

NSTB60BDW1

PNP General Purpose and NPN Bias Resistor Transistor Combination

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7 inch/3000 Unit Tape and Reel
- ESD Rating – Human Body Model: Class 1B
– Machine Model: Class B
- 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

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

| Rating | Symbol | Q_1 | Q_2 | Unit |
|--------------------------------|-----------|-------|-------|------|
| Collector-Emitter Voltage | V_{CEO} | -50 | 50 | Vdc |
| Collector-Base Voltage | V_{CBO} | -50 | 50 | Vdc |
| Emitter-Base Voltage | V_{EBO} | -6.0 | 5.0 | Vdc |
| Collector Current – Continuous | I_C | -150 | 150 | mAdc |

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.

THERMAL CHARACTERISTICS

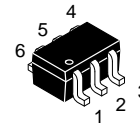
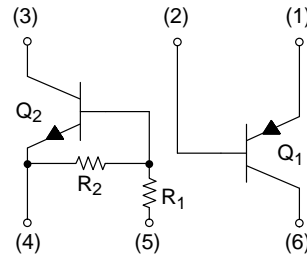
| Characteristic (One Junction Heated) | Symbol | Max | Unit |
|---|-----------------|--|----------------------------|
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 187 (Note 1) 256 (Note 2) 1.5 (Note 1) 2.0 (Note 2) | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance – Junction-to-Ambient | $R_{\theta JA}$ | 670 (Note 1) 490 (Note 2) | $^\circ\text{C}/\text{W}$ |
| Characteristic (Both Junctions Heated) | Symbol | Max | Unit |
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 250 (Note 1) 385 (Note 2) 2.0 (Note 1) 3.0 (Note 2) | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance – Junction-to-Ambient | $R_{\theta JA}$ | 493 (Note 1) 325 (Note 2) | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance – Junction-to-Lead | $R_{\theta JL}$ | 188 (Note 1) 208 (Note 2) | $^\circ\text{C}/\text{W}$ |
| Junction and Storage Temperature | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 x 1.0 inch Pad



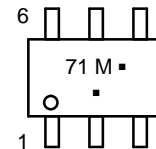
ON Semiconductor®

www.onsemi.com



SOT-363
CASE 419B
STYLE 1

MARKING DIAGRAM



71 = Device Code
M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)
*Date Code orientation may vary depending upon manufacturing location.

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|----------------------|--------------------|
| NSTB60BDW1T1G | SOT-363 (Pb-Free) | 3000 / Tape & Reel |
| NSVTB60BDW1T1G | SOT-363 (Pb-Free) | 3000 / 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.

NSTB60BDW1

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|----------------------|------|-----|------|------|
| Q₁ | | | | | |
| Collector-Base Breakdown Voltage (I _C = -50 μAdc, I _E = 0) | V _{(BR)CBO} | -50 | - | - | Vdc |
| Collector-Emitter Breakdown Voltage (I _C = -1.0 mAdc, I _B = 0) | V _{(BR)CEO} | -50 | - | - | Vdc |
| Emitter-Base Breakdown Voltage (I _E = -50 μAdc, I _E = 0) | V _{(BR)EBO} | -6.0 | - | - | Vdc |
| Collector-Base Cutoff Current (V _{CB} = -50 Vdc, I _E = 0) | I _{CBO} | - | - | -0.1 | μA |
| Emitter-Base Cutoff Current (V _{EB} = -6.0 Vdc, I _B = 0) | I _{EBO} | - | - | -0.1 | μA |
| Collector-Emitter Saturation Voltage (I _C = -50 mAdc, I _B = -5.0 mAdc) (Note 3) | V _{CE(sat)} | - | - | -0.5 | Vdc |
| DC Current Gain (V _{CE} = -10 V, I _C = -5.0 mA) (Note 3) | h _{FE} | 120 | - | 560 | - |
| Transition Frequency (V _{CE} = -12 Vdc, I _C = -2.0 mAdc, f = 100 MHz) | f _T | - | 140 | - | MHz |
| Output Capacitance (V _{CB} = -12 Vdc, I _E = 0 Adc, f = 1.0 MHz) | C _{OB} | - | 3.5 | - | pF |

Q₂

| | | | | | |
|---|----------------------|------|------|------|------|
| Collector-Base Breakdown Voltage (I _C = 50 μA, I _E = 0) | V _{(BR)CBO} | 50 | - | - | Vdc |
| Collector-Emitter Breakdown Voltage (I _C = 1.0 mA, I _B = 0) (Note 3) | V _{(BR)CEO} | 50 | - | - | Vdc |
| Collector-Base Cutoff Current (V _{CB} = 50 V, I _E = 0) | I _{CBO} | - | - | 100 | nAdc |
| Collector-Emitter Cutoff Current (V _{CE} = 50 V, I _B = 0) | I _{CEO} | - | - | 500 | nAdc |
| Emitter-Base Cutoff Current (V _{EB} = 6.0 V, I _C = 0) | I _{EBO} | - | - | 0.13 | mAdc |
| Collector-Emitter Saturation Voltage (I _C = 10 mA, I _B = 5.0 mA) (Note 3) | V _{CE(sat)} | - | - | 0.25 | Vdc |
| DC Current Gain (V _{CE} = 10 V, I _C = 5.0 mA) (Note 3) | h _{FE} | 80 | - | - | |
| Output Voltage (on) (V _{CC} = 5.0 V, V _B = 4.0 V, R _L = 1.0 kΩ) (Note 3) | V _{OL} | - | - | 0.2 | Vdc |
| Output Voltage (off) (V _{CC} = 5.0 V, V _B = 0.25 V, R _L = 1.0 kΩ) (Note 3) | V _{OH} | 4.9 | - | - | Vdc |
| Input Resistor (Note 3) | R1 | 15.4 | 22 | 28.6 | kΩ |
| Resistor Ratio (Note 3) | R2/R1 | 1.70 | 2.13 | 2.55 | |

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.

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

NSTB60BDW1

TYPICAL ELECTRICAL CHARACTERISTICS – PNP Transistor

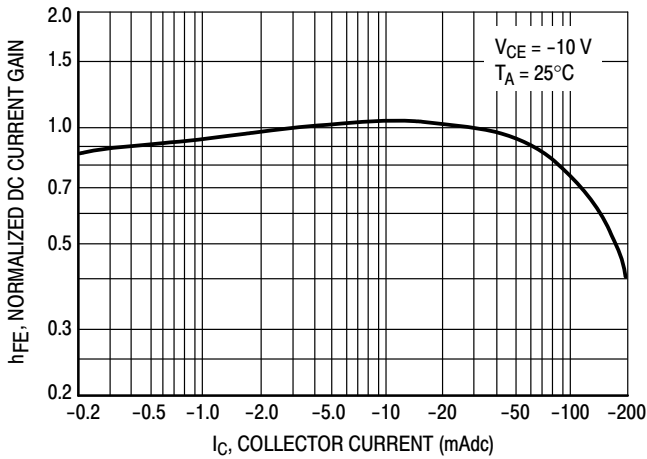


Figure 1. Normalized DC Current Gain

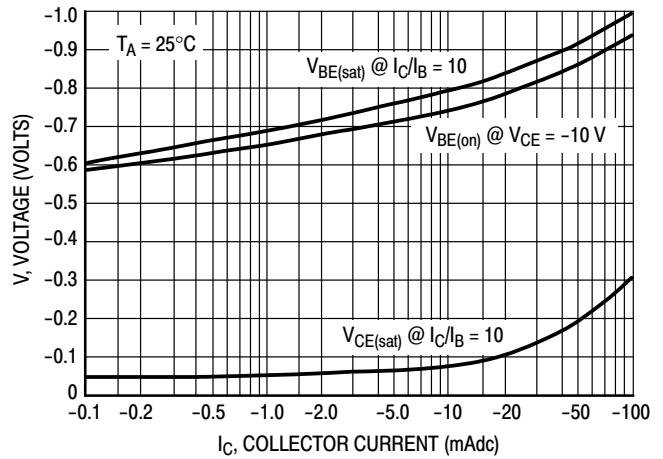


Figure 2. "Saturation" and "On" Voltages

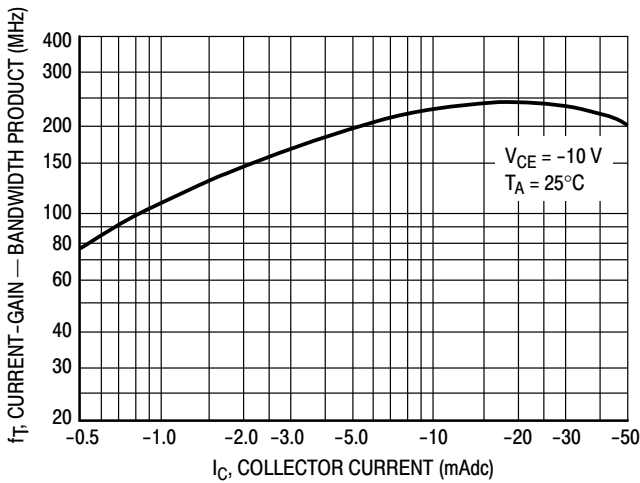


Figure 3. Current-Gain – Bandwidth Product

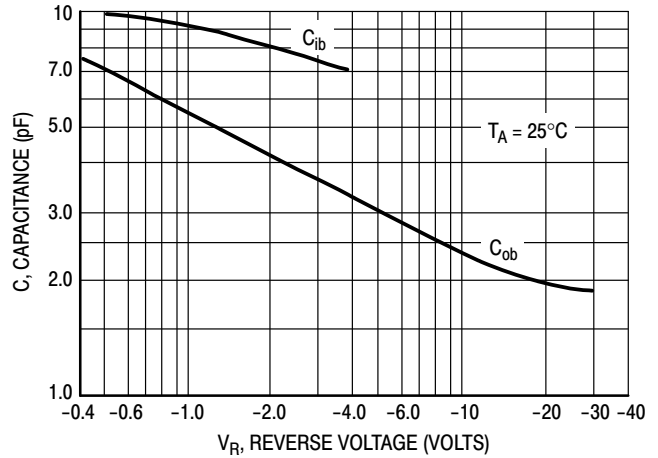


Figure 4. Capacitances

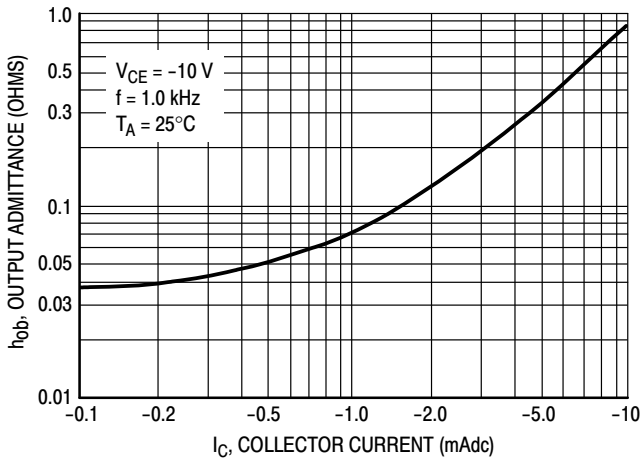


Figure 5. Output Admittance

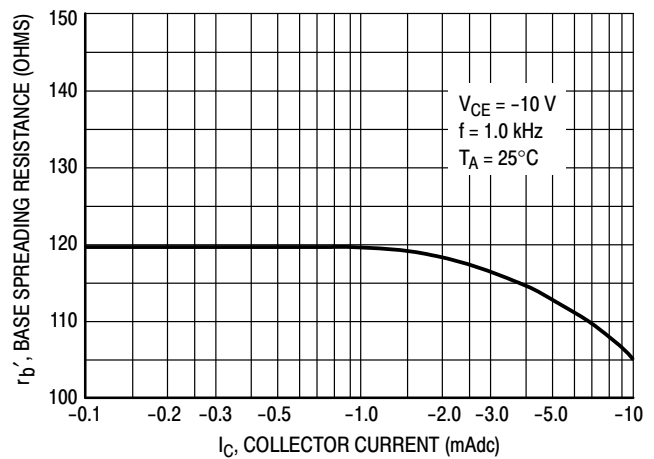


Figure 6. Base Spreading Resistance

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TYPICAL ELECTRICAL CHARACTERISTICS – NPN Transistor

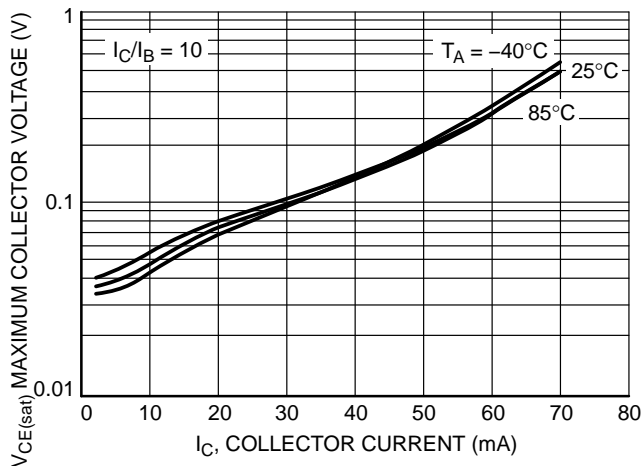


Figure 7. Maximum Collector Voltage versus Collector Current

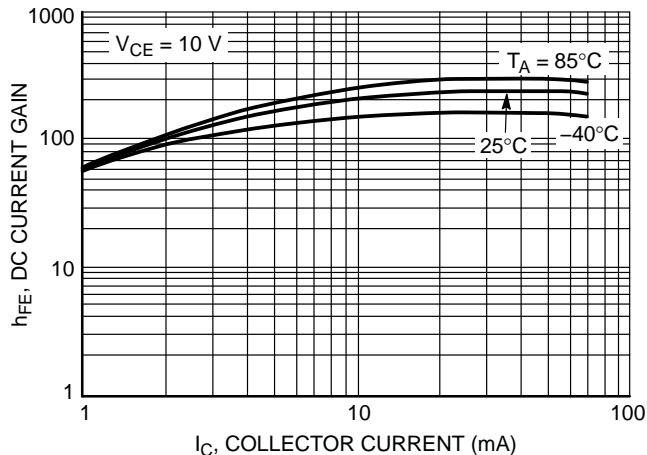


Figure 8. DC Current Gain

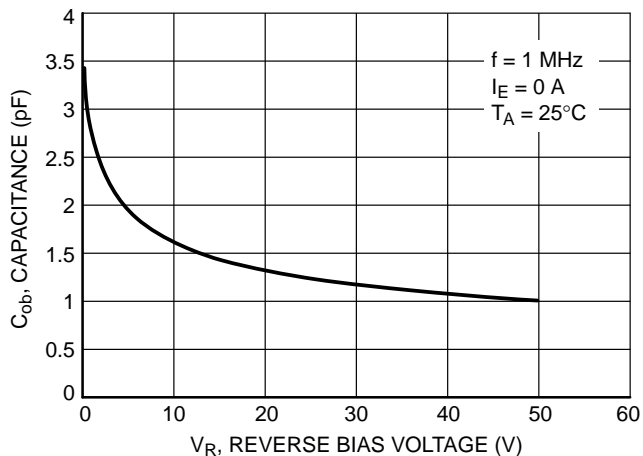


Figure 9. Output Capacitance

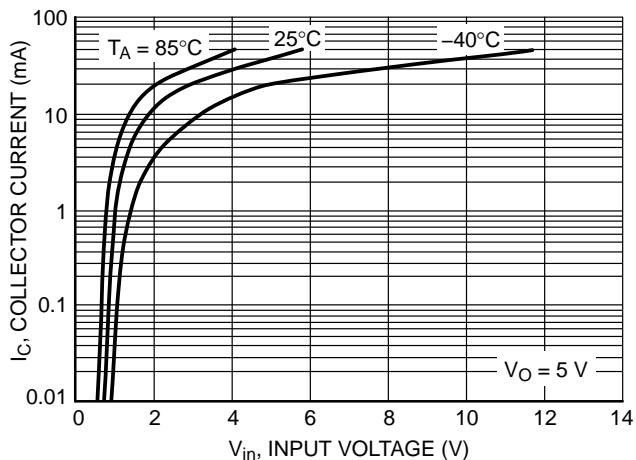


Figure 10. Output Current versus Input Voltage

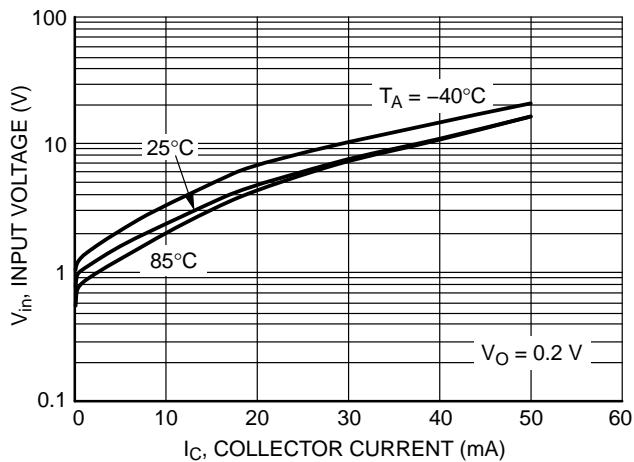
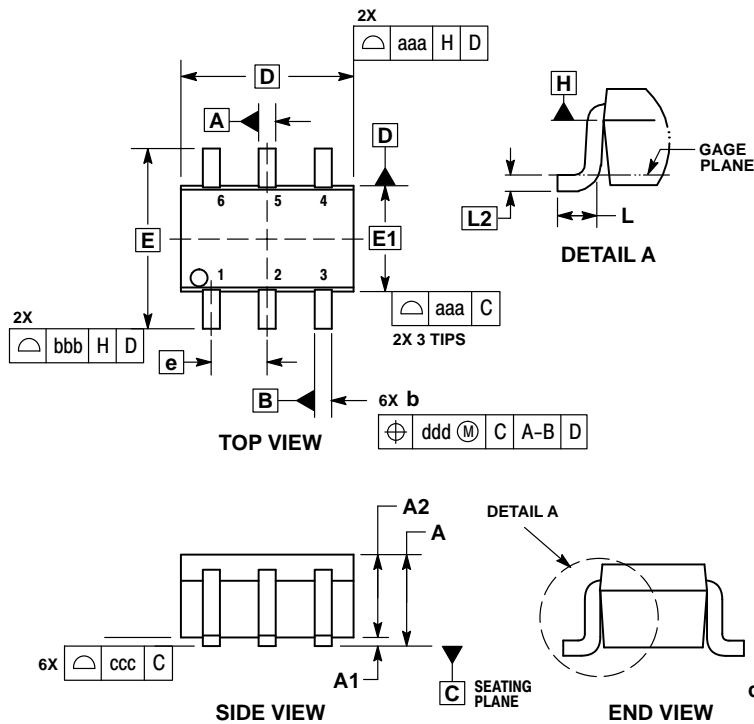


Figure 11. Input Voltage versus Output Current

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PACKAGE DIMENSIONS

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



NOTES:

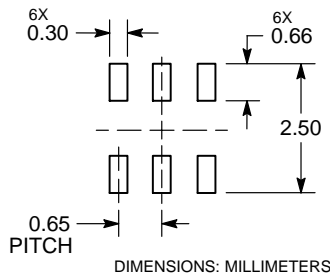
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | --- | --- | 1.10 | --- | --- | 0.043 |
| A1 | 0.00 | --- | 0.10 | 0.000 | --- | 0.004 |
| A2 | 0.70 | 0.90 | 1.00 | 0.027 | 0.035 | 0.039 |
| b | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| C | 0.08 | 0.15 | 0.22 | 0.003 | 0.006 | 0.009 |
| D | 1.80 | 2.00 | 2.20 | 0.070 | 0.078 | 0.086 |
| E | 2.00 | 2.10 | 2.20 | 0.078 | 0.082 | 0.086 |
| E1 | 1.15 | 1.25 | 1.35 | 0.045 | 0.049 | 0.053 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| L | 0.26 | 0.36 | 0.46 | 0.010 | 0.014 | 0.018 |
| L2 | 0.15 BSC | | | 0.006 BSC | | |
| aaa | 0.15 | | | 0.006 | | |
| bbb | 0.30 | | | 0.012 | | |
| ccc | 0.10 | | | 0.004 | | |
| ddd | 0.10 | | | 0.004 | | |

STYLE 1:

1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

RECOMMENDED 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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