

# Dual Common Base-Collector Bias Resistor Transistors

NPN and PNP Silicon Surface Mount  
Transistors with Monolithic Bias  
Resistor Network

**UMC2NT1G,  
NSVUMC2NT1G,  
UMC3NT1G,  
NSVUMC3NT1G,  
UMC5NT1G,  
NSVUMC5NT2G**

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

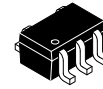
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7 inch/3000 Unit Tape and Reel
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen 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)

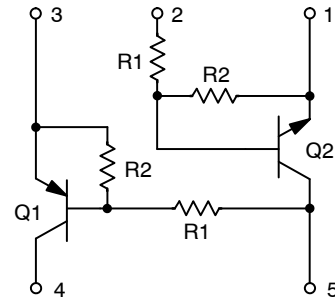
| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage    | $V_{CBO}$ | 50    | Vdc  |
| Collector-Emitter Voltage | $V_{CEO}$ | 50    | Vdc  |
| Collector Current         | $I_C$     | 100   | mAdc |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

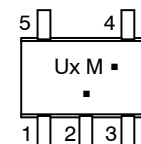
\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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 4 of this data sheet.

# UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G

**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               |
|---------------------------------------------------------------|-----------------|-------------|--------------------|
| <b>THERMAL CHARACTERISTICS</b>                                |                 |             |                    |
| Thermal Resistance – Junction-to-Ambient (surface mounted)    | $R_{\theta JA}$ | 833         | $^\circ\text{C/W}$ |
| 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.

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

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

## Q1 TRANSISTOR: PNP

### OFF CHARACTERISTICS

|                                                                         |           |   |   |     |      |
|-------------------------------------------------------------------------|-----------|---|---|-----|------|
| Collector-Base Cutoff Current<br>( $V_{CB} = 50\text{ V}, I_E = 0$ )    | $I_{CBO}$ | – | – | 100 | nAdc |
| Collector-Emitter Cutoff Current<br>( $V_{CE} = 50\text{ V}, I_B = 0$ ) | $I_{CEO}$ | – | – | 500 | nAdc |
| Emitter-Base Cutoff Current<br>( $V_{EB} = 6.0, I_C = 0\text{ mA}$ )    | $I_{EBO}$ |   |   |     | mAdc |
| UMC2NT1G, NSVUMC2NT1G                                                   |           | – | – | 0.2 |      |
| UMC3NT1G, NSVUMC3NT1G                                                   |           | – | – | 0.5 |      |
| UMC5NT1G/T2G, NSVUMC5NT2G                                               |           | – | – | 1.0 |      |

### ON CHARACTERISTICS

|                                                                                                   |               |                    |                    |                    |            |
|---------------------------------------------------------------------------------------------------|---------------|--------------------|--------------------|--------------------|------------|
| Collector-Base Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}, I_E = 0$ )                    | $V_{(BR)CBO}$ | 50                 | –                  | –                  | Vdc        |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 2.0\text{ mA}, I_B = 0$ )                         | $V_{(BR)CEO}$ | 50                 | –                  | –                  | Vdc        |
| DC Current Gain<br>( $V_{CE} = 10\text{ V}, I_C = 5.0\text{ mA}$ )                                | $h_{FE}$      |                    |                    |                    |            |
| UMC2NT1G, NSVUMC2NT1G                                                                             |               | 60                 | 100                | –                  |            |
| UMC3NT1G, NSVUMC3NT1G                                                                             |               | 35                 | 60                 | –                  |            |
| UMC5NT1G/T2G, NSVUMC5NT2G                                                                         |               | 20                 | 35                 | –                  |            |
| Collector-Emitter Saturation Voltage<br>( $I_C = 10\text{ mA}, I_B = 0.3\text{ mA}$ )             | $V_{CE(SAT)}$ | –                  | –                  | 0.25               | Vdc        |
| Output Voltage (on)<br>( $V_{CC} = 5.0\text{ V}, V_B = 2.5\text{ V}, R_L = 1.0\text{ k}\Omega$ )  | $V_{OL}$      | –                  | –                  | 0.2                | Vdc        |
| Output Voltage (off)<br>( $V_{CC} = 5.0\text{ V}, V_B = 0.5\text{ V}, R_L = 1.0\text{ k}\Omega$ ) | $V_{OH}$      | 4.9                | –                  | –                  | Vdc        |
| Input Resistor<br>UMC2NT1G<br>UMC3NT1G<br>UMC5NT1G/T2G                                            | $R_1$         | 15.4<br>7.0<br>3.3 | 22<br>10<br>4.7    | 28.6<br>13<br>6.1  | k $\Omega$ |
| Resistor Ratio<br>UMC2NT1G<br>UMC3NT1G<br>UMC5NT1G/T2G                                            | $R_1/R_2$     | 0.8<br>0.8<br>0.38 | 1.0<br>1.0<br>0.47 | 1.2<br>1.2<br>0.56 |            |

# UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G

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

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

### Q2 TRANSISTOR: NPN OFF CHARACTERISTICS

|                                                                                                                       |                  |             |             |                   |      |
|-----------------------------------------------------------------------------------------------------------------------|------------------|-------------|-------------|-------------------|------|
| 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, I <sub>C</sub> = 0 mA)<br>UMC2NT1G<br>UMC3NT1G<br>UMC5NT1G/T2G | I <sub>EBO</sub> | –<br>–<br>– | –<br>–<br>– | 0.2<br>0.5<br>0.1 | mAdc |

### ON CHARACTERISTICS

|                                                                                                              |                      |                   |                   |                   |     |
|--------------------------------------------------------------------------------------------------------------|----------------------|-------------------|-------------------|-------------------|-----|
| 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<br>(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)<br>UMC2NT1G<br>UMC3NT1G<br>UMC5NT1G/T2G | h <sub>FE</sub>      | 60<br>35<br>80    | 100<br>60<br>140  | –<br>–<br>–       |     |
| Collector-Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)                    | V <sub>CE(SAT)</sub> | –                 | –                 | 0.25              | Vdc |
| Output Voltage (on)<br>(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ)            | V <sub>OL</sub>      | –                 | –                 | 0.2               | Vdc |
| Output Voltage (off)<br>(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<br>UMC2NT1G<br>UMC3NT1G<br>UMC5NT1G/T2G                                                       | R1                   | 15.4<br>7.0<br>33 | 22<br>10<br>47    | 28.6<br>13<br>61  | kΩ  |
| Resistor Ratio<br>UMC2NT1G<br>UMC3NT1G<br>UMC5NT1G/T2G                                                       | R1/R2                | 0.8<br>0.8<br>0.8 | 1.0<br>1.0<br>1.0 | 1.2<br>1.2<br>1.2 |     |

# **UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G**

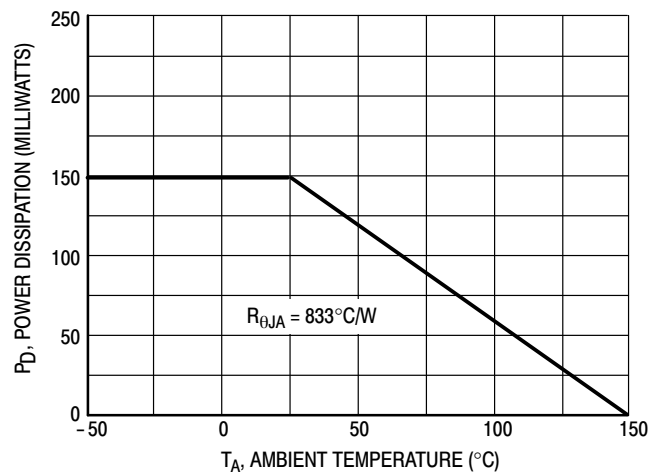
## **ORDERING INFORMATION**

| Device      | Package                     | Shipping <sup>†</sup> |
|-------------|-----------------------------|-----------------------|
| UMC2NT1G    | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / Tape & Reel   |
| NSVUMC2NT1G | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / Tape & Reel   |
| UMC3NT1G    | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / Tape & Reel   |
| NSVUMC3NT1G | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / Tape & Reel   |
| UMC3NT2G    | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / Tape & Reel   |
| UMC5NT1G    | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / Tape & Reel   |
| UMC5NT2G    | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / Tape & Reel   |
| NSVUMC5NT2G | SC-88A/SOT-353<br>(Pb-Free) | 3,000 / 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.

## **DEVICE MARKING AND RESISTOR VALUES**

| Device                | Marking | Transistor 1 – PNP |        | Transistor 2 – NPN |        |
|-----------------------|---------|--------------------|--------|--------------------|--------|
|                       |         | R1 (K)             | R2 (K) | R1 (K)             | R2 (K) |
| UMC2NT1G, NSVUMC2NT1G | U2      | 22                 | 22     | 22                 | 22     |
| UMC3NT1G, NSVUMC3NT1G | U3      | 10                 | 10     | 10                 | 10     |
| UMC3NT2G              | U3      | 10                 | 10     | 10                 | 10     |
| UMC5NT1G              | U5      | 4.7                | 10     | 47                 | 47     |
| UMC5NT2G, NSVUMC5NT2G | U5      | 4.7                | 10     | 47                 | 47     |



**Figure 1. Derating Curve**

# UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC2NT1G, NSVUMC2NT1G PNP TRANSISTOR

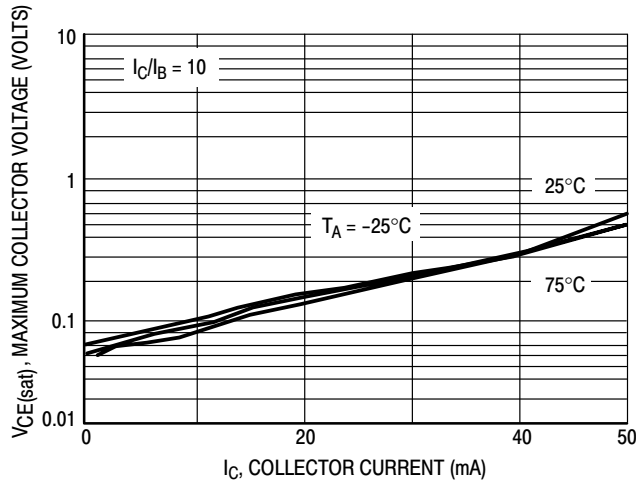


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

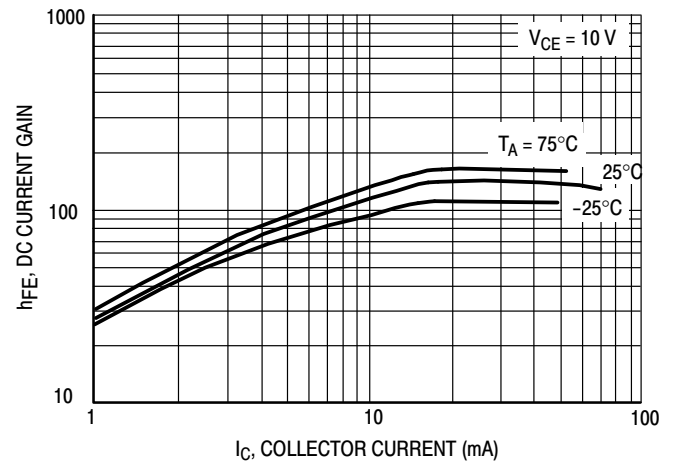


Figure 3. DC Current Gain

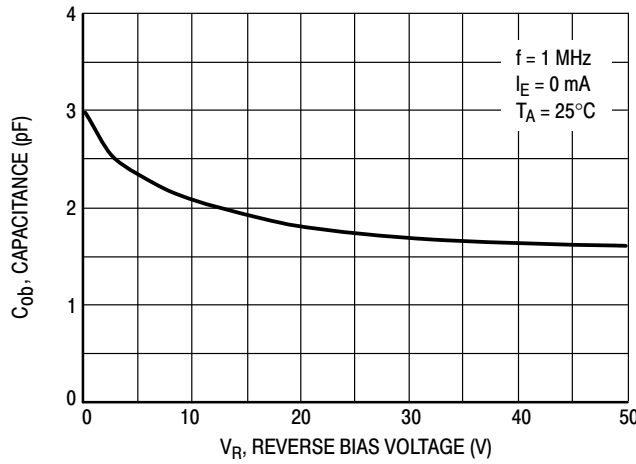


Figure 4. Output Capacitance

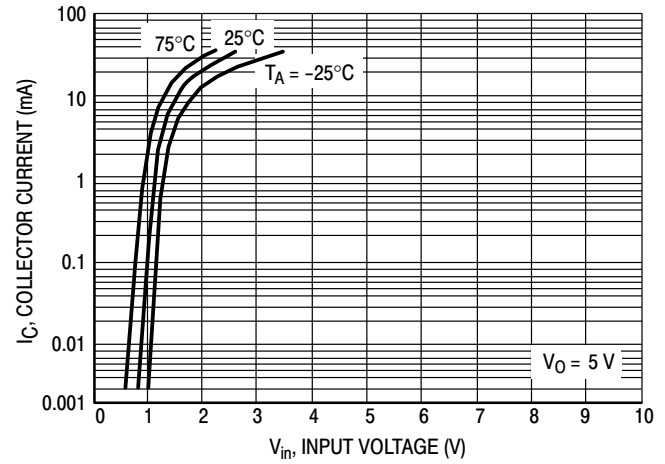


Figure 5. Output Current versus Input Voltage

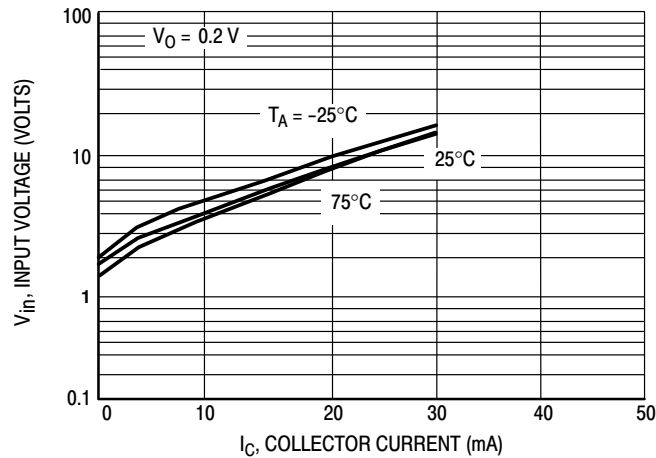


Figure 6. Input Voltage versus Output Current

# UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC2NT1G, NSVUMC2NT1G NPN TRANSISTOR

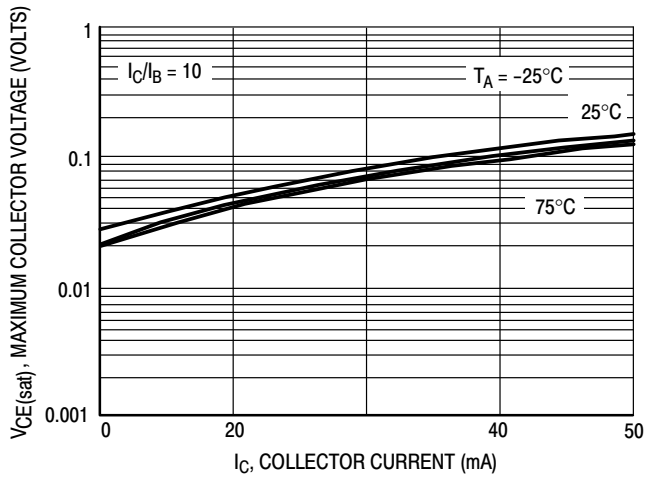


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

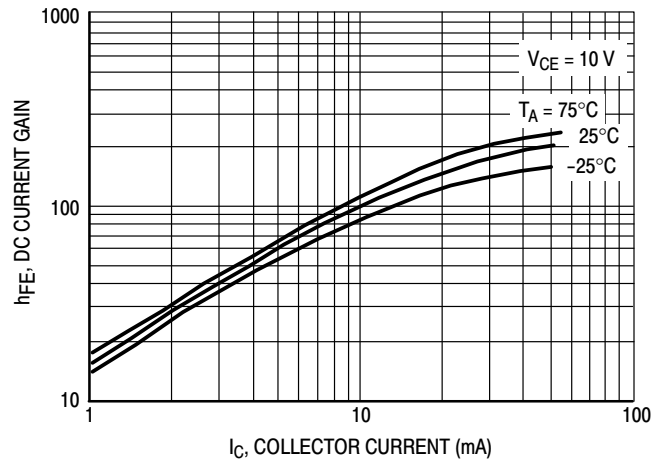


Figure 8. DC Current Gain

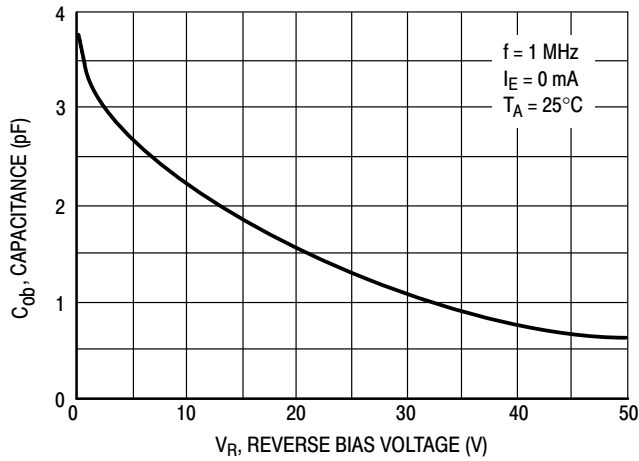


Figure 9. Output Capacitance

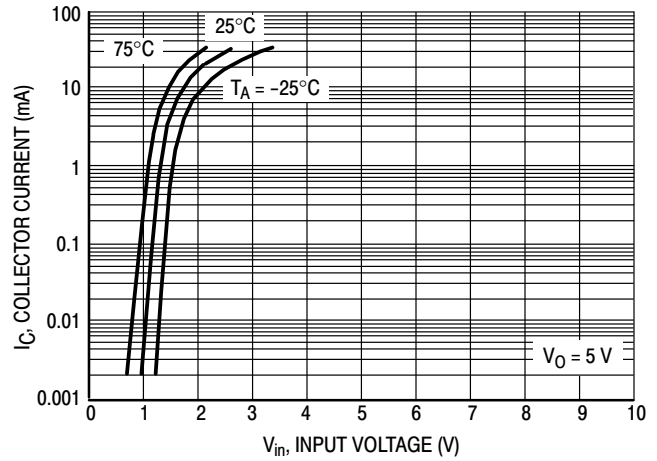


Figure 10. Output Current versus Input Voltage

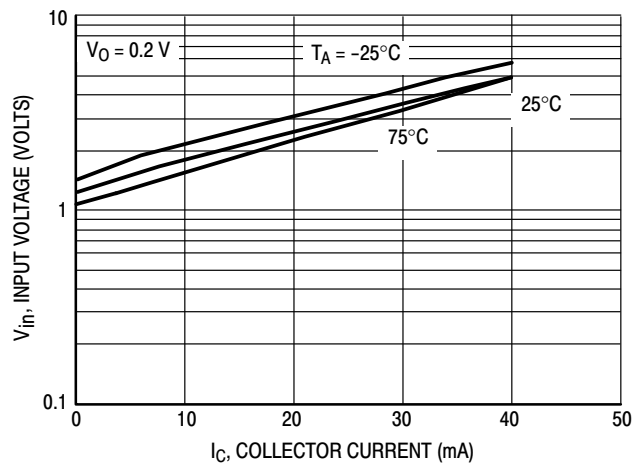


Figure 11. Input Voltage versus Output Current

# UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC3NT1G PNP TRANSISTOR

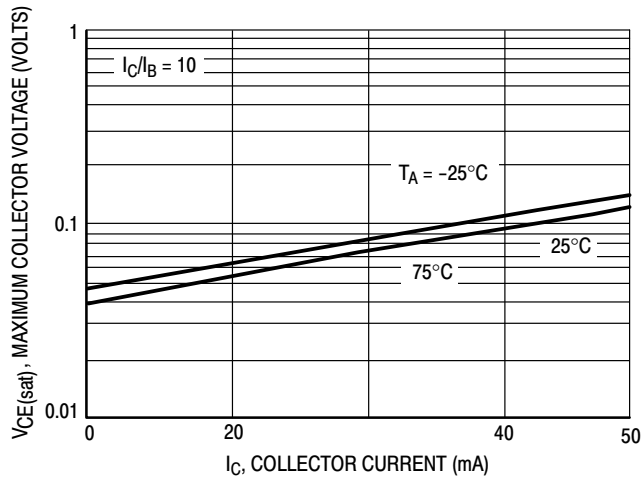


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

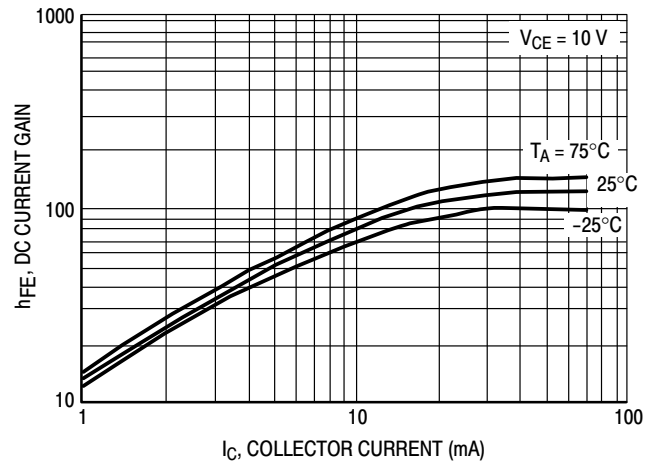


Figure 13. DC Current Gain

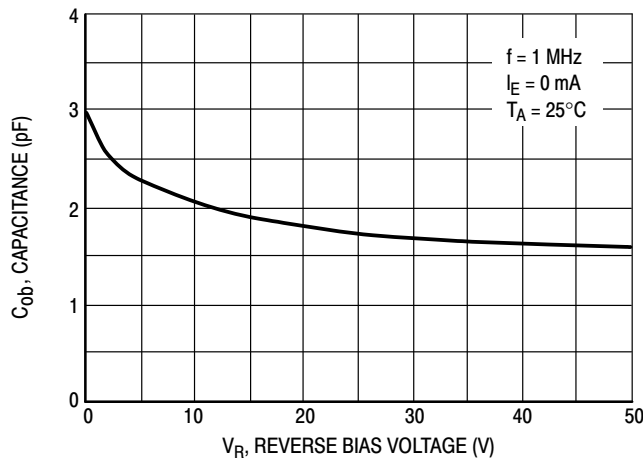


Figure 14. Output Capacitance

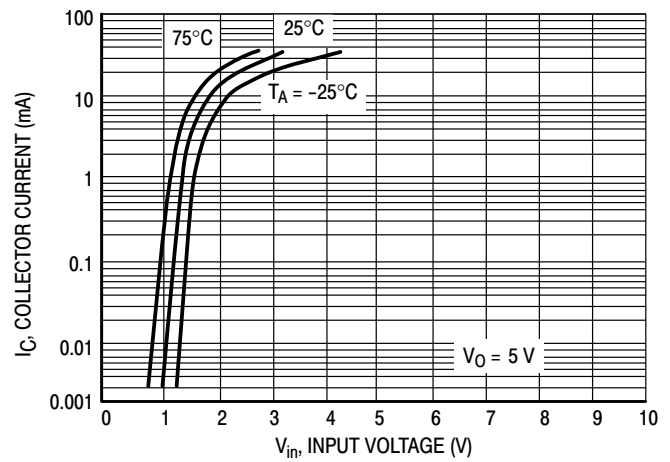


Figure 15. Output Current versus Input Voltage

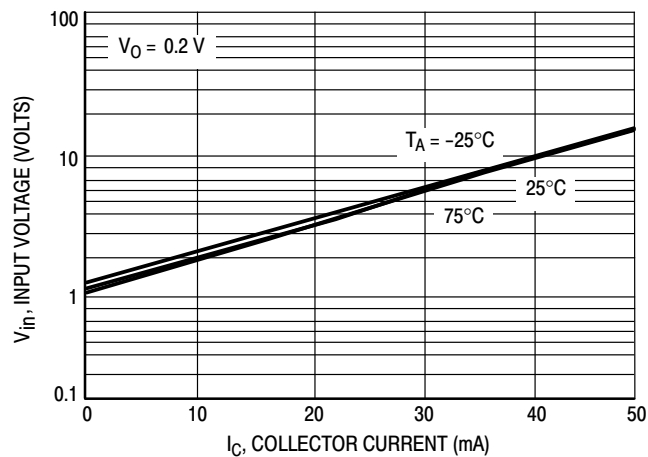


Figure 16. Input Voltage versus Output Current

# UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC3NT1G NPN TRANSISTOR

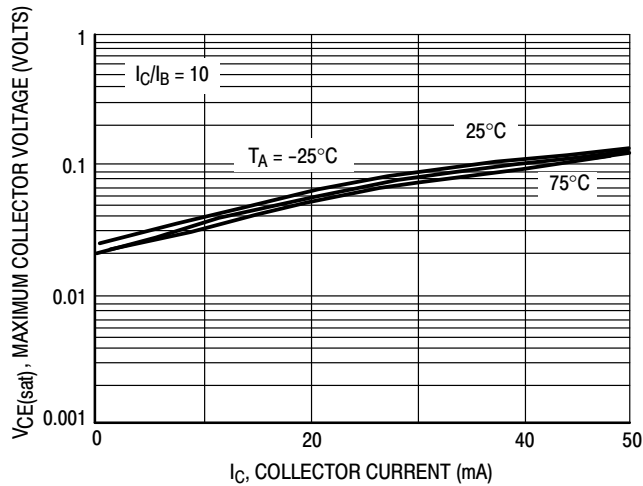


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

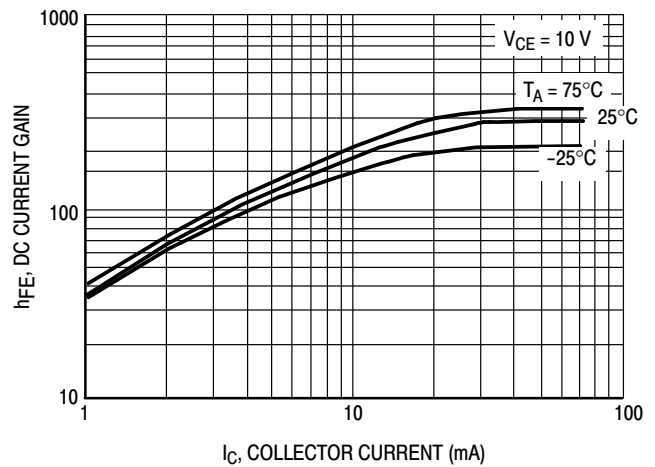


Figure 18. DC Current Gain

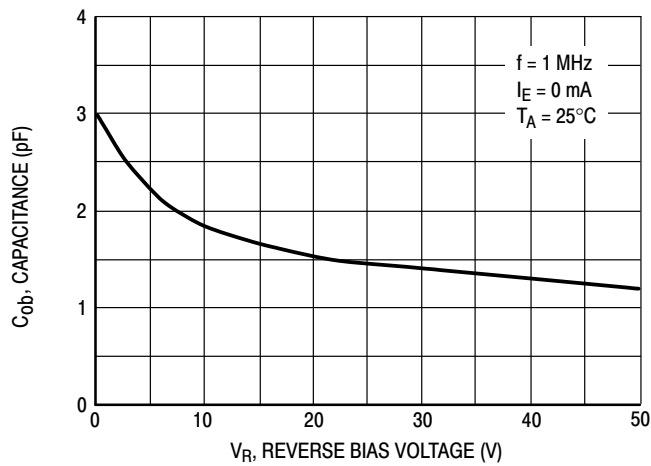


Figure 19. Output Capacitance

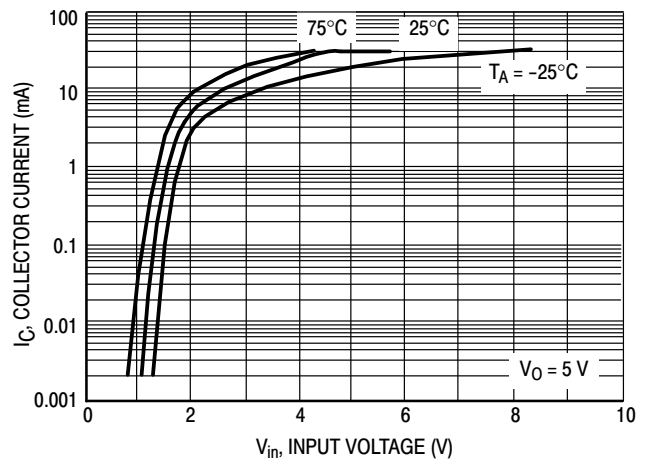


Figure 20. Output Current versus Input Voltage

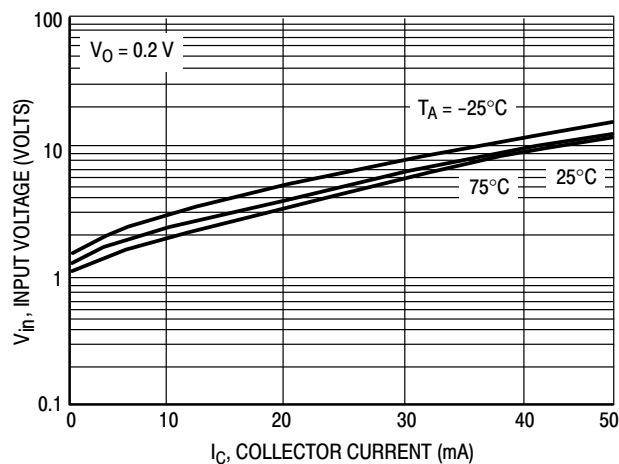
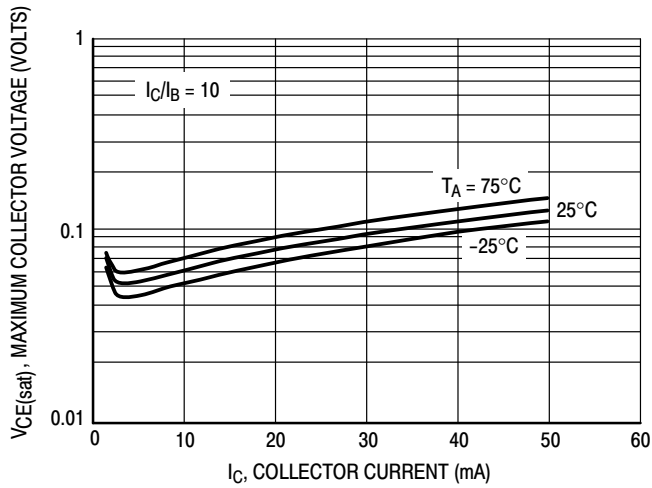


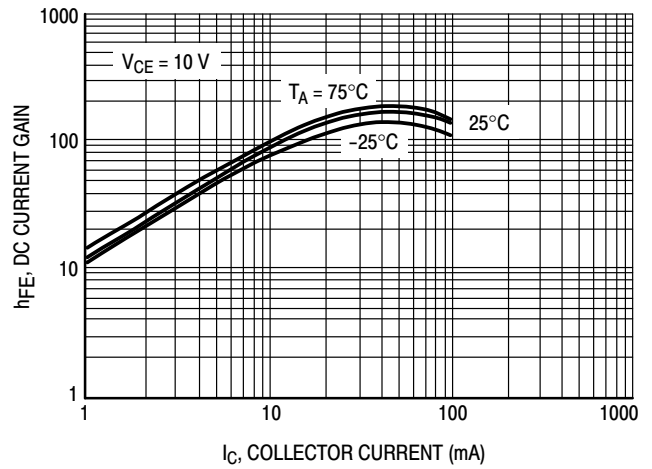
Figure 21. Input Voltage versus Output Current

**UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G,  
NSVUMC5NT2G**

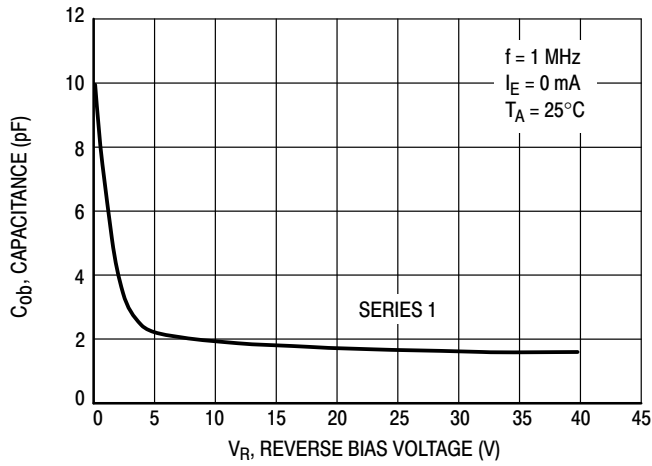
**TYPICAL ELECTRICAL CHARACTERISTICS — UMC5NT1G PNP TRANSISTOR**



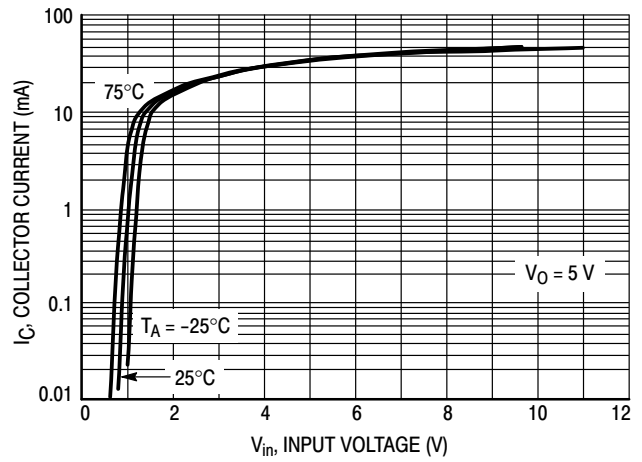
**Figure 22.  $V_{CE(sat)}$  versus  $I_C$**



**Figure 23. DC Current Gain**



**Figure 24. Output Capacitance**



**Figure 25. Output Current versus Input Voltage**

# UMC2NT1G, NSVUMC2NT1G, UMC3NT1G, NSVUMC3NT1G, UMC5NT1G, NSVUMC5NT2G

## TYPICAL ELECTRICAL CHARACTERISTICS — UMC5NT1G NPN TRANSISTOR

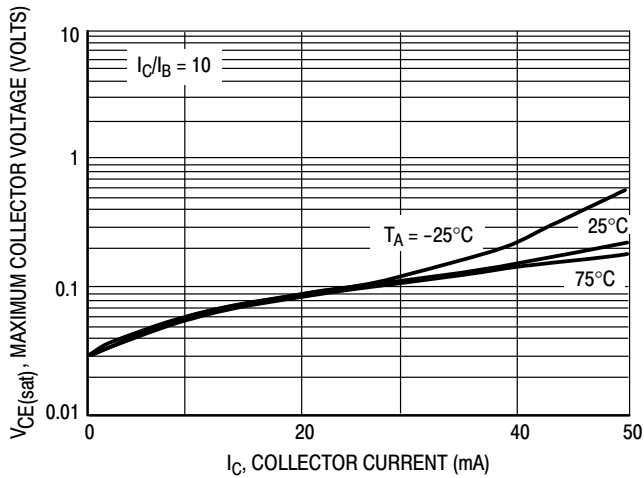


Figure 26.  $V_{CE(sat)}$  versus  $I_C$

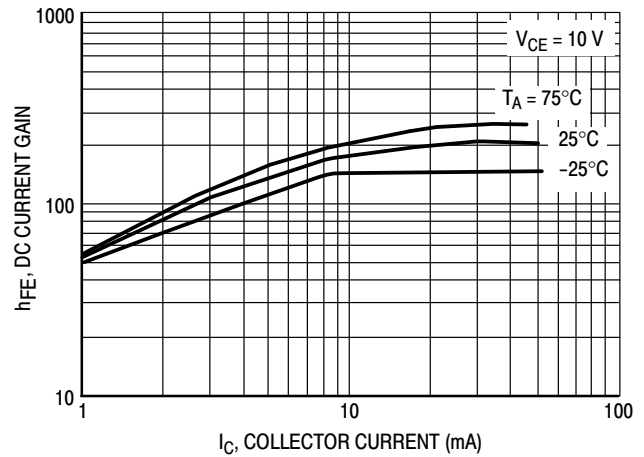


Figure 27. DC Current Gain

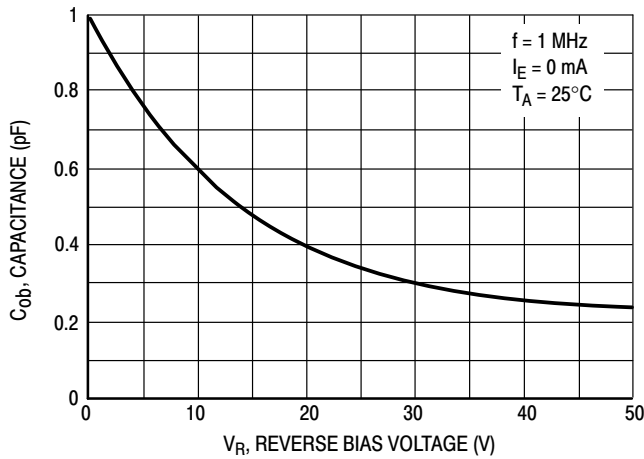


Figure 28. Output Capacitance

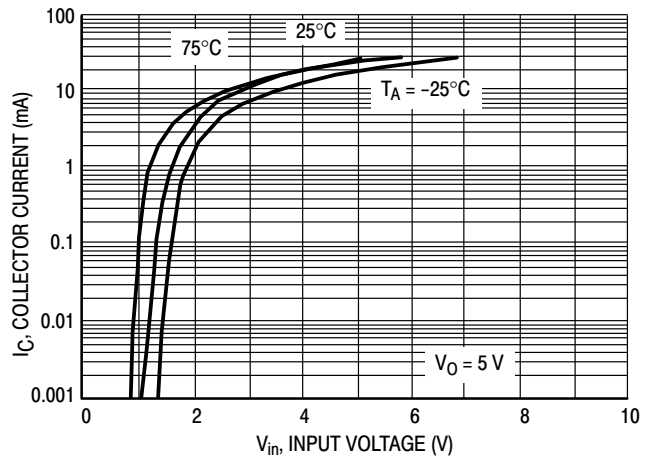


Figure 29. Output Current versus Input Voltage

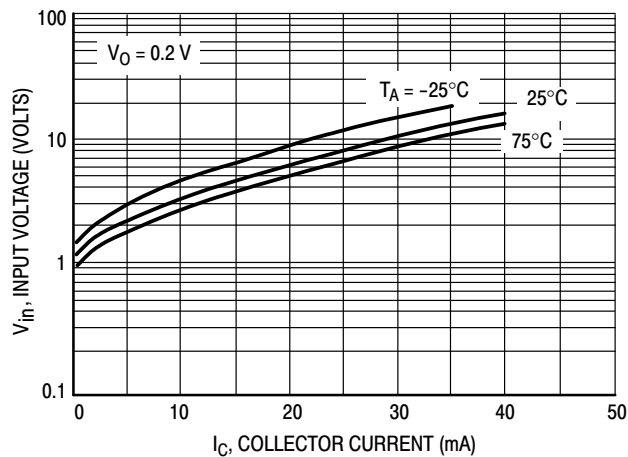


Figure 30. Input Voltage versus Output Current

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

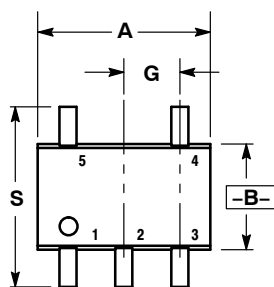
ON Semiconductor®



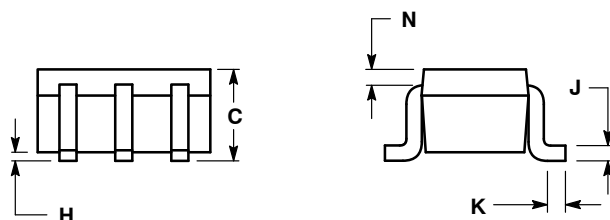
SCALE 2:1

SC-88A (SC-70-5/SOT-353)  
CASE 419A-02  
ISSUE L

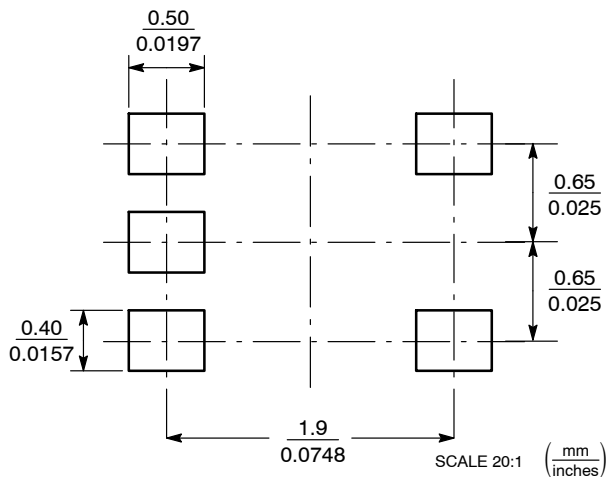
DATE 17 JAN 2013



D 5 PL  $\oplus$  0.2 (0.008) (M) B (M)



## SOLDER FOOTPRINT

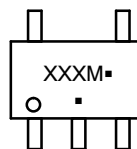


### NOTES:

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 |

## GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLE 1:  
PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

STYLE 2:  
PIN 1. ANODE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. CATHODE

STYLE 3:  
PIN 1. ANODE 1  
2. N/C  
3. ANODE 2  
4. CATHODE 2  
5. CATHODE 1

STYLE 4:  
PIN 1. SOURCE 1  
2. DRAIN 1/2  
3. SOURCE 1  
4. GATE 1  
5. GATE 2

STYLE 5:  
PIN 1. CATHODE  
2. COMMON ANODE  
3. CATHODE 2  
4. CATHODE 3  
5. CATHODE 4

STYLE 6:  
PIN 1. EMITTER 2  
2. BASE 2  
3. EMITTER 1  
4. COLLECTOR  
5. COLLECTOR 2/BASE 1

STYLE 7:  
PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

STYLE 8:  
PIN 1. CATHODE  
2. COLLECTOR  
3. N/C  
4. BASE  
5. EMITTER

STYLE 9:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. ANODE

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

|                  |                          |                                                                                                                                                                                     |
|------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | SC-88A (SC-70-5/SOT-353) | PAGE 1 OF 1                                                                                                                                                                         |

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