

# 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
- Available in 8 mm, 7 inch/3000 Unit Tape & Reel
- Pb-Free Packages are Available

#### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage    | $V_{CB0}$ | 50    | Vdc  |
| Collector-Emitter Voltage | $V_{CEO}$ | 50    | Vdc  |
| Collector Current         | $I_C$     | 100   | mAdc |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

#### THERMAL CHARACTERISTICS

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

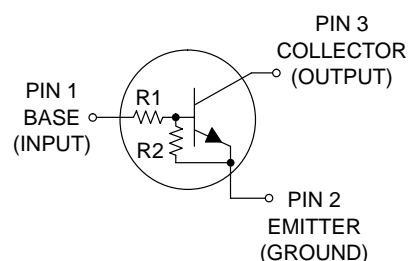
1. FR-4 @ Minimum Pad
2. FR-4 @  $1.0 \times 1.0$  Inch Pad



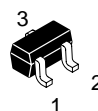
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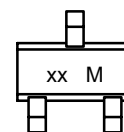
## NPN SILICON BIAS RESISTOR TRANSISTORS



#### MARKING DIAGRAM



SC-75/SOT-416  
CASE 463  
STYLE 1



xx = Specific Device Code  
M = Date Code

#### ORDERING INFORMATION

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

## DTC114EET1 Series

### 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 | 8A      | 10     | 10     | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC124EET1  | 8B      | 22     | 22     | SC-75/SOT-416              |                  |
| DTC124EET1G | 8B      | 22     | 22     | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC144EET1  | 8C      | 47     | 47     | SC-75/SOT-416              |                  |
| DTC144EET1G | 8C      | 47     | 47     | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC114YET1  | 8D      | 10     | 47     | SC-75/SOT-416              |                  |
| DTC114YET1G | 8D      | 10     | 47     | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC114TET1  | 94      | 10     | ∞      | SC-75/SOT-416              |                  |
| DTC114TET1G | 94      | 10     | ∞      | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC143TET1  | 8F      | 4.7    | ∞      | SC-75/SOT-416              |                  |
| DTC143TET1G | 8F      | 4.7    | ∞      | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC123EET1  | 8H      | 2.2    | 2.2    | SC-75/SOT-416              |                  |
| DTC123EET1G | 8H      | 2.2    | 2.2    | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC143EET1  | 8J      | 4.7    | 4.7    | SC-75/SOT-416              |                  |
| DTC143EET1G | 8J      | 4.7    | 4.7    | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC143ZET1  | 8K      | 4.7    | 47     | SC-75/SOT-416              |                  |
| DTC143ZET1G | 8K      | 4.7    | 47     | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC124XET1  | 8L      | 22     | 47     | SC-75/SOT-416              |                  |
| DTC124XET1G | 8L      | 22     | 47     | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC123JET1  | 8M      | 2.2    | 47     | SC-75/SOT-416              |                  |
| DTC123JET1G | 8M      | 2.2    | 47     | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC115EET1  | 8N      | 100    | 100    | SC-75/SOT-416              |                  |
| DTC115EET1G | 8N      | 100    | 100    | SC-75/SOT-416<br>(Pb-Free) |                  |
| DTC144WET1  | 8P      | 47     | 22     | SC-75/SOT-416              |                  |

†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.

# DTC114EET1 Series

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

| Characteristic  | Symbol        | Min | Typ | Max  | Unit |
|---|---------------|-----|-----|------|------|
| <b>OFF CHARACTERISTICS</b>  |               |     |     |      |      |
| Collector–Base Cutoff Current ( $V_{CB} = 50\text{ V}$ , $I_E = 0$ )  | $I_{CBO}$     | –   | –   | 100  | nAdc |
| Collector–Emitter Cutoff Current ( $V_{CE} = 50\text{ V}$ , $I_B = 0$ )   | $I_{CEO}$     | –   | –   | 500  | nAdc |
| Emitter–Base Cutoff Current<br>( $V_{EB} = 6.0\text{ V}$ , $I_C = 0$ )  | $I_{EBO}$     | –   | –   | 0.5  | mAdc |
|   | DTC114EET1    | –   | –   | 0.2  |      |
|   | DTC124EET1    | –   | –   | 0.1  |      |
|   | DTC144EET1    | –   | –   | 0.2  |      |
|   | DTC114YET1    | –   | –   | 0.9  |      |
|   | DTC114TET1    | –   | –   | 1.9  |      |
|   | DTC143TET1    | –   | –   | 2.3  |      |
|   | DTC123EET1    | –   | –   | 1.5  |      |
|   | DTC143EET1    | –   | –   | 0.18 |      |
|   | DTC143ZET1    | –   | –   | 0.13 |      |
|   | DTC124XET1    | –   | –   | 0.2  |      |
|   | DTC123JET1    | –   | –   | 0.05 |      |
|   | DTC115EET1    | –   | –   | 0.13 |      |
|   | DTC144WET1    | –   | –   | 0.13 |      |
| Collector–Base Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ , $I_E = 0$ )  | $V_{(BR)CBO}$ | 50  | –   | –    | Vdc  |
| Collector–Emitter Breakdown Voltage (Note 3)<br>( $I_C = 2.0\text{ mA}$ , $I_B = 0$ )   | $V_{(BR)CEO}$ | 50  | –   | –    | Vdc  |
| <b>ON CHARACTERISTICS (Note 3)</b>  |               |     |     |      |      |
| DC Current Gain<br>( $V_{CE} = 10\text{ V}$ , $I_C = 5.0\text{ mA}$ )   | $h_{FE}$      | 35  | 60  | –    |      |
|   | DTC114EET1    | 60  | 100 | –    |      |
|   | DTC124EET1    | 80  | 140 | –    |      |
|   | DTC144EET1    | 80  | 140 | –    |      |
|   | DTC114YET1    | 160 | 350 | –    |      |
|   | DTC114TET1    | 160 | 350 | –    |      |
|   | DTC143TET1    | 8.0 | 15  | –    |      |
|   | DTC123EET1    | 15  | 30  | –    |      |
|   | DTC143EET1    | 80  | 200 | –    |      |
|   | DTC143ZET1    | 80  | 150 | –    |      |
|   | DTC124XET1    | 80  | 140 | –    |      |
|   | DTC123JET1    | 80  | 150 | –    |      |
|   | DTC115EET1    | 80  | 140 | –    |      |
|   | DTC144WET1    | 80  | 140 | –    |      |
| Collector–Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 0.3\text{ mA}$ )<br>( $I_C = 10\text{ mA}$ , $I_B = 5\text{ mA}$ ) DTC123EET1<br>( $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$ ) DTC143TET1/DTC114TET1/<br>DTC143EET1/DTC143ZET1/DTC124XET1 | $V_{CE(sat)}$ | –   | –   | 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  |
|   | 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  |      |
| ( $V_{CC} = 5.0\text{ V}$ , $V_B = 3.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )   | DTC144EET1    | –   | –   | 0.2  |      |
| ( $V_{CC} = 5.0\text{ V}$ , $V_B = 5.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )   | DTC115EET1    | –   | –   | 0.2  |      |
| ( $V_{CC} = 5.0\text{ V}$ , $V_B = 4.0\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )   | DTC144WET1    | –   | –   | 0.2  |      |
| Output Voltage (off) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )<br>( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.25\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )  | $V_{OH}$      | 4.9 | –   | –    | Vdc  |
|   | DTC143TET1    |     |     |      |      |
|   | DTC143ZET1    |     |     |      |      |
|   | DTC114TET1    |     |     |      |      |

3. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%

# DTC114EET1 Series

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

| Characteristic |   | Symbol    | Min   | Typ   | Max   | Unit       |
|----------------|---|-----------|-------|-------|-------|------------|
| Input Resistor | TC114EET1                                       | R1        | 7.0   | 10    | 13    | k $\Omega$ |
|                | 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/<br>DTC115EET1 | $R_1/R_2$ | 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   |            |

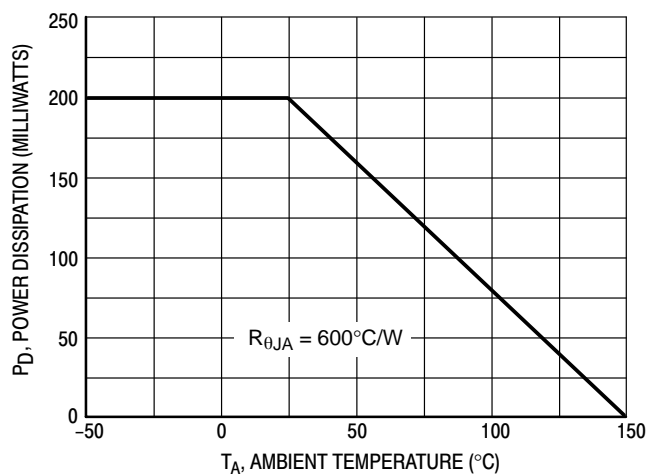


Figure 1. Derating Curve

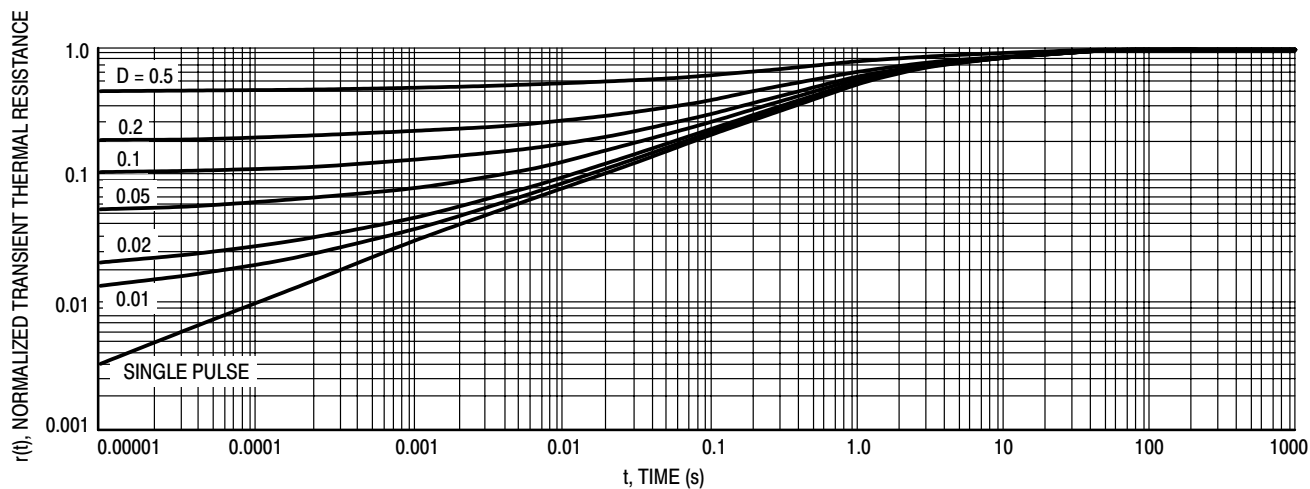


Figure 2. Normalized Thermal Response

# DTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114EET1

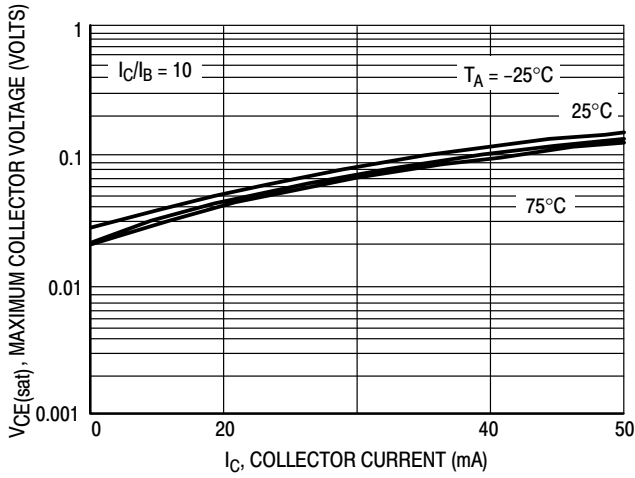


Figure 3.  $V_{CE(sat)}$  versus  $I_C$

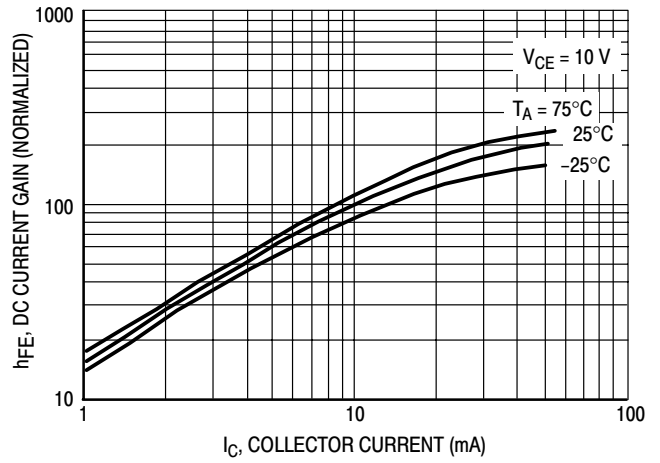


Figure 4. DC Current Gain

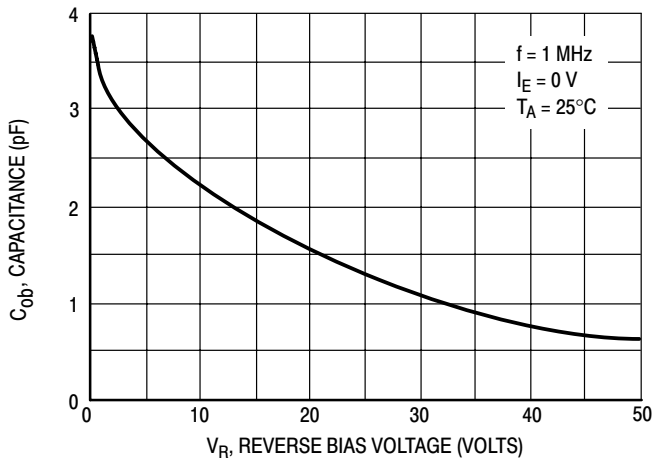


Figure 5. Output Capacitance

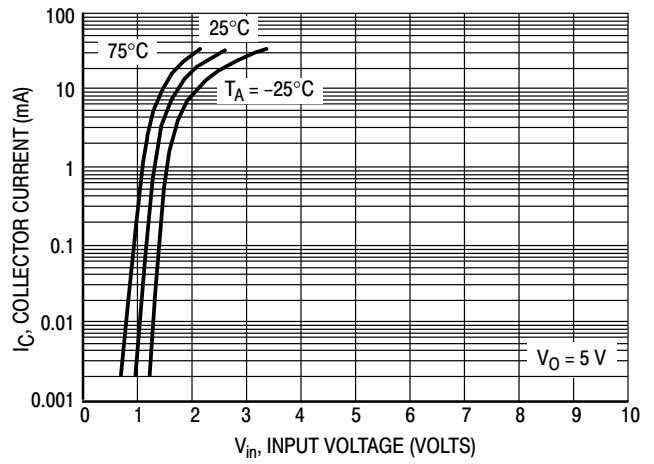


Figure 6. Output Current versus Input Voltage

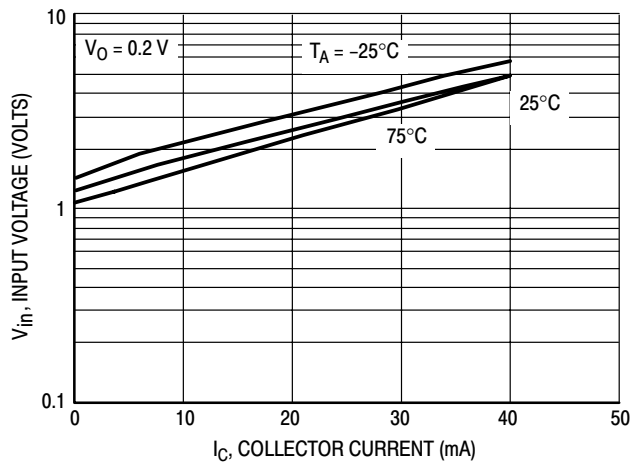


Figure 7. Input Voltage versus Output Current

# DTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC124EET1

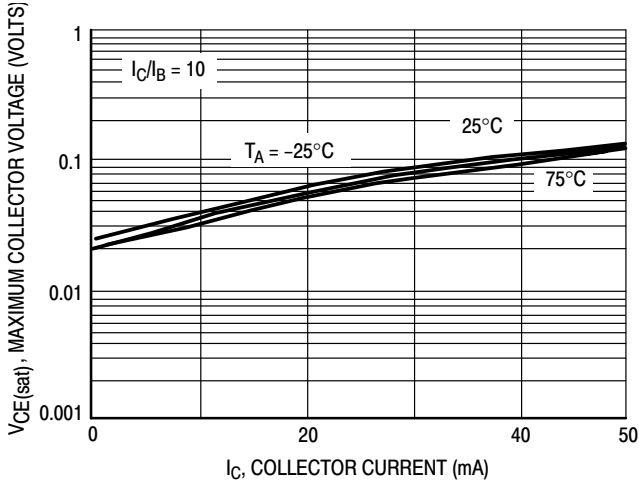


Figure 8.  $V_{CE(sat)}$  versus  $I_C$

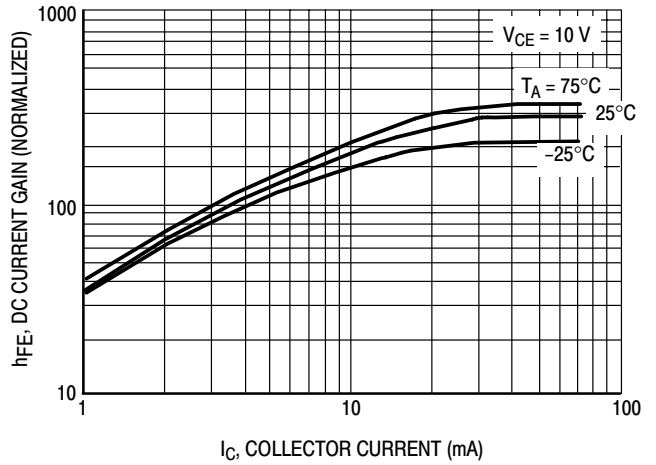


Figure 9. DC Current Gain

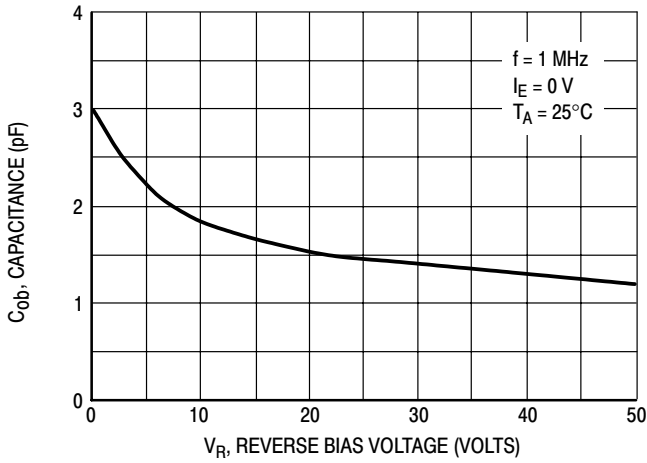


Figure 10. Output Capacitance

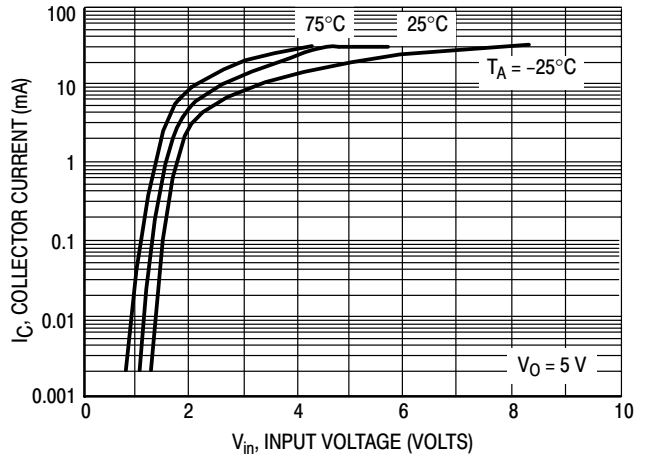


Figure 11. Output Current versus Input Voltage

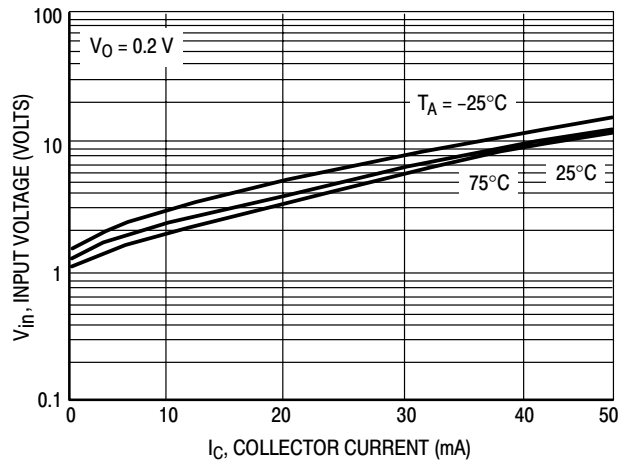


Figure 12. Input Voltage versus Output Current

# DTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114EET1

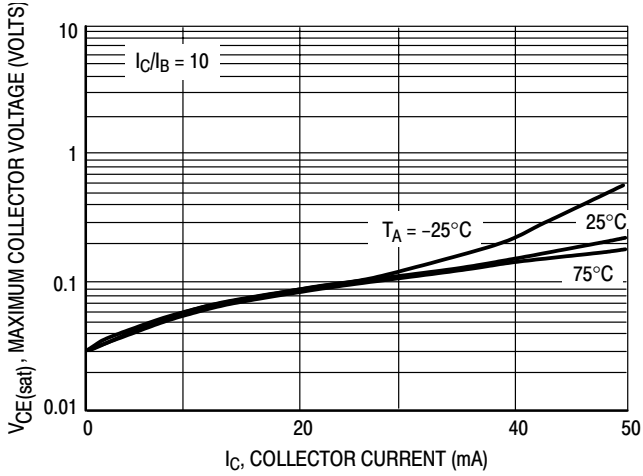


Figure 13.  $V_{CE(sat)}$  versus  $I_C$

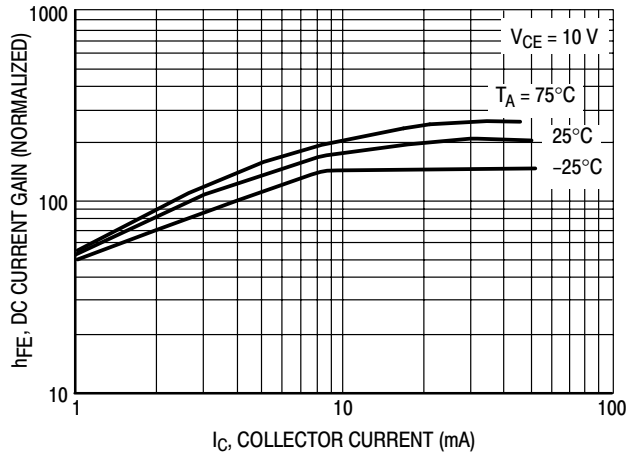


Figure 14. DC Current Gain

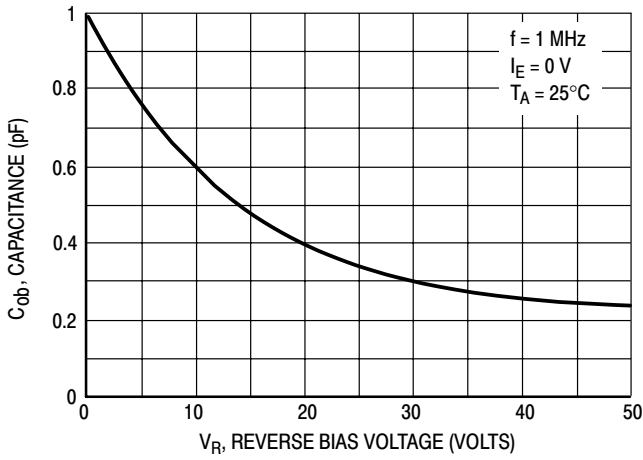


Figure 15. Output Capacitance

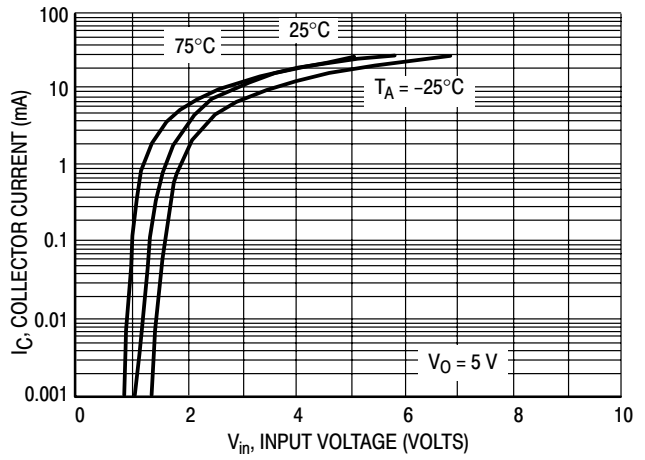


Figure 16. Output Current versus Input Voltage

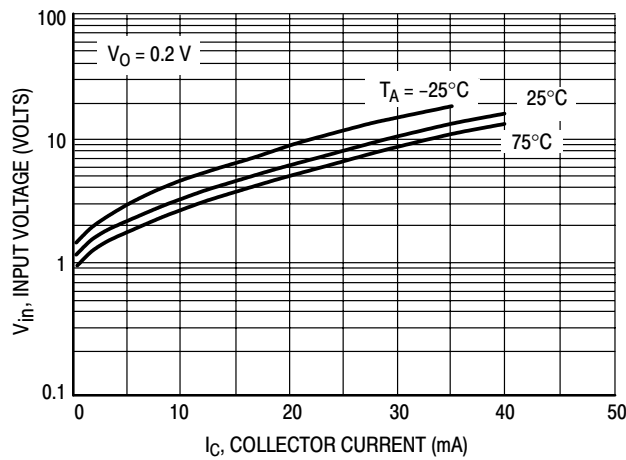


Figure 17. Input Voltage versus Output Current

# DTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114YET1

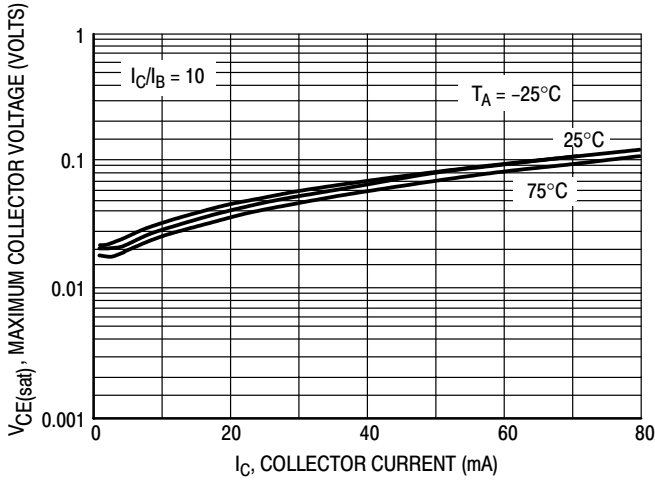


Figure 18.  $V_{CE(sat)}$  versus  $I_C$

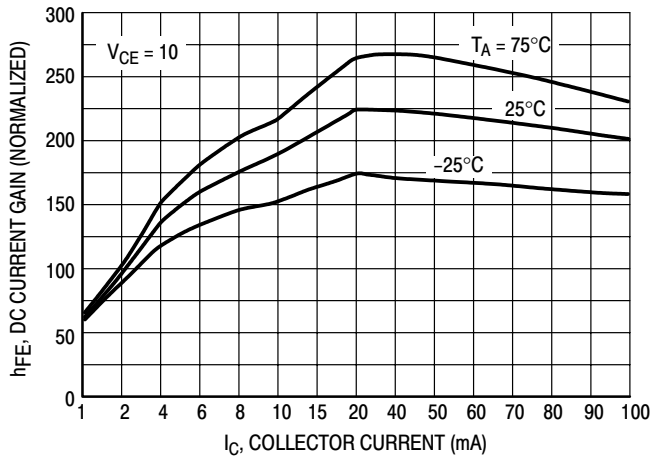


Figure 19. DC Current Gain

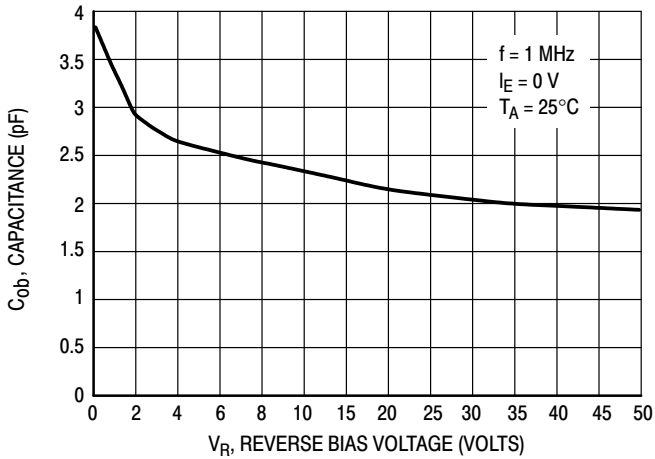


Figure 20. Output Capacitance

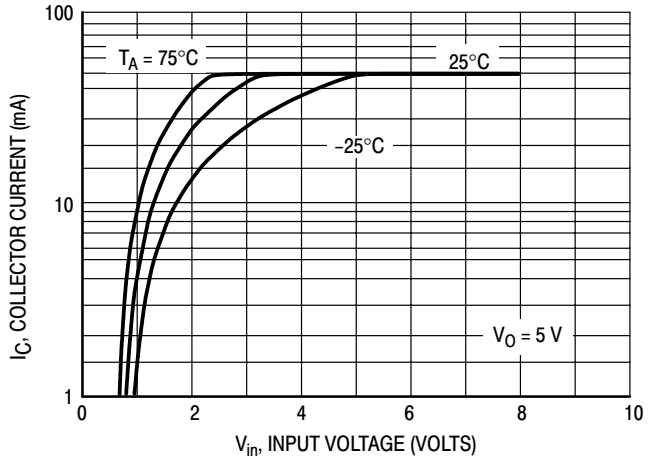


Figure 21. Output Current versus Input Voltage

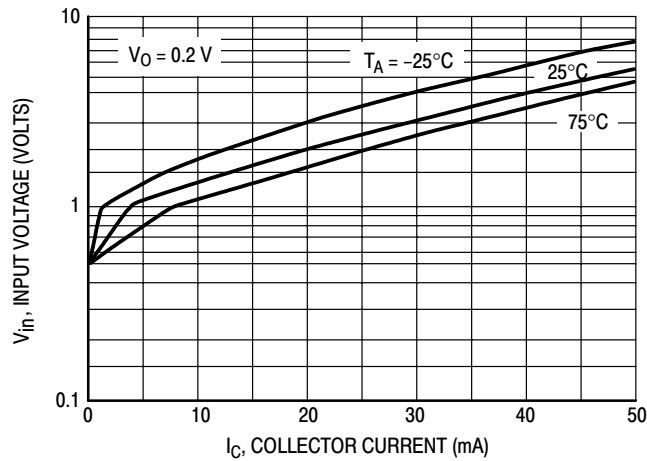


Figure 22. Input Voltage versus Output Current



# DTC114EET1 Series

## TYPICAL APPLICATIONS FOR NPN BRTs

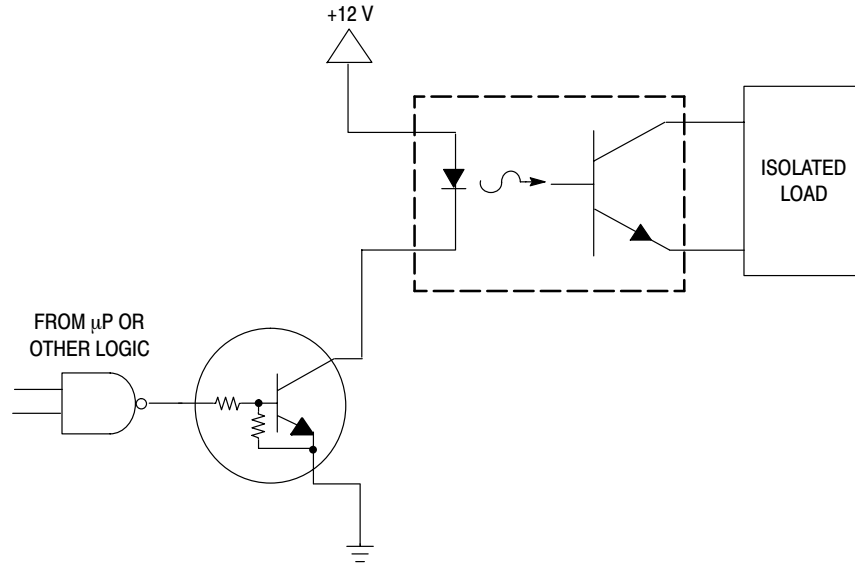


Figure 23. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

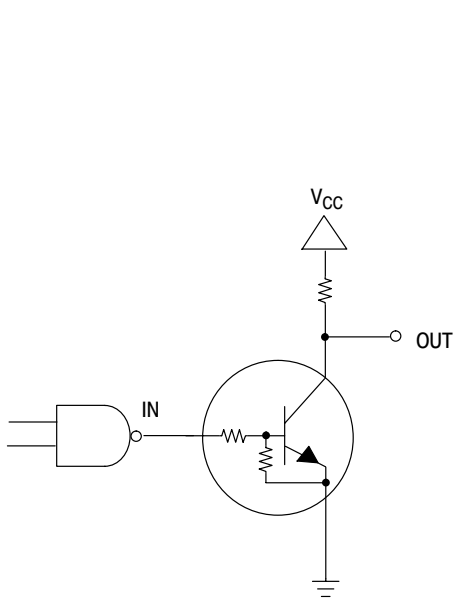


Figure 24. Open Collector Inverter:  
Inverts the Input Signal

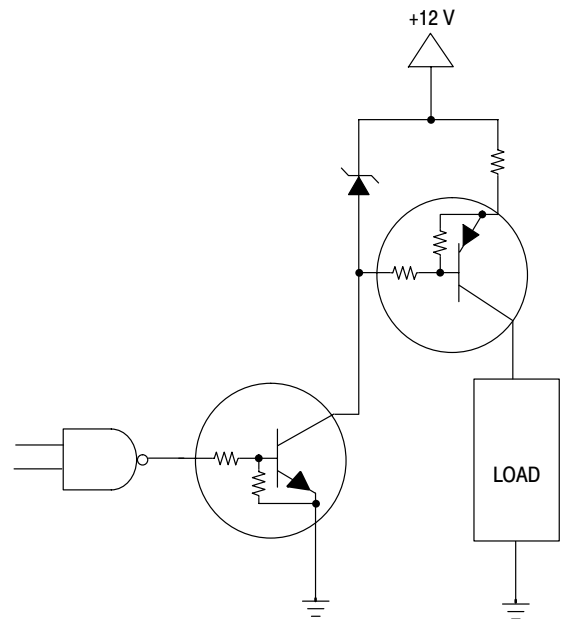
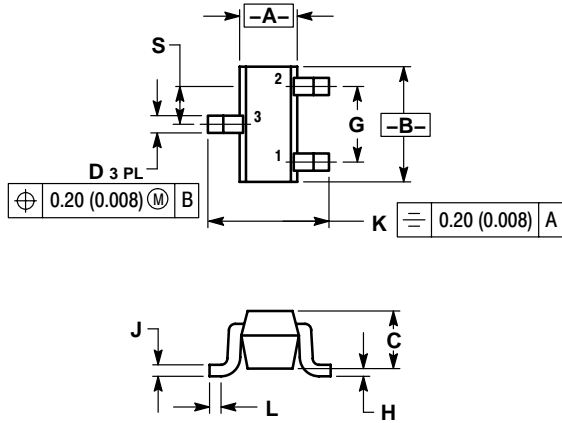


Figure 25. Inexpensive, Unregulated Current Source

# DTC114EET1 Series

## PACKAGE DIMENSIONS

SC-75/SOT-416  
CASE 463-01  
ISSUE C



### NOTES:

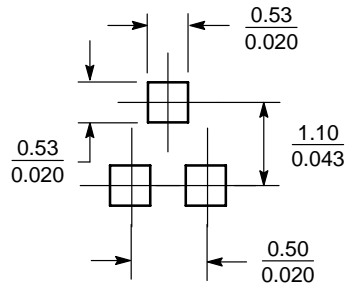
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 0.70        | 0.90 | 0.028     | 0.035 |
| B   | 1.40        | 1.80 | 0.055     | 0.071 |
| C   | 0.60        | 0.90 | 0.024     | 0.035 |
| D   | 0.15        | 0.30 | 0.006     | 0.012 |
| G   | 1.00 BSC    |      | 0.039 BSC |       |
| H   | ---         | 0.10 | ---       | 0.004 |
| J   | 0.10        | 0.25 | 0.004     | 0.010 |
| K   | 1.45        | 1.75 | 0.057     | 0.069 |
| L   | 0.10        | 0.20 | 0.004     | 0.008 |
| S   | 0.50 BSC    |      | 0.020 BSC |       |

### STYLE 1:


- PIN 1. BASE
- EMITTER
- COLLECTOR

## SOLDERING FOOTPRINT\*



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

\*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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