Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

# DTC114EET1 Series

# 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−75/SOT−416 package which is designed for low power surface mount applications.

### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SC−75/SOT−416 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
- Pb−Free Packages are Available

**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**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Total Device Dissipation, FR−4 Board (Note 1) @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 200<br>1.6 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient (Note 1) | $R_{\theta JA}$ | 600 | °C/W |
| Total Device Dissipation, FR−4 Board (Note 2) @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 300<br>2.4 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient (Note 2) | $R_{\theta JA}$ | 400 | °C/W |
| Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

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.

1. FR−4 @ Minimum Pad
2. FR−4 @ 1.0 × 1.0 Inch Pad

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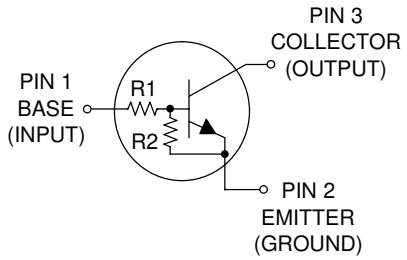
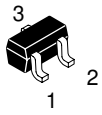
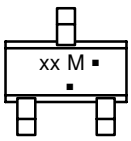
## NPN SILICON BIAS RESISTOR TRANSISTORS




**SC−75 (SOT−416)**
**CASE 463**
**STYLE 1**

**MARKING DIAGRAM**




xx = Specific Device Code
xx = (Refer to page 2)
M = Date Code*
▪ = Pb−Free Package
(Note: Microdot may be in either location)

*Date Code orientation may vary depending upon manufacturing location.

**ORDERING INFORMATION**

See detailed ordering, marking, and shipping information in the package dimensions section on page 2 of this data sheet.

**ORDERING INFORMATION, DEVICE MARKING and RESISTOR VALUES**

| Device | Marking | R1 (K) | R2 (K) | Package | Shipping† |
|---|---|---|---|---|---|
| DTC114EET1 | 8A | 10 | 10 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC114EET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC124EET1 | 8B | 22 | 22 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC124EET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC144EET1 | 8C | 47 | 47 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC144EET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC114YET1 | 8D | 10 | 47 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC114YET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC114TET1 | 94 | 10 | ∞ | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC114TET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC143TET1 | 8F | 4.7 | ∞ | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC143TET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC123EET1 | 8H | 2.2 | 2.2 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC123EET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC143EET1 | 8J | 4.7 | 4.7 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC143EET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC143ZET1 | 8K | 4.7 | 47 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC143ZET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC124XET1 | 8L | 22 | 47 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC124XET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC123JET1 | 8M | 2.2 | 47 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC123JET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC115EET1 | 8N | 100 | 100 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC115EET1G | | | | SC−75/SOT−416 (Pb−Free) | 3000 Tape & Reel |
| DTC144WET1 | 8P | 47 | 22 | SC−75/SOT−416 | 3000 Tape & Reel |
| DTC144WET1G | | | | SC−75/SOT−416 | 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.

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| 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 ($V_{EB}$ = 6.0 V, $I_C$ = 0) | DTC114EET1 | $I_{EBO}$ | – | – | 0.5 | mAdc |
| | DTC124EET1 | | – | – | 0.2 | |
| | DTC144EET1 | | – | – | 0.1 | |
| | DTC114YET1 | | – | – | 0.2 | |
| | DTC114TET1 | | – | – | 0.9 | |
| | DTC143TET1 | | – | – | 1.9 | |
| | DTC123EET1 | | – | – | 2.3 | |
| | DTC143EET1 | | – | – | 1.5 | |
| | DTC143ZET1 | | – | – | 0.18 | |
| | DTC124XET1 | | – | – | 0.13 | |
| | DTC123JET1 | | – | – | 0.2 | |
| | DTC115EET1 | | – | – | 0.05 | |
| | DTC144WET1 | | – | – | 0.13 | |
| Collector−Base Breakdown Voltage ($I_C$ = 10 μA, $I_E$ = 0) | | $V_{(BR)CBO}$ | 50 | – | – | Vdc |
| Collector−Emitter Breakdown Voltage (Note 3) ($I_C$ = 2.0 mA, $I_B$ = 0) | | $V_{(BR)CEO}$ | 50 | – | – | Vdc |
| **ON CHARACTERISTICS** (Note 3) | | | | | | |
| DC Current Gain ($V_{CE}$ = 10 V, $I_C$ = 5.0 mA) | DTC114EET1 | $h_{FE}$ | 35 | 60 | – | |
| | DTC124EET1 | | 60 | 100 | – | |
| | DTC144EET1 | | 80 | 140 | – | |
| | DTC114YET1 | | 80 | 140 | – | |
| | DTC114TET1 | | 160 | 350 | – | |
| | DTC143TET1 | | 160 | 350 | – | |
| | DTC123EET1 | | 8.0 | 15 | – | |
| | DTC143EET1 | | 15 | 30 | – | |
| | DTC143ZET1 | | 80 | 200 | – | |
| | DTC124XET1 | | 80 | 150 | – | |
| | DTC123JET1 | | 80 | 140 | – | |
| | DTC115EET1 | | 80 | 150 | – | |
| | DTC144WET1 | | 80 | 140 | – | |
| Collector−Emitter Saturation Voltage ($I_C$ = 10 mA, $I_B$ = 0.3 mA) ($I_C$ = 10 mA, $I_B$ = 5 mA) DTC123EET1 ($I_C$ = 10 mA, $I_B$ = 1 mA) DTC143TET1/DTC114TET1/ DTC143EET1/DTC143ZET1/DTC124XET1 | | $V_{CE(sat)}$ | – | – | 0.25 | Vdc |
| Output Voltage (on) | | $V_{OL}$ | | | | Vdc |
| ($V_{CC}$ = 5.0 V, $V_B$ = 2.5 V, $R_L$ = 1.0 kΩ) | DTC114EET1 | | – | – | 0.2 | |
| | DTC124EET1 | | – | – | 0.2 | |
| | DTC114YET1 | | – | – | 0.2 | |
| | DTC114TET1 | | – | – | 0.2 | |
| | DTC143TET1 | | – | – | 0.2 | |
| | DTC123EET1 | | – | – | 0.2 | |
| | DTC143EET1 | | – | – | 0.2 | |
| | DTC143ZET1 | | – | – | 0.2 | |
| | DTC124XET1 | | – | – | 0.2 | |
| | DTC123JET1 | | – | – | 0.2 | |
| ($V_{CC}$ = 5.0 V, $V_B$ = 3.5 V, $R_L$ = 1.0 kΩ) | DTC144EET1 | | – | – | 0.2 | |
| ($V_{CC}$ = 5.0 V, $V_B$ = 5.5 V, $R_L$ = 1.0 kΩ) | DTC115EET1 | | – | – | 0.2 | |
| ($V_{CC}$ = 5.0 V, $V_B$ = 4.0 V, $R_L$ = 1.0 kΩ) | DTC144WET1 | | – | – | 0.2 | |
| Output Voltage (off) ($V_{CC}$ = 5.0 V, $V_B$ = 0.5 V, $R_L$ = 1.0 kΩ) ($V_{CC}$ = 5.0 V, $V_B$ = 0.25 V, $R_L$ = 1.0 kΩ) | DTC143TET1 DTC143ZET1 DTC114TET1 | $V_{OH}$ | 4.9 | – | – | Vdc |

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

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted) (Continued)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Input Resistor | TC114EET1 | R1 | 7.0 | 10 | 13 | kΩ |
| | DTC124EET1 | | 15.4 | 22 | 28.6 | |
| | DTC144EET1 | | 32.9 | 47 | 61.1 | |
| | DTC114YET1 | | 7.0 | 10 | 13 | |
| | DTC114TET1 | | 7.0 | 10 | 13 | |
| | DTC143TET1 | | 3.3 | 4.7 | 6.1 | |
| | DTC123EET1 | | 1.5 | 2.2 | 2.9 | |
| | DTC143EET1 | | 3.3 | 4.7 | 6.1 | |
| | DTC143ZET1 | | 3.3 | 4.7 | 6.1 | |
| | DTC124XET1 | | 15.4 | 22 | 28.6 | |
| | DTC123JET1 | | 1.54 | 2.2 | 2.86 | |
| | DTC115EET1 | | 70 | 100 | 130 | |
| | DTC144WET1 | | 32.9 | 47 | 61.1 | |
| Resistor Ratio | DTC114EET1/DTC124EET1/DTC144EET1/ | $R_1/R_2$ | | | | |
| | DTC115EET1 | | 0.8 | 1.0 | 1.2 | |
| | DTC114YET1 | | 0.17 | 0.21 | 0.25 | |
| | DTC143TET1/DTC114TET1 | | – | – | – | |
| | DTC123EET1/DTC143EET1 | | 0.8 | 1.0 | 1.2 | |
| | DTC143ZET1 | | 0.055 | 0.1 | 0.185 | |
| | DTC124XET1 | | 0.38 | 0.47 | 0.56 | |
| | DTC123JET1 | | 0.038 | 0.047 | 0.056 | |
| | DTC144WET1D | | 1.7 | 2.1 | 2.6 | |

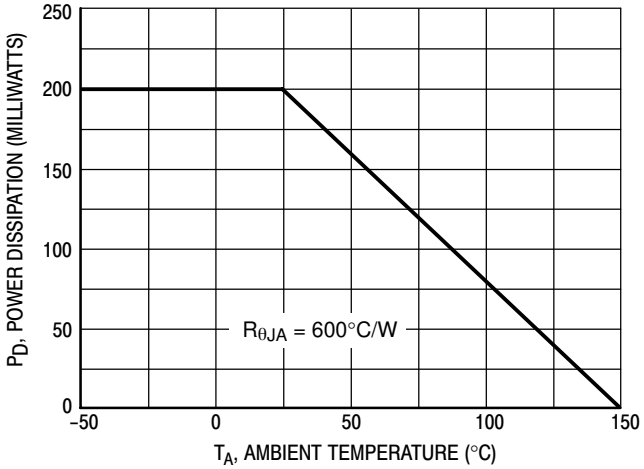



**Figure 1. Derating Curve**

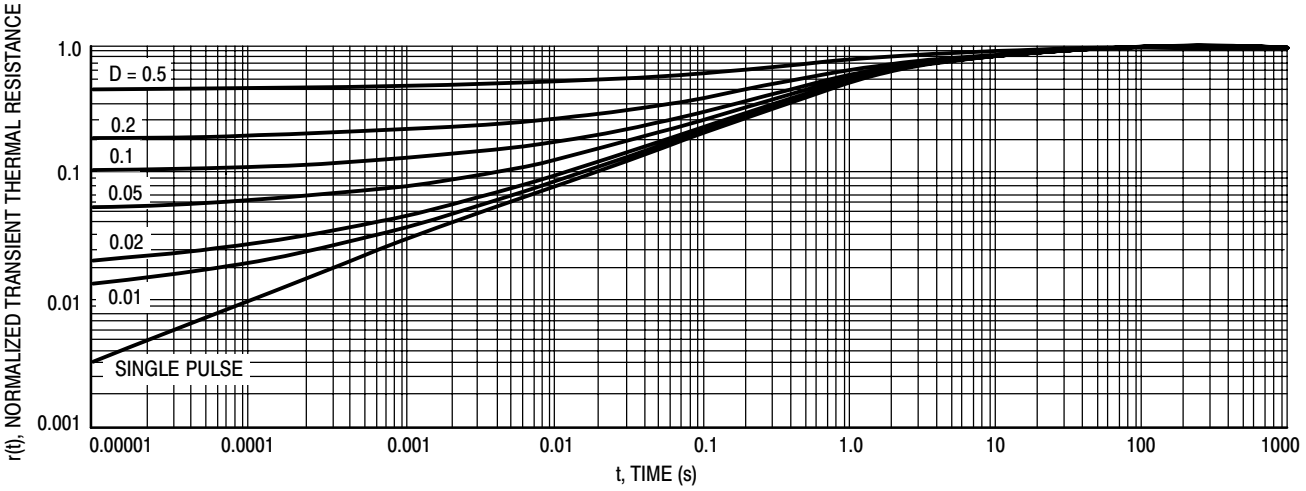



**Figure 2. Normalized Thermal Response**

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114EET1

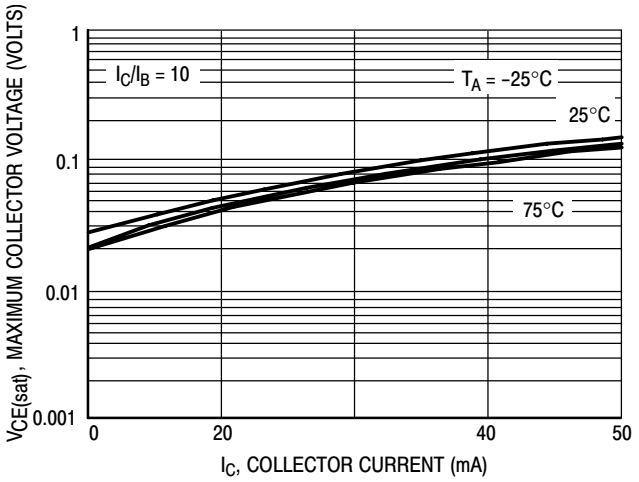



**Figure 3. $V_{CE(sat)}$ versus $I_C$**

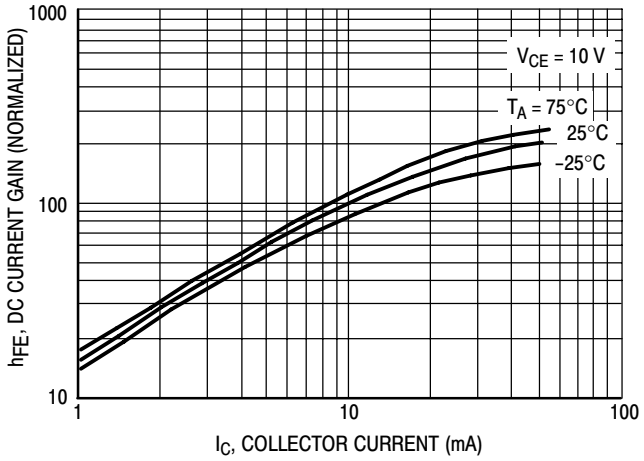



**Figure 4. DC Current Gain**

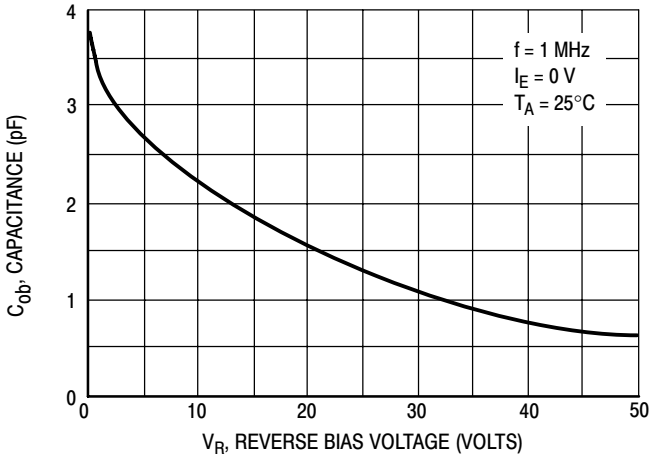



**Figure 5. Output Capacitance**

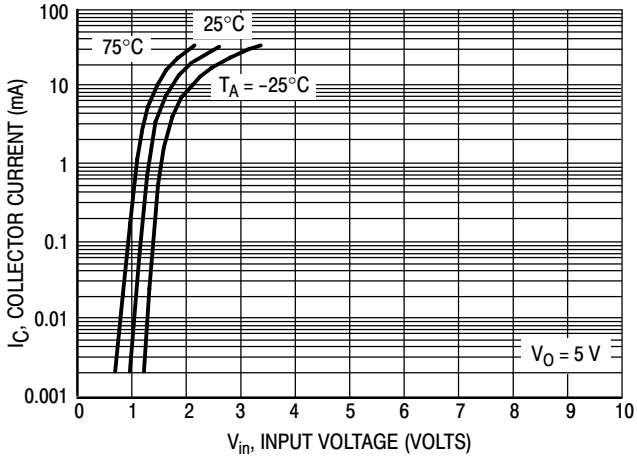



**Figure 6. Output Current versus Input Voltage**

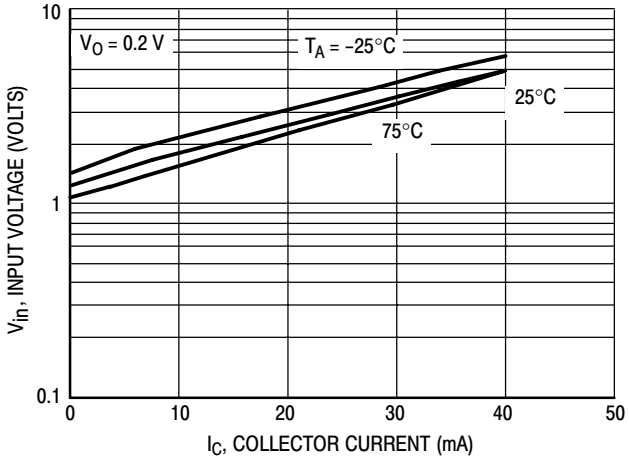



**Figure 7. Input Voltage versus Output Current**

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC123EET1

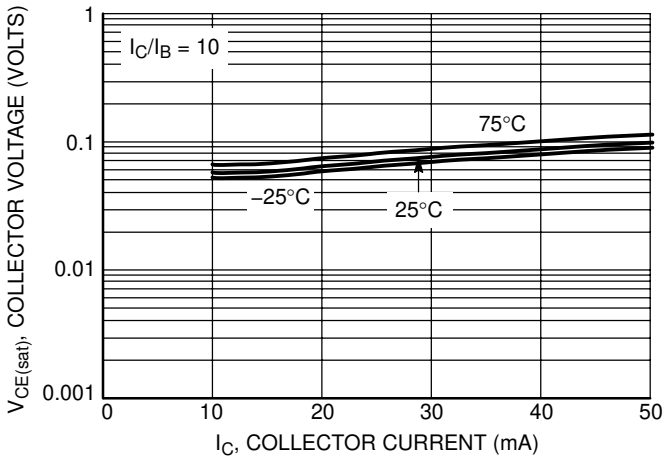



**Figure 8. $V_{CE(sat)}$ versus $I_C$**

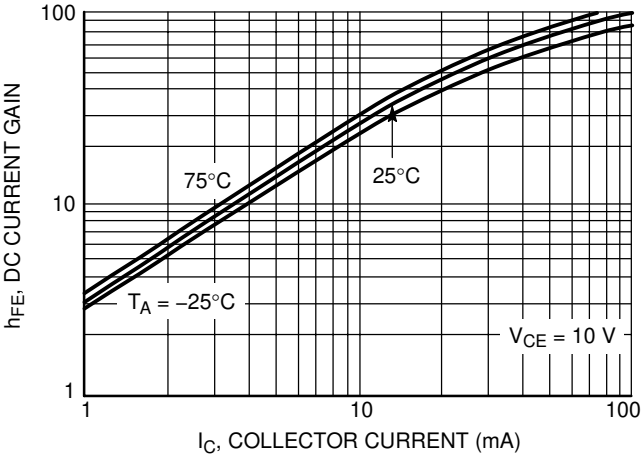



**Figure 9. DC Current Gain**

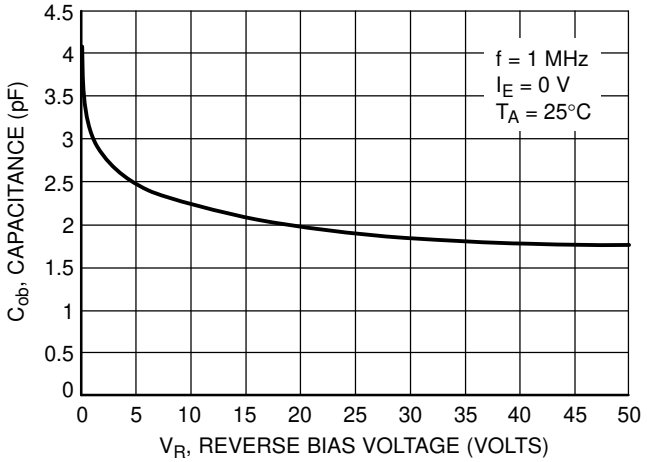



**Figure 10. Output Capacitance**

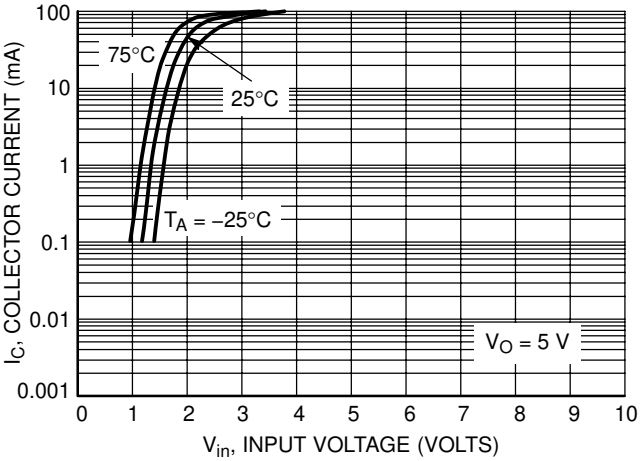



**Figure 11. Output Current versus Input Voltage**

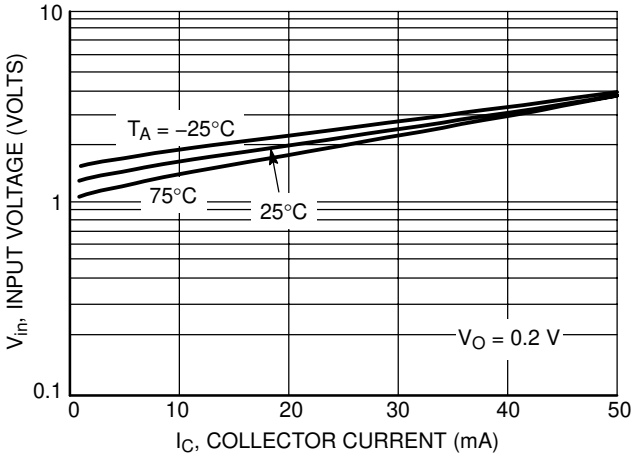



**Figure 12. Input Voltage versus Output Current**

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC124EET1

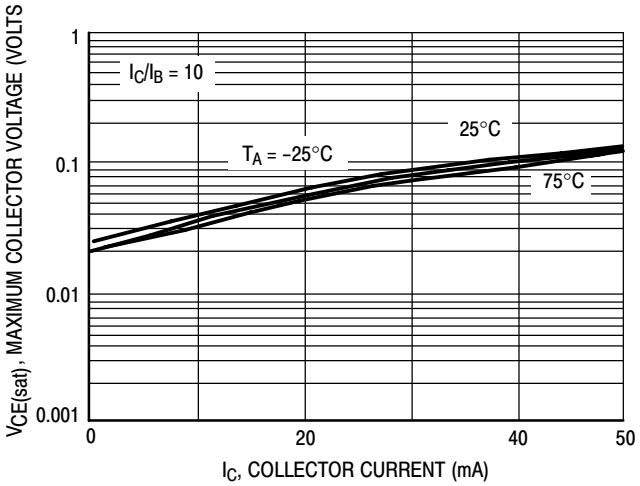



**Figure 13. $V_{CE(sat)}$ versus $I_C$**

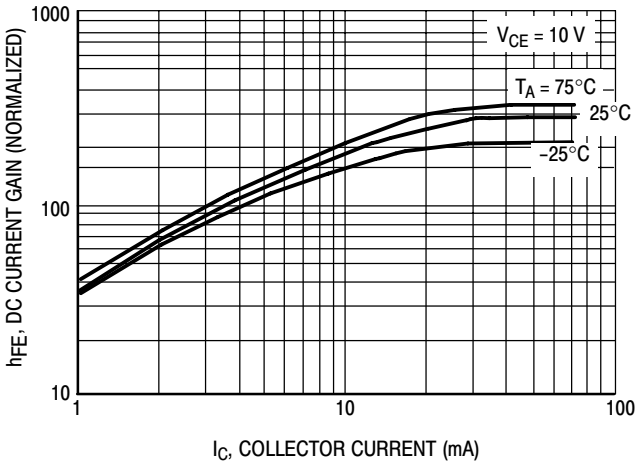



**Figure 14. DC Current Gain**

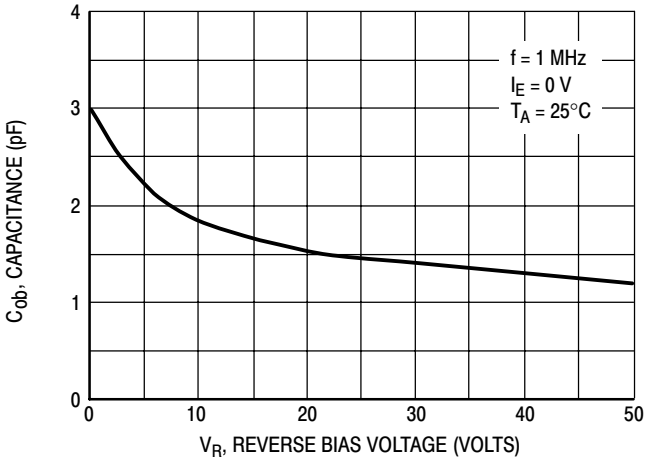



**Figure 15. Output Capacitance**

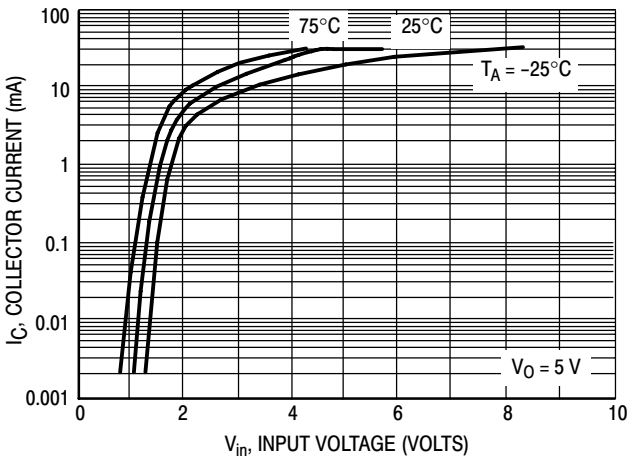



**Figure 16. Output Current versus Input Voltage**

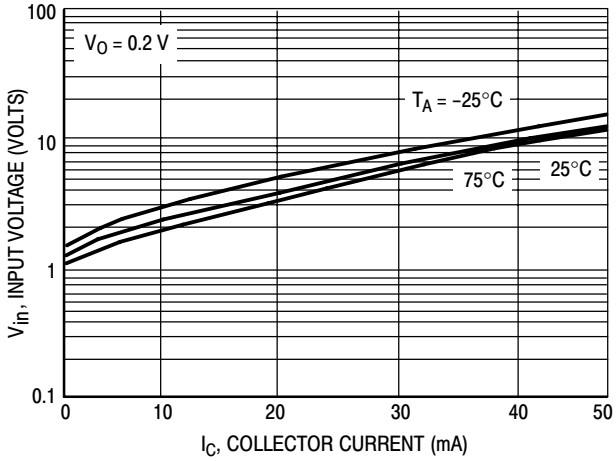



**Figure 17. Input Voltage versus Output Current**

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC144EET1

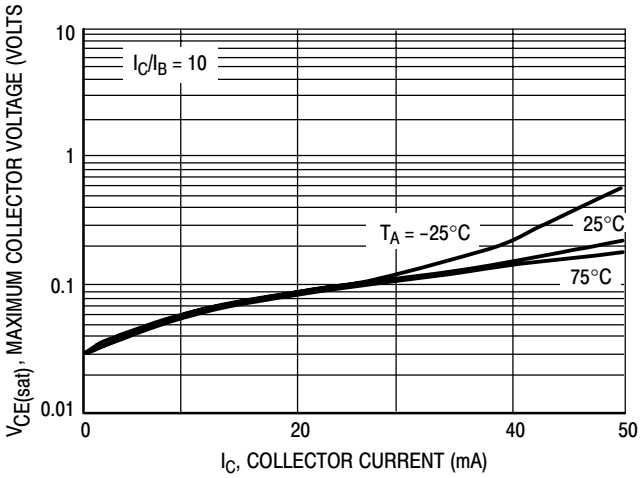



**Figure 18. $V_{CE(sat)}$ versus $I_C$**

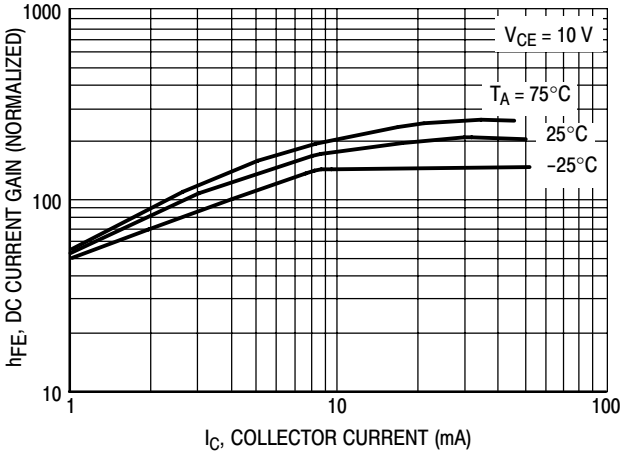



**Figure 19. DC Current Gain**

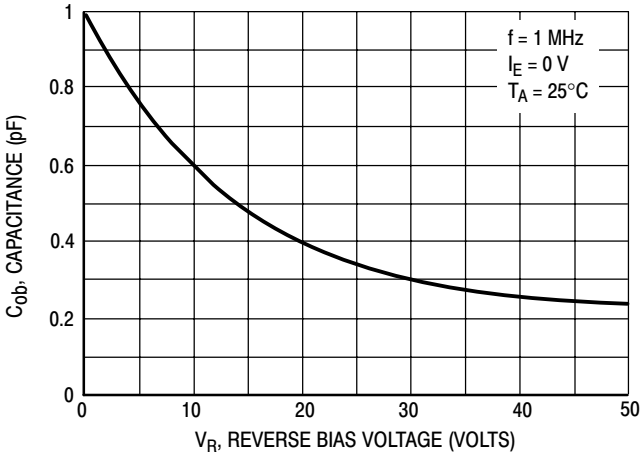



**Figure 20. Output Capacitance**

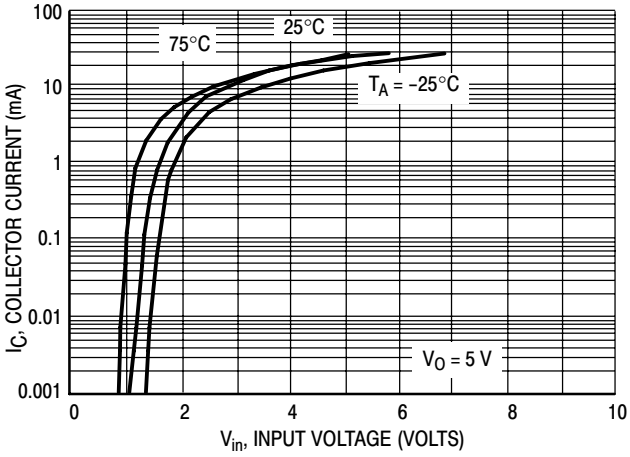



**Figure 21. Output Current versus Input Voltage**

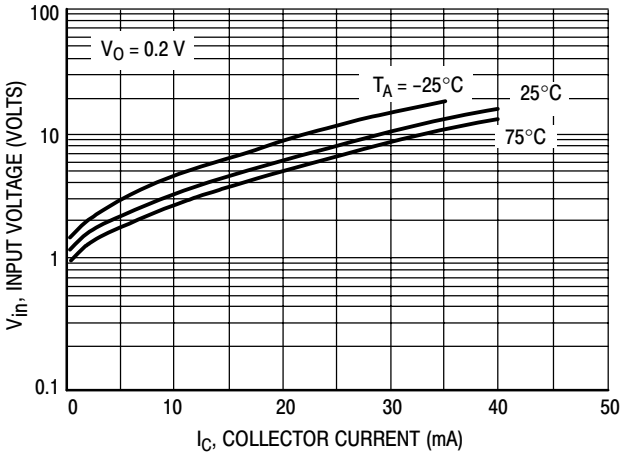



**Figure 22. Input Voltage versus Output Current**

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114YET1

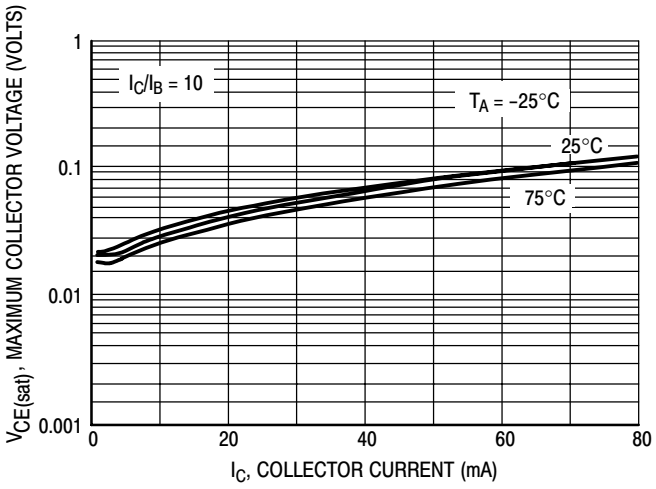



**Figure 23. $V_{CE(sat)}$ versus $I_C$**

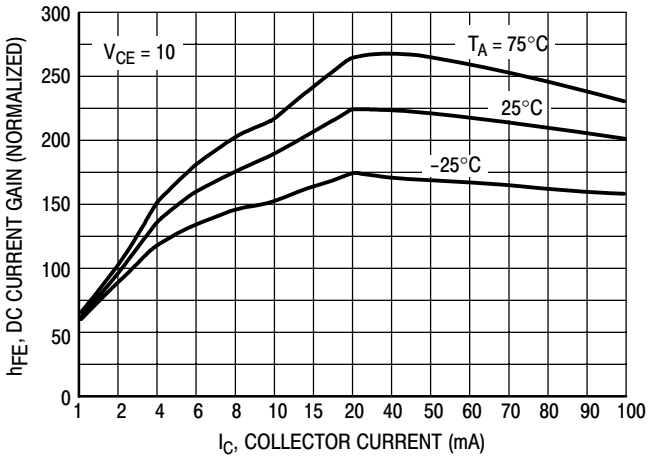



**Figure 24. DC Current Gain**

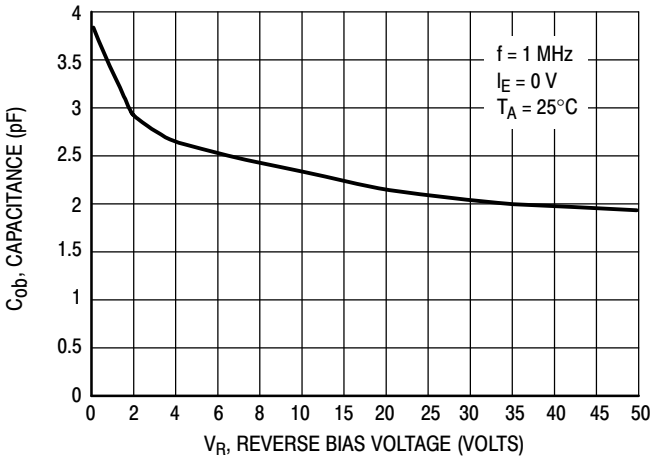



**Figure 25. Output Capacitance**

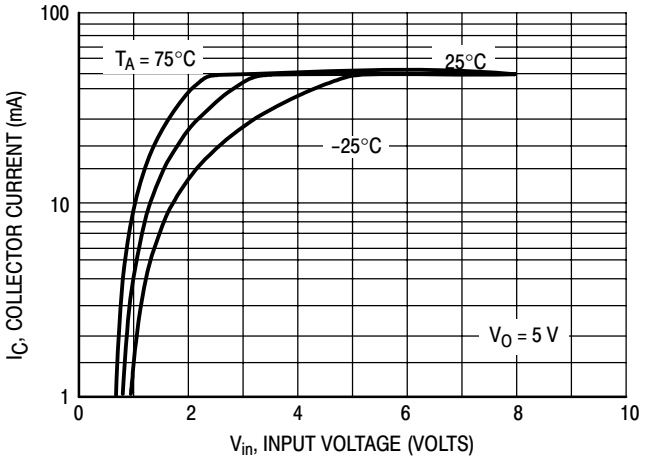



**Figure 26. Output Current versus Input Voltage**

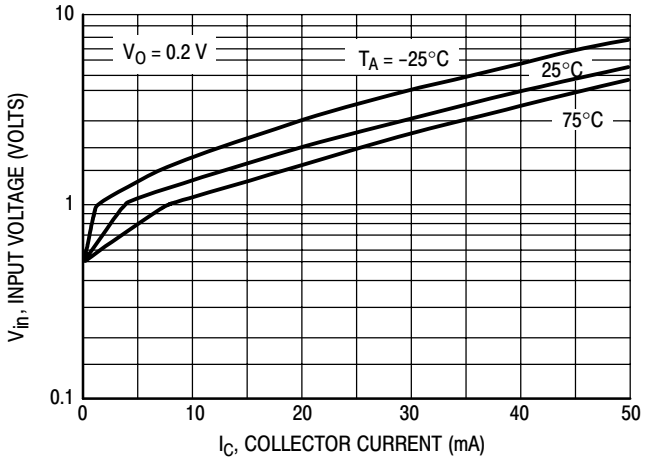



**Figure 27. Input Voltage versus Output Current**

## TYPICAL APPLICATIONS FOR NPN BRTs

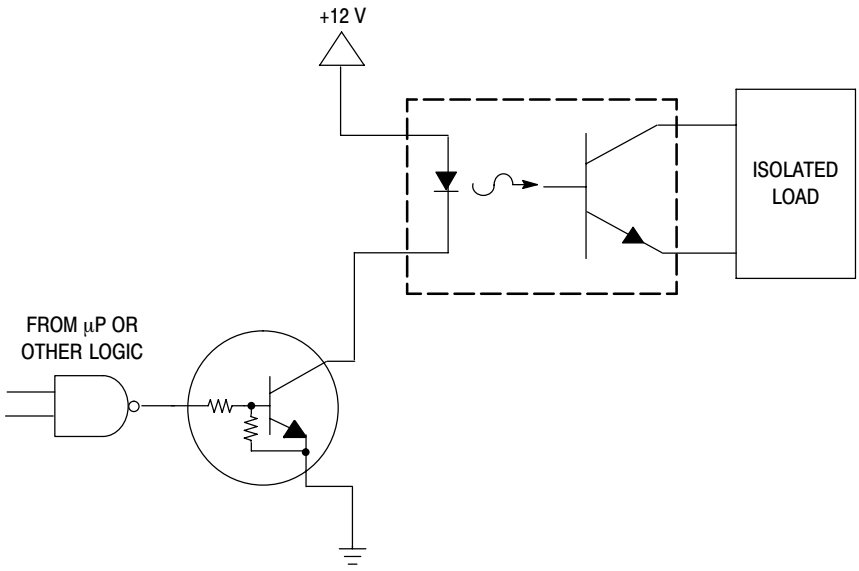



**Figure 28. Level Shifter: Connects 12 or 24 Volt Circuits to Logic**

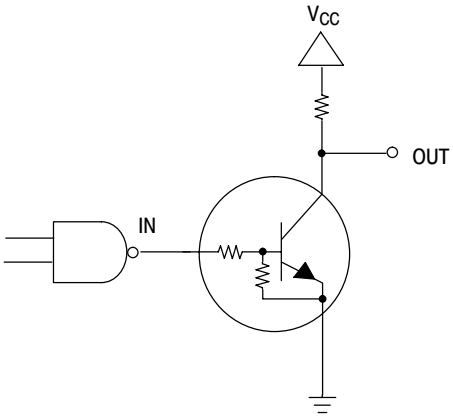



**Figure 29. Open Collector Inverter: Inverts the Input Signal**

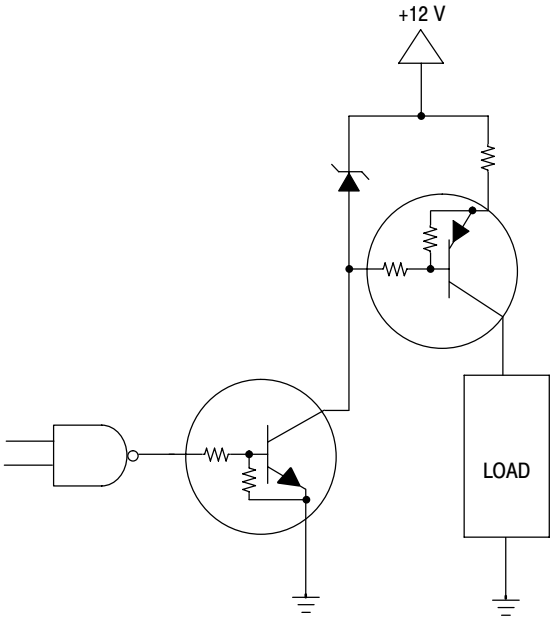
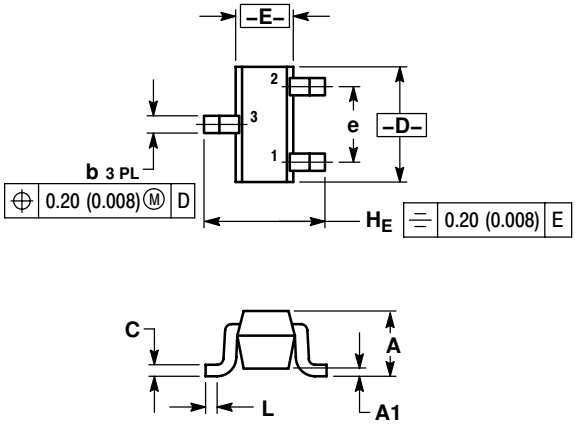



**Figure 30. Inexpensive, Unregulated Current Source**

## PACKAGE DIMENSIONS

**SC–75/SOT–416**
CASE 463–01
ISSUE F

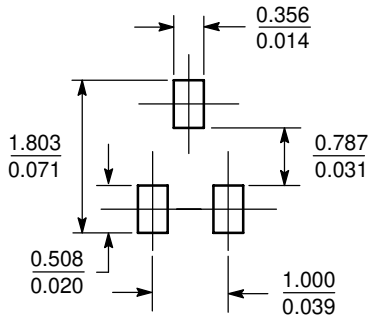



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| | 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 | 0.059 | 0.063 | 0.067 |
| 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 | 0.061 | 0.063 | 0.065 |

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

## SOLDERING FOOTPRINT*




SCALE 10:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*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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