

# MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

## Complementary Bias Resistor Transistors R1 = 22 kΩ, R2 = 22 kΩ

### NPN and PNP Transistors with Monolithic Bias Resistor Network

This series of digital transistors is designed to replace a single device and its external resistor bias network. The Bias Resistor Transistor (BRT) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The BRT eliminates these individual components by integrating them into a single device. The use of a BRT can reduce both system cost and board space.

#### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### MAXIMUM RATINGS

(T<sub>A</sub> = 25°C both polarities Q<sub>1</sub> (PNP) & Q<sub>2</sub> (NPN), unless otherwise noted)

| Rating                         | Symbol               | Max | Unit |
|--------------------------------|----------------------|-----|------|
| Collector-Base Voltage         | V <sub>CBO</sub>     | 50  | Vdc  |
| Collector-Emitter Voltage      | V <sub>CEO</sub>     | 50  | Vdc  |
| Collector Current – Continuous | I <sub>C</sub>       | 100 | mAdc |
| Input Forward Voltage          | V <sub>IN(fwd)</sub> | 40  | Vdc  |
| Input Reverse Voltage          | V <sub>IN(rev)</sub> | 10  | Vdc  |

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.

#### ORDERING INFORMATION

| Device                           | Package | Shipping <sup>†</sup> |
|----------------------------------|---------|-----------------------|
| MUN5312DW1T1G,<br>SMUN5312DW1T1G | SOT-363 | 3,000/Tape & Reel     |
| MUN5312DW1T2G                    | SOT-363 | 3,000/Tape & Reel     |
| NSBC124EPDXV6T1G                 | SOT-563 | 4,000/Tape & Reel     |
| NSBC124EPDXV6T5G                 | SOT-563 | 8,000/Tape & Reel     |
| NSBC124EPDP6T5G                  | SOT-963 | 8,000/Tape & Reel     |

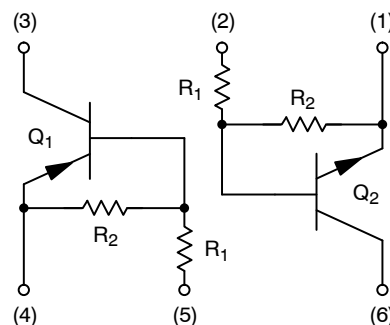
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



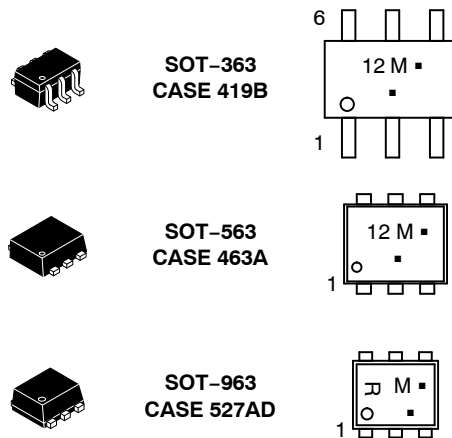
ON Semiconductor®

<http://onsemi.com>

#### PIN CONNECTIONS



#### MARKING DIAGRAMS



12/R = Specific Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

# MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

## THERMAL CHARACTERISTICS

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

### MUN5312DW1 (SOT-363) ONE JUNCTION HEATED

|                                                                                         |                                              |                                   |                            |
|-----------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | (Note 1)<br>(Note 2)<br>(Note 1)<br>(Note 2) | $P_D$<br>187<br>256<br>1.5<br>2.0 | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction to Ambient                                              | (Note 1)<br>(Note 2)                         | $R_{\theta JA}$<br>670<br>490     | $^\circ\text{C/W}$         |

### MUN5312DW1 (SOT-363) BOTH JUNCTION HEATED (Note 3)

|                                                                                         |                                              |                                   |                            |
|-----------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | (Note 1)<br>(Note 2)<br>(Note 1)<br>(Note 2) | $P_D$<br>250<br>385<br>2.0<br>3.0 | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction to Ambient                                              | (Note 1)<br>(Note 2)                         | $R_{\theta JA}$<br>493<br>325     | $^\circ\text{C/W}$         |
| Thermal Resistance,<br>Junction to Lead                                                 | (Note 1)<br>(Note 2)                         | $R_{\theta JL}$<br>188<br>208     | $^\circ\text{C/W}$         |
| Junction and Storage Temperature Range                                                  | $T_J, T_{stg}$                               | -55 to +150                       | $^\circ\text{C}$           |

### NSBC124EPDXV6 (SOT-563) ONE JUNCTION HEATED

|                                                                                         |                      |                        |                            |
|-----------------------------------------------------------------------------------------|----------------------|------------------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | (Note 1)<br>(Note 1) | $P_D$<br>357<br>2.9    | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction to Ambient                                              | (Note 1)             | $R_{\theta JA}$<br>350 | $^\circ\text{C/W}$         |

### NSBC124EPDXV6 (SOT-563) BOTH JUNCTION HEATED (Note 3)

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

### NSBC124EPDP6 (SOT-963) ONE JUNCTION HEATED

|                                                                                         |                                              |                                   |                            |
|-----------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | (Note 4)<br>(Note 5)<br>(Note 4)<br>(Note 5) | $P_D$<br>231<br>269<br>1.9<br>2.2 | MW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction to Ambient                                              | (Note 4)<br>(Note 5)                         | $R_{\theta JA}$<br>540<br>464     | $^\circ\text{C/W}$         |

### NSBC124EPDP6 (SOT-963) BOTH JUNCTION HEATED (Note 3)

|                                                                                         |                                              |                                   |                            |
|-----------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | (Note 4)<br>(Note 5)<br>(Note 4)<br>(Note 5) | $P_D$<br>339<br>408<br>2.7<br>3.3 | MW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction to Ambient                                              | (Note 4)<br>(Note 5)                         | $R_{\theta JA}$<br>369<br>306     | $^\circ\text{C/W}$         |
| Junction and Storage Temperature Range                                                  | $T_J, T_{stg}$                               | -55 to +150                       | $^\circ\text{C}$           |

- FR-4 @ Minimum Pad.
- FR-4 @  $1.0 \times 1.0$  Inch Pad.
- Both junction heated values assume total power is sum of two equally powered channels.
- FR-4 @  $100 \text{ mm}^2$ , 1 oz. copper traces, still air.
- FR-4 @  $500 \text{ mm}^2$ , 1 oz. copper traces, still air.

# MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

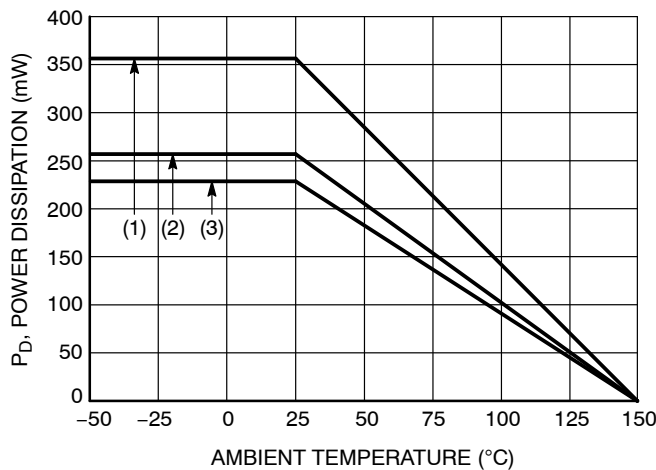
## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ both polarities $Q_1$ (PNP) & $Q_2$ (NPN), unless otherwise noted)

| Characteristic                                                                        | Symbol        | Min | Typ | Max | Unit |
|---------------------------------------------------------------------------------------|---------------|-----|-----|-----|------|
| <b>OFF CHARACTERISTICS</b>                                                            |               |     |     |     |      |
| Collector-Base Cutoff Current<br>( $V_{CB} = 50\text{ V}$ , $I_E = 0$ )               | $I_{CBO}$     | –   | –   | 100 | nAdc |
| Collector-Emitter Cutoff Current<br>( $V_{CE} = 50\text{ V}$ , $I_B = 0$ )            | $I_{CEO}$     | –   | –   | 500 | nAdc |
| Emitter-Base Cutoff Current<br>( $V_{EB} = 6.0\text{ V}$ , $I_C = 0$ )                | $I_{EBO}$     | –   | –   | 0.2 | mAdc |
| Collector-Base Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ )     | $V_{(BR)CBO}$ | 50  | –   | –   | Vdc  |
| Collector-Emitter Breakdown Voltage (Note 6)<br>( $I_C = 2.0\text{ mA}$ , $I_B = 0$ ) | $V_{(BR)CEO}$ | 50  | –   | –   | Vdc  |

## ON CHARACTERISTICS

|                                                                                                                                                                 |               |        |            |        |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|------------|--------|------------|
| DC Current Gain (Note 6)<br>( $I_C = 5.0\text{ mA}$ , $V_{CE} = 10\text{ V}$ )                                                                                  | $h_{FE}$      | 60     | 100        | –      |            |
| Collector-Emitter Saturation Voltage (Note 6)<br>( $I_C = 10\text{ mA}$ , $I_B = 0.3\text{ mA}$ )                                                               | $V_{CE(sat)}$ | –      | –          | 0.25   | V          |
| Input Voltage (Off)<br>( $V_{CE} = 5.0\text{ V}$ , $I_C = 100\text{ }\mu\text{A}$ ) (NPN)<br>( $V_{CE} = 5.0\text{ V}$ , $I_C = 100\text{ }\mu\text{A}$ ) (PNP) | $V_{i(off)}$  | –<br>– | 1.2<br>1.2 | –<br>– | Vdc        |
| Input Voltage (On)<br>( $V_{CE} = 0.2\text{ V}$ , $I_C = 5.0\text{ mA}$ ) (NPN)<br>( $V_{CE} = 0.2\text{ V}$ , $I_C = 5.0\text{ mA}$ ) (PNP)                    | $V_{i(on)}$   | –<br>– | 1.9<br>2.0 | –<br>– | Vdc        |
| Output Voltage (On)<br>( $V_{CC} = 5.0\text{ V}$ , $V_B = 2.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )                                                          | $V_{OL}$      | –      | –          | 0.2    | Vdc        |
| Output Voltage (Off)<br>( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )                                                         | $V_{OH}$      | 4.9    | –          | –      | Vdc        |
| Input Resistor                                                                                                                                                  | $R_1$         | 15.4   | 22         | 28.6   | k $\Omega$ |
| Resistor Ratio                                                                                                                                                  | $R_1/R_2$     | 0.8    | 1.0        | 1.2    |            |

6. Pulsed Condition: Pulse Width = 300 ms, Duty Cycle  $\leq 2\%$ .



- (1) SOT-363; 1.0 x 1.0 Inch Pad
- (2) SOT-563; Minimum Pad
- (3) SOT-963; 100 mm<sup>2</sup>, 1 oz. Copper Trace

Figure 1. Derating Curve

TYPICAL CHARACTERISTICS – NPN TRANSISTOR  
MUN5312DW1, NSBC124EPDXV6

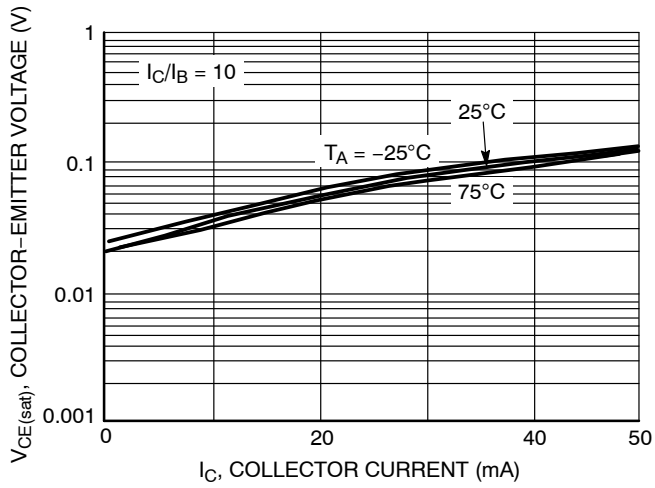


Figure 2.  $V_{CE(sat)}$  vs.  $I_C$

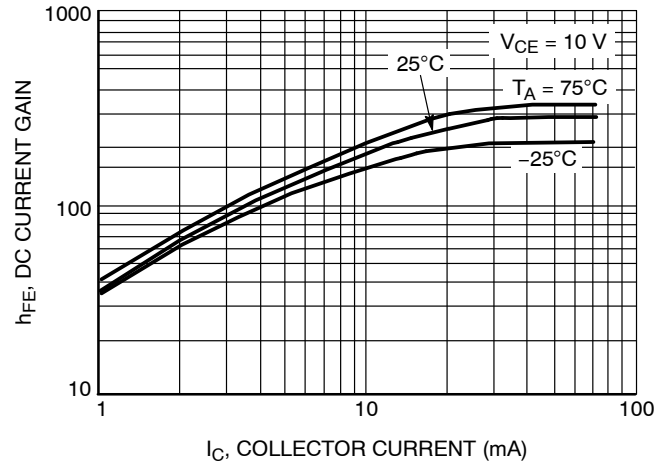


Figure 3. DC Current Gain

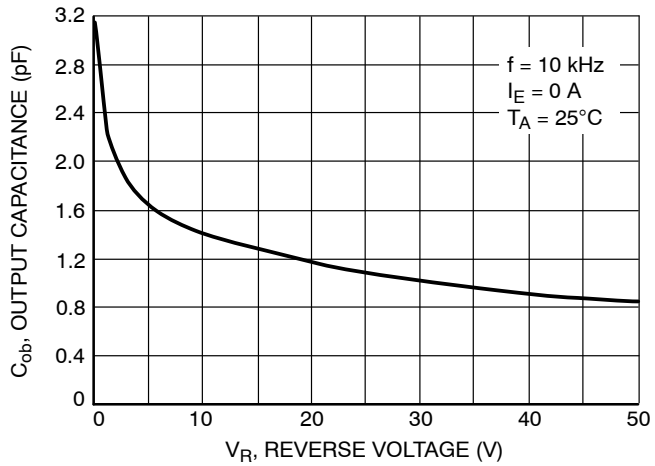


Figure 4. Output Capacitance

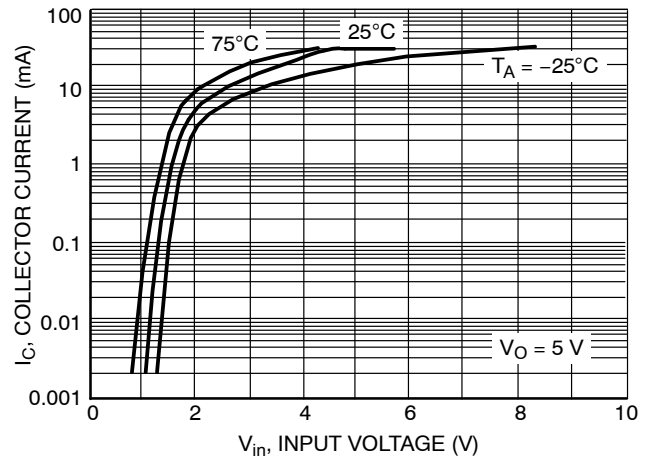


Figure 5. Output Current vs. Input Voltage

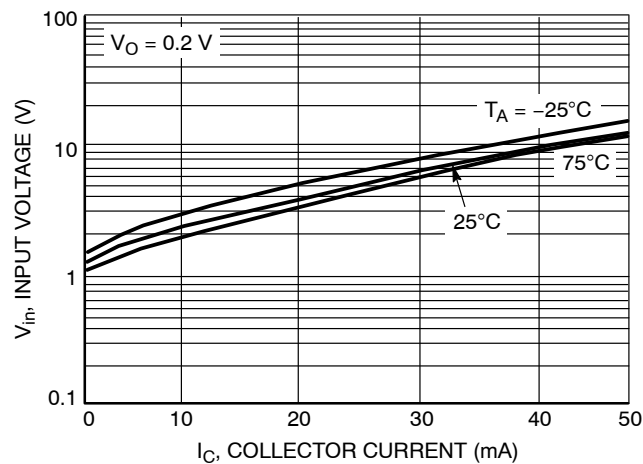


Figure 6. Input Voltage vs. Output Current

TYPICAL CHARACTERISTICS – PNP TRANSISTOR  
MUN5312DW1, NSBC124EPDXV6

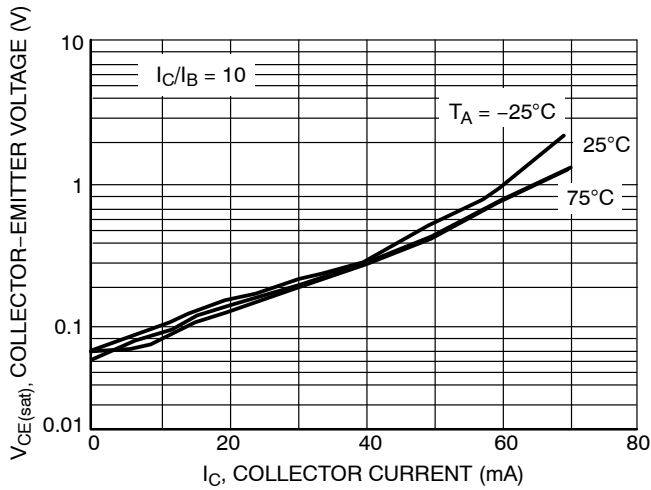


Figure 7.  $V_{CE(sat)}$  vs.  $I_C$

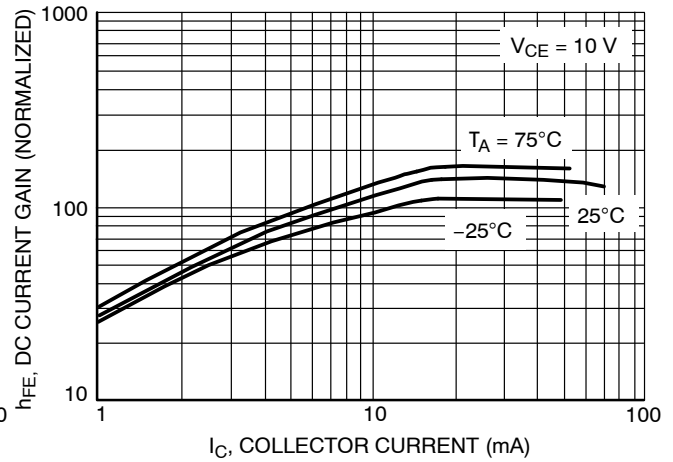


Figure 8. DC Current Gain

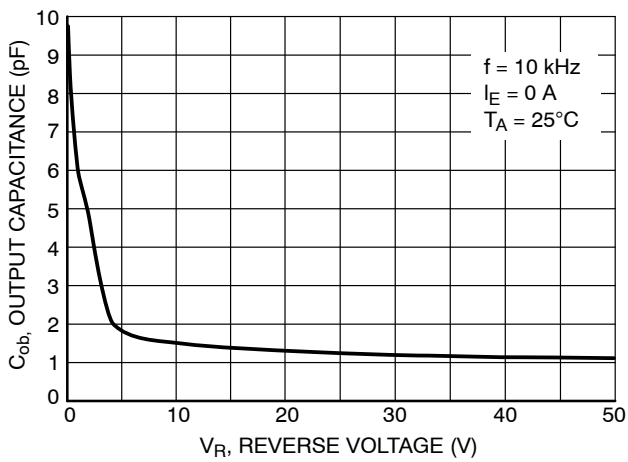


Figure 9. Output Capacitance

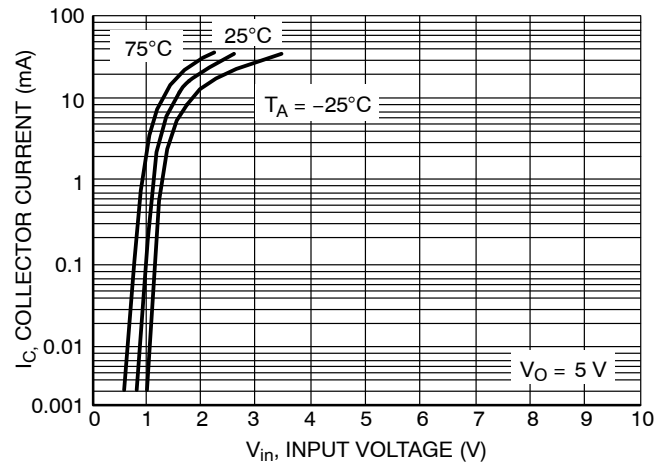


Figure 10. Output Current vs. Input Voltage

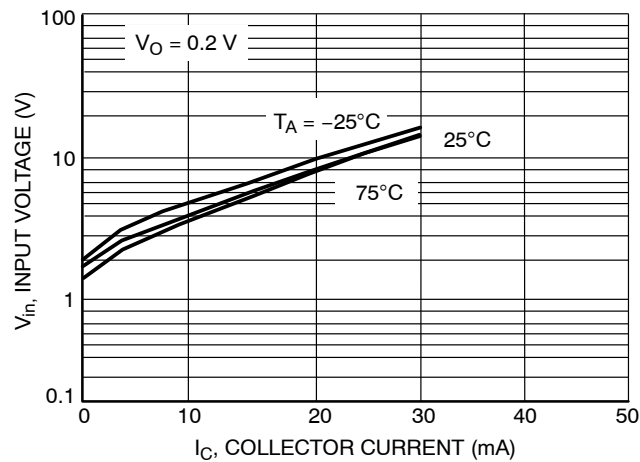


Figure 11. Input Voltage vs. Output Current

TYPICAL CHARACTERISTICS – NPN TRANSISTOR  
NSBC124EPDP6

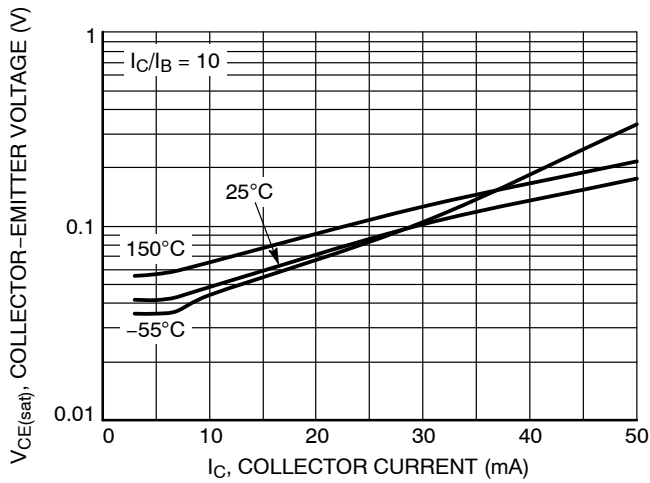


Figure 12.  $V_{CE(sat)}$  vs.  $I_C$

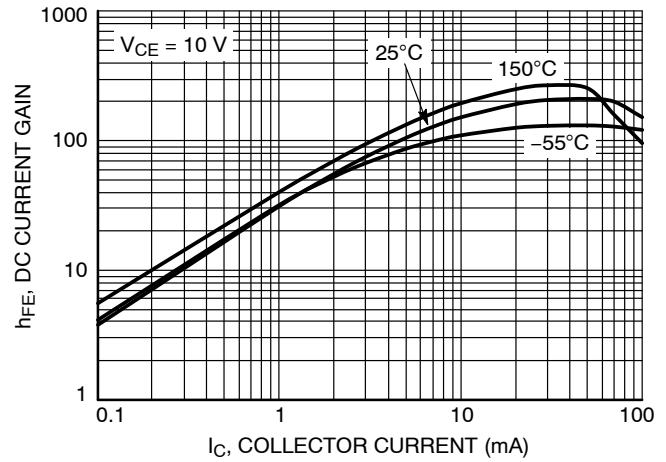


Figure 13. DC Current Gain

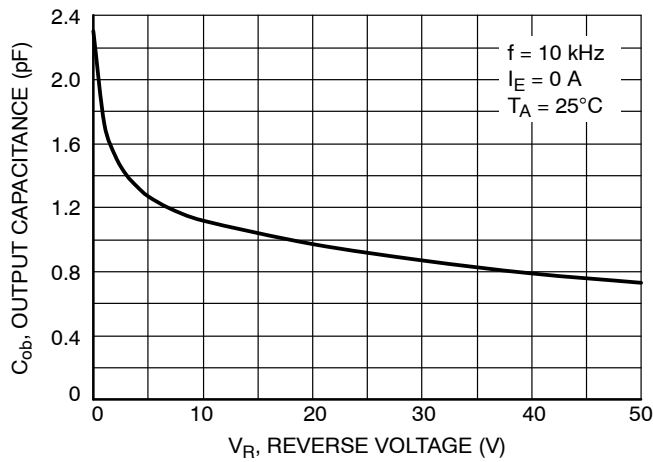


Figure 14. Output Capacitance

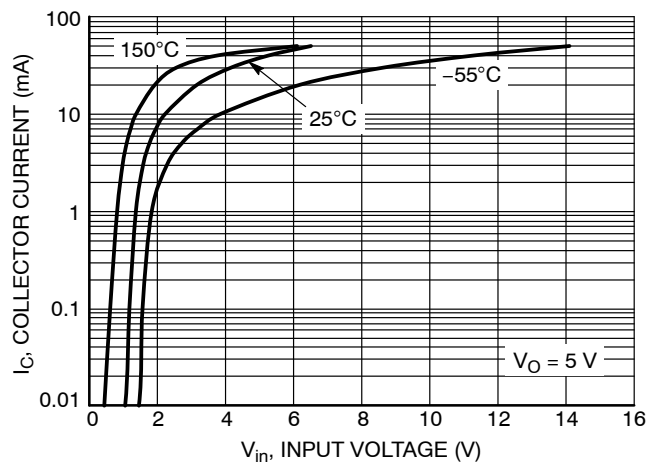


Figure 15. Output Current vs. Input Voltage

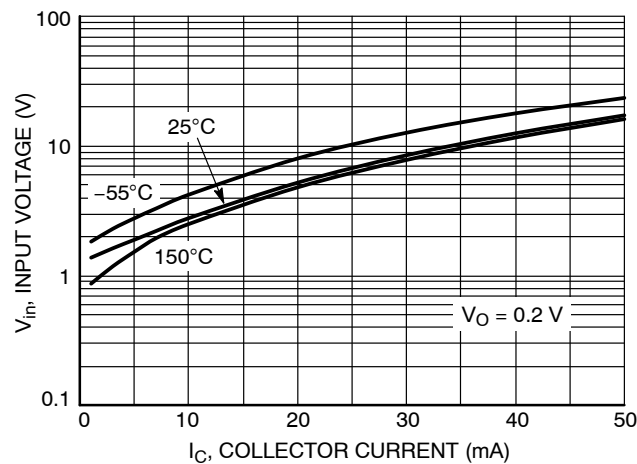


Figure 16. Input Voltage vs. Output Current

TYPICAL CHARACTERISTICS – PNP TRANSISTOR  
NSBC124EPDP6

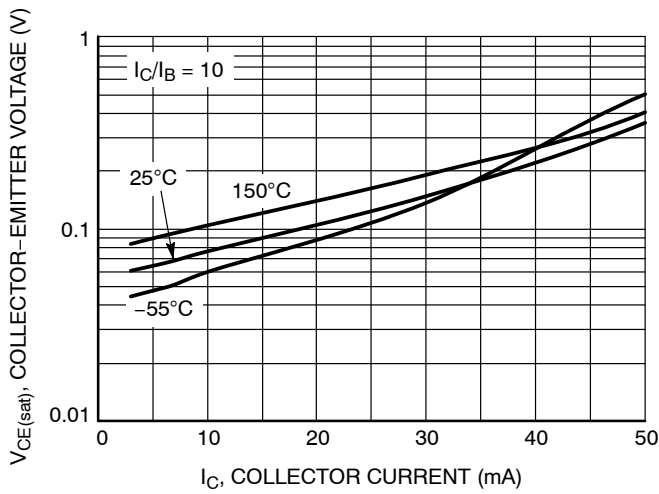


Figure 17.  $V_{CE(sat)}$  vs.  $I_C$

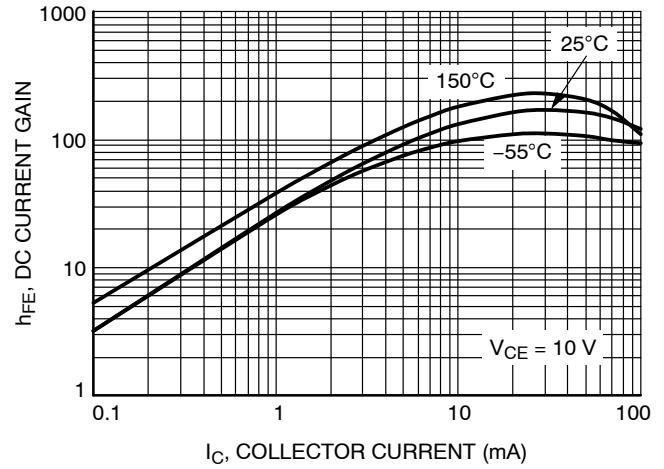


Figure 18. DC Current Gain

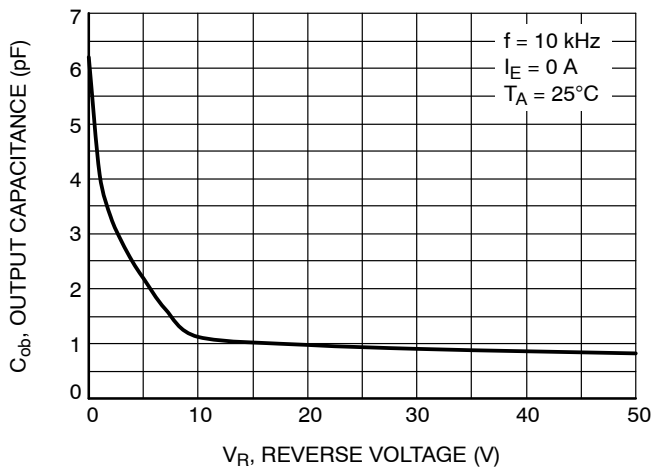


Figure 19. Output Capacitance

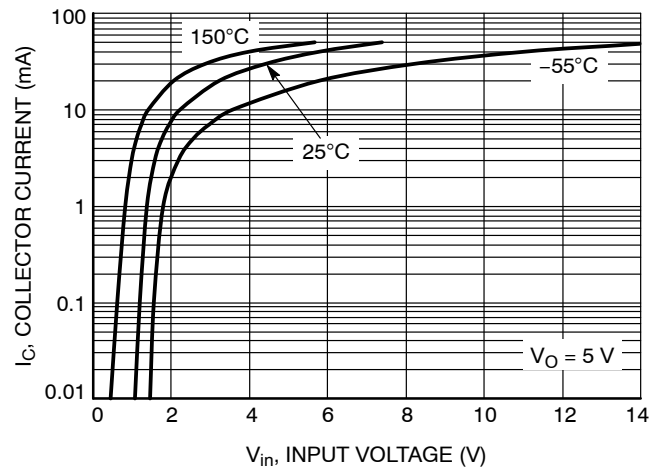


Figure 20. Output Current vs. Input Voltage

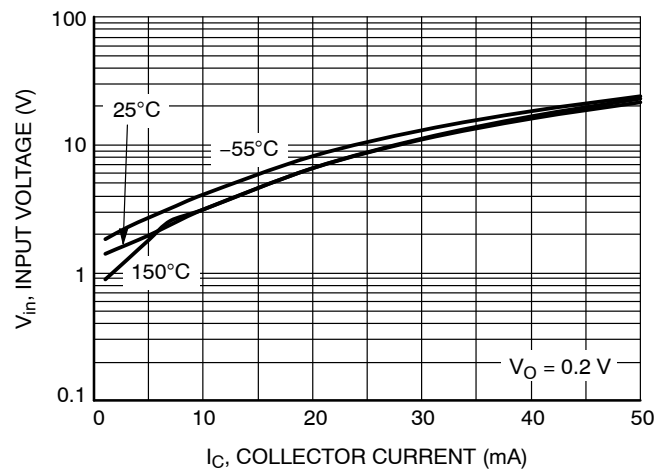
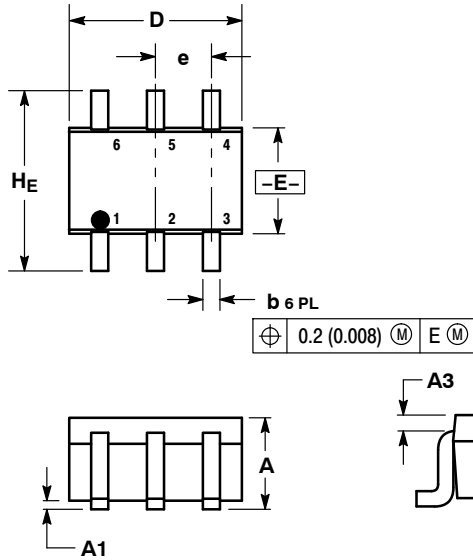


Figure 21. Input Voltage vs. Output Current

PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE W

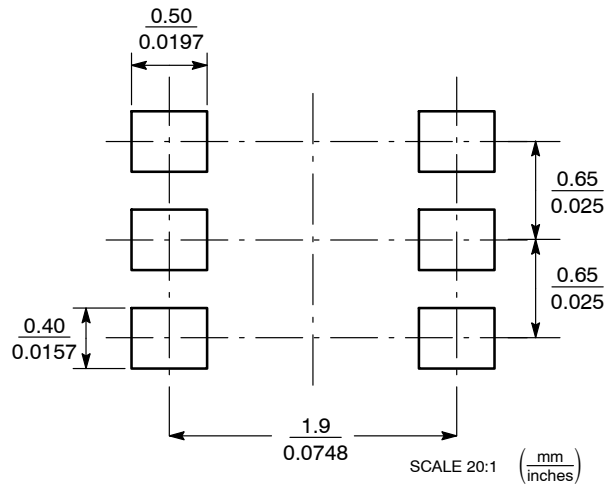


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 0.80        | 0.95 | 1.10 | 0.031     | 0.037 | 0.043 |
| A1  | 0.00        | 0.05 | 0.10 | 0.000     | 0.002 | 0.004 |
| A3  | 0.20 REF    |      |      | 0.008 REF |       |       |
| b   | 0.10        | 0.21 | 0.30 | 0.004     | 0.008 | 0.012 |
| C   | 0.10        | 0.14 | 0.25 | 0.004     | 0.005 | 0.010 |
| D   | 1.80        | 2.00 | 2.20 | 0.070     | 0.078 | 0.086 |
| E   | 1.15        | 1.25 | 1.35 | 0.045     | 0.049 | 0.053 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L   | 0.10        | 0.20 | 0.30 | 0.004     | 0.008 | 0.012 |
| HE  | 2.00        | 2.10 | 2.20 | 0.078     | 0.082 | 0.086 |

SOLDERING FOOTPRINT\*

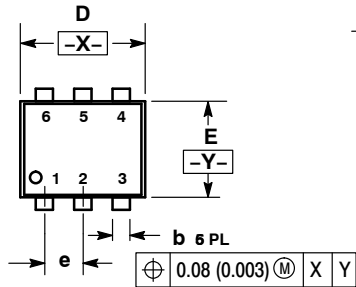


SC-88/SC70-6/SOT-363

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



## PACKAGE DIMENSIONS

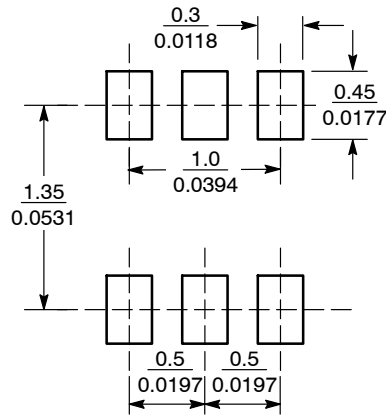
SOT-563, 6 LEAD  
CASE 463A  
ISSUE F

## 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\*

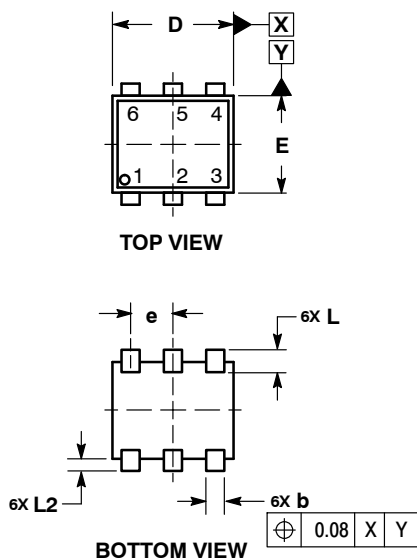
SCALE 20:1 ( $\frac{\text{mm}}{\text{inches}}$ )

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MUN5312DW1, NSBC124EPDXV6, NSBC124EPDP6

## PACKAGE DIMENSIONS

### SOT-963 CASE 527AD ISSUE E

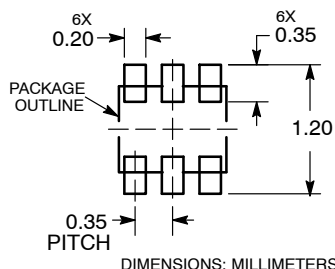


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM            | MILLIMETERS |      |      |
|----------------|-------------|------|------|
|                | MIN         | NOM  | MAX  |
| A              | 0.34        | 0.37 | 0.40 |
| b              | 0.10        | 0.15 | 0.20 |
| C              | 0.07        | 0.12 | 0.17 |
| D              | 0.95        | 1.00 | 1.05 |
| E              | 0.75        | 0.80 | 0.85 |
| e              | 0.35 BSC    |      |      |
| H <sub>E</sub> | 0.95        | 1.00 | 1.05 |
| L              | 0.19 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.

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