

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## Dual Bias Resistor Transistors

### NPN and PNP 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 NSBC114EPDXV6T1 series, two complementary 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.

#### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7 inch Tape and Reel
- These are Pb-Free Devices

**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted, common for  $Q_1$  and  $Q_2$ , – minus sign for  $Q_1$  (PNP) omitted)

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

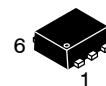
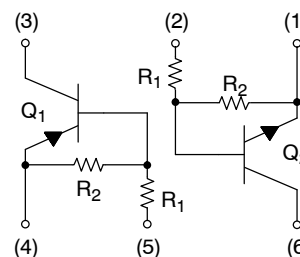
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. FR-4 @ Minimum Pad



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SOT-563  
CASE 463A  
PLASTIC

#### MARKING DIAGRAM



xx = Specific Device Code  
(see table on page 2)  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

| Device           | Package | Shipping†                      |
|------------------|---------|--------------------------------|
| NSBC114EPDXV6T1G | SOT-563 | 4 mm pitch<br>4000/Tape & Reel |
| NSBC114EPDXV6T5G | SOT-563 | 2 mm pitch<br>8000/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

#### DEVICE MARKING INFORMATION

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

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## DEVICE MARKING AND RESISTOR VALUES

| Device                    | Package | Marking | R1 (kΩ) | R2 (kΩ) |
|---------------------------|---------|---------|---------|---------|
| NSBC114EPDXV6T1G          | SOT-563 | 11      | 10      | 10      |
| NSBC124EPDXV6T1G          | SOT-563 | 12      | 22      | 22      |
| NSBC144EPDXV6T1G          | SOT-563 | 13      | 47      | 47      |
| NSBC114YPDXV6T1G          | SOT-563 | 14      | 10      | 47      |
| NSBC114TPDXV6T1G (Note 2) | SOT-563 | 15      | 10      | ∞       |
| NSBC143TPDXV6T1G (Note 2) | SOT-563 | 16      | 4.7     | ∞       |
| NSBC113EPDXV6T1G (Note 2) | SOT-563 | 30      | 1.0     | 1.0     |
| NSBC123EPDXV6T1G (Note 2) | SOT-563 | 31      | 2.2     | 2.2     |
| NSBC143EPDXV6T1G (Note 2) | SOT-563 | 32      | 4.7     | 4.7     |
| NSBC143ZPDXV6T1G (Note 2) | SOT-563 | 33      | 4.7     | 47      |
| NSBC124XPDXV6T1G (Note 2) | SOT-563 | 34      | 22      | 47      |
| NSBC123JPDXV6T1G (Note 2) | SOT-563 | 35      | 2.2     | 47      |

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>, - minus sign for Q<sub>1</sub> (PNP) omitted)

| 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 (V <sub>EB</sub> = 6.0 V, I <sub>C</sub> = 0)                  | I <sub>EBO</sub>     | -  | - | 0.5  | mAdc |
|  | NSBC114EPDXV6T1G     | -  | - | 0.2  |      |
|  | NSBC124EPDXV6T1G     | -  | - | 0.1  |      |
|  | NSBC144EPDXV6T1G     | -  | - | 0.2  |      |
|  | NSBC114YPDXV6T1G     | -  | - | 0.9  |      |
|  | NSBC114TPDXV6T1G     | -  | - | 1.9  |      |
|  | NSBC143TPDXV6T1G     | -  | - | 4.3  |      |
|  | NSBC113EPDXV6T1G     | -  | - | 2.3  |      |
|  | NSBC123EPDXV6T1G     | -  | - | 1.5  |      |
|  | NSBC143EPDXV6T1G     | -  | - | 0.18 |      |
|  | NSBC143ZPDXV6T1G     | -  | - | 0.13 |      |
|  | NSBC124XPDXV6T1G     | -  | - | 0.2  |      |
|  | NSBC123JPDXV6T1G     | -  | - |      |      |
| 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  |

### ON CHARACTERISTICS (Note 3)

|   |                  |     |     |   |  |
|---|------------------|-----|-----|---|--|
| DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA) | h <sub>FE</sub>  | 35  | 60  | - |  |
|   | NSBC114EPDXV6T1G | 60  | 100 | - |  |
|   | NSBC124EPDXV6T1G | 80  | 140 | - |  |
|   | NSBC144EPDXV6T1G | 80  | 140 | - |  |
|   | NSBC114YPDXV6T1G | 160 | 350 | - |  |
|   | NSBC114TPDXV6T1G | 160 | 350 | - |  |
|   | NSBC143TPDXV6T1G | 3.0 | 5.0 | - |  |
|   | NSBC113EPDXV6T1G | 8.0 | 15  | - |  |
|   | NSBC123EPDXV6T1G | 15  | 30  | - |  |
|   | NSBC143EPDXV6T1G | 80  | 200 | - |  |
|   | NSBC143ZPDXV6T1G | 80  | 150 | - |  |
|   | NSBC124XPDXV6T1G | 80  | 140 | - |  |
|   | NSBC123JPDXV6T1G | 80  | 140 | - |  |

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

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

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>, – minus sign for Q<sub>1</sub> (PNP) omitted)

| Characteristic   | Symbol               | Min | Typ  | Max  | Unit |
|--|----------------------|-----|------|------|------|
| <b>ON CHARACTERISTICS</b> (Note 3)   |                      |     |      |      |      |
| Collector-Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)          | V <sub>CE(sat)</sub> | –   | –    | 0.25 | Vdc  |
| NSBC114EPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC124EPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC144EPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC114YPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC143TPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC123JPDXV6T1G   |                      | –   | –    | 0.25 |      |
| (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 5 mA)  |                      | –   | –    | 0.25 |      |
| NSBC113EPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC123EPDXV6T1G   |                      | –   | –    | 0.25 |      |
| (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1 mA)  |                      | –   | –    | 0.25 |      |
| NSBC114TPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC143EPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC143ZPDXV6T1G   |                      | –   | –    | 0.25 |      |
| NSBC124XPDXV6T1G   | –                    | –   | 0.25 |      |      |
| 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)  | V <sub>OL</sub>      | –   | –    | 0.2  | Vdc  |
| NSBC114EPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC124EPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC114YPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC114TPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC143TPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC113EPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC123EPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC143EPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC143ZPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC124XPDXV6T1G   |                      | –   | –    | 0.2  |      |
| NSBC123JPDXV6T1G   |                      | –   | –    | 0.2  |      |
| (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ)                         |                      | –   | –    | 0.2  |      |
| NSBC144EPDXV6T1G   |                      | –   | –    | 0.2  |      |
| 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) | V <sub>OH</sub>      | 4.9 | –    | –    | Vdc  |
| NSBC114EPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC124EPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC144EPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC114YPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC143TPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC143ZPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC124XPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC123JPDXV6T1G   |                      | 4.9 | –    | –    |      |
| (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.050 V, R <sub>L</sub> = 1.0 kΩ)                       |                      | 4.9 | –    | –    |      |
| NSBC113EPDXV6T1G   |                      | 4.9 | –    | –    |      |
| (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.25 V, R <sub>L</sub> = 1.0 kΩ)                        |                      | 4.9 | –    | –    |      |
| NSBC114TPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC123EPDXV6T1G   |                      | 4.9 | –    | –    |      |
| NSBC143EPDXV6T1G   | 4.9                  | –   | –    |      |      |

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

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

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## ELECTRICAL CHARACTERISTICS

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

| Characteristic                     | Symbol           | Min   | Typ   | Max   | Unit  |            |
|------------------------------------|------------------|-------|-------|-------|-------|------------|
| <b>ON CHARACTERISTICS</b> (Note 3) |                  |       |       |       |       |            |
| Input Resistor                     | NSBC114EPDXV6T1G | R1    | 7.0   | 10    | 13    | k $\Omega$ |
|                                    | NSBC124EPDXV6T1G |       | 15.4  | 22    | 28.6  |            |
|                                    | NSBC144EPDXV6T1G |       | 32.9  | 47    | 61.1  |            |
|                                    | NSBC114YPDXV6T1G |       | 7.0   | 10    | 13    |            |
|                                    | NSBC114TPDXV6T1G |       | 7.0   | 10    | 13    |            |
|                                    | NSBC143TPDXV6T1G |       | 3.3   | 4.7   | 6.1   |            |
|                                    | NSBC113EPDXV6T1G |       | 0.7   | 1.0   | 1.3   |            |
|                                    | NSBC123EPDXV6T1G |       | 1.5   | 2.2   | 2.9   |            |
|                                    | NSBC143EPDXV6T1G |       | 3.3   | 4.7   | 6.1   |            |
|                                    | NSBC143ZPDXV6T1G |       | 3.3   | 4.7   | 6.1   |            |
|                                    | NSBC124XPDXV6T1G |       | 15.4  | 22    | 28.6  |            |
|                                    | NSBC123JPDXV6T1G |       | 1.54  | 2.2   | 2.86  |            |
| Resistor Ratio                     | NSBC114EPDXV6T1G | R1/R2 | 0.8   | 1.0   | 1.2   |            |
|                                    | NSBC124EPDXV6T1G |       | 0.8   | 1.0   | 1.2   |            |
|                                    | NSBC144EPDXV6T1G |       | 0.8   | 1.0   | 1.2   |            |
|                                    | NSBC114YPDXV6T1G |       | 0.17  | 0.21  | 0.25  |            |
|                                    | NSBC114TPDXV6T1G |       | -     | -     | -     |            |
|                                    | NSBC143TPDXV6T1G |       | -     | -     | -     |            |
|                                    | NSBC113EPDXV6T1G |       | 0.8   | 1.0   | 1.2   |            |
|                                    | NSBC123EPDXV6T1G |       | 0.8   | 1.0   | 1.2   |            |
|                                    | NSBC143EPDXV6T1G |       | 0.8   | 1.0   | 1.2   |            |
|                                    | NSBC143ZPDXV6T1G |       | 0.055 | 0.1   | 0.185 |            |
|                                    | NSBC124XPDXV6T1G |       | 0.38  | 0.47  | 0.56  |            |
|                                    | NSBC123JPDXV6T1G |       | 0.038 | 0.047 | 0.056 |            |

2. New resistor combinations. Updated curves to follow in subsequent data sheets.
3. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%

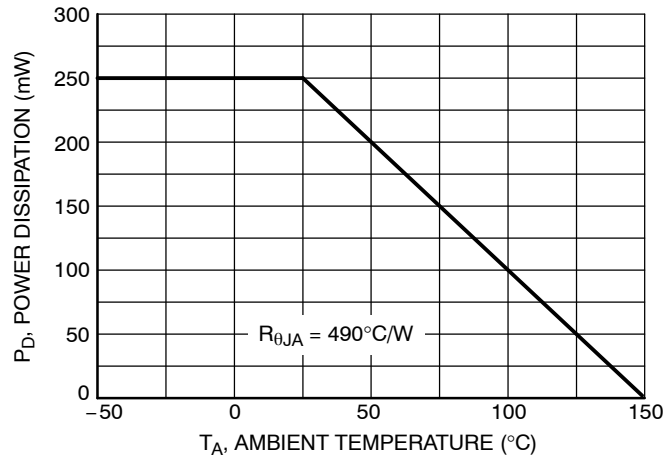


Figure 1. Derating Curve

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## TYPICAL ELECTRICAL CHARACTERISTICS – NSBC114EPDXV6T1 NPN TRANSISTOR

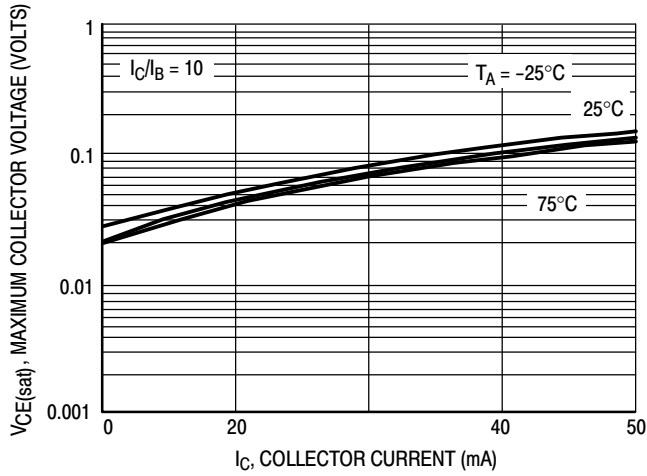


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

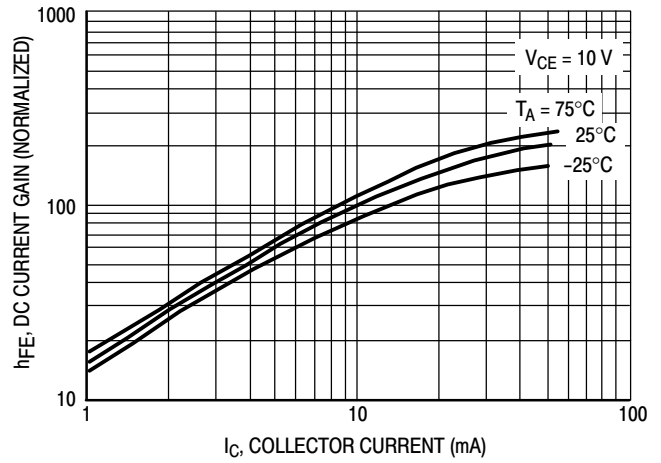


Figure 3. DC Current Gain

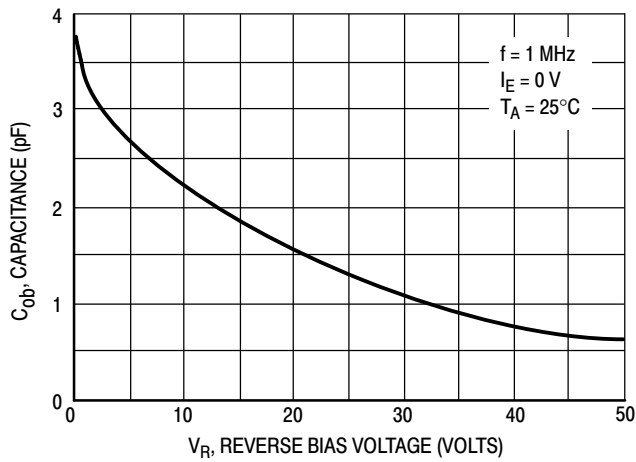


Figure 4. Output Capacitance

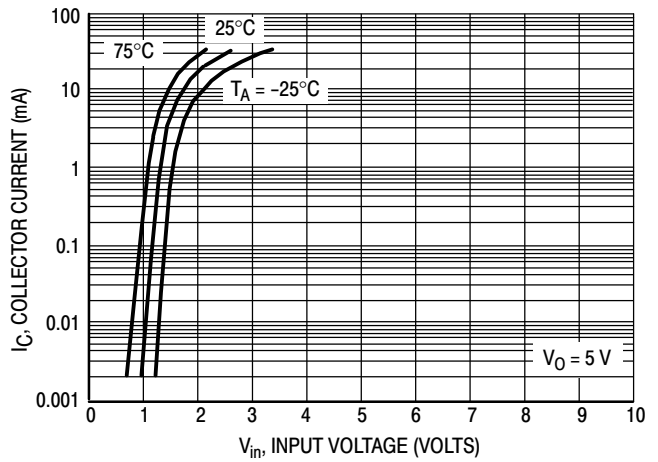


Figure 5. Output Current versus Input Voltage

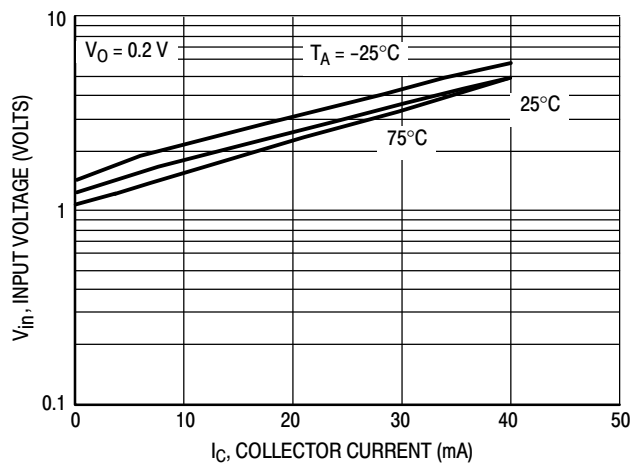


Figure 6. Input Voltage versus Output Current

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## TYPICAL ELECTRICAL CHARACTERISTICS – NSBC114EPDXV6T1 PNP TRANSISTOR

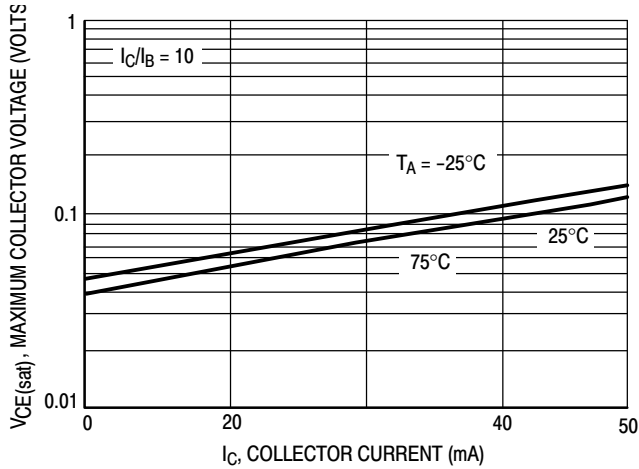


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

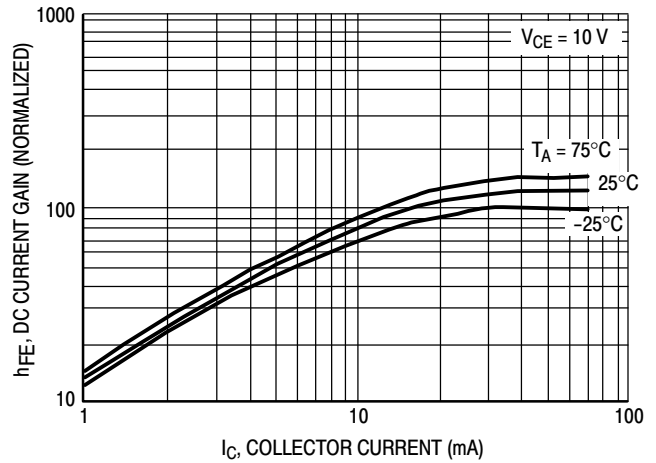


Figure 8. DC Current Gain

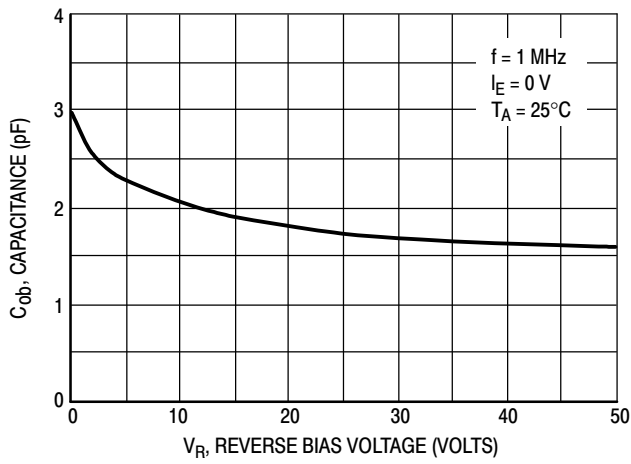


Figure 9. Output Capacitance

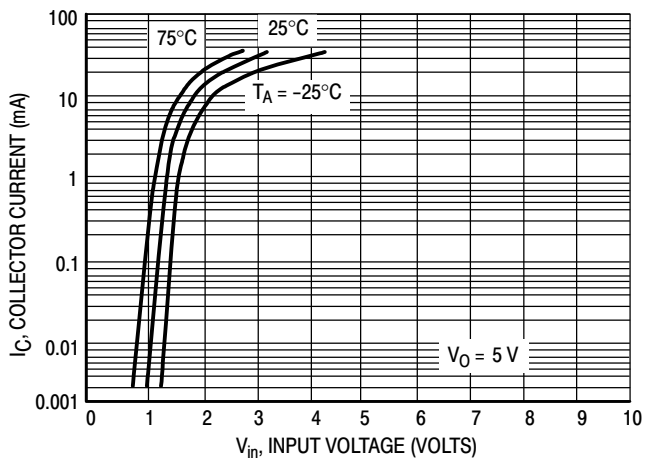


Figure 10. Output Current versus Input Voltage

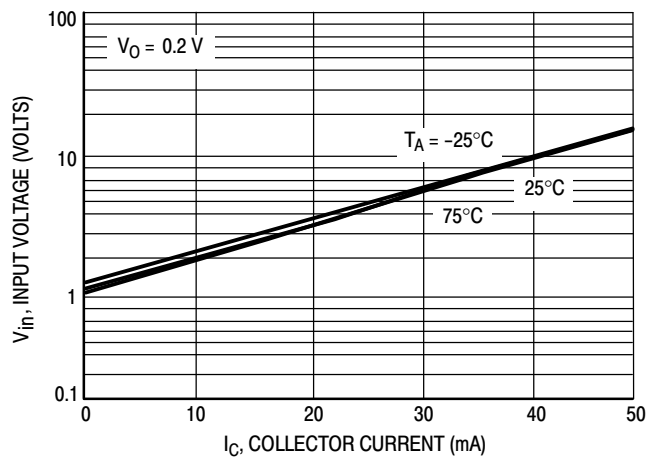


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – NSBC124EPDXV6T1 NPN TRANSISTOR

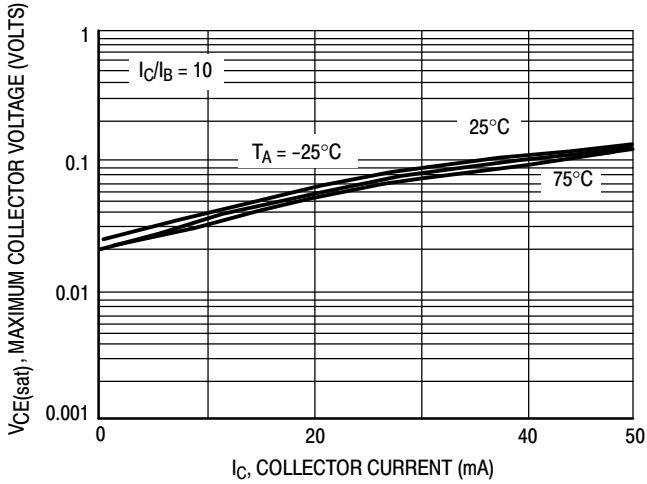


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

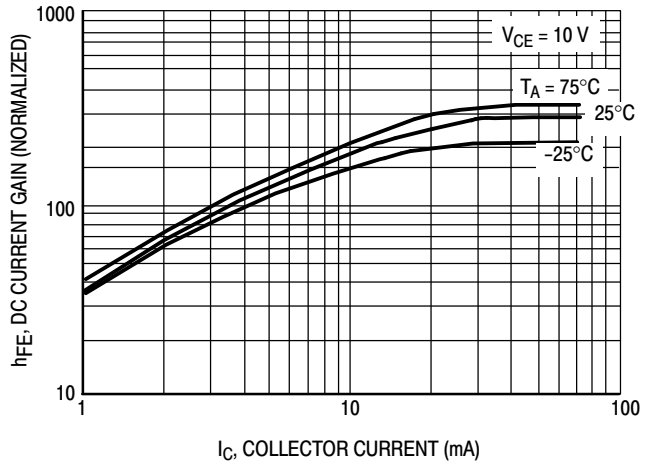


Figure 13. DC Current Gain

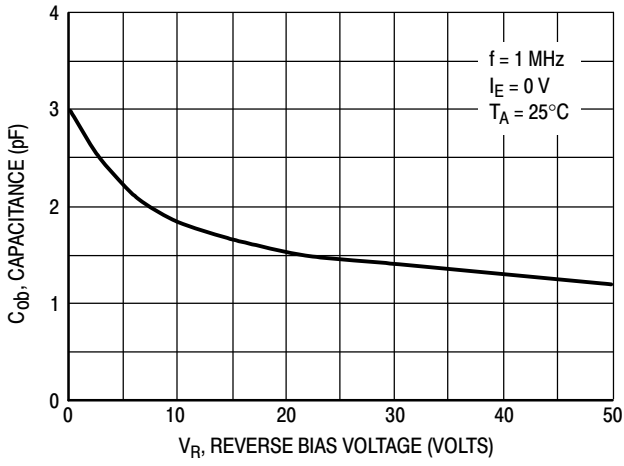


Figure 14. Output Capacitance

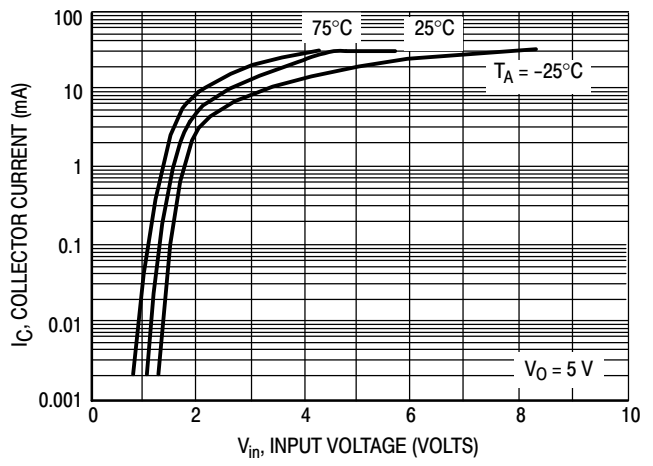


Figure 15. Output Current versus Input Voltage

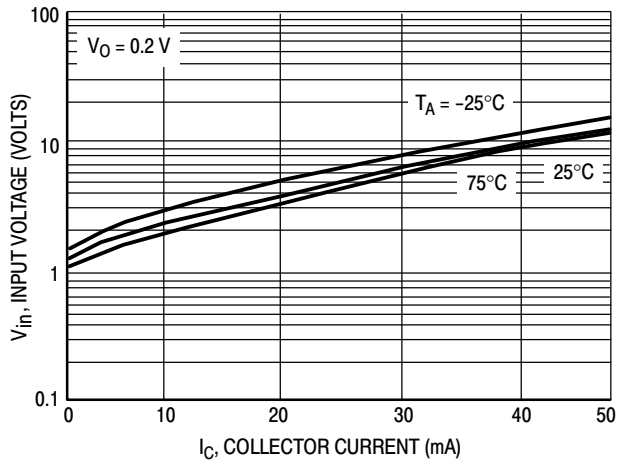


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – NSBC124EPDXV6T1 PNP TRANSISTOR

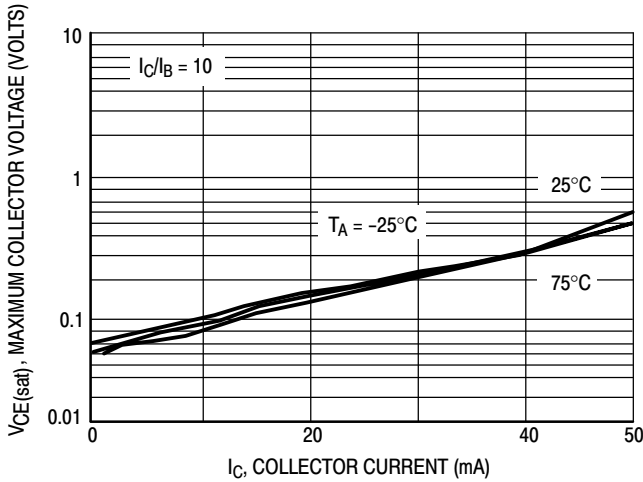


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

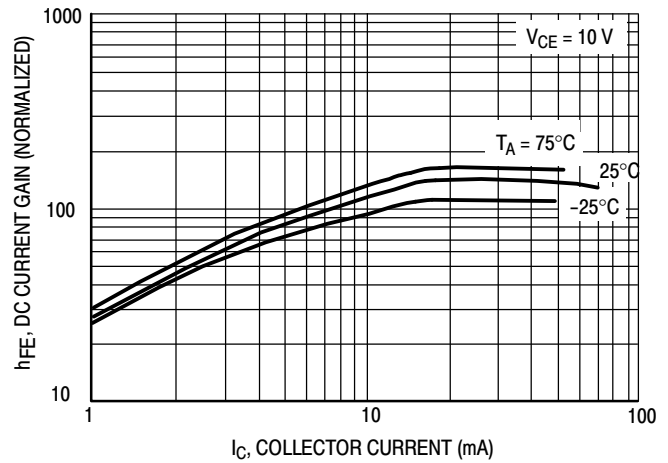


Figure 18. DC Current Gain

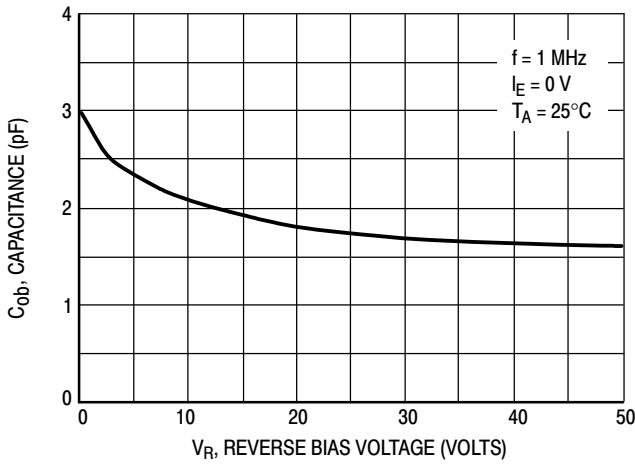


Figure 19. Output Capacitance

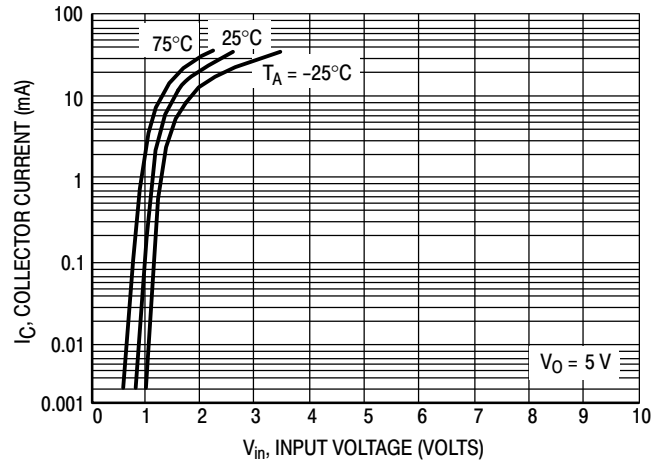


Figure 20. Output Current versus Input Voltage

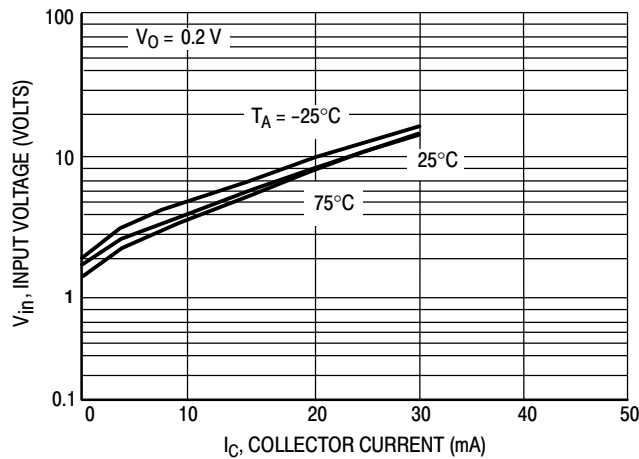


Figure 21. Input Voltage versus Output Current



# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## TYPICAL ELECTRICAL CHARACTERISTICS – NSBC144EPDXV6T1 NPN TRANSISTOR

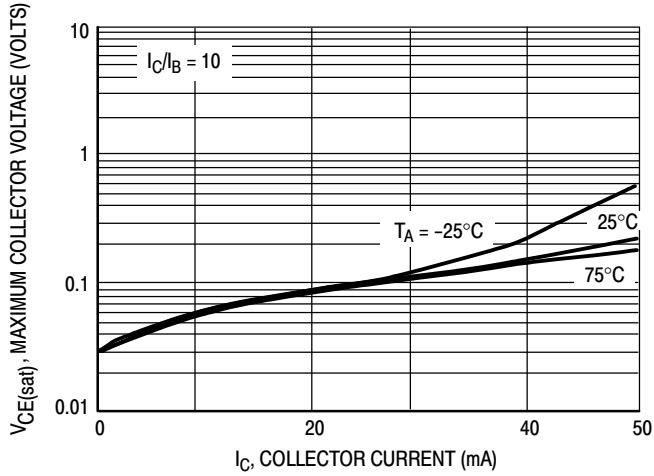


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

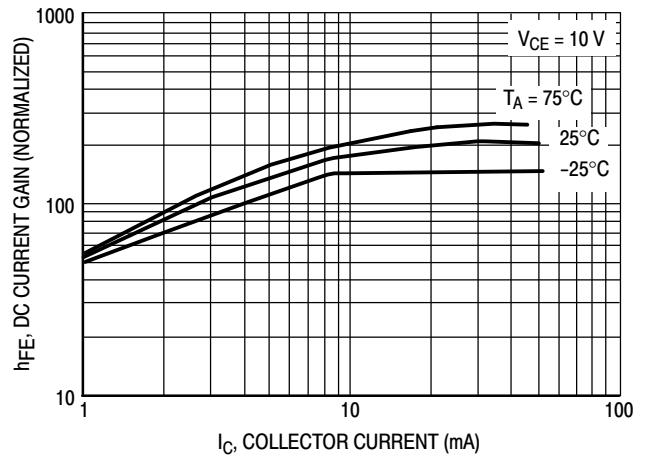


Figure 23. DC Current Gain

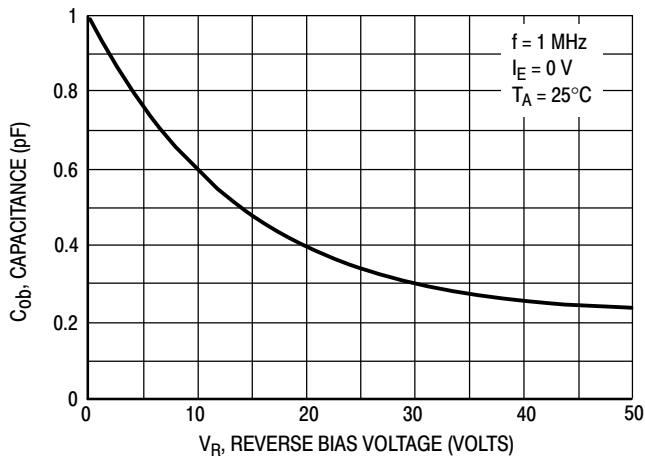


Figure 24. Output Capacitance

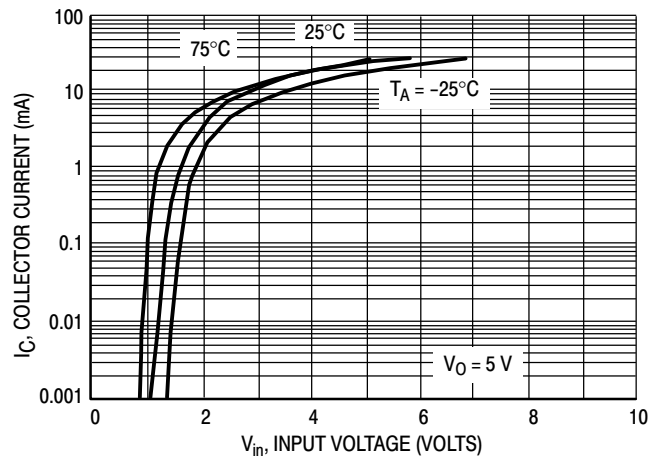


Figure 25. Output Current versus Input Voltage

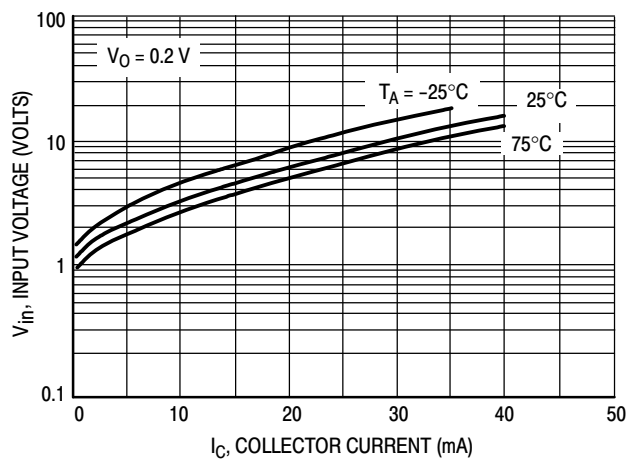


Figure 26. Input Voltage versus Output Current

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## TYPICAL ELECTRICAL CHARACTERISTICS – NSBC144EPDXV6T1 PNP TRANSISTOR

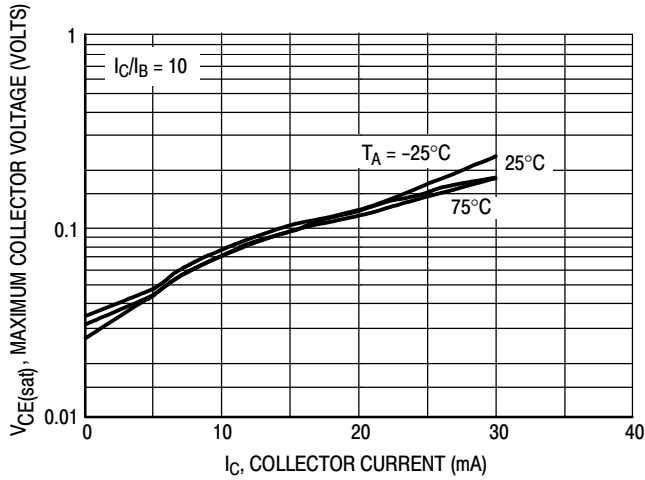


Figure 27.  $V_{CE(sat)}$  versus  $I_C$

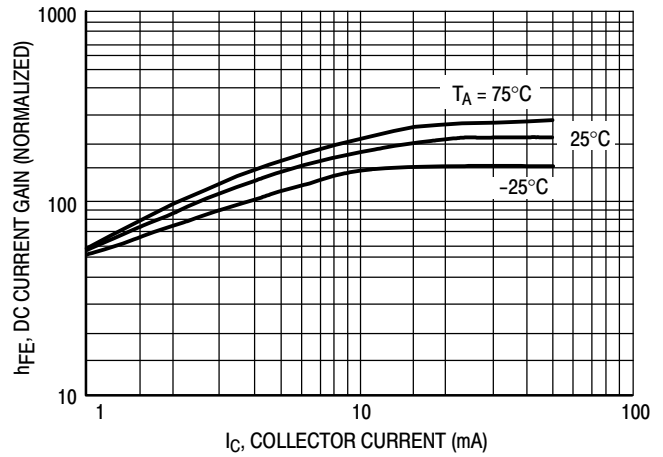


Figure 28. DC Current Gain

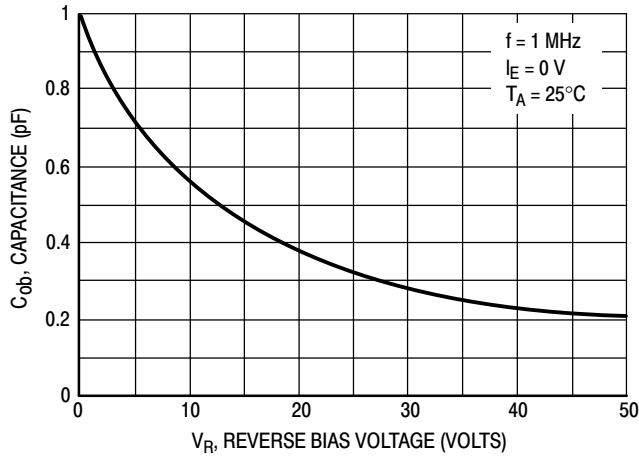


Figure 29. Output Capacitance

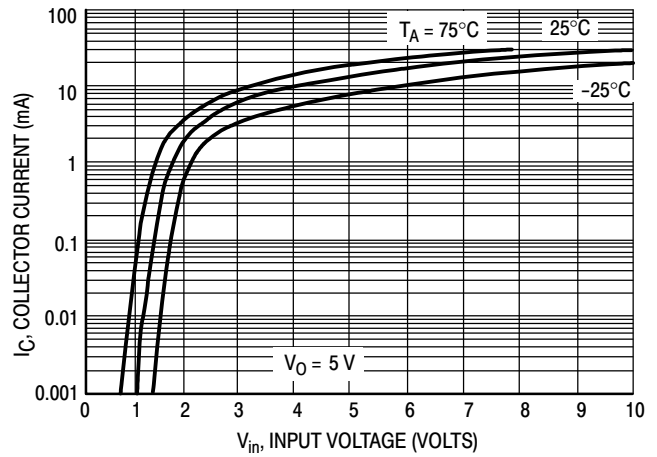


Figure 30. Output Current versus Input Voltage

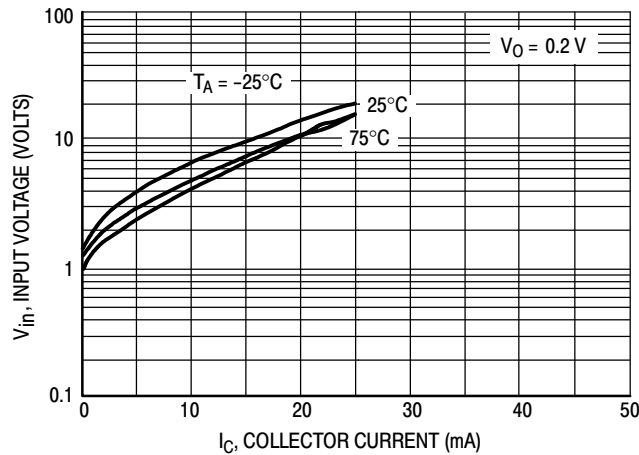


Figure 31. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – NSBC114YPDXV6T1 NPN TRANSISTOR

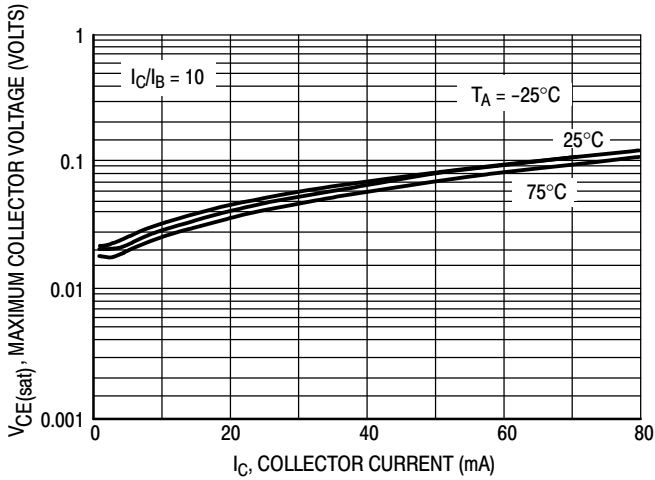


Figure 32.  $V_{CE(sat)}$  versus  $I_C$

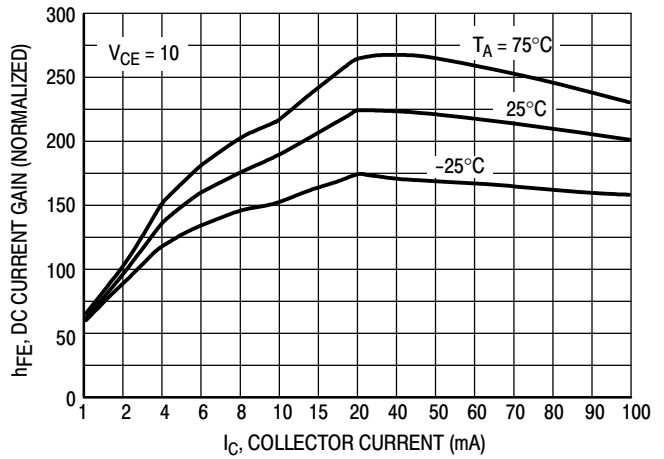


Figure 33. DC Current Gain

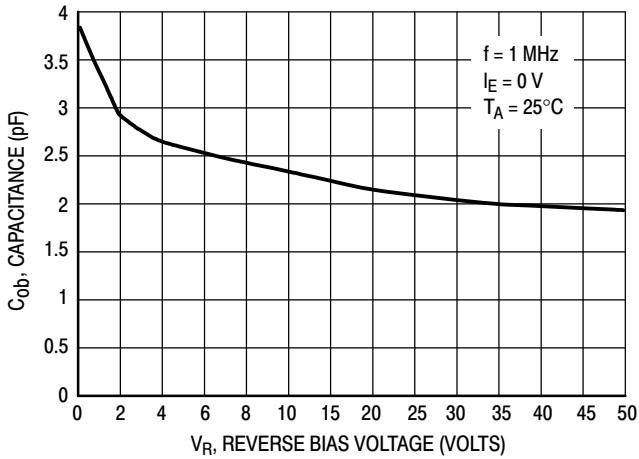


Figure 34. Output Capacitance

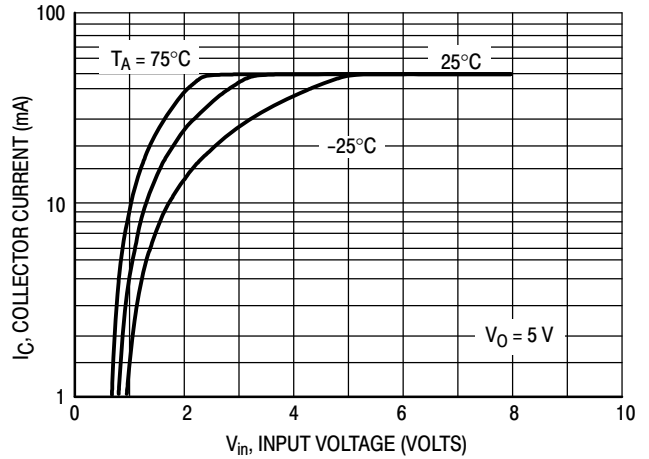


Figure 35. Output Current versus Input Voltage

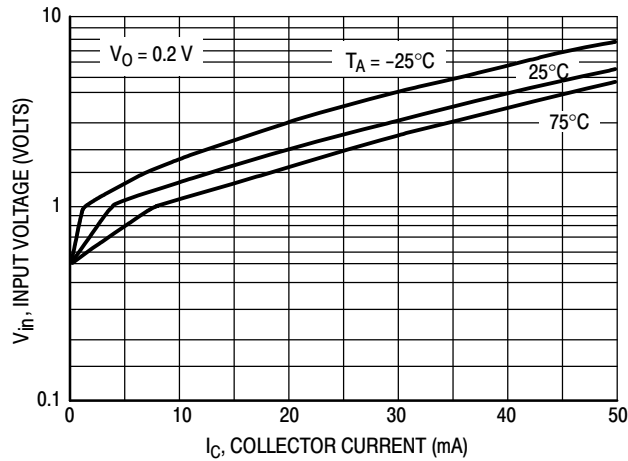


Figure 36. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – NSBC114YPDXV6T1 PNP TRANSISTOR

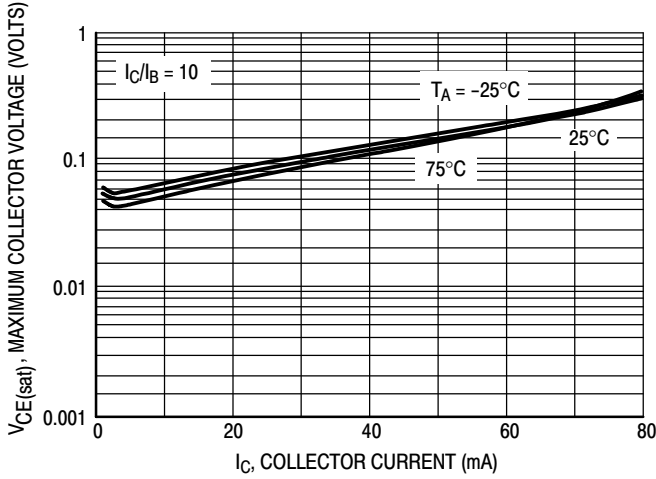


Figure 37.  $V_{CE(sat)}$  versus  $I_C$

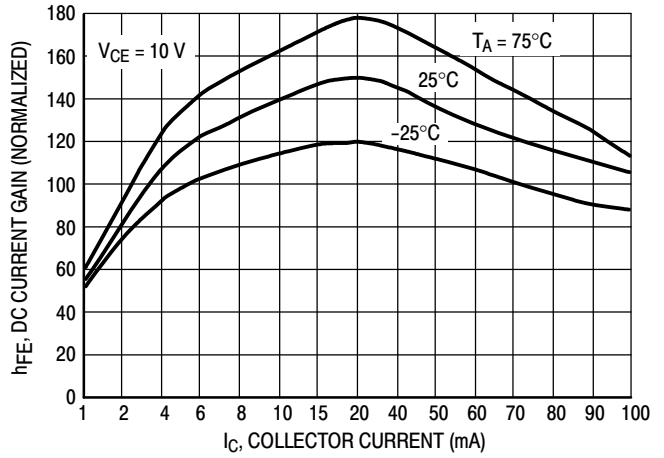


Figure 38. DC Current Gain

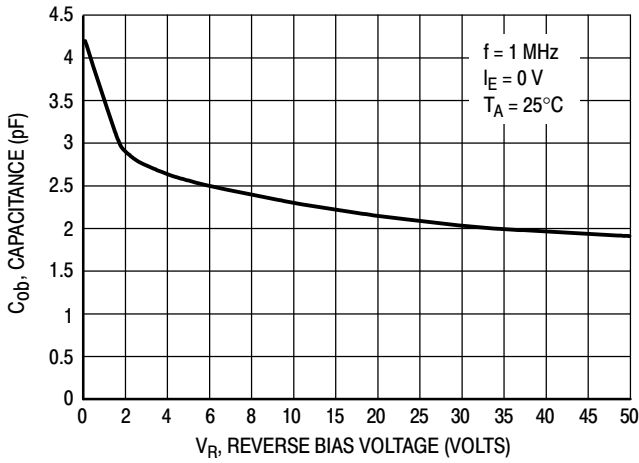


Figure 39. Output Capacitance

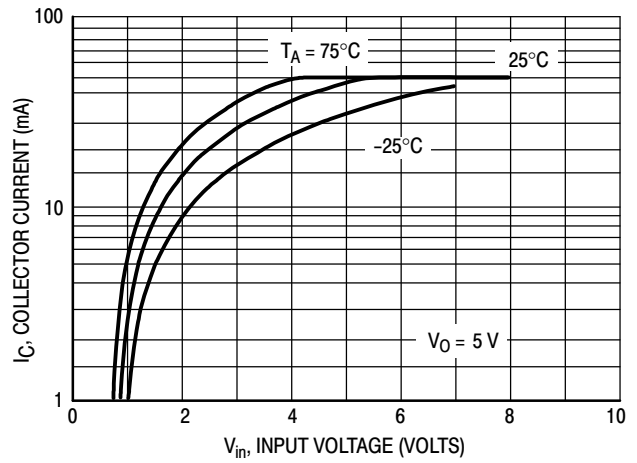


Figure 40. Output Current versus Input Voltage

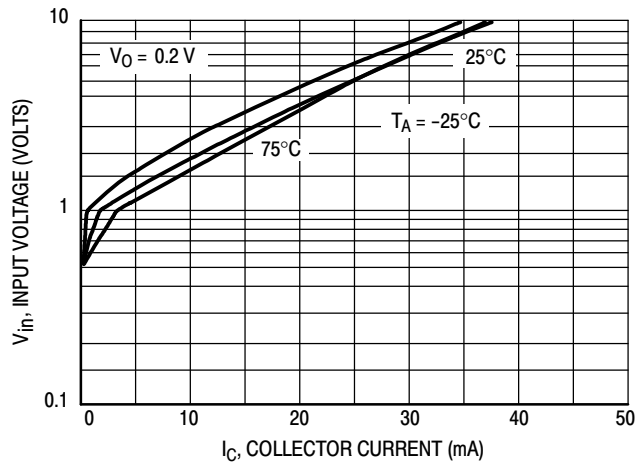


Figure 41. Input Voltage versus Output Current

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## TYPICAL ELECTRICAL CHARACTERISTICS – NSBC114TPDXV6T1

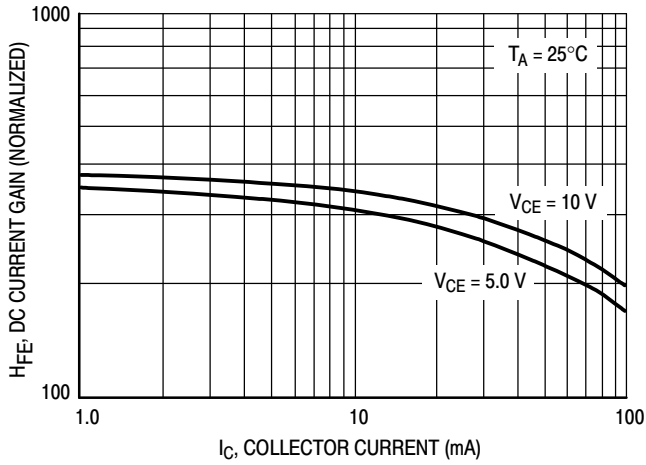


Figure 42. DC Current Gain – PNP

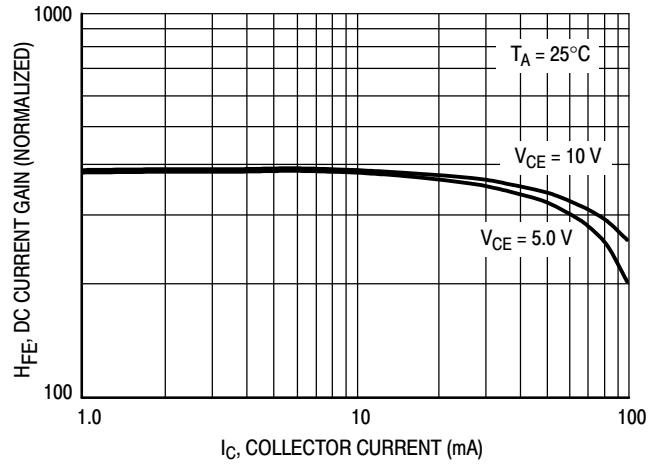


Figure 43. DC Current Gain – NPN

## TYPICAL ELECTRICAL CHARACTERISTICS – NSBC143TPDXV6T1

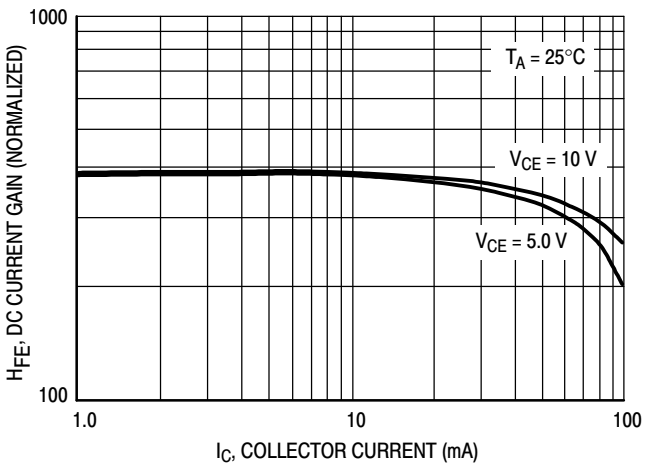


Figure 44. DC Current Gain – PNP

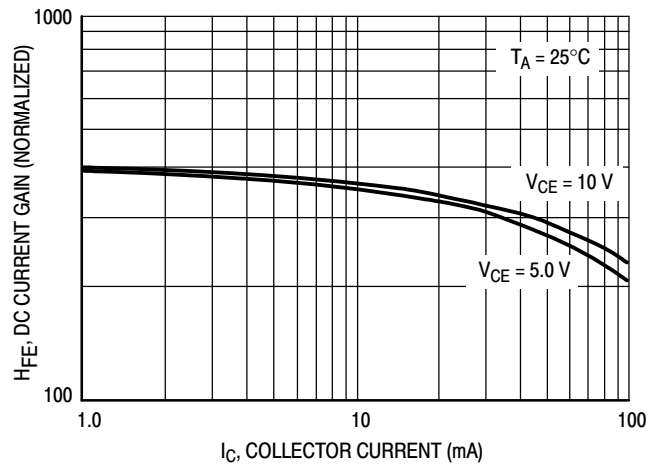
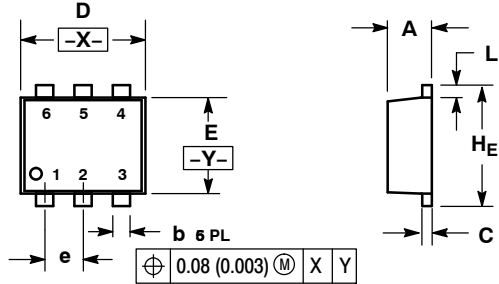


Figure 45. DC Current Gain – NPN

# NSBC114EPDXV6T1G, NSBC114EPDXV6T5G

## PACKAGE DIMENSIONS

### SOT-563, 6 LEAD CASE 463A-01 ISSUE F

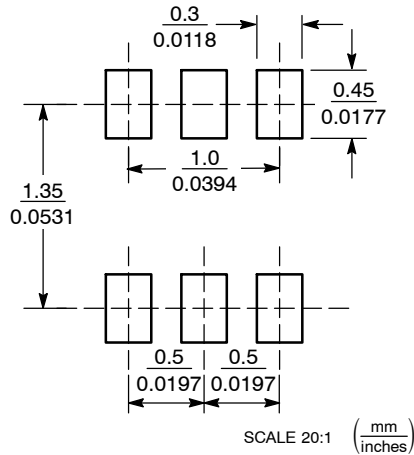


#### NOTES:

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              | 0.50        | 0.55 | 0.60 | 0.020    | 0.021 | 0.023 |
| b              | 0.17        | 0.22 | 0.27 | 0.007    | 0.009 | 0.011 |
| C              | 0.08        | 0.12 | 0.18 | 0.003    | 0.005 | 0.007 |
| D              | 1.50        | 1.60 | 1.70 | 0.059    | 0.062 | 0.066 |
| E              | 1.10        | 1.20 | 1.30 | 0.043    | 0.047 | 0.051 |
| e              | 0.5 BSC     |      |      | 0.02 BSC |       |       |
| L              | 0.10        | 0.20 | 0.30 | 0.004    | 0.008 | 0.012 |
| H <sub>E</sub> | 1.50        | 1.60 | 1.70 | 0.059    | 0.062 | 0.066 |

### 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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