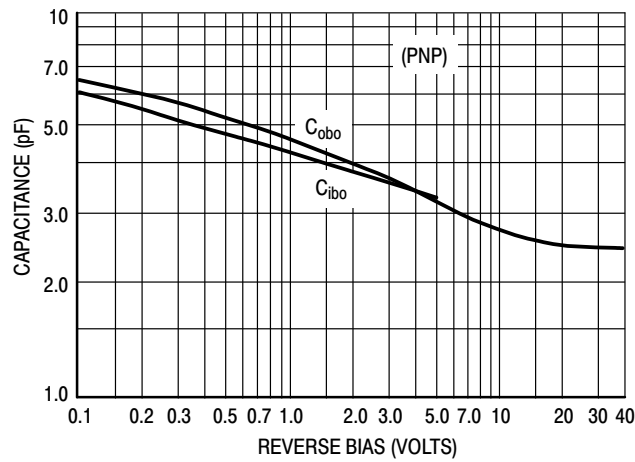


Figure 21. Capacitance

— $T_J = 25^\circ\text{C}$
 - - - $T_J = 125^\circ\text{C}$

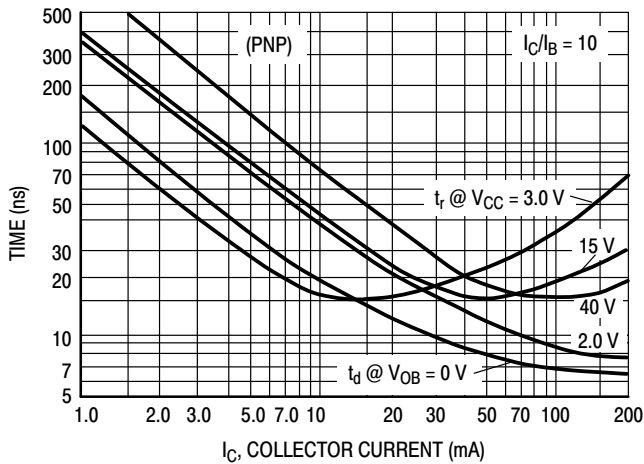


Figure 22. Turn-On Time

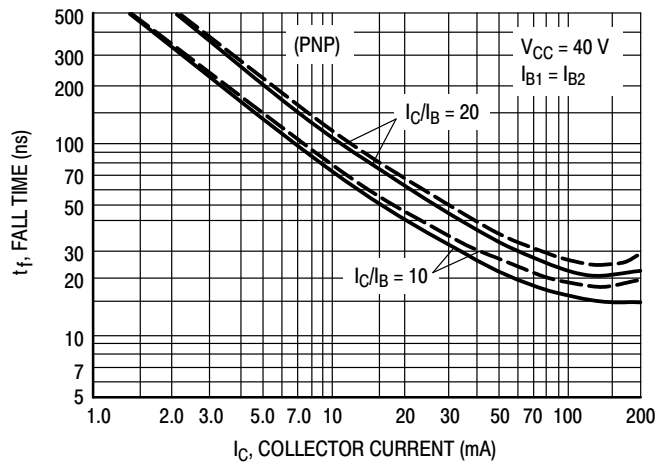


Figure 23. Fall Time

NST3946DXV6T1G, NST3946DXV6T5G

(PNP)

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

($V_{CE} = -5.0$ Vdc, $T_A = 25^\circ\text{C}$, Bandwidth = 1.0 Hz)

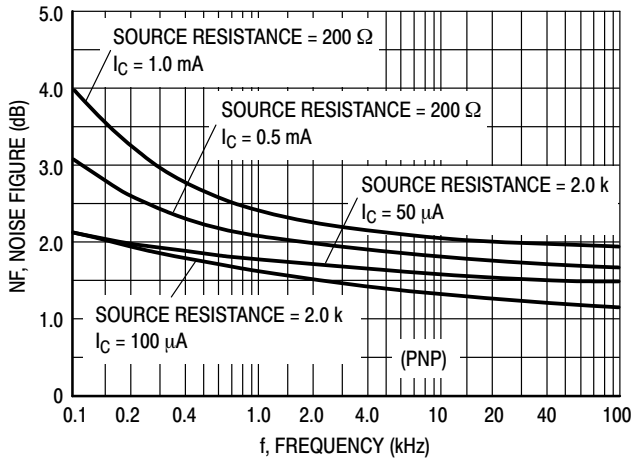


Figure 24.

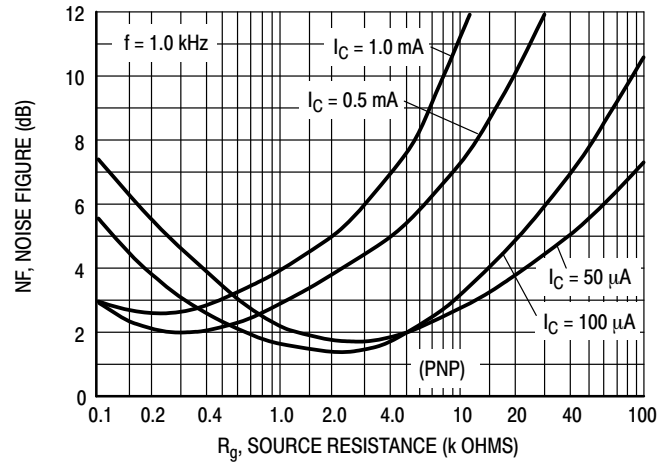


Figure 25.

h PARAMETERS

($V_{CE} = -10$ Vdc, $f = 1.0$ kHz, $T_A = 25^\circ\text{C}$)

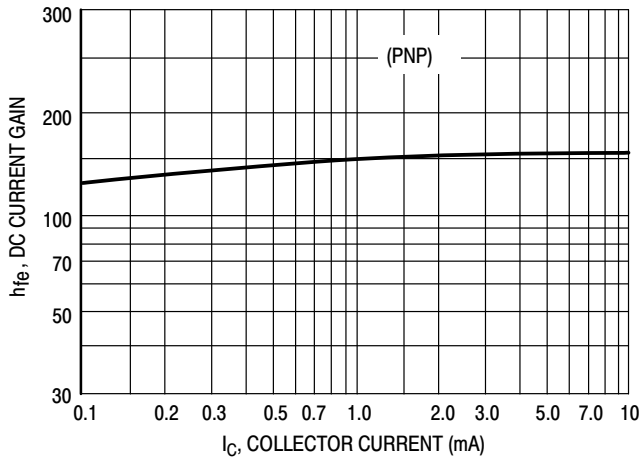


Figure 26. Current Gain

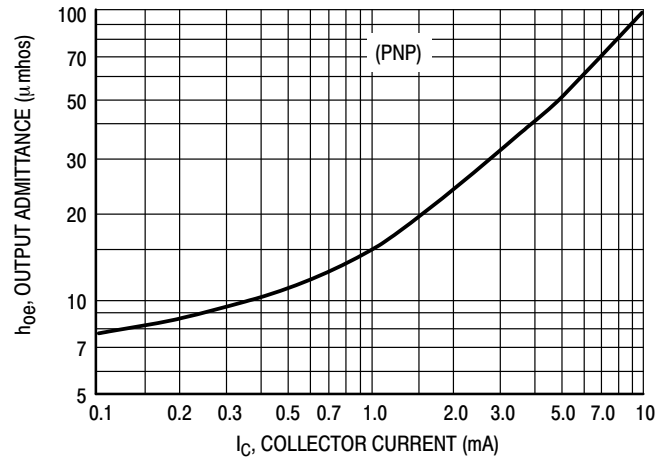


Figure 27. Output Admittance

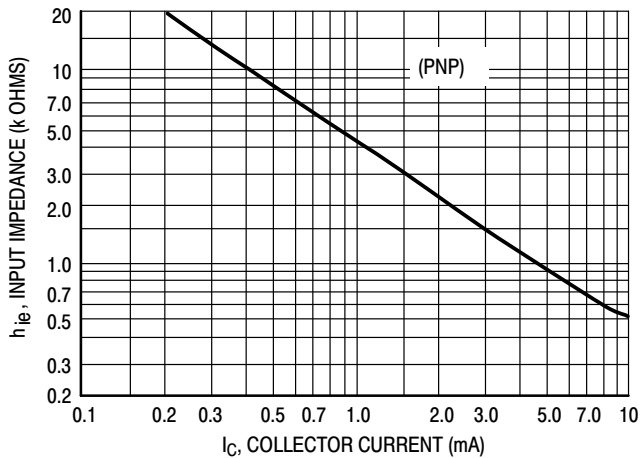


Figure 28. Input Impedance

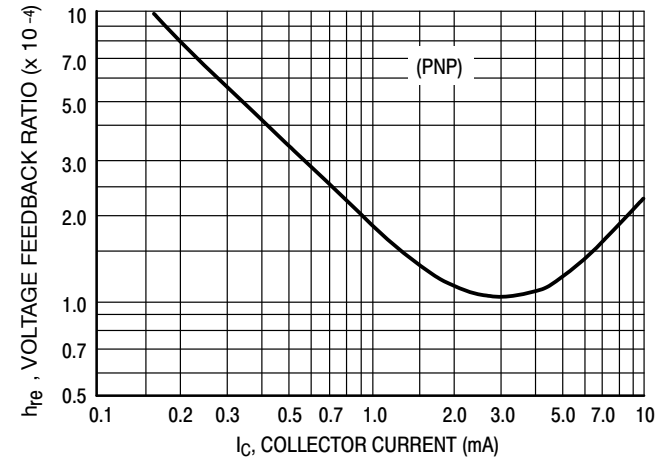


Figure 29. Voltage Feedback Ratio

NST3946DXV6T1G, NST3946DXV6T5G

(PNP)

TYPICAL STATIC CHARACTERISTICS

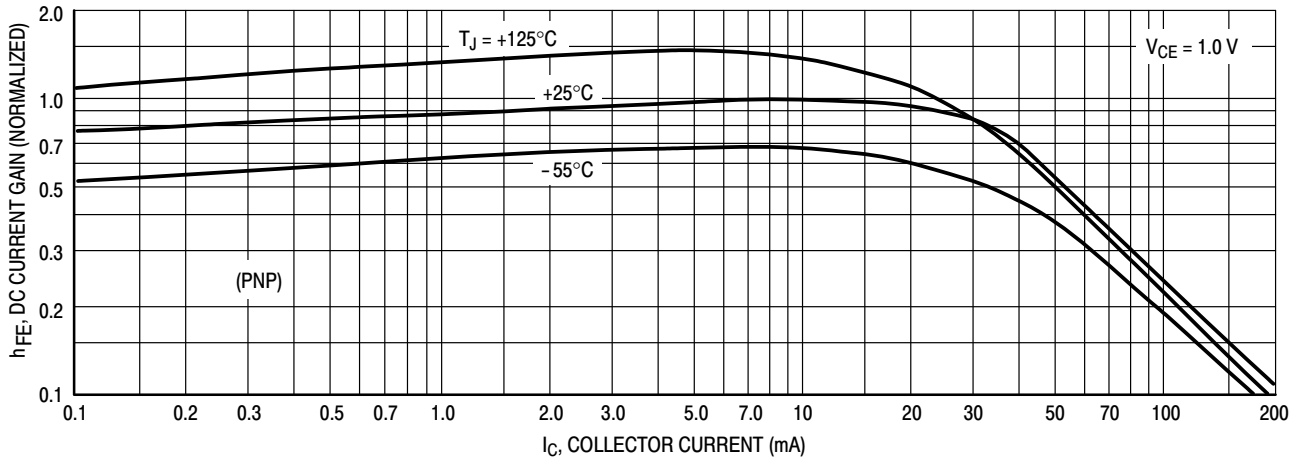


Figure 30. DC Current Gain

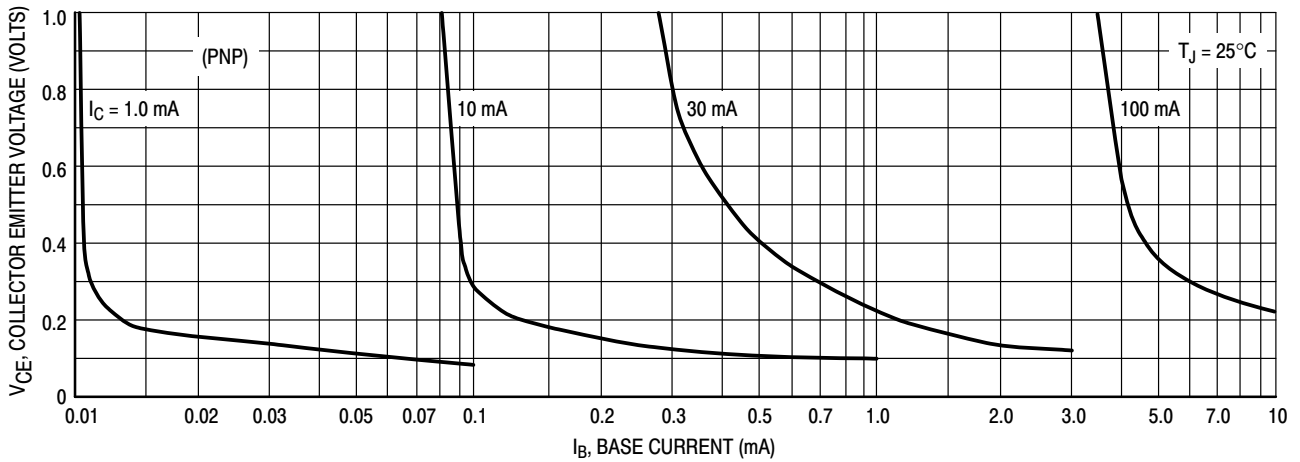


Figure 31. Collector Saturation Region

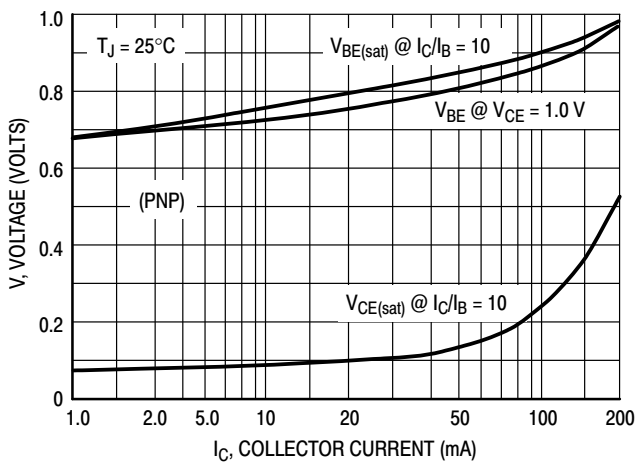


Figure 32. "ON" Voltages

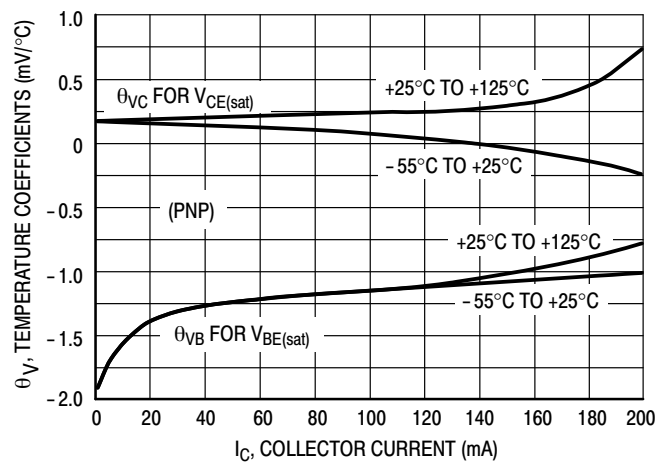


Figure 33. Temperature Coefficients

NST3946DXV6T1G, NST3946DXV6T5G

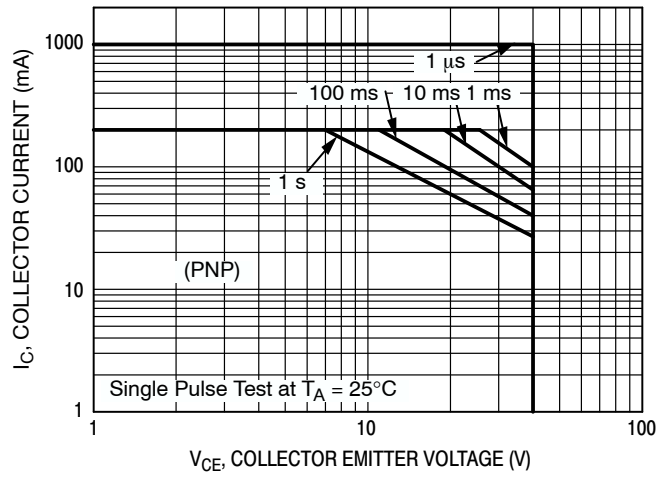
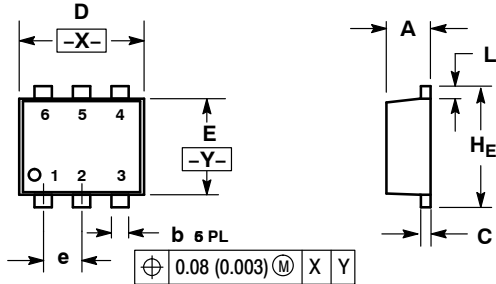


Figure 34. Safe Operating Area

NST3946DXV6T1G, NST3946DXV6T5G

PACKAGE DIMENSIONS

SOT-563, 6 LEAD CASE 463A ISSUE F

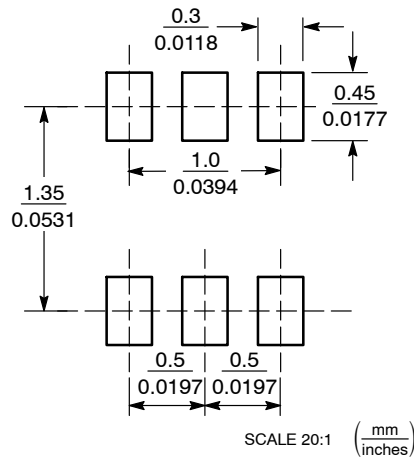


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.50	0.55	0.60	0.020	0.021	0.023
b	0.17	0.22	0.27	0.007	0.009	0.011
C	0.08	0.12	0.18	0.003	0.005	0.007
D	1.50	1.60	1.70	0.059	0.062	0.066
E	1.10	1.20	1.30	0.043	0.047	0.051
e	0.5 BSC			0.02 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
H _E	1.50	1.60	1.70	0.059	0.062	0.066

SOLDERING FOOTPRINT*



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

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