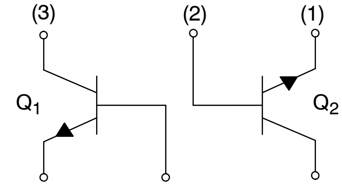
# Dual General Purpose Transistor

# NST3904DXV6T1G, NSVT3904DXV6T1G, NST3904DXV6T5G

The NST/NSV3904DXV6 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.

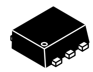
## Features

- $h_{FE}$, 100−300
- Low $V_{CE(sat)}$, ≤ 0.4 V
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- AEC−Q101 Qualified and PPAP Capable − NSVT3904DXV6T1G
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements



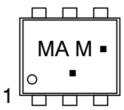

**NST/NSV3904DXV6**

### MARKING DIAGRAM



1

**SOT−563**
**CASE 463A**
**STYLE 1**




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

(Note: Microdot may be in either location)

### 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 | >16000<br>>2000 | V |

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.

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NST3904DXV6T1G | SOT−563 (Pb−Free) | 4000/Tape & Reel |
| NSVT3904DXV6T1G | SOT−563 (Pb−Free) | 4000/Tape & Reel |
| NST3904DXV6T5G | SOT−563 (Pb−Free) | 8000/Tape & Reel |
| SNST3904DXV6T1G | SOT−563 (Pb−Free) | 4000/Tape & Reel |
| SNST3904DXV6T5G | SOT−563 (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.



April, 2022 − Rev. 9

Publication Order Number:
NST3904DXV6T1/D

### THERMAL CHARACTERISTICS

| Characteristic (One Junction Heated) | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation $T_A$ = 25°C<br>Derate above 25°C (Note 1) | $P_D$ | 357<br>2.9 | mW<br>mW/°C |
| Thermal Resistance Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 350 | °C/W |
| **Characteristic (Both Junctions Heated)** | **Symbol** | **Max** | **Unit** |
| Total Device Dissipation $T_A$ = 25°C<br>Derate above 25°C (Note 1) | $P_D$ | 500<br>4.0 | mW<br>mW/°C |
| Thermal Resistance, Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 250 | °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°C unless otherwise noted)

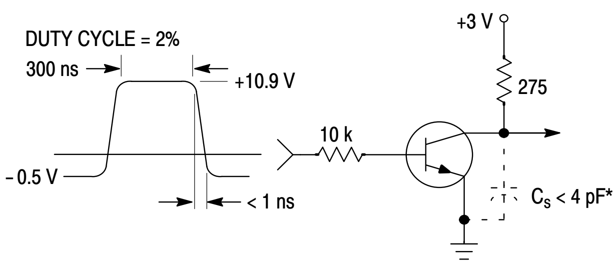
| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector−Emitter Breakdown Voltage (Note 2) ($I_C$ = 1.0 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | 40 | – | Vdc |
| Collector−Base Breakdown Voltage ($I_C$ = 10 μAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 60 | – | Vdc |
| Emitter−Base Breakdown Voltage ($I_E$ = 10 μAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 6.0 | – | Vdc |
| Base Cutoff Current ($V_{CE}$ = 30 Vdc, $V_{EB}$ = 3.0 Vdc) | $I_{BL}$ | – | 50 | nAdc |
| Collector Cutoff Current ($V_{CE}$ = 30 Vdc, $V_{EB}$ = 3.0 Vdc) | $I_{CEX}$ | – | 50 | nAdc |
| **ON CHARACTERISTICS** (Note 2) | | | | |
| DC Current Gain<br>($I_C$ = 0.1 mAdc, $V_{CE}$ = 1.0 Vdc)<br>($I_C$ = 1.0 mAdc, $V_{CE}$ = 1.0 Vdc)<br>($I_C$ = 10 mAdc, $V_{CE}$ = 1.0 Vdc)<br>($I_C$ = 50 mAdc, $V_{CE}$ = 1.0 Vdc)<br>($I_C$ = 100 mAdc, $V_{CE}$ = 1.0 Vdc) | $h_{FE}$ | <br>40<br>70<br>100<br>60<br>30 | <br>–<br>–<br>300<br>–<br>– | – |
| Collector−Emitter Saturation Voltage<br>($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc)<br>($I_C$ = 50 mAdc, $I_B$ = 5.0 mAdc) | $V_{CE(sat)}$ | <br>–<br>– | <br>0.2<br>0.3 | Vdc |
| Base−Emitter Saturation Voltage<br>($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc)<br>($I_C$ = 50 mAdc, $I_B$ = 5.0 mAdc) | $V_{BE(sat)}$ | <br>0.65<br>– | <br>0.85<br>0.95 | Vdc |
| **SMALL−SIGNAL CHARACTERISTICS** | | | | |
| Current−Gain − Bandwidth Product ($I_C$ = 10 mAdc, $V_{CE}$ = 20 Vdc, f = 100 MHz) | $f_T$ | 300 | – | MHz |
| Output Capacitance ($V_{CB}$ = 5.0 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{obo}$ | – | 4.0 | pF |
| Input Capacitance ($V_{EB}$ = 0.5 Vdc, $I_C$ = 0, f = 1.0 MHz) | $C_{ibo}$ | – | 8.0 | pF |
| Input Impedance ($V_{CE}$ = 10 Vdc, $I_C$ = 1.0 mAdc, f = 1.0 kHz) | $h_{ie}$ | 1.0<br>2.0 | 10<br>12 | k Ω |
| Voltage Feedback Ratio ($V_{CE}$ = 10 Vdc, $I_C$ = 1.0 mAdc, f = 1.0 kHz) | $h_{re}$ | 0.5<br>0.1 | 8.0<br>10 | X $10^{-4}$ |
| Small−Signal Current Gain ($V_{CE}$ = 10 Vdc, $I_C$ = 1.0 mAdc, f = 1.0 kHz) | $h_{fe}$ | 100<br>100 | 400<br>400 | – |
| Output Admittance ($V_{CE}$ = 10 Vdc, $I_C$ = 1.0 mAdc, f = 1.0 kHz) | $h_{oe}$ | 1.0<br>3.0 | 40<br>60 | μmhos |
| Noise Figure ($V_{CE}$ = 5.0 Vdc, $I_C$ = 100 μAdc, $R_S$ = 1.0 k Ω, f = 1.0 kHz) | NF | –<br>– | 5.0<br>4.0 | dB |

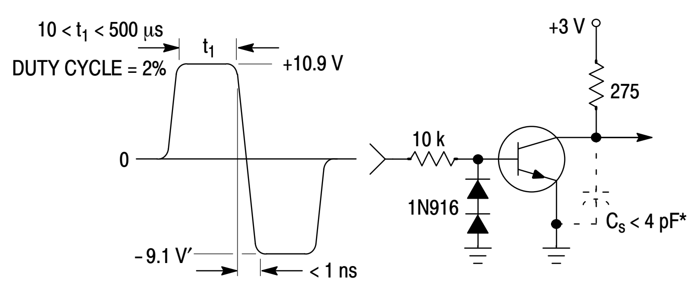
**SWITCHING CHARACTERISTICS**

| Characteristic | Conditions | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| Delay Time | ($V_{CC}$ = 3.0 Vdc, $V_{BE}$ = −0.5 Vdc) | $t_d$ | – | 35 | ns |
| Rise Time | ($I_C$ = 10 mAdc, $I_{B1}$ = 1.0 mAdc) | $t_r$ | – | 35 | |
| Storage Time | ($V_{CC}$ = 3.0 Vdc, $I_C$ = 10 mAdc) | $t_s$ | – | 200 | ns |
| Fall Time | ($I_{B1}$ = $I_{B2}$ = 1.0 mAdc) | $t_f$ | – | 50 | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

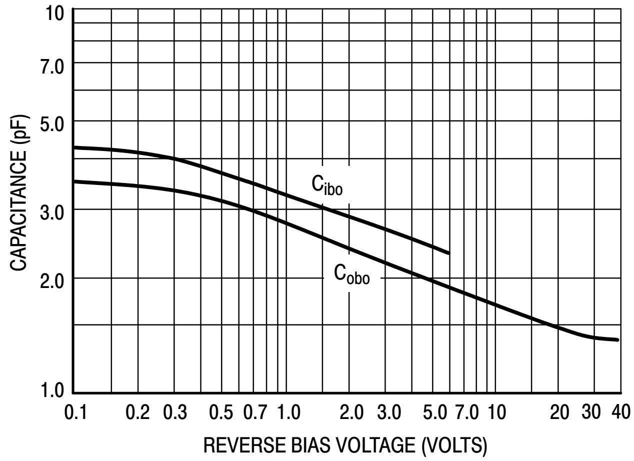



**Figure 3. Capacitance**

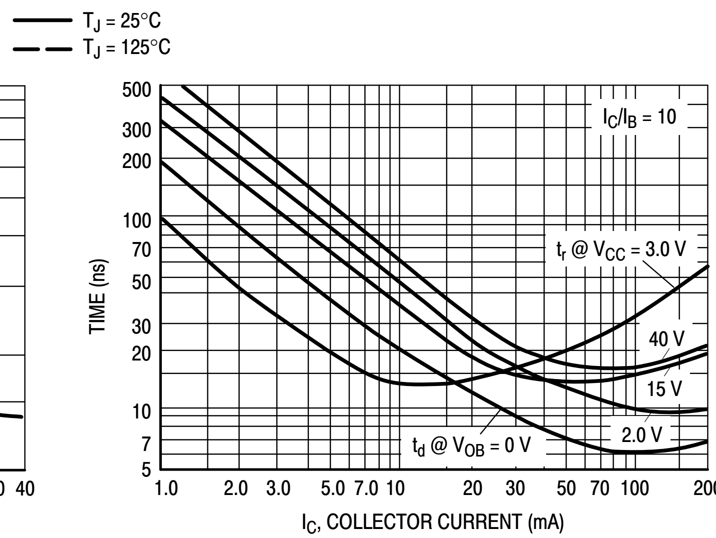



**Figure 4. Turn−On Time**

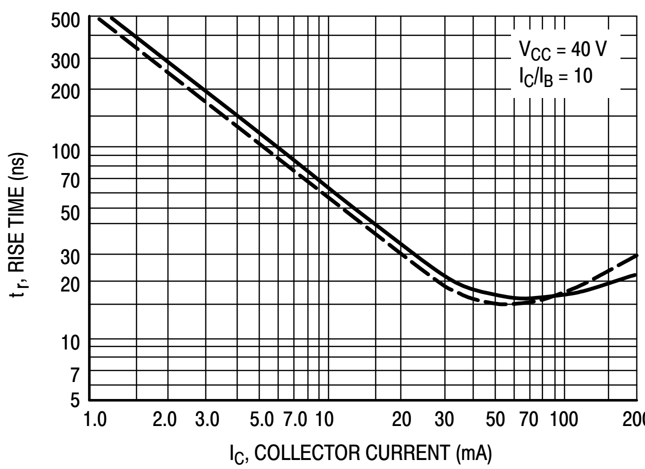



**Figure 5. Rise Time**

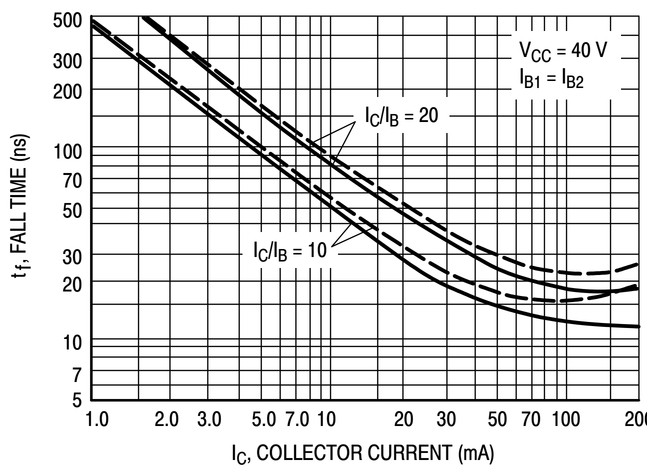



**Figure 6. Fall Time**

## TYPICAL AUDIO SMALL–SIGNAL CHARACTERISTICS
## NOISE FIGURE VARIATIONS

($V_{CE}$ = 5.0 Vdc, $T_A$ = 25°C, Bandwidth = 1.0 Hz)

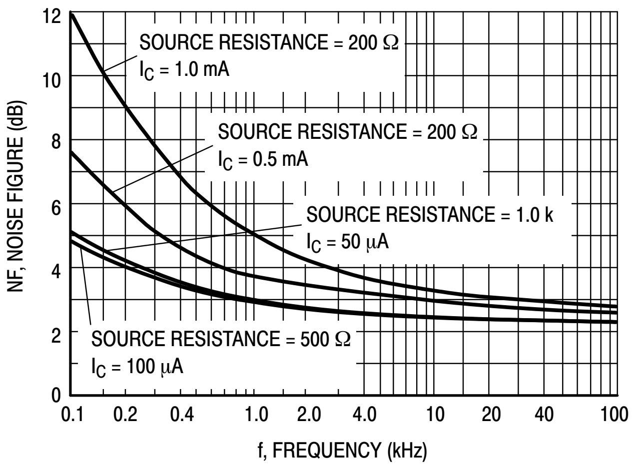



**Figure 7. Noise Figure**

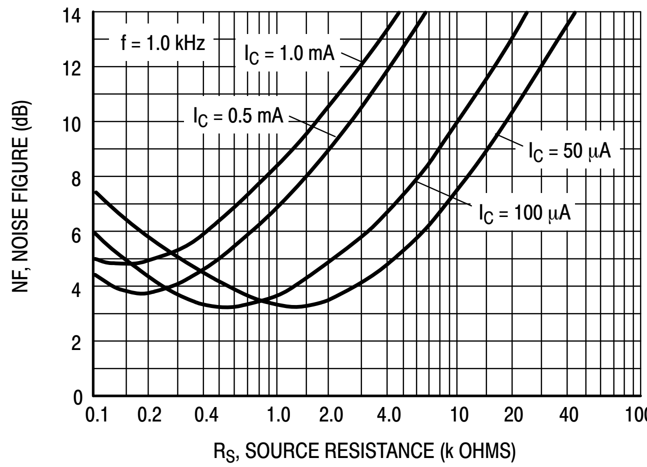



**Figure 8. Noise Figure**

## h PARAMETERS

($V_{CE}$ = 10 Vdc, f = 1.0 kHz, $T_A$ = 25°C)

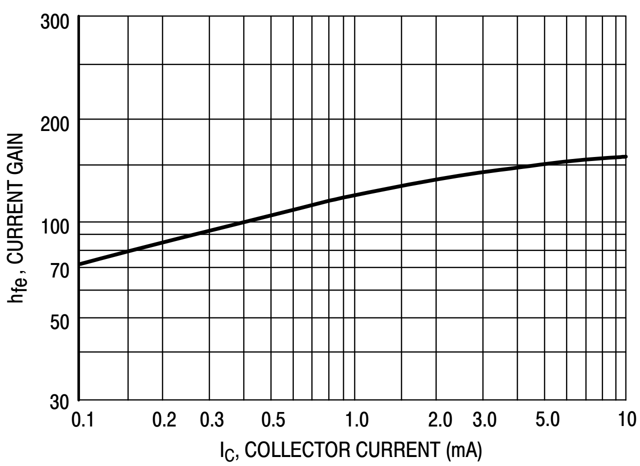



**Figure 9. Current Gain**

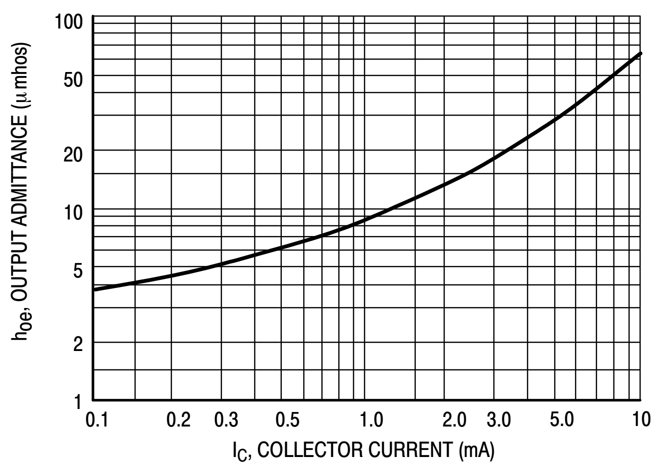



**Figure 10. Output Admittance**

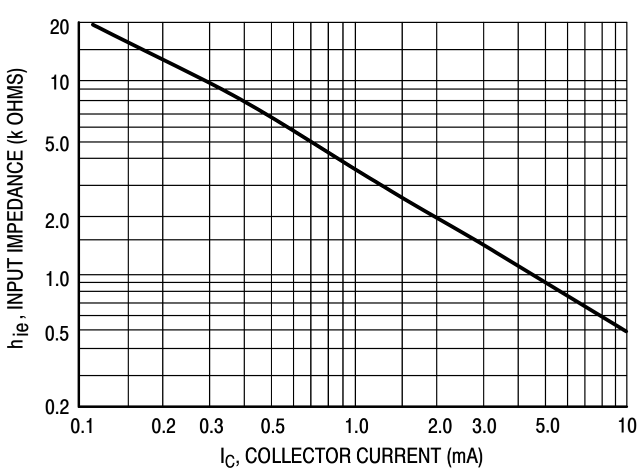



**Figure 11. Input Impedance**

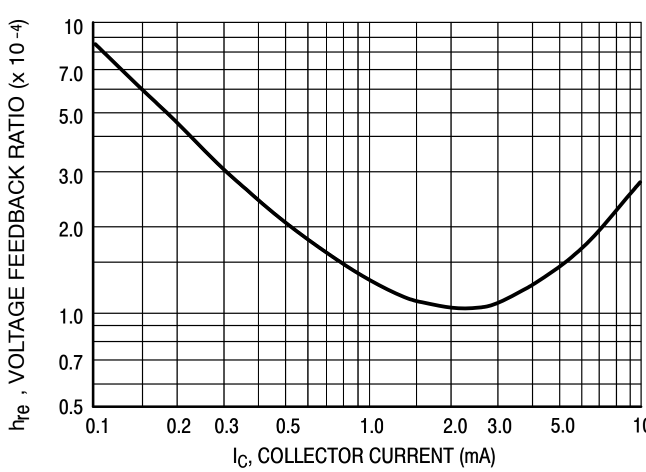



**Figure 12. Voltage Feedback Ratio**

## TYPICAL STATIC CHARACTERISTICS

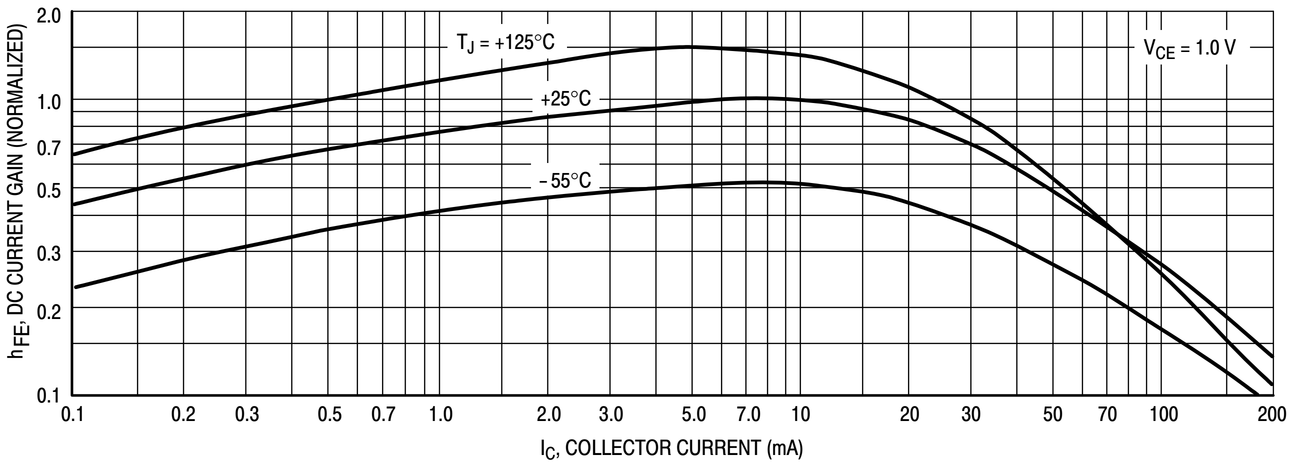



**Figure 13. DC Current Gain**

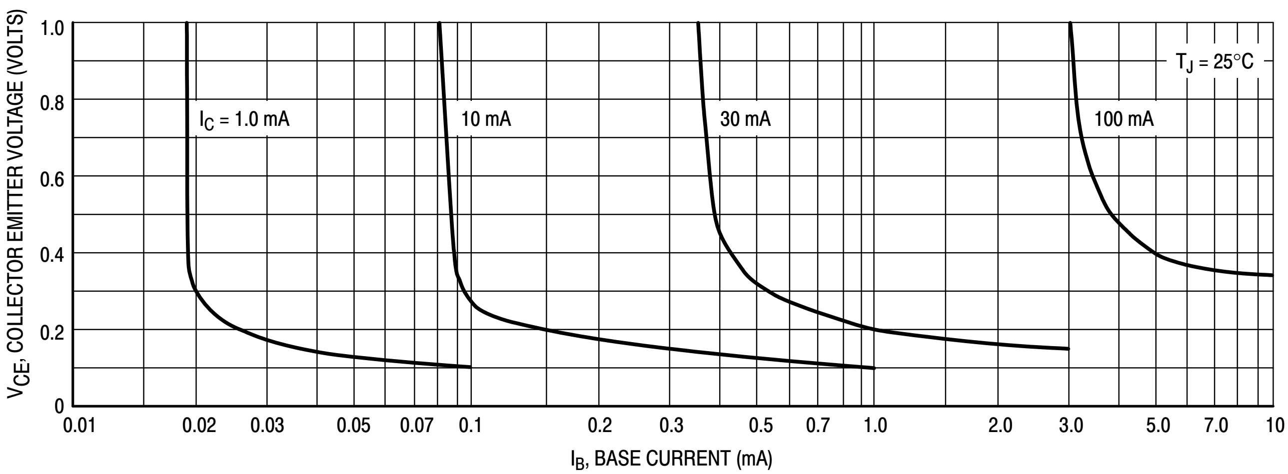



**Figure 14. Collector Saturation Region**

## TYPICAL STATIC CHARACTERISTICS

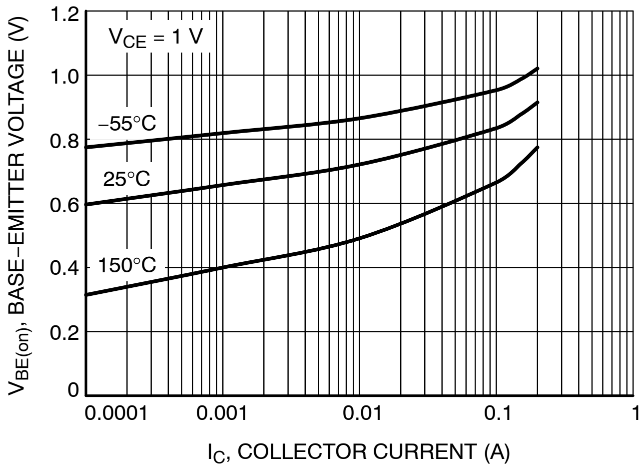



**Figure 15. Base Emitter Voltage vs. Collector Current**

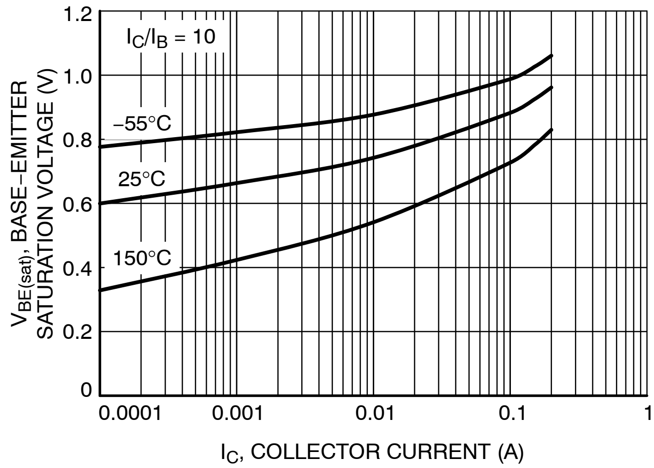



**Figure 16. Base Emitter Saturation Voltage vs. Collector Current**

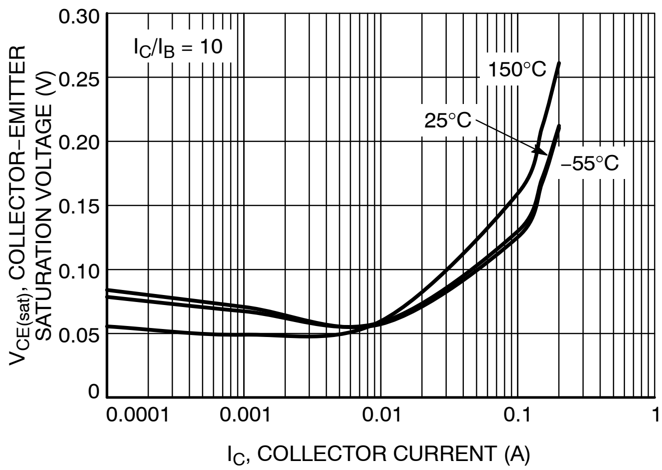



**Figure 17. Collector Emitter Saturation Voltage vs. Collector Current**

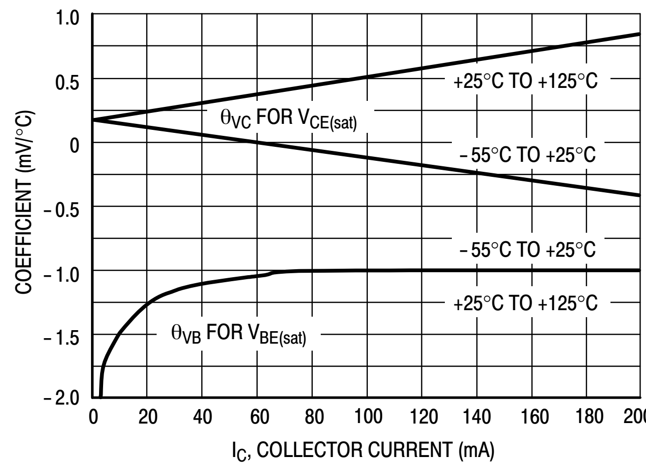
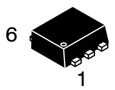



**Figure 18. Temperature Coefficients**

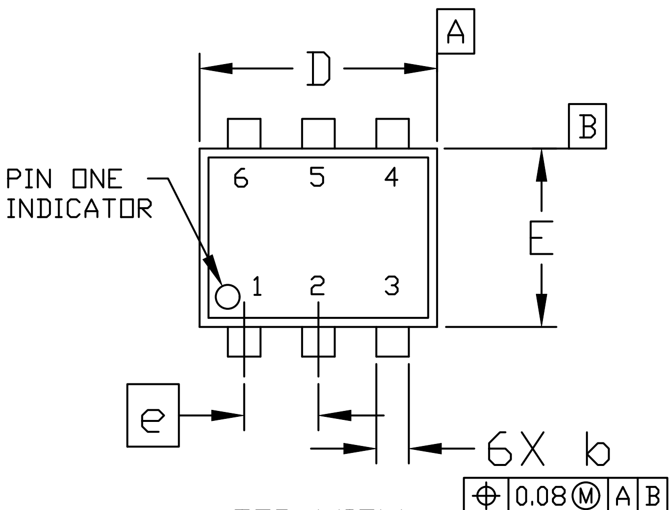



SCALE 4:1

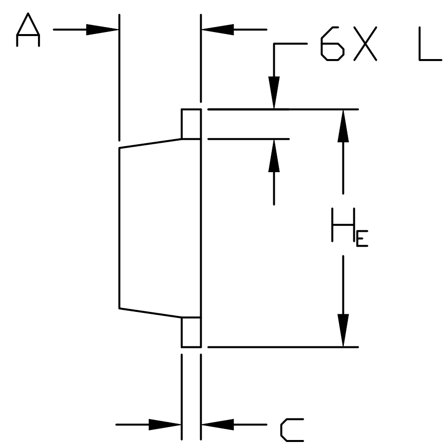
**SOT−563, 6 LEAD**
CASE 463A
ISSUE H

DATE 26 JAN 2021

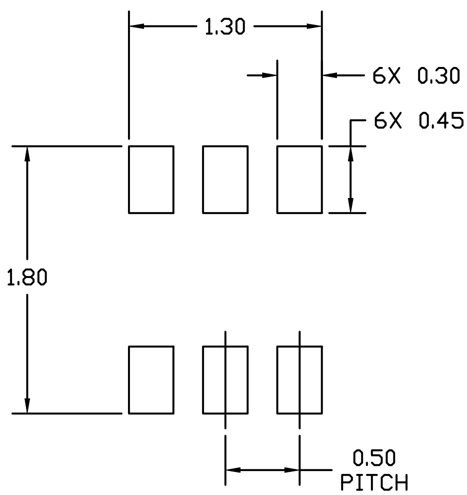
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.




TOP VIEW




SIDE VIEW




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.

| DIM | MILLIMETERS MIN. | NOM. | MAX. |
|---|---|---|---|
| A | 0.50 | 0.55 | 0.60 |
| b | 0.17 | 0.22 | 0.27 |
| c | 0.08 | 0.13 | 0.18 |
| D | 1.50 | 1.60 | 1.70 |
| E | 1.10 | 1.20 | 1.30 |
| e | 0.50 BSC | | |
| L | 0.10 | 0.20 | 0.30 |
| $H_E$ | 1.50 | 1.60 | 1.70 |

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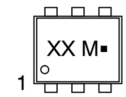
|---|---|---|
| DESCRIPTION: | SOT−563, 6 LEAD | PAGE 1 OF 2 |

**SOT−563, 6 LEAD**
CASE 463A
ISSUE H

DATE 26 JAN 2021

```
STYLE 1:
PIN 1. EMITTER 1
    2. BASE 1
    3. COLLECTOR 2
    4. EMITTER 2
    5. BASE 2
    6. COLLECTOR 1

STYLE 2:
PIN 1. EMITTER 1
    2. EMITTER 2
    3. BASE 2
    4. COLLECTOR 2
    5. BASE 1
    6. COLLECTOR 1

STYLE 3:
PIN 1. CATHODE 1
    2. CATHODE 1
    3. ANODE/ANODE 2
    4. CATHODE 2
    5. CATHODE 2
    6. ANODE/ANODE 1

STYLE 4:
PIN 1. COLLECTOR
    2. COLLECTOR
    3. BASE
    4. EMITTER
    5. COLLECTOR
    6. COLLECTOR

STYLE 5:
PIN 1. CATHODE
    2. CATHODE
    3. ANODE
    4. ANODE
    5. CATHODE
    6. CATHODE

STYLE 6:
PIN 1. CATHODE
    2. ANODE
    3. CATHODE
    4. CATHODE
    5. CATHODE
    6. CATHODE

STYLE 7:
PIN 1. CATHODE
    2. ANODE
    3. CATHODE
    4. CATHODE
    5. ANODE
    6. CATHODE

STYLE 8:
PIN 1. DRAIN
    2. DRAIN
    3. GATE
    4. SOURCE
    5. DRAIN
    6. DRAIN

STYLE 9:
PIN 1. SOURCE 1
    2. GATE 1
    3. DRAIN 2
    4. SOURCE 2
    5. GATE 2
    6. DRAIN 1

STYLE 10:
PIN 1. CATHODE 1
    2. N/C
    3. CATHODE 2
    4. ANODE 2
    5. N/C
    6. ANODE 1

STYLE 11:
PIN 1. EMITTER 2
    2. BASE 2
    3. COLLECTOR 1
    4. EMITTER 1
    5. BASE 1
    6. COLLECTOR 2
```

**GENERIC**
**MARKING DIAGRAM***




XX = Specific Device Code
M = Month Code
▪ = Pb−Free Package

*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.

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