www.omseni.com

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MUN2216T1G, MMUN2216LT1G,
MUN5216T1G, DTC143TET1G,
DTC143TM3T5G

# Digital Transistors (BRT)
# R1 = 4.7 kΩ, R2 = ∞ kΩ

## NPN Transistors with Monolithic Bias Resistor Network

This series of digital transistors is designed to replace a single device and its external resistor bias 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. 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.

**Features**

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count

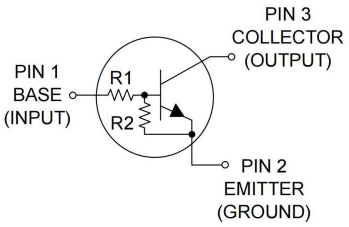
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

**MAXIMUM RATINGS** ($T_A$ = 25°C)

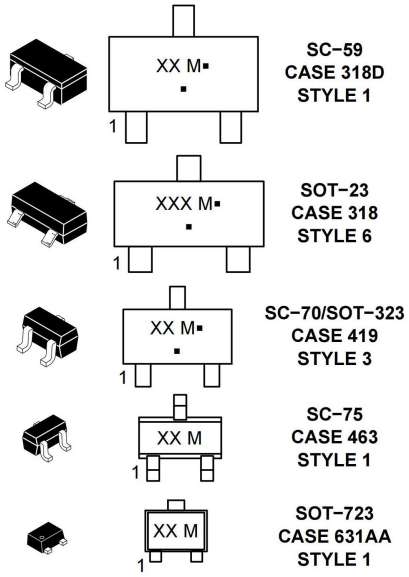
| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Collector–Base Voltage | $V_{CBO}$ | 50 | Vdc |
| Collector–Emitter Voltage | $V_{CEO}$ | 50 | Vdc |
| Collector Current – Continuous | $I_C$ | 100 | mAdc |
| Input Forward Voltage | $V_{IN(fwd)}$ | 30 | Vdc |
| Input Reverse Voltage | $V_{IN(rev)}$ | 6 | Vdc |

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.

**PIN CONNECTIONS**




**MARKING DIAGRAMS**




XXX = Specific Device Code
M = Date Code*
▪ = Pb–Free Package

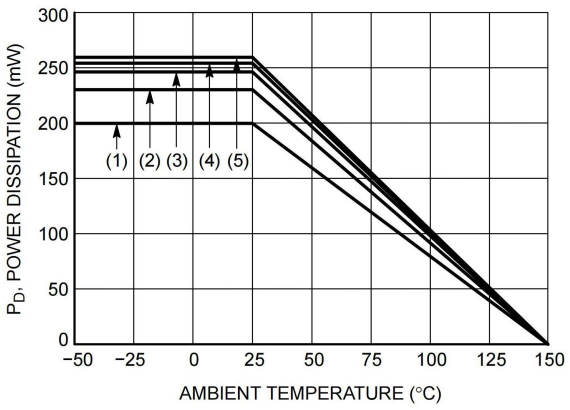
(Note: Microdot may be in either location)

*Date Code orientation may vary depending up-
on manufacturing location.

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**Table 1. ORDERING INFORMATION**

| Device | Part Marking | Package | Shipping† |
|---|---|---|---|
| MUN2216T1G | 8F | SC−59<br>(Pb−Free) | 3000 / Tape & Reel |
| MMUN2216LT1G | A8F | SOT−23<br>(Pb−Free) | 3000 / Tape & Reel |
| MUN5216T1G | 8F | SC−70/SOT−323<br>(Pb−Free) | 3000 / Tape & Reel |
| DTC143TET1G | 8F | SC−75<br>(Pb−Free) | 3000 / Tape & Reel |
| DTC143TM3T5G | 8F | SOT−723<br>(Pb−Free) | 8000 / Tape & Reel |




(1) SC−75 and SC−70/SOT323; Minimum Pad
(2) SC−59; Minimum Pad
(3) SOT−23; Minimum Pad
(4) SOT−1123; 100 $mm^2$, 1 oz. copper trace
(5) SOT−723; Minimum Pad

**Figure 1. Derating Curve**

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**Table 2. THERMAL CHARACTERISTICS**

| Characteristic | | Symbol | Max | Unit |
|---|---|---|---|---|
| **THERMAL CHARACTERISTICS (SC−59) (MUN2216)** | | | | |
| Total Device Dissipation | | $P_D$ | | |
| $T_A$ = 25°C | (Note 1) | | 230 | mW |
| | (Note 2) | | 338 | |
| Derate above 25°C | (Note 1) | | 1.8 | mW/°C |
| | (Note 2) | | 2.7 | |
| Thermal Resistance, Junction to Ambient | (Note 1) | $R_{\theta JA}$ | 540 | °C/W |
| | (Note 2) | | 370 | |
| Thermal Resistance, Junction to Lead | (Note 1) | $R_{\theta JL}$ | 264 | °C/W |
| | (Note 2) | | 287 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SOT−23) (MMUN2216L)** | | | | |
| Total Device Dissipation | | $P_D$ | | |
| $T_A$ = 25°C | (Note 1) | | 246 | mW |
| | (Note 2) | | 400 | |
| Derate above 25°C | (Note 1) | | 2.0 | mW/°C |
| | (Note 2) | | 3.2 | |
| Thermal Resistance, Junction to Ambient | (Note 1) | $R_{\theta JA}$ | 508 | °C/W |
| | (Note 2) | | 311 | |
| Thermal Resistance, Junction to Lead | (Note 1) | $R_{\theta JL}$ | 174 | °C/W |
| | (Note 2) | | 208 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SC−70/SOT−323) (MUN5216)** | | | | |
| Total Device Dissipation | | $P_D$ | | |
| $T_A$ = 25°C | (Note 1) | | 202 | mW |
| | (Note 2) | | 310 | |
| Derate above 25°C | (Note 1) | | 1.6 | mW/°C |
| | (Note 2) | | 2.5 | |
| Thermal Resistance, Junction to Ambient | (Note 1) | $R_{\theta JA}$ | 618 | °C/W |
| | (Note 2) | | 403 | |
| Thermal Resistance, Junction to Lead | (Note 1) | $R_{\theta JL}$ | 280 | °C/W |
| | (Note 2) | | 332 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SC−75) (DTC143TE)** | | | | |
| Total Device Dissipation | | $P_D$ | | |
| $T_A$ = 25°C | (Note 1) | | 200 | mW |
| | (Note 2) | | 300 | |
| Derate above 25°C | (Note 1) | | 1.6 | mW/°C |
| | (Note 2) | | 2.4 | |
| Thermal Resistance, Junction to Ambient | (Note 1) | $R_{\theta JA}$ | 600 | °C/W |
| | (Note 2) | | 400 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| **THERMAL CHARACTERISTICS (SOT−723) (DTC143TM3)** | | | | |
| Total Device Dissipation | | $P_D$ | | |
| $T_A$ = 25°C | (Note 1) | | 260 | mW |
| | (Note 2) | | 600 | |
| Derate above 25°C | (Note 1) | | 2.0 | mW/°C |
| | (Note 2) | | 4.8 | |
| Thermal Resistance, Junction to Ambient | (Note 1) | $R_{\theta JA}$ | 480 | °C/W |
| | (Note 2) | | 205 | |
| 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.
3. FR−4 @ 100 $mm^2$, 1 oz. copper traces, still air.
4. FR−4 @ 500 $mm^2$, 1 oz. copper traces, still air.

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**Table 2. THERMAL CHARACTERISTICS**

| Characteristic | | Symbol | Max | Unit |
|---|---|---|---|---|
| **THERMAL CHARACTERISTICS (SOT−1123) (NSBC143TF3)** | | | | |
| Total Device Dissipation<br>$T_A$ = 25°C<br><br>Derate above 25°C | <br>(Note 3)<br>(Note 4)<br>(Note 3)<br>(Note 4) | $P_D$ | <br>254<br>297<br>2.0<br>2.4 | <br>mW<br><br>mW/°C |
| Thermal Resistance,<br>Junction to Ambient | (Note 3)<br>(Note 4) | $R_{\theta JA}$ | 493<br>421 | °C/W |
| Thermal Resistance, Junction to Lead | (Note 3) | $R_{\theta JL}$ | 193 | °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.
3. FR−4 @ 100 $mm^2$, 1 oz. copper traces, still air.
4. FR−4 @ 500 $mm^2$, 1 oz. copper traces, still air.

**Table 3. ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C, unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector−Base Cutoff Current<br>($V_{CB}$ = 50 V, $I_E$ = 0) | $I_{CBO}$ | − | − | 100 | nAdc |
| Collector−Emitter Cutoff Current<br>($V_{CE}$ = 50 V, $I_B$ = 0) | $I_{CEO}$ | − | − | 500 | nAdc |
| Emitter−Base Cutoff Current<br>($V_{EB}$ = 6.0 V, $I_C$ = 0) | $I_{EBO}$ | − | − | 1.9 | mAdc |
| Collector−Base Breakdown Voltage<br>($I_C$ = 10 μA, $I_E$ = 0) | $V_{(BR)CBO}$ | 50 | − | − | Vdc |
| Collector−Emitter Breakdown Voltage (Note 5)<br>($I_C$ = 2.0 mA, $I_B$ = 0) | $V_{(BR)CEO}$ | 50 | − | − | Vdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain (Note 5)<br>($I_C$ = 5.0 mA, $V_{CE}$ = 10 V) | $h_{FE}$ | 160 | 350 | − | |
| Collector−Emitter Saturation Voltage (Note 5)<br>($I_C$ = 10 mA, $I_B$ = 1.0 mA) | $V_{CE(sat)}$ | − | − | 0.25 | Vdc |
| Input Voltage (off)<br>($V_{CE}$ = 5.0 V, $I_C$ = 100 μA) | $V_{i(off)}$ | − | 0.6 | 0.5 | Vdc |
| Input Voltage (on)<br>($V_{CE}$ = 0.3 V, $I_C$ = 10 mA) | $V_{i(on)}$ | 1.3 | 0.9 | − | Vdc |
| Output Voltage (on)<br>($V_{CC}$ = 5.0 V, $V_B$ = 2.5 V, $R_L$ = 1.0 kΩ) | $V_{OL}$ | − | − | 0.2 | Vdc |
| Output Voltage (off)<br>($V_{CC}$ = 5.0 V, $V_B$ = 0.25 V, $R_L$ = 1.0 kΩ) | $V_{OH}$ | 4.9 | − | − | Vdc |
| Input Resistor | R1 | 3.3 | 4.7 | 6.1 | kΩ |
| Resistor Ratio | $R_1/R_2$ | − | − | − | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle ≤ 2%.

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**TYPICAL CHARACTERISTICS**
**MUN2216, MMUN2216L, MUN5216, DTC143TE, DTC143TM3**

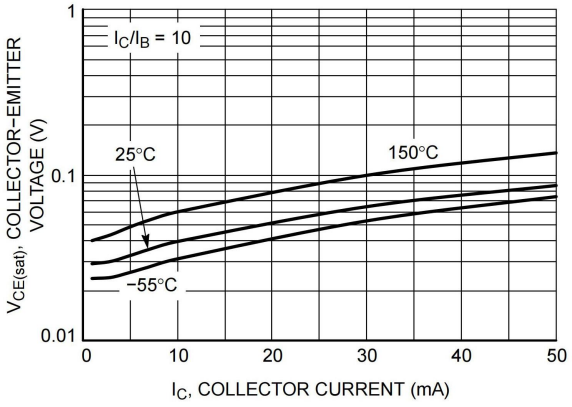



**Figure 2. $V_{CE(sat)}$ vs. $I_C$**

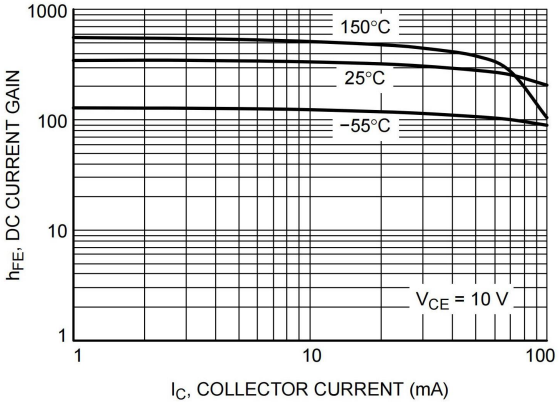



**Figure 3. DC Current Gain**

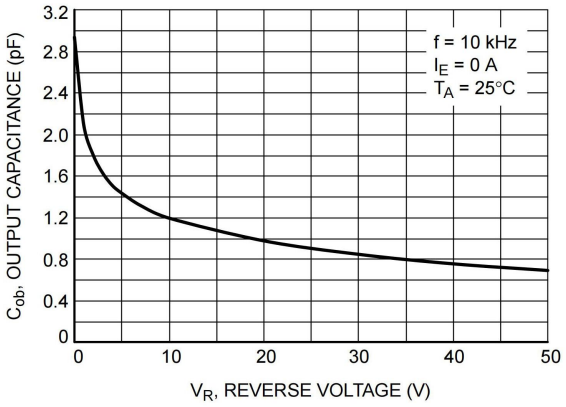



**Figure 4. Output Capacitance**

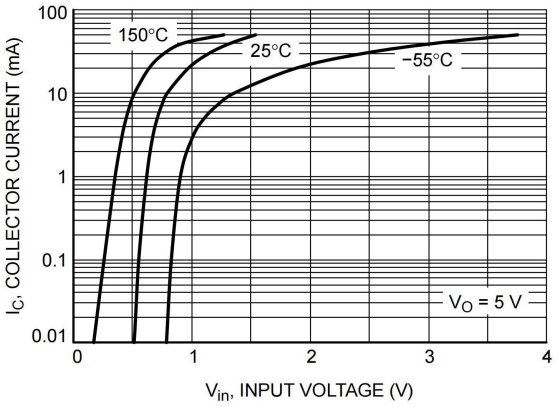



**Figure 5. Output Current vs. Input Voltage**

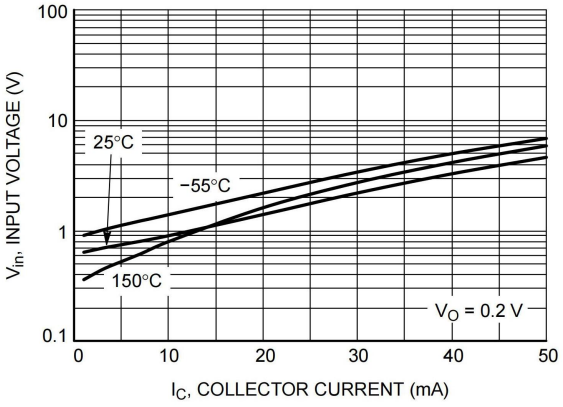
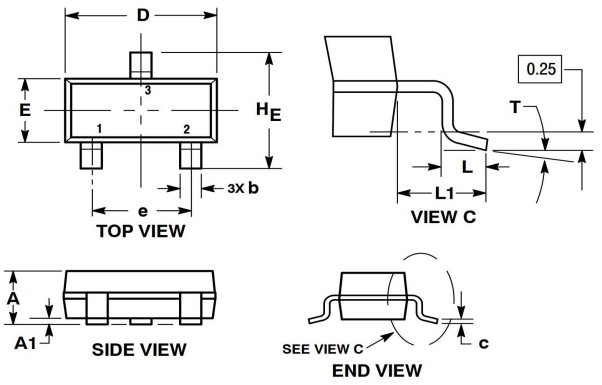



**Figure 6. Input Voltage vs. Output Current**

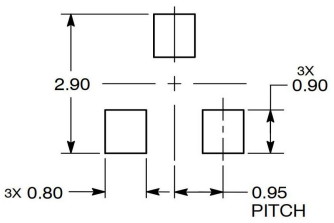
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NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| 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 | 0.080 |
| L | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | --- | 10° | 0° | --- | 10° |

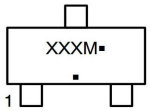
**RECOMMENDED SOLDERING FOOTPRINT**



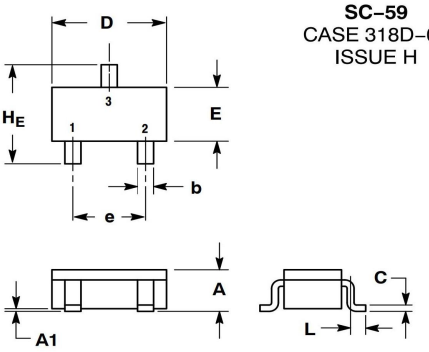

DIMENSIONS: MILLIMETERS

**SOT–23 (TO–236)**
CASE 318–08
ISSUE AS

**GENERIC MARKING DIAGRAM***




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

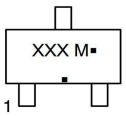



**SC–59**
CASE 318D–04
ISSUE H

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

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.00 | 1.15 | 1.30 | 0.039 | 0.045 | 0.051 |
| A1 | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.35 | 0.43 | 0.50 | 0.014 | 0.017 | 0.020 |
| c | 0.09 | 0.14 | 0.18 | 0.003 | 0.005 | 0.007 |
| D | 2.70 | 2.90 | 3.10 | 0.106 | 0.114 | 0.122 |
| E | 1.30 | 1.50 | 1.70 | 0.051 | 0.059 | 0.067 |
| e | 1.70 | 1.90 | 2.10 | 0.067 | 0.075 | 0.083 |
| L | 0.20 | 0.40 | 0.60 | 0.008 | 0.016 | 0.024 |
| $H_E$ | 2.50 | 2.80 | 3.00 | 0.099 | 0.110 | 0.118 |

**GENERIC MARKING DIAGRAM**

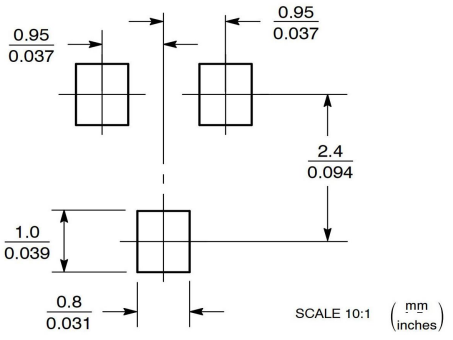



XXX = Specific Device Code
M = Date Code
▪ = Pb–Free Package*

(*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.

**SOLDERING FOOTPRINT***




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

STYLE 2:
PIN 1. ANODE
2. N.C.
3. CATHODE

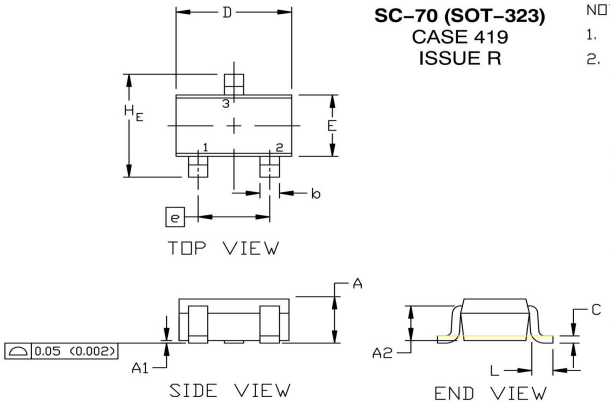
STYLE 3:
PIN 1. ANODE
2. ANODE
3. CATHODE

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

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

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE/CATHODE

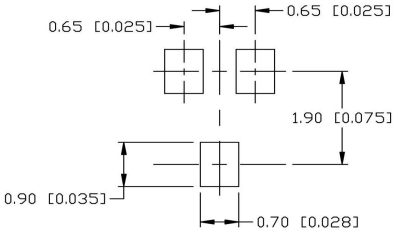
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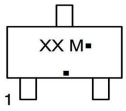

**SC–70 (SOT–323)**
CASE 419
ISSUE R

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

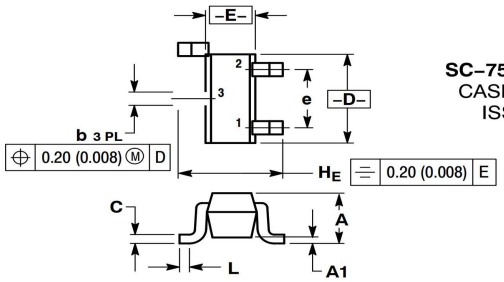
| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.80 | 0.90 | 1.00 | 0.032 | 0.035 | 0.040 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| A2 | 0.70 REF | | | 0.028 BSC | | |
| b | 0.30 | 0.35 | 0.40 | 0.012 | 0.014 | 0.016 |
| c | 0.10 | 0.18 | 0.25 | 0.004 | 0.007 | 0.010 |
| D | 1.80 | 2.00 | 2.20 | 0.071 | 0.080 | 0.087 |
| E | 1.15 | 1.24 | 1.35 | 0.045 | 0.049 | 0.053 |
| e | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e1 | 0.65 BSC | | | 0.026 BSC | | |
| L | 0.20 | 0.38 | 0.56 | 0.008 | 0.015 | 0.022 |
| $H_E$ | 2.00 | 2.10 | 2.40 | 0.079 | 0.083 | 0.095 |




**GENERIC MARKING DIAGRAM**




XX = Specific Device Code
M = Date Code
▪ = Pb–Free Package




**SC–75/SOT–416**
CASE 463–01
ISSUE G

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

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.70 | 0.80 | 0.90 | 0.027 | 0.031 | 0.035 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.15 | 0.20 | 0.30 | 0.006 | 0.008 | 0.012 |
| C | 0.10 | 0.15 | 0.25 | 0.004 | 0.006 | 0.010 |
| D | 1.55 | 1.60 | 1.65 | 0.061 | 0.063 | 0.065 |
| E | 0.70 | 0.80 | 0.90 | 0.027 | 0.031 | 0.035 |
| e | 1.00 BSC | | | 0.04 BSC | | |
| L | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| $H_E$ | 1.50 | 1.60 | 1.70 | 0.060 | 0.063 | 0.067 |

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

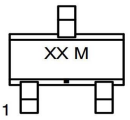
STYLE 2:
PIN 1. ANODE
2. N/C
3. CATHODE

STYLE 3:
PIN 1. ANODE
2. ANODE
3. CATHODE

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

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

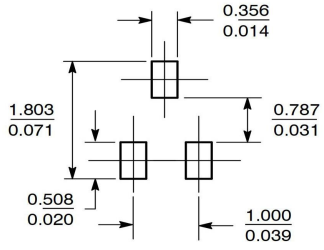
**GENERIC MARKING DIAGRAM***




XX = Specific Device Code
M = Date Code
▪ = Pb–Free Package

*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.

**SOLDERING FOOTPRINT***

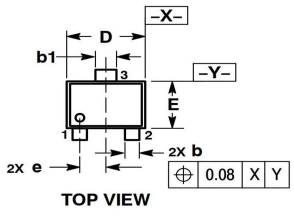



SCALE 10:1 (mm / inches)

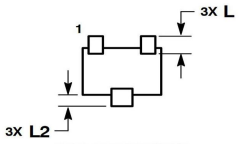
# OM SENI

PACKAGE OUTLINE

DIMENSIONS: MILLIMETERS

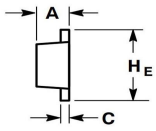



TOP VIEW




BOTTOM VIEW

**SOT–723**
CASE 631AA–01
ISSUE D




SIDE VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

| | MILLIMETERS | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 0.45 | 0.50 | 0.55 |
| b | 0.15 | 0.21 | 0.27 |
| b1 | 0.25 | 0.31 | 0.37 |
| C | 0.07 | 0.12 | 0.17 |
| D | 1.15 | 1.20 | 1.25 |
| E | 0.75 | 0.80 | 0.85 |
| e | | 0.40 BSC | |
| H E | 1.15 | 1.20 | 1.25 |
| L | | 0.29 REF | |
| L2 | 0.15 | 0.20 | 0.25 |

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

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

STYLE 3:
PIN 1. ANODE
2. ANODE
3. CATHODE

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

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

**GENERIC MARKING DIAGRAM***




XX = Specific Device Code
M = Date Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb–Free indicator, “G”, may or not be present.

**RECOMMENDED SOLDERING FOOTPRINT***

