

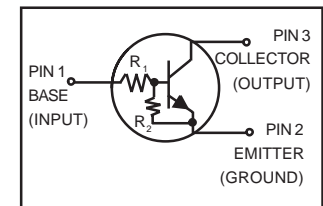
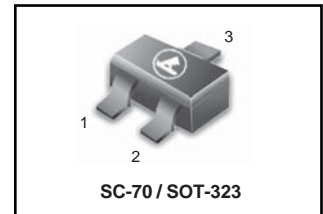
Bias Resistor Transistor

NPN Silicon Surface Mount Transistor with Monolithic Bias Resistor Network

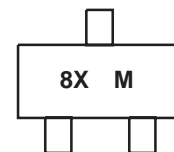
This new series of digital transistors is designed to replace a single device and its external resistor bias network. The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The BRT 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-70/SOT-323 package which is designed for low power surface mount applications.

- 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.
- Pb-Free package is available

LMUN5211T1G Series



MARKING DIAGRAM



8x = Specific Device Code
 x = (See Marking Table)
 M = Date Code

DEVICE MARKING INFORMATION

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

MAXIMUM RATINGS (T_A = 25°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°C Derate above 25°C | P _D | 202 (Note 1.) 310 (Note 2.) 1.6 (Note 1.) 2.5 (Note 2.) | mW mW/°C |
| Thermal Resistance – Junction-to-Ambient | R _{θJA} | 618 (Note 1.) 403 (Note 2.) | °C/W |
| Thermal Resistance – Junction-to-Lead | R _{θJL} | 280 (Note 1.) 332 (Note 2.) | °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

LMUN5211T1G Series

DEVICE MARKING RESISTOR VALUES AND ORDERING INFORMATION

| Device | Package | Marking | R1(K) | R2(K) | Shipping |
|---------------------|---------------|---------|-------|-------|-----------------|
| LMUN5211T1G | SC-70/SOT-323 | 8A | 10 | 10 | 3000/Tape&Reel |
| LMUN5211T3G | SC-70/SOT-323 | 8A | 10 | 10 | 10000/Tape&Reel |
| LMUN5212T1G | SC-70/SOT-323 | 8B | 22 | 22 | 3000/Tape&Reel |
| LMUN5212T3G | SC-70/SOT-323 | 8B | 22 | 22 | 10000/Tape&Reel |
| LMUN5213T1G | SC-70/SOT-323 | 8C | 47 | 47 | 3000/Tape&Reel |
| LMUN5213T3G | SC-70/SOT-323 | 8C | 47 | 47 | 10000/Tape&Reel |
| LMUN5214T1G | SC-70/SOT-323 | 8D | 10 | 47 | 3000/Tape&Reel |
| LMUN5214T3G | SC-70/SOT-323 | 8D | 10 | 47 | 10000/Tape&Reel |
| LMUN5215T1G(Note 3) | SC-70/SOT-323 | 8E | 10 | ∞ | 3000/Tape&Reel |
| LMUN5215T3G | SC-70/SOT-323 | 8E | 10 | ∞ | 10000/Tape&Reel |
| LMUN5216T1G(Note 3) | SC-70/SOT-323 | 8F | 4.7 | ∞ | 3000/Tape&Reel |
| LMUN5216T3G | SC-70/SOT-323 | 8F | 4.7 | ∞ | 10000/Tape&Reel |
| LMUN5230T1G(Note 3) | SC-70/SOT-323 | 8G | 1 | 1 | 3000/Tape&Reel |
| LMUN5230T3G | SC-70/SOT-323 | 8G | 1 | 1 | 10000/Tape&Reel |
| LMUN5231T1G(Note 3) | SC-70/SOT-323 | 8H | 2.2 | 2.2 | 3000/Tape&Reel |
| LMUN5231T3G | SC-70/SOT-323 | 8H | 2.2 | 2.2 | 10000/Tape&Reel |
| LMUN5232T1G(Note 3) | SC-70/SOT-323 | 8J | 4.7 | 4.7 | 3000/Tape&Reel |
| LMUN5232T3G | SC-70/SOT-323 | 8J | 4.7 | 4.7 | 10000/Tape&Reel |
| LMUN5233T1G(Note 3) | SC-70/SOT-323 | 8K | 4.7 | 47 | 3000/Tape&Reel |
| LMUN5233T3G | SC-70/SOT-323 | 8K | 4.7 | 47 | 10000/Tape&Reel |
| LMUN5234T1G(Note 3) | SC-70/SOT-323 | 8L | 22 | 47 | 3000/Tape&Reel |
| LMUN5234T3G | SC-70/SOT-323 | 8L | 22 | 47 | 10000/Tape&Reel |
| LMUN5235T1G(Note 3) | SC-70/SOT-323 | 8M | 2.2 | 47 | 3000/Tape&Reel |
| LMUN5235T3G | SC-70/SOT-323 | 8M | 2.2 | 47 | 10000/Tape&Reel |
| LMUN5236T1G(Note 3) | SC-70/SOT-323 | 8N | 100 | 100 | 3000/Tape&Reel |
| LMUN5236T3G | SC-70/SOT-323 | 8N | 100 | 100 | 10000/Tape&Reel |
| LMUN5237T1G(Note 3) | SC-70/SOT-323 | 8P | 47 | 22 | 3000/Tape&Reel |
| LMUN5237T3G | SC-70/SOT-323 | 8P | 47 | 22 | 10000/Tape&Reel |

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

LMUN5211T1G Series

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|-----|------|------|------|
| OFF CHARACTERISTICS | | | | | |
| Collector-Base Cutoff Current ($V_{CB} = 50\text{ V}, I_E = 0$) | I_{CBO} | – | – | 100 | nAdc |
| Collector-Emitter Cutoff Current ($V_{CE} = 50\text{ V}, I_B = 0$) | I_{CEO} | – | – | 500 | nAdc |
| Emitter-Base Cutoff Current ($V_{EB} = 6.0\text{ V}, I_C = 0$) | LMUN5211T1G | – | – | 0.5 | mAdc |
| | LMUN5212T1G | – | – | 0.2 | |
| | LMUN5213T1G | – | – | 0.1 | |
| | LMUN5214T1G | – | – | 0.2 | |
| | LMUN5215T1G | – | – | 0.9 | |
| | LMUN5216T1G | – | – | 1.9 | |
| | LMUN5230T1G | – | – | 4.3 | |
| | LMUN5231T1G | – | – | 2.3 | |
| | LMUN5232T1G | – | – | 1.5 | |
| | LMUN5233T1G | – | – | 0.18 | |
| | LMUN5234T1G | – | – | 0.13 | |
| | LMUN5235T1G | – | – | 0.2 | |
| | LMUN5236T1G | – | – | 0.05 | |
| LMUN5237T1G | – | – | 0.13 | | |
| Collector-Base Breakdown Voltage ($I_C = 10\ \mu\text{A}, I_E = 0$) | $V_{(BR)CBO}$ | 50 | – | – | Vdc |
| Collector-Emitter Breakdown Voltage (Note 4.) ($I_C = 2.0\text{ mA}, I_B = 0$) | $V_{(BR)CEO}$ | 50 | – | – | Vdc |

ON CHARACTERISTICS (Note 4.)

| | | | | | | | |
|---|---|----------|-------------|------|-----|-----|-----|
| DC Current Gain ($V_{CE} = 10\text{ V}, I_C = 5.0\text{ mA}$) | LMUN5211T1G | h_{FE} | 35 | 60 | – | | |
| | LMUN5212T1G | | 60 | 100 | – | | |
| | LMUN5213T1G | | 80 | 140 | – | | |
| | LMUN5214T1G | | 80 | 140 | – | | |
| | LMUN5215T1G | | 160 | 350 | – | | |
| | LMUN5216T1G | | 160 | 350 | – | | |
| | LMUN5230T1G | | 3.0 | 5.0 | – | | |
| | LMUN5231T1G | | 8.0 | 15 | – | | |
| | LMUN5232T1G | | 15 | 30 | – | | |
| | LMUN5233T1G | | 80 | 200 | – | | |
| | LMUN5234T1G | | 80 | 150 | – | | |
| | LMUN5235T1G | | 80 | 140 | – | | |
| | LMUN5236T1G | | 80 | 150 | – | | |
| LMUN5237T1G | 80 | 140 | – | | | | |
| Collector-Emitter Saturation Voltage ($I_C = 10\text{ mA}, I_B = 0.3\text{ mA}$) ($I_C = 10\text{ mA}, I_B = 5\text{ mA}$) LMUN5230T1/LMUN5231T1 ($I_C = 10\text{ mA}, I_B = 1\text{ mA}$) LMUN5215T1/LMUN5216T1/ LMUN5232T1/LMUN5233T1/LMUN5234T1 | $V_{CE(sat)}$ | – | – | 0.25 | Vdc | | |
| Output Voltage (on) ($V_{CC} = 5.0\text{ V}, V_B = 2.5\text{ V}, R_L = 1.0\text{ k}\Omega$) | LMUN5211T1G | V_{OL} | – | – | 0.2 | Vdc | |
| | LMUN5212T1G | | – | – | 0.2 | | |
| | LMUN5214T1G | | – | – | 0.2 | | |
| | LMUN5215T1G | | – | – | 0.2 | | |
| | LMUN5216T1G | | – | – | 0.2 | | |
| | LMUN5230T1G | | – | – | 0.2 | | |
| | LMUN5231T1G | | – | – | 0.2 | | |
| | LMUN5232T1G | | – | – | 0.2 | | |
| | LMUN5233T1G | | – | – | 0.2 | | |
| | LMUN5234T1G | | – | – | 0.2 | | |
| | LMUN5235T1G | | – | – | 0.2 | | |
| | ($V_{CC} = 5.0\text{ V}, V_B = 3.5\text{ V}, R_L = 1.0\text{ k}\Omega$) | | LMUN5213T1G | – | – | | 0.2 |
| | ($V_{CC} = 5.0\text{ V}, V_B = 5.5\text{ V}, R_L = 1.0\text{ k}\Omega$) | | LMUN5236T1G | – | – | | 0.2 |
| ($V_{CC} = 5.0\text{ V}, V_B = 4.0\text{ V}, R_L = 1.0\text{ k}\Omega$) | LMUN5237T1G | – | – | 0.2 | | | |

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

LMUN5211T1G Series

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|-----------|-----|-----|-----|------------------|
| ON CHARACTERISTICS (Note 5.) (Continued) | | | | | |
| Output Voltage (off) ($V_{CC} = 5.0\text{ V}$, $V_B = 0.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 0.050\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 0.25\text{ V}$, $R_L = 1.0\text{ k}\Omega$) | V_{OH} | 4.9 | – | – | Vdc |
| Input Resistor | R_1 | 7.0 | 10 | 13 | $\text{k}\Omega$ |
| Resistor Rati | R_1/R_2 | 0.8 | 1.0 | 1.2 | |

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

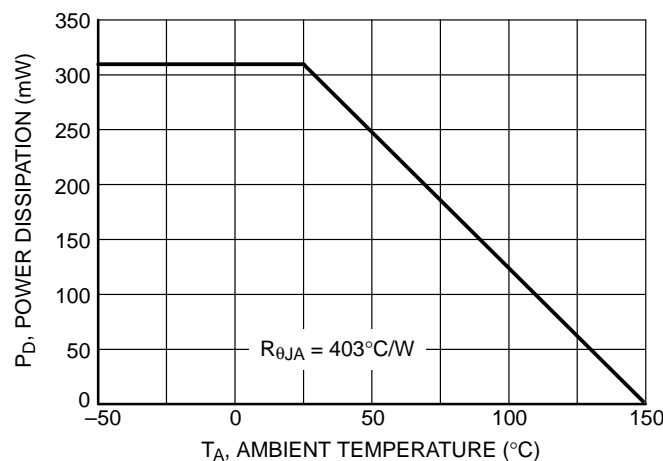


Figure 1. Derating Curve

LMUN5211T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5211T1G

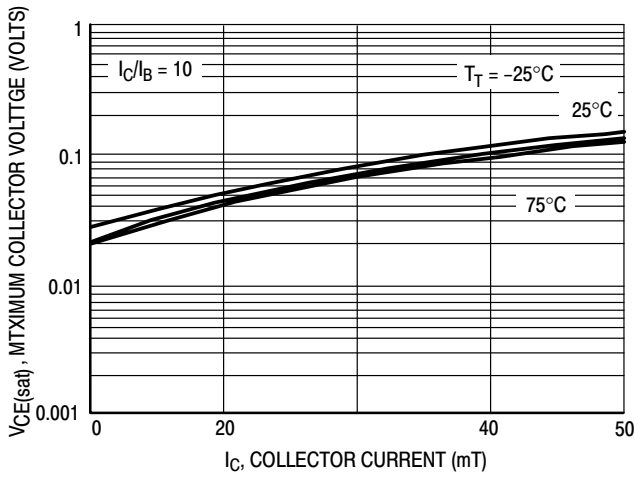


Figure 2. $V_{CE(sat)}$ versus I_C

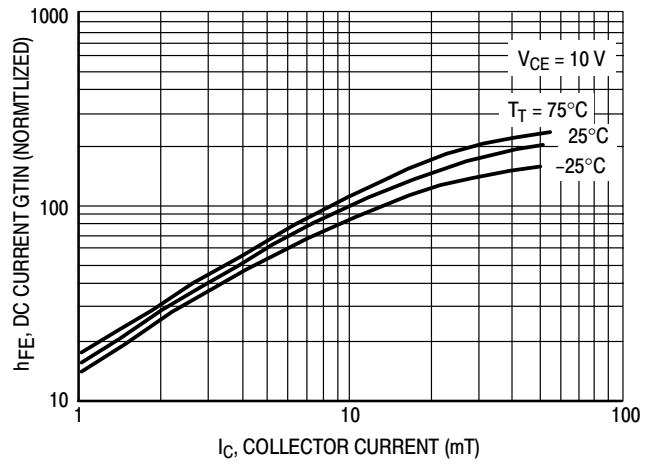


Figure 3. DC Current Gain

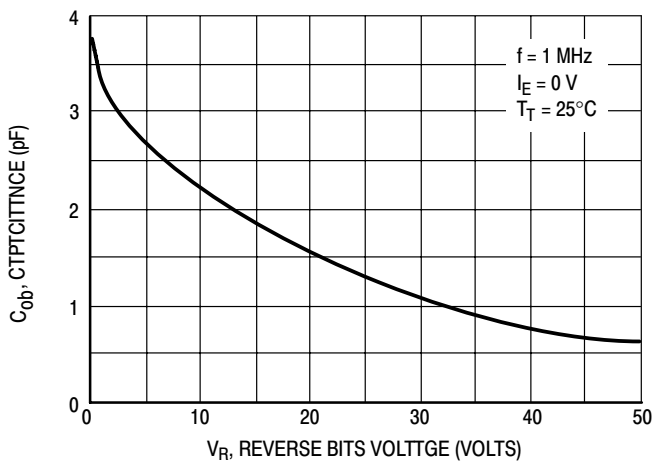


Figure 4. Output Capacitance

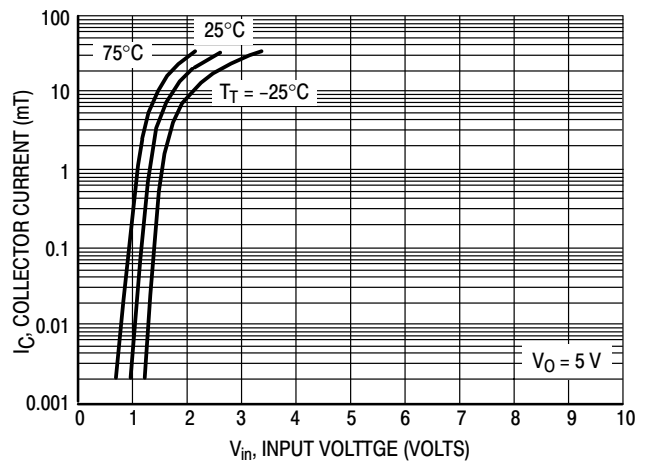


Figure 5. Output Current versus Input Voltage

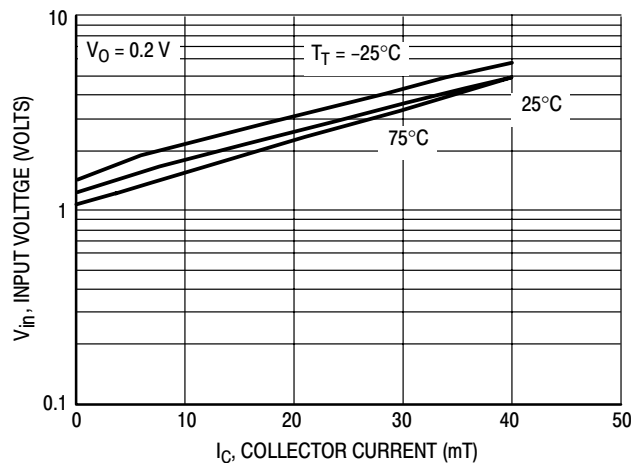


Figure 6. Input Voltage versus Output Current

LMUN5211T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5212T1G

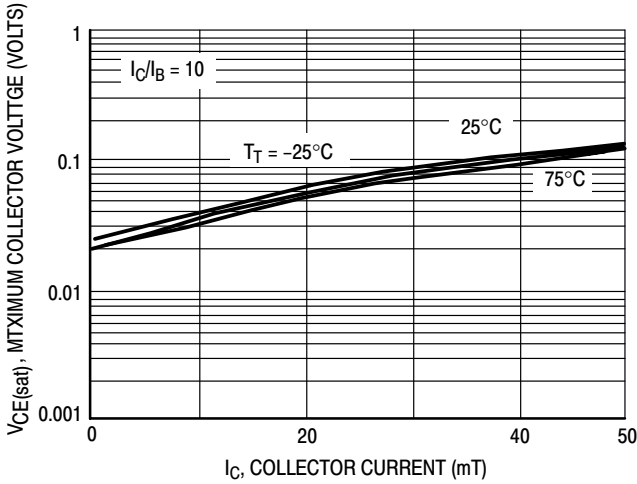


Figure 7. $V_{CE(sat)}$ versus I_C

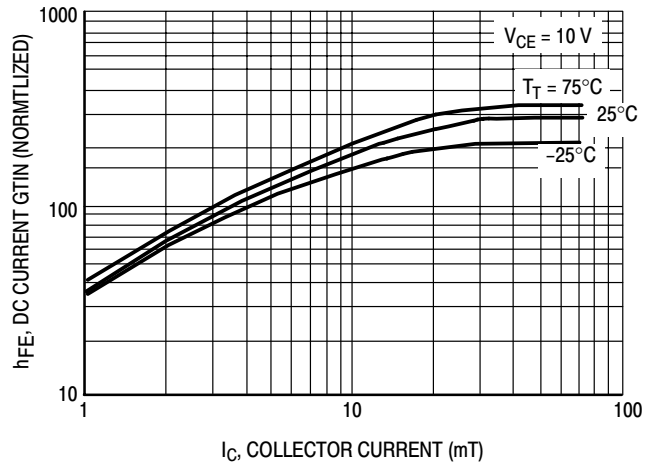


Figure 8. DC Current Gain

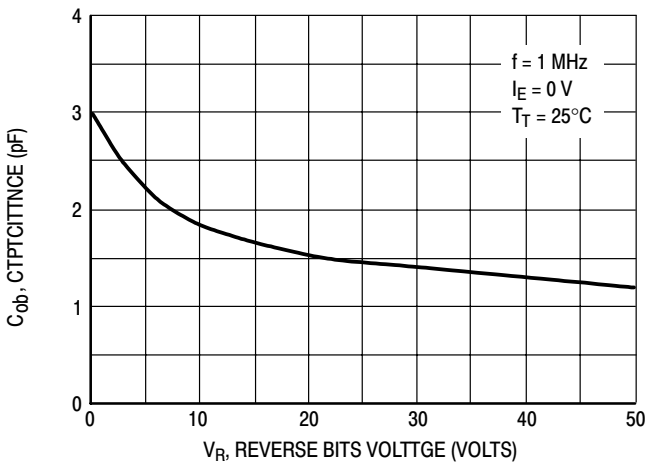


Figure 9. Output Capacitance

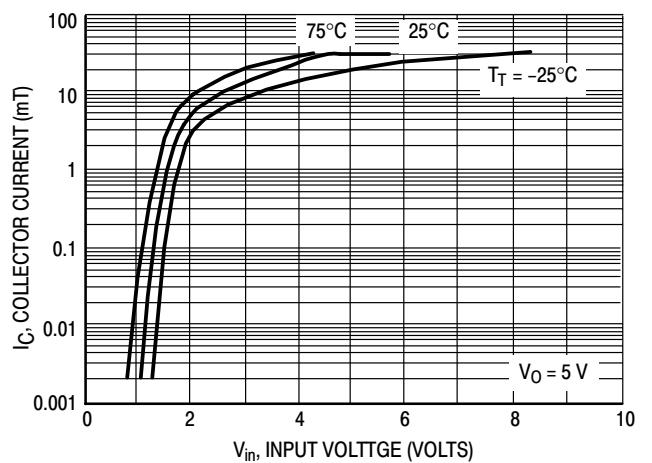


Figure 10. Output Current versus Input Voltage

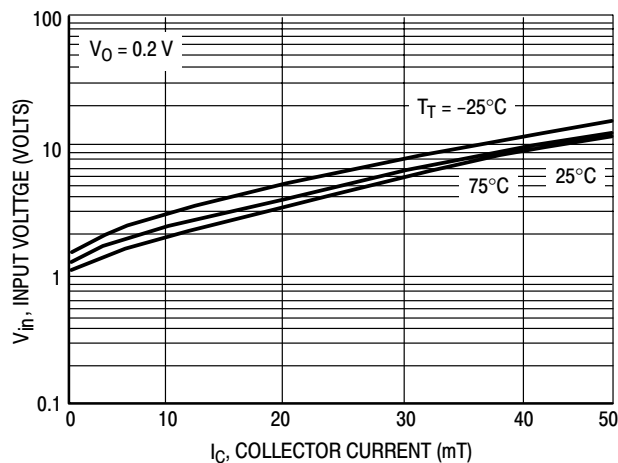


Figure 11. Input Voltage versus Output Current

LMUN5211T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5213T1G

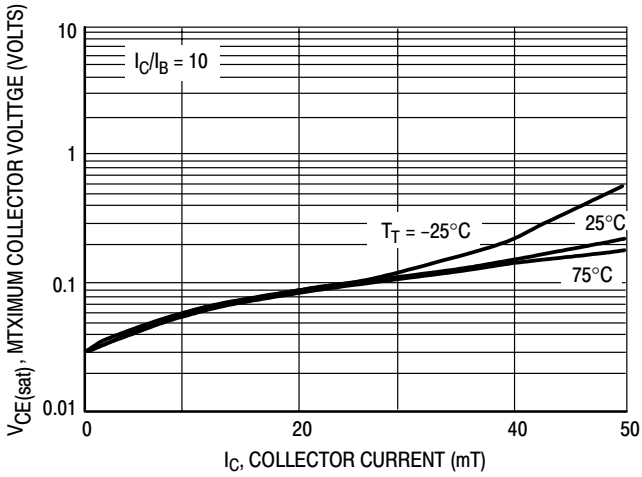


Figure 12. $V_{CE(sat)}$ versus I_C

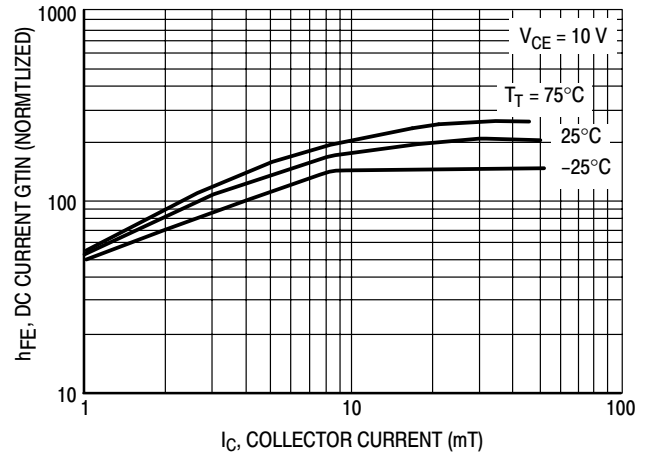


Figure 13. DC Current Gain

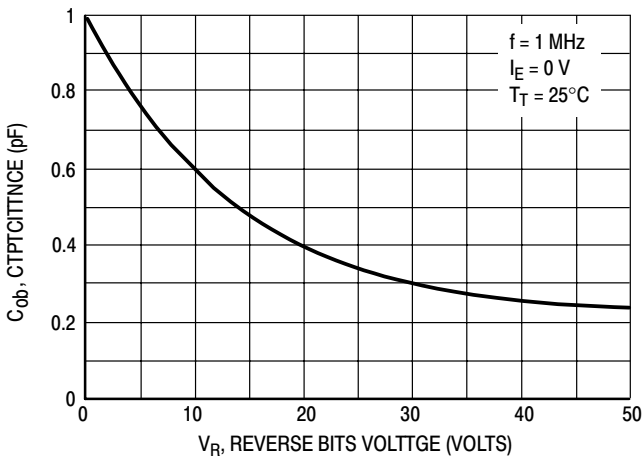


Figure 14. Output Capacitance

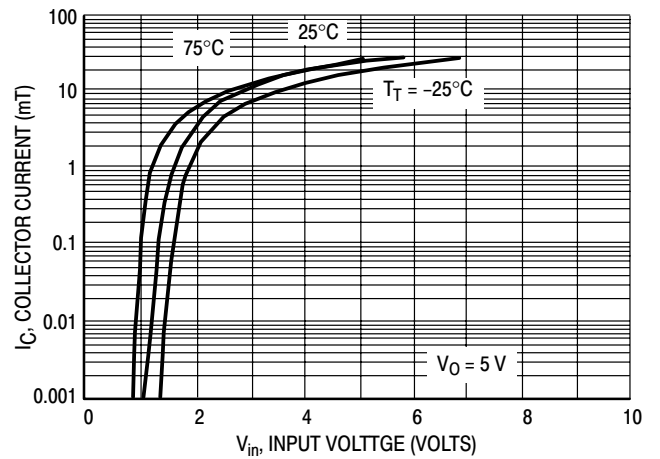


Figure 15. Output Current versus Input Voltage

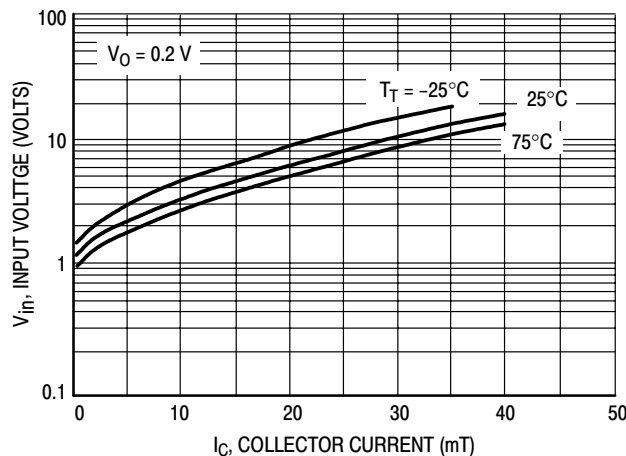


Figure 16. Input Voltage versus Output Current

LMUN5211T1G Series

TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5214T1G

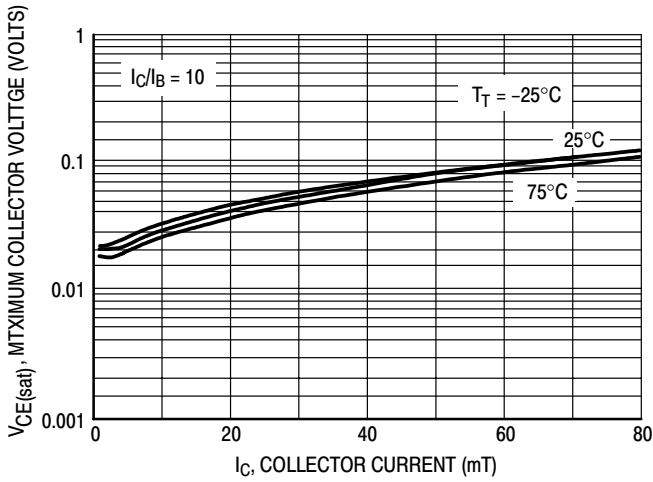


Figure 17. $V_{CE(sat)}$ versus I_C

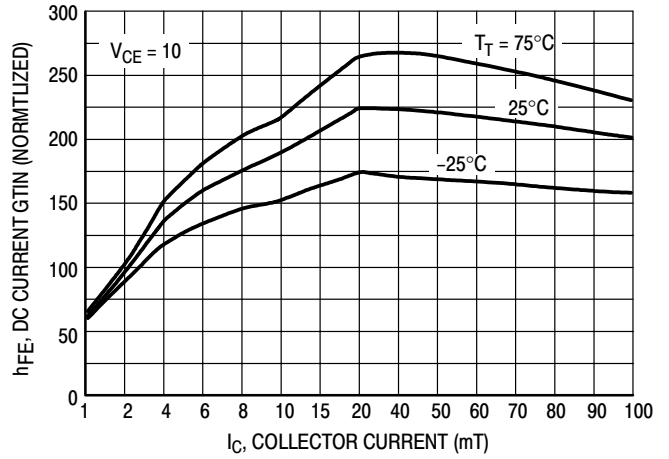


Figure 18. DC Current Gain

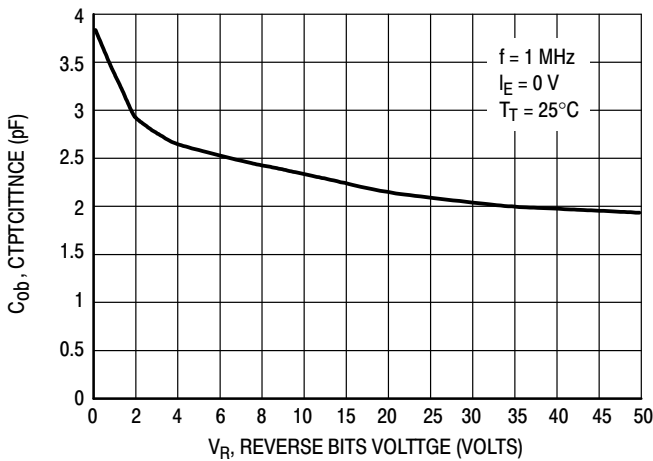


Figure 19. Output Capacitance

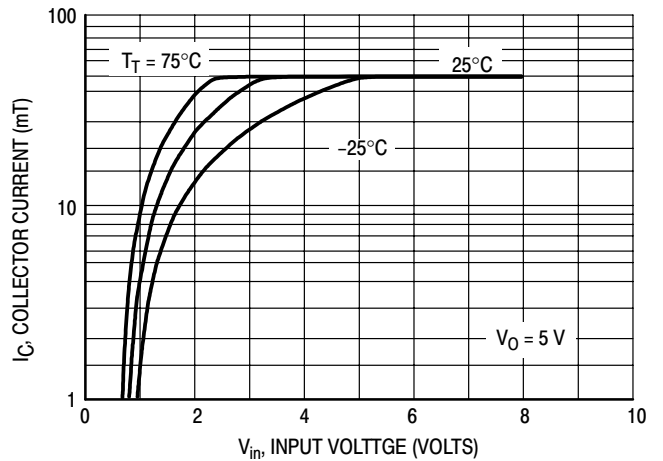


Figure 20. Output Current versus Input Voltage

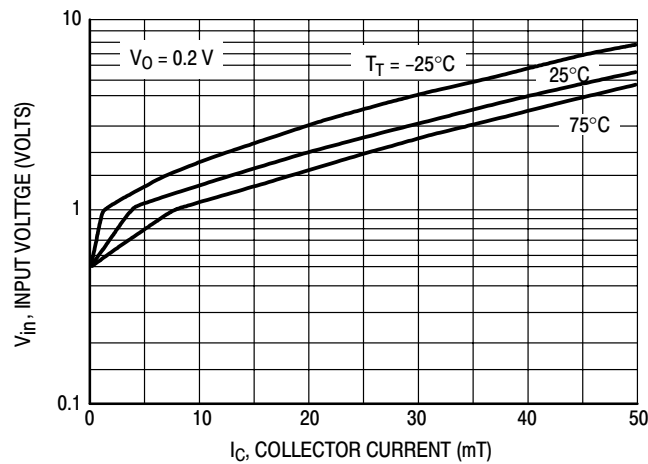


Figure 21. Input Voltage versus Output Current

LMUN5211T1G Series

TYPICAL APPLICATIONS FOR NPN BRTs

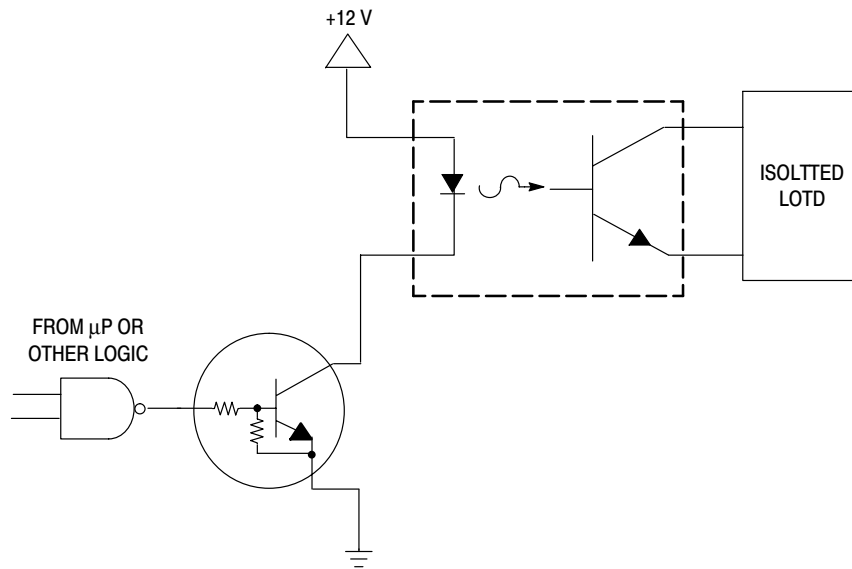


Figure 22. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

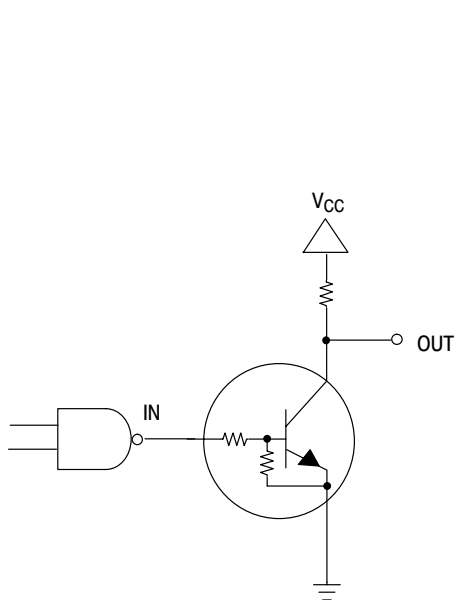


Figure 23. Open Collector Inverter: Inverts the Input Signal

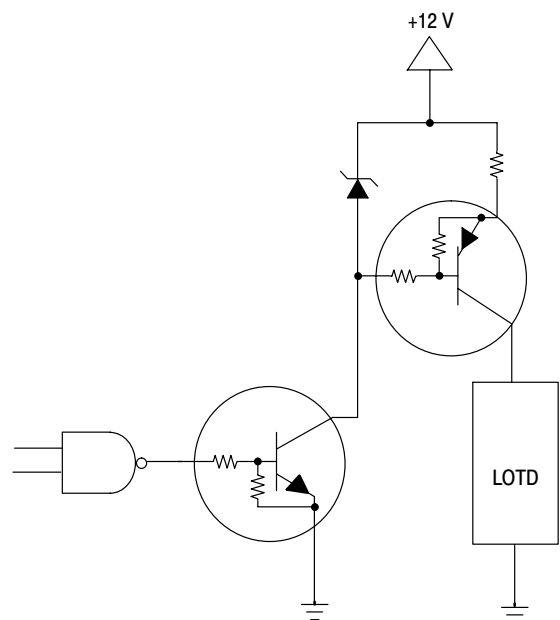


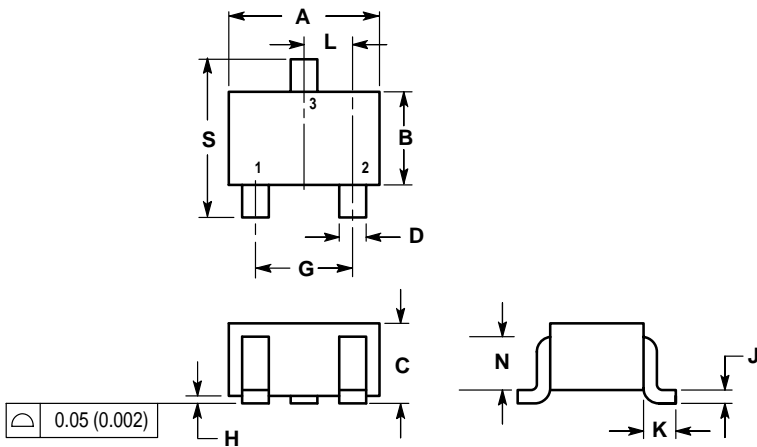
Figure 24. Inexpensive, Unregulated Current Source

LMUN5211T1G Series

SC-70 / SOT-323

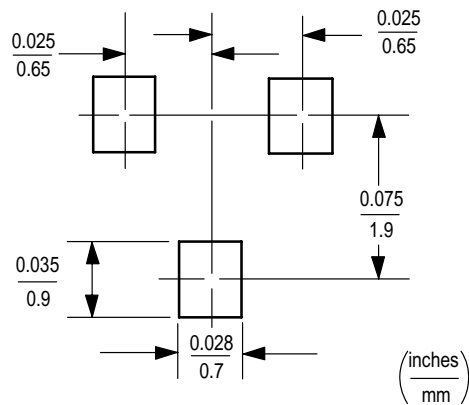
NOTES:

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



| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.032 | 0.040 | 0.80 | 1.00 |
| D | 0.012 | 0.016 | 0.30 | 0.40 |
| G | 0.047 | 0.055 | 1.20 | 1.40 |
| H | 0.000 | 0.004 | 0.00 | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.017 REF | | 0.425 REF | |
| L | 0.026 BSC | | 0.650 BSC | |
| N | 0.028 REF | | 0.700 REF | |
| S | 0.079 | 0.095 | 2.00 | 2.40 |

- PIN 1. BASE
2. EMITTER
3. COLLECTOR



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[NTE195A](#) [NTE92](#) [C4460](#) [2N4401-A](#) [2N6728](#) [2SA1419T-TD-H](#) [2SA2126-E](#) [2SB1204S-TL-E](#) [2SC2712S-GR,LF](#) [2SC5488A-TL-H](#)
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[MJE340](#) [US6T6TR](#) [NJL0281DG](#) [732314D](#) [CPH3121-TL-E](#) [CPH6021-TL-H](#) [873787E](#) [IMZ2AT108](#) [UMX21NTR](#) [MCH6102-TL-E](#)
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