

# Dual Bias Resistor Transistors

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

### EMD5DXV6T5G

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 EMD5DXV6 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
- Lead Free Solder Plating
- These Devices are Pb-Free and are RoHS Compliant

**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)

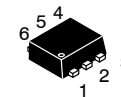
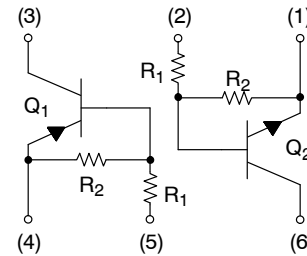
| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage    | $V_{CBO}$ | 50    | Vdc  |
| Collector-Emitter Voltage | $V_{CEO}$ | 50    | Vdc  |
| Collector Current         | $I_C$     | 100   | mAdc |

#### THERMAL CHARACTERISTICS

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

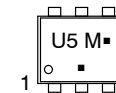
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR-4 @ Minimum Pad



SOT-563  
CASE 463A

#### MARKING DIAGRAM



U5 = Specific Device Code  
M = Month Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

| Device      | Package           | Shipping <sup>†</sup> |
|-------------|-------------------|-----------------------|
| EMD5DXV6T5G | SOT-563 (Pb-Free) | 8000 / Tape & Reel    |
| EMD5DXV6T1G | SOT-563 (Pb-Free) | 4000 / 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 Specification Brochure, BRD8011/D.

# EMD5DXV6T5G

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

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

### Q1 TRANSISTOR: PNP

#### OFF CHARACTERISTICS

|   |                  |   |   |     |                  |
|---|------------------|---|---|-----|------------------|
| Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)    | I <sub>CBO</sub> | - | - | 100 | nA <sub>dc</sub> |
| Collector-Emitter Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>B</sub> = 0) | I <sub>CEO</sub> | - | - | 500 | nA <sub>dc</sub> |
| Emitter-Base Cutoff Current (V <sub>EB</sub> = 6.0, I <sub>C</sub> = 5.0 mA)  | I <sub>EBO</sub> | - | - | 1.0 | mA <sub>dc</sub> |

#### ON CHARACTERISTICS

|   |                      |      |      |      |                 |
|---|----------------------|------|------|------|-----------------|
| Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)                   | V <sub>(BR)CBO</sub> | 50   | -    | -    | V <sub>dc</sub> |
| Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)               | V <sub>(BR)CEO</sub> | 50   | -    | -    | V <sub>dc</sub> |
| DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)                               | h <sub>FE</sub>      | 20   | 35   | -    |                 |
| Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)          | V <sub>CE(SAT)</sub> | -    | -    | 0.25 | V <sub>dc</sub> |
| Output Voltage (on) (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  | V <sub>dc</sub> |
| Output Voltage (off) (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  | -    | -    | V <sub>dc</sub> |
| Input Resistor  | R1                   | 3.3  | 4.7  | 6.1  | kΩ              |
| Resistor Ratio  | R1/R2                | 0.38 | 0.47 | 0.56 |                 |

### Q2 TRANSISTOR: NPN

#### OFF CHARACTERISTICS

|   |                  |   |   |     |                  |
|---|------------------|---|---|-----|------------------|
| Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)    | I <sub>CBO</sub> | - | - | 100 | nA <sub>dc</sub> |
| Collector-Emitter Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>B</sub> = 0) | I <sub>CEO</sub> | - | - | 500 | nA <sub>dc</sub> |
| Emitter-Base Cutoff Current (V <sub>EB</sub> = 6.0, I <sub>C</sub> = 5.0 mA)  | I <sub>EBO</sub> | - | - | 0.1 | mA <sub>dc</sub> |

#### ON CHARACTERISTICS

|   |                      |     |     |      |                 |
|---|----------------------|-----|-----|------|-----------------|
| Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)                   | V <sub>(BR)CBO</sub> | 50  | -   | -    | V <sub>dc</sub> |
| Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)               | V <sub>(BR)CEO</sub> | 50  | -   | -    | V <sub>dc</sub> |
| DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)                               | h <sub>FE</sub>      | 80  | 140 | -    |                 |
| Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)          | V <sub>CE(SAT)</sub> | -   | -   | 0.25 | V <sub>dc</sub> |
| Output Voltage (on) (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  | V <sub>dc</sub> |
| Output Voltage (off) (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 | -   | -    | V <sub>dc</sub> |
| Input Resistor  | R1                   | 33  | 47  | 61   | kΩ              |
| Resistor Ratio  | R1/R2                | 0.8 | 1.0 | 1.2  |                 |

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.

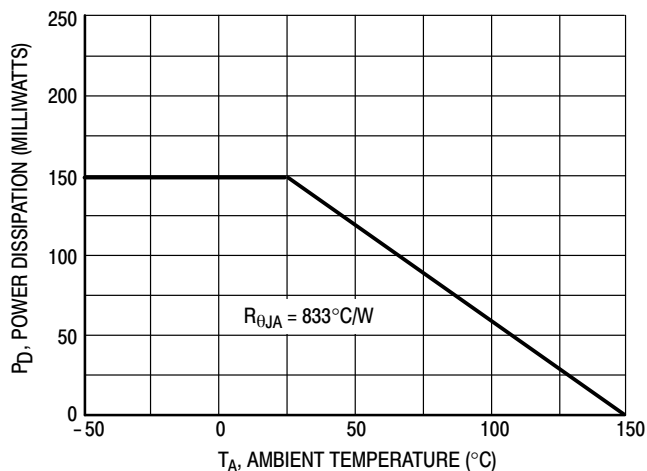


Figure 1. Derating Curve

# EMD5DXV6T5G

## TYPICAL ELECTRICAL CHARACTERISTICS — EMD5DXV6 PNP TRANSISTOR

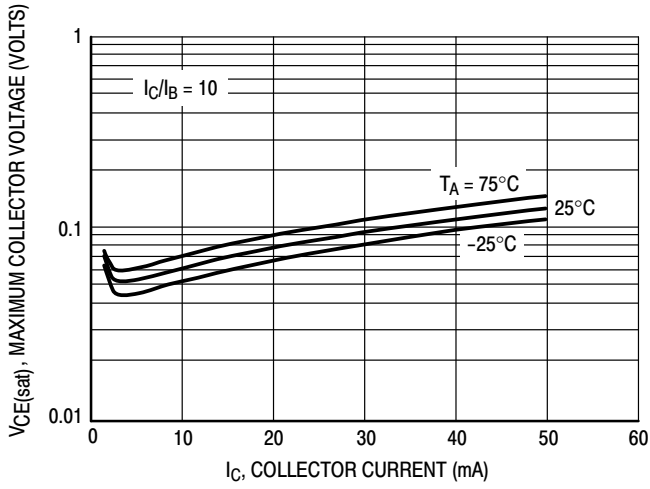


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

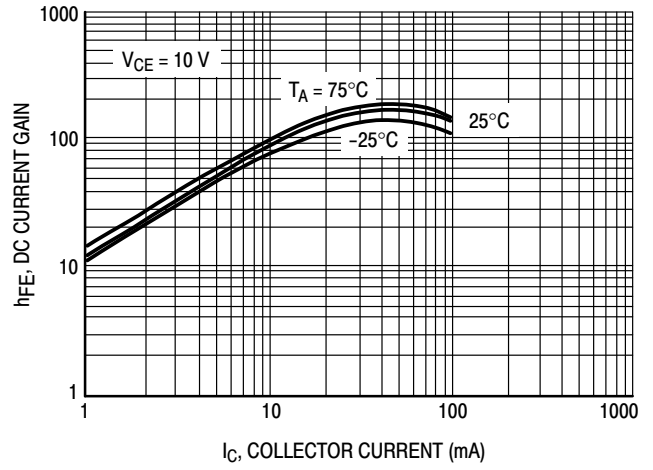


Figure 3. DC Current Gain

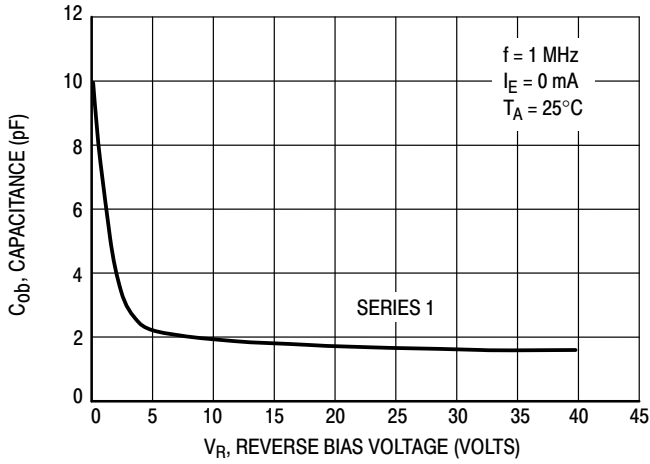


Figure 4. Output Capacitance

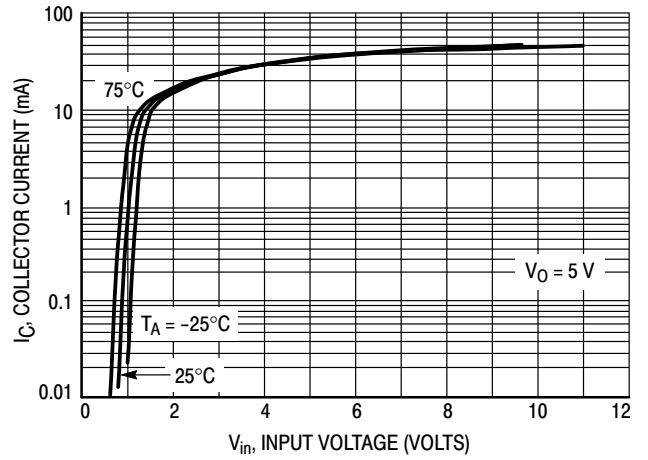


Figure 5. Output Current versus Input Voltage

# EMD5DXV6T5G

## TYPICAL ELECTRICAL CHARACTERISTICS — EMD5DXV6 NPN TRANSISTOR

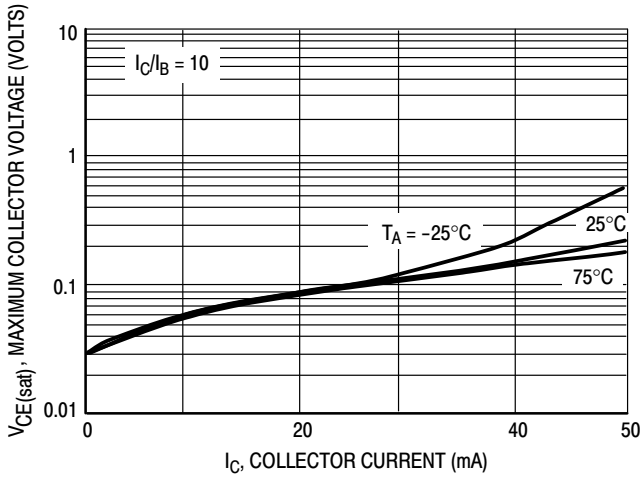


Figure 6.  $V_{CE(sat)}$  versus  $I_C$

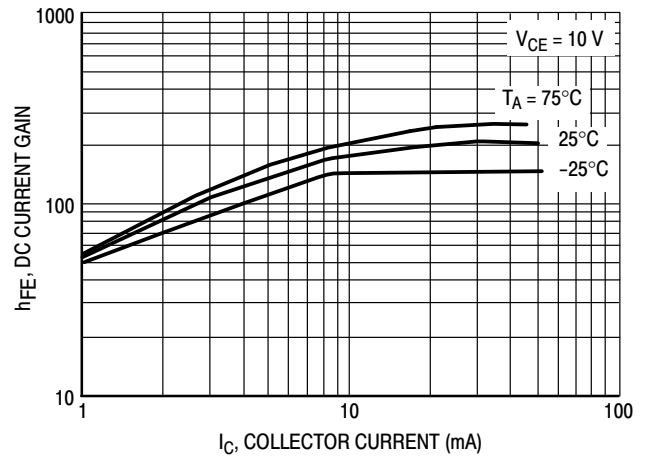


Figure 7. DC Current Gain

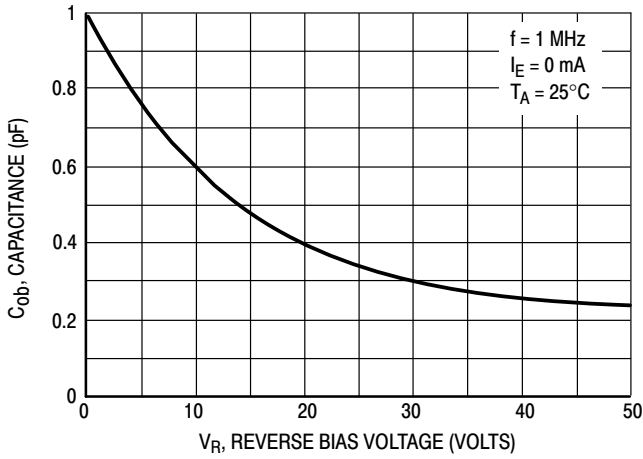


Figure 8. Output Capacitance

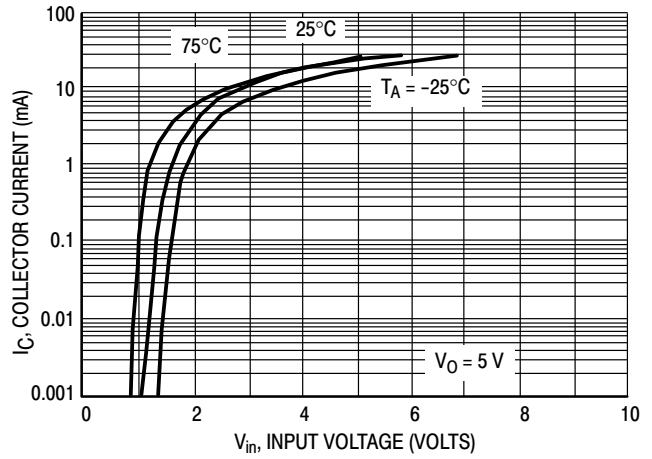


Figure 9. Output Current versus Input Voltage

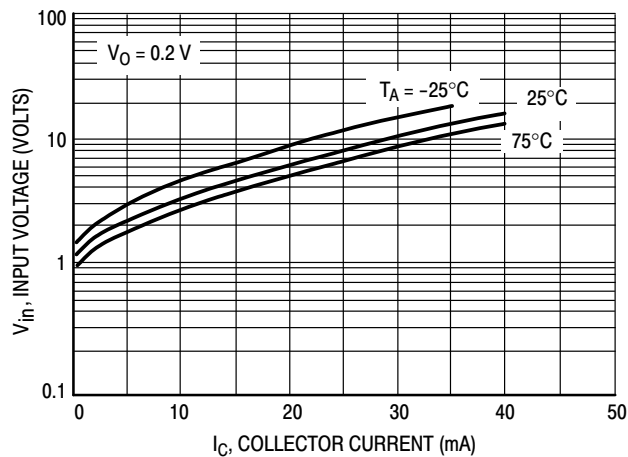
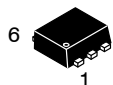


Figure 10. Input Voltage versus Output Current

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



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.



| 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 <sub>E</sub> | 1.50        | 1.60 | 1.70 |

**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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**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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