

# NPN General Purpose Transistor

## NST3904F3T5G

The NST3904F3T5G device is a spin-off of our popular SOT-23/SOT-323/SOT-563/SOT-963 three-leaded device. It is designed for general purpose amplifier applications and is housed in the SOT-1123 surface mount 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
- Reduces Board Space
- This is a Pb-Free Device

### MAXIMUM RATINGS

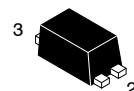
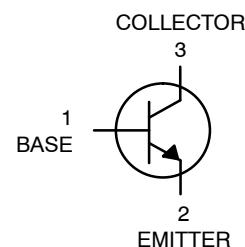
| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector–Emitter Voltage      | $V_{CEO}$ | 40    | Vdc  |
| Collector–Base Voltage         | $V_{CBO}$ | 60    | Vdc  |
| Emitter–Base Voltage           | $V_{EBO}$ | 6.0   | Vdc  |
| Collector Current – Continuous | $I_C$     | 200   | mAdc |

### THERMAL CHARACTERISTICS

| Characteristic  | Symbol                      | Max            | Unit                       |
|---|-----------------------------|----------------|----------------------------|
| Total Device Dissipation, $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$<br>(Note 1)           | 290<br>2.3     | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction-to-Ambient  | $R_{\theta JA}$<br>(Note 1) | 432            | $^\circ\text{C}/\text{W}$  |
| Total Device Dissipation, $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$<br>(Note 2)           | 347<br>2.8     | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction-to-Ambient  | $R_{\theta JA}$<br>(Note 2) | 360            | $^\circ\text{C}/\text{W}$  |
| Thermal Resistance,<br>Junction-to-Lead 3   | $R_{\theta JL}$<br>(Note 2) | 143            | $^\circ\text{C}/\text{W}$  |
| Junction and Storage Temperature Range  | $T_J, T_{stg}$              | –55 to<br>+150 | $^\circ\text{C}$           |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1.  $100 \text{ mm}^2$  1 oz, copper traces.
2.  $500 \text{ mm}^2$  1 oz, copper traces.



**SOT-1123  
CASE 524AA  
STYLE 1**

### MARKING DIAGRAM



2 = Device Code  
M = Date Code

### ORDERING INFORMATION

| Device       | Package               | Shipping <sup>†</sup> |
|--------------|-----------------------|-----------------------|
| NST3904F3T5G | SOT-1123<br>(Pb-Free) | 8000 / Tape & Reel    |

<sup>†</sup>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.

# NST3904F3T5G

## 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 3) ( $I_C = 1.0 \text{ mA}$ , $I_B = 0$ ) | $V_{(\text{BR})\text{CEO}}$ | 40  | –   | Vdc  |
| Collector – Base Breakdown Voltage ( $I_C = 10 \text{ }\mu\text{A}$ , $I_E = 0$ )     | $V_{(\text{BR})\text{CBO}}$ | 60  | –   | Vdc  |
| Emitter – Base Breakdown Voltage ( $I_E = 10 \text{ }\mu\text{A}$ , $I_C = 0$ )       | $V_{(\text{BR})\text{EBO}}$ | 6.0 | –   | Vdc  |
| Collector Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $V_{EB} = 3.0 \text{ Vdc}$ )   | $I_{CEX}$                   | –   | 50  | nA   |

## ON CHARACTERISTICS (Note 3)

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

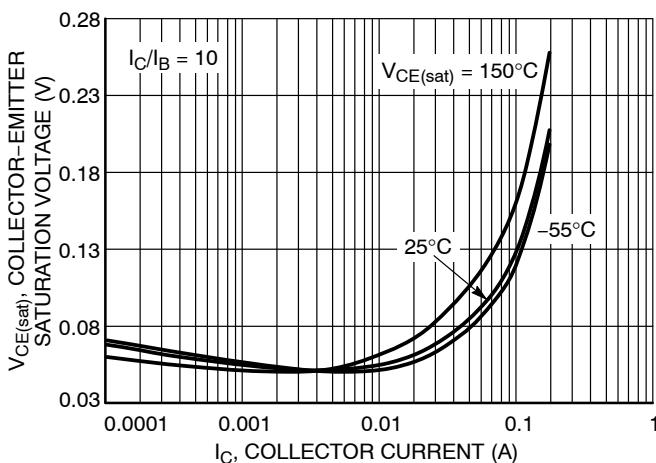
## SMALL-SIGNAL CHARACTERISTICS

|   |                  |     |     |     |
|---|------------------|-----|-----|-----|
| Current – Gain – Bandwidth Product ( $I_C = 10 \text{ mA}$ , $V_{CE} = 20 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )                    | $f_T$            | 200 | –   | MHz |
| Output Capacitance ( $V_{CB} = 5.0 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )   | $C_{\text{obo}}$ | –   | 4.0 | pF  |
| Input Capacitance ( $V_{EB} = 0.5 \text{ Vdc}$ , $I_C = 0$ , $f = 1.0 \text{ MHz}$ )  | $C_{\text{ibo}}$ | –   | 8.0 | pF  |
| Noise Figure ( $V_{CE} = 5.0 \text{ Vdc}$ , $I_C = 100 \text{ }\mu\text{A}$ , $R_S = 1.0 \text{ k}\Omega$ , $f = 1.0 \text{ kHz}$ ) | NF               | –   | 5.0 | dB  |

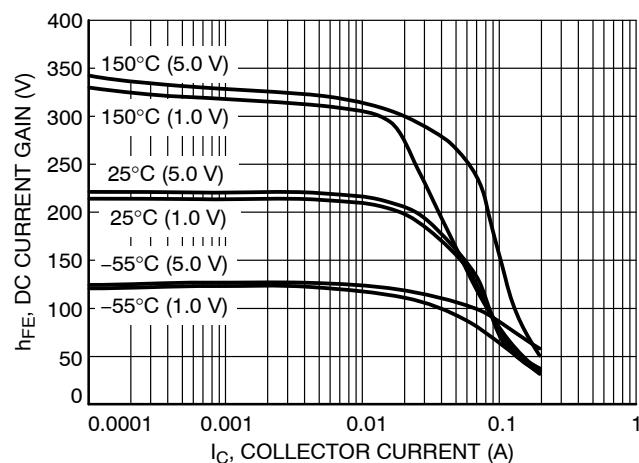
## SWITCHING CHARACTERISTICS

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

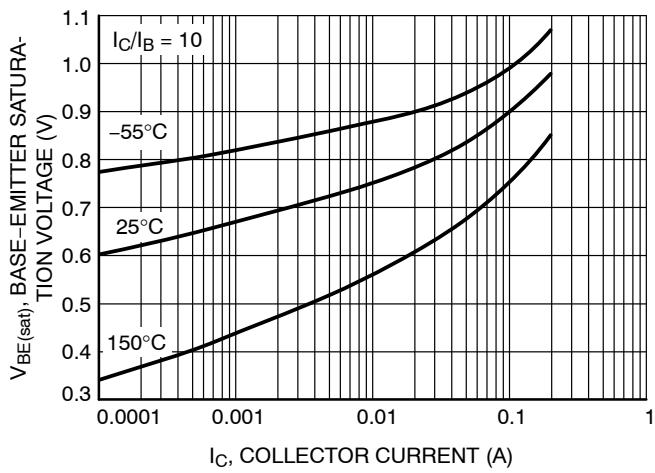
3. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ ; Duty Cycle  $\leq 2.0\%$ .



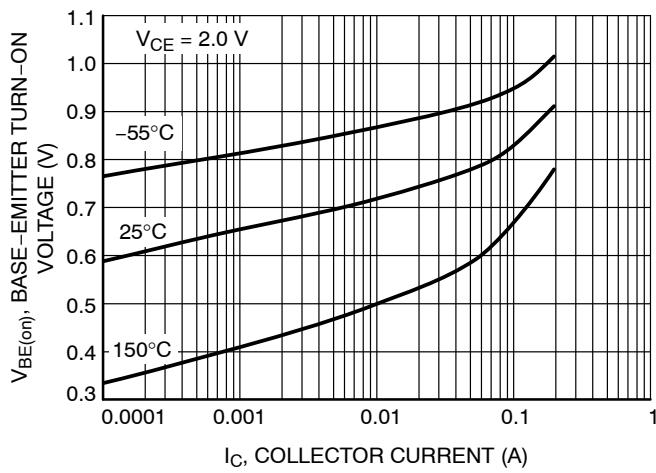
**Figure 1. Collector Emitter Saturation Voltage vs. Collector Current**



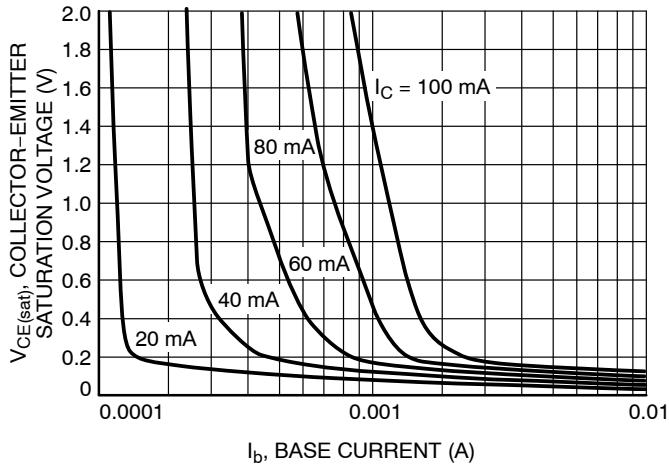
**Figure 2. DC Current Gain vs. Collector Current**



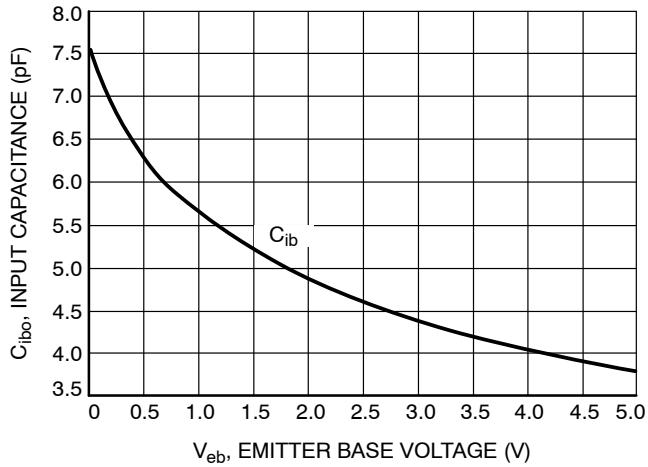
**Figure 3. Base Emitter Saturation Voltage vs. Collector Current**



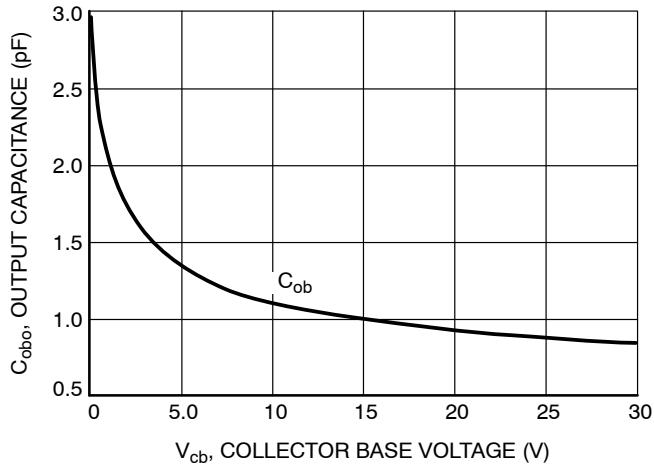
**Figure 4. Base Emitter Turn-On Voltage vs. Collector Current**



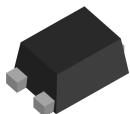
**Figure 5. Saturation Region**



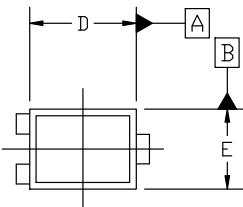
**Figure 6. Input Capacitance**



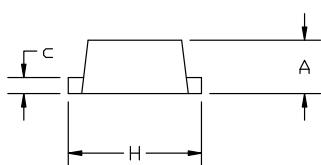
**Figure 7. Output Capacitance**


**SOT-1123 0.80x0.60x0.37, 0.35P**  
CASE 524AA  
ISSUE D

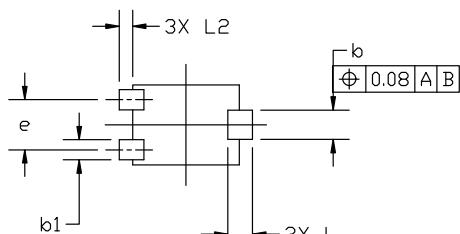
DATE 18 JAN 2024



TOP VIEW



SIDE VIEW



BOTTOM VIEW

**GENERIC  
MARKING DIAGRAM\***

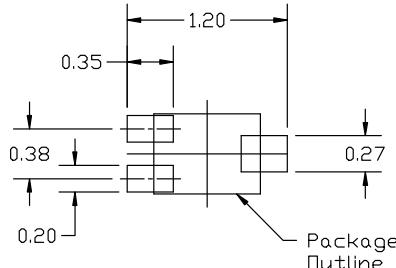

X = Specific Device Code  
M = Date Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH.  
MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| MILLIMETERS |           |       |       |
|-------------|-----------|-------|-------|
| DIM         | MIN       | NOM   | MAX   |
| A           | 0.34      | 0.37  | 0.40  |
| b           | 0.15      | 0.22  | 0.28  |
| b1          | 0.10      | 0.15  | 0.20  |
| c           | 0.07      | 0.12  | 0.17  |
| D           | 0.75      | 0.80  | 0.85  |
| E           | 0.55      | 0.60  | 0.65  |
| e           | 0.35      | 0.38  | 0.40  |
| H           | 0.950     | 1.000 | 1.050 |
| L           | 0.185 REF |       |       |
| L2          | 0.05      | 0.10  | 0.15  |


**RECOMMENDED  
MOUNTING 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.

STYLE 1:  
PIN 1. BASE  
2. Emitter  
3. Collector

STYLE 2:  
PIN 1. ANODE  
2. N/C  
3. CATHODE

STYLE 3:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 4:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 5:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

|                  |                                |   |
|------------------|--------------------------------|---|
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| DESCRIPTION:     | SOT-1123 0.80x0.60x0.37, 0.35P | PAGE 1 OF 1   |

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