

# NSBC114EDXV6T1, NSBC114EDXV6T5

Preferred Devices

## Dual Bias Resistor Transistors

### NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the NSBC114EDXV6T1 series, two BRT devices are housed in the SOT-563 package which is ideal for low power surface mount applications where board space is at a premium.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Lead-Free Solder Plating

#### MAXIMUM RATINGS

( $T_A = 25^\circ\text{C}$  unless otherwise noted, common for  $Q_1$  and  $Q_2$ )

| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage    | $V_{CBO}$ | 50    | Vdc  |
| Collector-Emitter Voltage | $V_{CEO}$ | 50    | Vdc  |
| Collector Current         | $I_C$     | 100   | mAdc |

#### THERMAL CHARACTERISTICS

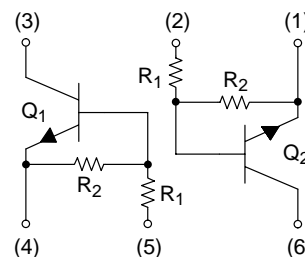
| Characteristic (One Junction Heated)  | Symbol          | Max                          | Unit                       |
|---|-----------------|------------------------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$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

1. FR-4 @ Minimum Pad

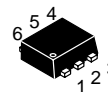


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NSBC114EDXV6T1



SOT-563  
CASE 463A  
PLASTIC

#### MARKING DIAGRAM



xx = Specific Device Code  
(see table on following page)  
D = Date Code

#### ORDERING INFORMATION

| Device         | Package | Shipping                       |
|----------------|---------|--------------------------------|
| NSBC114EDXV6T1 | SOT-563 | 4 mm pitch<br>4000/Tape & Reel |
| NSBC114EDXV6T5 | SOT-563 | 2 mm pitch<br>8000/Tape & Reel |

#### DEVICE MARKING INFORMATION

See specific marking information in the device marking table on page 2 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

# NSBC114EDXV6T1, NSBC114EDXV6T5

## DEVICE MARKING AND RESISTOR VALUES

| Device                   | Package | Marking | R1 (kΩ) | R2 (kΩ) |
|--------------------------|---------|---------|---------|---------|
| NSBC114EDXV6T1           | SOT-563 | 7A      | 10      | 10      |
| NSBC124EDXV6T1           | SOT-563 | 7B      | 22      | 22      |
| NSBC144EDXV6T1           | SOT-563 | 7C      | 47      | 47      |
| NSBC114YDXV6T1           | SOT-563 | 7D      | 10      | 47      |
| NSBC114TDXV6T1 (Note 2)  | SOT-563 | 7E      | 10      | ∞       |
| NSBC143TDXV6T1 (Notes 2) | SOT-563 | 7F      | 4.7     | ∞       |
| NSBC113EDXV6T1 (Note 2)  | SOT-563 | 7G      | 1.0     | 1.0     |
| NSBC123EDXV6T1 (Notes 2) | SOT-563 | 7H      | 2.2     | 2.2     |
| NSBC143EDXV6T1 (Notes 2) | SOT-563 | 7J      | 4.7     | 4.7     |
| NSBC143ZDXV6T1 (Notes 2) | SOT-563 | 7K      | 4.7     | 47      |
| NSBC124XDXV6T1 (Notes 2) | SOT-563 | 7L      | 22      | 47      |
| NSBC123JDXV6T1 (Note 2)  | SOT-563 | 7M      | 2.2     | 47      |
| NSBC115EDXV6T1 (Notes 2) | SOT-563 | 7N      | 100     | 100     |
| NSBC144WDXV6T1 (Notes 2) | SOT-563 | 7P      | 47      | 22      |

2. New resistor combinations. Updated curves to follow in subsequent data sheets.

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>)

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

### OFF CHARACTERISTICS

|  |                      |    |   |      |      |
|--|----------------------|----|---|------|------|
| Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)                 | I <sub>CBO</sub>     | -  | - | 100  | nAdc |
| Collector-Emitter Cutoff Current (V <sub>CE</sub> = 50 V, I <sub>B</sub> = 0)              | I <sub>CEO</sub>     | -  | - | 500  | nAdc |
| Emitter-Base Cutoff Current<br>(V <sub>EB</sub> = 6.0 V, I <sub>C</sub> = 0)               | I <sub>EBO</sub>     | -  | - | 0.5  | mAdc |
|  | NSBC114EDXV6T1       | -  | - | 0.2  |      |
|  | NSBC124EDXV6T1       | -  | - | 0.1  |      |
|  | NSBC144EDXV6T1       | -  | - | 0.2  |      |
|  | NSBC114YDXV6T1       | -  | - | 0.9  |      |
|  | NSBC114TDXV6T1       | -  | - | 1.9  |      |
|  | NSBC143TDXV6T1       | -  | - | 4.3  |      |
|  | NSBC113EDXV6T1       | -  | - | 2.3  |      |
|  | NSBC123EDXV6T1       | -  | - | 1.5  |      |
|  | NSBC143EDXV6T1       | -  | - | 0.18 |      |
|  | NSBC143ZDXV6T1       | -  | - | 0.13 |      |
|  | NSBC124XDXV6T1       | -  | - | 0.2  |      |
|  | NSBC123JDXV6T1       | -  | - | 0.05 |      |
|  | NSBC115EDXV6T1       | -  | - | 0.13 |      |
|  | NSBC144WDXV6T1       | -  | - |      |      |
| Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)              | V <sub>(BR)CBO</sub> | 50 | - | -    | Vdc  |
| Collector-Emitter Breakdown Voltage (Note 3) (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0) | V <sub>(BR)CEO</sub> | 50 | - | -    | Vdc  |

3. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%

# NSBC114EDXV6T1, NSBC114EDXV6T5

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>) (Continued)

| Characteristic  | Symbol   | Min  | Typ  | Max   | Unit  |  |     |
|---|--|--|--|---|---|--|-----|
| <b>ON CHARACTERISTICS</b> (Note 4)  |  |  |  |   |   |  |     |
| DC Current Gain<br>(V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)  | NSBC114EDXV6T1<br>NSBC124EDXV6T1<br>NSBC144EDXV6T1<br>NSBC114YDXV6T1<br>NSBC114TDXV6T1<br>NSBC143TDXV6T1<br>NSBC113EDXV6T1<br>NSBC123EDXV6T1<br>NSBC143EDXV6T1<br>NSBC143ZDXV6T1<br>NSBC124XDXV6T1<br>NSBC123JDXV6T1<br>NSBC115EDXV6T1<br>NSBC144WDXV6T1   | h <sub>FE</sub>  | 35<br>60<br>80<br>80<br>160<br>160<br>3.0<br>8.0<br>15<br>80<br>80<br>80<br>80<br>80 | 60<br>100<br>140<br>140<br>350<br>350<br>5.0<br>15<br>30<br>200<br>150<br>140<br>150<br>140 | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-      |  |     |
| Collector-Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 5 mA) NSBC113EDXV6T1/NSBC123EDXV6T1<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1 mA) NSBC114TDXV6T1/NSBC143TDXV6T1<br>NSBC143EDXV6T1/NSBC143ZDXV6T1/NSBC124XDXV6T1 |  | V <sub>CE(sat)</sub>   | -  | -   | 0.25  | Vdc  |     |
| Output Voltage (on)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 kΩ)   | NSBC114EDXV6T1<br>NSBC124EDXV6T1<br>NSBC114YDXV6T1<br>NSBC114TDXV6T1<br>NSBC143TDXV6T1<br>NSBC113EDXV6T1<br>NSBC123EDXV6T1<br>NSBC143EDXV6T1<br>NSBC143ZDXV6T1<br>NSBC124XDXV6T1<br>NSBC123JDXV6T1<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 5.5 V, R <sub>L</sub> = 1.0 kΩ)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 4.0 V, R <sub>L</sub> = 1.0 kΩ) | NSBC114EDXV6T1<br>NSBC124EDXV6T1<br>NSBC114YDXV6T1<br>NSBC114TDXV6T1<br>NSBC143TDXV6T1<br>NSBC113EDXV6T1<br>NSBC123EDXV6T1<br>NSBC143EDXV6T1<br>NSBC143ZDXV6T1<br>NSBC124XDXV6T1<br>NSBC123JDXV6T1<br>NSBC144EDXV6T1<br>NSBC115EDXV6T1<br>NSBC144WDXV6T1 | V <sub>OL</sub>  | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-                | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | 0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2<br>0.2 | Vdc |
| Output Voltage (off)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.050 V, R <sub>L</sub> = 1.0 kΩ)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.25 V, R <sub>L</sub> = 1.0 kΩ)   | NSBC113EDXV6T1<br>NSBC114TDXV6T1<br>NSBC143TDXV6T1<br>NSBC143ZDXV6T1   | V <sub>OH</sub>  | 4.9  | -   | -   | Vdc  |     |

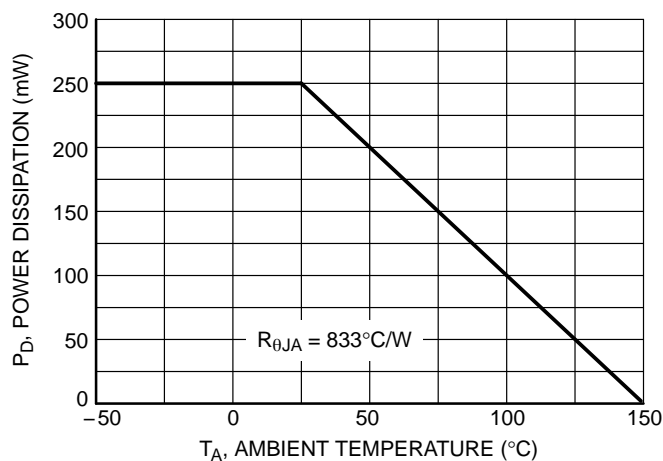
4. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%

# NSBC114EDXV6T1, NSBC114EDXV6T5

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>) (Continued)

| Characteristic                                 | Symbol  | Min   | Typ   | Max   | Unit  |            |
|--|---|-------|-------|-------|-------|------------|
| <b>ON CHARACTERISTICS</b> (Note 5) (Continued) |   |       |       |       |       |            |
| Input Resistor                                 | NSBC114EDXV6T1  | R1    | 7.0   | 10    | 13    | k $\Omega$ |
|  | NSBC124EDXV6T1  |       | 15.4  | 22    | 28.6  |            |
|  | NSBC144EDXV6T1  |       | 32.9  | 47    | 61.1  |            |
|  | NSBC114YDXV6T1  |       | 7.0   | 10    | 13    |            |
|  | NSBC114TDXV6T1  |       | 7.0   | 10    | 13    |            |
|  | NSBC143TDXV6T1  |       | 3.3   | 4.7   | 6.1   |            |
|  | NSBC113EDXV6T1  |       | 0.7   | 1.0   | 1.3   |            |
|  | NSBC123EDXV6T1  |       | 1.5   | 2.2   | 2.9   |            |
|  | NSBC143EDXV6T1  |       | 3.3   | 4.7   | 6.1   |            |
|  | NSBC143ZDXV6T1  |       | 3.3   | 4.7   | 6.1   |            |
|  | NSBC124XDXV6T1  |       | 15.4  | 22    | 28.6  |            |
|  | NSBC123JDXV6T1  |       | 1.54  | 2.2   | 2.86  |            |
|  | NSBC115EDXV6T1  |       | 70    | 100   | 130   |            |
| NSBC144WDXV6T1                                 |   | 32.9  | 47    | 61.1  |       |            |
| Resistor Ratio                                 | NSBC114EDXV6T1/NSBC124EDXV6T1/<br>NSBC144EDXV6T1/NSBC115EDXV6T1<br>NSBC114YDXV6T1 | R1/R2 | 0.8   | 1.0   | 1.2   |            |
|  | NSBC114TDXV6T1/NSBC143TDXV6T1   |       | 0.17  | 0.21  | 0.25  |            |
|  | NSBC113EDXV6T1/NSBC123EDXV6T1/NSBC143EDXV6T1                                      |       | –     | –     | –     |            |
|  | NSBC143ZDXV6T1  |       | 0.8   | 1.0   | 1.2   |            |
|  | NSBC124XDXV6T1  |       | 0.055 | 0.1   | 0.185 |            |
|  | NSBC124XDXV6T1  |       | 0.38  | 0.47  | 0.56  |            |
|  | NSBC123JDXV6T1  |       | 0.038 | 0.047 | 0.056 |            |
|  | NSBC144WDXV6T1  |       | 1.7   | 2.1   | 2.6   |            |

5. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%



**Figure 1. Derating Curve**

# NSBC114EDXV6T1, NSBC114EDXV6T5

## TYPICAL ELECTRICAL CHARACTERISTICS — NSBC114EDXV6T1

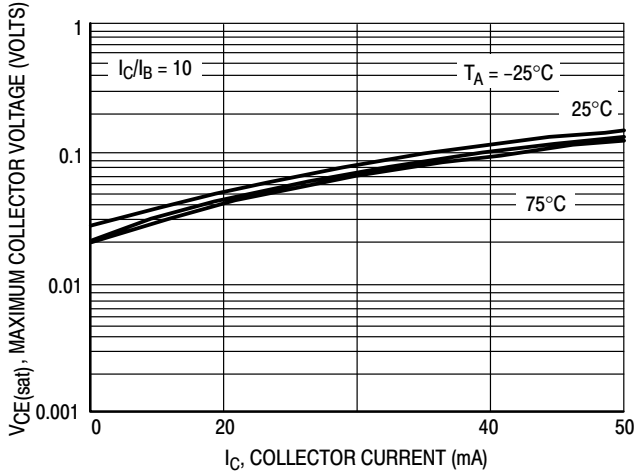


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

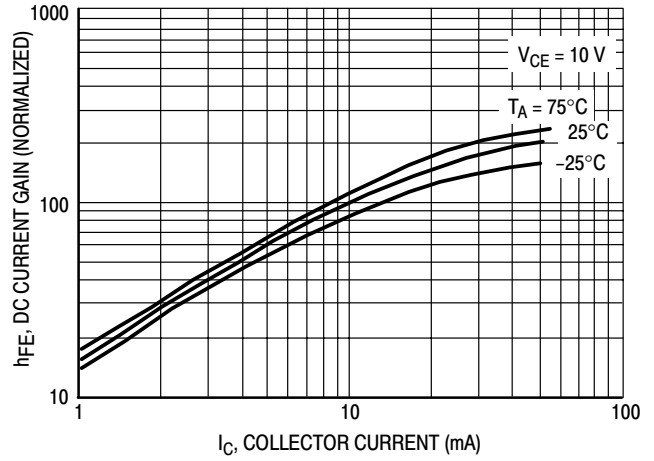


Figure 3. DC Current Gain

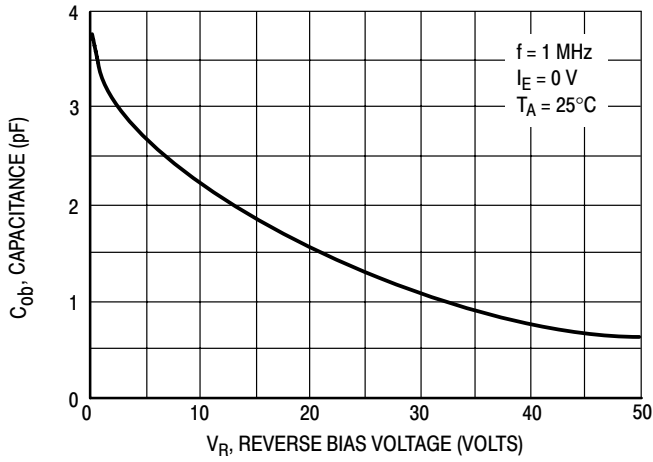


Figure 4. Output Capacitance

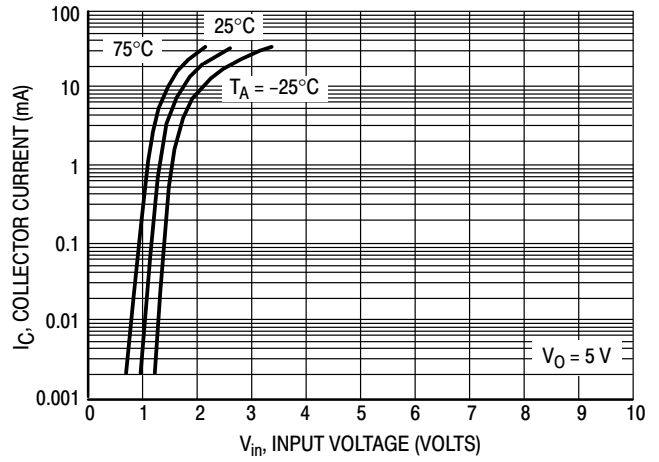


Figure 5. Output Current versus Input Voltage

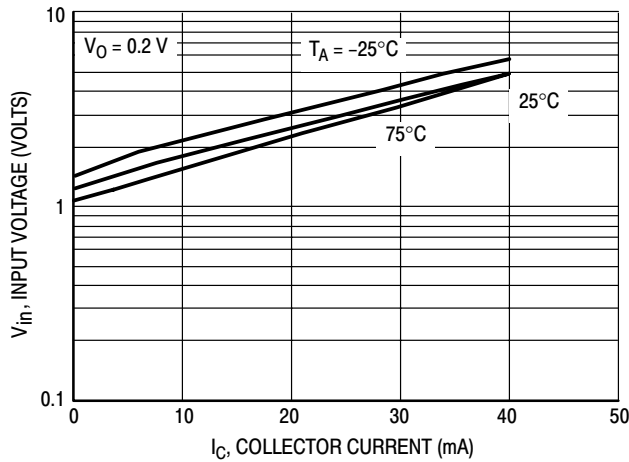


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — NSBC124EDXV6T1

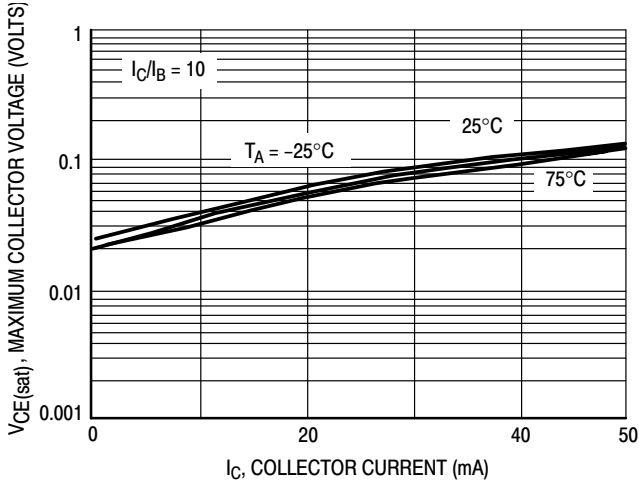


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

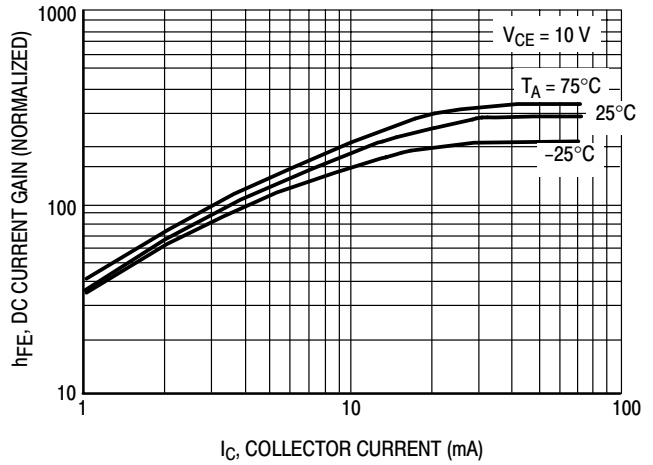


Figure 8. DC Current Gain

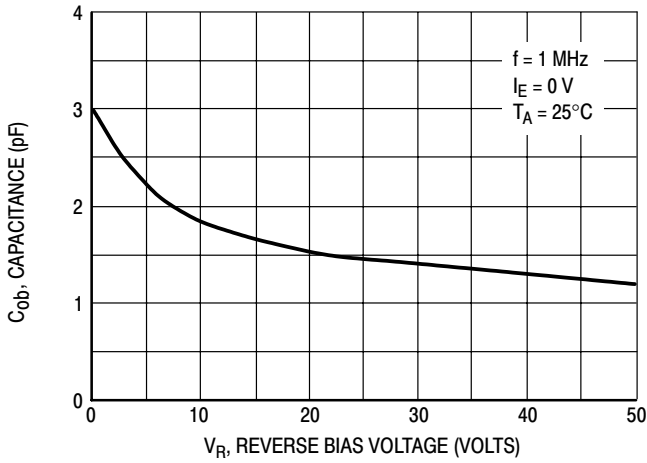


Figure 9. Output Capacitance

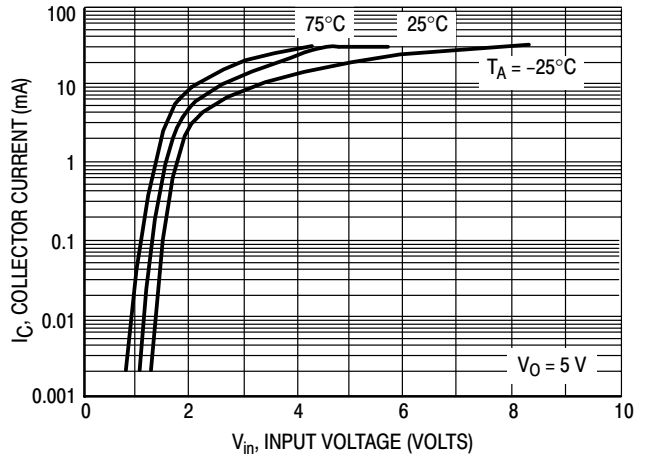


Figure 10. Output Current versus Input Voltage

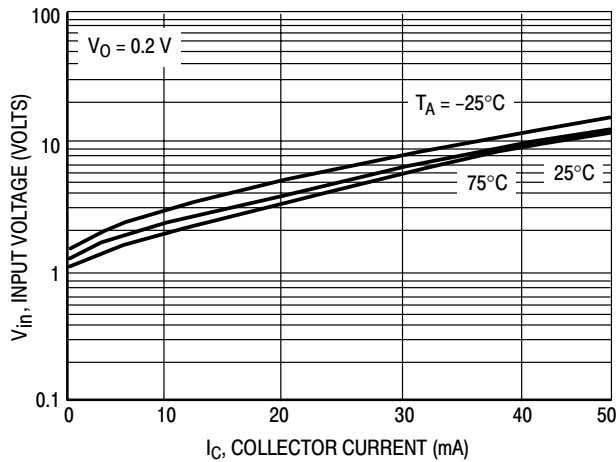


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — NSBC114EDXV6T1

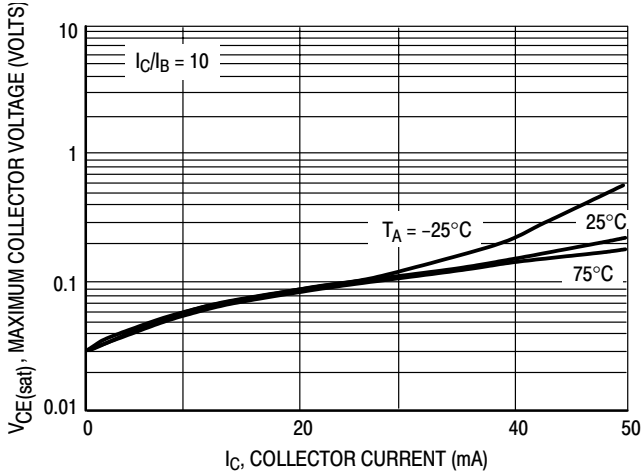


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

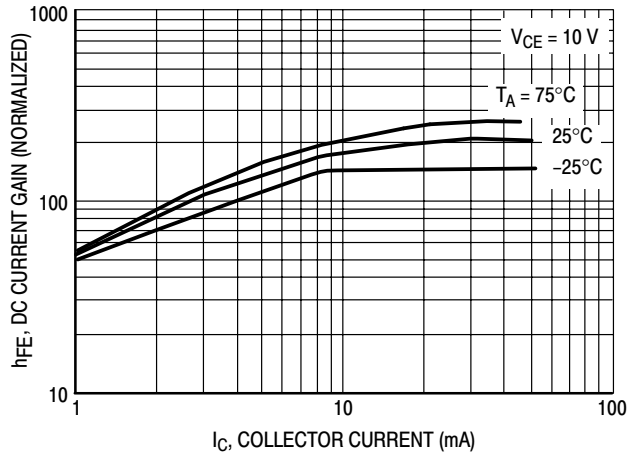


Figure 13. DC Current Gain

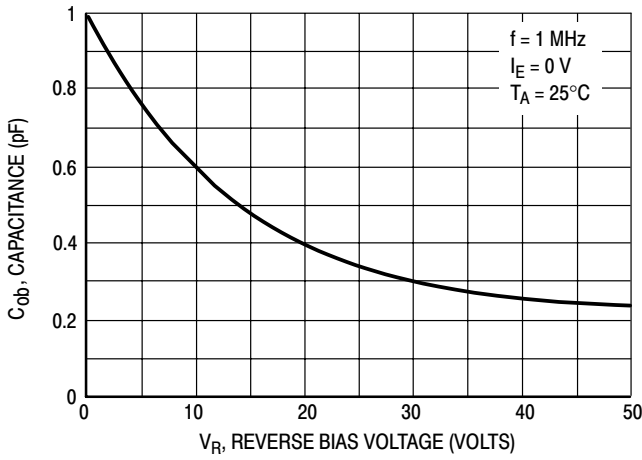


Figure 14. Output Capacitance

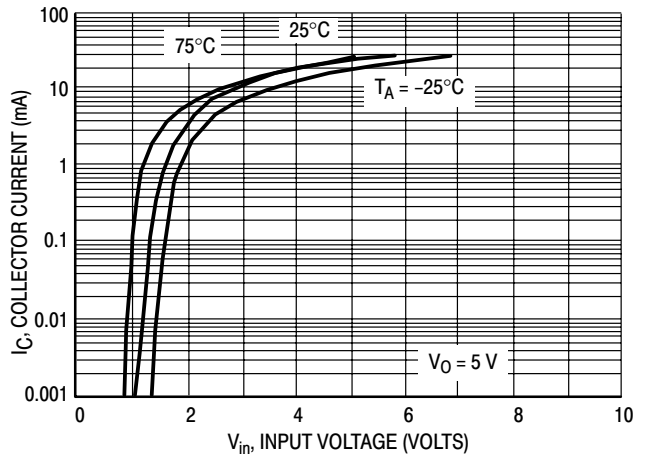


Figure 15. Output Current versus Input Voltage

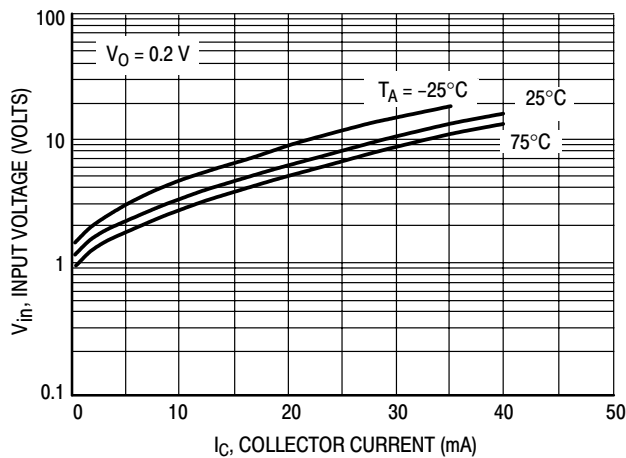


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — NSBC114YDXV6T1

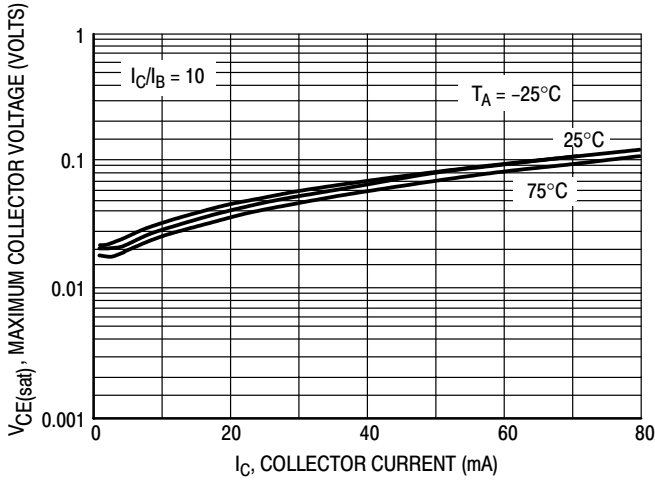


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

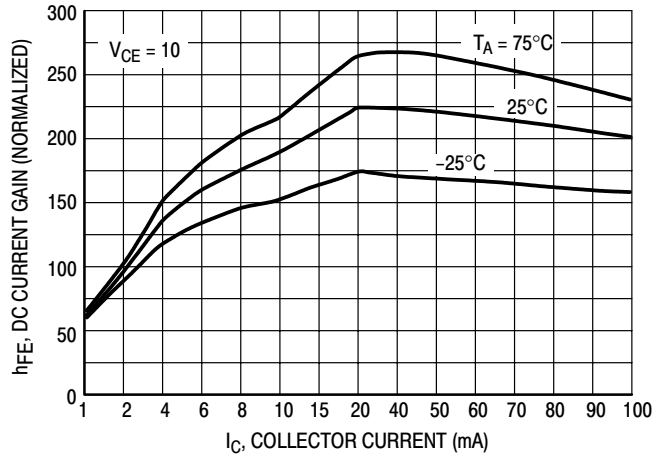


Figure 18. DC Current Gain

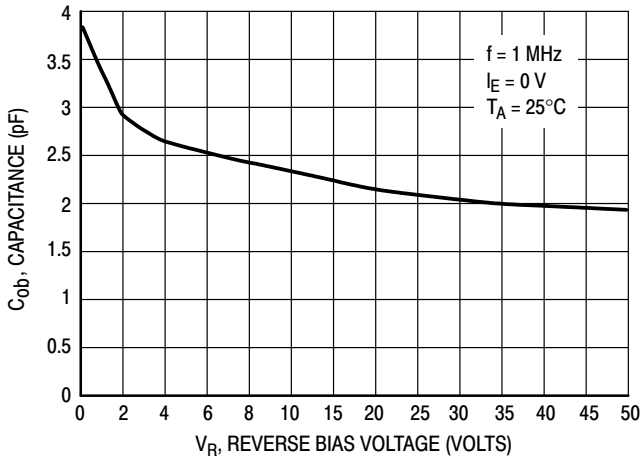


Figure 19. Output Capacitance

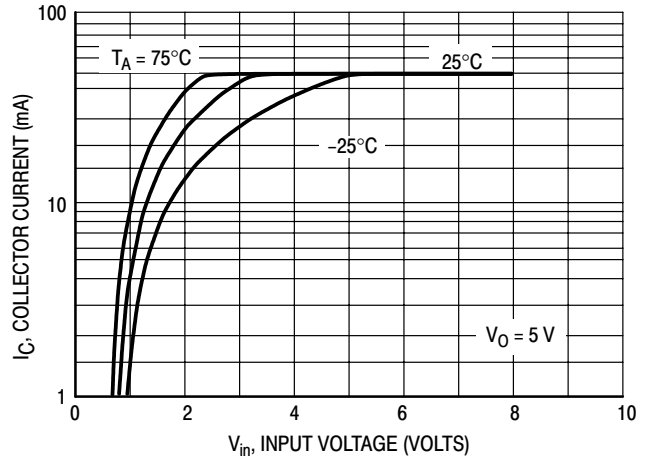


Figure 20. Output Current versus Input Voltage

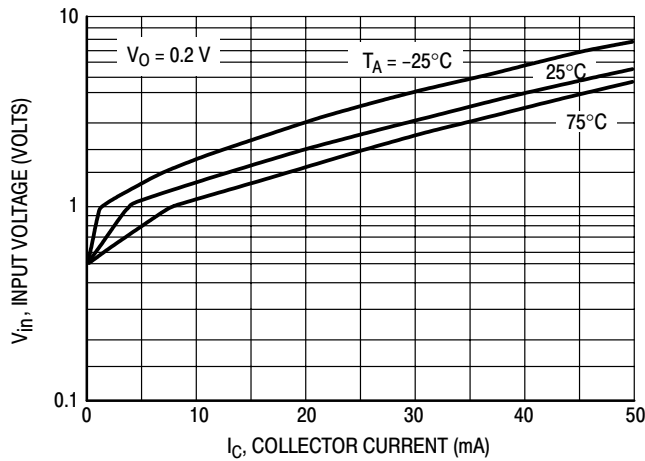


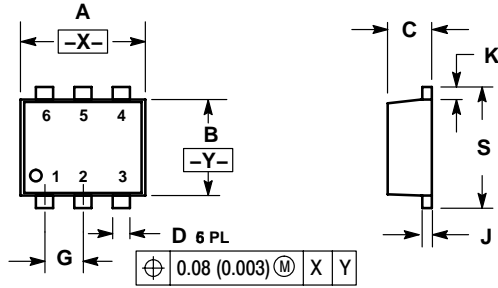
Figure 21. Input Voltage versus Output Current



# NSBC114EDXV6T1, NSBC114EDXV6T5

## PACKAGE DIMENSIONS

SOT-563, 6 LEAD  
CASE 463A-01  
ISSUE O



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         | MAX  | MIN       | MAX   |
| A   | 1.50        | 1.70 | 0.059     | 0.067 |
| B   | 1.10        | 1.30 | 0.043     | 0.051 |
| C   | 0.50        | 0.60 | 0.020     | 0.024 |
| D   | 0.17        | 0.27 | 0.007     | 0.011 |
| G   | 0.50 BSC    |      | 0.020 BSC |       |
| J   | 0.08        | 0.18 | 0.003     | 0.007 |
| K   | 0.10        | 0.30 | 0.004     | 0.012 |
| S   | 1.50        | 1.70 | 0.059     | 0.067 |

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

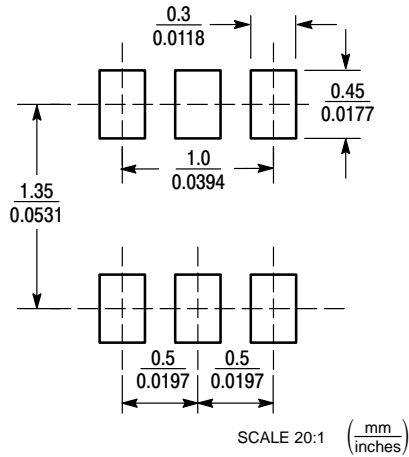
STYLE 3:

- 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

### 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.

# NSBC114EDXV6T1, NSBC114EDXV6T5

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