

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## Dual Common Base-Collector 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 EMC2DXV5T1G series, two complementary BRT devices are housed in the SOT-553 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
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- 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)

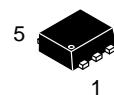
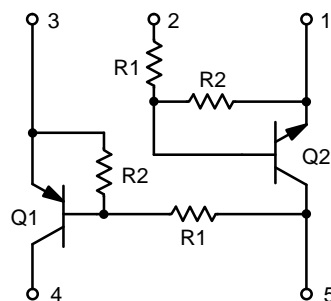
| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage    | $V_{CBO}$ | 50    | Vdc  |
| Collector-Emitter Voltage | $V_{CEO}$ | 50    | Vdc  |
| Collector Current         | $I_C$     | 100   | mAdc |

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.



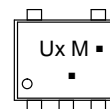
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SOT-553  
CASE 463B

#### MARKING DIAGRAM



Ux = Specific Device Code  
x = C, 3, E, or 5

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## THERMAL CHARACTERISTICS

| Characteristic  | Symbol          | Max                          | Unit                       |
|---|-----------------|------------------------------|----------------------------|
| <b>ONE JUNCTION HEATED</b>  |                 |                              |                            |
| 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, Junction-to-Ambient   | $R_{\theta JA}$ | 350 (Note 1)                 | $^\circ\text{C/W}$         |

## BOTH JUNCTIONS HEATED

|   |                 |                              |                            |
|---|-----------------|------------------------------|----------------------------|
| 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, Junction-to-Ambient   | $R_{\theta JA}$ | 250 (Note 1)                 | $^\circ\text{C/W}$         |
| Junction and Storage Temperature  | $T_J, T_{stg}$  | -55 to +150                  | $^\circ\text{C}$           |

1. FR-4 @ Minimum Pad

## DEVICE ORDERING INFORMATION, MARKING AND RESISTOR VALUES

| Device          | Marking | Transistor 1 – PNP |        | Transistor 2 – NPN |        | Package              | Shipping†          |
|-----------------|---------|--------------------|--------|--------------------|--------|----------------------|--------------------|
|                 |         | R1 (K)             | R2 (K) | R1 (K)             | R2 (K) |                      |                    |
| EMC2DXV5T1G     | UC      | 22                 | 22     | 22                 | 22     | SOT-553<br>(Pb-Free) | 4000 / Tape & Reel |
| NSVEMC2DXV5T1G* | UC      | 22                 | 22     | 22                 | 22     |                      | 4000 / Tape & Reel |
| EMC3DXV5T1G     | U3      | 10                 | 10     | 10                 | 10     |                      | 4000 / Tape & Reel |
| EMC3DXV5T5G     |         |                    |        |                    |        |                      | 8000 / Tape & Reel |
| EMC4DXV5T1G     | UE      | 10                 | 47     | 47                 | 47     |                      | 4000 / Tape & Reel |
| EMC5DXV5T1G     | U5      | 4.7                | 10     | 47                 | 47     |                      | 4000 / Tape & Reel |

†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.

\*NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

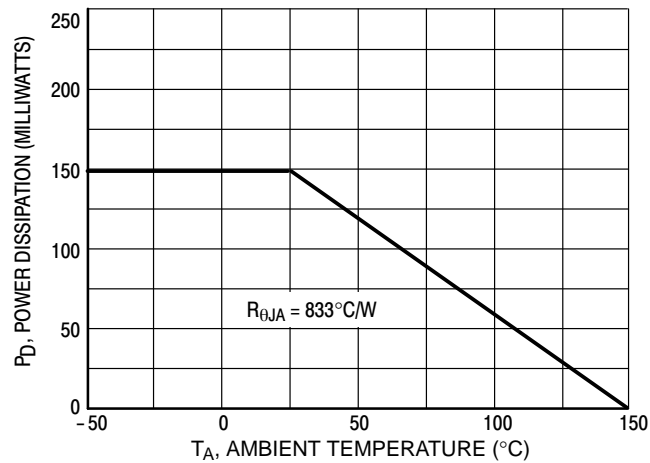


Figure 1. Derating Curve

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## 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 | nAdc |
| Collector-Emitter Cutoff Current (V <sub>CB</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> | – | – | 0.2 | mAdc |
| EMC2DXV5T1G   |                  | – | – | 0.5 |      |
| EMC3DXV5T1G   |                  | – | – | 0.2 |      |
| EMC4DXV5T1G   |                  | – | – | 1.0 |      |
| EMC5DXV5T1G   |                  | – | – |     |      |

### ON CHARACTERISTICS

|   |                      |      |      |      |     |
|---|----------------------|------|------|------|-----|
| 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 (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)               | V <sub>(BR)CEO</sub> | 50   | –    | –    | Vdc |
| DC Current Gain<br>(V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)                            | h <sub>FE</sub>      | 60   | 100  | –    |     |
| EMC2DXV5T1G   |                      | 35   | 60   | –    |     |
| EMC3DXV5T1G   |                      | 80   | 140  | –    |     |
| EMC4DXV5T1G   |                      | 20   | 35   | –    |     |
| EMC5DXV5T1G   |                      |      |      |      |     |
| Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)          | V <sub>CE(SAT)</sub> | –    | –    | 0.25 | Vdc |
| 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  | Vdc |
| 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  | –    | –    | Vdc |
| Input Resistor  | R1                   | 15.4 | 22   | 28.6 | kΩ  |
| EMC2DXV5T1G   |                      | 7.0  | 10   | 13   |     |
| EMC3DXV5T1G   |                      | 3.3  | 4.7  | 6.1  |     |
| EMC4DXV5T1G   |                      |      |      |      |     |
| EMC5DXV5T1G   |                      |      |      |      |     |
| Resistor Ratio  | R1/R2                | 0.8  | 1.0  | 1.2  |     |
| EMC2DXV5T1G   |                      | 0.8  | 1.0  | 1.2  |     |
| EMC3DXV5T1G   |                      | 0.17 | 0.21 | 0.25 |     |
| EMC4DXV5T1G   |                      | 0.38 | 0.47 | 0.56 |     |
| EMC5DXV5T1G   |                      |      |      |      |     |

### 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 | nAdc |
| Collector-Emitter Cutoff Current (V <sub>CB</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> | – | – | 0.2 | mAdc |
| EMC2DXV5T1G   |                  | – | – | 0.5 |      |
| EMC3DXV5T1G   |                  | – | – | 0.1 |      |
| EMC4DXV5T1G, EMC5DXV5T1G  |                  | – | – |     |      |

### ON CHARACTERISTICS

|   |                      |      |     |      |     |
|---|----------------------|------|-----|------|-----|
| 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 (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)               | V <sub>(BR)CEO</sub> | 50   | –   | –    | Vdc |
| DC Current Gain<br>(V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)                            | h <sub>FE</sub>      | 60   | 100 | –    |     |
| EMC2DXV5T1G   |                      | 35   | 60  | –    |     |
| EMC3DXV5T1G   |                      | 80   | 140 | –    |     |
| EMC4DXV5T1G, EMC5DXV5T1G  |                      |      |     |      |     |
| Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)          | V <sub>CE(SAT)</sub> | –    | –   | 0.25 | Vdc |
| 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  | Vdc |
| 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  | –   | –    | Vdc |
| Input Resistor  | R1                   | 15.4 | 22  | 28.6 | kΩ  |
| EMC2DXV5T1G   |                      | 7.0  | 10  | 13   |     |
| EMC3DXV5T1G   |                      | 33   | 47  | 61   |     |
| EMC4DXV5T1G, EMC5DXV5T1G  |                      |      |     |      |     |
| Resistor Ratio  | R1/R2                | 0.8  | 1.0 | 1.2  |     |
| EMC2DXV5T1G   |                      | 0.8  | 1.0 | 1.2  |     |
| EMC3DXV5T1G   |                      | 0.8  | 1.0 | 1.2  |     |
| EMC4DXV5T1G, EMC5DXV5T1G  |                      | 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.

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## TYPICAL ELECTRICAL CHARACTERISTICS – EMC2DXV5T1 PNP TRANSISTOR

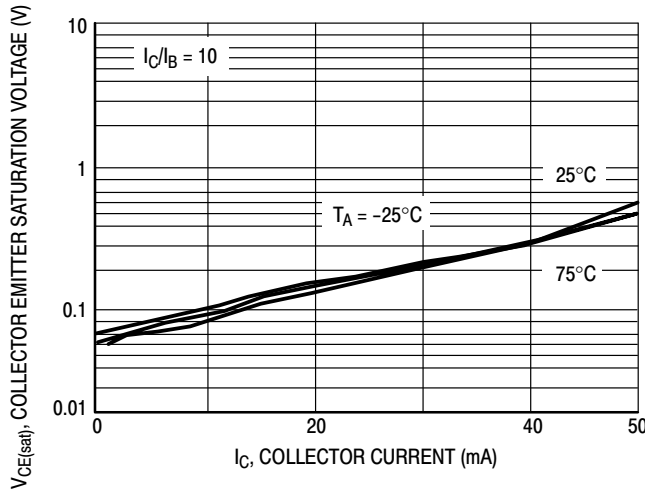


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

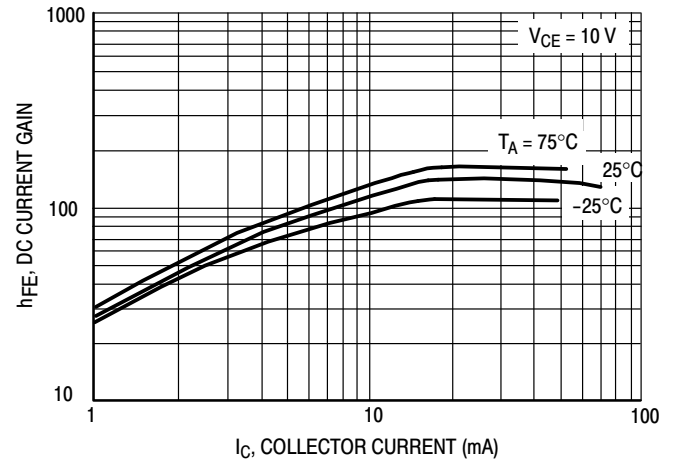


Figure 3. DC Current Gain

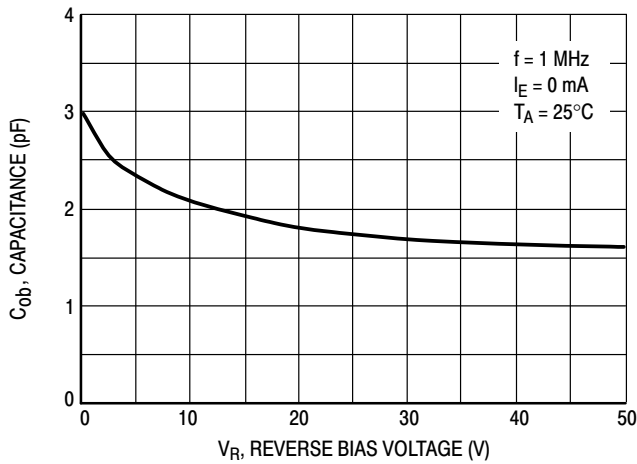


Figure 4. Output Capacitance

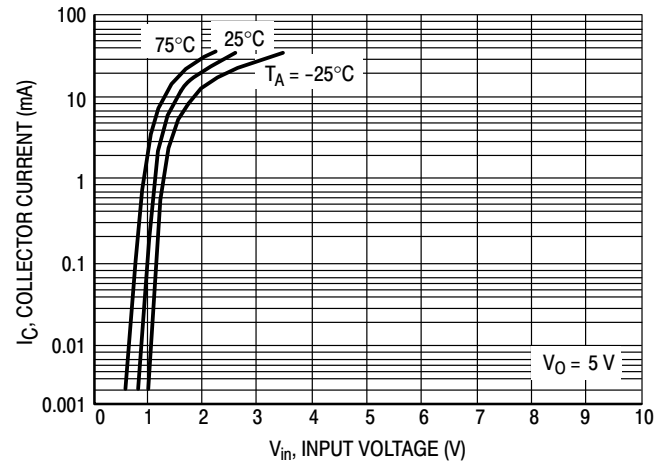


Figure 5. Output Current versus Input Voltage

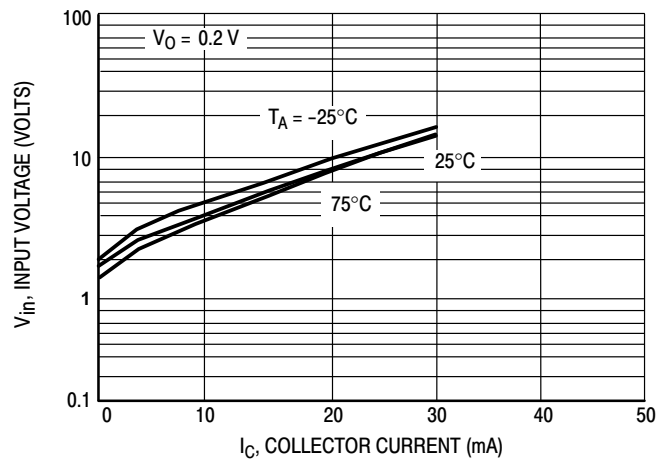


Figure 6. Input Voltage versus Output Current

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## TYPICAL ELECTRICAL CHARACTERISTICS – EMC2DXV5T1 NPN TRANSISTOR

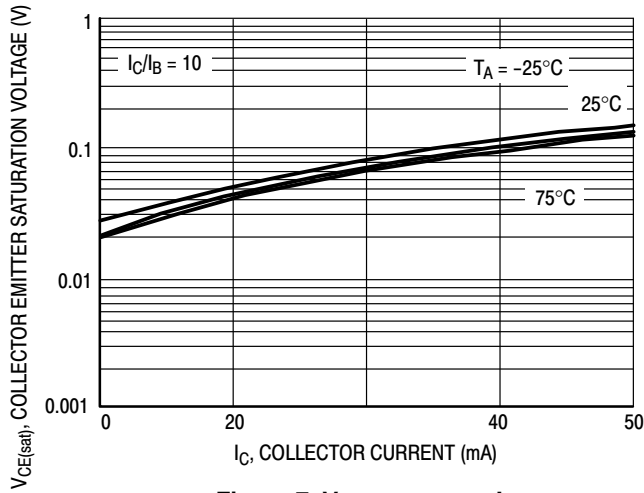


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

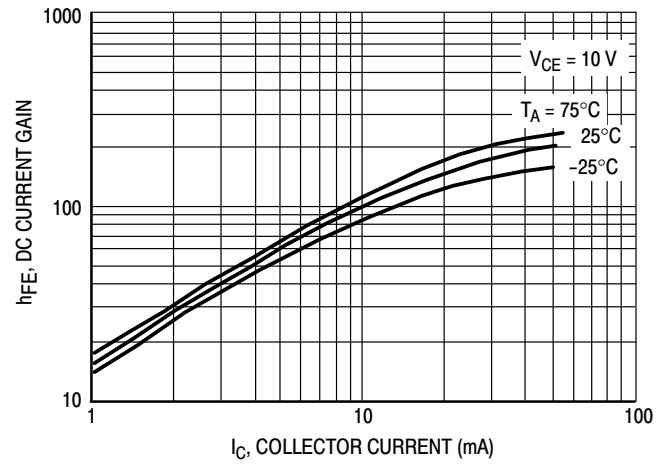


Figure 8. DC Current Gain

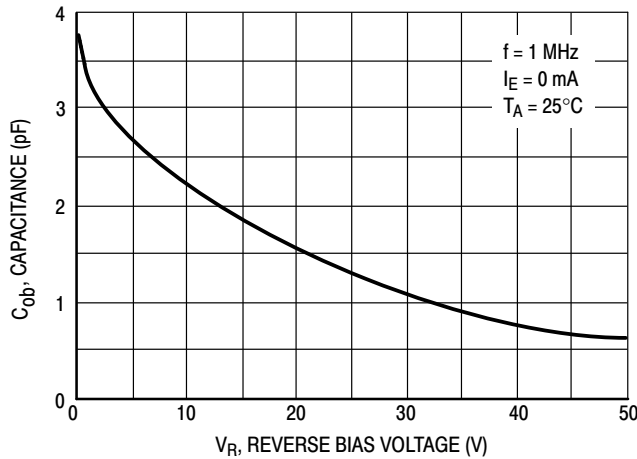


Figure 9. Output Capacitance

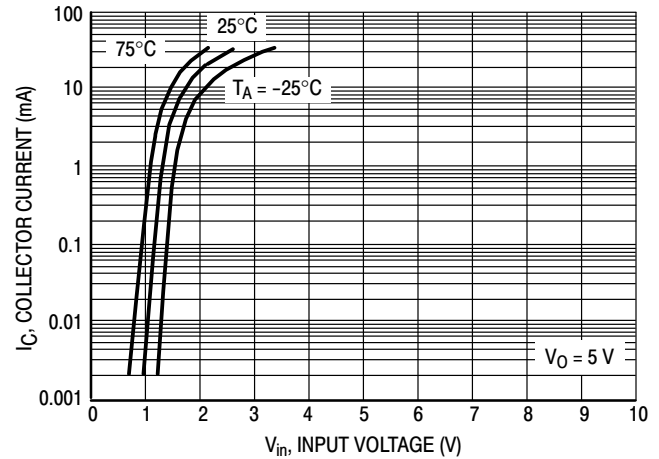


Figure 10. Output Current versus Input Voltage

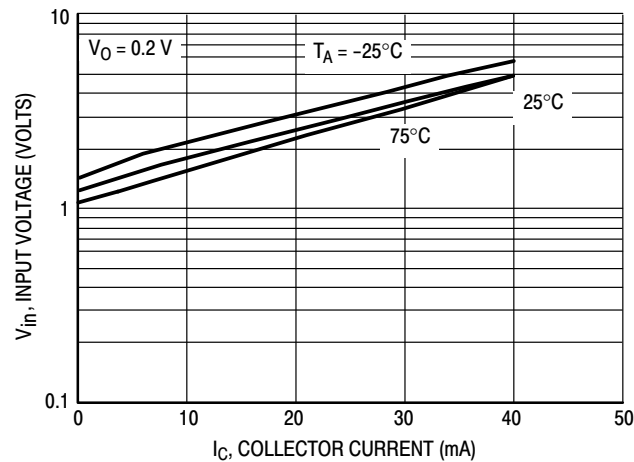


Figure 11. Input Voltage versus Output Current

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## TYPICAL ELECTRICAL CHARACTERISTICS – EMC3DXV5T1 PNP TRANSISTOR

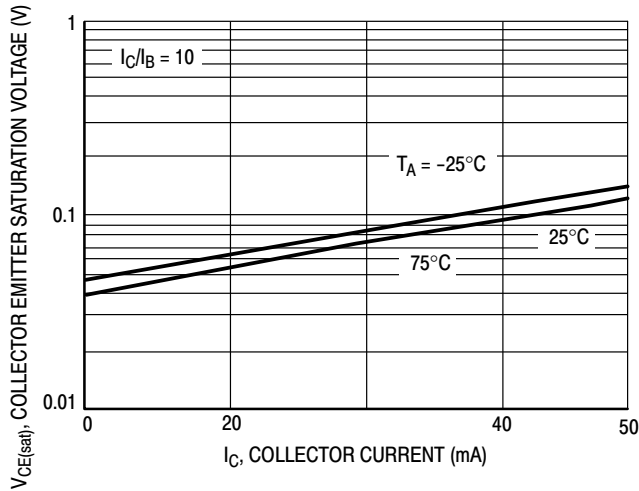


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

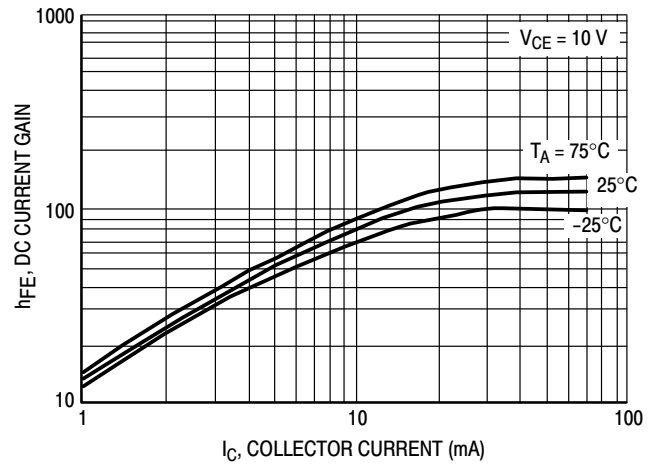


Figure 13. DC Current Gain

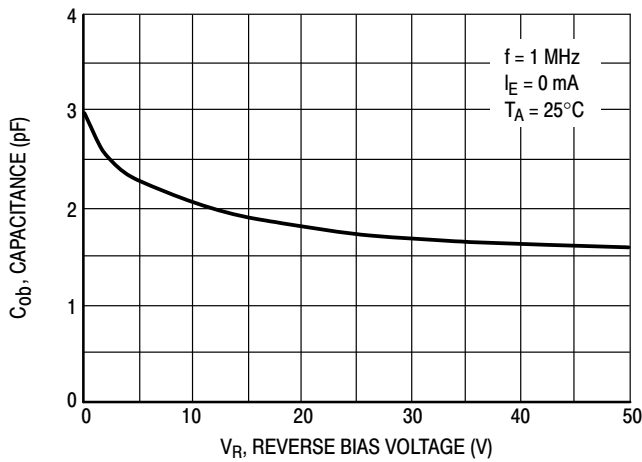


Figure 14. Output Capacitance

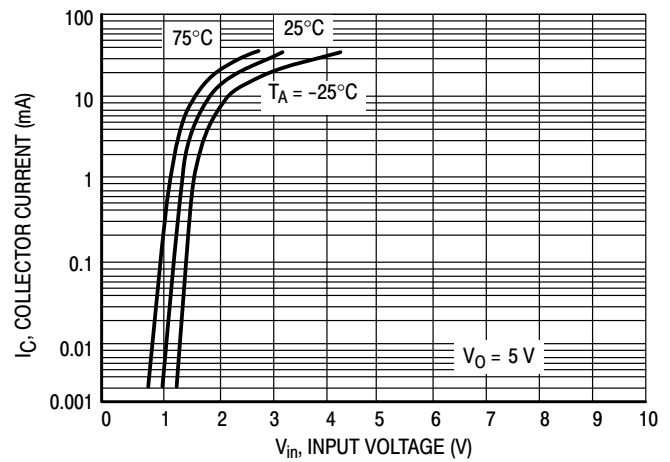


Figure 15. Output Current versus Input Voltage

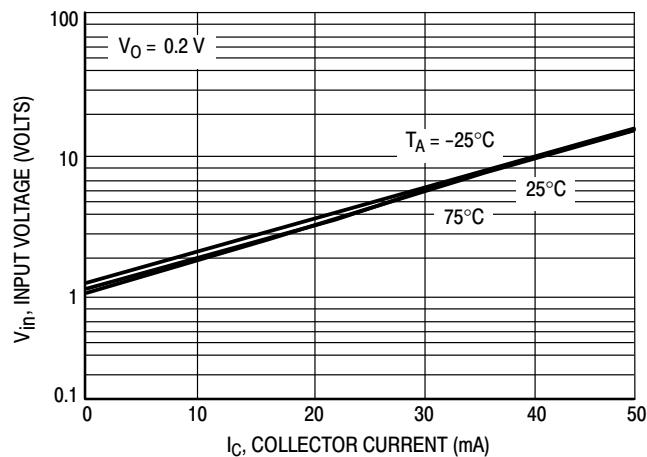


Figure 16. Input Voltage versus Output Current

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## TYPICAL ELECTRICAL CHARACTERISTICS – EMC3DXV5T1 NPN TRANSISTOR

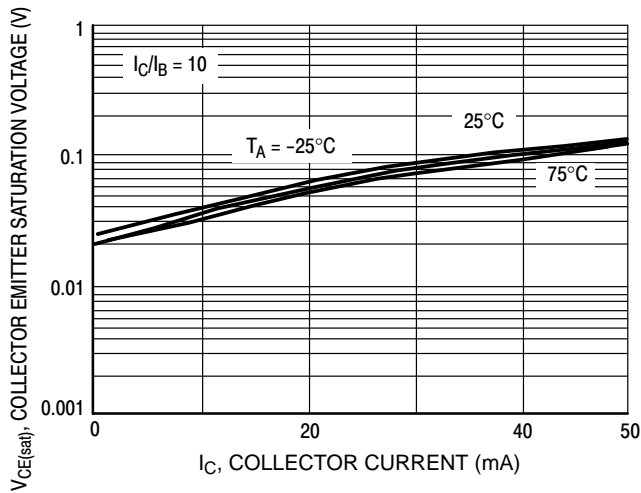


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

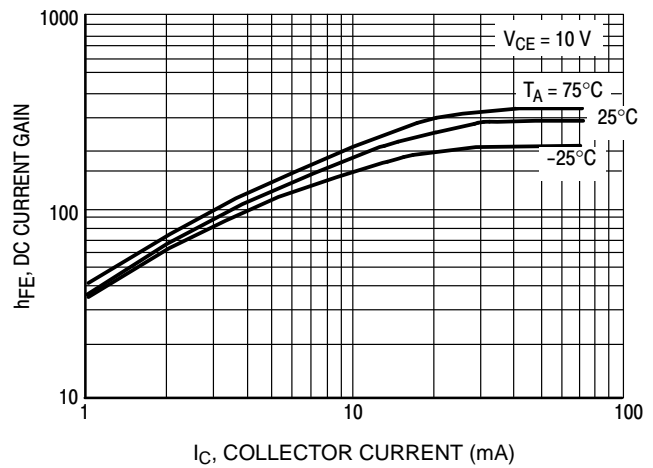


Figure 18. DC Current Gain

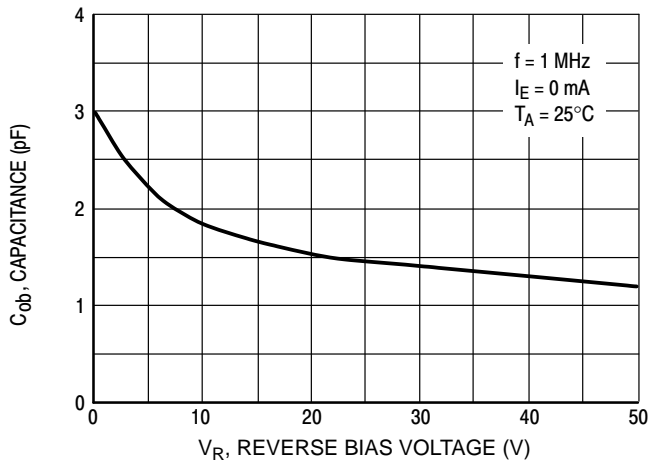


Figure 19. Output Capacitance

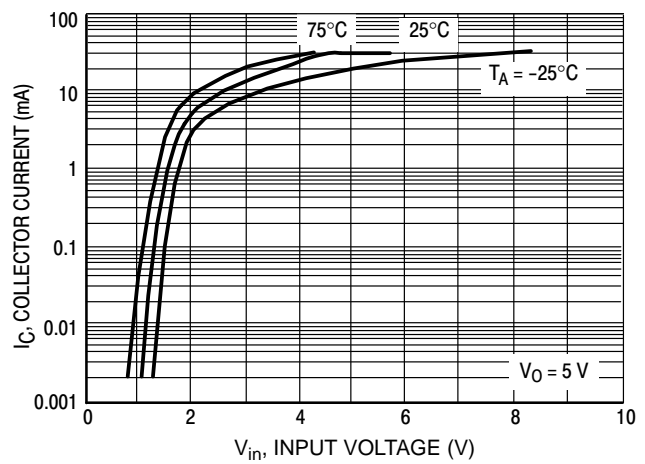


Figure 20. Output Current versus Input Voltage

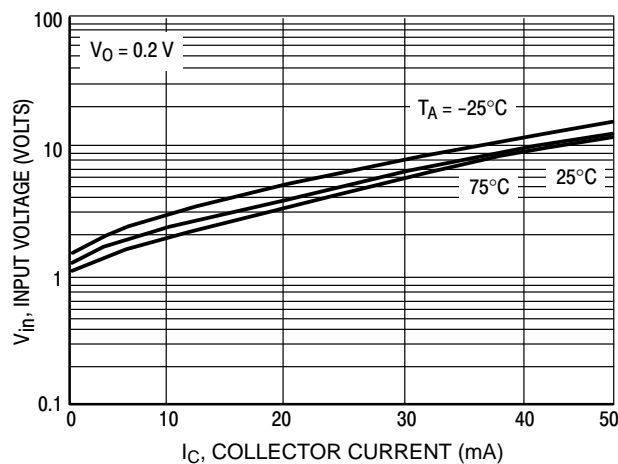


Figure 21. Input Voltage versus Output Current

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## TYPICAL ELECTRICAL CHARACTERISTICS –EMC4DXV5T1 PNP TRANSISTOR

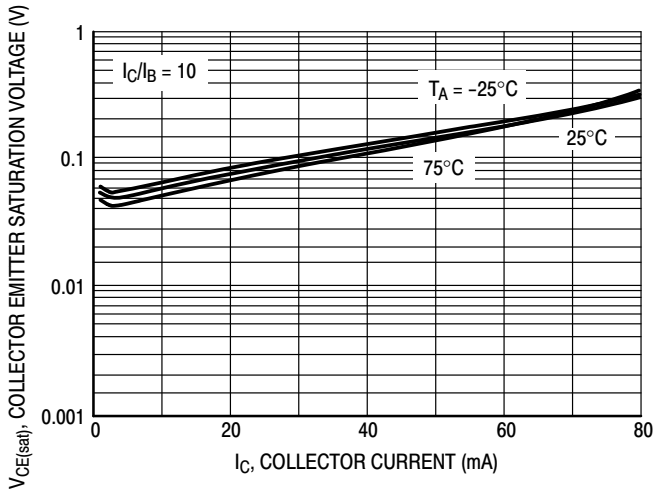


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

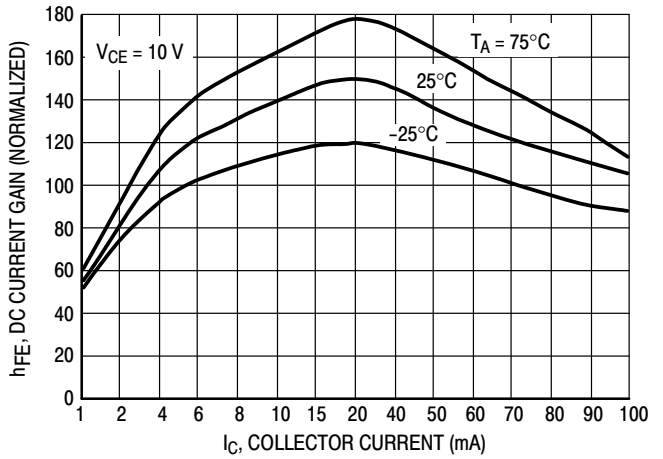


Figure 23. DC Current Gain

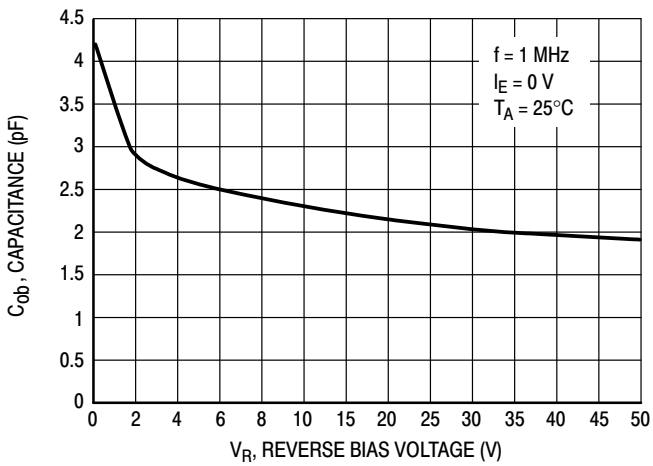


Figure 24. Output Capacitance

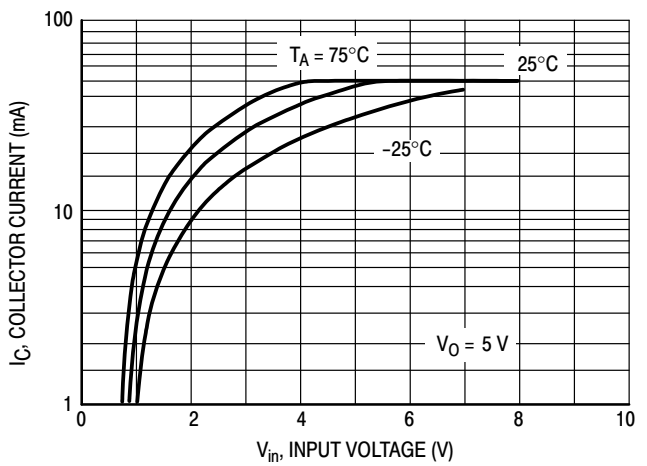


Figure 25. Output Current versus Input Voltage

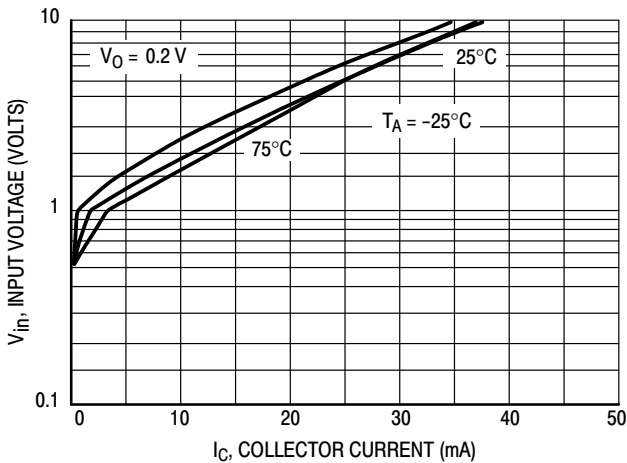


Figure 26. Input Voltage versus Output Current

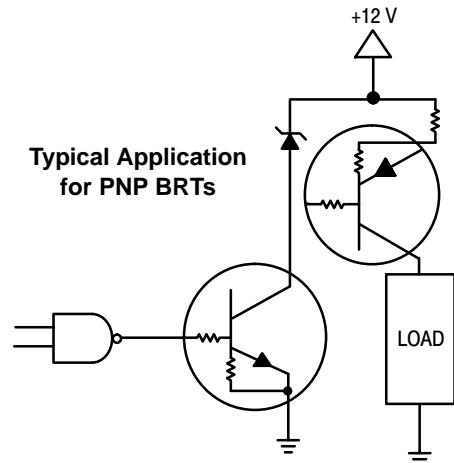


Figure 27. Inexpensive, Unregulated Current Source



# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## TYPICAL ELECTRICAL CHARACTERISTICS – EMC5DXV5T1 PNP TRANSISTOR

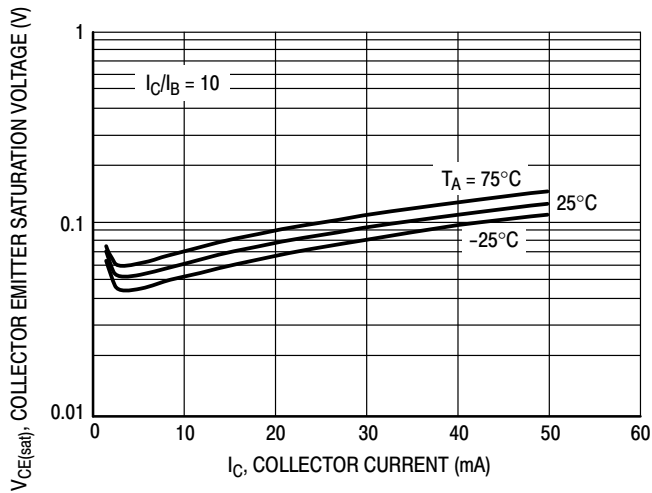


Figure 28.  $V_{CE(sat)}$  versus  $I_C$

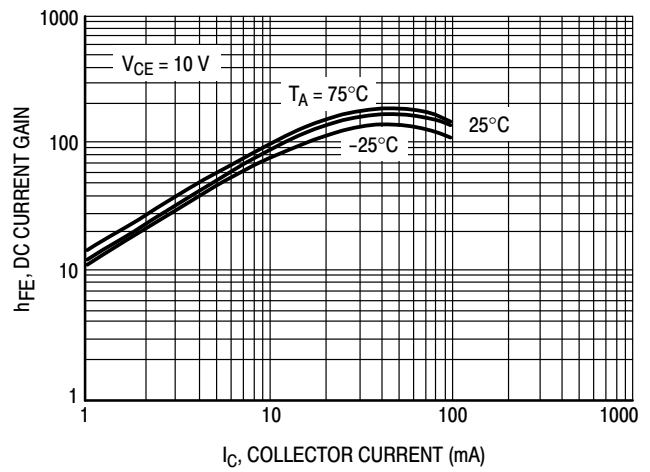


Figure 29. DC Current Gain

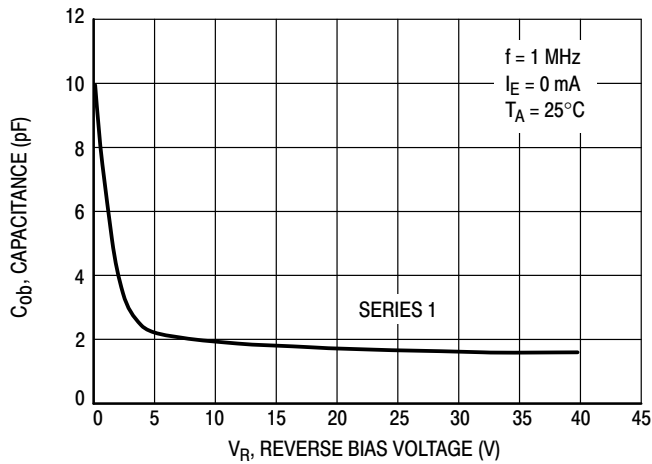


Figure 30. Output Capacitance

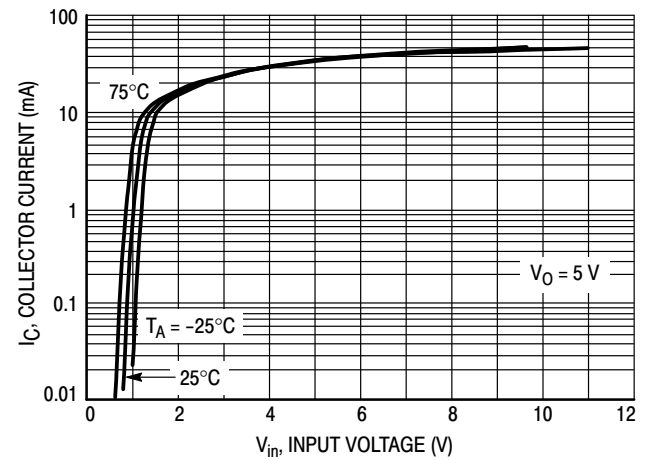


Figure 31. Output Current versus Input Voltage

# EMC2DXV5T1G, EMC3DXV5T1G, EMC4DXV5T1G, EMC5DXV5T1G

## TYPICAL ELECTRICAL CHARACTERISTICS – EMC4DXV5T1, EMC5DXV5T1 NPN TRANSISTOR

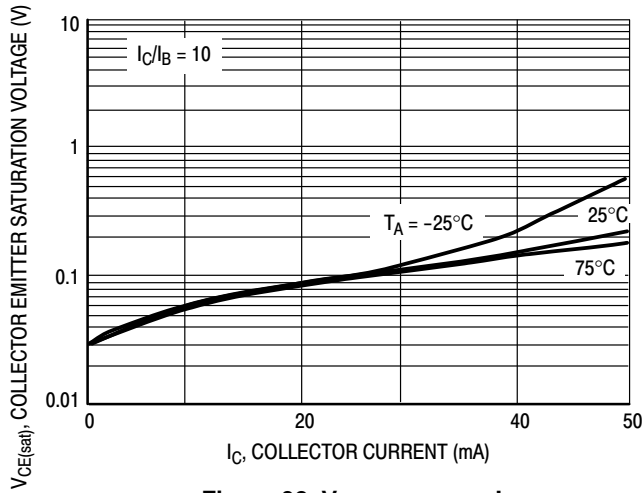


Figure 32.  $V_{CE(sat)}$  versus  $I_C$

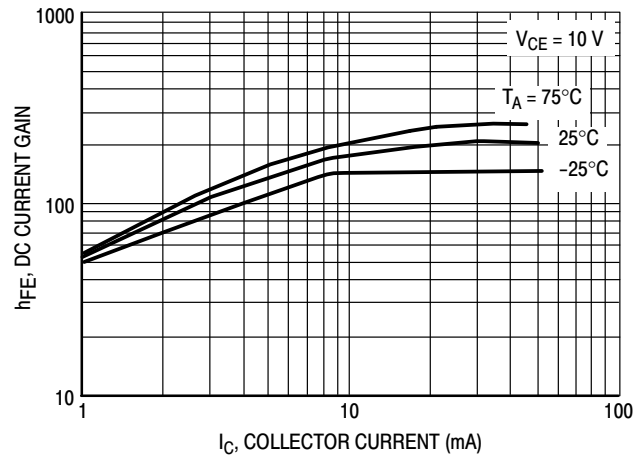


Figure 33. DC Current Gain

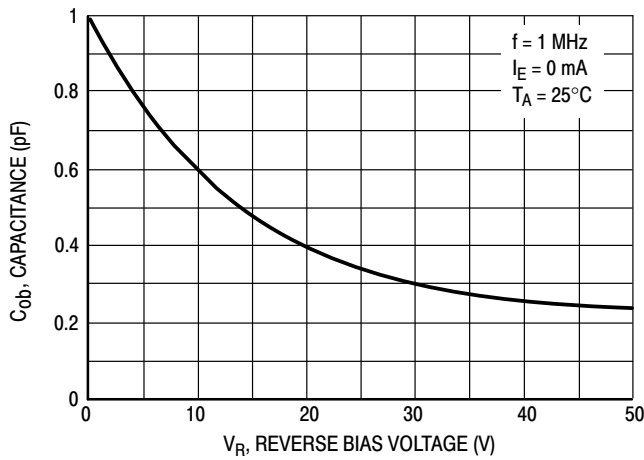


Figure 34. Output Capacitance

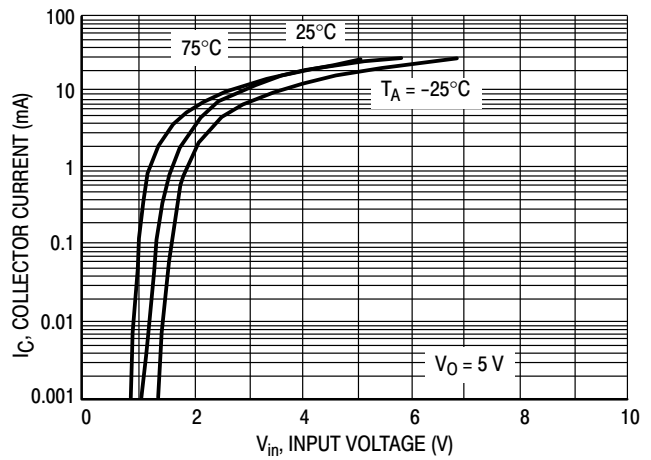


Figure 35. Output Current versus Input Voltage

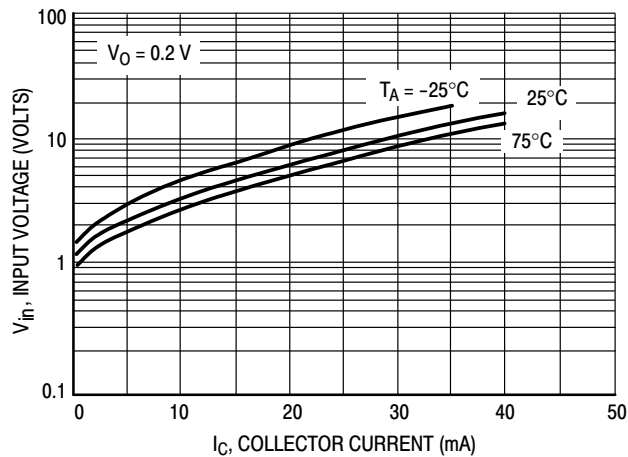


Figure 36. Input Voltage versus Output Current

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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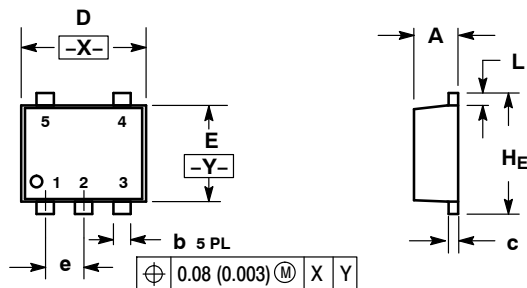
SCALE 4:1

### SOT-553, 5 LEAD

#### CASE 463B

#### ISSUE C

DATE 20 MAR 2013

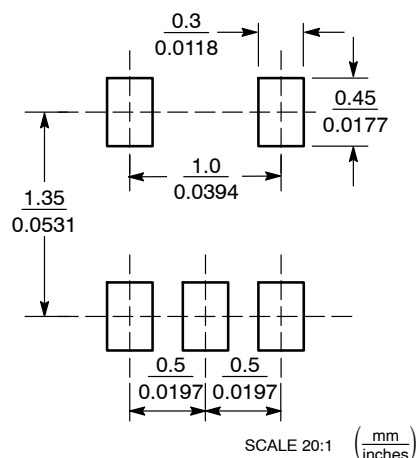


#### NOTES:

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     | 0.022 | 0.024 |
| b   | 0.17        | 0.22 | 0.27 | 0.007     | 0.009 | 0.011 |
| c   | 0.08        | 0.13 | 0.18 | 0.003     | 0.005 | 0.007 |
| D   | 1.55        | 1.60 | 1.65 | 0.061     | 0.063 | 0.065 |
| E   | 1.15        | 1.20 | 1.25 | 0.045     | 0.047 | 0.049 |
| e   | 0.50 BSC    |      |      | 0.020 BSC |       |       |
| L   | 0.10        | 0.20 | 0.30 | 0.004     | 0.008 | 0.012 |
| H_E | 1.55        | 1.60 | 1.65 | 0.061     | 0.063 | 0.065 |

#### RECOMMENDED SOLDERING FOOTPRINT\*



#### GENERIC MARKING DIAGRAM\*



- XX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*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.

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

#### STYLE 1:

- PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

#### STYLE 2:

- PIN 1. CATHODE  
2. COMMON ANODE  
3. CATHODE 2  
4. CATHODE 3  
5. CATHODE 4

#### STYLE 3:

- PIN 1. ANODE 1  
2. N/C  
3. ANODE 2  
4. CATHODE 2  
5. CATHODE 1

#### STYLE 4:

- PIN 1. SOURCE 1  
2. DRAIN 1/2  
3. SOURCE 1  
4. GATE 1  
5. GATE 2

#### STYLE 5:

- PIN 1. ANODE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. CATHODE

#### STYLE 6:

- PIN 1. EMITTER 2  
2. BASE 2  
3. EMITTER 1  
4. COLLECTOR 1  
5. COLLECTOR 2/BASE 1

#### STYLE 7:

- PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR


#### STYLE 8:

- PIN 1. CATHODE  
2. COLLECTOR  
3. N/C  
4. BASE  
5. EMITTER

#### STYLE 9:

- PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. ANODE

|                  |                           |  |
|------------------|---------------------------|--|
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| DESCRIPTION:     | SOT-553, 5 LEAD           | PAGE 1 OF 2  |

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