

# MUN5111T1 Series

## Bias Resistor Transistors

### PNP Silicon Surface Mount Transistor 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 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. The device is housed in the SC-70/SOT-323 package which is designed for low power surface mount applications.

#### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SC-70/SOT-323 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. Replace “T1” with “T3” in the Device Number to order the 13 inch/10,000 unit reel.
- 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    | $V_{CBO}$ | 50    | Vdc  |
| Collector-Emitter Voltage | $V_{CEO}$ | 50    | Vdc  |
| Collector Current         | $I_C$     | 100   | mAdc |

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.

#### THERMAL CHARACTERISTICS

| Characteristic  | Symbol          | Max  | Unit                                |
|---|-----------------|--|-------------------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 202 (Note 1)<br>310 (Note 2)<br>1.6 (Note 1)<br>2.5 (Note 2) | mW<br><br>$^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient   | $R_{\theta JA}$ | 618 (Note 1)<br>403 (Note 2)                                 | $^\circ\text{C}/\text{W}$           |
| Thermal Resistance, Junction-to-Lead  | $R_{\theta JL}$ | 280 (Note 1)<br>332 (Note 2)                                 | $^\circ\text{C}/\text{W}$           |
| Junction and Storage Temperature Range  | $T_J, T_{stg}$  | -55 to +150  | $^\circ\text{C}$                    |

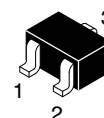
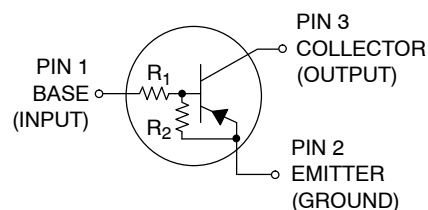
1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 x 1.0 inch Pad



ON Semiconductor®

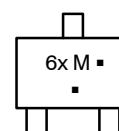
<http://onsemi.com>

### PNP SILICON BIAS RESISTOR TRANSISTORS



SC-70/SOT-323  
CASE 419  
STYLE 3

#### MARKING DIAGRAM



- 6x = 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 specific ordering and shipping information in the package dimensions section on page 2 of this data sheet.

## MUN511T1 Series

### ORDERING INFORMATION AND RESISTOR VALUES

| Device              | Package                    | Marking | R1 (K) | R2 (K) | Shipping <sup>†</sup> |
|---------------------|----------------------------|---------|--------|--------|-----------------------|
| MUN5111T1G          | SC-70/SOT-323<br>(Pb-Free) | 6A      | 10     | 10     | 3000/Tape & Reel      |
| MUN5112T1G          | SC-70/SOT-323<br>(Pb-Free) | 6B      | 22     | 22     | 3000/Tape & Reel      |
| MUN5113T1G          | SC-70/SOT-323<br>(Pb-Free) | 6C      | 47     | 47     | 3000/Tape & Reel      |
| MUN5113T3G          | SC-70/SOT-323<br>(Pb-Free) | 6C      | 47     | 47     | 10,000/Tape & Reel    |
| MUN5113T1G          | SC-70/SOT-323<br>(Pb-Free) | 6C      | 47     | 47     | 3000/Tape & Reel      |
| MUN5114T1G          | SC-70/SOT-323<br>(Pb-Free) | 6D      | 10     | 47     | 3000/Tape & Reel      |
| MUN5115T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6E      | 10     | ∞      | 3000/Tape & Reel      |
| MUN5116T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6F      | 4.7    | ∞      | 3000/Tape & Reel      |
| MUN5130T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6G      | 1.0    | 1.0    | 3000/Tape & Reel      |
| MUN5131T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6H      | 2.2    | 2.2    | 3000/Tape & Reel      |
| MUN5132T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6J      | 4.7    | 4.7    | 3000/Tape & Reel      |
| MUN5133T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6K      | 4.7    | 47     | 3000/Tape & Reel      |
| MUN5134T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6L      | 22     | 47     | 3000/Tape & Reel      |
| MUN5135T1G (Note 3) | SC-70/SOT-323<br>(Pb-Free) | 6M      | 2.2    | 47     | 3000/Tape & Reel      |
| MUN5136T1G          | SC-70/SOT-323<br>(Pb-Free) | 6N      | 100    | 100    | 3000/Tape & Reel      |
| MUN5137T1G          | SC-70/SOT-323<br>(Pb-Free) | 6P      | 47     | 22     | 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.

# MUN511T1 Series

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

| Characteristic   | Symbol               | Min | Typ | Max  | Unit |
|--|----------------------|-----|-----|------|------|
| <b>OFF CHARACTERISTICS</b>   |                      |     |     |      |      |
| Collector-Base Cutoff Current<br>(V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)  | I <sub>CBO</sub>     | -   | -   | 100  | nAdc |
| Collector-Emitter Cutoff Current<br>(V <sub>CE</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>     | -   | -   | 0.5  | mAdc |
|  | MUN511T1             | -   | -   | 0.2  |      |
|  | MUN5112T1            | -   | -   | 0.1  |      |
|  | MUN5113T1            | -   | -   | 0.2  |      |
|  | MUN5114T1            | -   | -   | 0.9  |      |
|  | MUN5115T1            | -   | -   | 1.9  |      |
|  | MUN5116T1            | -   | -   | 4.3  |      |
|  | MUN5130T1            | -   | -   | 2.3  |      |
|  | MUN5131T1            | -   | -   | 1.5  |      |
|  | MUN5132T1            | -   | -   | 0.18 |      |
|  | MUN5133T1            | -   | -   | 0.13 |      |
|  | MUN5134T1            | -   | -   | 0.2  |      |
|  | MUN5135T1            | -   | -   | 0.05 |      |
|  | MUN5136T1            | -   | -   | 0.13 |      |
|  | MUN5137T1            | -   | -   |      |      |
| Collector-Base Breakdown Voltage<br>(I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)   | V <sub>(BR)CBO</sub> | 50  | -   | -    | Vdc  |
| Collector-Emitter Breakdown Voltage (Note 4)<br>(I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)  | V <sub>(BR)CEO</sub> | 50  | -   | -    | Vdc  |
| <b>ON CHARACTERISTICS (Note 4)</b>   |                      |     |     |      |      |
| DC Current Gain<br>(V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)   | h <sub>FE</sub>      | 35  | 60  | -    |      |
|  | MUN511T1             | 60  | 100 | -    |      |
|  | MUN5112T1            | 80  | 140 | -    |      |
|  | MUN5113T1            | 80  | 140 | -    |      |
|  | MUN5114T1            | 160 | 250 | -    |      |
|  | MUN5115T1            | 160 | 250 | -    |      |
|  | MUN5116T1            | 3.0 | 5.0 | -    |      |
|  | MUN5130T1            | 8.0 | 15  | -    |      |
|  | MUN5131T1            | 15  | 27  | -    |      |
|  | MUN5132T1            | 80  | 140 | -    |      |
|  | MUN5133T1            | 80  | 130 | -    |      |
|  | MUN5134T1            | 80  | 140 | -    |      |
|  | MUN5135T1            | 80  | 150 | -    |      |
|  | MUN5136T1            | 80  | 140 | -    |      |
|  | MUN5137T1            | 80  | 140 | -    |      |
| Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>E</sub> = 0.3 mA)<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 5 mA) MUN5130T1/MUN5131T1<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1 mA) MUN5115T1/MUN5116T1/<br>MUN5132T1/MUN5133T1/MUN5134T1 | V <sub>CE(sat)</sub> | -   | -   | 0.25 | Vdc  |
| Output Voltage (on)<br>(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  |
|  | MUN511T1             | -   | -   | 0.2  |      |
|  | MUN5112T1            | -   | -   | 0.2  |      |
|  | MUN5114T1            | -   | -   | 0.2  |      |
|  | MUN5115T1            | -   | -   | 0.2  |      |
|  | MUN5116T1            | -   | -   | 0.2  |      |
|  | MUN5130T1            | -   | -   | 0.2  |      |
|  | MUN5131T1            | -   | -   | 0.2  |      |
|  | MUN5132T1            | -   | -   | 0.2  |      |
|  | MUN5133T1            | -   | -   | 0.2  |      |
|  | MUN5134T1            | -   | -   | 0.2  |      |
|  | MUN5135T1            | -   | -   | 0.2  |      |
| (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ)   | MUN5113T1            | -   | -   | 0.2  |      |
| (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 5.5 V, R <sub>L</sub> = 1.0 kΩ)   | MUN5136T1            | -   | -   | 0.2  |      |
| (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 4.0 V, R <sub>L</sub> = 1.0 kΩ)   | MUN5137T1            | -   | -   | 0.2  |      |

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

# MUN511T1 Series

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

| Characteristic  | Symbol    | Min   | Typ   | Max   | Unit       |
|---|-----------|-------|-------|-------|------------|
| 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  | R1        |       |       |       | k $\Omega$ |
| MUN5111T1   |           | 7.0   | 10    | 13    |            |
| MUN5112T1   |           | 15.4  | 22    | 28.6  |            |
| MUN5113T1   |           | 32.9  | 47    | 61.1  |            |
| MUN5114T1   |           | 7.0   | 10    | 13    |            |
| MUN5115T1   |           | 7.0   | 10    | 13    |            |
| MUN5116T1   |           | 3.3   | 4.7   | 6.1   |            |
| MUN5130T1   |           | 0.7   | 1.0   | 1.3   |            |
| MUN5131T1   |           | 1.5   | 2.2   | 2.9   |            |
| MUN5132T1   |           | 3.3   | 4.7   | 6.1   |            |
| MUN5133T1   |           | 3.3   | 4.7   | 6.1   |            |
| MUN5134T1   |           | 15.4  | 22    | 28.6  |            |
| MUN5135T1   |           | 1.54  | 2.2   | 2.86  |            |
| MUN5136T1   |           | 70    | 100   | 130   |            |
| MUN5137T1   |           | 32.9  | 47    | 61.1  |            |
| Resistor Ratio  | $R_1/R_2$ |       |       |       |            |
| MUN5111T1/MUN5112T1/MUN5113T1/MUN5136T1   |           | 0.8   | 1.0   | 1.2   |            |
| MUN5114T1   |           | 0.17  | 0.21  | 0.25  |            |
| MUN5115T1/MUN5116T1   |           | -     | -     | -     |            |
| MUN5130T1/MUN5131T1/MUN5132T1   |           | 0.8   | 1.0   | 1.2   |            |
| MUN5133T1   |           | 0.055 | 0.1   | 0.185 |            |
| MUN5134T1   |           | 0.38  | 0.47  | 0.56  |            |
| MUN5135T1   |           | 0.038 | 0.047 | 0.056 |            |
| MUN5137T1   |           | 1.7   | 2.1   | 2.6   |            |

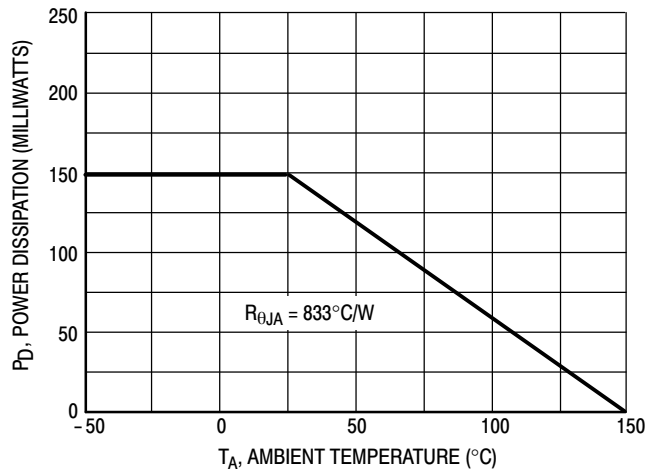


Figure 1. Derating Curve

# MUN511T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN511T1

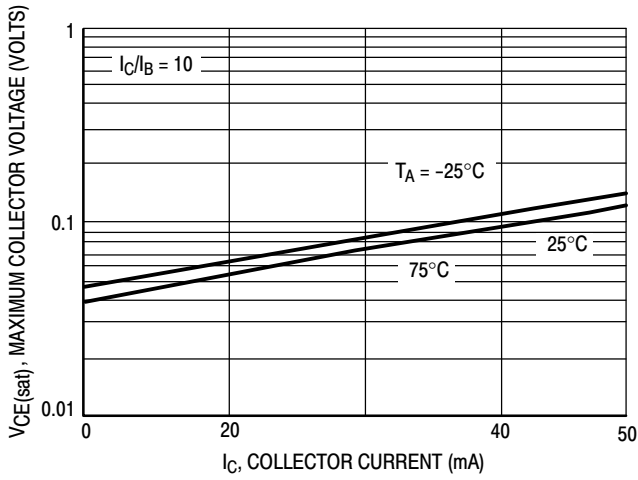


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

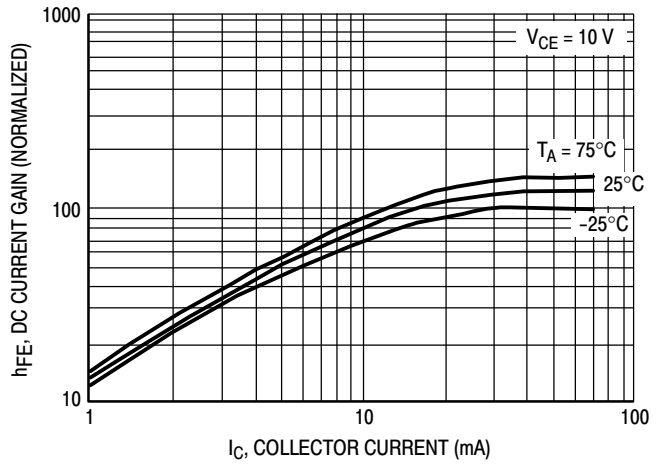


Figure 3. DC Current Gain

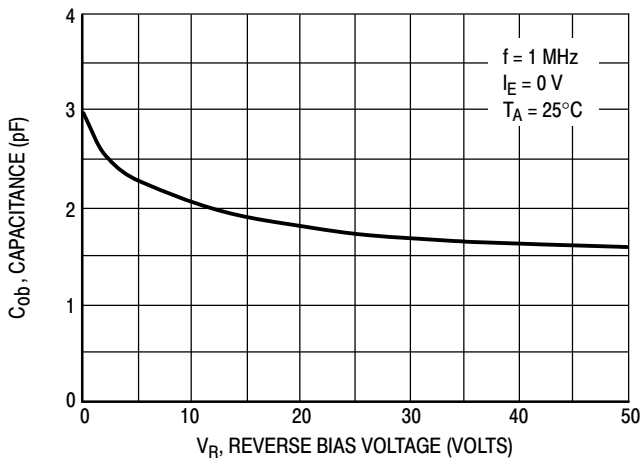


Figure 4. Output Capacitance

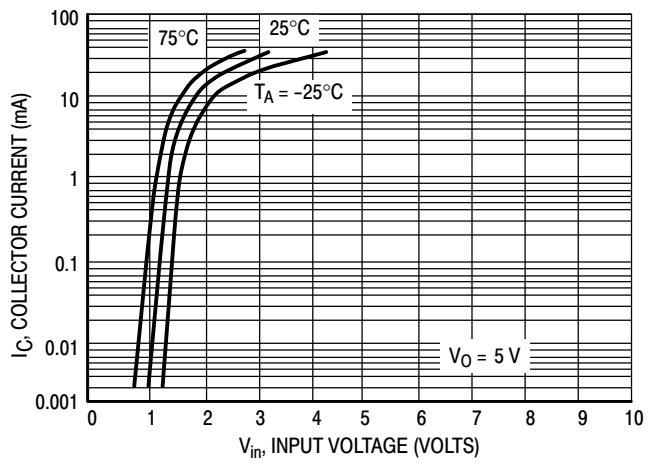


Figure 5. Output Current versus Input Voltage

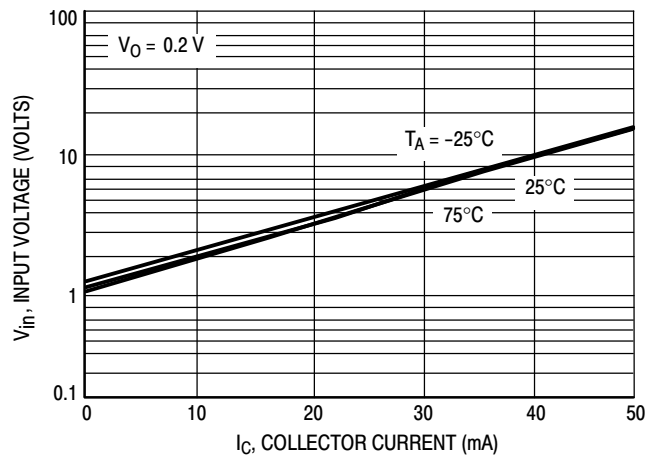


Figure 6. Input Voltage versus Output Current

# MUN511T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN5112T1

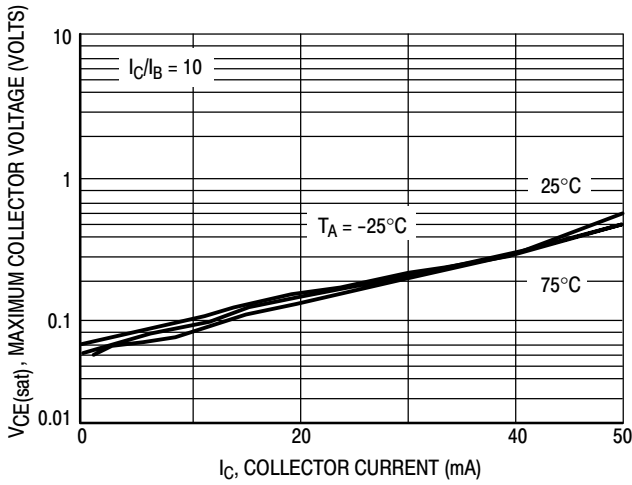


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

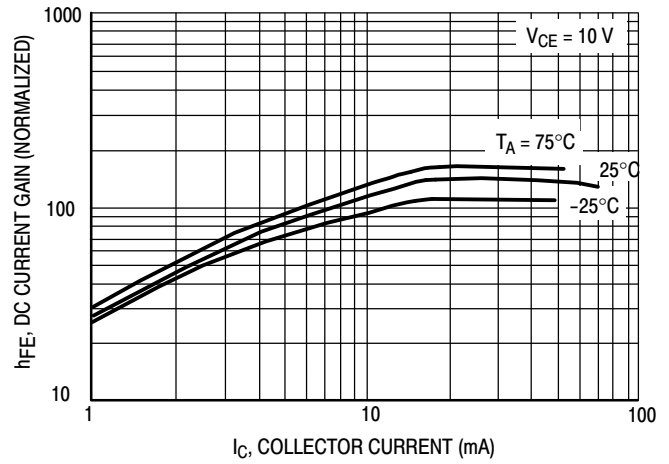


Figure 8. DC Current Gain

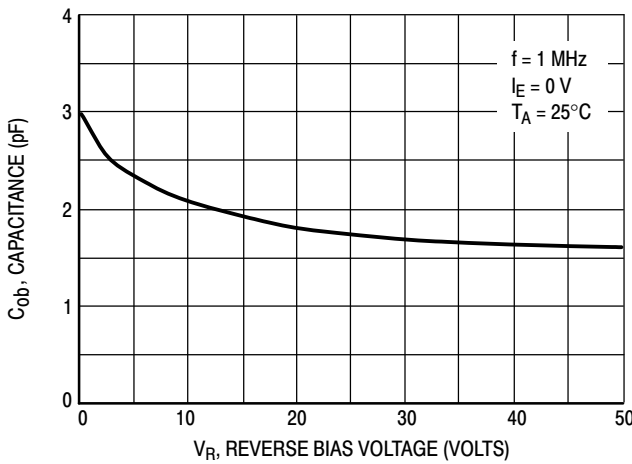


Figure 9. Output Capacitance

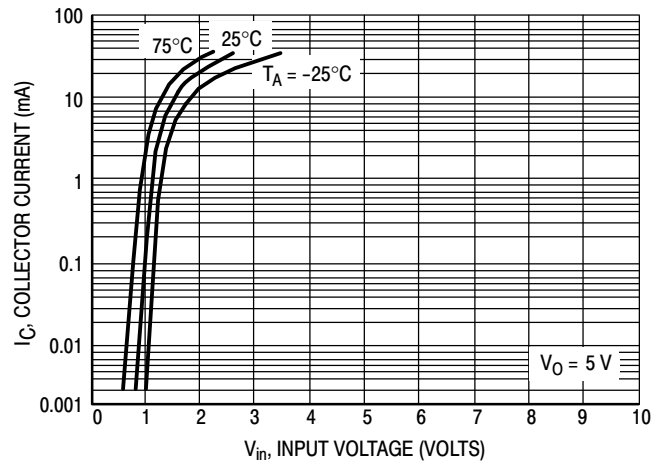


Figure 10. Output Current versus Input Voltage

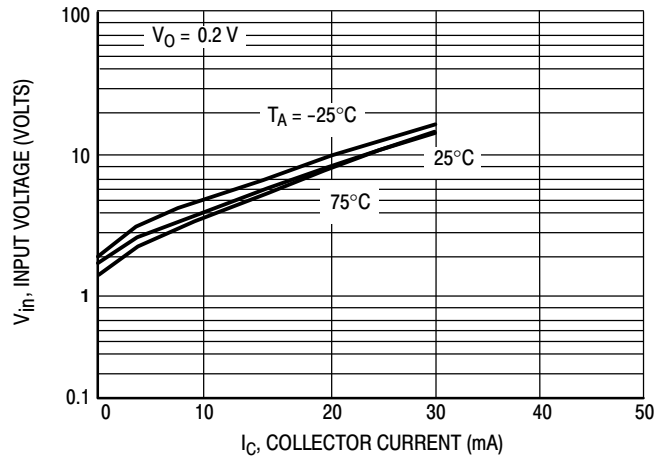


Figure 11. Input Voltage versus Output Current

# MUN511T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN5113T1

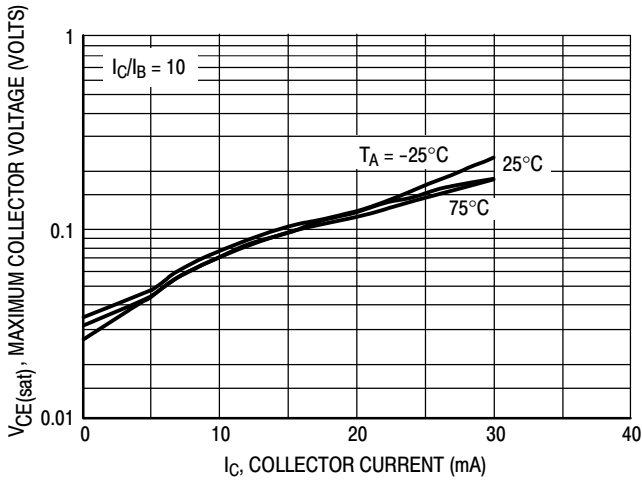


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

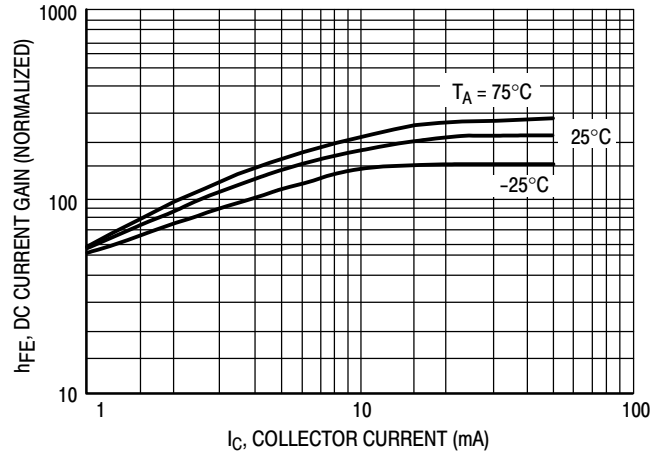


Figure 13. DC Current Gain

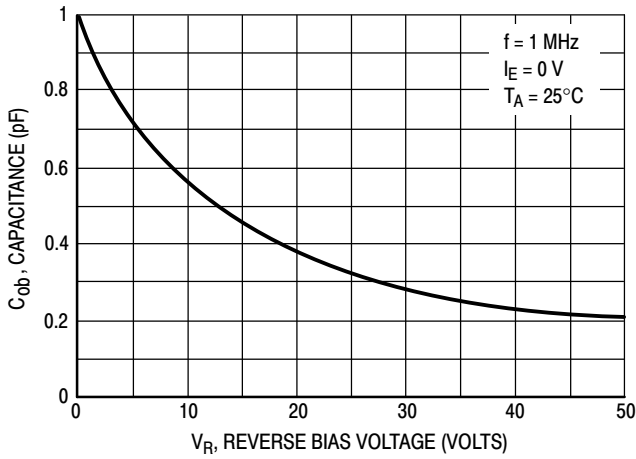


Figure 14. Output Capacitance

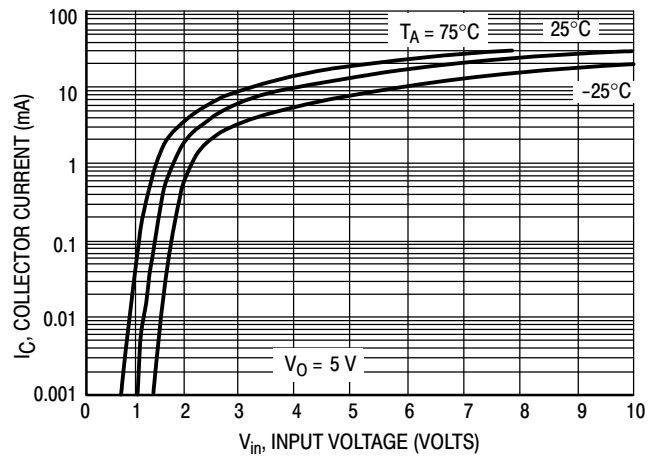


Figure 15. Output Current versus Input Voltage

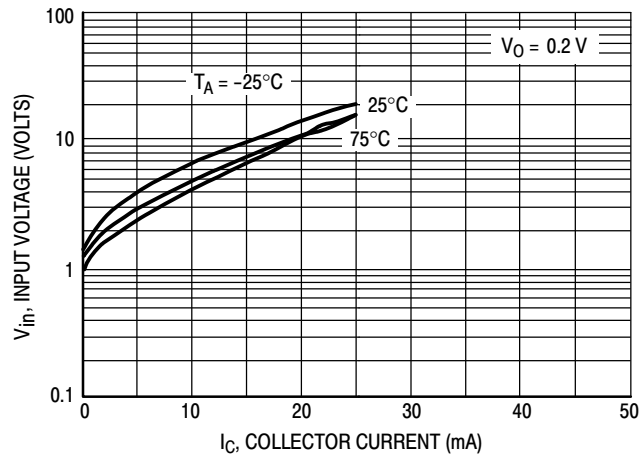


Figure 16. Input Voltage versus Output Current

# MUN511T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – MUN5114T1

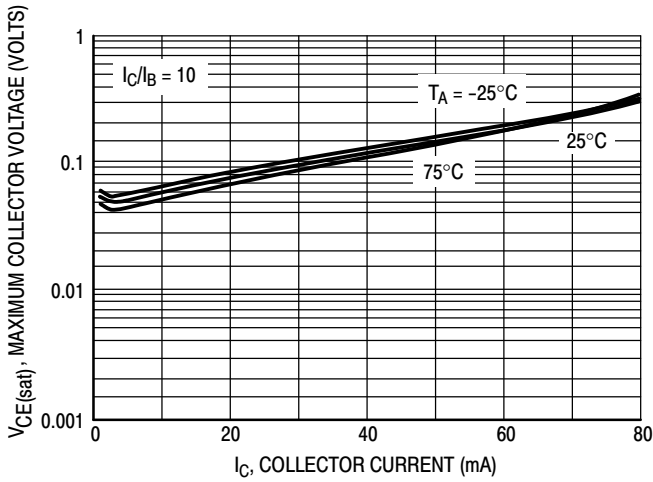


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

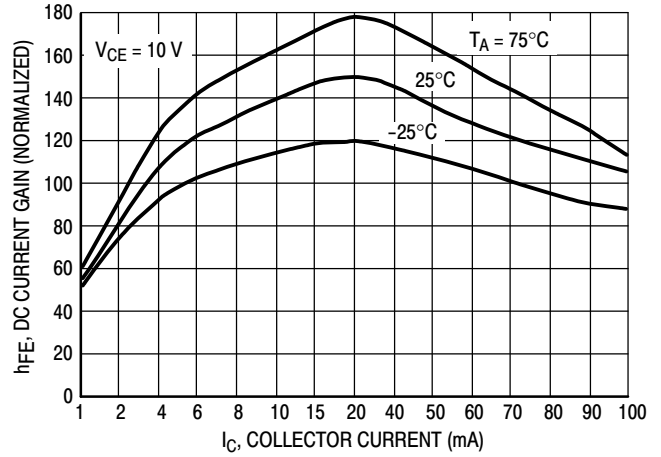


Figure 18. DC Current Gain

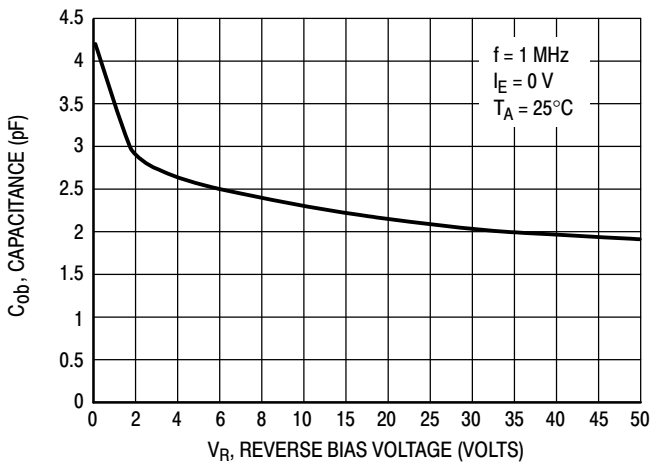


Figure 19. Output Capacitance

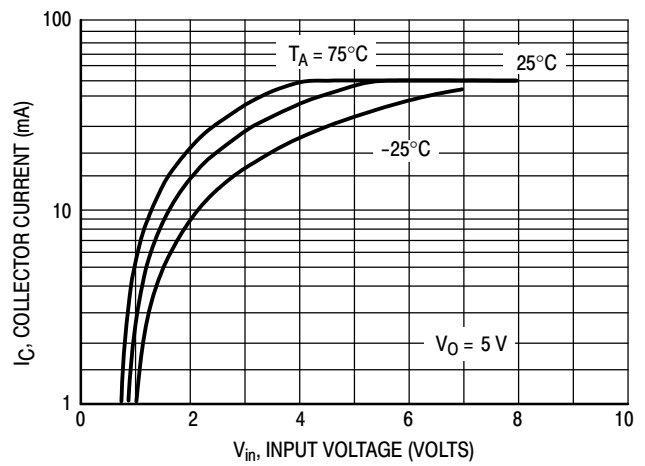


Figure 20. Output Current versus Input Voltage

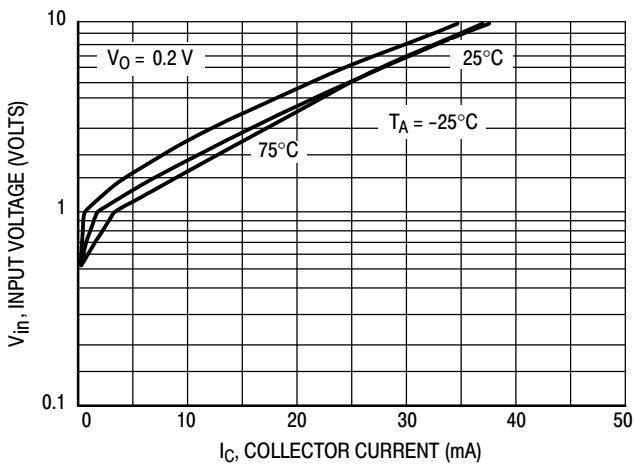


Figure 21. Input Voltage versus Output Current

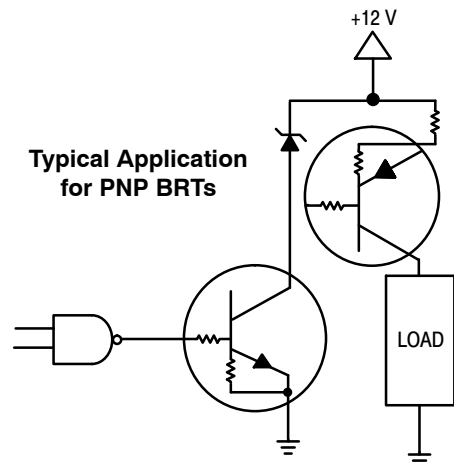


Figure 22. Inexpensive, Unregulated Current Source



# MUN5111T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5132T1

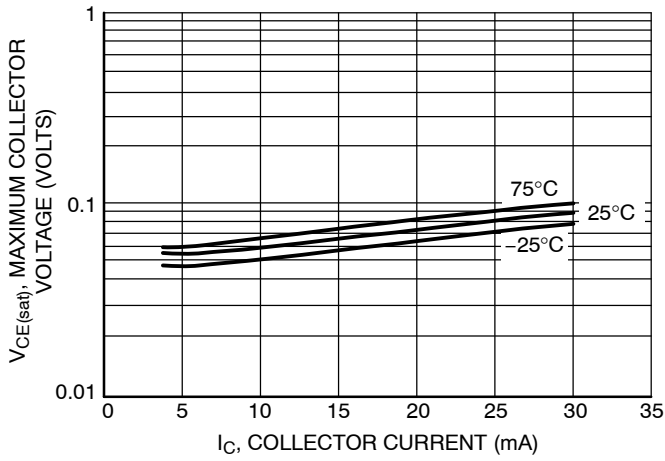


Figure 23. Maximum Collector Voltage versus Collector Current

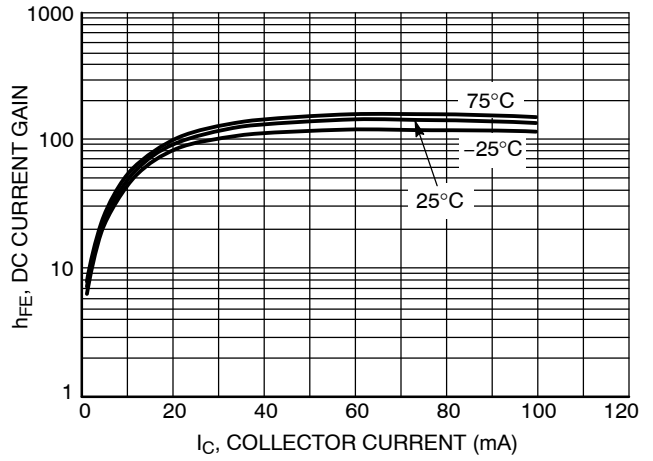


Figure 24. DC Current Gain

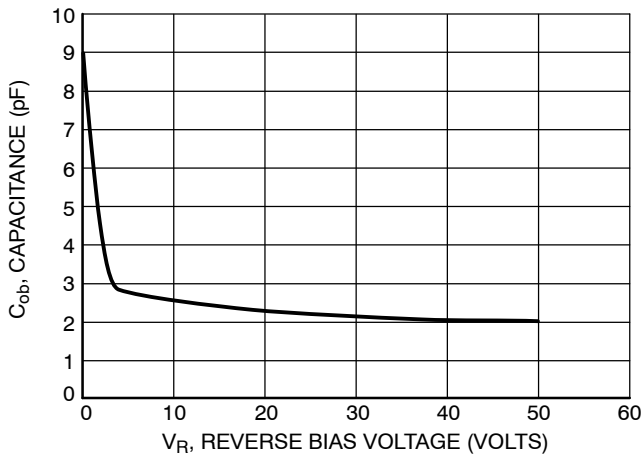


Figure 25. Output Capacitance

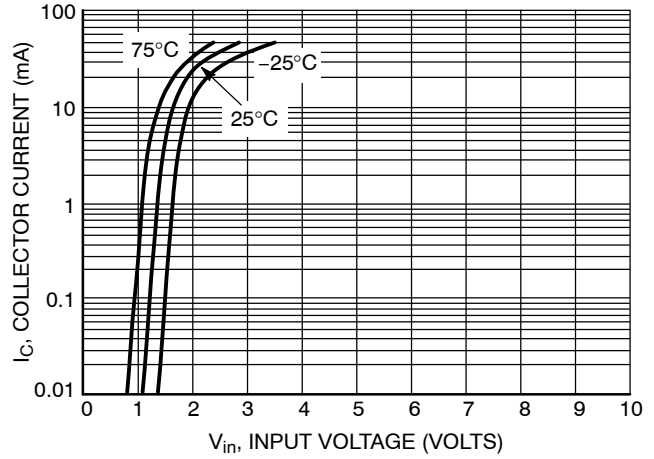


Figure 26. Output Current versus Input Voltage

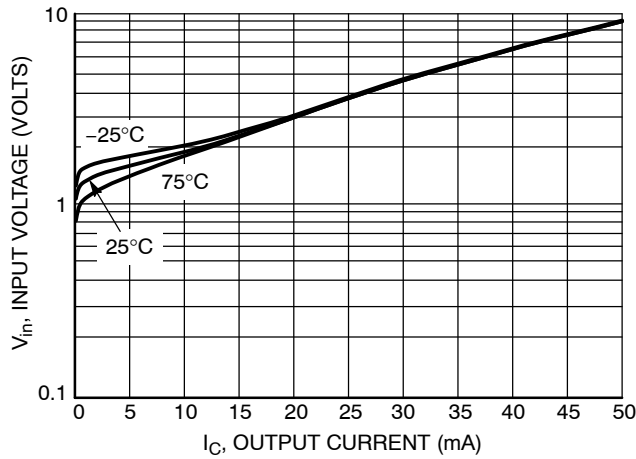


Figure 27. Input Voltage versus Output Current

# MUN5111T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5133T1

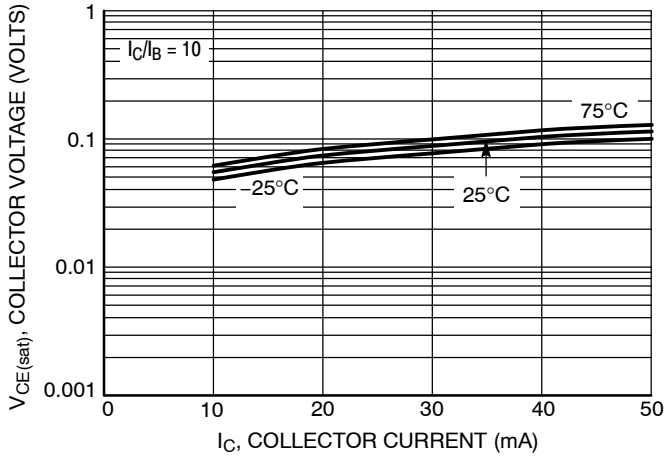


Figure 28.  $V_{CE(sat)}$  versus  $I_C$

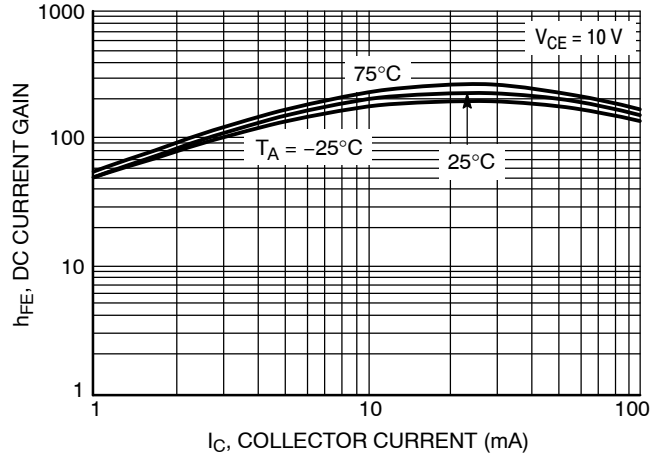


Figure 29. DC Current Gain

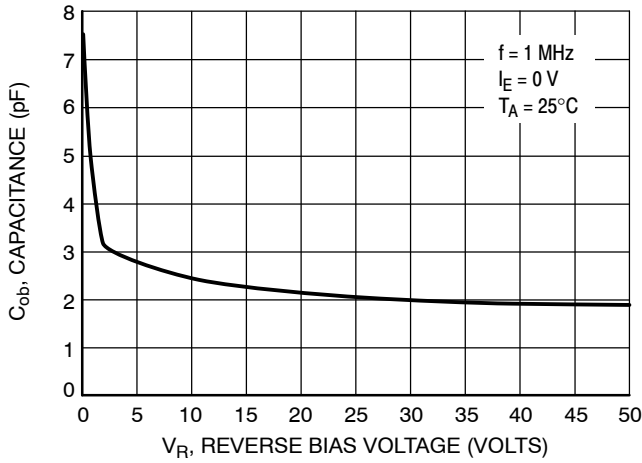


Figure 30. Output Capacitance

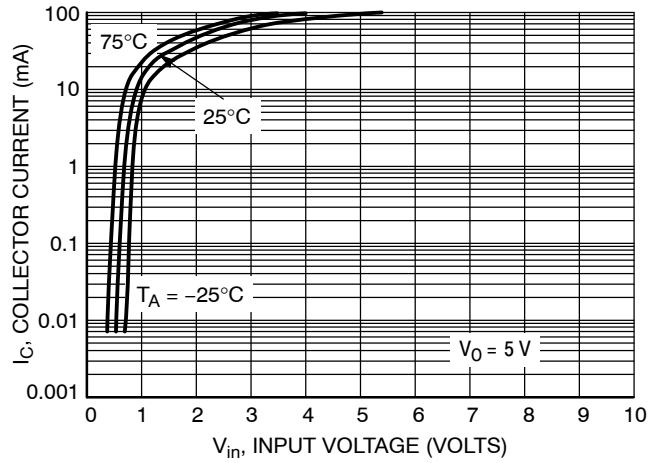


Figure 31. Output Current versus Input Voltage

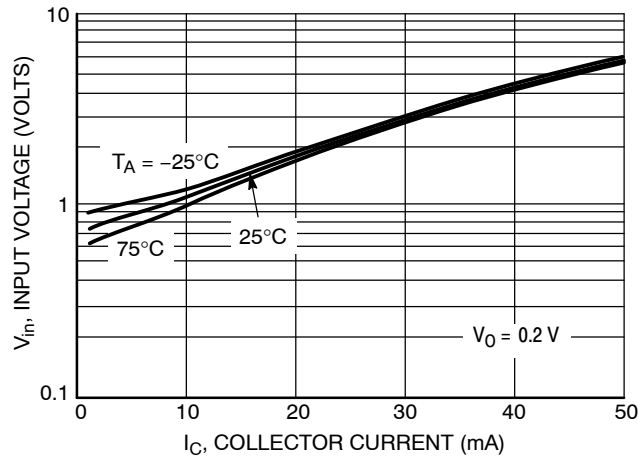
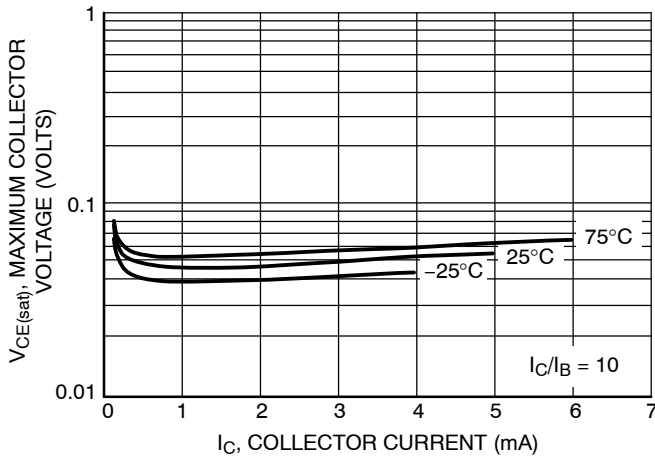


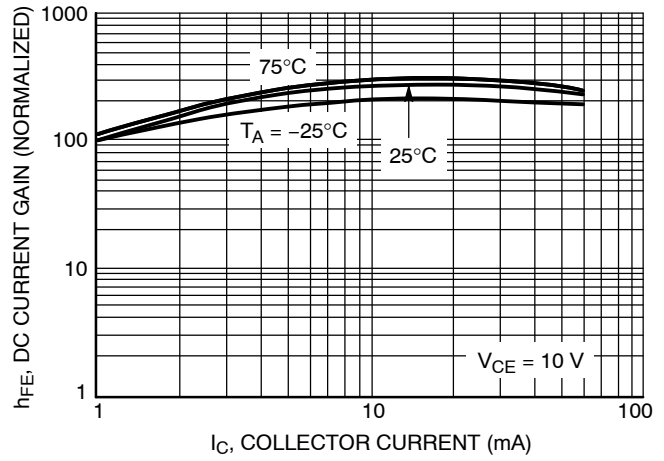
Figure 32. Input Voltage versus Output Current

# MUN511T1 Series

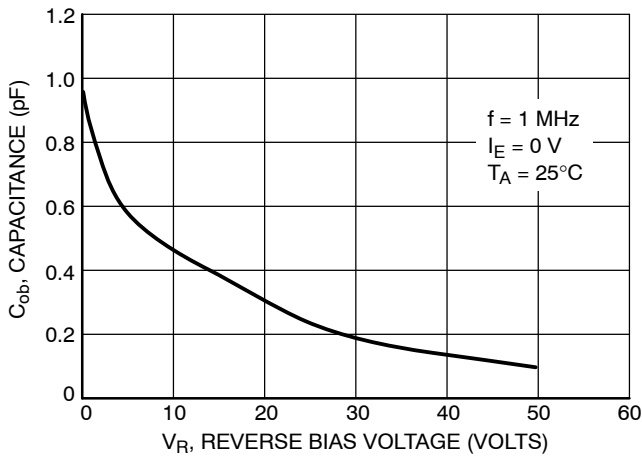
## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5136T1



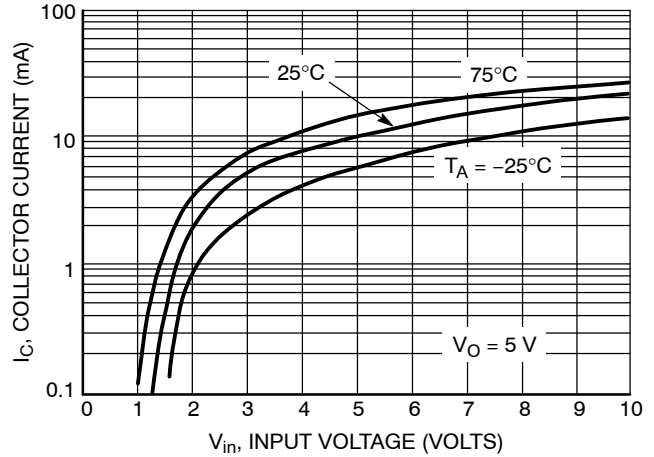
**Figure 33. Maximum Collector Voltage versus Collector Current**



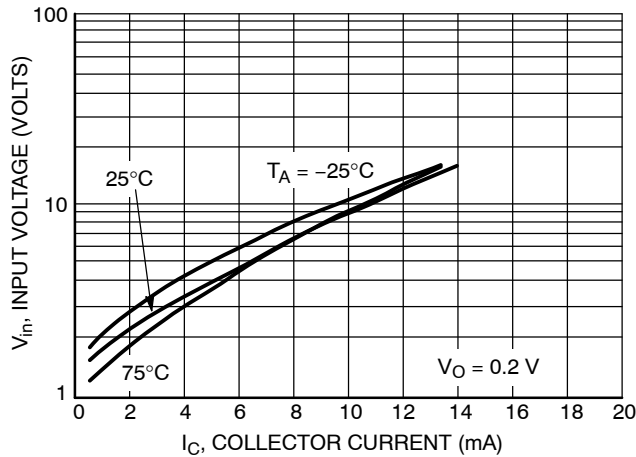
**Figure 34. DC Current Gain**



**Figure 35. Output Capacitance**



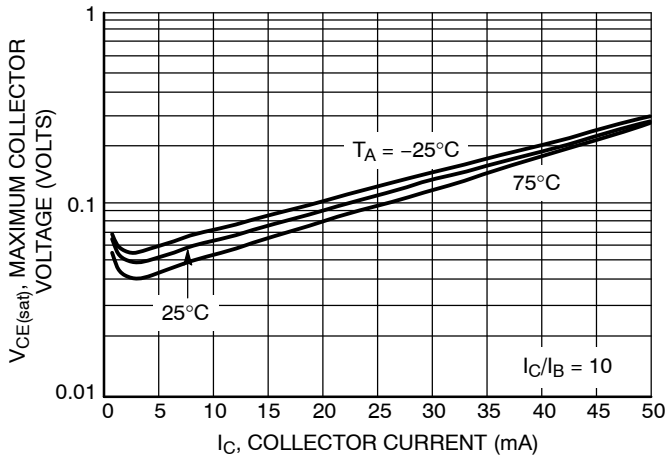
**Figure 36. Output Current versus Input Voltage**



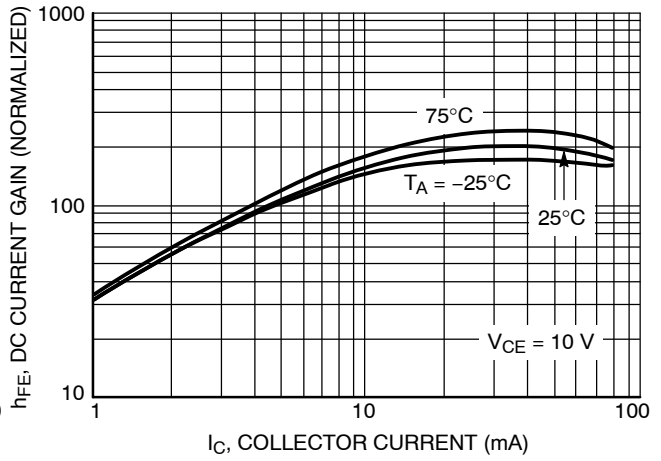
**Figure 37. Input Voltage versus Output Current**

# MUN511T1 Series

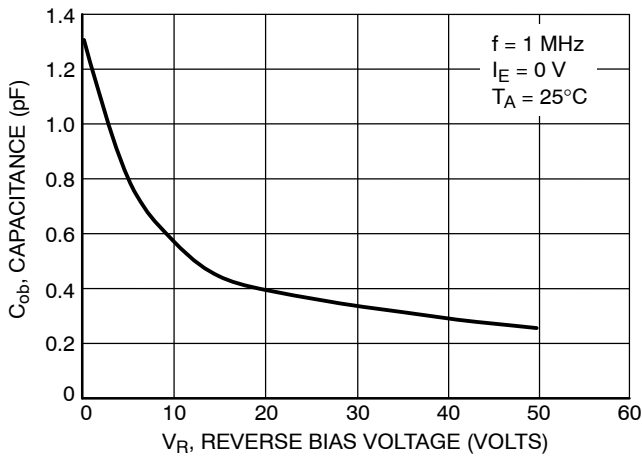
## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5137T1



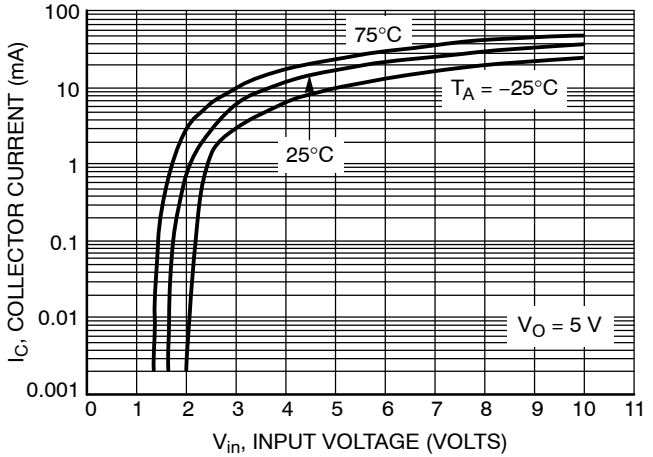
**Figure 38. Maximum Collector Voltage versus Collector Current**



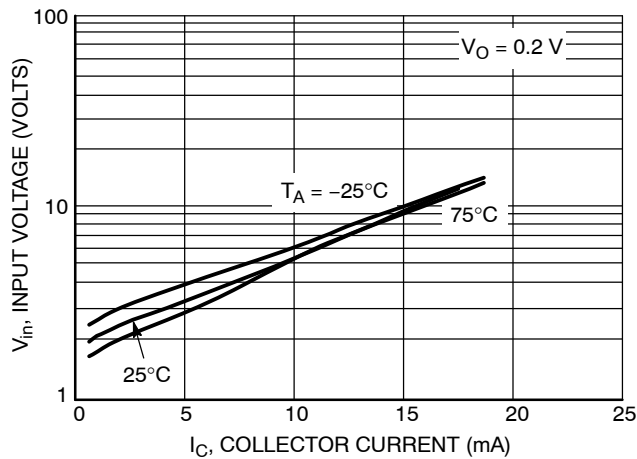
**Figure 39. DC Current Gain**



**Figure 40. Output Capacitance**



**Figure 41. Output Current versus Input Voltage**

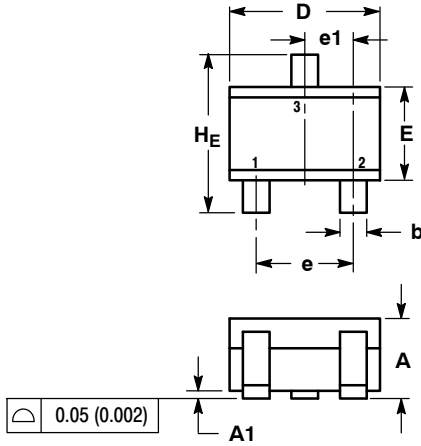


**Figure 42. Input Voltage versus Output Current**

# MUN511T1 Series

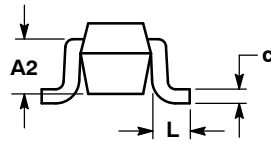
## PACKAGE DIMENSIONS

SC-70/SOT-323  
CASE 419-04  
ISSUE N



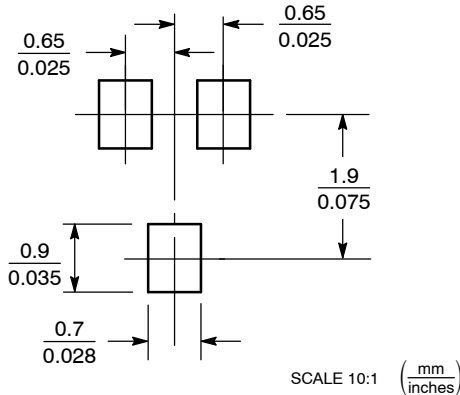
- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

| 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 |
| HE  | 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.

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 5163, Denver, Colorado 80217 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free  
USA/Canada  
Europe, Middle East and Africa Technical Support:  
Phone: 421 33 790 2910  
Japan Customer Focus Center  
Phone: 81-3-5773-3850

ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative