

# MUN2211T1 Series

Preferred Devices

## 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 SC-59 package which is designed for low power surface mount applications.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Moisture Sensitivity Level: 1
- ESD Rating – Human Body Model: Class 1  
– Machine Model: Class B
- The SC-59 package can be soldered using wave or reflow. The modified gull-winged leads absorb thermal stress during soldering eliminating the possibility of damage to the die.
- Available in 8 mm embossed tape and reel  
Use the Device Number to order the 7 inch/3000 unit reel.
- Pb-Free Packages are Available

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

| 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  | 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  | $^\circ\text{C}$         |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

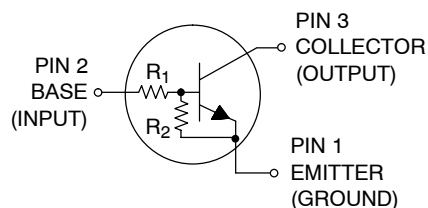
1. FR-4 @ Minimum Pad.
2. FR-4 @ 1.0 x 1.0 inch Pad.



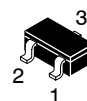
ON Semiconductor®

<http://onsemi.com>

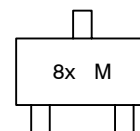
### NPN SILICON BIAS RESISTOR TRANSISTORS



#### MARKING DIAGRAM



SC-59  
CASE 318D  
STYLE 1



8x = Specific Device Code\*  
M = Date Code

#### ORDERING INFORMATION

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

#### DEVICE MARKING INFORMATION

\*See specific marking information in the device marking table on page 2 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

## MUN2211T1 Series

### DEVICE MARKING AND RESISTOR VALUES

| Device              | Package            | Marking | R1 (K) | R2 (K) | Shipping <sup>†</sup> |
|---------------------|--------------------|---------|--------|--------|-----------------------|
| MUN2211T1           | SC-59              | 8A      | 10     | 10     | 3000/Tape & Reel      |
| MUN2211T1G          | SC-59<br>(Pb-Free) | 8A      | 10     | 10     | 3000/Tape & Reel      |
| MUN2212T1           | SC-59              | 8B      | 22     | 22     | 3000/Tape & Reel      |
| MUN2212T1G          | SC-59<br>(Pb-Free) | 8B      | 22     | 22     | 3000/Tape & Reel      |
| MUN2213T1           | SC-59              | 8C      | 47     | 47     | 3000/Tape & Reel      |
| MUN2213T1G          | SC-59<br>(Pb-Free) | 8C      | 47     | 47     | 3000/Tape & Reel      |
| MUN2214T1           | SC-59              | 8D      | 10     | 47     | 3000/Tape & Reel      |
| MUN2214T1G          | SC-59<br>(Pb-Free) | 8D      | 10     | 47     | 3000/Tape & Reel      |
| MUN2215T1 (Note 3)  | SC-59              | 8E      | 10     | ∞      | 3000/Tape & Reel      |
| MUN2215T1G (Note 3) | SC-59<br>(Pb-Free) | 8E      | 10     | ∞      | 3000/Tape & Reel      |
| MUN2216T1 (Note 3)  | SC-59              | 8F      | 4.7    | ∞      | 3000/Tape & Reel      |
| MUN2216T1G (Note 3) | SC-59<br>(Pb-Free) | 8F      | 4.7    | ∞      | 3000/Tape & Reel      |
| MUN2230T1 (Note 3)  | SC-59              | 8G      | 1.0    | 1.0    | 3000/Tape & Reel      |
| MUN2231T1 (Note 3)  | SC-59              | 8H      | 2.2    | 2.2    | 3000/Tape & Reel      |
| MUN2232T1 (Note 3)  | SC-59              | 8J      | 4.7    | 4.7    | 3000/Tape & Reel      |
| MUN2232T1G (Note 3) | SC-59<br>(Pb-Free) | 8J      | 4.7    | 4.7    | 3000/Tape & Reel      |
| MUN2233T1 (Note 3)  | SC-59              | 8K      | 4.7    | 47     | 3000/Tape & Reel      |
| MUN2233T1G (Note 3) | SC-59<br>(Pb-Free) | 8K      | 4.7    | 47     | 3000/Tape & Reel      |
| MUN2234T1 (Note 3)  | SC-59              | 8L      | 22     | 47     | 3000/Tape & Reel      |
| MUN2236T1           | SC-59              | 8N      | 100    | 100    | 3000/Tape & Reel      |
| MUN2237T1           | SC-59              | 8P      | 47     | 22     | 3000/Tape & Reel      |
| MUN2237T1G          | SC-59<br>(Pb-Free) | 8P      | 47     | 22     | 3000/Tape & Reel      |
| MUN2240T1 (Note 3)  | SC-59              | 8T      | 47     | ∞      | 3000/Tape & Reel      |
| MUN2241T1 (Note 3)  | SC-59              | 8U      | 100    | ∞      | 3000/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.

3. New devices. Updated curves to follow in subsequent data sheets.



# MUN2211T1 Series

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

| Characteristic  | Symbol    | Min   | Typ  | Max   | Unit             |
|---|-----------|-------|------|-------|------------------|
| <b>ON CHARACTERISTICS</b> (Note 5) (Continued)  |           |       |      |       |                  |
| Output Voltage (off) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )<br>( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.050\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )<br>( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.25\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) | $V_{OH}$  | 4.9   | –    | –     | Vdc              |
| Input Resistor  | $R_1$     | 7.0   | 10   | 13    | $\text{k}\Omega$ |
| MUN2211T1   |           | 7.0   | 10   | 13    |                  |
| MUN2212T1   |           | 15.4  | 22   | 28.6  |                  |
| MUN2213T1   |           | 32.9  | 47   | 61.1  |                  |
| MUN2214T1   |           | 7.0   | 10   | 13    |                  |
| MUN2215T1   |           | 7.0   | 10   | 13    |                  |
| MUN2216T1   |           | 3.3   | 4.7  | 6.1   |                  |
| MUN2230T1   |           | 0.7   | 1.0  | 1.3   |                  |
| MUN2231T1   |           | 1.5   | 2.2  | 2.9   |                  |
| MUN2232T1   |           | 3.3   | 4.7  | 6.1   |                  |
| MUN2233T1   |           | 3.3   | 4.7  | 6.1   |                  |
| MUN2234T1   |           | 15.4  | 22   | 28.6  |                  |
| MUN2235T1   |           | 70    | 100  | 130   |                  |
| MUN2236T1   |           | 70    | 100  | 130   |                  |
| MUN2237T1   |           | 32.9  | 47   | 61.1  |                  |
| MUN2240T1   |           | 32.9  | 47   | 61.1  |                  |
| MUN2241T1   |           | 70    | 100  | 100   |                  |
| Resistor Ratio  | $R_1/R_2$ | 0.8   | 1.0  | 1.2   |                  |
| MUN2211T1/MUN2212T1/MUN2213T1/<br>MUN2236T1<br>MUN2214T1  |           | 0.17  | 0.21 | 0.25  |                  |
| MUN2215T1/MUN2216T1/MUN2240T1/<br>MUN2241T1   |           | –     | –    | –     |                  |
| MUN2230T1/MUN2231T1/MUN2232T1<br>MUN2233T1  |           | 0.8   | 1.0  | 1.2   |                  |
| MUN2234T1   |           | 0.055 | 0.1  | 0.185 |                  |
| MUN2237T1   |           | 0.38  | 0.47 | 0.56  |                  |
| MUN2237T1   |           | 1.7   | 2.1  | 2.6   |                  |

5. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%.

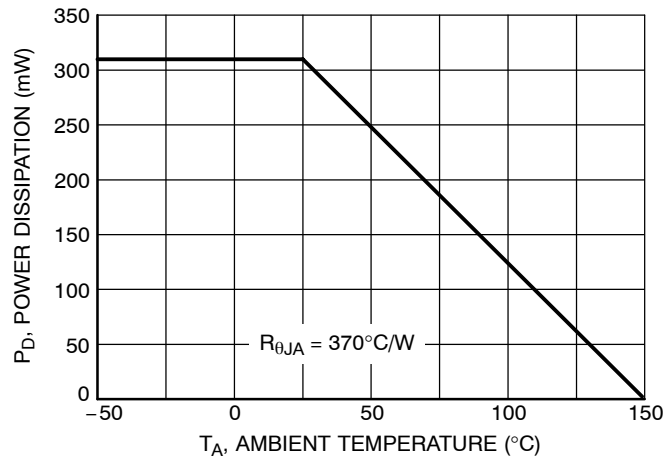


Figure 1. Derating Curve

# MUN2211T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN2211T1

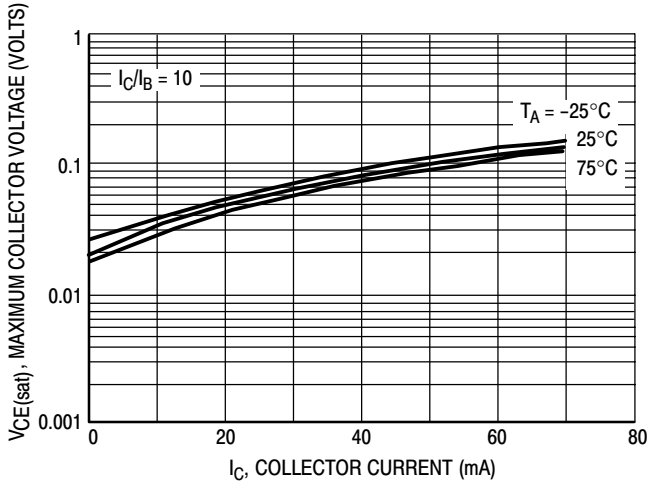


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

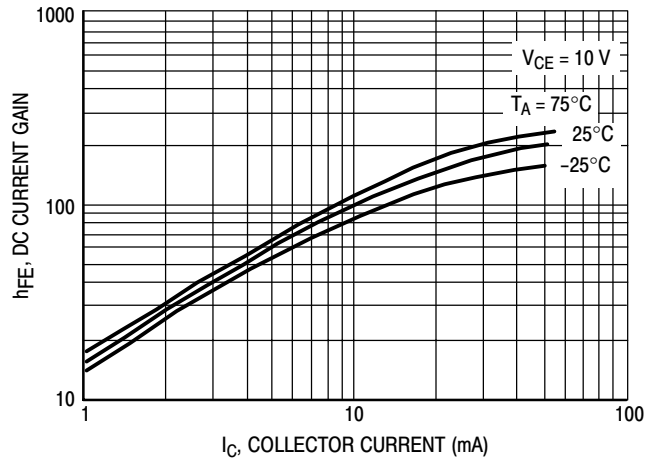


Figure 3. DC Current Gain

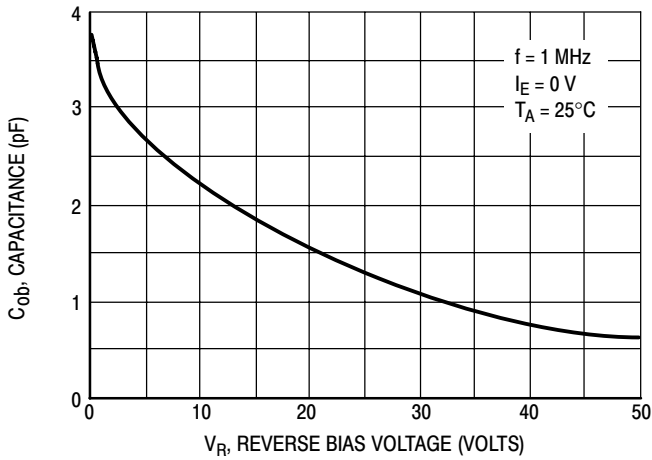


Figure 4. Output Capacitance

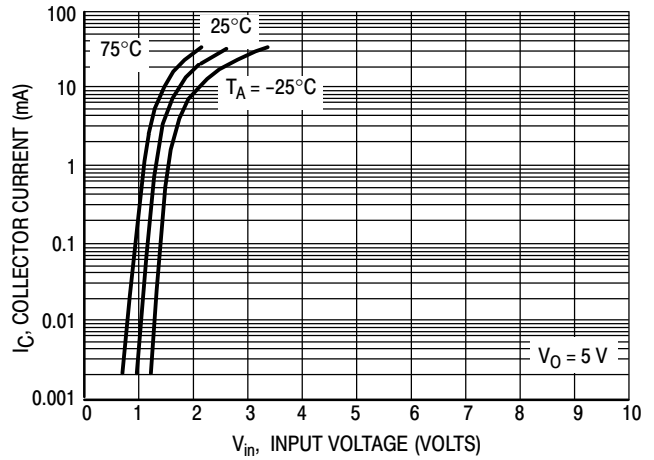


Figure 5. Output Current versus Input Voltage

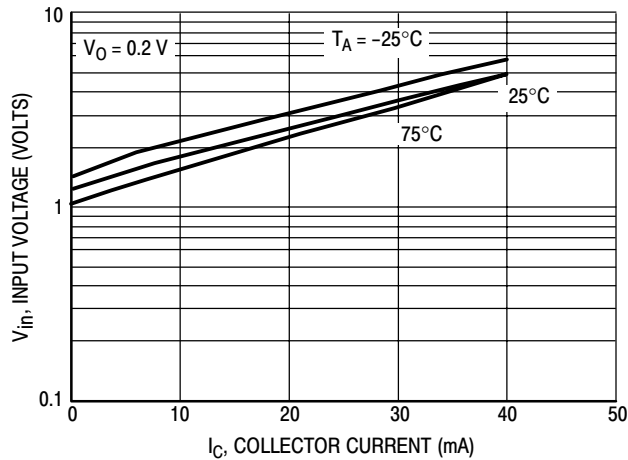


Figure 6. Input Voltage versus Output Current

# MUN2211T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN2212T1

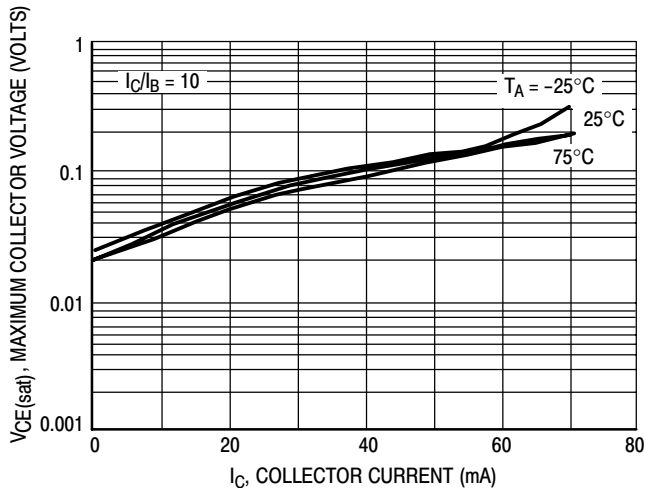


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

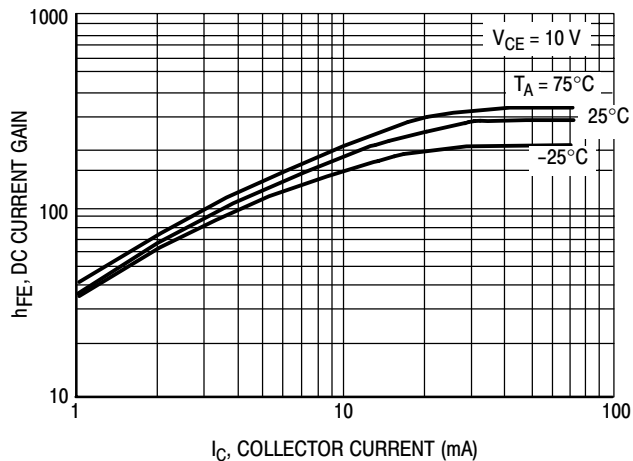


Figure 8. DC Current Gain

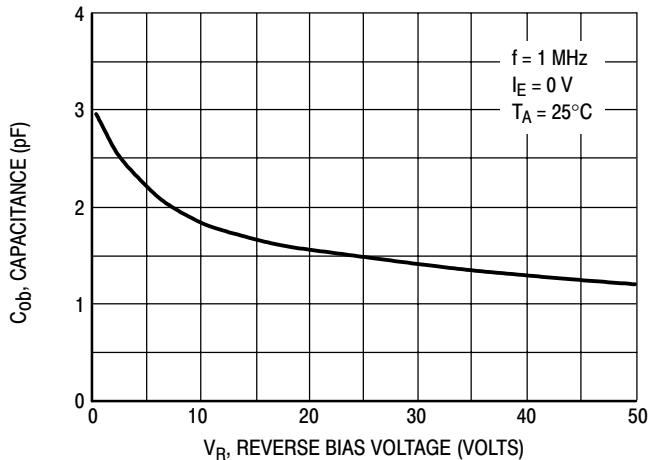


Figure 9. Output Capacitance

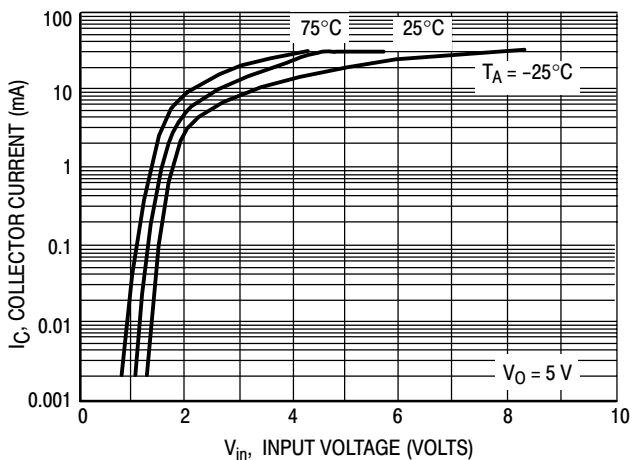


Figure 10. Output Current versus Input Voltage

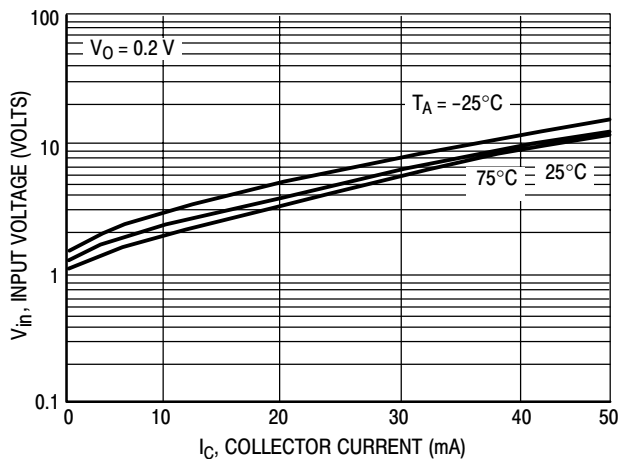


Figure 11. Input Voltage versus Output Current

# MUN2211T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN2213T1

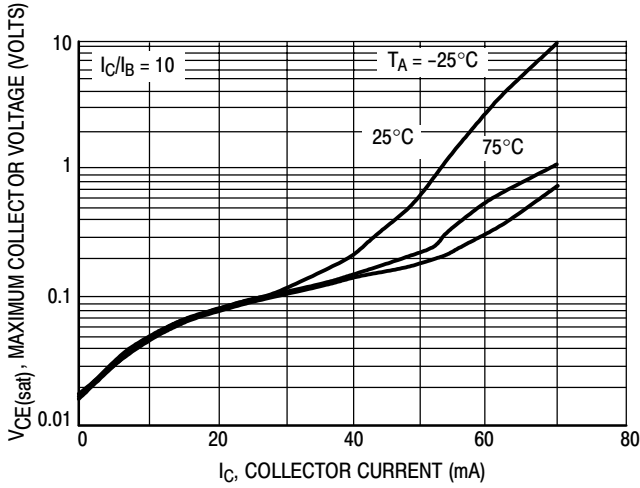


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

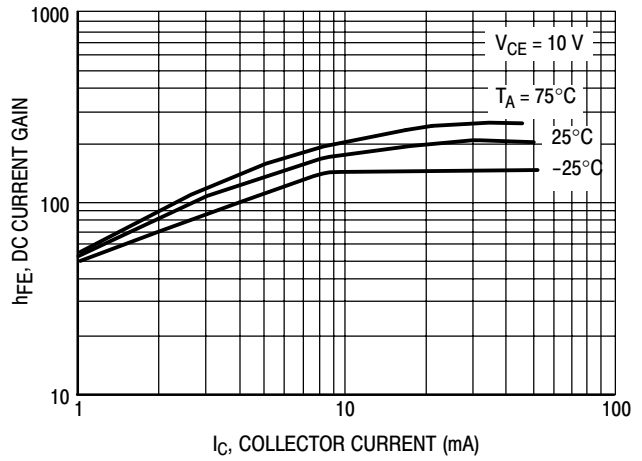


Figure 13. DC Current Gain

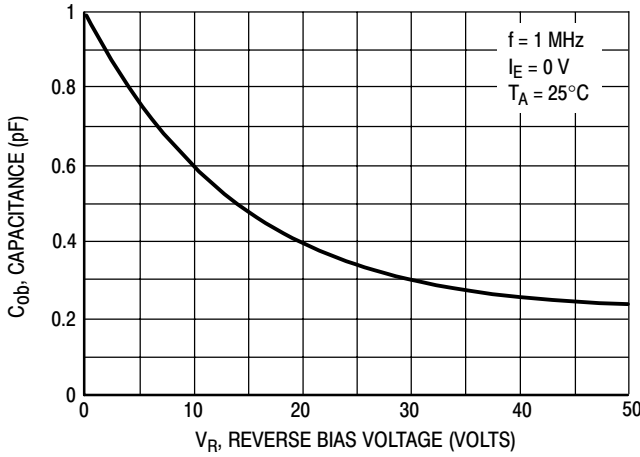


Figure 14. Output Capacitance

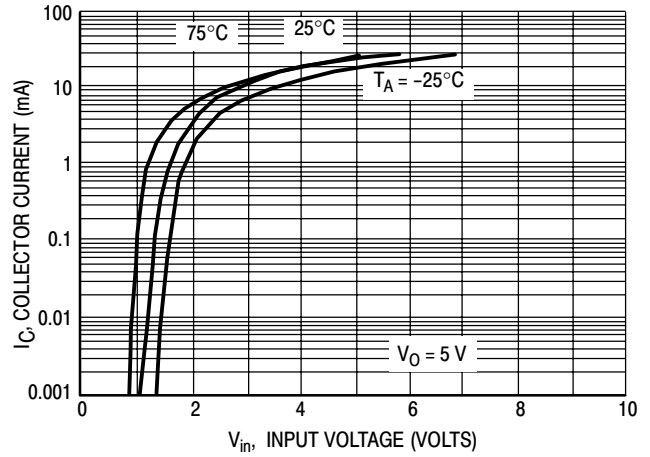


Figure 15. Output Current versus Input Voltage

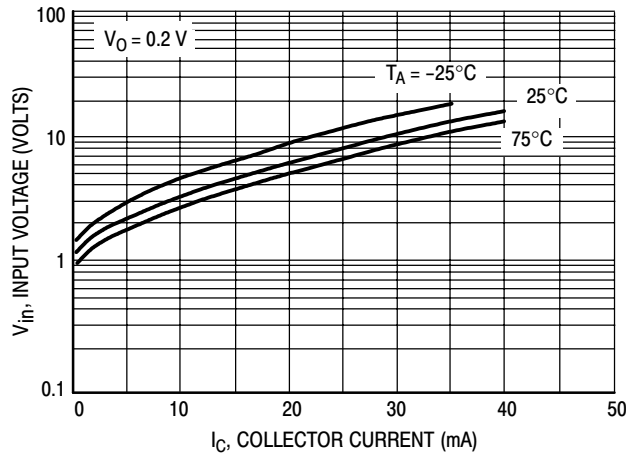


Figure 16. Input Voltage versus Output Current

# MUN2211T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN2214T1

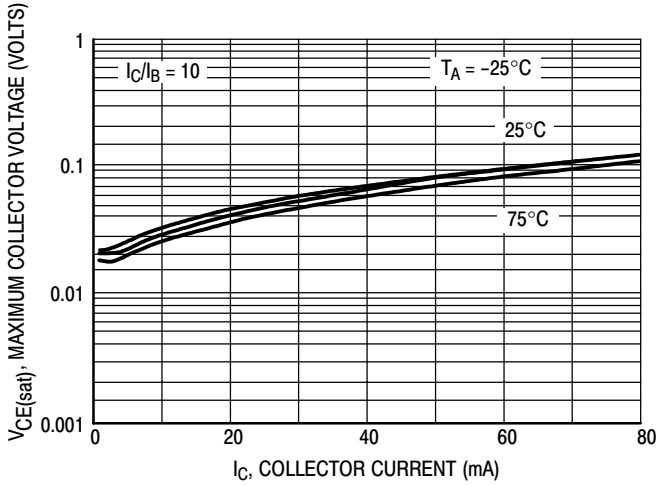


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

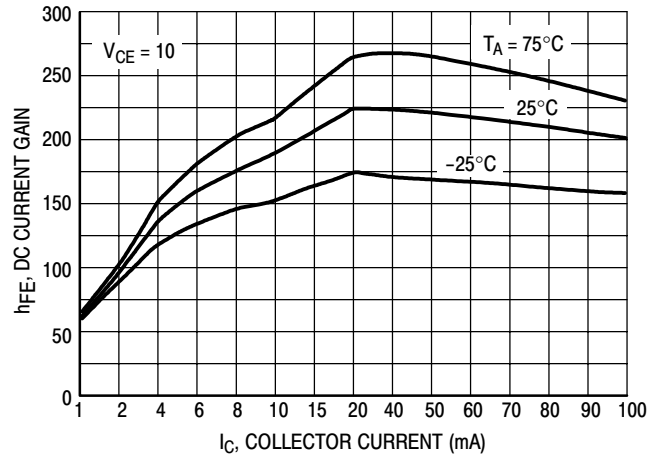


Figure 18. DC Current Gain

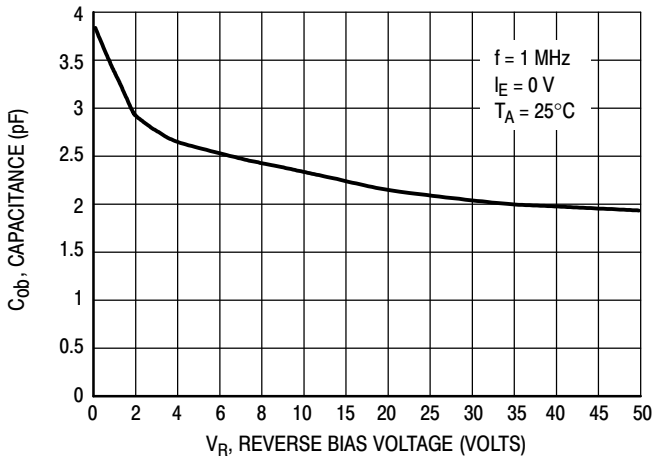


Figure 19. Output Capacitance

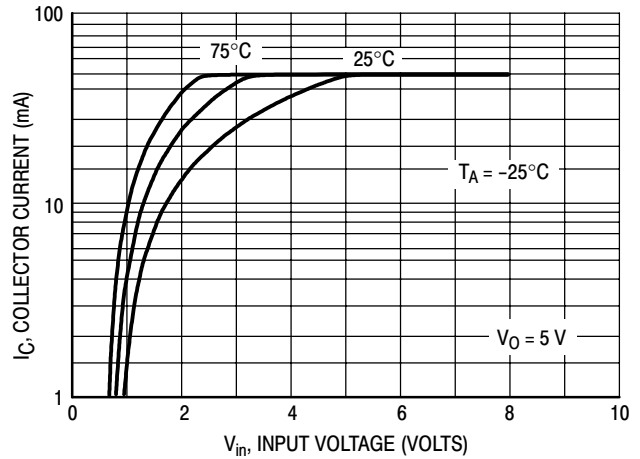


Figure 20. Output Current versus Input Voltage

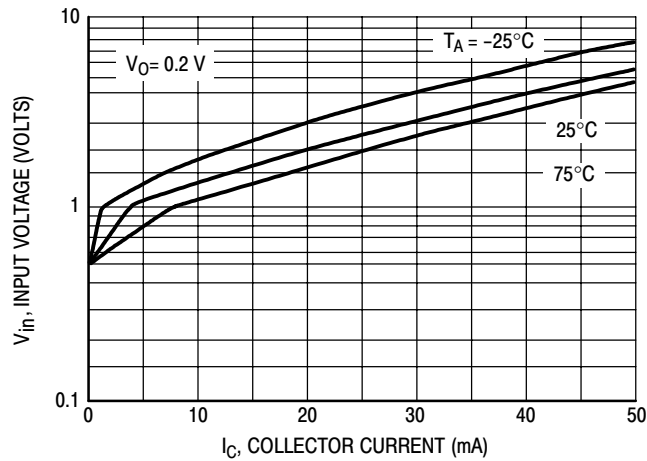


Figure 21. Input Voltage versus Output Current



# MUN2211T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN2236T1

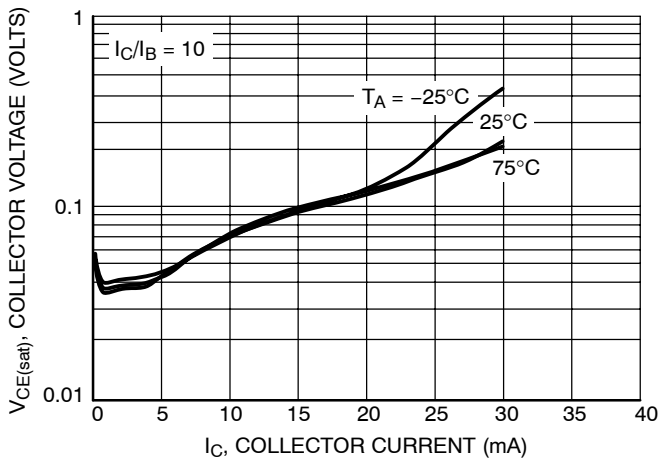


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

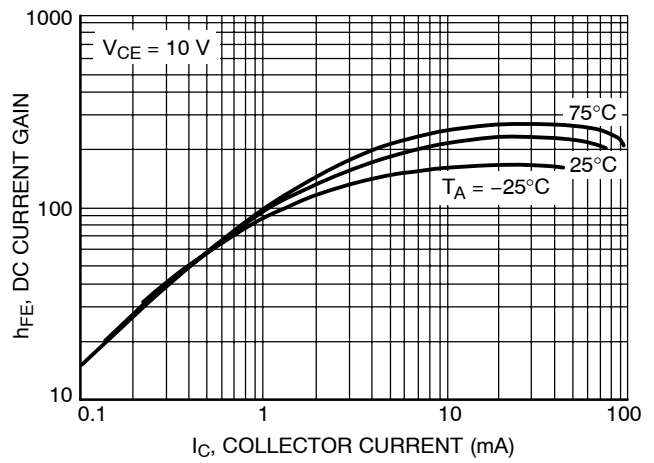


Figure 23. DC Current Gain

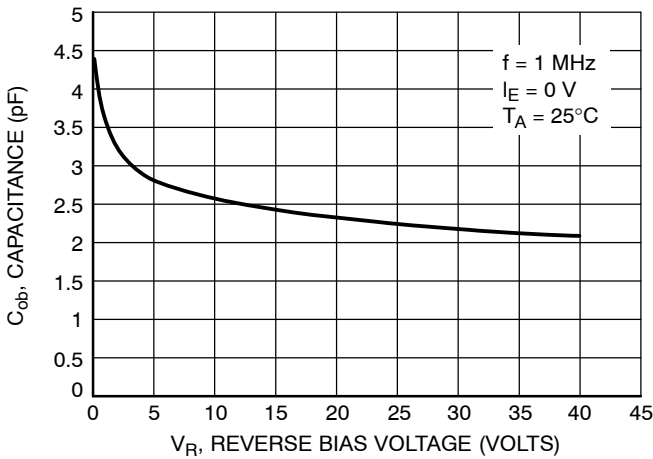


Figure 24. Output Capacitance

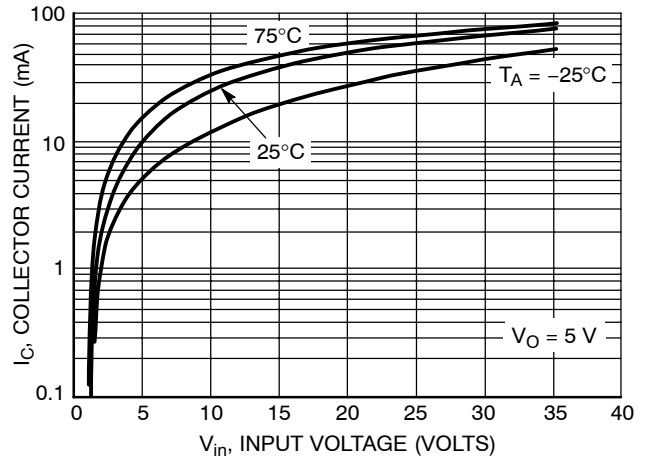


Figure 25. Output Current versus Input Voltage

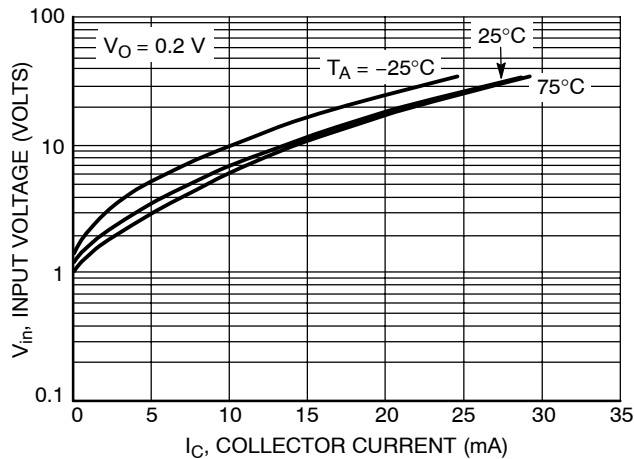


Figure 26. Input Voltage versus Output Current

# MUN2211T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN2237T1

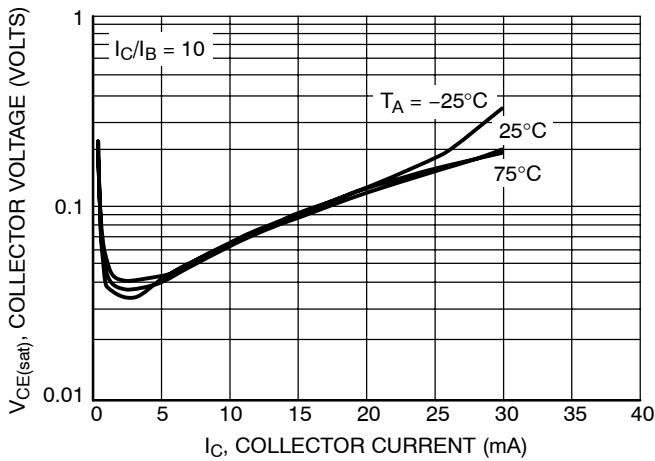


Figure 27.  $V_{CE(sat)}$  versus  $I_C$

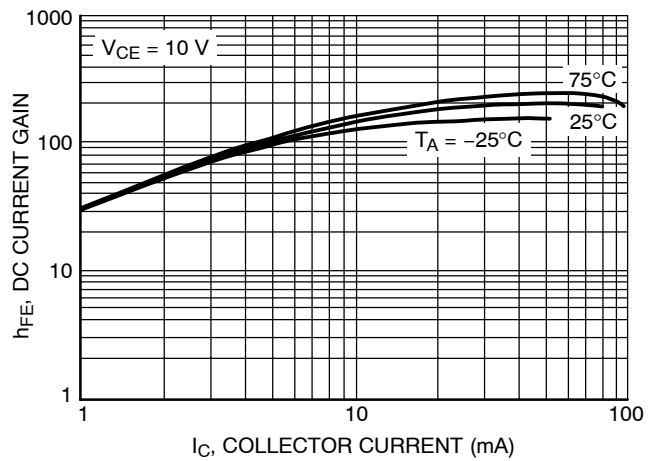


Figure 28. DC Current Gain

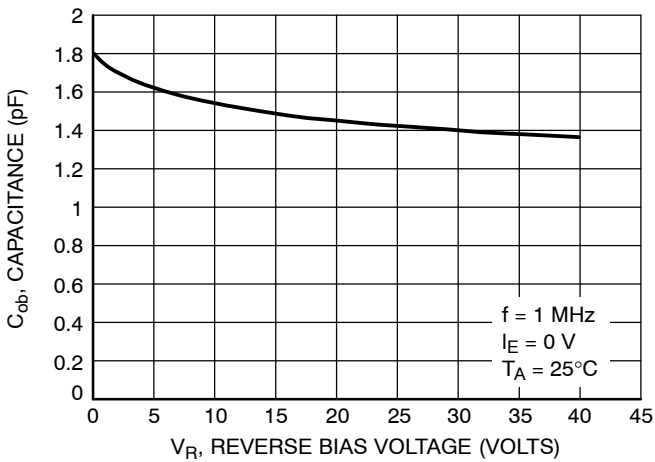


Figure 29. Output Capacitance

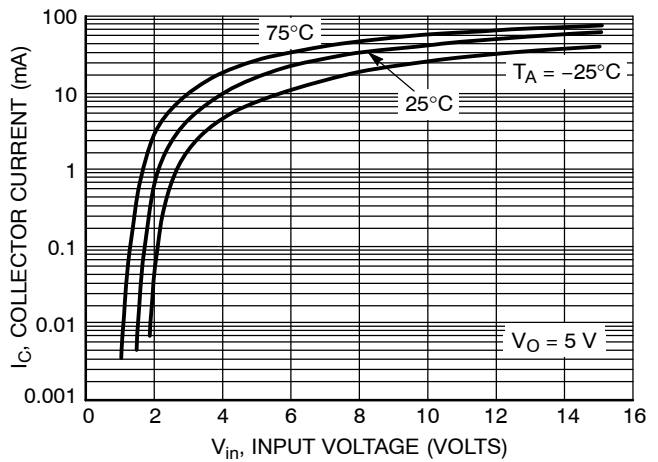


Figure 30. Output Current versus Input Voltage

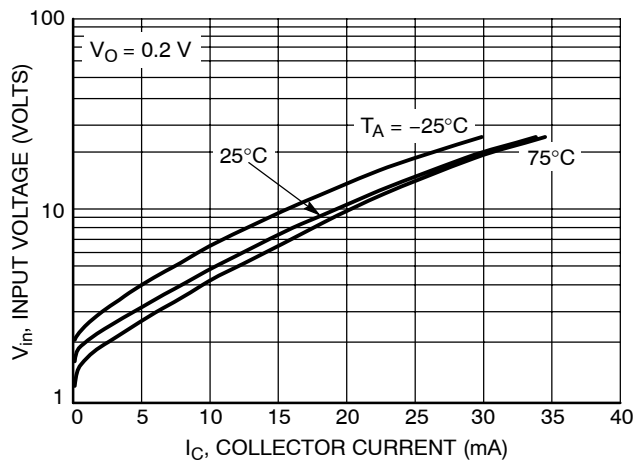


Figure 31. Input Voltage versus Output Current

# MUN2211T1 Series

## TYPICAL APPLICATIONS FOR NPN BRTs

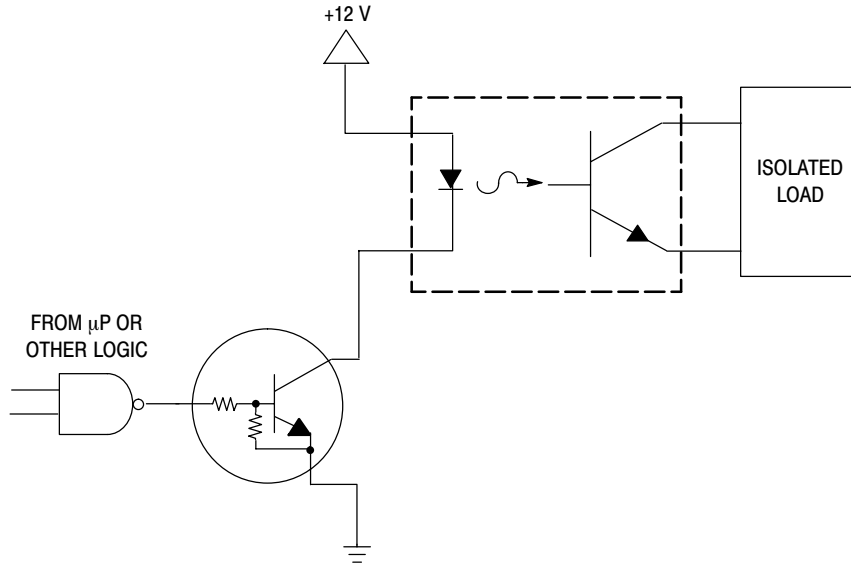


Figure 32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

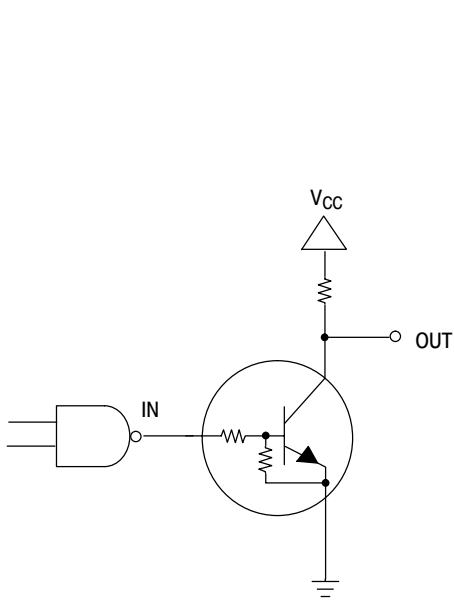


Figure 33. Open Collector Inverter: Inverts the Input Signal

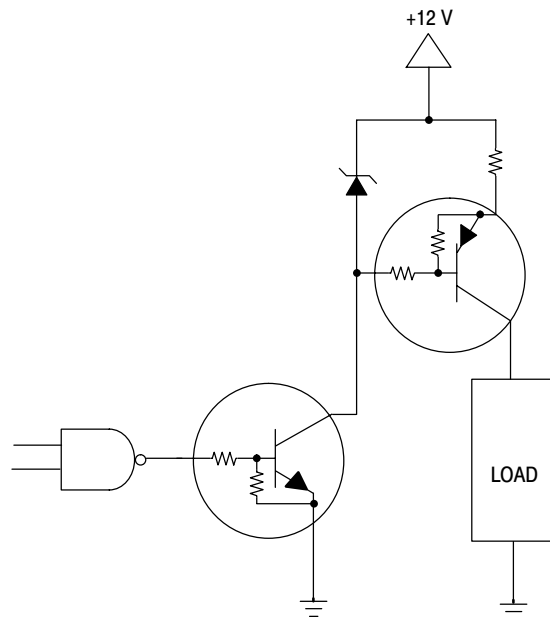
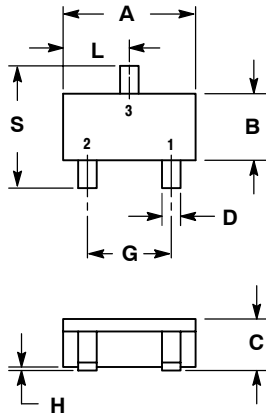


Figure 34. Inexpensive, Unregulated Current Source

# MUN2211T1 Series

## PACKAGE DIMENSIONS

SC-59  
CASE 318D-04  
ISSUE F

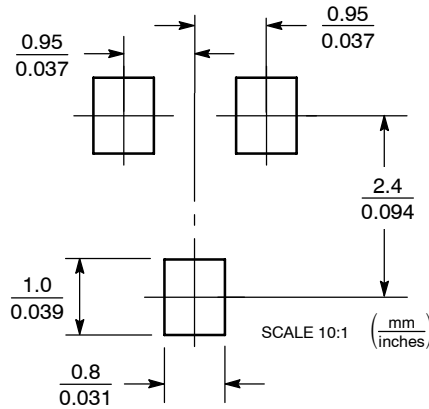


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: MILLIMETER.


| DIM | MILLIMETERS |       | INCHES |        |
|-----|-------------|-------|--------|--------|
|     | MIN         | MAX   | MIN    | MAX    |
| A   | 2.70        | 3.10  | 0.1063 | 0.1220 |
| B   | 1.30        | 1.70  | 0.0512 | 0.0669 |
| C   | 1.00        | 1.30  | 0.0394 | 0.0511 |
| D   | 0.35        | 0.50  | 0.0138 | 0.0196 |
| G   | 1.70        | 2.10  | 0.0670 | 0.0826 |
| H   | 0.013       | 0.100 | 0.0005 | 0.0040 |
| J   | 0.09        | 0.18  | 0.0034 | 0.0070 |
| K   | 0.20        | 0.60  | 0.0079 | 0.0236 |
| L   | 1.25        | 1.65  | 0.0493 | 0.0649 |
| S   | 2.50        | 3.00  | 0.0985 | 0.1181 |

- STYLE 1:  
PIN 1. EMITTER  
2. BASE  
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.

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.

Copyright © Each Manufacturing Company.

All Datasheets cannot be modified without permission.

This datasheet has been download from :

[www.AllDataSheet.com](http://www.AllDataSheet.com)

100% Free DataSheet Search Site.

Free Download.

No Register.

Fast Search System.

[www.AllDataSheet.com](http://www.AllDataSheet.com)