WINSOURCE
ELECTRONICS

# THE DATASHEET OF

# MUN2211T3G

# MUN2211, MMUN2211L, MUN5211, DTC114EE, DTC114EM3, NSBC114EF3

# Digital Transistors (BRT) R1 = 10 kΩ, R2 = 10 kΩ

## NPN 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** ($T_A$ = 25°C)

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Collector−Base Voltage | $V_{CBO}$ | 50 | Vdc |
| Collector−Emitter Voltage | $V_{CEO}$ | 50 | Vdc |
| Collector Current − Continuous | $I_C$ | 100 | mAdc |
| Input Forward Voltage | $V_{IN(fwd)}$ | 40 | Vdc |
| Input Reverse Voltage | $V_{IN(rev)}$ | 10 | Vdc |

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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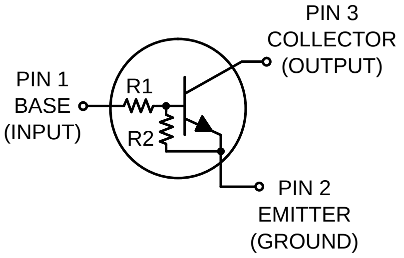
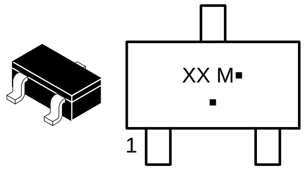
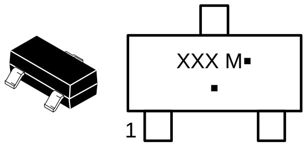
### PIN CONNECTIONS



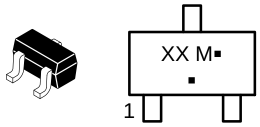
### MARKING DIAGRAMS



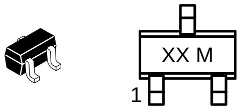
**SC−59**
**CASE 318D**
**STYLE 1**



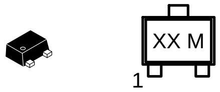
**SOT−23**
**CASE 318**
**STYLE 6**



**SC−70/SOT−323**
**CASE 419**
**STYLE 3**



**SC−75**
**CASE 463**
**STYLE 1**



**SOT−723**
**CASE 631AA**
**STYLE 1**

**SOT−1123**
**CASE 524AA**
**STYLE 1**

XXX = 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.

### ORDERING INFORMATION

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

### Table 1. ORDERING INFORMATION

| Device | Part Marking | Package | Shipping† |
|---|---|---|---|
| MUN2211T1G, SMUN2211T1G | 8A | SC−59<br>(Pb−Free) | 3000 / Tape & Reel |
| MUN2211T3G, SMUN2211T3G | 8A | SC−59<br>(Pb−Free) | 10000 / Tape & Reel |
| MMUN2211LT1G, SMMUN2211LT1G | A8A | SOT−23<br>(Pb−Free) | 3000 / Tape & Reel |
| MMUN2211LT3G, SMMUN2211LT3G | A8A | SOT−23<br>(Pb−Free) | 10000 / Tape & Reel |
| MUN5211T1G, SMUN5211T1G | 8A | SC−70/SOT−323<br>(Pb−Free) | 3000 / Tape & Reel |
| SMUN5211T3G | 8A | SC−70/SOT−323<br>(Pb−Free) | 10000 / Tape & Reel |
| DTC114EET1G, SDTC114EET1G | 8A | SC−75<br>(Pb−Free) | 3000 / Tape & Reel |
| DTC114EM3T5G | 8A | SOT−723<br>(Pb−Free) | 8000 / Tape & Reel |
| NSBC114EF3T5G | A | SOT−1123<br>(Pb−Free) | 8000 / 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.

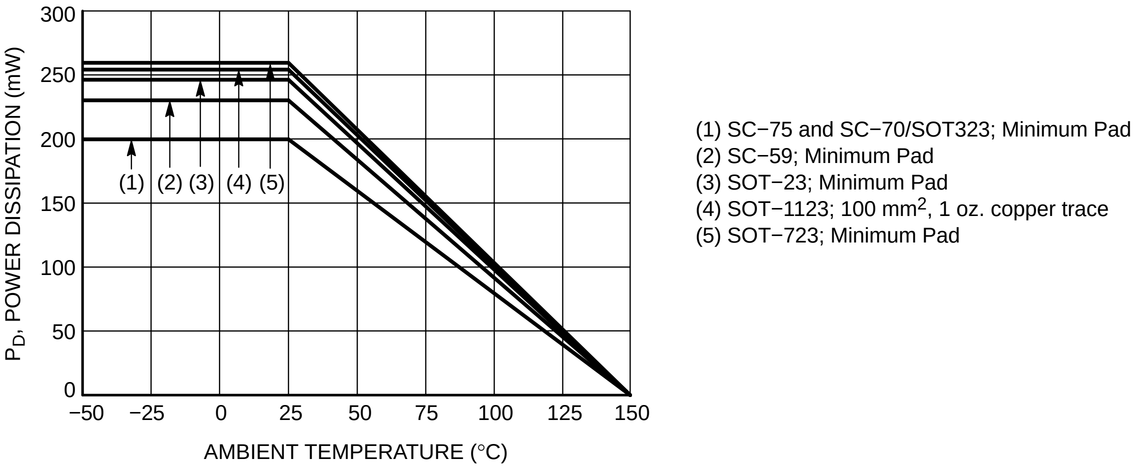


**Figure 1. Derating Curve**

**Table 2. THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| **THERMAL CHARACTERISTICS (SC−59) (MUN2211)** | | | |
| Total Device Dissipation | $P_D$ | | |
| $T_A$ = 25°C (Note 1) | | 230 | mW |
| (Note 2) | | 338 | |
| Derate above 25°C (Note 1) | | 1.8 | mW/°C |
| (Note 2) | | 2.7 | |
| Thermal Resistance, (Note 1) | $R_{\theta JA}$ | 540 | °C/W |
| Junction to Ambient (Note 2) | | 370 | |
| Thermal Resistance, (Note 1) | $R_{\theta JL}$ | 264 | °C/W |
| Junction to Lead (Note 2) | | 287 | |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SOT−23) (MMUN2211L)** | | | |
| Total Device Dissipation | $P_D$ | | |
| $T_A$ = 25°C (Note 1) | | 246 | mW |
| (Note 2) | | 400 | |
| Derate above 25°C (Note 1) | | 2.0 | mW/°C |
| (Note 2) | | 3.2 | |
| Thermal Resistance, (Note 1) | $R_{\theta JA}$ | 508 | °C/W |
| Junction to Ambient (Note 2) | | 311 | |
| Thermal Resistance, (Note 1) | $R_{\theta JL}$ | 174 | °C/W |
| Junction to Lead (Note 2) | | 208 | |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SC−70/SOT−323) (MUN5211)** | | | |
| Total Device Dissipation | $P_D$ | | |
| $T_A$ = 25°C (Note 1) | | 202 | mW |
| (Note 2) | | 310 | |
| Derate above 25°C (Note 1) | | 1.6 | mW/°C |
| (Note 2) | | 2.5 | |
| Thermal Resistance, (Note 1) | $R_{\theta JA}$ | 618 | °C/W |
| Junction to Ambient (Note 2) | | 403 | |
| Thermal Resistance, (Note 1) | $R_{\theta JL}$ | 280 | °C/W |
| Junction to Lead (Note 2) | | 332 | |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SC−75) (DTC114EE)** | | | |
| Total Device Dissipation | $P_D$ | | |
| $T_A$ = 25°C (Note 1) | | 200 | mW |
| (Note 2) | | 300 | |
| Derate above 25°C (Note 1) | | 1.6 | mW/°C |
| (Note 2) | | 2.4 | |
| Thermal Resistance, (Note 1) | $R_{\theta JA}$ | 600 | °C/W |
| Junction to Ambient (Note 2) | | 400 | |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SOT−723) (DTC114EM3)** | | | |
| Total Device Dissipation | $P_D$ | | |
| $T_A$ = 25°C (Note 1) | | 260 | mW |
| (Note 2) | | 600 | |
| Derate above 25°C (Note 1) | | 2.0 | mW/°C |
| (Note 2) | | 4.8 | |
| Thermal Resistance, (Note 1) | $R_{\theta JA}$ | 480 | °C/W |
| Junction to Ambient (Note 2) | | 205 | |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

1. FR−4 @ Minimum Pad.
2. FR−4 @ 1.0 x 1.0 Inch Pad.
3. FR−4 @ 100 $mm^2$, 1 oz. copper traces, still air.
4. FR−4 @ 500 $mm^2$, 1 oz. copper traces, still air.

### Table 2. THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| **THERMAL CHARACTERISTICS (SOT−1123) (NSBC114EF3)** | | | |
| Total Device Dissipation<br>$T_A$ = 25°C (Note 3)<br>(Note 4)<br>Derate above 25°C (Note 3)<br>(Note 4) | $P_D$ | <br>254<br>297<br>2.0<br>2.4 | <br>mW<br><br>mW/°C |
| Thermal Resistance, (Note 3)<br>Junction to Ambient (Note 4) | $R_{\theta JA}$ | 493<br>421 | °C/W |
| Thermal Resistance, Junction to Lead (Note 3) | $R_{\theta JL}$ | 193 | °C/W |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

1. FR−4 @ Minimum Pad.
2. FR−4 @ 1.0 x 1.0 Inch Pad.
3. FR−4 @ 100 mm$^2$, 1 oz. copper traces, still air.
4. FR−4 @ 500 mm$^2$, 1 oz. copper traces, still air.

### Table 3. ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C, unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector−Base Cutoff Current<br>($V_{CB}$ = 50 V, $I_E$ = 0) | $I_{CBO}$ | – | – | 100 | nAdc |
| Collector−Emitter Cutoff Current<br>($V_{CE}$ = 50 V, $I_B$ = 0) | $I_{CEO}$ | – | – | 500 | nAdc |
| Emitter−Base Cutoff Current<br>($V_{EB}$ = 6.0 V, $I_C$ = 0) | $I_{EBO}$ | – | – | 0.5 | mAdc |
| Collector−Base Breakdown Voltage<br>($I_C$ = 10 μA, $I_E$ = 0) | $V_{(BR)CBO}$ | 50 | – | – | Vdc |
| Collector−Emitter Breakdown Voltage (Note 5)<br>($I_C$ = 2.0 mA, $I_B$ = 0) | $V_{(BR)CEO}$ | 50 | – | – | Vdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain (Note 5)<br>($I_C$ = 5.0 mA, $V_{CE}$ = 10 V) | $h_{FE}$ | 35 | 60 | – | |
| Collector−Emitter Saturation Voltage (Note 5)<br>($I_C$ = 10 mA, $I_B$ = 0.3 mA) | $V_{CE(sat)}$ | – | – | 0.25 | Vdc |
| Input Voltage (off)<br>($V_{CE}$ = 5.0 V, $I_C$ = 100 μA) | $V_{i(off)}$ | – | 1.2 | 0.8 | Vdc |
| Input Voltage (on)<br>($V_{CE}$ = 0.3 V, $I_C$ = 10 mA) | $V_{i(on)}$ | 2.5 | 1.8 | – | Vdc |
| Output Voltage (on)<br>($V_{CC}$ = 5.0 V, $V_B$ = 2.5 V, $R_L$ = 1.0 kΩ) | $V_{OL}$ | – | – | 0.2 | Vdc |
| Output Voltage (off)<br>($V_{CC}$ = 5.0 V, $V_B$ = 0.5 V, $R_L$ = 1.0 kΩ) | $V_{OH}$ | 4.9 | – | – | Vdc |
| Input Resistor | R1 | 7.0 | 10 | 13 | kΩ |
| Resistor Ratio | $R_1/R_2$ | 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.

5. Pulsed Condition: Pulse Width = 300 μsec, Duty Cycle ≤ 2%.

## TYPICAL CHARACTERISTICS
## MUN2211, MMUN2211L, MUN5211, DTC114EE, DTC114EM3

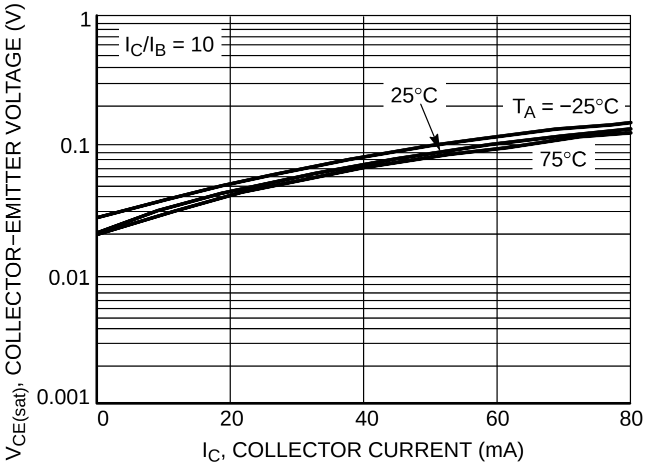


**Figure 2. $V_{CE(sat)}$ vs. $I_C$**

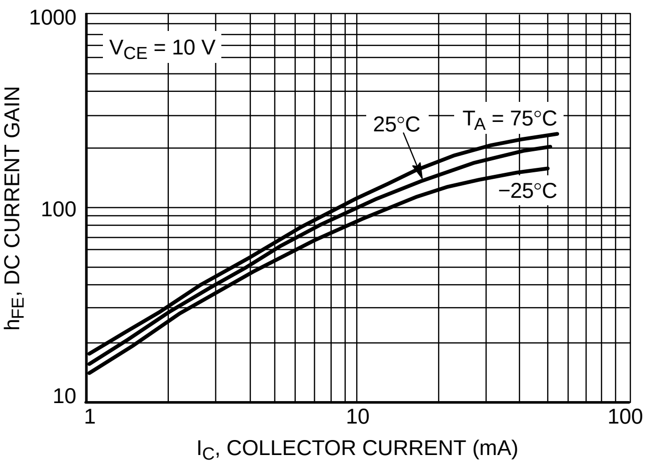


**Figure 3. DC Current Gain**

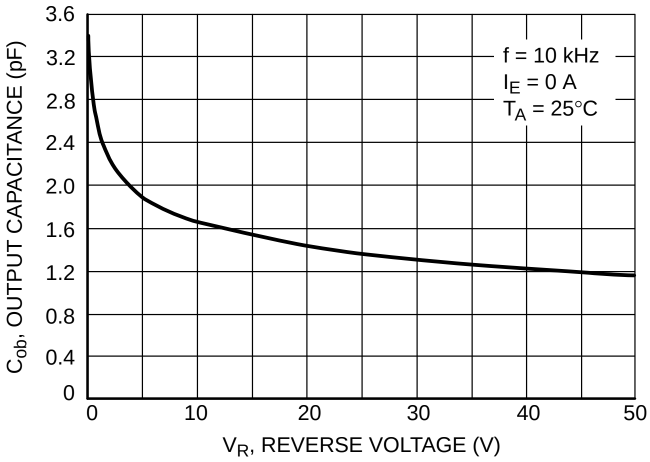


**Figure 4. Output Capacitance**

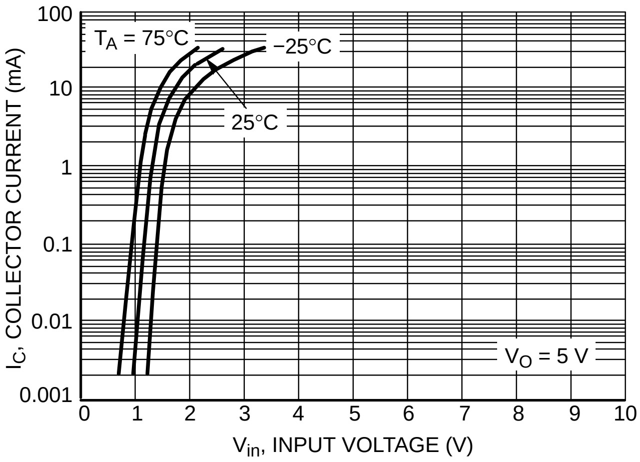


**Figure 5. Output Current vs. Input Voltage**

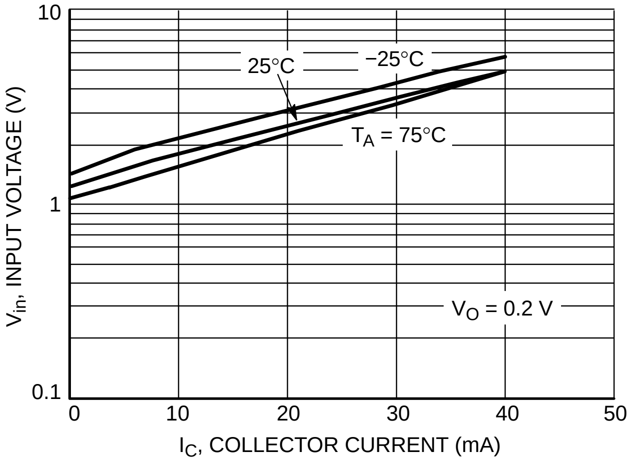


**Figure 6. Input Voltage vs. Output Current**

## TYPICAL CHARACTERISTICS − NSBC114EF3

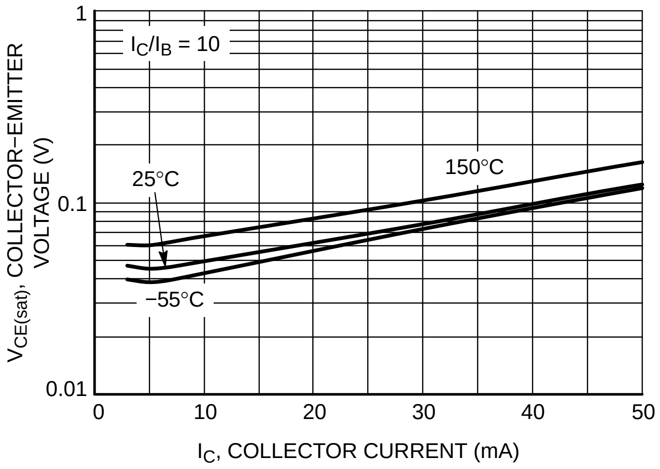


**Figure 7. $V_{CE(sat)}$ vs. $I_C$**

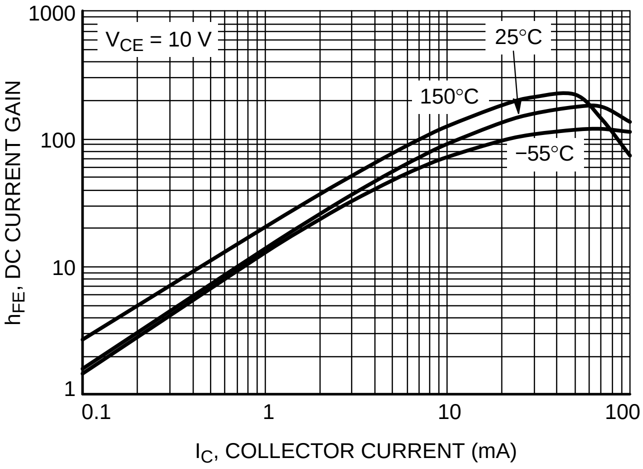


**Figure 8. DC Current Gain**

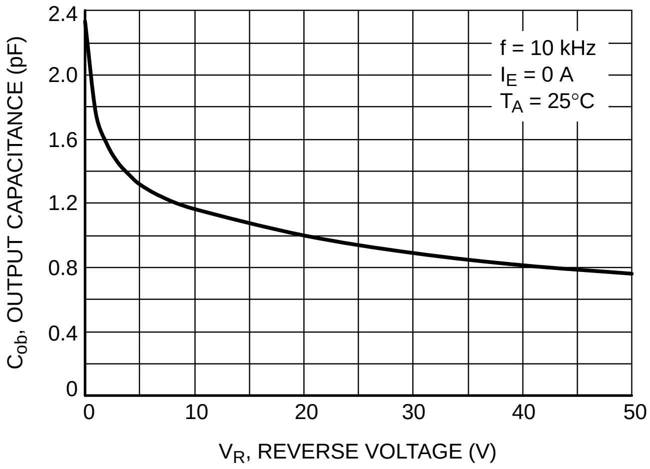


**Figure 9. Output Capacitance**

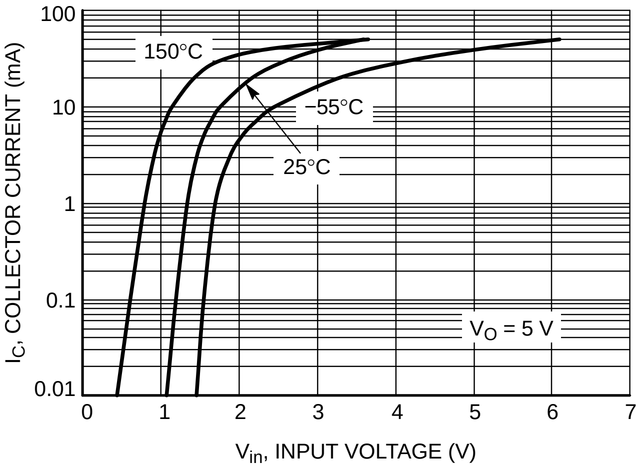


**Figure 10. Output Current vs. Input Voltage**

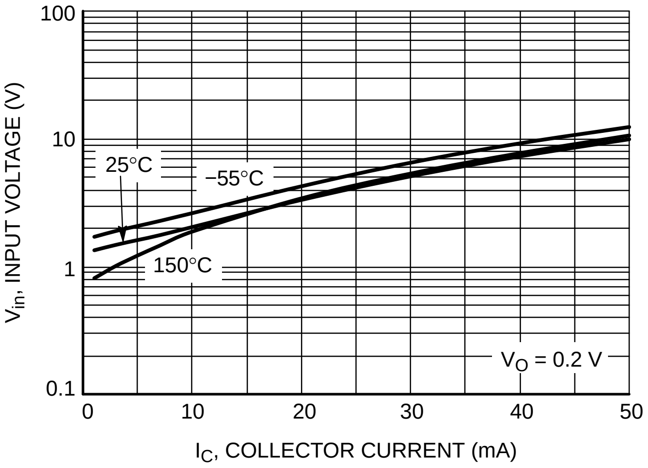
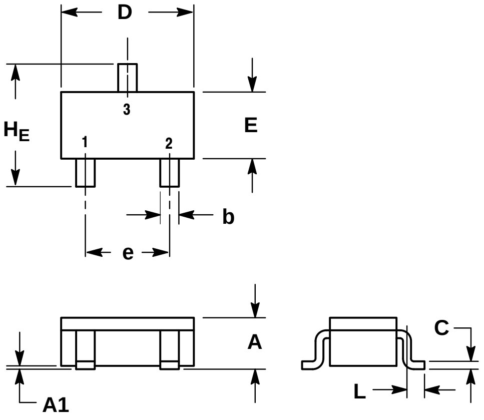


**Figure 11. Input Voltage vs. Output Current**

## PACKAGE DIMENSIONS

### SC−59
CASE 318D−04
ISSUE H

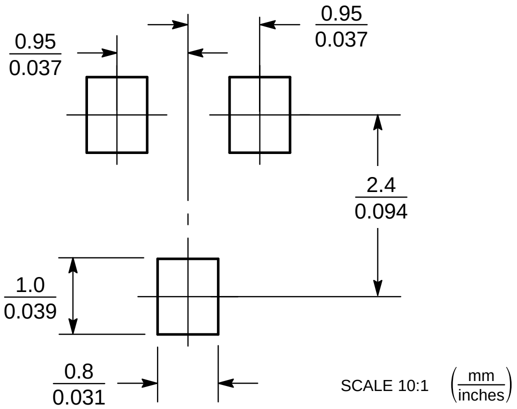


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| **DIM** | **MIN** | **NOM** | **MAX** | **MIN** | **NOM** | **MAX** |
| **A** | 1.00 | 1.15 | 1.30 | 0.039 | 0.045 | 0.051 |
| **A1** | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| **b** | 0.35 | 0.43 | 0.50 | 0.014 | 0.017 | 0.020 |
| **c** | 0.09 | 0.14 | 0.18 | 0.003 | 0.005 | 0.007 |
| **D** | 2.70 | 2.90 | 3.10 | 0.106 | 0.114 | 0.122 |
| **E** | 1.30 | 1.50 | 1.70 | 0.051 | 0.059 | 0.067 |
| **e** | 1.70 | 1.90 | 2.10 | 0.067 | 0.075 | 0.083 |
| **L** | 0.20 | 0.40 | 0.60 | 0.008 | 0.016 | 0.024 |
| **$H_E$** | 2.50 | 2.80 | 3.00 | 0.099 | 0.110 | 0.118 |

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

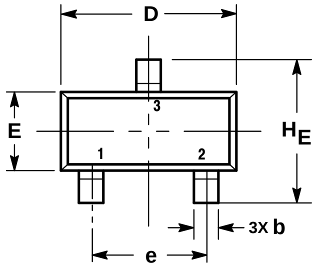
### SOLDERING FOOTPRINT*



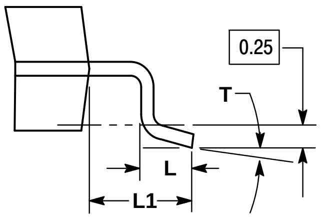
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## PACKAGE DIMENSIONS

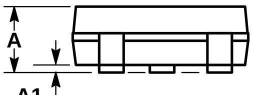
### SOT−23 (TO−236)
CASE 318−08
ISSUE AS



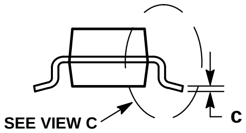
TOP VIEW



VIEW C



SIDE VIEW



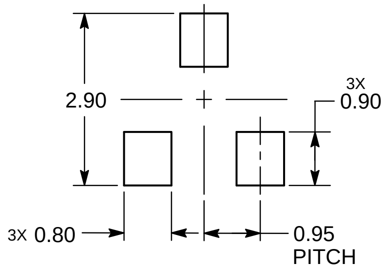
END VIEW

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

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| **DIM** | **MIN** | **NOM** | **MAX** | **MIN** | **NOM** | **MAX** |
| **A** | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| **A1** | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| **b** | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| **c** | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| **D** | 2.80 | 2.90 | 3.04 | 0.110 | 0.114 | 0.120 |
| **E** | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| **e** | 1.78 | 1.90 | 2.04 | 0.070 | 0.075 | 0.080 |
| **L** | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| **L1** | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| **$H_E$** | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| **T** | 0° | −−− | 10° | 0° | −−− | 10° |

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

### RECOMMENDED SOLDERING FOOTPRINT*



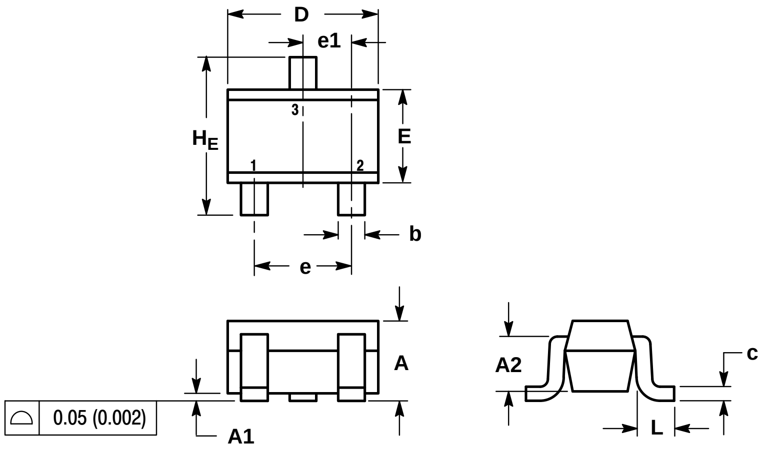
DIMENSIONS: MILLIMETERS

*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

### SC−70 (SOT−323)

CASE 419−04
ISSUE N

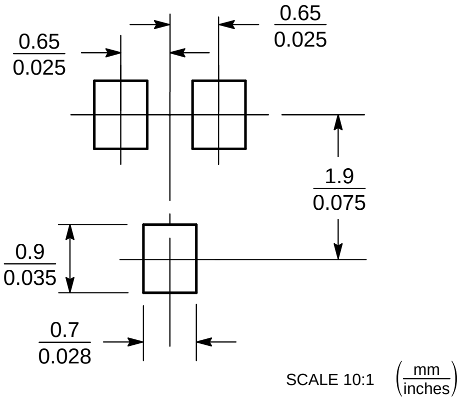


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.80 | 0.90 | 1.00 | 0.032 | 0.035 | 0.040 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| A2 | 0.70 REF | | | 0.028 REF | | |
| b | 0.30 | 0.35 | 0.40 | 0.012 | 0.014 | 0.016 |
| c | 0.10 | 0.18 | 0.25 | 0.004 | 0.007 | 0.010 |
| D | 1.80 | 2.10 | 2.20 | 0.071 | 0.083 | 0.087 |
| E | 1.15 | 1.24 | 1.35 | 0.045 | 0.049 | 0.053 |
| e | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e1 | 0.65 BSC | | | 0.026 BSC | | |
| L | 0.20 | 0.38 | 0.56 | 0.008 | 0.015 | 0.022 |
| $H_E$ | 2.00 | 2.10 | 2.40 | 0.079 | 0.083 | 0.095 |

STYLE 3:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

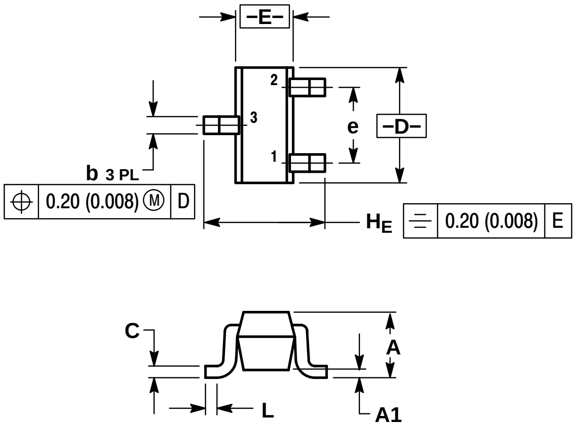
### SOLDERING FOOTPRINT*



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

## PACKAGE DIMENSIONS

### SC−75/SOT−416
CASE 463
ISSUE G

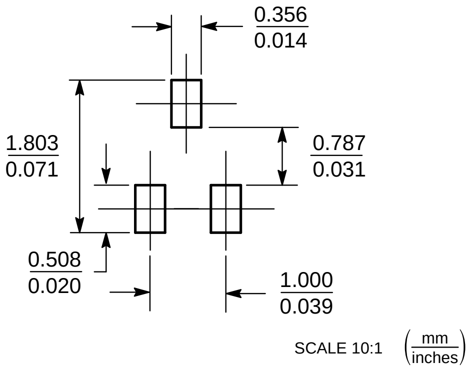


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.70 | 0.80 | 0.90 | 0.027 | 0.031 | 0.035 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.15 | 0.20 | 0.30 | 0.006 | 0.008 | 0.012 |
| C | 0.10 | 0.15 | 0.25 | 0.004 | 0.006 | 0.010 |
| D | 1.55 | 1.60 | 1.65 | 0.061 | 0.063 | 0.065 |
| E | 0.70 | 0.80 | 0.90 | 0.027 | 0.031 | 0.035 |
| e | 1.00 BSC | | | 0.04 BSC | | |
| L | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| $H_E$ | 1.50 | 1.60 | 1.70 | 0.060 | 0.063 | 0.067 |

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

### SOLDERING FOOTPRINT*



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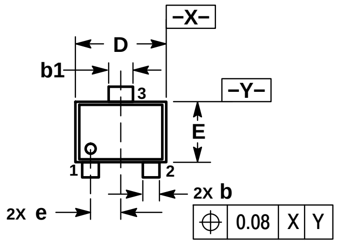
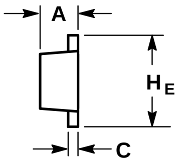
## PACKAGE DIMENSIONS

### SOT−723

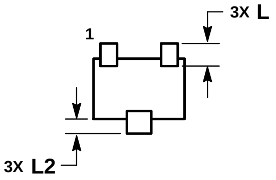
CASE 631AA
ISSUE D



TOP VIEW



SIDE VIEW



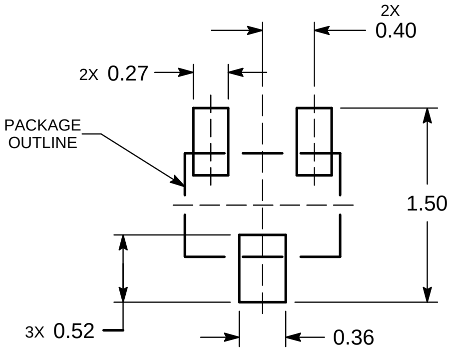
BOTTOM VIEW

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

| | MILLIMETERS | | |
|---|---|---|---|
| **DIM** | **MIN** | **NOM** | **MAX** |
| **A** | 0.45 | 0.50 | 0.55 |
| **b** | 0.15 | 0.21 | 0.27 |
| **b1** | 0.25 | 0.31 | 0.37 |
| **C** | 0.07 | 0.12 | 0.17 |
| **D** | 1.15 | 1.20 | 1.25 |
| **E** | 0.75 | 0.80 | 0.85 |
| **e** | 0.40 BSC | | |
| **$H_E$** | 1.15 | 1.20 | 1.25 |
| **L** | 0.29 REF | | |
| **L2** | 0.15 | 0.20 | 0.25 |

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

### RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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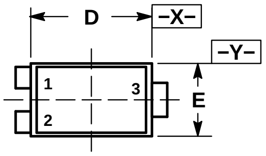
## PACKAGE DIMENSIONS

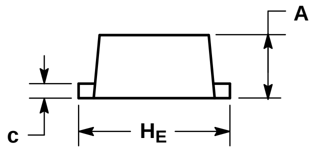
### SOT−1123

CASE 524AA

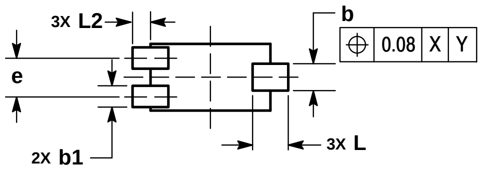
ISSUE C



TOP VIEW



SIDE VIEW



BOTTOM VIEW

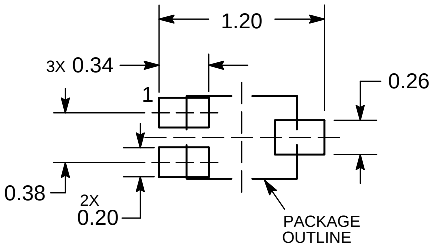
NOTES:

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

| | MILLIMETERS | |
|---|---|---|
| **DIM** | **MIN** | **MAX** |
| **A** | 0.34 | 0.40 |
| **b** | 0.15 | 0.28 |
| **b1** | 0.10 | 0.20 |
| **c** | 0.07 | 0.17 |
| **D** | 0.75 | 0.85 |
| **E** | 0.55 | 0.65 |
| **e** | 0.35 | 0.40 |
| $H_E$ | 0.95 | 1.05 |
| **L** | 0.185 REF | |
| **L2** | 0.05 | 0.15 |

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

### SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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