

# EMG2DXV5, EMG5DXV5

## Dual Bias Resistor Transistors

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

This new series of digital transistors is designed to replace a single device and its external resistor bias 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. 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. The device is housed in the SOT-553 package which is designed for low power surface mount applications.

#### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Moisture Sensitivity Level: 1
- Available in 8 mm, 7 inch Tape and Reel
- Lead-Free Solder Plating
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage    | $V_{CB0}$ | 50    | Vdc  |
| Collector-Emitter Voltage | $V_{CEO}$ | 50    | Vdc  |
| Collector Current         | $I_C$     | 100   | mAdc |

#### THERMAL CHARACTERISTICS

| Characteristic                                                                          | Symbol          | Max                                                          | Unit                     |
|-----------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------|--------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 230 (Note 1)<br>338 (Note 2)<br>1.8 (Note 1)<br>2.7 (Note 2) | mW<br>$^\circ\text{C/W}$ |
| Thermal Resistance –<br>Junction-to-Ambient                                             | $R_{\theta JA}$ | 540 (Note 1)<br>370 (Note 2)                                 | $^\circ\text{C/W}$       |
| Thermal Resistance –<br>Junction-to-Lead                                                | $R_{\theta JL}$ | 264 (Note 1)<br>287 (Note 2)                                 | $^\circ\text{C/W}$       |
| Junction and Storage<br>Temperature Range                                               | $T_J, T_{stg}$  | -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.

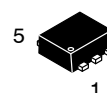
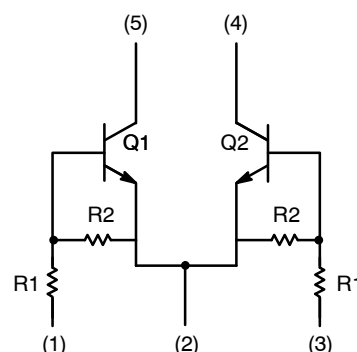
1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 x 1.0 inch Pad



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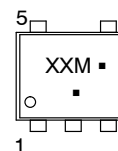
<http://onsemi.com>

### NPN SILICON BIAS RESISTOR TRANSISTORS



SOT-553  
CASE 463B

#### MARKING DIAGRAM



XX = UF (EMG5)  
UP (EMG2)  
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 6 of this data sheet.

# EMG2DXV5, EMG5DXV5

## DEVICE MARKING AND RESISTOR VALUES

| Device   | Package | Marking | R1 (K) | R2 (K) |
|----------|---------|---------|--------|--------|
| EMG2DXV5 | SOT-553 | UP      | 47     | 47     |
| EMG5DXV5 | SOT-553 | UF      | 10     | 47     |

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

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

### OFF CHARACTERISTICS (Q1 & Q2)

|                                                                                               |                      |    |   |     |      |
|-----------------------------------------------------------------------------------------------|----------------------|----|---|-----|------|
| 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>     | –  | – | 0.1 | mAdc |
|                                                                                               |                      | –  | – | 0.2 |      |
| 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)<br>(I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0) | V <sub>(BR)CEO</sub> | 50 | – | –   | Vdc  |

### ON CHARACTERISTICS (Q1 & Q2) (Note 3)

|                                                                                                   |                      |                                |             |             |             |     |
|---------------------------------------------------------------------------------------------------|----------------------|--------------------------------|-------------|-------------|-------------|-----|
| DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)                                 | EMG2DXV5<br>EMG5DXV5 | h <sub>FE</sub>                | 80<br>80    | 140<br>140  | –<br>–      |     |
| 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)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ) | EMG2DXV5             | V <sub>OL</sub>                | –           | –           | 0.2         | Vdc |
| (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 kΩ)                        | EMG5DXV5             |                                | –           | –           | 0.2         |     |
| 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                                                                                    | EMG2DXV5<br>EMG5DXV5 | R <sub>1</sub>                 | 32.9<br>7.0 | 47<br>10    | 61.1<br>13  | kΩ  |
| Resistor Ratio                                                                                    | EMG2DXV5<br>EMG5DXV5 | R <sub>1</sub> /R <sub>2</sub> | 0.8<br>0.17 | 1.0<br>0.21 | 1.2<br>0.25 |     |

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

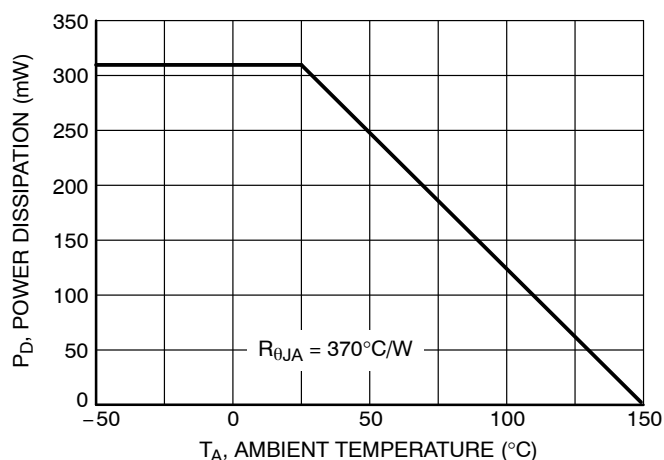


Figure 1. Derating Curve

# EMG2DXV5, EMG5DXV5

## TYPICAL ELECTRICAL CHARACTERISTICS — EMG2DXV5

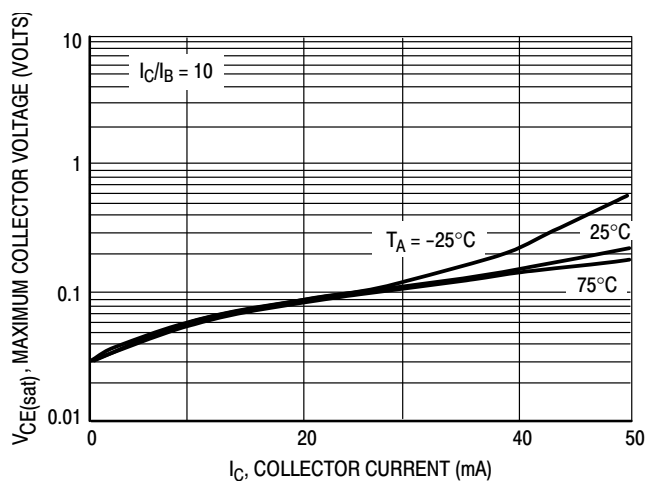


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

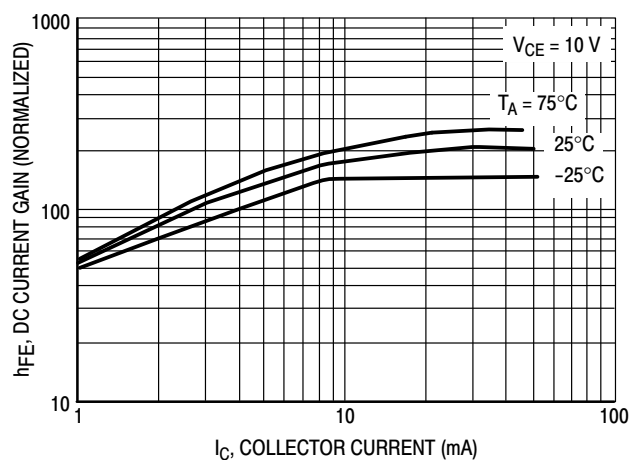


Figure 3. DC Current Gain

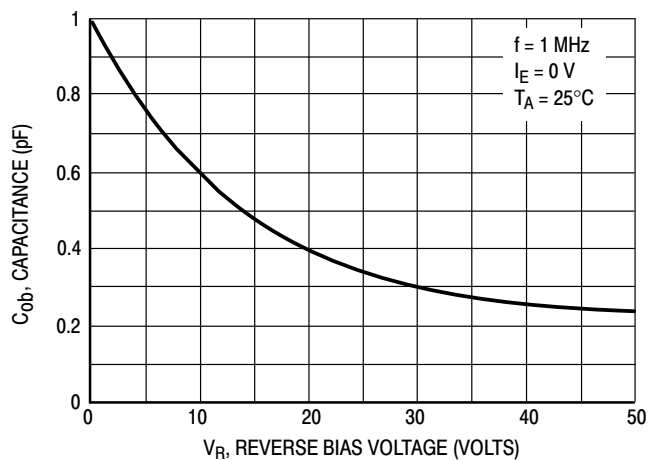


Figure 4. Output Capacitance

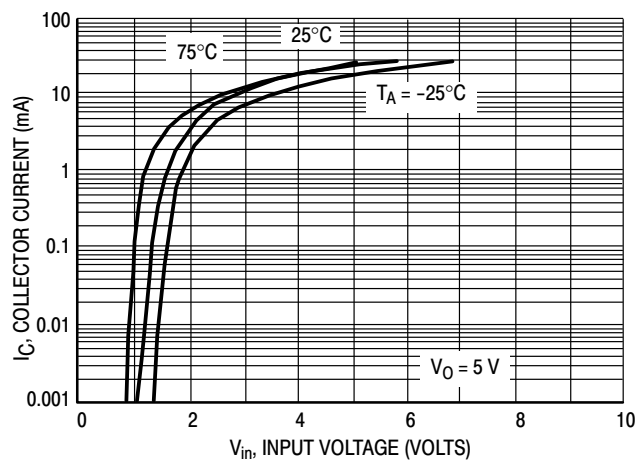


Figure 5. Output Current versus Input Voltage

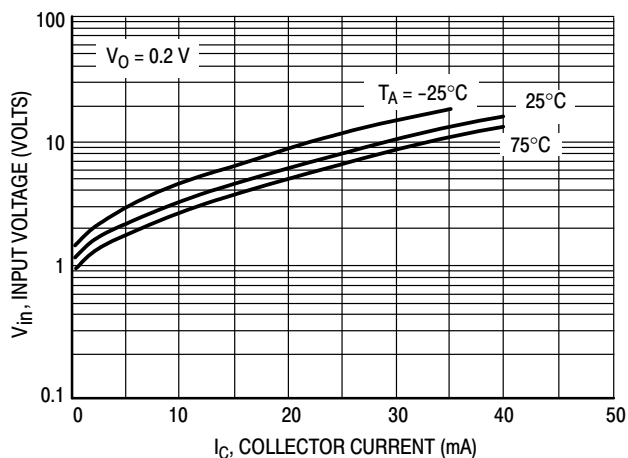


Figure 6. Input Voltage versus Output Current

# EMG2DXV5, EMG5DXV5

## TYPICAL ELECTRICAL CHARACTERISTICS – EMG5DXV5

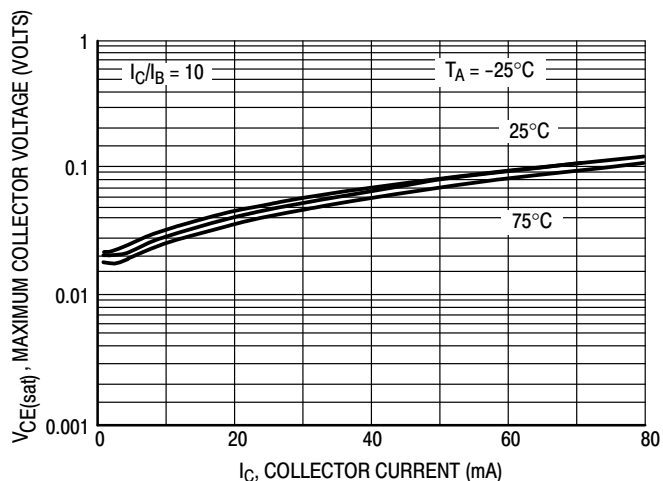


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

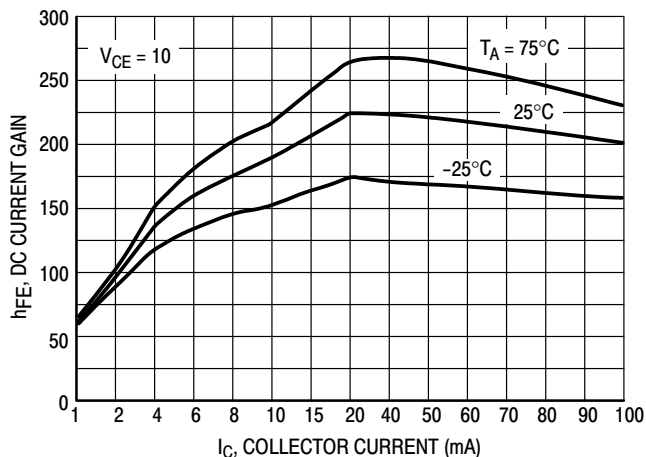


Figure 8. DC Current Gain

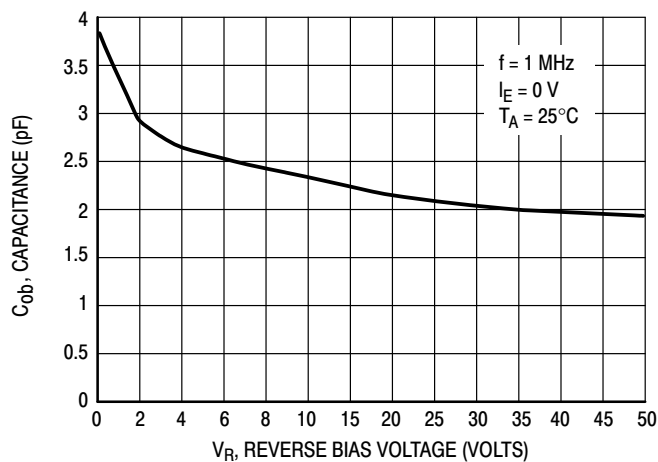


Figure 9. Output Capacitance

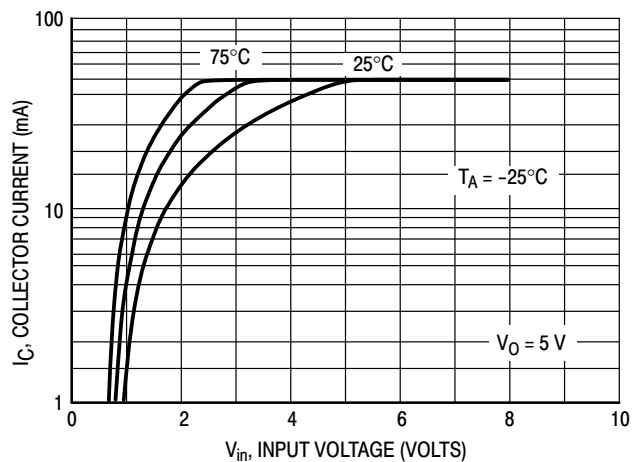


Figure 10. Output Current versus Input Voltage

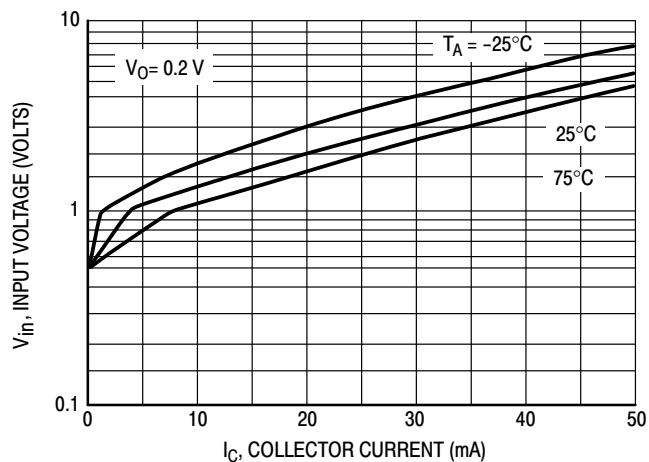


Figure 11. Input Voltage versus Output Current

## EMG2DXV5, EMG5DXV5

### TYPICAL APPLICATIONS FOR NPN BRTs

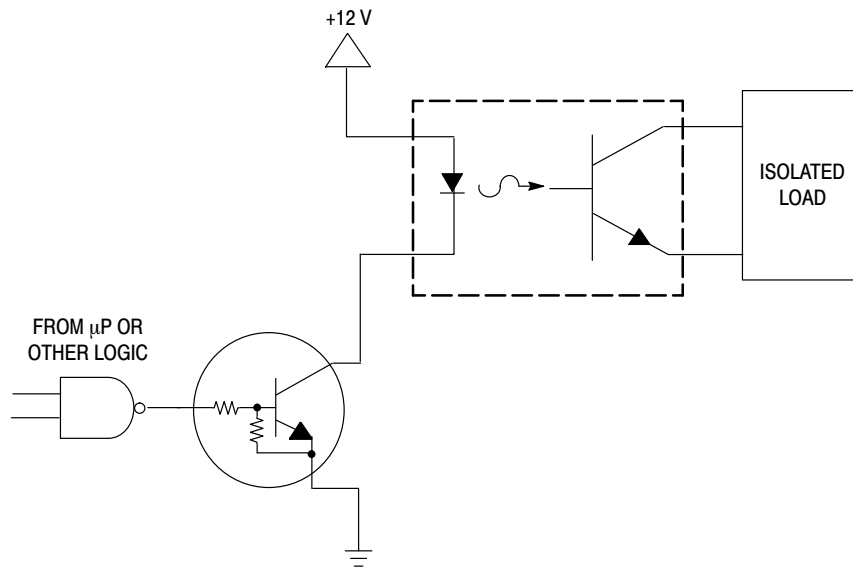


Figure 12. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

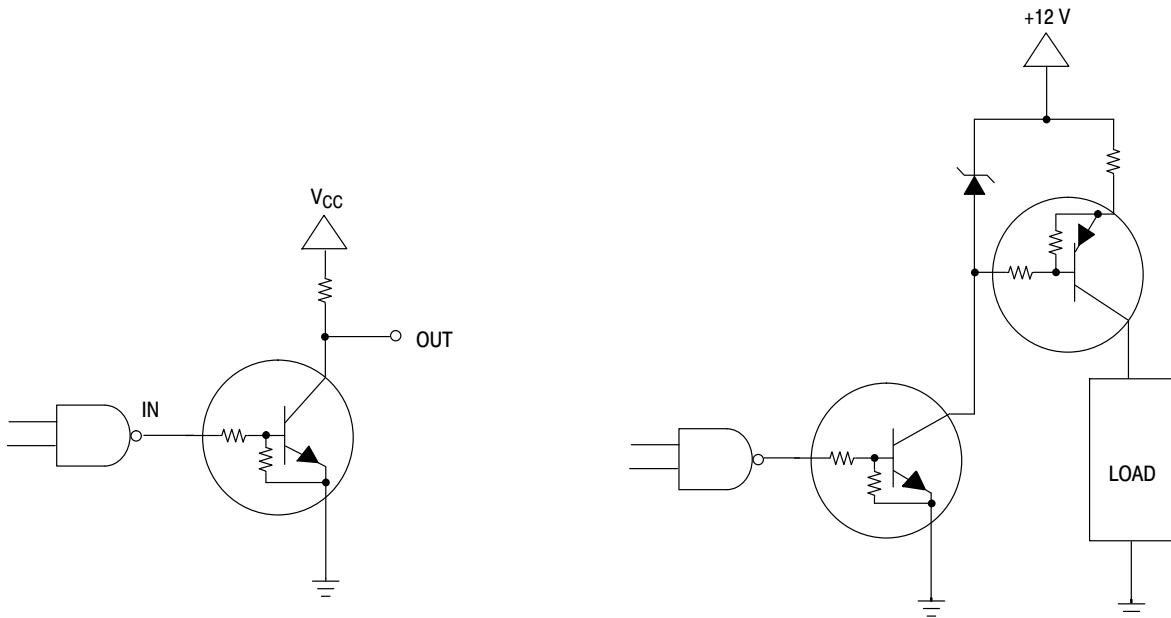


Figure 13. Open Collector Inverter:  
Inverts the Input Signal

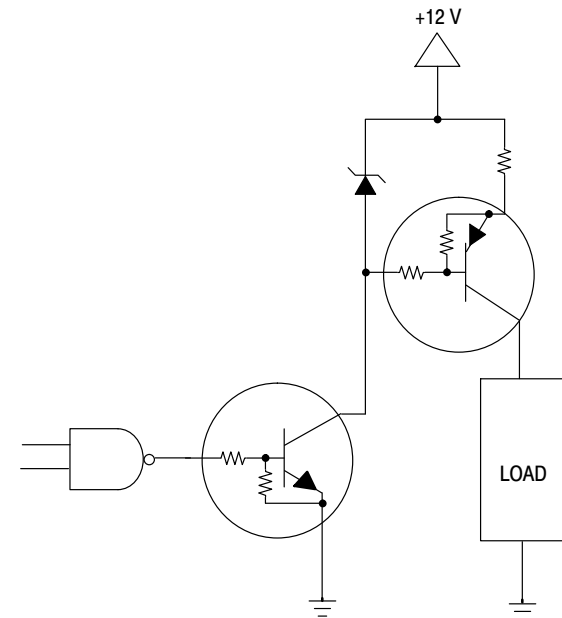


Figure 14. Inexpensive, Unregulated Current Source

## EMG2DXV5, EMG5DXV5

### DEVICE ORDERING INFORMATION

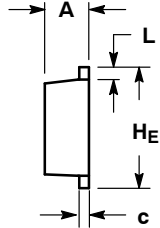
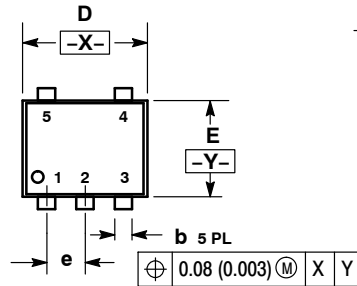
| Device      | Package              | Shipping <sup>†</sup> |
|-------------|----------------------|-----------------------|
| EMG2DXV5T1G | SOT-553<br>(Pb-Free) | 4000 / Tape & Reel    |
| EMG2DXV5T5G | SOT-553<br>(Pb-Free) | 8000 / Tape & Reel    |
| EMG5DXV5T1G | SOT-553<br>(Pb-Free) | 4000 / Tape & Reel    |
| EMG5DXV5T5G | SOT-553<br>(Pb-Free) | 8000 / 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.

# EMG2DXV5, EMG5DXV5

## PACKAGE DIMENSIONS

### SOT-553 CASE 463B ISSUE B

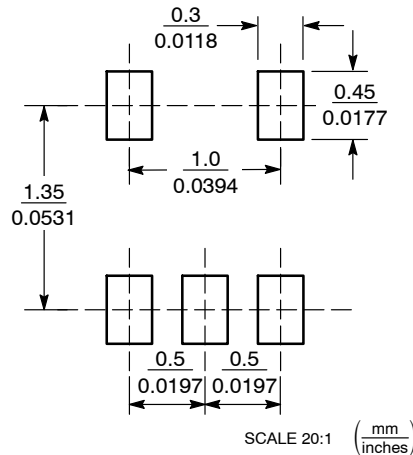


#### NOTES:

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   | 1.50        | 1.60 | 1.70 | 0.059     | 0.063 | 0.067 |
| E   | 1.10        | 1.20 | 1.30 | 0.043     | 0.047 | 0.051 |
| e   | 0.50 BSC    |      |      | 0.020 BSC |       |       |
| L   | 0.10        | 0.20 | 0.30 | 0.004     | 0.008 | 0.012 |
| HE  | 1.50        | 1.60 | 1.70 | 0.059     | 0.063 | 0.067 |

### 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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