

# NST3904DXV6T1, NSVT3904DXV6T1, NST3904DXV6T5, SNST3904DXV6T5



## Dual General Purpose Transistor

The NST3904DXV6T1 device is a spin-off of our popular SOT-23/SOT-323 three-lead device. It is designed for general purpose amplifier applications and is housed in the SOT-563 six-lead 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.

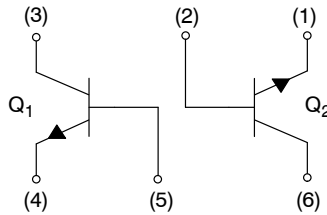
### Features

- $h_{FE}$ , 100–300
- Low  $V_{CE(sat)}$ ,  $\leq 0.4$  V
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- AEC-Q101 Qualified and PPAP Capable – NSVT3904DXV6T1, SNST3904DXV6T5
- S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- These are Pb-Free Devices

### MAXIMUM RATINGS

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

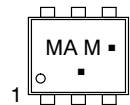
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



NST3904DXV6T1



SOT-563  
CASE 463A  
PLASTIC



MA = Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### MARKING DIAGRAM

### ORDERING INFORMATION

Device	Package	Shipping†
NST3904DXV6T1	SOT-563*	4000/Tape & Reel
NST3904DXV6T1G	SOT-563*	4000/Tape & Reel
NSVT3904DXV6T1G	SOT-563*	4000/Tape & Reel
NST3904DXV6T5	SOT-563*	8000/Tape & Reel
NST3904DXV6T5G	SOT-563*	8000/Tape & Reel
SNST3904DXV6T5G	SOT-563*	8000/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.

\*This package is inherently Pb-Free.

# NST3904DXV6T1, NSVT3904DXV6T1, NST3904DXV6T5, SNST3904DXV6T5

## THERMAL CHARACTERISTICS

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

1. FR-4 @ Minimum Pad

# NST3904DXV6T1, NSVT3904DXV6T1, NST3904DXV6T5, SNST3904DXV6T5

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector - Emitter Breakdown Voltage (Note 2) ( $I_C = 1.0 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	40	-	Vdc
Collector - Base Breakdown Voltage ( $I_C = 10 \text{ }\mu\text{Adc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	60	-	Vdc
Emitter - Base Breakdown Voltage ( $I_E = 10 \text{ }\mu\text{Adc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	6.0	-	Vdc
Base Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $V_{EB} = 3.0 \text{ Vdc}$ )	$I_{BL}$	-	50	nAdc
Collector Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $V_{EB} = 3.0 \text{ Vdc}$ )	$I_{CEX}$	-	50	nAdc

## ON CHARACTERISTICS (Note 2)

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

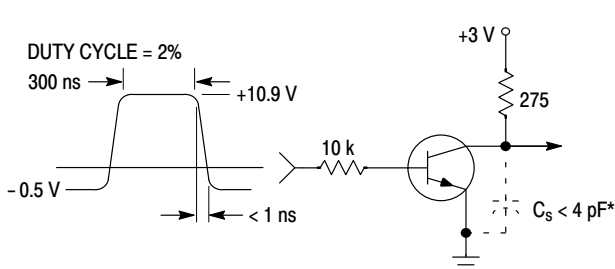
## SMALL-SIGNAL CHARACTERISTICS

Current - Gain - Bandwidth Product ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 20 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )	$f_T$	300	-	MHz
Output Capacitance ( $V_{CB} = 5.0 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{obo}$	-	4.0	pF
Input Capacitance ( $V_{EB} = 0.5 \text{ Vdc}$ , $I_C = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{ibo}$	-	8.0	pF
Input Impedance ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{ie}$	1.0 2.0	10 12	k $\Omega$
Voltage Feedback Ratio ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{re}$	0.5 0.1	8.0 10	$\times 10^{-4}$
Small - Signal Current Gain ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{fe}$	100 100	400 400	-
Output Admittance ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )	$h_{oe}$	1.0 3.0	40 60	$\mu\text{mhos}$
Noise Figure ( $V_{CE} = 5.0 \text{ Vdc}$ , $I_C = 100 \text{ }\mu\text{Adc}$ , $R_S = 1.0 \text{ k}\Omega$ , $f = 1.0 \text{ kHz}$ )	NF	- -	5.0 4.0	dB

## SWITCHING CHARACTERISTICS

Delay Time	( $V_{CC} = 3.0 \text{ Vdc}$ , $V_{BE} = -0.5 \text{ Vdc}$ )	$t_d$	-	35	ns
Rise Time	( $I_C = 10 \text{ mAdc}$ , $I_{B1} = 1.0 \text{ mAdc}$ )	$t_r$	-	35	
Storage Time	( $V_{CC} = 3.0 \text{ Vdc}$ , $I_C = 10 \text{ mAdc}$ )	$t_s$	-	200	ns
Fall Time	( $I_{B1} = I_{B2} = 1.0 \text{ mAdc}$ )	$t_f$	-	50	

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



\* Total shunt capacitance of test jig and connectors

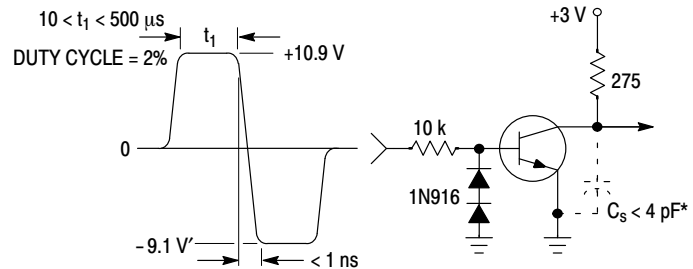


Figure 1. Delay and Rise Time Equivalent Test Circuit

Figure 2. Storage and Fall Time Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

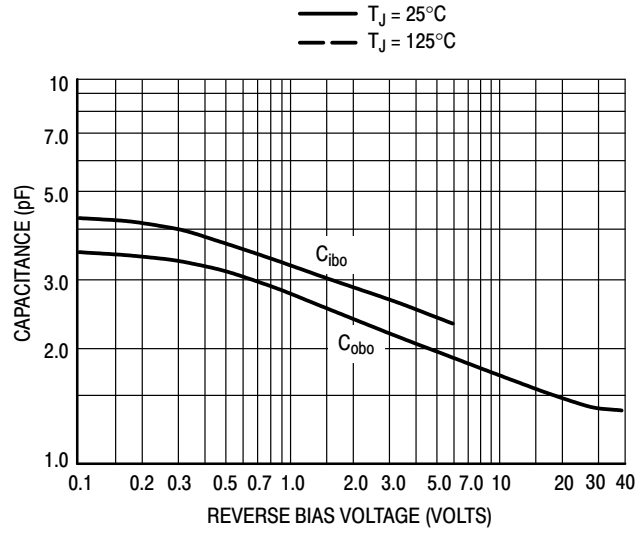


Figure 3. Capacitance

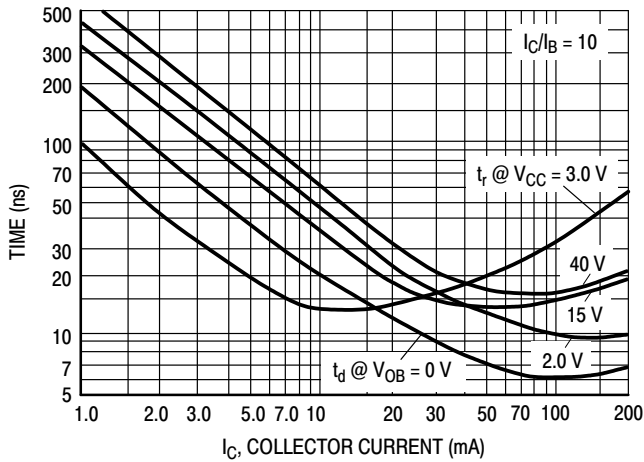


Figure 4. Turn-On Time

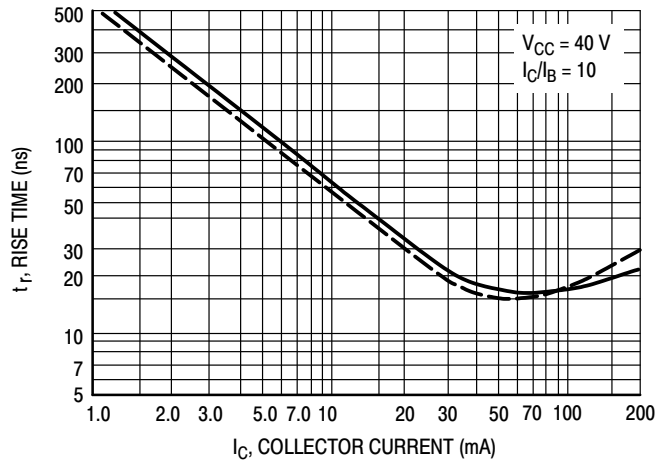


Figure 5. Rise Time

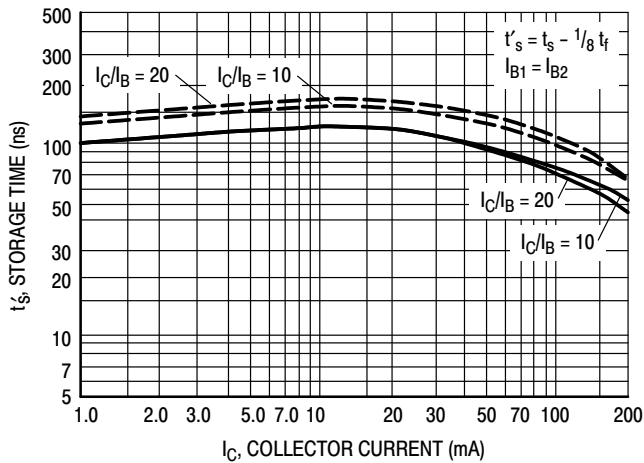


Figure 6. Storage Time

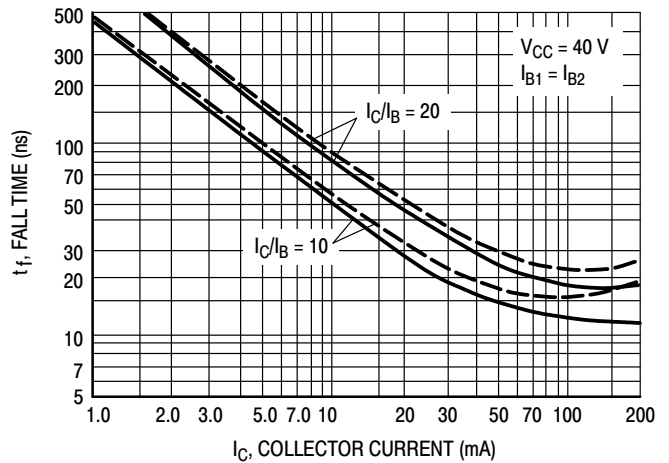


Figure 7. Fall Time

**TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS  
NOISE FIGURE VARIATIONS**

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

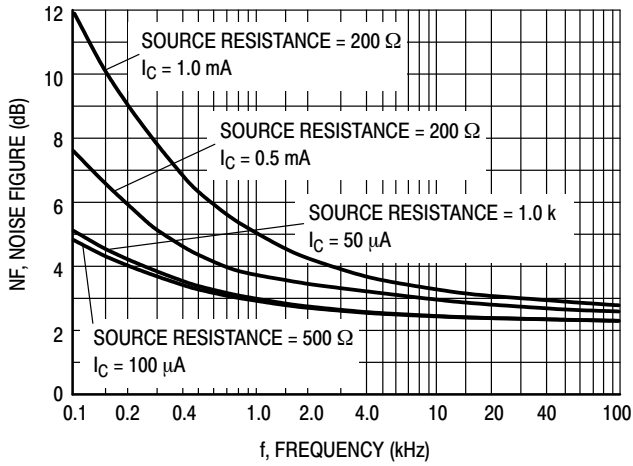


Figure 8. Noise Figure

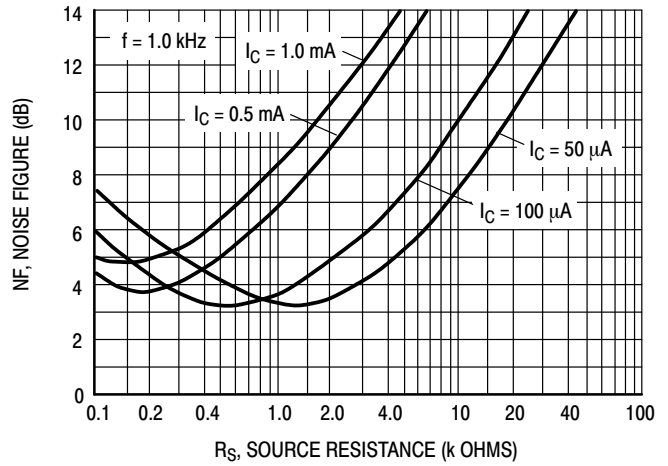


Figure 9. Noise Figure

**h PARAMETERS**

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

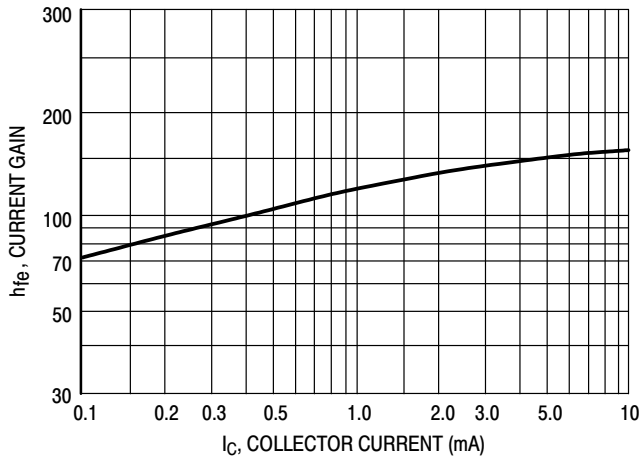


Figure 10. Current Gain

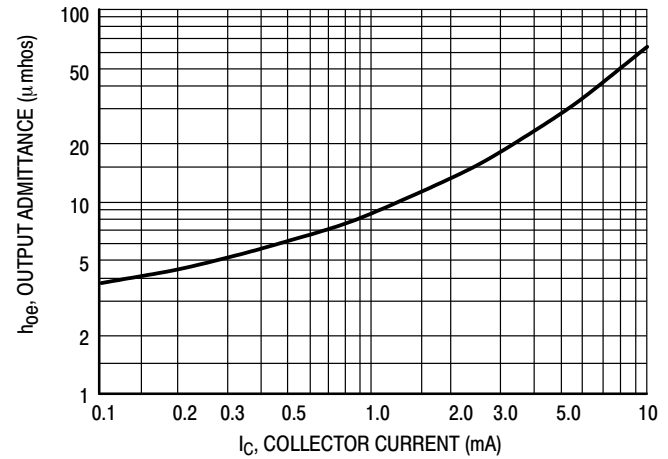


Figure 11. Output Admittance

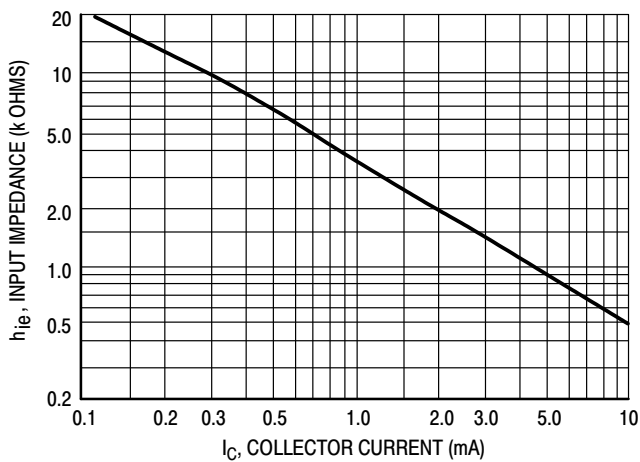


Figure 12. Input Impedance

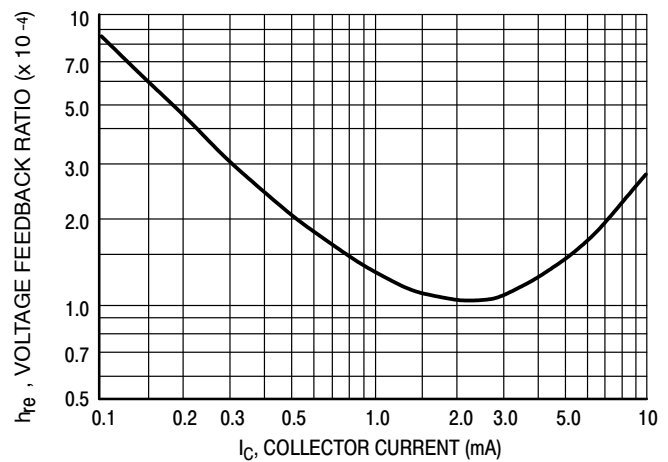


Figure 13. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

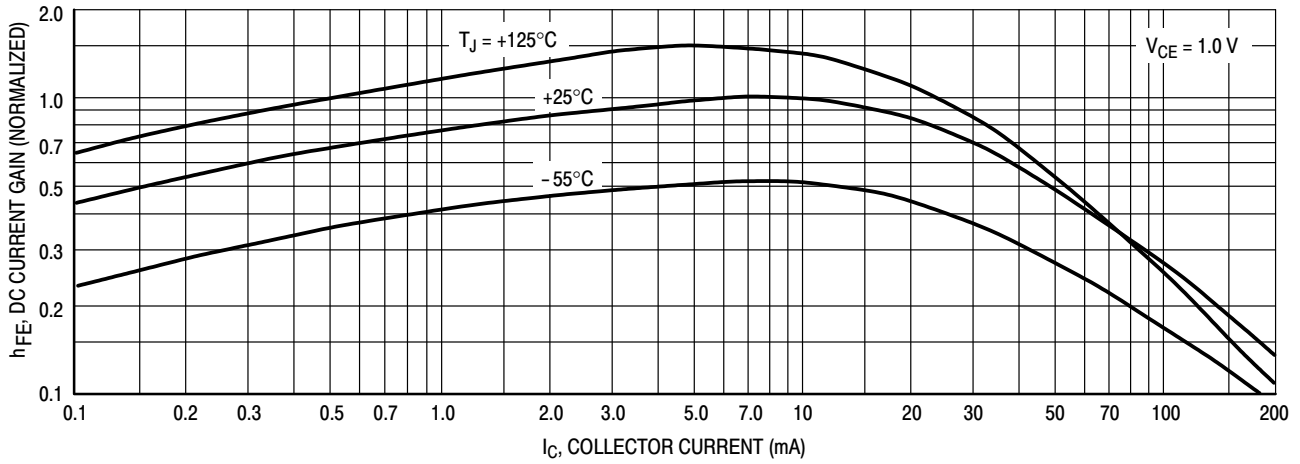


Figure 14. DC Current Gain

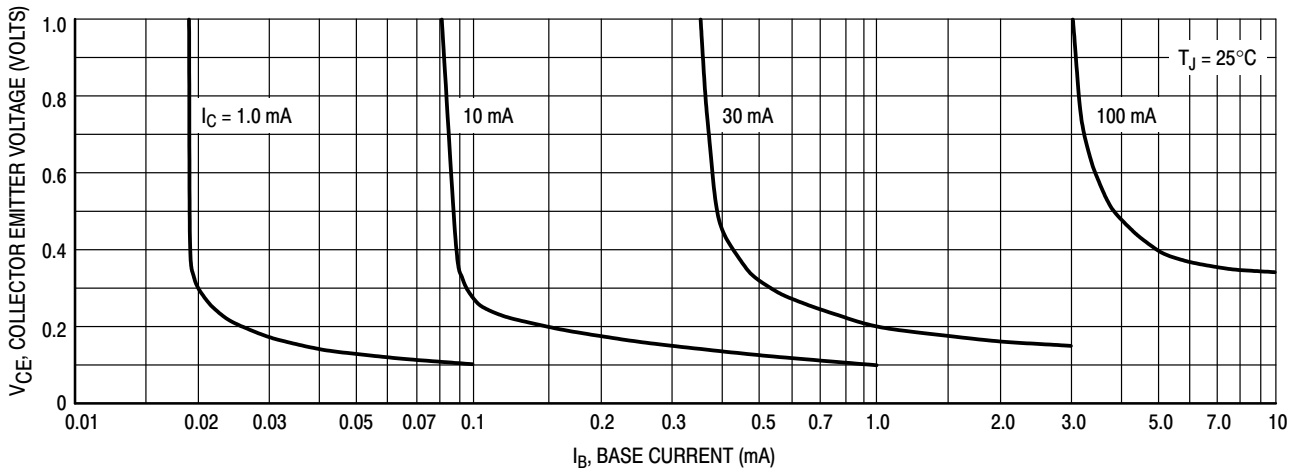


Figure 15. Collector Saturation Region

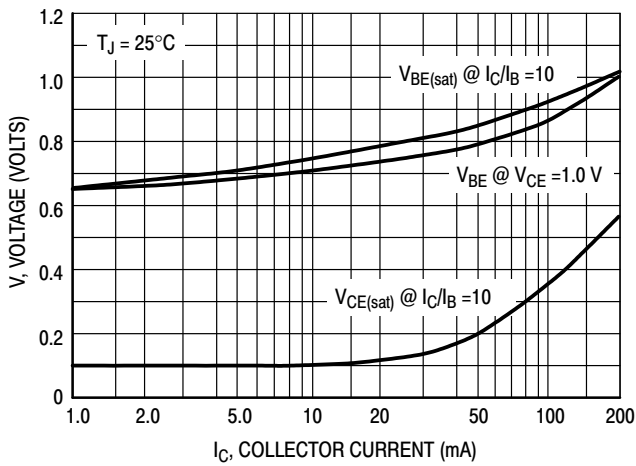


Figure 16. "ON" Voltages

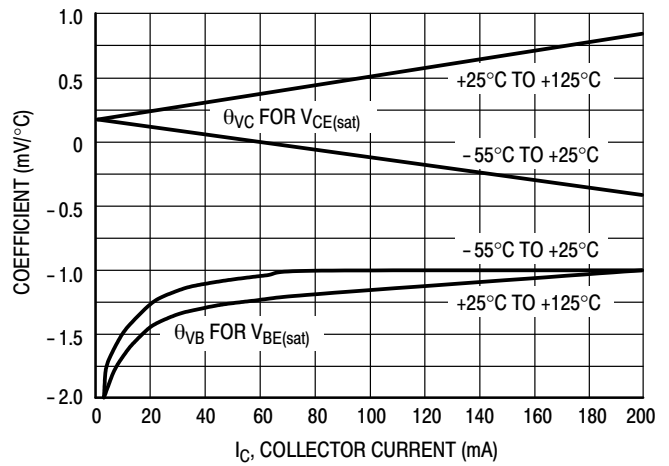
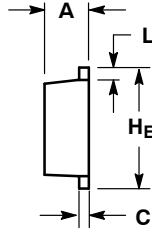
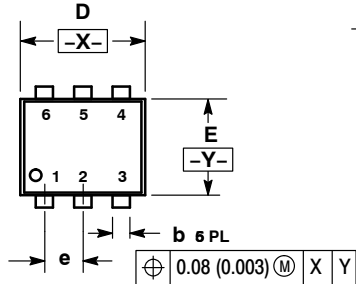


Figure 17. Temperature Coefficients

# NST3904DXV6T1, NSVT3904DXV6T1, NST3904DXV6T5, SNST3904DXV6T5

## PACKAGE DIMENSIONS

### SOT-563, 6 LEAD CASE 463A-01 ISSUE F

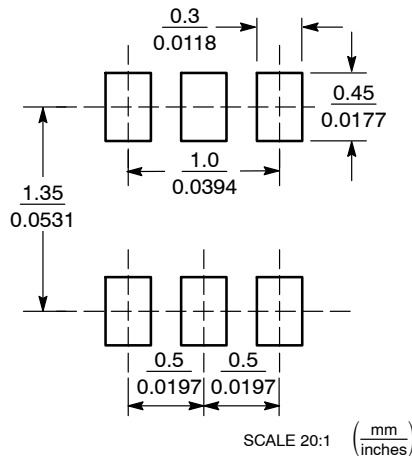


#### NOTES:

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
HE	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.

ON Semiconductor and are registered 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. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### 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: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

**NST3904DXV6T1/D**