

MMUN2111LT1G Series

Bias Resistor Transistors

PNP 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-23 package which is designed for low power surface mount applications.

Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SOT-23 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.
- 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 |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|-----------------|------------------------------|---------------------------|
| Total Device Dissipation $T_A = 25^\circ\text{C}$ | P_D | 246 (Note 1) 400 (Note 2) | mW |
| Derate above 25°C | | 2.0 (Note 1) 3.2 (Note 2) | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 508 (Note 1) 311 (Note 2) | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Lead | $R_{\theta JL}$ | 174 (Note 1) 208 (Note 2) | $^\circ\text{C}/\text{W}$ |
| Junction and Storage, Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

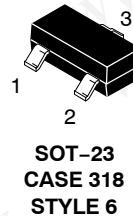
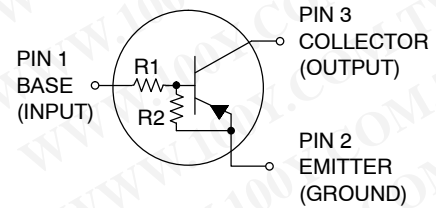
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

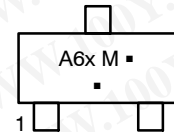


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MARKING DIAGRAM



- A6x = Device Code
- x = A - L (Refer to page 2)
- M = Date Code*
- = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation may vary depending upon manufacturing location.

ORDERING INFORMATION

| Device | Package | Shipping† |
|--------------|------------------|-------------------|
| MMUN21xxLT1G | SOT-23 (Pb-Free) | 3000/Tape & Reel |
| MMUN21xxLT3G | SOT-23 (Pb-Free) | 10000/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.

DEVICE MARKING INFORMATION

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

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MMUN2111LT1G Series

DEVICE MARKING AND RESISTOR VALUES

| Device* | Package | Marking | R1 (K) | R2 (K) | Shipping |
|------------------------------|---------|---------|--------|--------|--|
| MMUN2111LT1G MMUN2111LT3G | SOT-23 | A6A | 10 | 10 | 3000/Tape & Reel 10,000/Tape & Reel |
| MMUN2112LT1G | SOT-23 | A6B | 22 | 22 | 3000/Tape & Reel |
| MMUN2113LT1G MMUN2113LT3G | SOT-23 | A6C | 47 | 47 | 3000/Tape & Reel 10,000/Tape & Reel |
| MMUN2114LT1G MMUN2114LT3G | SOT-23 | A6D | 10 | 47 | 3000/Tape & Reel 10,000/Tape & Reel |
| MMUN2115LT1G | SOT-23 | A6E | 10 | ∞ | 3000/Tape & Reel |
| MMUN2116LT1G | SOT-23 | A6F | 4.7 | ∞ | 3000/Tape & Reel |
| MMUN2130LT1G (Note 3) | SOT-23 | A6G | 1.0 | 1.0 | 3000/Tape & Reel |
| MMUN2131LT1G (Note 3) | SOT-23 | A6H | 2.2 | 2.2 | 3000/Tape & Reel |
| MMUN2132LT1G | SOT-23 | A6J | 4.7 | 4.7 | 3000/Tape & Reel |
| MMUN2133LT1G | SOT-23 | A6K | 4.7 | 47 | 3000/Tape & Reel |
| MMUN2134LT1G (Note 3) | SOT-23 | A6L | 22 | 47 | 3000/Tape & Reel |

*The "G" suffix indicates Pb-Free package available.

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

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|----------------------|-----|-----|------|------|
| OFF CHARACTERISTICS | | | | | |
| Collector-Base Cutoff Current (V _{CB} = 50 V, I _E = 0) | I _{CBO} | - | - | 100 | nAdc |
| Collector-Emitter Cutoff Current (V _{CE} = 50 V, I _B = 0) | I _{CEO} | - | - | 500 | nAdc |
| Emitter-Base Cutoff Current (V _{EB} = 6.0 V, I _C = 0) | I _{EBO} | - | - | 0.5 | mAdc |
| | MMUN2111LT1G | - | - | 0.2 | |
| | MMUN2112LT1G | - | - | 0.1 | |
| | MMUN2113LT1G | - | - | 0.2 | |
| | MMUN2114LT1G | - | - | 0.9 | |
| | MMUN2115LT1G | - | - | 1.9 | |
| | MMUN2116LT1G | - | - | 4.3 | |
| | MMUN2130LT1G | - | - | 2.3 | |
| | MMUN2131LT1G | - | - | 1.5 | |
| | MMUN2132LT1G | - | - | 0.18 | |
| | MMUN2133LT1G | - | - | 0.13 | |
| | MMUN2134LT1G | - | - | - | |
| Collector-Base Breakdown Voltage (I _C = 10 μA, I _E = 0) | V _{(BR)CBO} | 50 | - | - | Vdc |
| Collector-Emitter Breakdown Voltage (Note 4) (I _C = 2.0 mA, I _B = 0) | V _{(BR)CEO} | 50 | - | - | Vdc |

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

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MMUN2111LT1G Series

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|--------------|-----|------|------|------|
| ON CHARACTERISTICS (Note 5) | | | | | |
| DC Current Gain ($V_{CE} = 10\text{ V}$, $I_C = 5.0\text{ mA}$) | MMUN2111LT1G | 35 | 60 | – | |
| | MMUN2112LT1G | 60 | 100 | – | |
| | MMUN2113LT1G | 80 | 140 | – | |
| | MMUN2114LT1G | 80 | 140 | – | |
| | MMUN2115LT1G | 160 | 250 | – | |
| | MMUN2116LT1G | 160 | 250 | – | |
| | MMUN2130LT1G | 3.0 | 5.0 | – | |
| | MMUN2131LT1G | 8.0 | 15 | – | |
| | MMUN2132LT1G | 15 | 27 | – | |
| | MMUN2133LT1G | 80 | 140 | – | |
| MMUN2134LT1G | 80 | 130 | – | | |
| Collector-Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 0.3\text{ mA}$) ($I_C = 10\text{ mA}$, $I_B = 5\text{ mA}$) ($I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$) | MMUN2111LT1G | – | – | 0.25 | Vdc |
| | MMUN2112LT1G | – | – | 0.25 | |
| | MMUN2113LT1G | – | – | 0.25 | |
| | MMUN2114LT1G | – | – | 0.25 | |
| | MMUN2133LT1G | – | – | 0.25 | |
| | MMUN2130LT1G | – | – | 0.25 | |
| | MMUN2131LT1G | – | – | 0.25 | |
| | MMUN2115LT1G | – | – | 0.25 | |
| | MMUN2116LT1G | – | – | 0.25 | |
| | MMUN2132LT1G | – | – | 0.25 | |
| MMUN2134LT1G | – | – | 0.25 | | |
| Output Voltage (on) ($V_{CC} = 5.0\text{ V}$, $V_B = 2.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 3.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) | MMUN2111LT1G | – | – | 0.2 | Vdc |
| | MMUN2112LT1G | – | – | 0.2 | |
| | MMUN2114LT1G | – | – | 0.2 | |
| | MMUN2115LT1G | – | – | 0.2 | |
| | MMUN2116LT1G | – | – | 0.2 | |
| | MMUN2130LT1G | – | – | 0.2 | |
| | MMUN2131LT1G | – | – | 0.2 | |
| | MMUN2132LT1G | – | – | 0.2 | |
| | MMUN2133LT1G | – | – | 0.2 | |
| | MMUN2134LT1G | – | – | 0.2 | |
| MMUN2113LT1G | – | – | 0.2 | | |
| Output Voltage (off) ($V_{CC} = 5.0\text{ V}$, $V_B = 0.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 0.25\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 0.050\text{ V}$, $R_L = 1.0\text{ k}\Omega$) | MMUN2111LT1G | 4.9 | – | – | Vdc |
| | MMUN2112LT1G | 4.9 | – | – | |
| | MMUN2113LT1G | 4.9 | – | – | |
| | MMUN2114LT1G | 4.9 | – | – | |
| | MMUN2133LT1G | 4.9 | – | – | |
| | MMUN2134LT1G | 4.9 | – | – | |
| | MMUN2115LT1G | 4.9 | – | – | |
| | MMUN2116LT1G | 4.9 | – | – | |
| | MMUN2131LT1G | 4.9 | – | – | |
| | MMUN2132LT1G | 4.9 | – | – | |
| MMUN2130LT1G | 4.9 | – | – | | |

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MMUN2111LT1G Series

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

| Characteristic | Symbol | Min | Typ | Max | Unit | |
|------------------------------------|--------------|--------------------------------|-------|------|-------|-----|
| ON CHARACTERISTICS (Note 5) | | | | | | |
| Input Resistor | MMUN2111LT1G | R1 | 7.0 | 10 | 13 | k Ω |
| | MMUN2112LT1G | | 15.4 | 22 | 28.6 | |
| | MMUN2113LT1G | | 32.9 | 47 | 61.1 | |
| | MMUN2114LT1G | | 7.0 | 10 | 13 | |
| | MMUN2115LT1G | | 7.0 | 10 | 13 | |
| | MMUN2116LT1G | | 3.3 | 4.7 | 6.1 | |
| | MMUN2130LT1G | | 0.7 | 1.0 | 1.3 | |
| | MMUN2131LT1G | | 1.5 | 2.2 | 2.9 | |
| | MMUN2132LT1G | | 3.3 | 4.7 | 6.1 | |
| | MMUN2133LT1G | | 3.3 | 4.7 | 6.1 | |
| MMUN2134LT1G | | 15.4 | 22 | 28.6 | | |
| Resistor Ratio | MMUN2111LT1G | R ₁ /R ₂ | 0.8 | 1.0 | 1.2 | |
| | MMUN2112LT1G | | 0.8 | 1.0 | 1.2 | |
| | MMUN2113LT1G | | 0.8 | 1.0 | 1.2 | |
| | MMUN2114LT1G | | 0.17 | 0.21 | 0.25 | |
| | MMUN2115LT1G | | – | – | – | |
| | MMUN2116LT1G | | – | – | – | |
| | MMUN2130LT1G | | 0.8 | 1.0 | 1.2 | |
| | MMUN2131LT1G | | 0.8 | 1.0 | 1.2 | |
| | MMUN2132LT1G | | 0.8 | 1.0 | 1.2 | |
| | MMUN2133LT1G | | 0.055 | 0.1 | 0.185 | |
| MMUN2134LT1G | | 0.38 | 0.47 | 0.56 | | |

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

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TYPICAL ELECTRICAL CHARACTERISTICS MMUN2111LT1

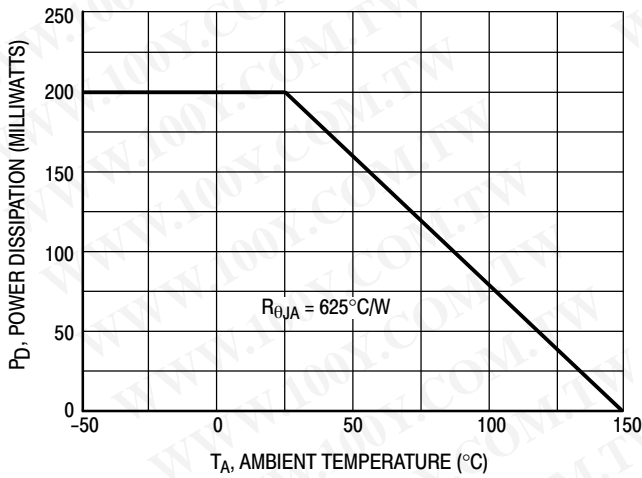


Figure 1. Derating Curve

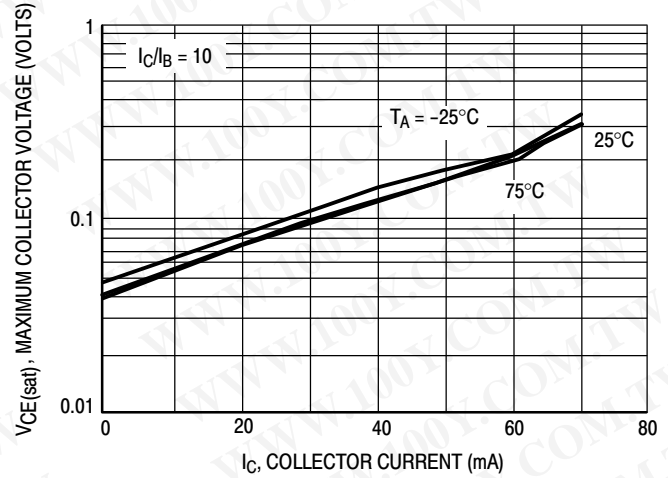


Figure 2. $V_{CE(sat)}$ versus I_C

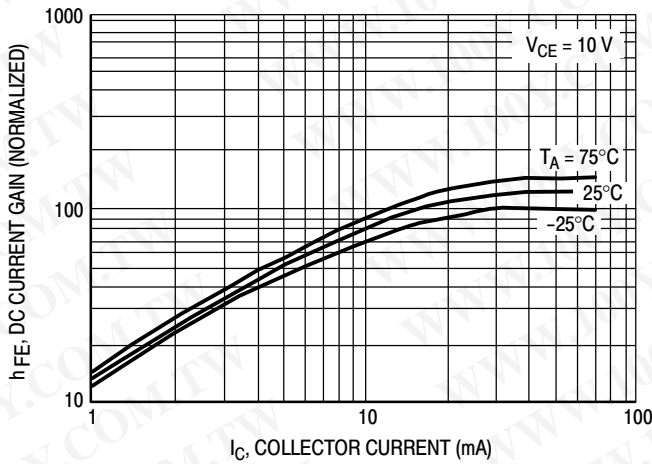


Figure 3. DC Current Gain

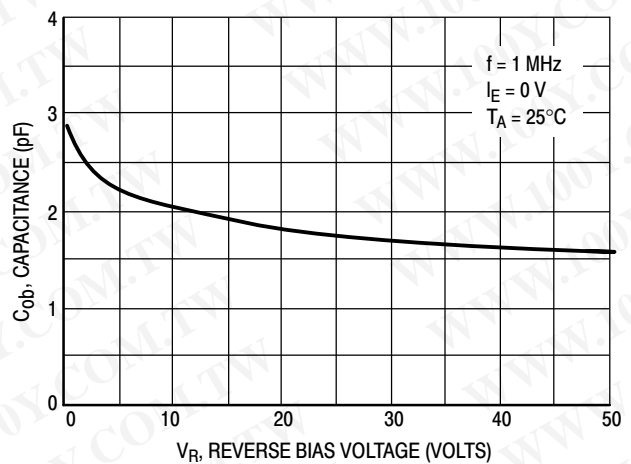


Figure 4. Output Capacitance

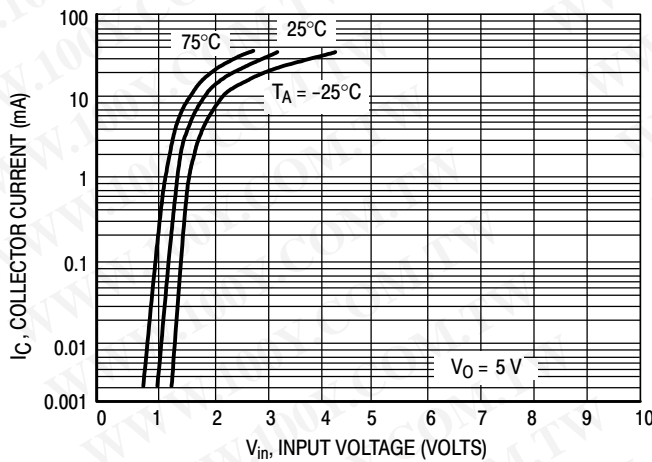


Figure 5. Output Current versus Input Voltage

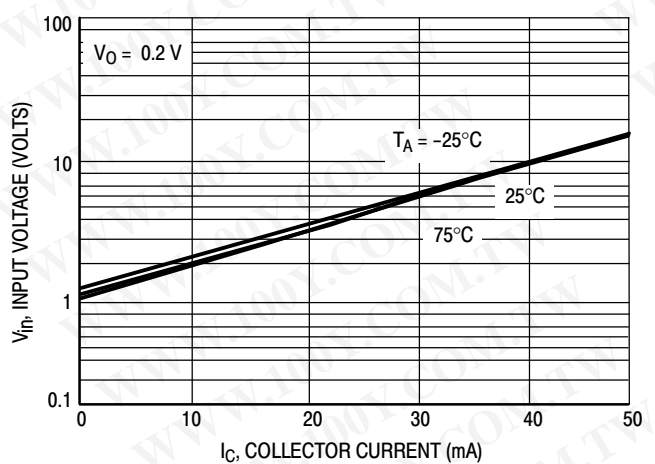


Figure 6. Input Voltage versus Output Current

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TYPICAL ELECTRICAL CHARACTERISTICS MMUN2112LT1

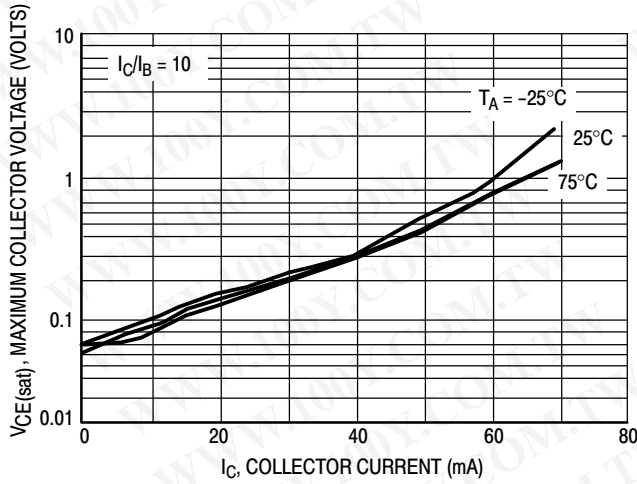


Figure 7. $V_{CE(sat)}$ versus I_C

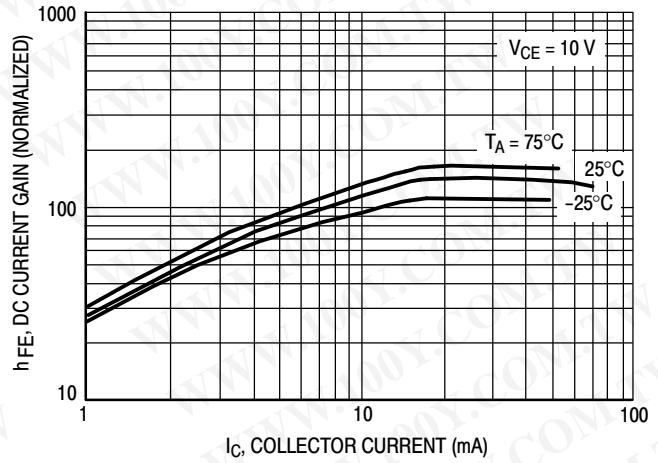


Figure 8. DC Current Gain

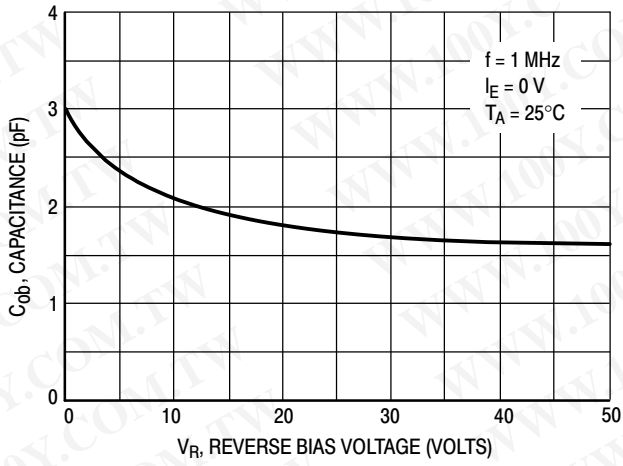


Figure 9. Output Capacitance

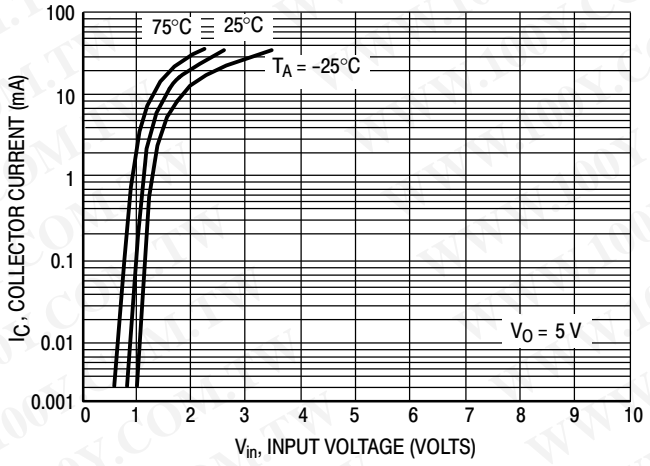


Figure 10. Output Current versus Input Voltage

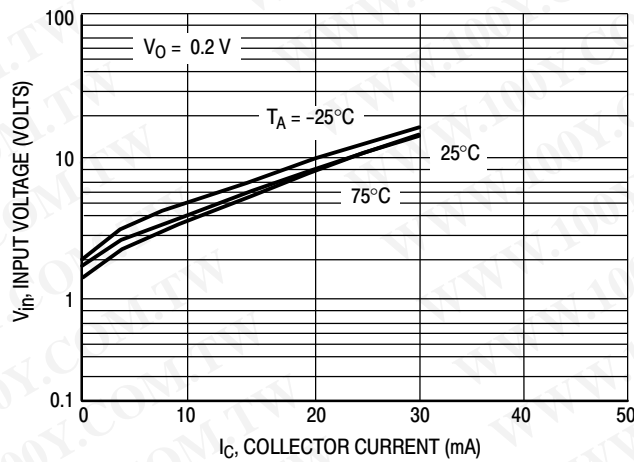


Figure 11. Input Voltage versus Output Current

MMUN2111LT1G Series

TYPICAL ELECTRICAL CHARACTERISTICS MMUN2113LT1

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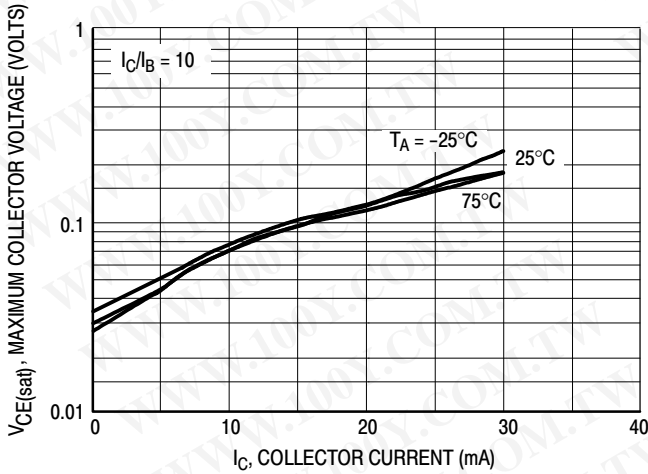


Figure 12. $V_{CE(sat)}$ versus I_C

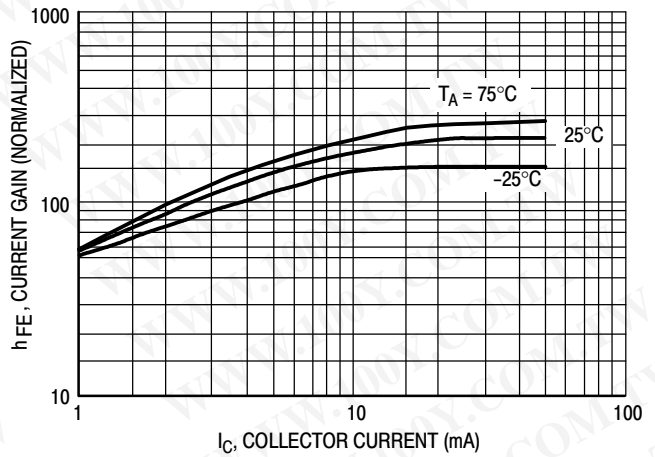


Figure 13. DC Current Gain

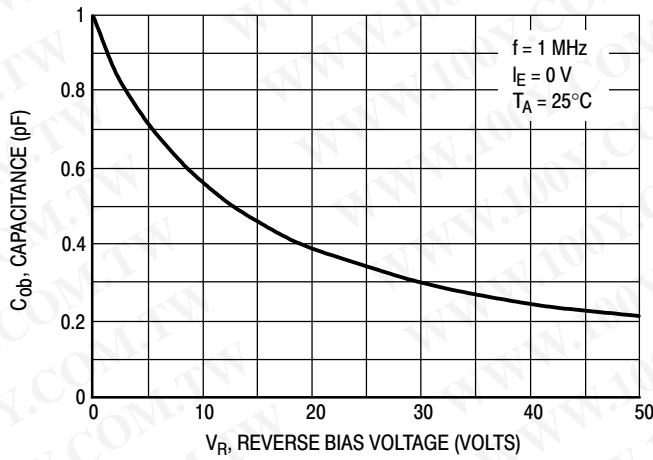


Figure 14. Output Capacitance

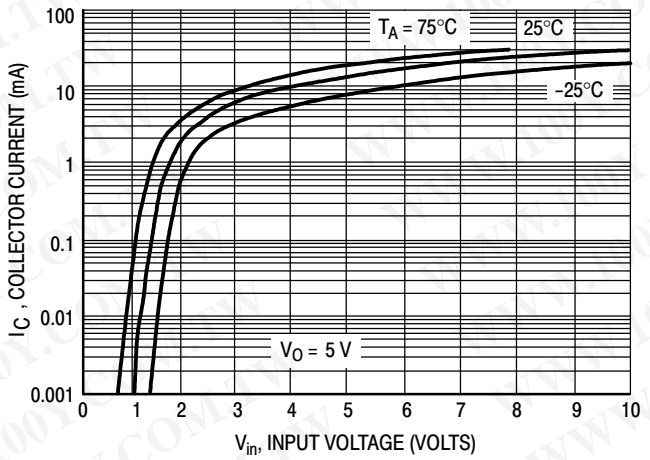


Figure 15. Output Current versus Input Voltage

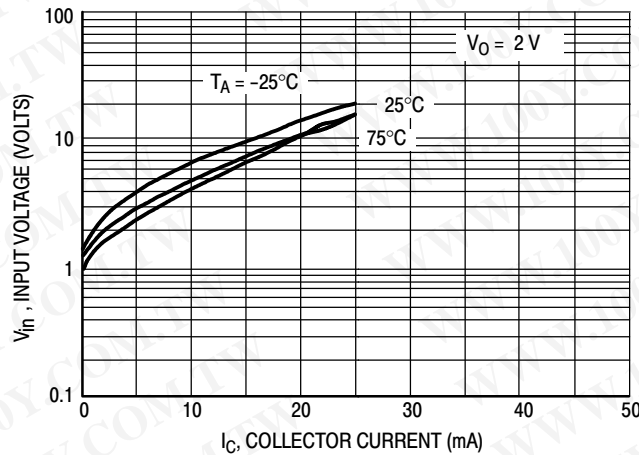


Figure 16. Input Voltage versus Output Current

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TYPICAL ELECTRICAL CHARACTERISTICS MMUN2114LT1

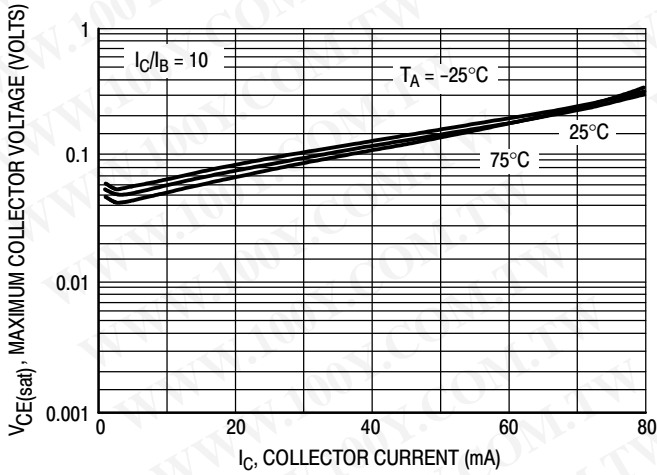


Figure 17. $V_{CE(sat)}$ versus I_C

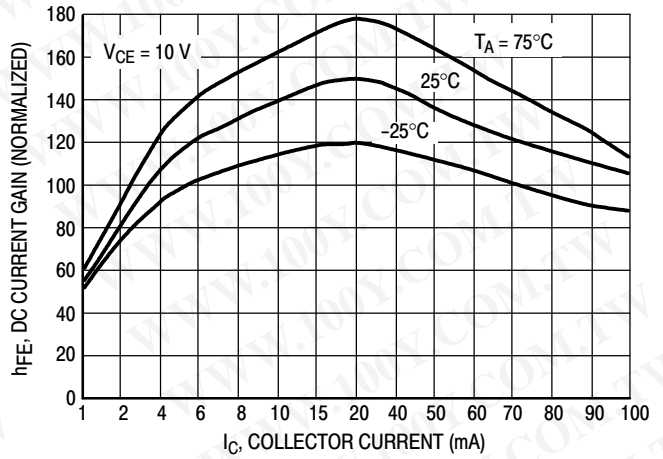


Figure 18. DC Current Gain

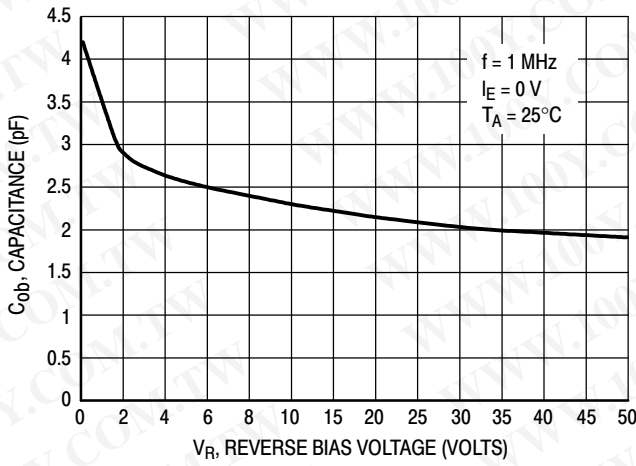


Figure 19. Output Capacitance

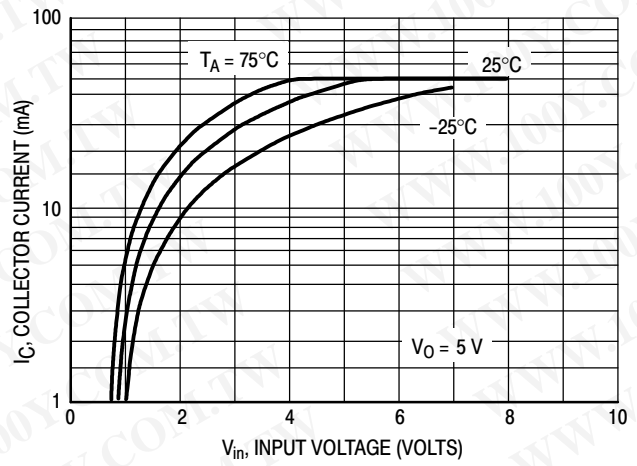


Figure 20. Output Current versus Input Voltage

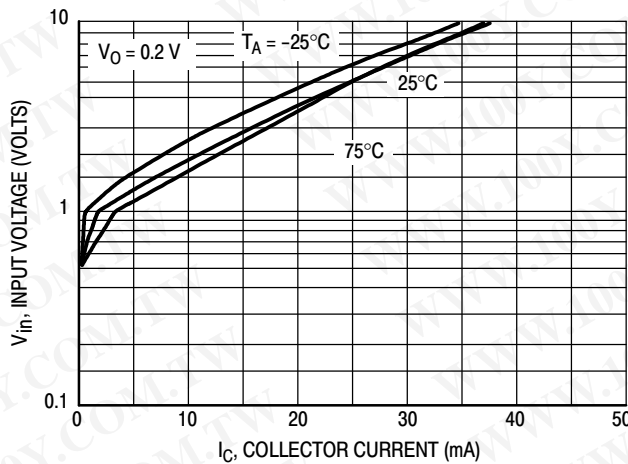


Figure 21. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
 MMUN2115LT1

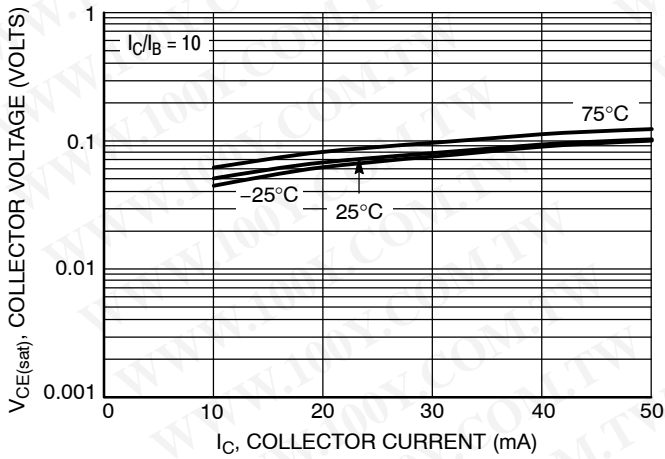


Figure 22. $V_{CE(sat)}$ versus I_C

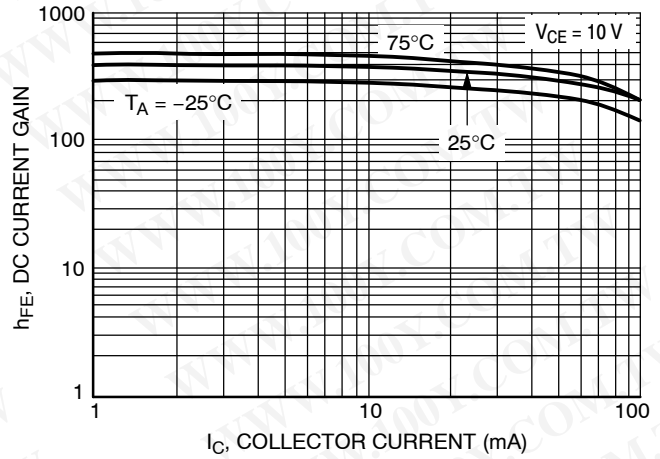


Figure 23. DC Current Gain

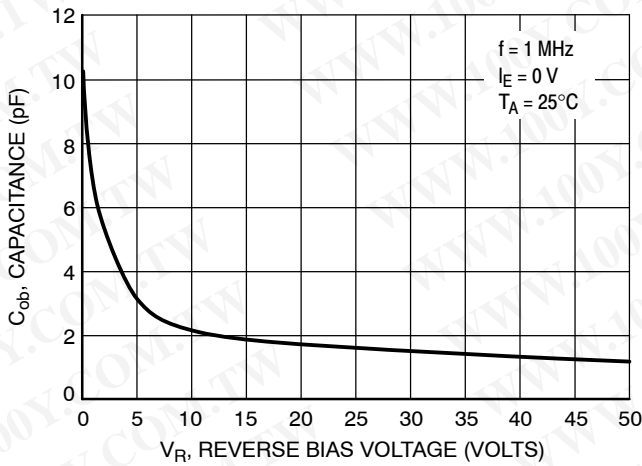


Figure 24. Output Capacitance

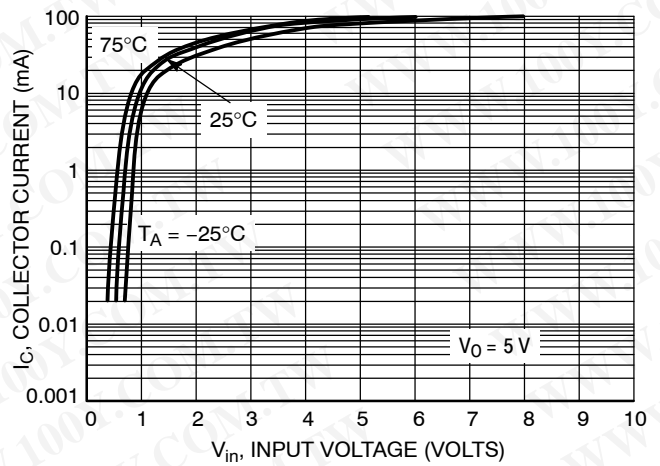


Figure 25. Output Current versus Input Voltage

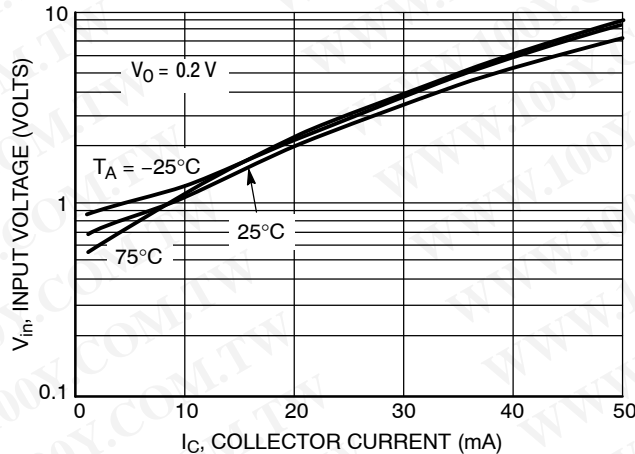


Figure 26. Input Voltage versus Output Current

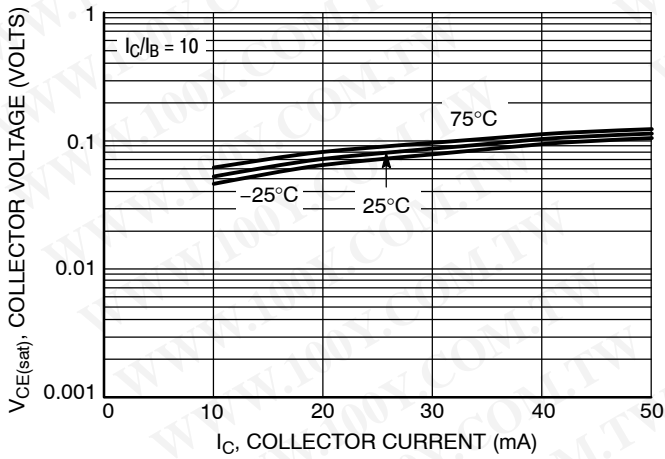


Figure 27. $V_{CE(sat)}$ versus I_C

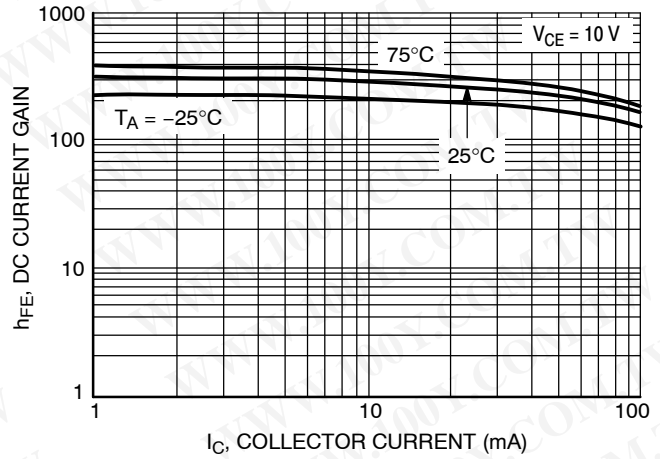


Figure 28. DC Current Gain

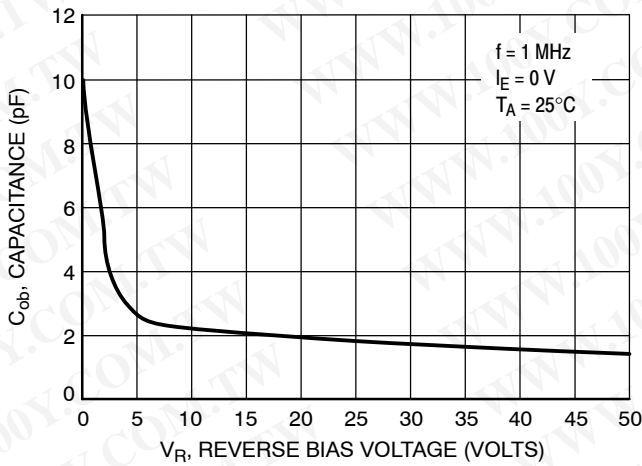


Figure 29. Output Capacitance

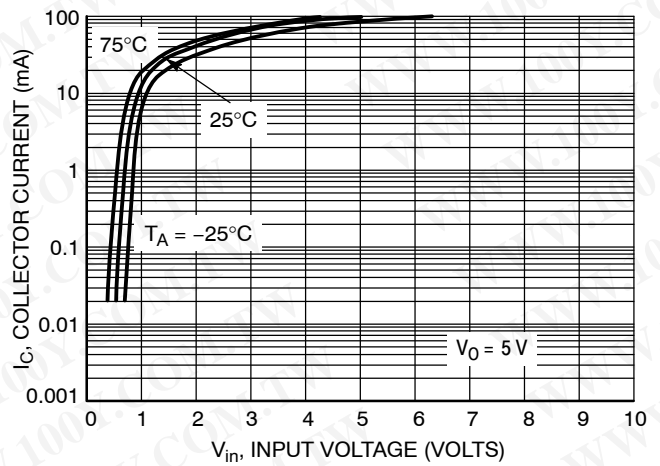


Figure 30. Output Current versus Input Voltage

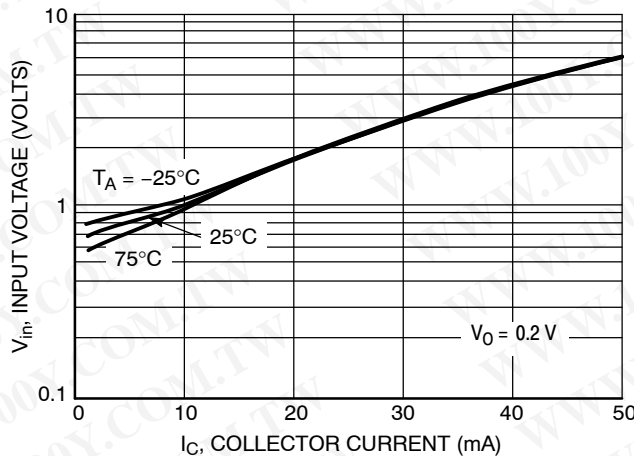


Figure 31. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
 MMUN2132LT1

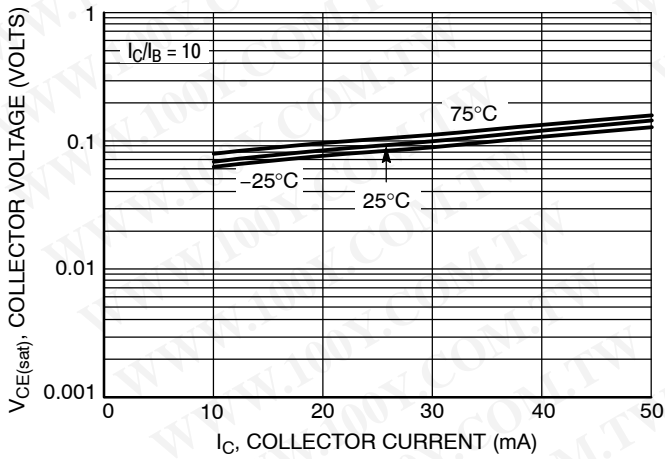


Figure 32. $V_{CE(sat)}$ versus I_C

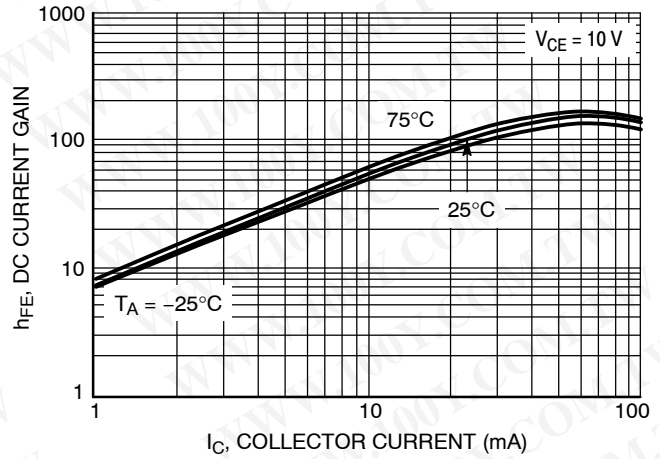


Figure 33. DC Current Gain

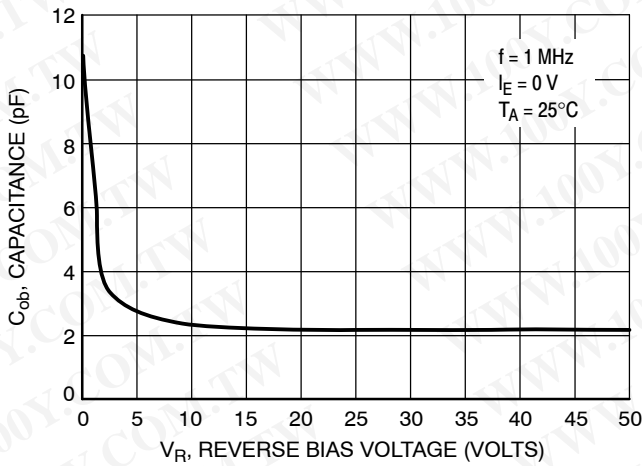


Figure 34. Output Capacitance

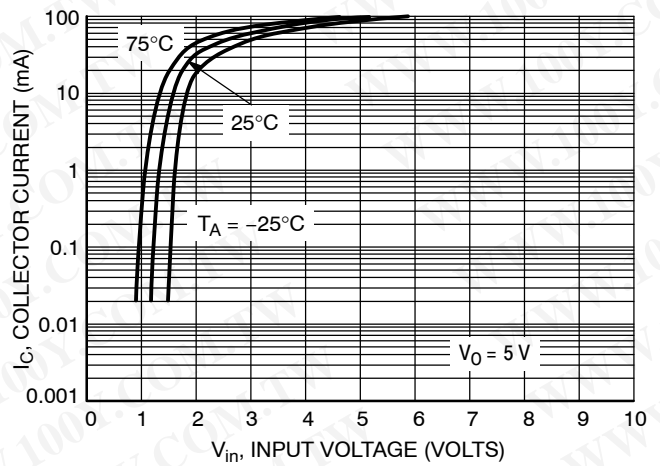


Figure 35. Output Current versus Input Voltage

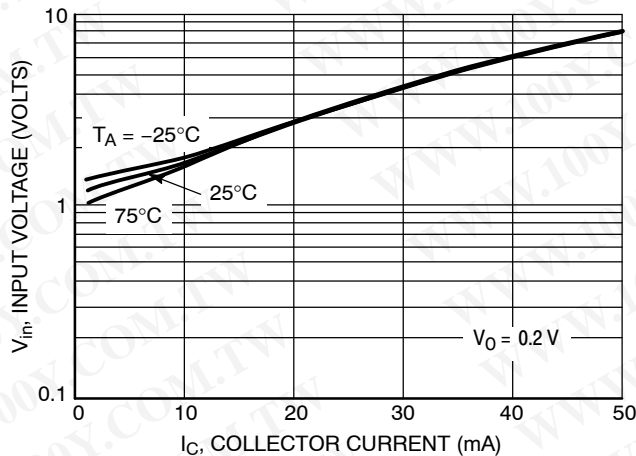


Figure 36. Input Voltage versus Output Current

MMUN2111LT1G Series

TYPICAL ELECTRICAL CHARACTERISTICS MMUN2133LT1

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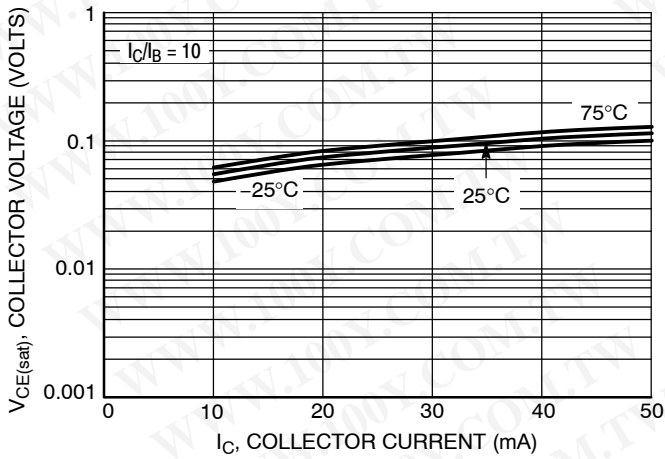


Figure 37. $V_{CE(sat)}$ versus I_C

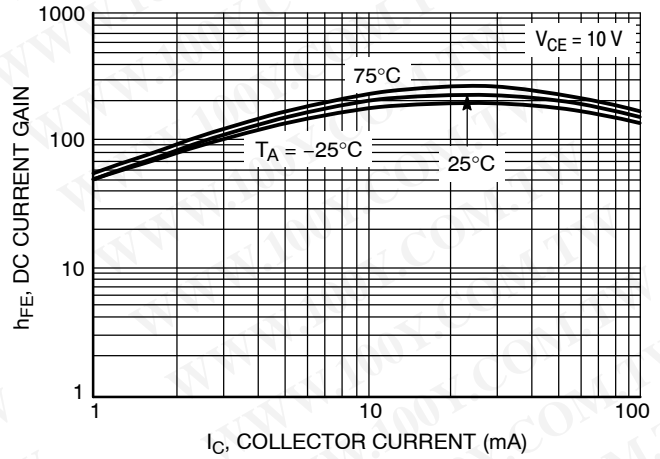


Figure 38. DC Current Gain

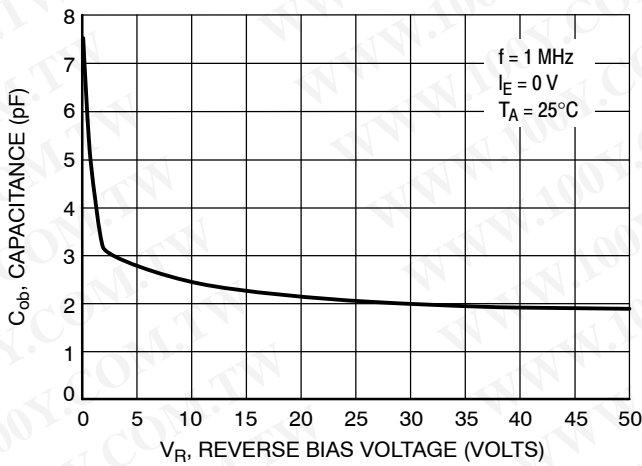


Figure 39. Output Capacitance

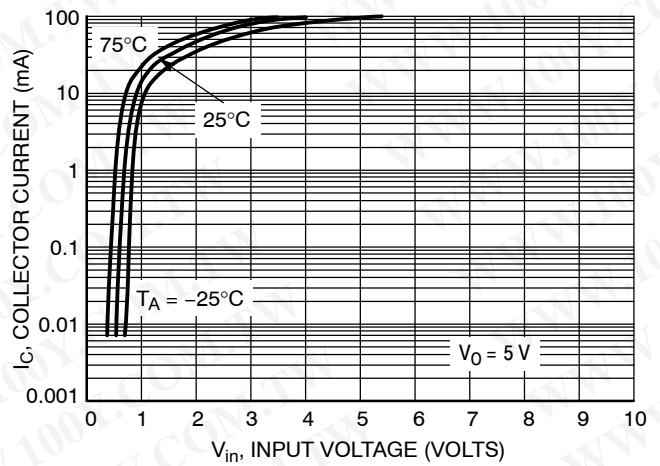


Figure 40. Output Current versus Input Voltage

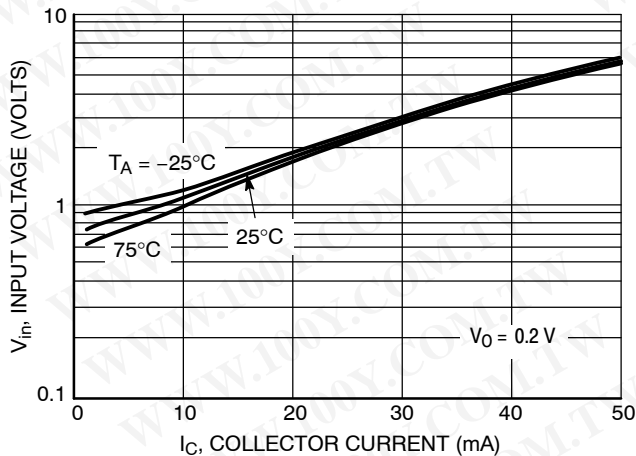


Figure 41. Input Voltage versus Output Current

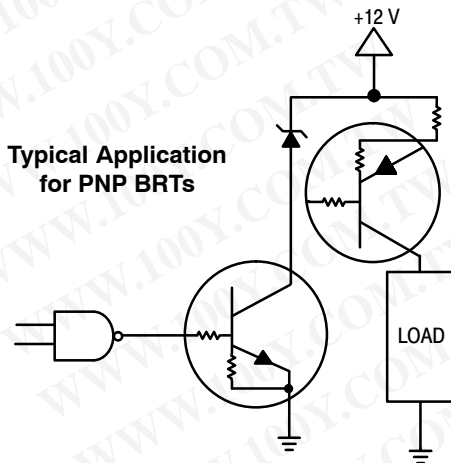


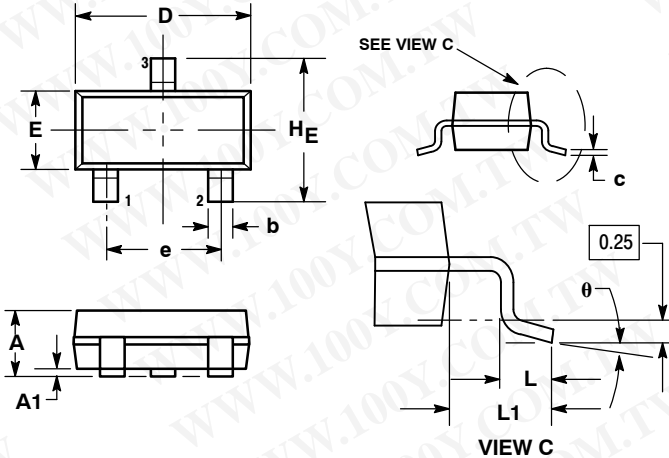
Figure 42. Inexpensive, Unregulated Current Source

MMUN2111LT1G Series

PACKAGE DIMENSIONS

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SOT-23 (TO-236)
 CASE 318-08
 ISSUE AN



NOTES:

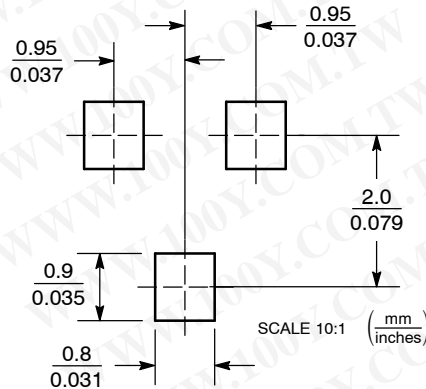
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|--------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.040 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.018 | 0.020 |
| c | 0.09 | 0.13 | 0.18 | 0.003 | 0.005 | 0.007 |
| 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 | 0.081 |
| L | 0.10 | 0.20 | 0.30 | 0.004 | 0.008 | 0.012 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.029 |
| HE | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |

STYLE 6:

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.

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