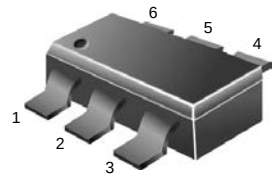
# Dual Bias Resistor Transistors

## PNP Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

**LMUN5111DW1T1G Series**

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. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the LMUN5111DW1T1G series, two BRT devices are housed in the SOT–363 package which is ideal for low–power surface mount applications where board space is at a premium.

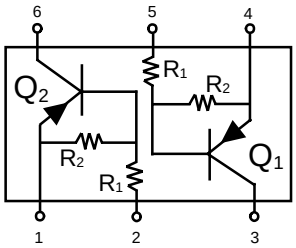
. Simplifies Circuit Design
. Reduces Board Space
. Reduces Component Count
. Available in 8 mm, 7 inch/3000 Unit Tape and Reel
. We declare that the material of product compliance with RoHS requirements.




SC-88/SOT-363

### Ordering Information

| Device | Package | Shipping |
|---|---|---|
| LMUN51XXDW1T1G | SC-88 | 3000/Tape&Reel |
| LMUN51XXDW1T3G | SC-88 | 10000/Tape&Reel |




**MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted, common for $Q_1$ and $Q_2$)

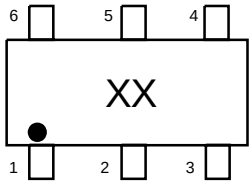
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | –50 | Vdc |
| Collector-Emitter Voltage | $V_{CEO}$ | –50 | Vdc |
| Collector Current | $I_C$ | –100 | mAdc |

**THERMAL CHARACTERISTICS**

| Characteristic (One Junction Heated) | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation $T_A$ = 25°C | $P_D$ | 187 (Note 1.)<br>256 (Note 2.) | mW |
| Derate above 25°C | | 1.5 (Note 1.)<br>2.0 (Note 2.) | mW/°C |
| Thermal Resistance – Junction-to-Ambient | $R_{\theta JA}$ | 670 (Note 1.)<br>490 (Note 2.) | °C/W |
| **Characteristic (Both Junctions Heated)** | **Symbol** | **Max** | **Unit** |
| Total Device Dissipation $T_A$ = 25°C | $P_D$ | 250 (Note 1.)<br>385 (Note 2.) | mW |
| Derate above 25°C | | 2.0 (Note 1.)<br>3.0 (Note 2.) | mW/°C |
| Thermal Resistance – Junction-to-Ambient | $R_{\theta JA}$ | 493 (Note 1.)<br>325 (Note 2.) | °C/W |
| Thermal Resistance – Junction-to-Lead | $R_{\theta JL}$ | 188 (Note 1.)<br>208 (Note 2.) | °C/W |
| Junction and Storage Temperature | $T_J$, $T_{stg}$ | –55 to +150 | °C |

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

**MARKING DIAGRAM**




xx = Device Marking
(See Page 2)

**DEVICE MARKING INFORMATION**

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

**DEVICE MARKING AND RESISTOR VALUES**

| Device | Package | Marking | $R_1$(K) | $R_2$(K) | Shipping |
|---|---|---|---|---|---|
| LMUN5111DW1T1G | SOT–363 | 0A | 10 | 10 | 3000/Tape & Reel |
| LMUN5112DW1T1G | SOT–363 | 0B | 22 | 22 | 3000/Tape & Reel |
| LMUN5113DW1T1G | SOT–363 | 0C | 47 | 47 | 3000/Tape & Reel |
| LMUN5114DW1T1G | SOT–363 | 0D | 10 | 47 | 3000/Tape & Reel |
| LMUN5115DW1T1G (Note 3.) | SOT–363 | 0E | 10 | – | 3000/Tape & Reel |
| LMUN5116DW1T1G (Note 3.) | SOT–363 | 0F | 4.7 | – | 3000/Tape & Reel |
| LMUN5130DW1T1G (Note 3.) | SOT–363 | 0G | 1.0 | 1.0 | 3000/Tape & Reel |
| LMUN5131DW1T1G (Note 3.) | SOT–363 | 0H | 2.2 | 2.2 | 3000/Tape & Reel |
| LMUN5132DW1T1G (Note 3.) | SOT–363 | 0J | 4.7 | 4.7 | 3000/Tape & Reel |
| LMUN5133DW1T1G (Note 3.) | SOT–363 | 0K | 4.7 | 47 | 3000/Tape & Reel |
| LMUN5134DW1T1G (Note 3.) | SOT–363 | 0L | 22 | 47 | 3000/Tape & Reel |
| LMUN5135DW1T1G (Note 3.) | SOT–363 | 0M | 2.2 | 47 | 3000/Tape & Reel |
| LMUN5136DW1T1G (Note 3.) | SOT–363 | 0N | 100 | 100 | 3000/Tape & Reel |
| LMUN5137DW1T1G (Note 3.) | SOT–363 | 0P | 47 | 22 | 3000/Tape & Reel |

**ELECTRICAL CHARACTERISTICS**

($T_A$ = 25°C unless otherwise noted, common for $Q_1$ and $Q_2$ )

| 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 | LMUN5111DW1T1G | $I_{EBO}$ | – | – | –0.5 | mAdc |
| ($V_{EB}$ = –6.0 V, $I_C$ = 0) | LMUN5112DW1T1G | | – | – | –0.2 | |
| | LMUN5113DW1T1G | | – | – | –0.1 | |
| | LMUN5114DW1T1G | | – | – | –0.2 | |
| | LMUN5115DW1T1G | | – | – | –0.9 | |
| | LMUN5116DW1T1G | | – | – | –1.9 | |
| | LMUN5130DW1T1G | | – | – | –4.3 | |
| | LMUN5131DW1T1G | | – | – | –2.3 | |
| | LMUN5132DW1T1G | | – | – | –1.5 | |
| | LMUN5133DW1T1G | | – | – | –0.18 | |
| | LMUN5134DW1T1G | | – | – | –0.13 | |
| | LMUN5135DW1T1G | | – | – | –0.2 | |
| | LMUN5136DW1T1G | | – | – | –0.05 | |
| | LMUN5137DW1T1G | | – | – | –0.13 | |
| 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 |
| **ON CHARACTERISTICS** (Note 4.) | | | | | | |
| Collector-Emitter Saturation Voltage ($I_C$= –10mA,$I_E$= –0.3 mA) | | $V_{CE(sat)}$ | – | – | –0.25 | Vdc |
| ($I_C$= –10mA, $I_B$= –5mA) LMUN5130DW1T1G/LMUN5131DW1T1G | | | | | | |
| ($I_C$= –10mA, $I_B$= –1mA) LMUN5115DW1T1/LMUN5116DW1T1G | | | | | | |
| LMUN5132DW1T1G/LMUN5133DW1T1G/LMUN5134DW1T1G | | | | | | |

3. New resistor combinations. Updated curves to follow in subsequent data sheets.
4. Pulse Test: Pulse Width < 300 µs, Duty Cycle < 2.0%

**ELECTRICAL CHARACTERISTICS**

($T_A$ = 25°C unless otherwise noted, common for $Q_1$ and $Q_2$,) (Continued)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **ON CHARACTERISTICS**(Note 5.) | | | | | | |
| DC Current Gain | LMUN5111DW1T1G | $h_{FE}$ | 35 | 60 | – | |
| ($V_{CE}$ = –10 V, $I_C$ = –5.0 mA) | LMUN5112DW1T1G | | 60 | 100 | – | |
| | LMUN5113DW1T1G | | 80 | 140 | – | |
| | LMUN5114DW1T1G | | 80 | 140 | – | |
| | LMUN5115DW1T1G | | 160 | 250 | – | |
| | LMUN5116DW1T1G | | 160 | 250 | – | |
| | LMUN5130DW1T1G | | 3.0 | 5.0 | – | |
| | LMUN5131DW1T1G | | 8.0 | 15 | – | |
| | LMUN5132DW1T1G | | 15 | 27 | – | |
| | LMUN5133DW1T1G | | 80 | 140 | – | |
| | LMUN5134DW1T1G | | 80 | 130 | – | |
| | LMUN5135DW1T1G | | 80 | 140 | – | |
| | LMUN5136DW1T1G | | 80 | 130 | – | |
| | LMUN5137DW1T1G | | 80 | 140 | – | |
| Output Voltage (on) | | $V_{OL}$ | | | | Vdc |
| ($V_{CC}$ = –5.0 V, $V_B$ = –2.5 V, $R_L$ = 1.0 kΩ) | LMUN5111DW1T1G | | – | – | –0.2 | |
| | LMUN5112DW1T1G | | – | – | –0.2 | |
| | LMUN5114DW1T1G | | – | – | –0.2 | |
| | LMUN5115DW1T1G | | – | – | –0.2 | |
| | LMUN5116DW1T1G | | – | – | –0.2 | |
| | LMUN5130DW1T1G | | – | – | –0.2 | |
| | LMUN5131DW1T1G | | – | – | –0.2 | |
| | LMUN5132DW1T1G | | – | – | –0.2 | |
| | LMUN5133DW1T1G | | – | – | –0.2 | |
| | LMUN5134DW1T1G | | – | – | –0.2 | |
| | LMUN5135DW1T1G | | – | – | –0.2 | |
| ($V_{CC}$ = –5.0 V, $V_B$ = –3.5 V, $R_L$ = 1.0 kΩ) | LMUN5113DW1T1G | | – | – | –0.2 | |
| ($V_{CC}$ = –5.0 V, $V_B$ = –5.5 V, $R_L$ = 1.0 kΩ) | LMUN5136DW1T1G | | – | – | –0.2 | |
| ($V_{CC}$ = –5.0 V, $V_B$ = –4.0 V, $R_L$ = 1.0 kΩ) | LMUN5137DW1T1G | | – | – | –0.2 | |
| Output Voltage (off) ($V_{CC}$ = –5.0 V, $V_B$ = –0.5 V, $R_L$ = 1.0 kΩ) | | $V_{OH}$ | –4.9 | – | – | Vdc |
| ($V_{CC}$ = –5.0 V, $V_B$ = –0.05 V, $R_L$ = 1.0 kΩ) | LMUN5130DW1T1G | | | | | |
| ($V_{CC}$ = –5.0 V, $V_B$ = –0.25 V, $R_L$ = 1.0 kΩ) | LMUN5115DW1T1G | | | | | |
| | LMUN5116DW1T1G | | | | | |
| | LMUN5131DW1T1G | | | | | |
| | LMUN5133DW1T1G | | | | | |

**ELECTRICAL CHARACTERISTICS**

($T_A$ = 25°C unless otherwise noted, common for $Q_1$ and $Q_2$,) (Continued)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **ON CHARACTERISTICS**(Note 5.) | | | | | | |
| Input Resistor | LMUN5111DW1T1G | $R_1$ | 7.0 | 10 | 13 | kΩ |
| | LMUN5112DW1T1G | | 15.4 | 22 | 28.6 | |
| | LMUN5113DW1T1G | | 32.9 | 47 | 61.1 | |
| | LMUN5114DW1T1G | | 7.0 | 10 | 13 | |
| | LMUN5115DW1T1G | | 7.0 | 10 | 13 | |
| | LMUN5116DW1T1G | | 3.3 | 4.7 | 6.1 | |
| | LMUN5130DW1T1G | | 0.7 | 1.0 | 1.3 | |
| | LMUN5131DW1T1G | | 1.5 | 2.2 | 2.9 | |
| | LMUN5132DW1T1G | | 3.3 | 4.7 | 6.1 | |
| | LMUN5133DW1T1G | | 3.3 | 4.7 | 6.1 | |
| | LMUN5134DW1T1G | | 15.4 | 22 | 28.6 | |
| | LMUN5135DW1T1G | | 1.54 | 2.2 | 2.86 | |
| | LMUN5136DW1T1G | | 70 | 100 | 130 | |
| | LMUN5137DW1T1G | | 32.9 | 47 | 61.1 | |
| Resistor Ratio | LMUN5111DW1T1G/LMUN5112DW1T1G | $R_1/R_2$ | | | | |
| | LMUN5113DW1T1G/LMUN5136DW1T1G | | 0.8 | 1.0 | 1.2 | |
| | LMUN5114DW1T1G/LMUN5115DW1T1G | | 0.17 | 0.21 | 0.25 | |
| | LMUN5116DW1T1G/LMUN5130DW1T1G | | – | – | – | |
| | LMUN5131DW1T1G/LMUN5132DW1T1G | | 0.8 | 1.0 | 1.2 | |
| | LMUN5133DW1T1G | | 0.055 | 0.1 | 0.185 | |
| | LMUN5134DW1T1G | | 0.38 | 0.47 | 0.56 | |
| | LMUN5135DW1T1G | | 0.038 | 0.047 | 0.056 | |
| | LMUN5137DW1T1G | | 1.7 | 2.1 | 2.6 | |

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

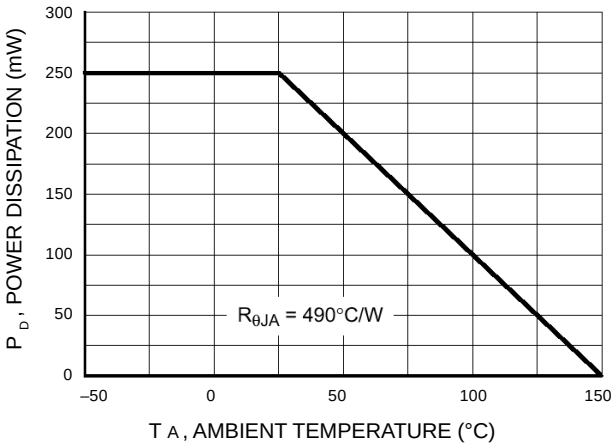



**Figure 1. Derating Curve**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5111DW1T1G

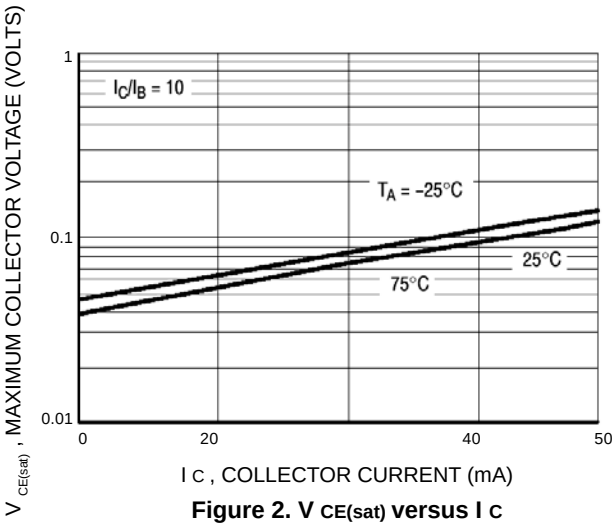



**Figure 2. V CE(sat) versus I C**

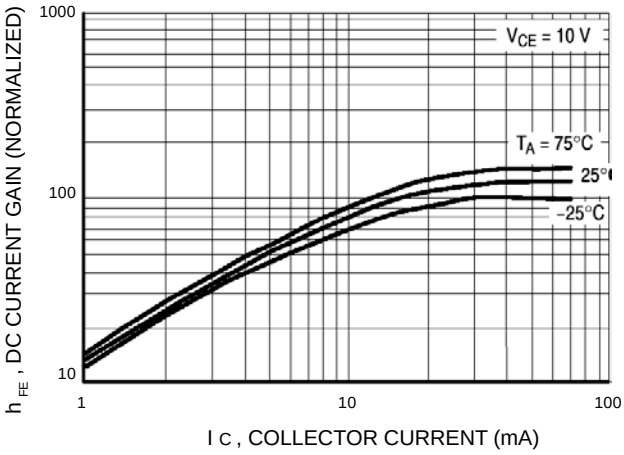



**Figure 3. DC Current Gain**

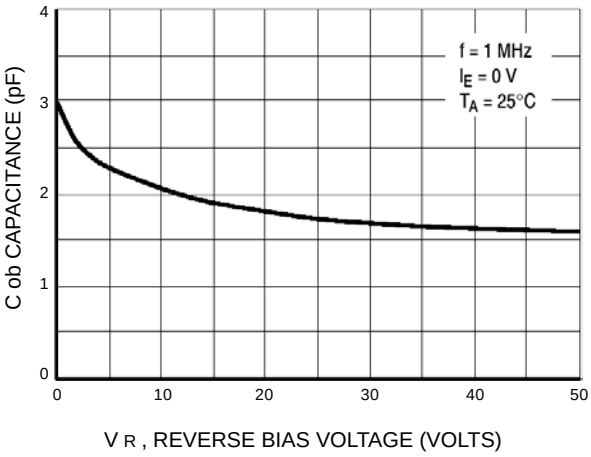



**Figure 4. Output Capacitance**

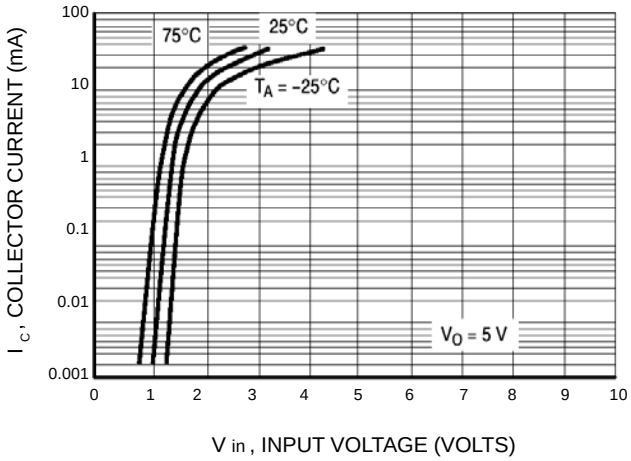



**Figure 5. Output Current versus Input Voltage**

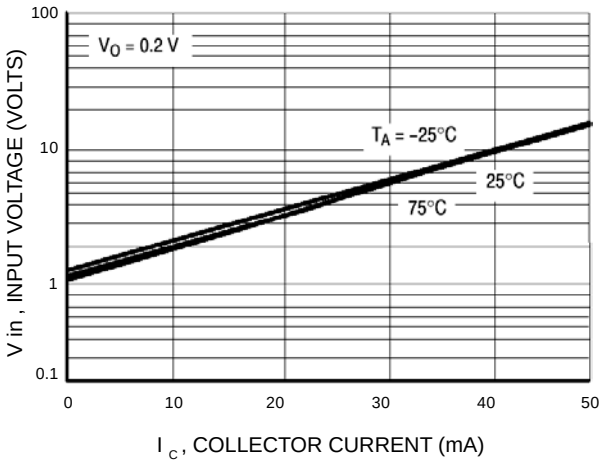



**Figure 6. Input Voltage versus Output Current**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5112DW1T1G

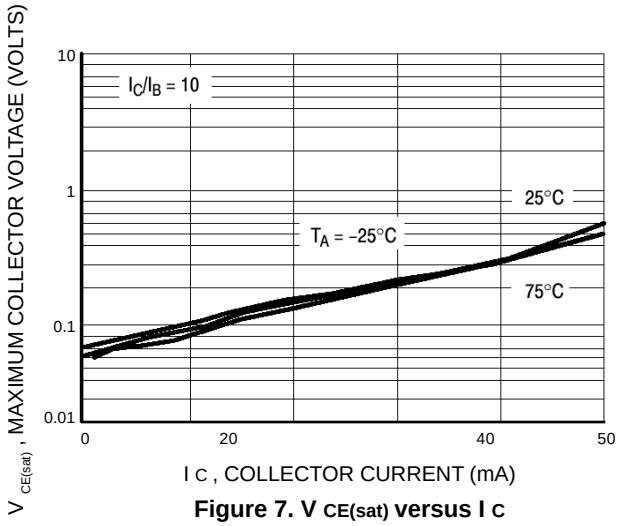



**Figure 7. V CE(sat) versus I C**

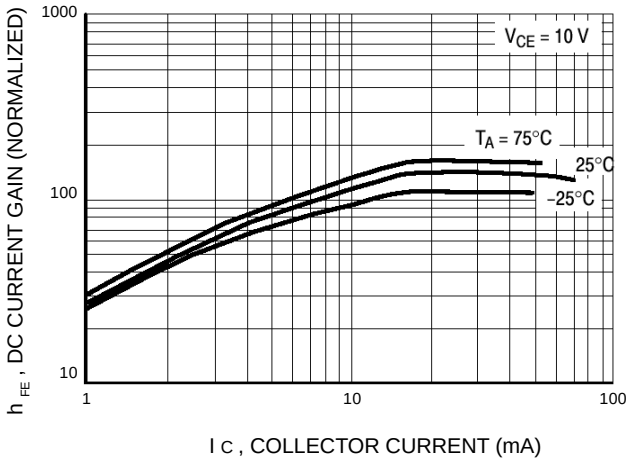



**Figure 8. DC Current Gain**

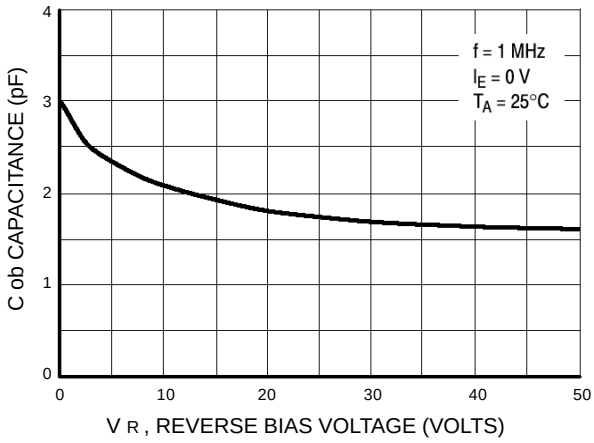



**Figure 9. Output Capacitance**

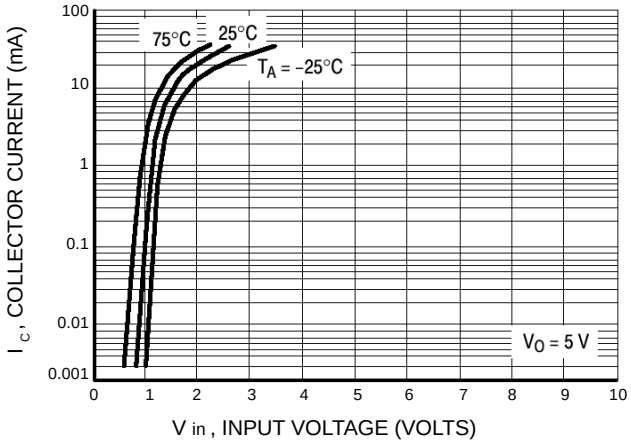



**Figure 10. Output Current versus Input voltage**

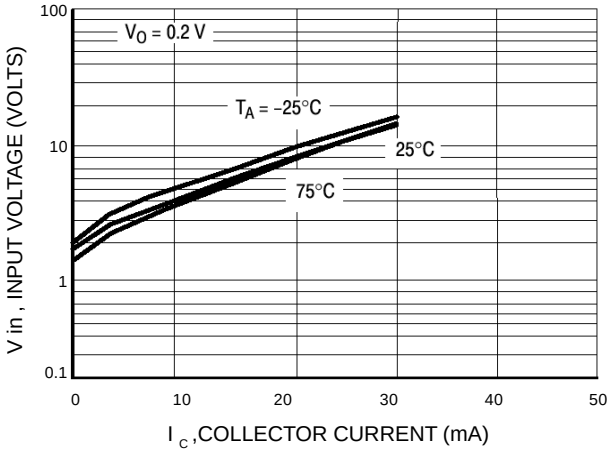



**Figure 11. Input Voltage versus Output Current**

**LMUN5111DW1T1G Series**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5113DW1T1G

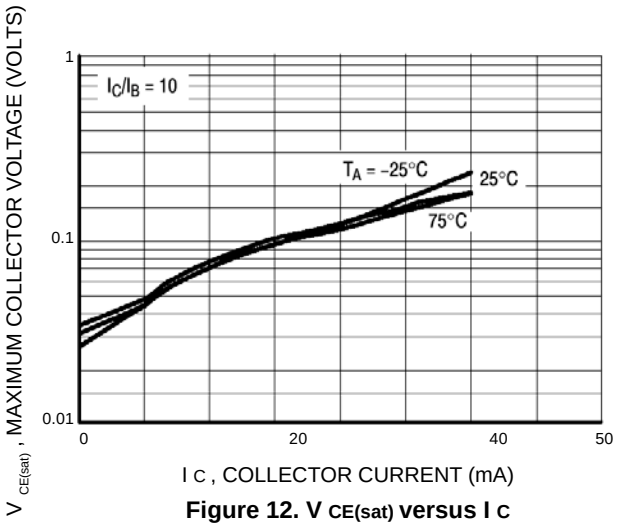



**Figure 12. V CE(sat) versus I C**

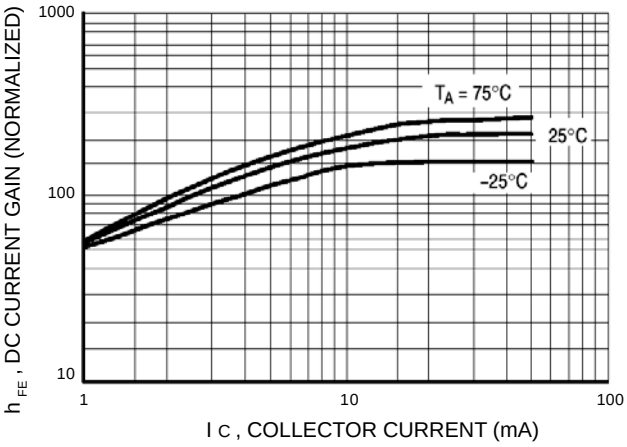



**Figure 13. DC Current Gain**

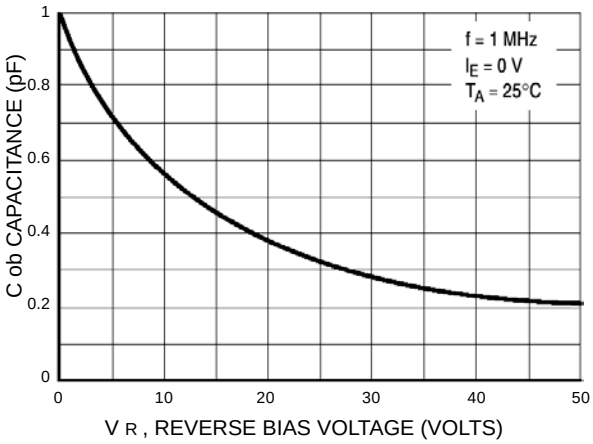



**Figure 14. Output Capacitance**

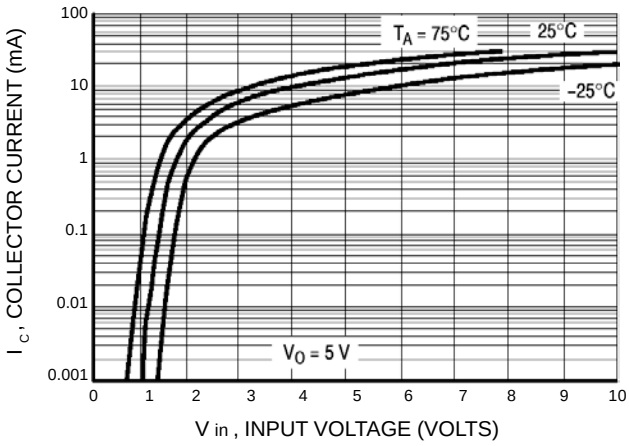



**Figure 15. Output Current versus Input oltage**

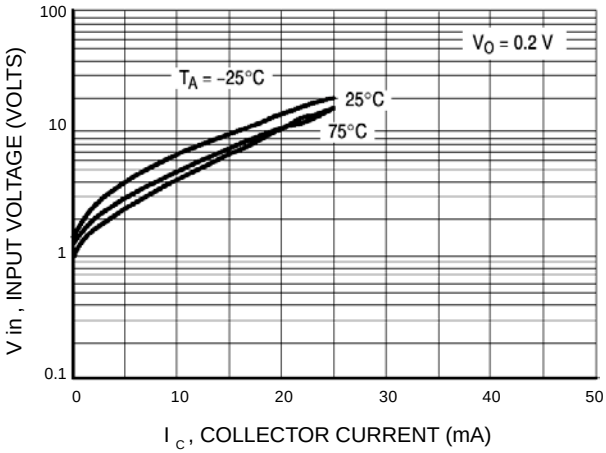



**Figure 16. Input Voltage versus Output Current**

**LMUN5111DW1T1G Series**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5114DW1T1G

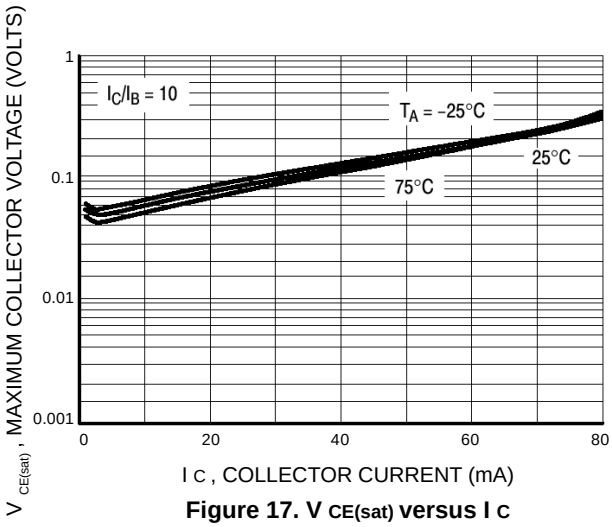



**Figure 17. V CE(sat) versus I C**

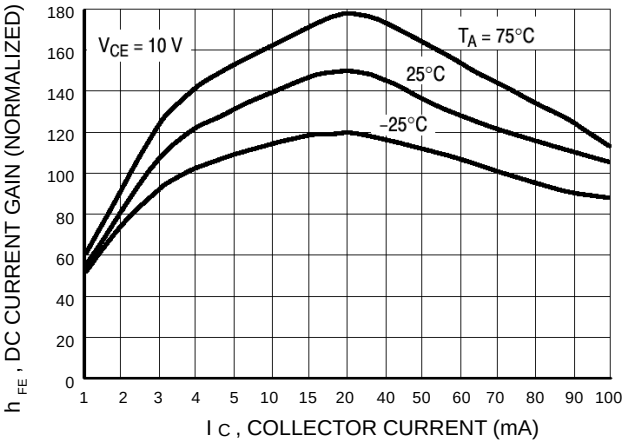



**Figure 18. DC Current Gain**

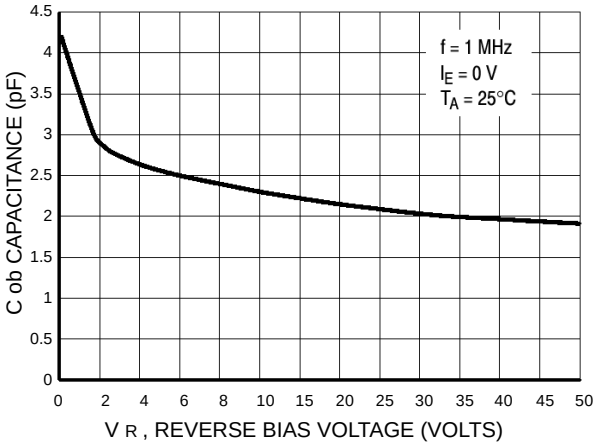



**Figure 19. Output Capacitance**

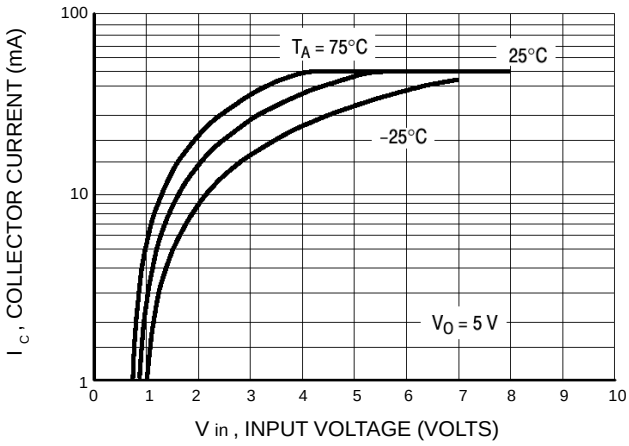



**Figure 20. Output Current versus Input oltage**

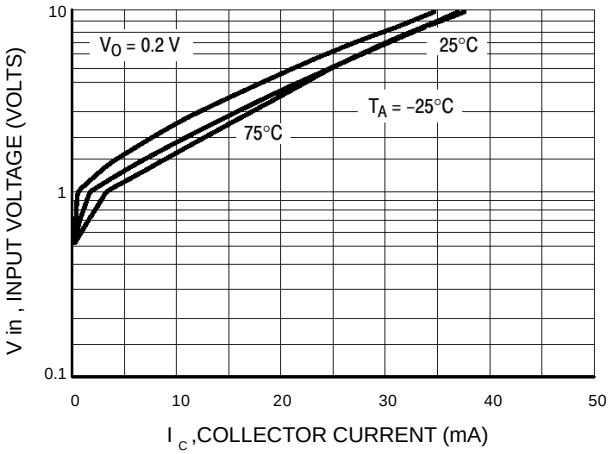



**Figure 21. Input Voltage versus Output Current**

**LMUN5111DW1T1G Series**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5115DW1T1G

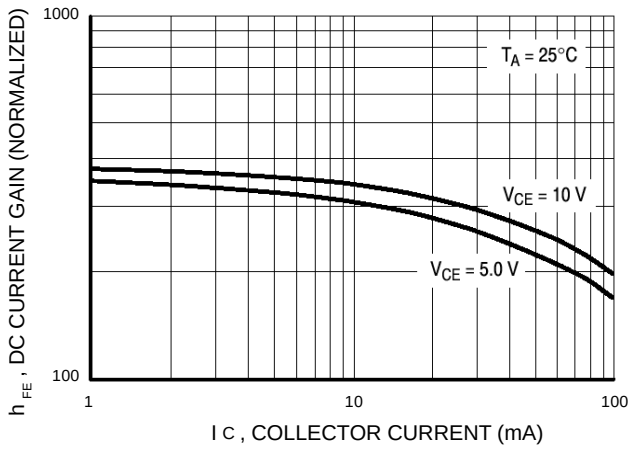



**Figure 22. DC Current Gain**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5116DW1T1

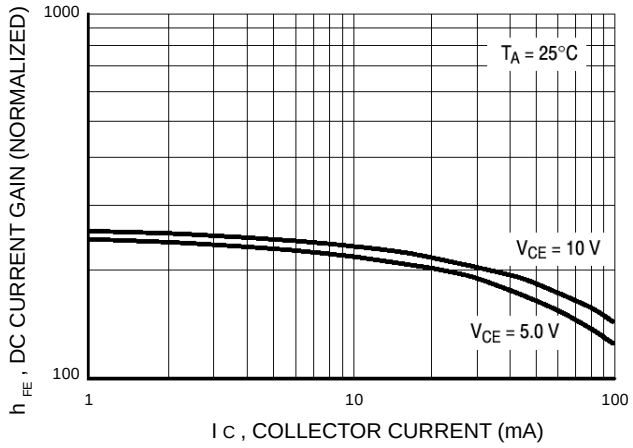



**Figure 23. DC Current Gain**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5136DW1T1G

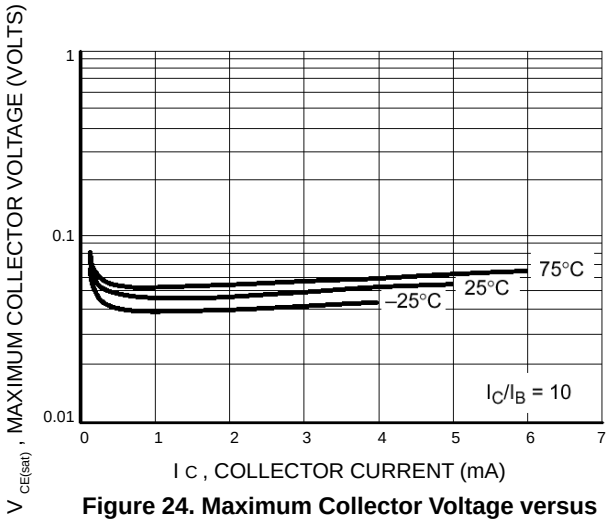



**Figure 24. Maximum Collector Voltage versus Collector Current**

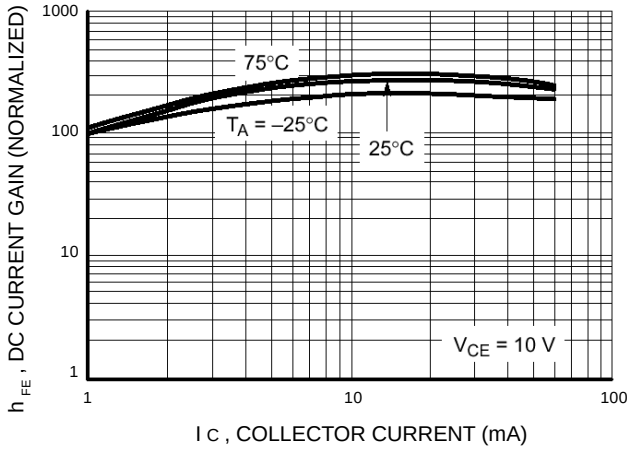



**Figure 25. DC Current Gain**

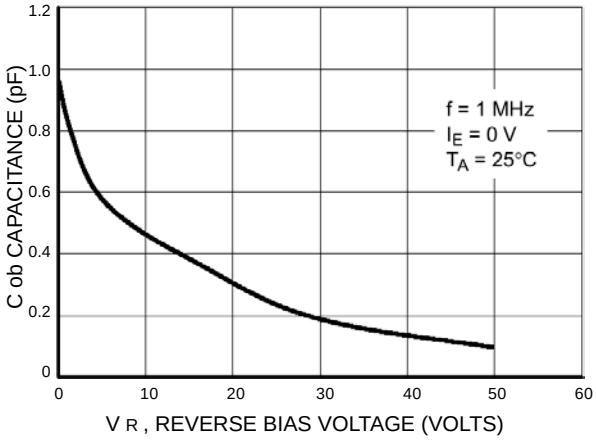



**Figure 26. Output Capacitance**

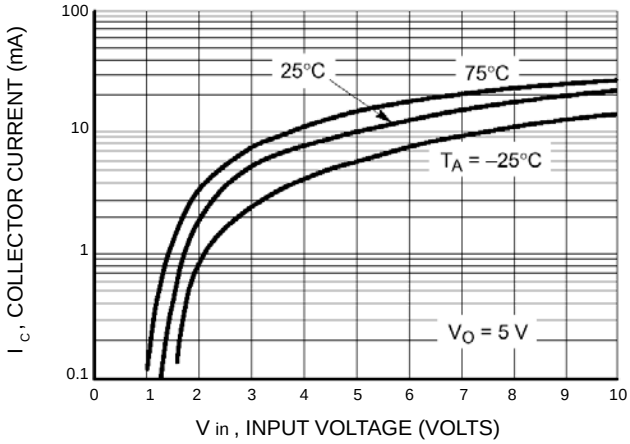



**Figure 27. Output Current versus Input oltage**

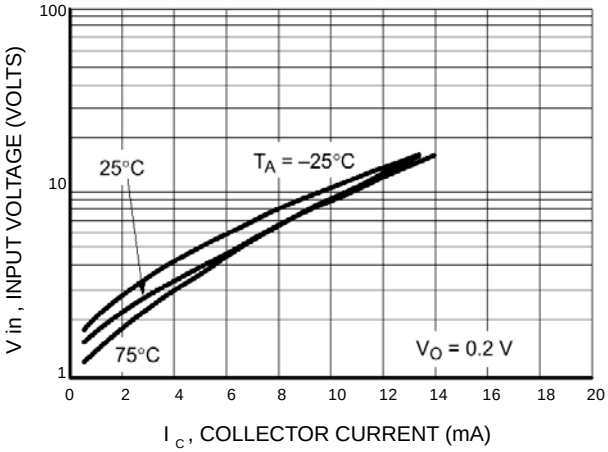



**Figure 28. Input Voltage versus Output Current**

## TYPICAL ELECTRICAL CHARACTERISTICS – LMUN5137DW1T1G

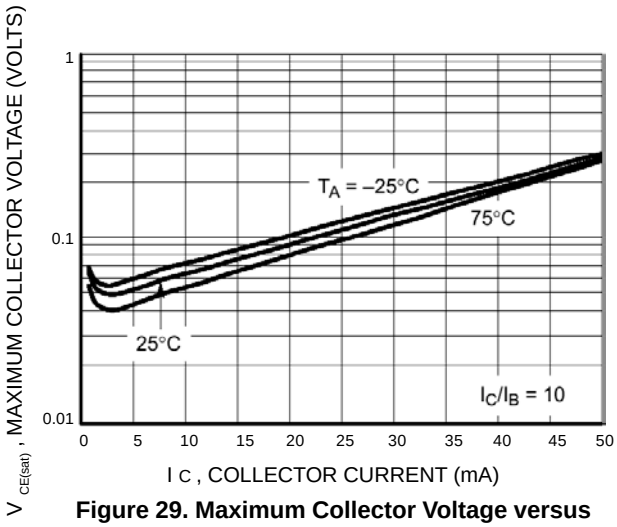



**Figure 29. Maximum Collector Voltage versus Collector Current**

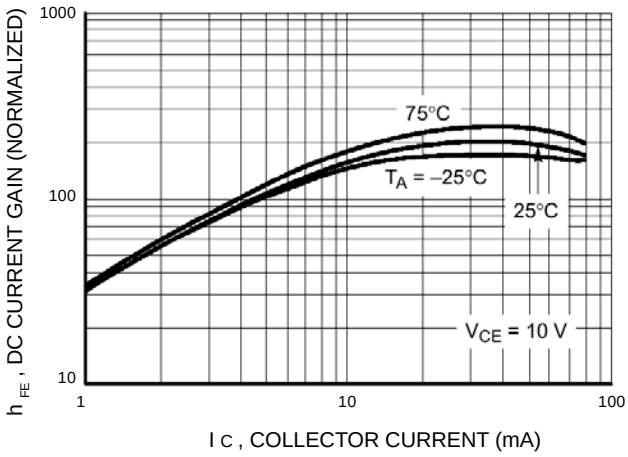



**Figure 30. DC Current Gain**

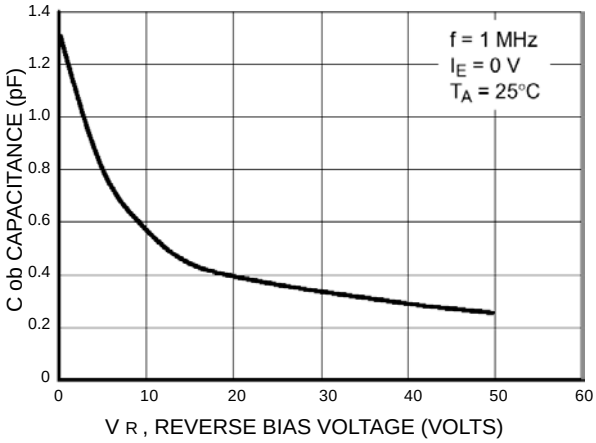



**Figure 31. Output Capacitance**

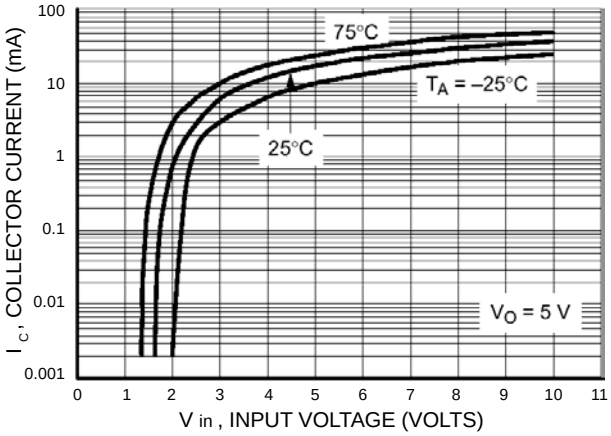



**Figure 32. Output Current versus Input oltage**

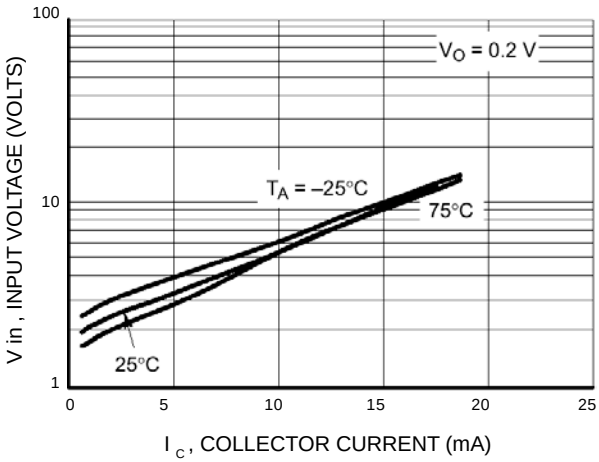
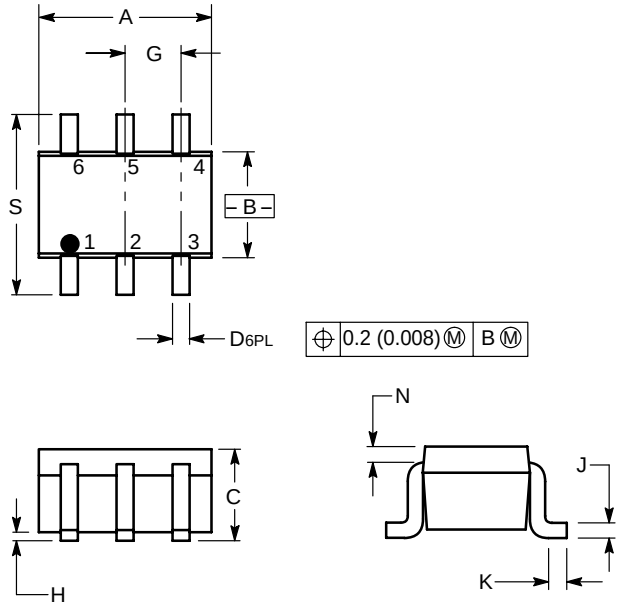



**Figure 33. Input Voltage versus Output Current**

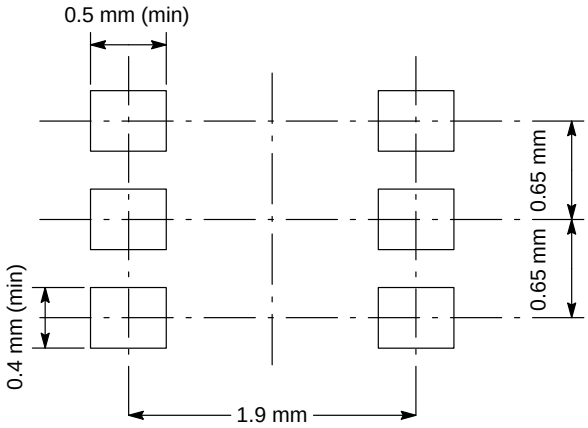
**LMUN5111DW1T1G Series**

SC−88/SOT−363




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 | 0.031 | 0.043 | 0.80 | 1.10 |
| D | 0.004 | 0.012 | 0.10 | 0.30 |
| G | 0.026 BSC | | 0.65 BSC | |
| H | --- | 0.004 | --- | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.004 | 0.012 | 0.10 | 0.30 |
| N | 0.008 REF | | 0.20 REF | |
| S | 0.079 | 0.087 | 2.00 | 2.20 |

PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4.EMITTER 1
5. BASE 1
6.COLLECTOR 2