

# NST3946DP6T5G

## Dual Complementary General Purpose Transistor

The NST3946DP6T5G device is a spin-off of our popular SOT-23/SOT-323/SOT-563 three-lead device. It is designed for general purpose amplifier applications and is housed in the SOT-963 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
- This is a Pb-Free Device

### 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 Class	2 B

### THERMAL CHARACTERISTICS

Characteristic (Single Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$ (Note 1)	$P_D$	240 1.9	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	520	$^\circ\text{C}/\text{W}$
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$ (Note 2)	$P_D$	280 2.2	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	446	$^\circ\text{C}/\text{W}$
Characteristic (Dual Heated) (Note 3)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$ (Note 1)	$P_D$	350 2.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	357	$^\circ\text{C}/\text{W}$
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$ (Note 2)	$P_D$	420 3.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	297	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

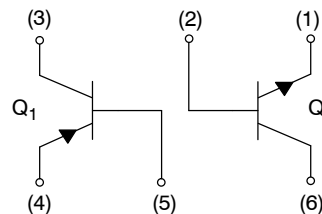
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. FR-4 @ 100 mm<sup>2</sup>, 1 oz. copper traces, still air.
2. FR-4 @ 500 mm<sup>2</sup>, 1 oz. copper traces, still air.
3. Dual heated values assume total power is sum of two equally powered channels



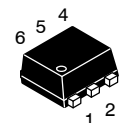
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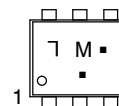
NST3946DP6T5G\*

\*Q1 PNP  
Q2 NPN



SOT-963  
CASE 527AD  
PLASTIC

### MARKING DIAGRAM



L = Device Code  
(180° Clockwise Rotation)  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping†
NST3946DP6T5G	SOT-963 (Pb-Free)	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.

# NST3946DP6T5G

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage (Note 4) (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0) (I <sub>C</sub> = -1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0)	(NPN) (PNP)	V <sub>(BR)CEO</sub>	40 -40	- -	V <sub>dc</sub>
Collector–Base Breakdown Voltage (I <sub>C</sub> = 10 μA <sub>dc</sub> , I <sub>E</sub> = 0) (I <sub>C</sub> = -10 μA <sub>dc</sub> , I <sub>E</sub> = 0)	(NPN) (PNP)	V <sub>(BR)CBO</sub>	60 -40	- -	V <sub>dc</sub>
Emitter–Base Breakdown Voltage (I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0) (I <sub>E</sub> = -10 μA <sub>dc</sub> , I <sub>C</sub> = 0)	(NPN) (PNP)	V <sub>(BR)EBO</sub>	6.0 -5.0	- -	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 30 V <sub>dc</sub> , V <sub>EB</sub> = 3.0 V <sub>dc</sub> ) (V <sub>CE</sub> = -30 V <sub>dc</sub> , V <sub>EB</sub> = -3.0 V <sub>dc</sub> )	(NPN) (PNP)	I <sub>CEx</sub>	- -	50 -50	nA <sub>dc</sub>
<b>ON CHARACTERISTICS (Note 4)</b>					
DC Current Gain (I <sub>C</sub> = 0.1 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 50 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 100 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )  (I <sub>C</sub> = -0.1 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -1.0 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -10 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -50 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -100 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> )	(NPN)      (PNP)	h <sub>FE</sub>	40 70 100 60 30  60 80 100 60 30	- - 300 - -  - - 300 - -	-
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = 50 mA <sub>dc</sub> , I <sub>B</sub> = 5.0 mA <sub>dc</sub> )  (I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B</sub> = -1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = -50 mA <sub>dc</sub> , I <sub>B</sub> = -5.0 mA <sub>dc</sub> )	(NPN)   (PNP)	V <sub>CE(sat)</sub>	- -  - -	0.2 0.3  -0.25 -0.4	V <sub>dc</sub>
Base–Emitter Saturation Voltage (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = 50 mA <sub>dc</sub> , I <sub>B</sub> = 5.0 mA <sub>dc</sub> )  (I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B</sub> = -1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = -50 mA <sub>dc</sub> , I <sub>B</sub> = -5.0 mA <sub>dc</sub> )	(NPN)   (PNP)	V <sub>BE(sat)</sub>	0.65 -  -0.65 -	0.85 0.95  -0.85 -0.95	V <sub>dc</sub>

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

# NST3946DP6T5G

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

Characteristic	Symbol	Min	Max	Unit
<b>SMALL-SIGNAL CHARACTERISTICS</b>				
Current-Gain - Bandwidth Product ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 100\text{ MHz}$ ) (NPN) ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -20\text{ Vdc}$ , $f = 100\text{ MHz}$ ) (PNP)	$f_T$	200 250	- -	MHz
Output Capacitance ( $V_{CB} = 5.0\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ ) (NPN) ( $V_{CB} = -5.0\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ ) (PNP)	$C_{obo}$	- -	4.0 4.5	pF
Input Capacitance ( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ ) (NPN) ( $V_{EB} = -0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ ) (PNP)	$C_{ibo}$	- -	8.0 10.0	pF
Noise Figure ( $V_{CE} = 5.0\text{ Vdc}$ , $I_C = 100\ \mu\text{Adc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ ) (NPN) ( $V_{CE} = -5.0\text{ Vdc}$ , $I_C = -100\ \mu\text{Adc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ ) (PNP)	NF	- -	5.0 4.0	dB

## SWITCHING CHARACTERISTICS

Delay Time	( $V_{CC} = 3.0\text{ Vdc}$ , $V_{BE} = -0.5\text{ Vdc}$ ) (NPN) ( $V_{CC} = -3.0\text{ Vdc}$ , $V_{BE} = 0.5\text{ Vdc}$ ) (PNP)	$t_d$	- -	35 35	ns
Rise Time	( $I_C = 10\text{ mAdc}$ , $I_{B1} = 1.0\text{ mAdc}$ ) (NPN) ( $I_C = -10\text{ mAdc}$ , $I_{B1} = -1.0\text{ mAdc}$ ) (PNP)	$t_r$	- -	35 35	
Storage Time	( $V_{CC} = 3.0\text{ Vdc}$ , $I_C = 10\text{ mAdc}$ ) (NPN) ( $V_{CC} = -3.0\text{ Vdc}$ , $I_C = -10\text{ mAdc}$ ) (PNP)	$t_s$	- -	275 250	ns
Fall Time	( $I_{B1} = I_{B2} = 1.0\text{ mAdc}$ ) (NPN) ( $I_{B1} = I_{B2} = -1.0\text{ mAdc}$ ) (PNP)	$t_f$	- -	50 50	

## NPN TRANSISTOR

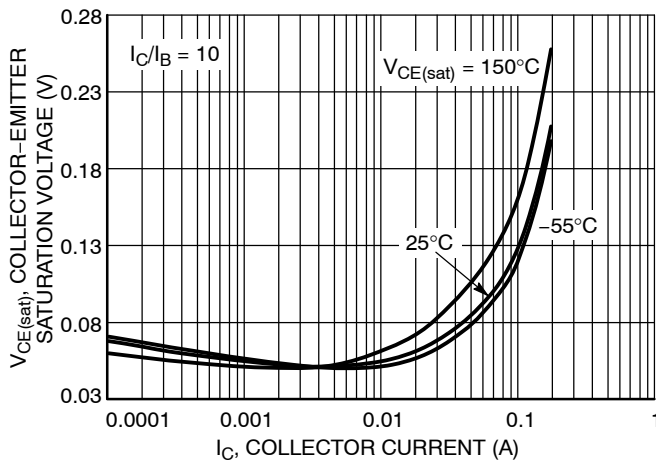


Figure 1. Collector Emitter Saturation Voltage vs. Collector Current

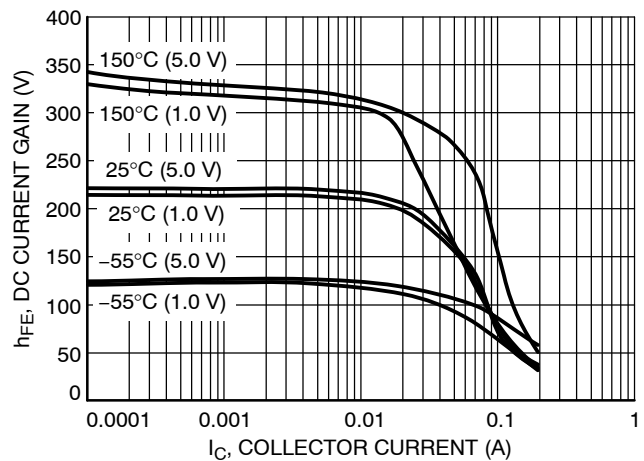


Figure 2. DC Current Gain vs. Collector Current

# NST3946DP6T5G

## NPN TRANSISTOR

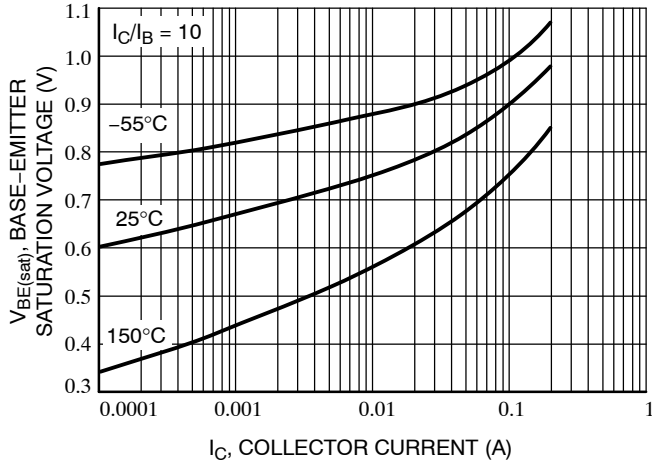


Figure 3. Base Emitter Saturation Voltage vs. Collector Current

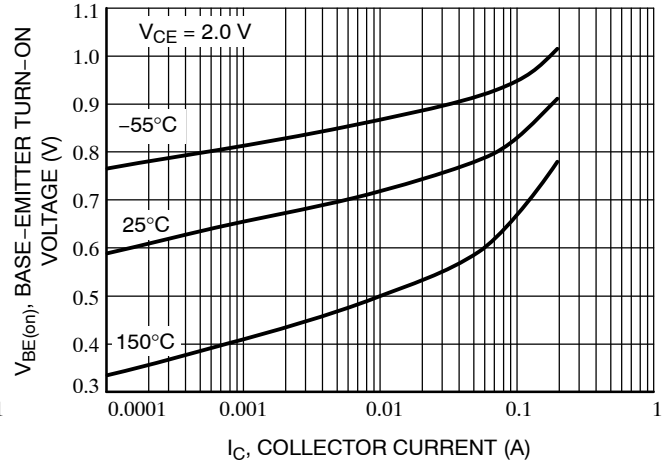


Figure 4. Base Emitter Turn-On Voltage vs. Collector Current

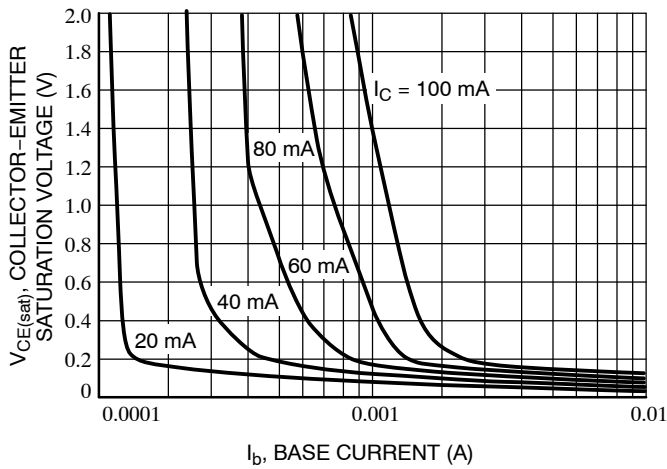


Figure 5. Saturation Region

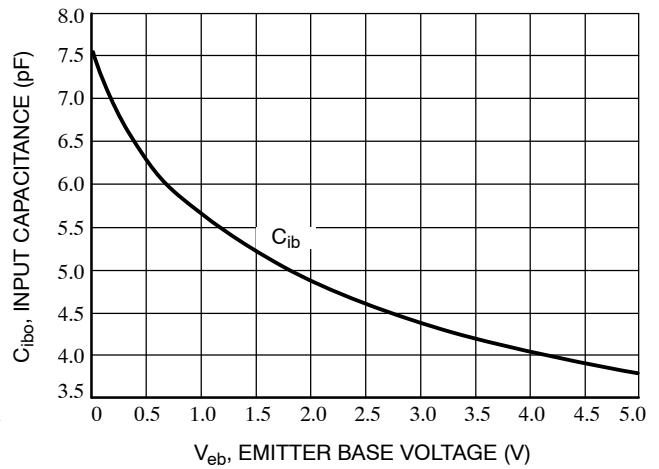


Figure 6. Input Capacitance

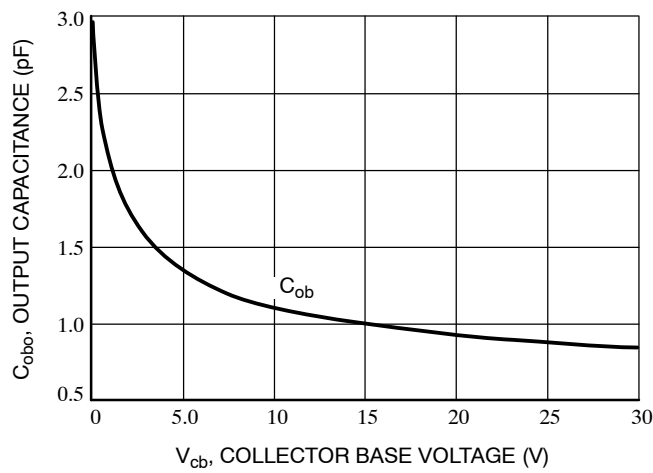


Figure 7. Output Capacitance

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## PNP TRANSISTOR

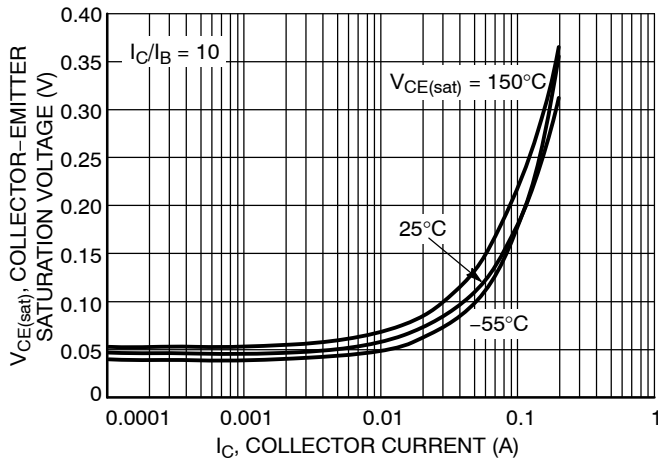


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

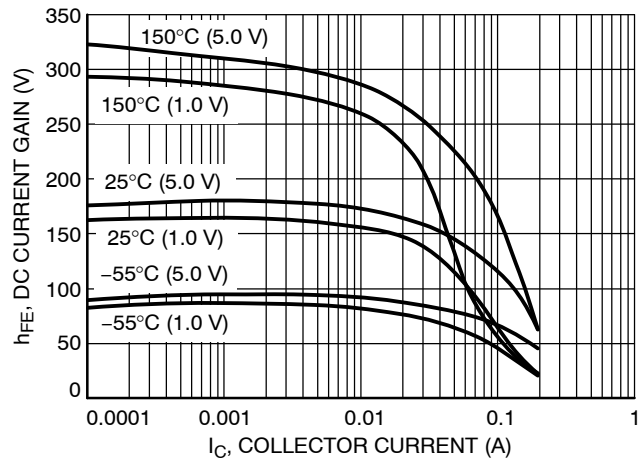
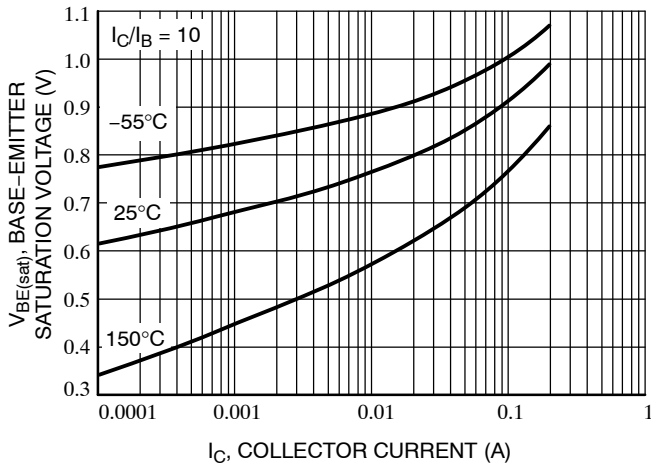


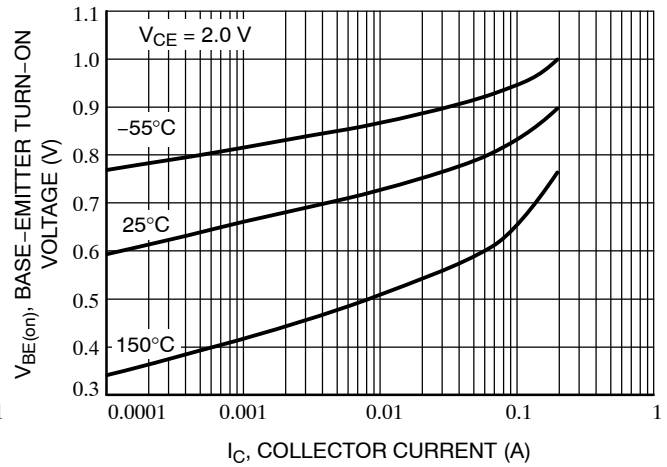
Figure 9. DC Current Gain vs. Collector Current

# NST3946DP6T5G

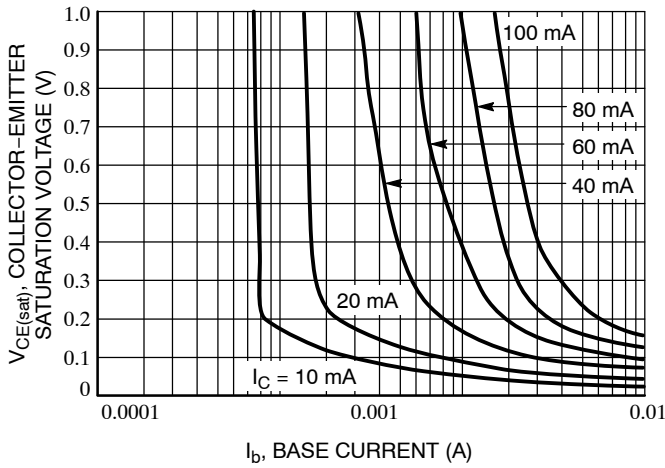
## PNP TRANSISTOR



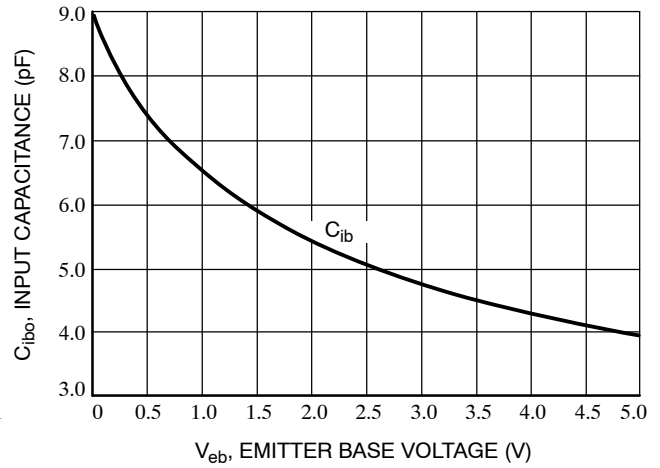
**Figure 10. Base-Emitter Saturation Voltage vs. Collector Current**



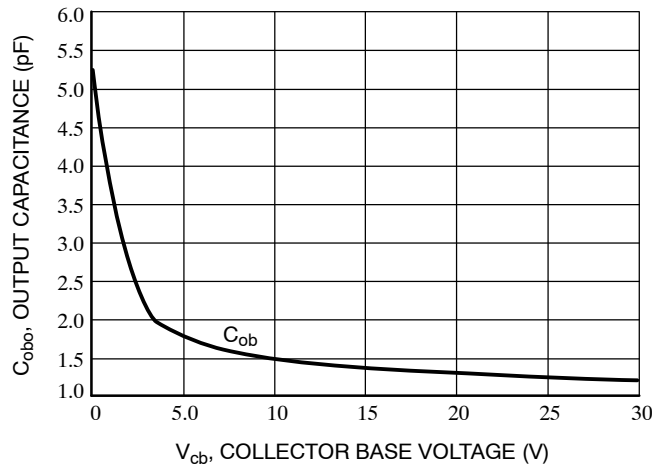
**Figure 11. Base-Emitter Turn-On Voltage vs. Collector Current**



**Figure 12. Saturation Region**



**Figure 13. Input Capacitance**

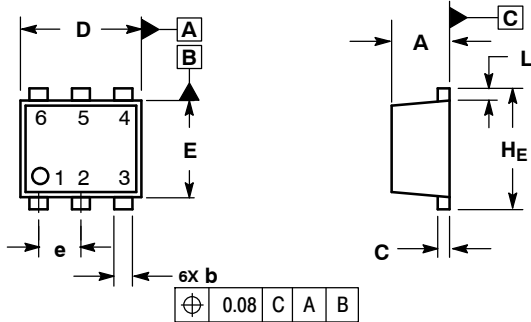


**Figure 14. Output Capacitance**

# NST3946DP6T5G

## PACKAGE DIMENSIONS

SOT-963  
CASE 527AD-01  
ISSUE C

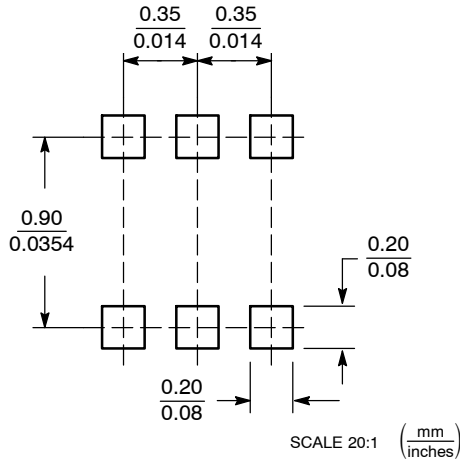


NOTES:

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	0.34	0.37	0.40			
b	0.10	0.15	0.20	0.004	0.006	0.008
C	0.07	0.12	0.17	0.003	0.005	0.007
D	0.95	1.00	1.05	0.037	0.039	0.041
E	0.75	0.80	0.85	0.03	0.032	0.034
e	0.35 BSC			0.014 BSC		
L	0.05	0.10	0.15	0.002	0.004	0.006
H <sub>E</sub>	0.95	1.00	1.05	0.037	0.039	0.041

### 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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NST3946DP6/D