

# UMC2NT1G, UMC3NT1G, UMC5NT1G

Preferred Devices

## Dual Common Base-Collector Bias Resistor Transistors

### NPN and PNP Silicon Surface Mount Transistors with Monolithic Bias Resistor 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. 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 UMC2NT1G series, two complementary BRT devices are housed in the SOT-353 package which is ideal for low power surface mount applications where board space is at a premium.

#### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7 inch/3000 Unit 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, common for  $Q_1$  and  $Q_2$ , - minus sign for  $Q_1$  (PNP) omitted)

| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage    | $V_{CB0}$ | 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

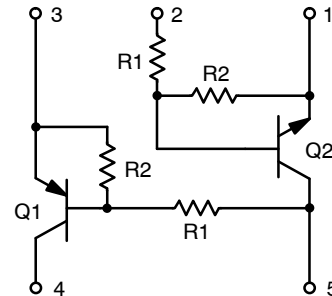
|   |                 |             |                           |
|---|-----------------|-------------|---------------------------|
| Thermal Resistance - Junction-to-Ambient (surface mounted)    | $R_{\theta JA}$ | 833         | $^\circ\text{C}/\text{W}$ |
| Operating and Storage Temperature Range                       | $T_J, T_{stg}$  | -65 to +150 | $^\circ\text{C}$          |
| Total Package Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1) | $P_D$           | 150         | mW                        |

1. Device mounted on a FR-4 glass epoxy printed circuit board using the minimum recommended footprint.



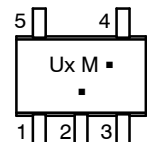
ON Semiconductor®

<http://onsemi.com>



SC-88A/SOT-353  
CASE 419A  
STYLE 6

#### MARKING DIAGRAM



Ux = Device Marking  
x = 2, 3 or 5  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

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

# UMC2NT1G, UMC3NT1G, UMC5NT1G

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### Q1 TRANSISTOR: PNP

#### OFF CHARACTERISTICS

|   |                  |   |   |     |      |
|---|------------------|---|---|-----|------|
| Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)    | I <sub>CBO</sub> | – | – | 100 | nAdc |
| Collector-Emitter Cutoff Current (V <sub>CB</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, I <sub>C</sub> = 0 mA) | I <sub>EBO</sub> | – | – | 0.2 | mAdc |
|   | UMC2NT1G         | – | – | 0.5 |      |
|   | UMC3NT1G         | – | – | 1.0 |      |
|   | UMC5NT1G / T2G   | – | – | –   |      |

#### ON CHARACTERISTICS

|   |                      |      |      |      |     |
|---|----------------------|------|------|------|-----|
| Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)                   | V <sub>(BR)CBO</sub> | 50   | –    | –    | Vdc |
| Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)               | V <sub>(BR)CEO</sub> | 50   | –    | –    | Vdc |
| DC Current Gain<br>(V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)                            | h <sub>FE</sub>      | 60   | 100  | –    |     |
|   | UMC2NT1G             | 35   | 60   | –    |     |
|   | UMC3NT1G             | 20   | 35   | –    |     |
|   | UMC5NT1G / T2G       | –    | –    | –    |     |
| Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)          | V <sub>CE(SAT)</sub> | –    | –    | 0.25 | Vdc |
| Output Voltage (on) (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 |
| Output Voltage (off) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ) | V <sub>OH</sub>      | 4.9  | –    | –    | Vdc |
| Input Resistor  | R1                   | 15.4 | 22   | 28.6 | kΩ  |
|   | UMC2NT1G             | 7.0  | 10   | 13   |     |
|   | UMC3NT1G             | 3.3  | 4.7  | 6.1  |     |
|   | UMC5NT1G / T2G       | –    | –    | –    |     |
| Resistor Ratio  | R1/R2                | 0.8  | 1.0  | 1.2  |     |
|   | UMC2NT1G             | 0.8  | 1.0  | 1.2  |     |
|   | UMC3NT1G             | 0.38 | 0.47 | 0.56 |     |
|   | UMC5NT1G / T2G       | –    | –    | –    |     |

### Q2 TRANSISTOR: NPN

#### OFF CHARACTERISTICS

|   |                  |   |   |     |      |
|---|------------------|---|---|-----|------|
| Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)    | I <sub>CBO</sub> | – | – | 100 | nAdc |
| Collector-Emitter Cutoff Current (V <sub>CB</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, I <sub>C</sub> = 0 mA) | I <sub>EBO</sub> | – | – | 0.2 | mAdc |
|   | UMC2NT1G         | – | – | 0.5 |      |
|   | UMC3NT1G         | – | – | 0.1 |      |
|   | UMC5NT1G / T2G   | – | – | –   |      |

#### ON CHARACTERISTICS

|   |                      |      |     |      |     |
|---|----------------------|------|-----|------|-----|
| Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)                   | V <sub>(BR)CBO</sub> | 50   | –   | –    | Vdc |
| Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)               | V <sub>(BR)CEO</sub> | 50   | –   | –    | Vdc |
| DC Current Gain<br>(V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)                            | h <sub>FE</sub>      | 60   | 100 | –    |     |
|   | UMC2NT1G             | 35   | 60  | –    |     |
|   | UMC3NT1G             | 80   | 140 | –    |     |
|   | UMC5NT1G / T2G       | –    | –   | –    |     |
| Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)          | V <sub>CE(SAT)</sub> | –    | –   | 0.25 | Vdc |
| Output Voltage (on) (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 |
| Output Voltage (off) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ) | V <sub>OH</sub>      | 4.9  | –   | –    | Vdc |
| Input Resistor  | R1                   | 15.4 | 22  | 28.6 | kΩ  |
|   | UMC2NT1G             | 7.0  | 10  | 13   |     |
|   | UMC3NT1G             | 33   | 47  | 61   |     |
|   | UMC5NT1G / T2G       | –    | –   | –    |     |
| Resistor Ratio  | R1/R2                | 0.8  | 1.0 | 1.2  |     |
|   | UMC2NT1G             | 0.8  | 1.0 | 1.2  |     |
|   | UMC3NT1G             | 0.8  | 1.0 | 1.2  |     |
|   | UMC5NT1G / T2G       | 0.8  | 1.0 | 1.2  |     |

# UMC2NT1G, UMC3NT1G, UMC5NT1G

## ORDERING INFORMATION

| Device   | Package                     | Shipping†          |
|----------|-----------------------------|--------------------|
| UMC2NT1G | SC-88A/SOT-353<br>(Pb-Free) | 3000 / Tape & Reel |
| UMC3NT1G | SC-88A/SOT-353<br>(Pb-Free) | 3000 / Tape & Reel |
| UMC3NT2G | SC-88A/SOT-353<br>(Pb-Free) | 3000 / Tape & Reel |
| UMC5NT1G | SC-88A/SOT-353<br>(Pb-Free) | 3000 / Tape & Reel |
| UMC5NT2G | SC-88A/SOT-353<br>(Pb-Free) | 3000 / 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 AND RESISTOR VALUES

| Device   | Marking | Transistor 1 - PNP |        | Transistor 2 - NPN |        |
|----------|---------|--------------------|--------|--------------------|--------|
|          |         | R1 (K)             | R2 (K) | R1 (K)             | R2 (K) |
| UMC2NT1G | U2      | 22                 | 22     | 22                 | 22     |
| UMC3NT1G | U3      | 10                 | 10     | 10                 | 10     |
| UMC3NT2G | U3      | 10                 | 10     | 10                 | 10     |
| UMC5NT1G | U5      | 4.7                | 10     | 47                 | 47     |
| UMC5NT2G | U5      | 4.7                | 10     | 47                 | 47     |

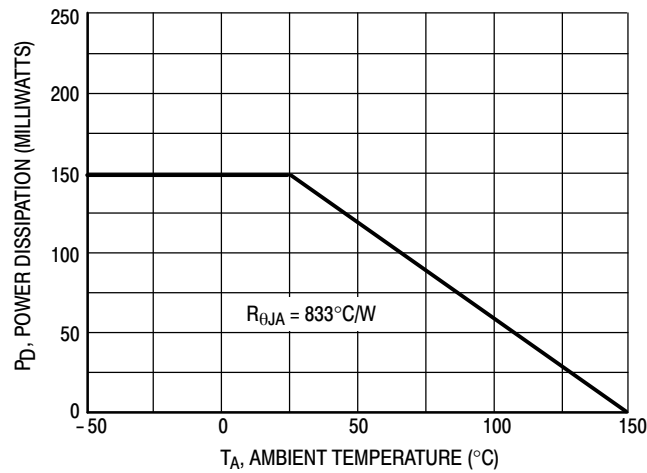


Figure 1. Derating Curve

# UMC2NT1G, UMC3NT1G, UMC5NT1G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC2NT1G PNP TRANSISTOR

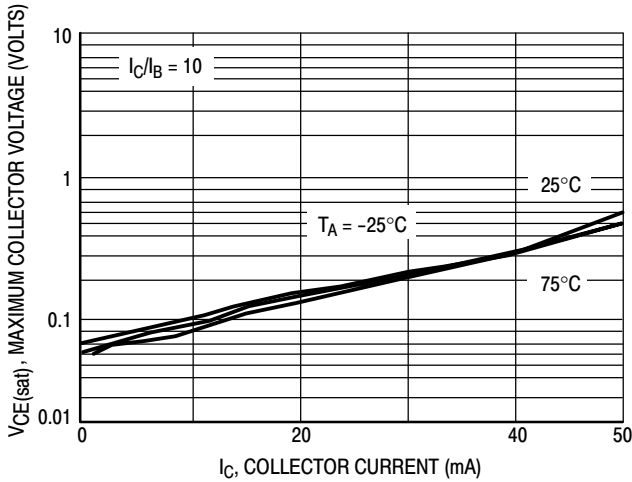


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

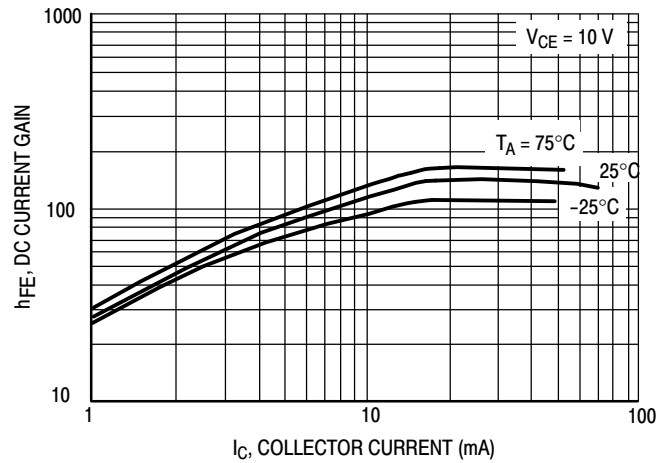


Figure 3. DC Current Gain

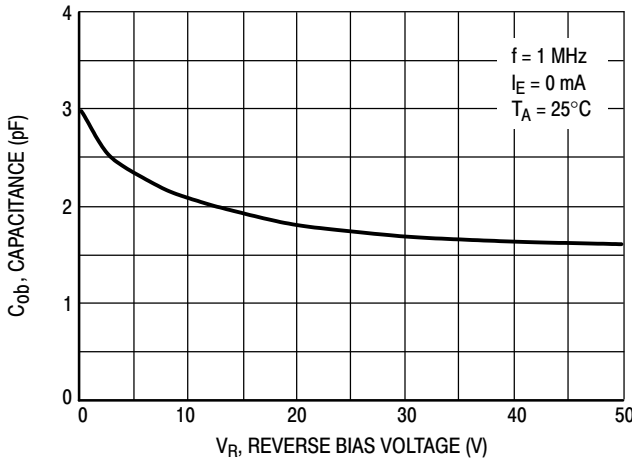


Figure 4. Output Capacitance

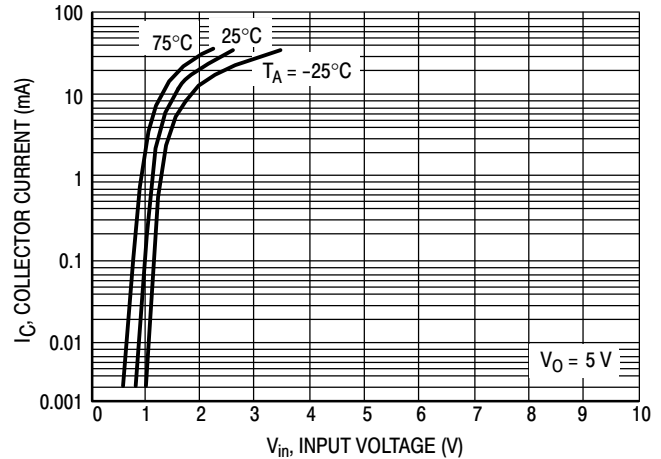


Figure 5. Output Current versus Input Voltage

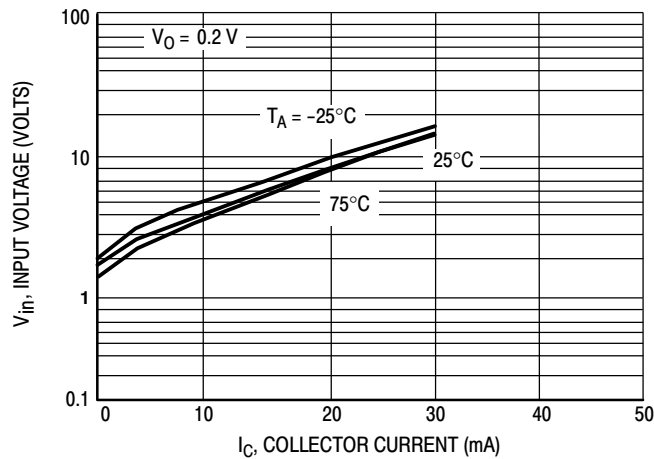


Figure 6. Input Voltage versus Output Current

# UMC2NT1G, UMC3NT1G, UMC5NT1G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC2NT1G NPN TRANSISTOR

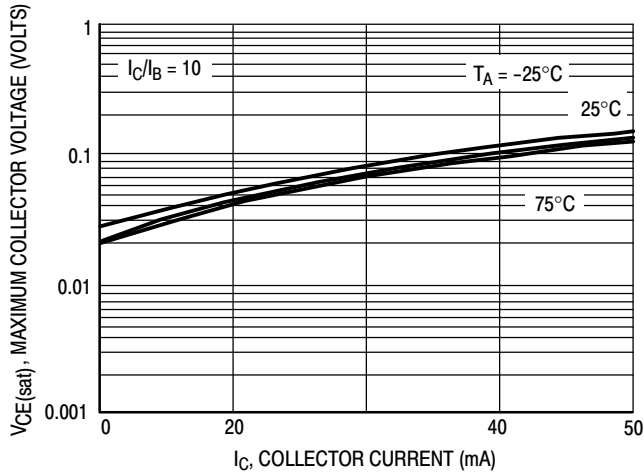


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

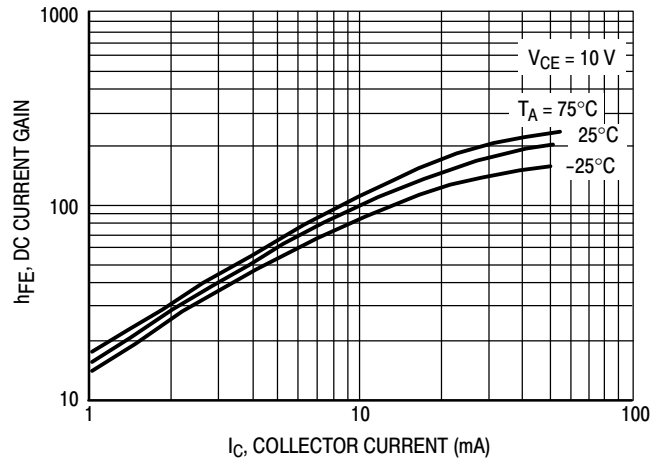


Figure 8. DC Current Gain

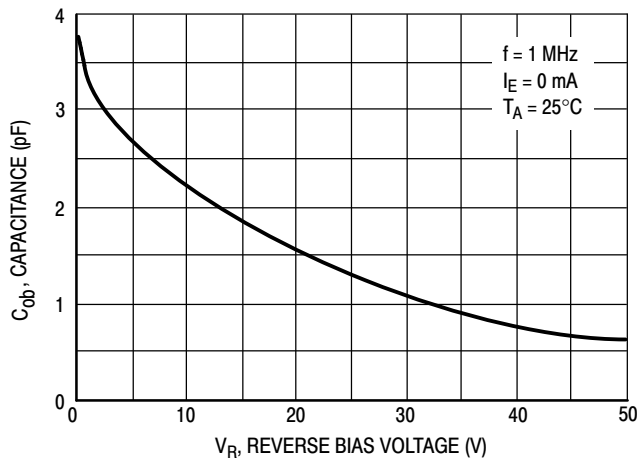


Figure 9. Output Capacitance

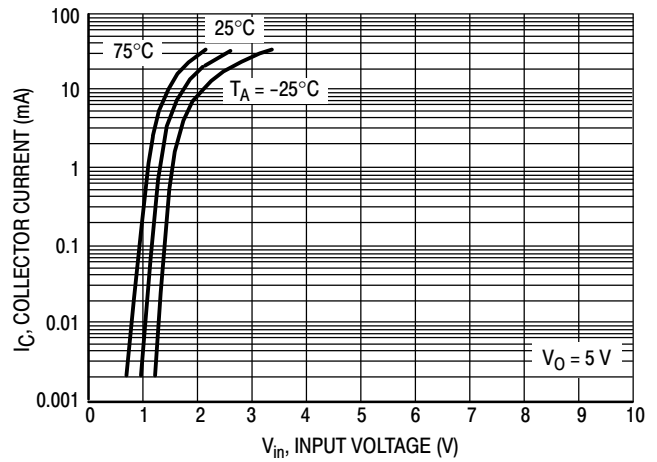


Figure 10. Output Current versus Input Voltage

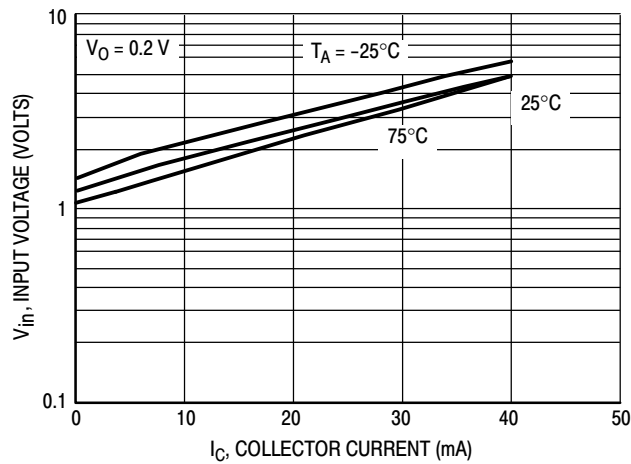


Figure 11. Input Voltage versus Output Current

# UMC2NT1G, UMC3NT1G, UMC5NT1G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC3NT1G PNP TRANSISTOR

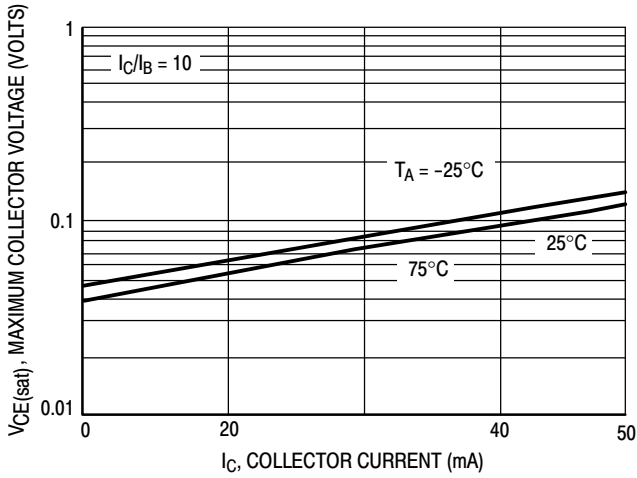


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

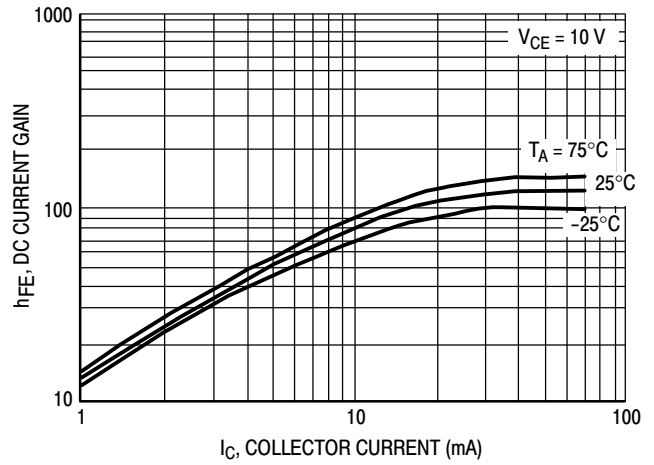


Figure 13. DC Current Gain

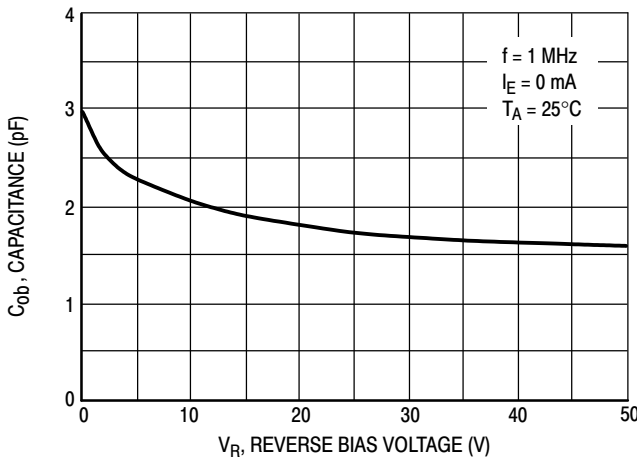


Figure 14. Output Capacitance

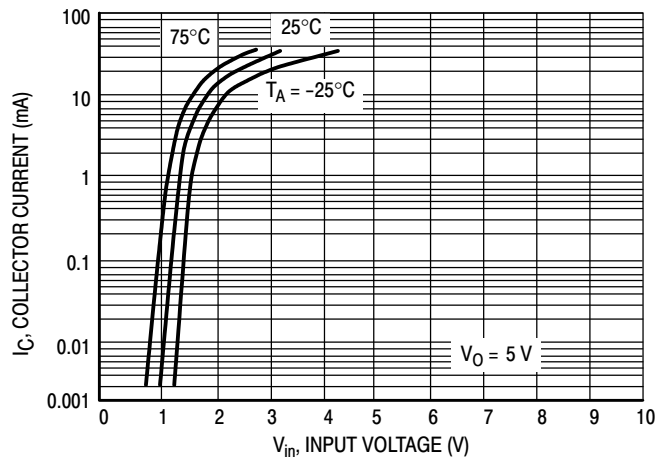


Figure 15. Output Current versus Input Voltage

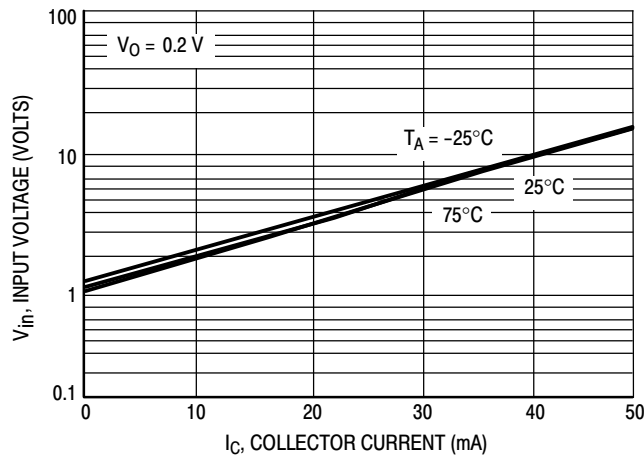


Figure 16. Input Voltage versus Output Current

# UMC2NT1G, UMC3NT1G, UMC5NT1G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC3NT1G NPN TRANSISTOR

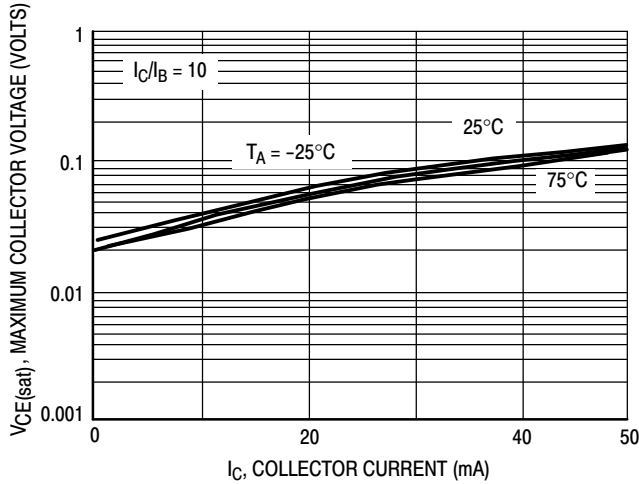


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

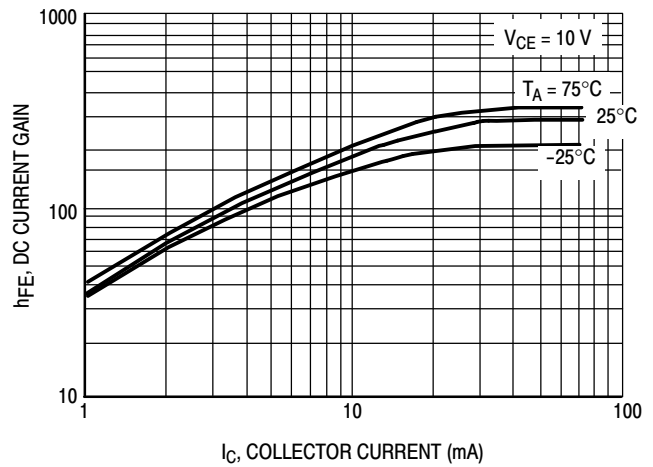


Figure 18. DC Current Gain

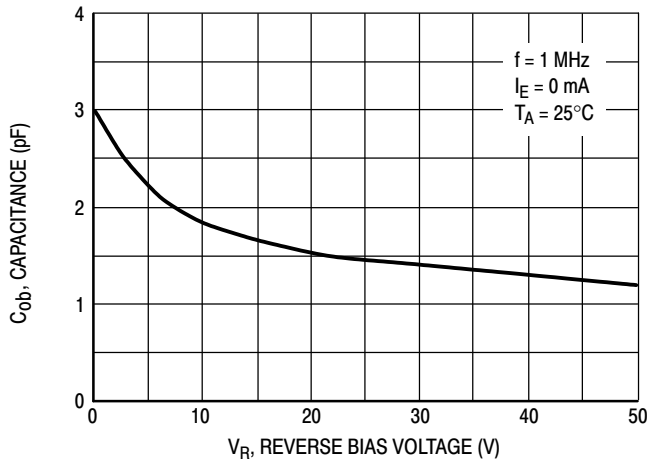


Figure 19. Output Capacitance

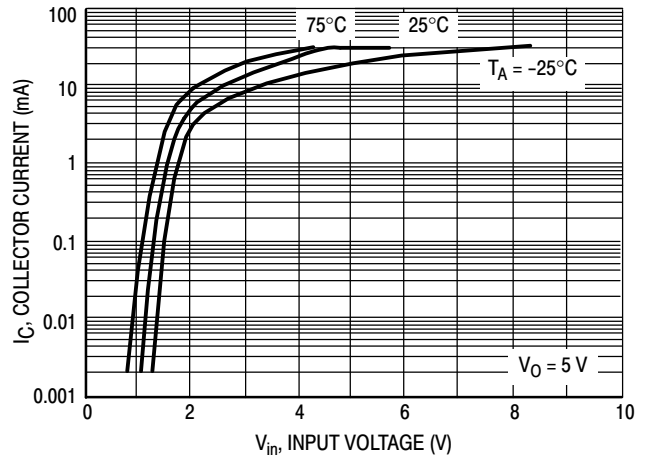


Figure 20. Output Current versus Input Voltage

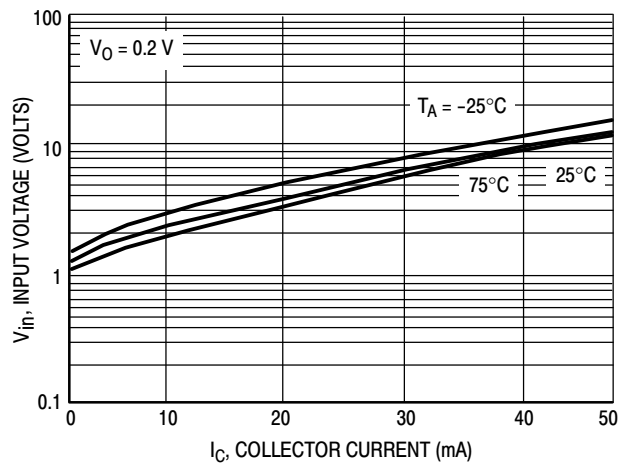


Figure 21. Input Voltage versus Output Current

# UMC2NT1G, UMC3NT1G, UMC5NT1G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC5NT1G PNP TRANSISTOR

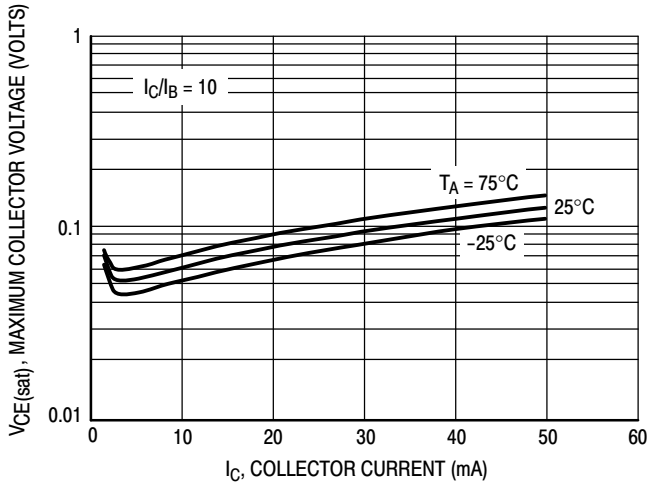


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

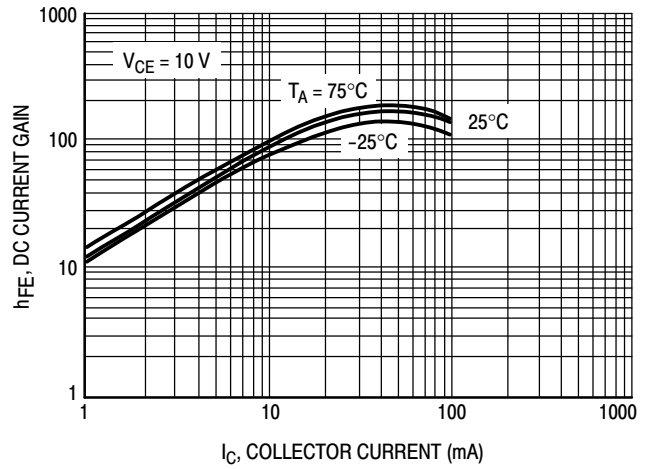


Figure 23. DC Current Gain

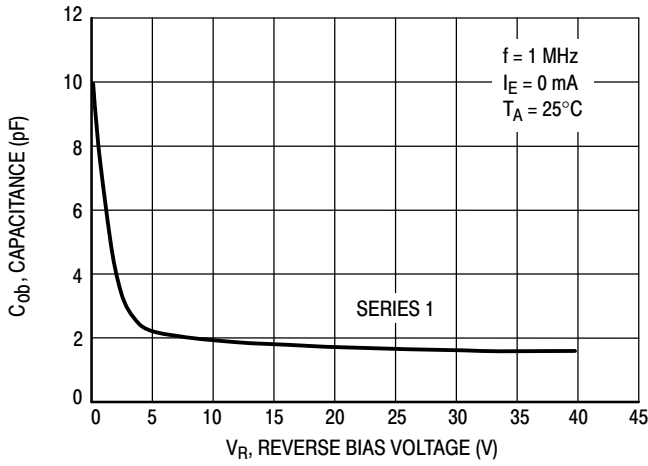


Figure 24. Output Capacitance

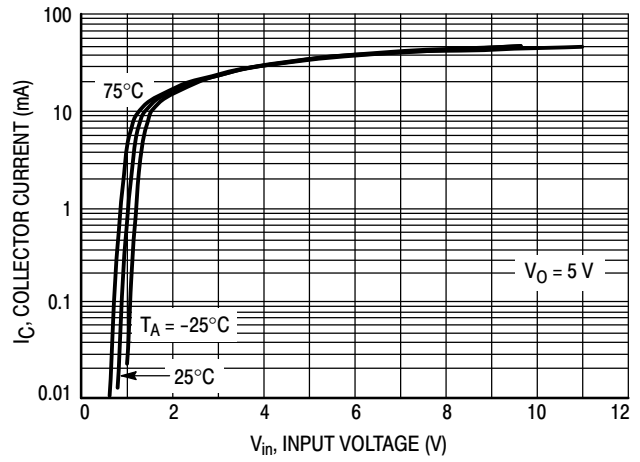


Figure 25. Output Current versus Input Voltage



# UMC2NT1G, UMC3NT1G, UMC5NT1G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC5NT1G NPN TRANSISTOR

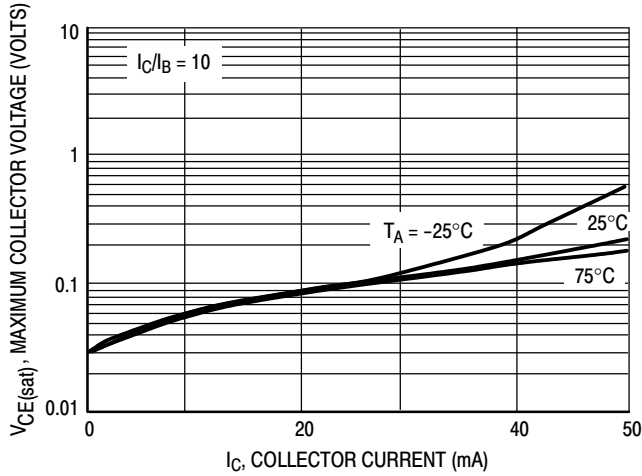


Figure 26.  $V_{CE(sat)}$  versus  $I_C$

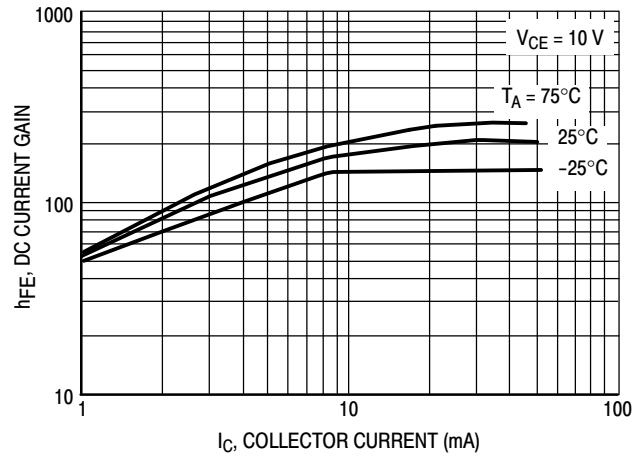


Figure 27. DC Current Gain

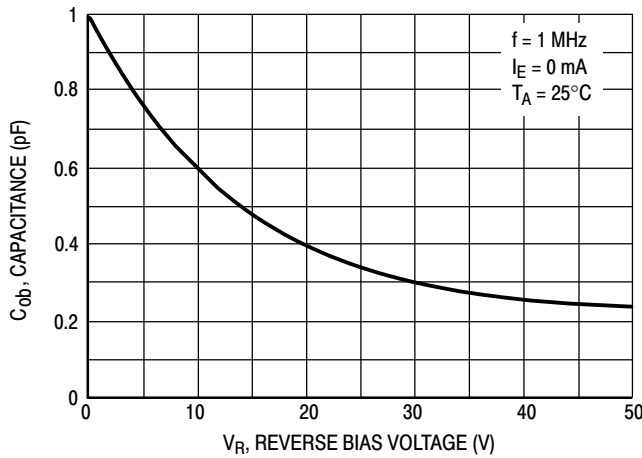


Figure 28. Output Capacitance

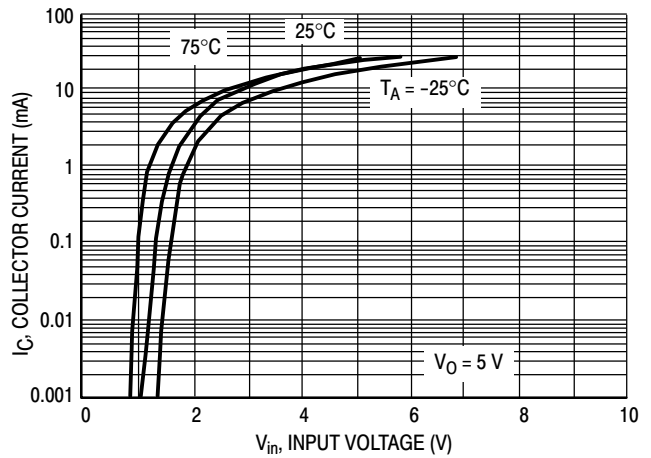


Figure 29. Output Current versus Input Voltage

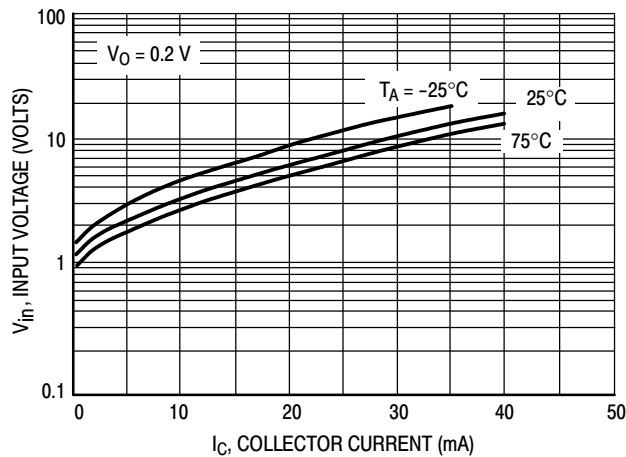
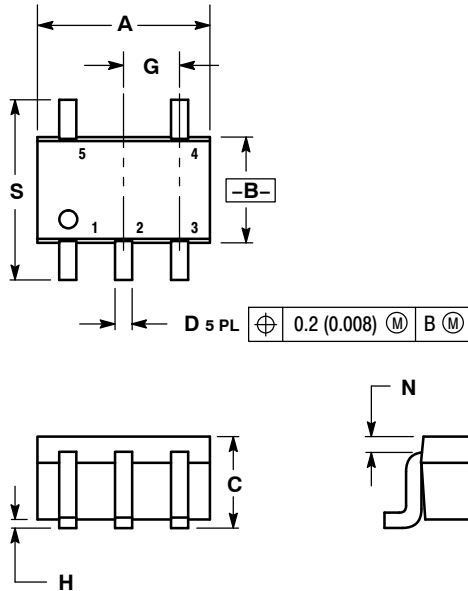


Figure 30. Input Voltage versus Output Current

# UMC2NT1G, UMC3NT1G, UMC5NT1G

## PACKAGE DIMENSIONS

SC-88A, SOT-353, SC-70  
CASE 419A-02  
ISSUE J



### NOTES:

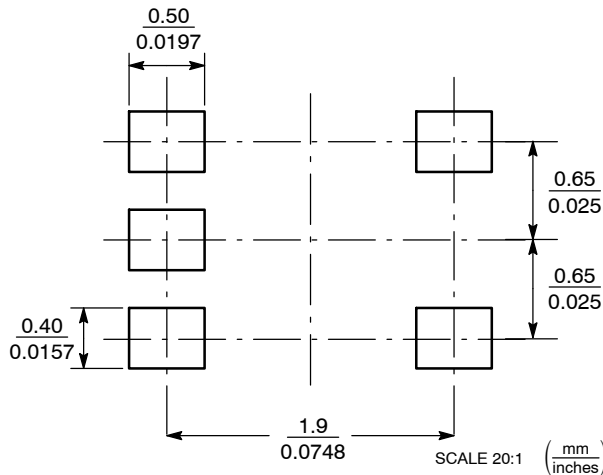
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| 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 |

### STYLE 6:

1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

### 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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