

# NST3904DP6T5G

## Dual General Purpose Transistor

The NST3904DP6T5G 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<br>MM | ESD<br>Class<br>2<br>B |      |

### THERMAL CHARACTERISTICS

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

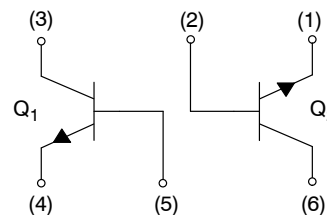
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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.

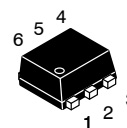


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<http://onsemi.com>

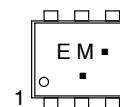


NST3904DP6T5G



SOT-963  
CASE 527AD  
PLASTIC

### MARKING DIAGRAM



E = Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device        | Package              | Shipping†        |
|---------------|----------------------|------------------|
| NST3904DP6T5G | SOT-963<br>(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.

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

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

### OFF CHARACTERISTICS

|  |                      |     |    |      |
|--|----------------------|-----|----|------|
| Collector - Emitter Breakdown Voltage (Note 4) (I <sub>C</sub> = 1.0 mAdc, I <sub>B</sub> = 0) | V <sub>(BR)CEO</sub> | 40  | -  | Vdc  |
| Collector - Base Breakdown Voltage (I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)              | V <sub>(BR)CBO</sub> | 60  | -  | Vdc  |
| Emitter - Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)                | V <sub>(BR)EBO</sub> | 6.0 | -  | Vdc  |
| Collector Cutoff Current (V <sub>CE</sub> = 30 Vdc, V <sub>EB</sub> = 3.0 Vdc)                 | I <sub>CEX</sub>     | -   | 50 | nAdc |

### ON CHARACTERISTICS (Note 4)

|   |                      |                             |                         |     |
|---|----------------------|-----------------------------|-------------------------|-----|
| DC Current Gain<br>(I <sub>C</sub> = 0.1 mAdc, V <sub>CE</sub> = 1.0 Vdc)<br>(I <sub>C</sub> = 1.0 mAdc, V <sub>CE</sub> = 1.0 Vdc)<br>(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc)<br>(I <sub>C</sub> = 50 mAdc, V <sub>CE</sub> = 1.0 Vdc)<br>(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 1.0 Vdc) | h <sub>FE</sub>      | 40<br>70<br>100<br>60<br>30 | -<br>-<br>300<br>-<br>- | -   |
| Collector - Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc)<br>(I <sub>C</sub> = 50 mAdc, I <sub>B</sub> = 5.0 mAdc)  | V <sub>CE(sat)</sub> | -<br>-                      | 0.2<br>0.3              | Vdc |
| Base - Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc)<br>(I <sub>C</sub> = 50 mAdc, I <sub>B</sub> = 5.0 mAdc)   | V <sub>BE(sat)</sub> | 0.65<br>-                   | 0.85<br>0.95            | Vdc |

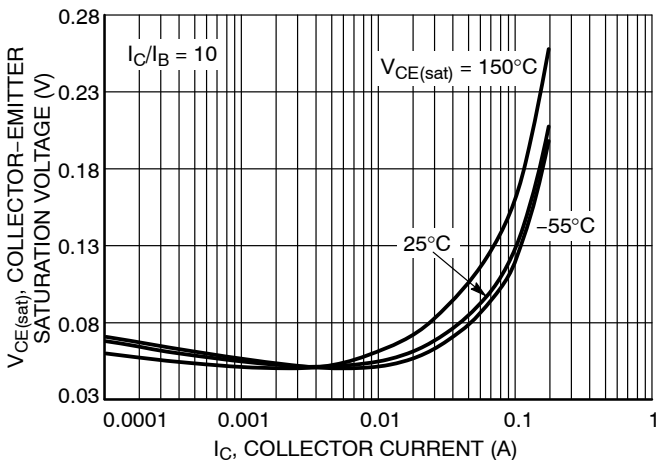
### SMALL-SIGNAL CHARACTERISTICS

|   |                  |     |     |     |
|---|------------------|-----|-----|-----|
| Current - Gain - Bandwidth Product (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 20 Vdc, f = 100 MHz)      | f <sub>T</sub>   | 200 | -   | MHz |
| Output Capacitance (V <sub>CB</sub> = 5.0 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)                           | C <sub>obo</sub> | -   | 4.0 | pF  |
| Input Capacitance (V <sub>EB</sub> = 0.5 Vdc, I <sub>C</sub> = 0, f = 1.0 MHz)                            | C <sub>ibo</sub> | -   | 8.0 | pF  |
| Noise Figure (V <sub>CE</sub> = 5.0 Vdc, I <sub>C</sub> = 100 μAdc, R <sub>S</sub> = 1.0 kΩ, f = 1.0 kHz) | NF               | -   | 5.0 | dB  |

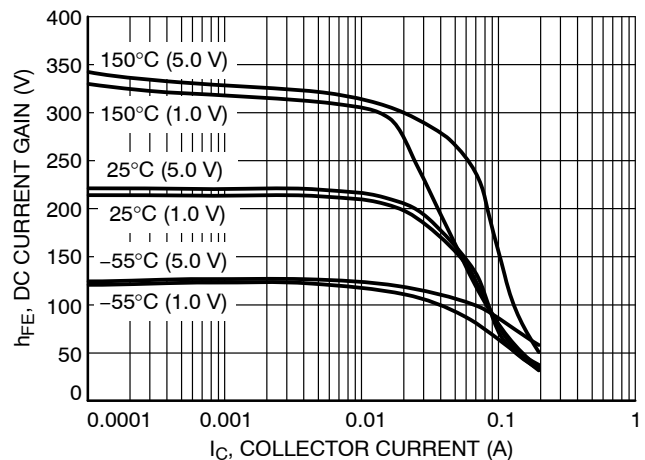
### SWITCHING CHARACTERISTICS

|              |   |                |   |     |    |
|--------------|---|----------------|---|-----|----|
| Delay Time   | (V <sub>CC</sub> = 3.0 Vdc, V <sub>BE</sub> = -0.5 Vdc) | t <sub>d</sub> | - | 35  | ns |
| Rise Time    | (I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 1.0 mAdc)  | t <sub>r</sub> | - | 35  |    |
| Storage Time | (V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc)   | t <sub>s</sub> | - | 275 | ns |
| Fall Time    | (I <sub>B1</sub> = I <sub>B2</sub> = 1.0 mAdc)          | t <sub>f</sub> | - | 50  |    |

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

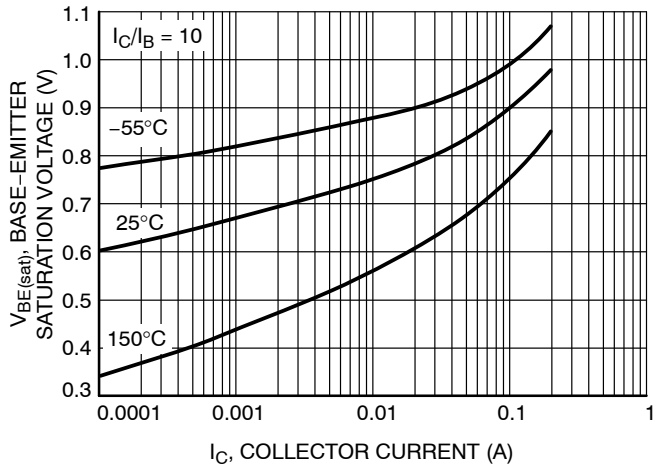


**Figure 1. Collector Emitter Saturation Voltage vs. Collector Current**

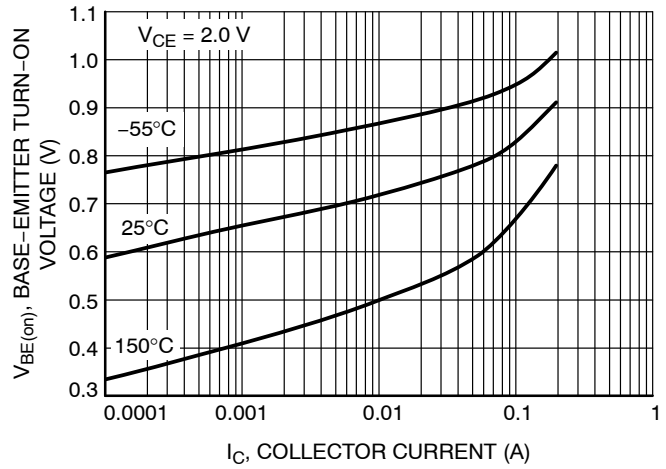


**Figure 2. DC Current Gain vs. Collector Current**

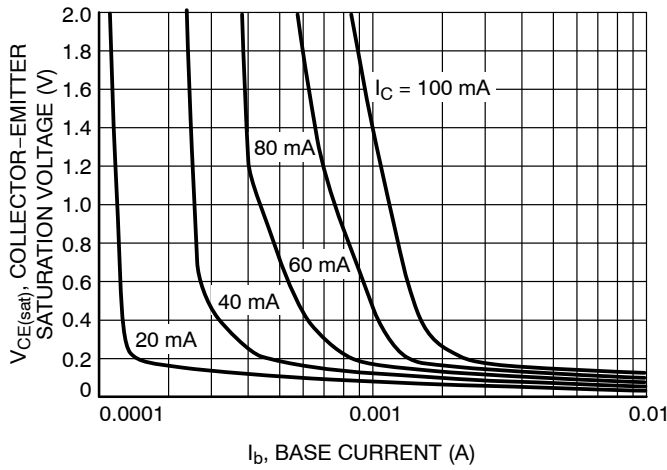
# NST3904DP6T5G



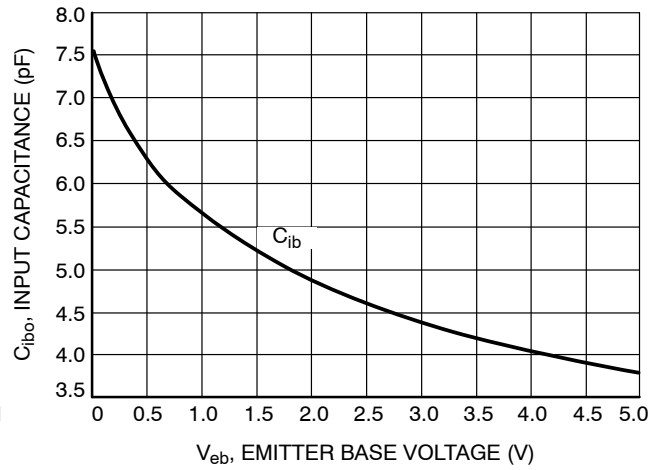
**Figure 3. Base Emitter Saturation Voltage vs. Collector Current**



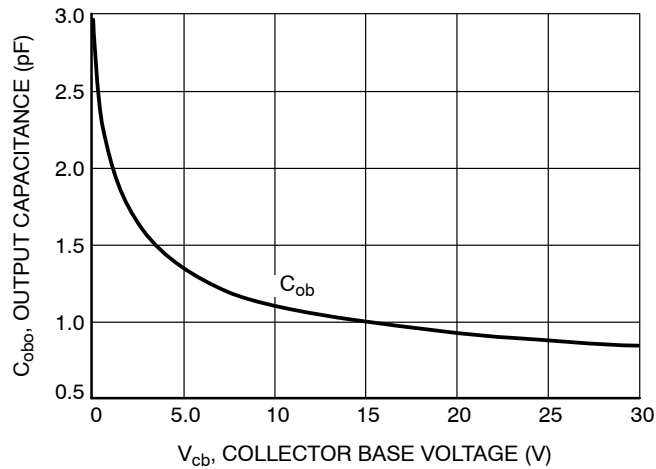
**Figure 4. Base Emitter Turn-On Voltage vs. Collector Current**



**Figure 5. Saturation Region**



**Figure 6. Input Capacitance**

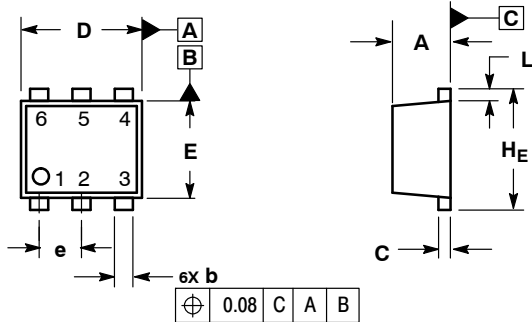


**Figure 7. Output Capacitance**

# NST3904DP6T5G

## PACKAGE DIMENSIONS

**SOT-963**  
CASE 527AD-01  
ISSUE B

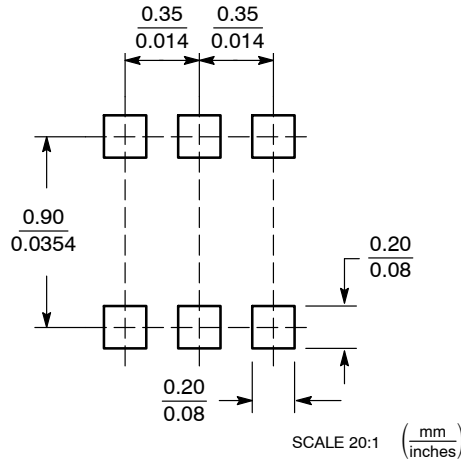


**NOTES:**

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 |
| HE  | 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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