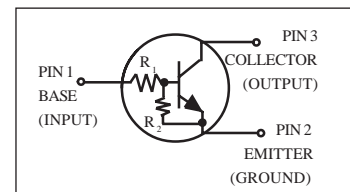
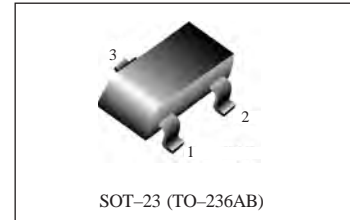


Bias Resistor Transistor

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 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 SOT-23 package which is designed for low power surface mount applications.

- Simplifies Circuit Design
- Reduces Board Space and Component Count
- The SOT-23 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.



MAXIMUM RATINGS (T_A = 25 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 |
| Total Power Dissipation @ T _A = 25 C (Note 1.) Derate above 25 C | P _D | 246 1.5 | mW C/W |

DEVICE MARKING AND RESISTOR VALUES

| Device | Marking | R1(K) | R2(K) | Shipping |
|--------|---------|-------|-------|------------------|
| DTC101 | A8J | 4.7 | 4.7 | 3000/Tape & Reel |
| DTC102 | A8A | 10 | 10 | 3000/Tape & Reel |
| DTC103 | A8B | 22 | 22 | 3000/Tape & Reel |
| DTC104 | A8C | 47 | 47 | 3000/Tape & Reel |
| DTC105 | A8M | 2.2 | 47 | 3000/Tape & Reel |
| DTC106 | A8K | 4.7 | 47 | 3000/Tape & Reel |
| DTC107 | A8D | 10 | 47 | 3000/Tape & Reel |
| DTC108 | A8L | 22 | 47 | 3000/Tape & Reel |
| DTC110 | A8F | 4.7 | ∞ | 3000/Tape & Reel |
| DTC111 | A8E | 10 | ∞ | 3000/Tape & Reel |
| DTC112 | A8U | 100 | ∞ | 3000/Tape & Reel |
| DTC114 | A8T | 47 | ∞ | 3000/Tape & Reel |
| DTC117 | A8H | 2.2 | 2.2 | 3000/Tape & Reel |
| DTC123 | A8G | 1.0 | 1.0 | 3000/Tape & Reel |
| DTC124 | A8R | 2.2 | ∞ | 3000/Tape & Reel |

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



THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|--|-----------------|-------------|----------|
| Thermal Resistance – Junction-to-Ambient (Note 1.) | $R_{\theta JA}$ | 508 | C/W |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | C |
| Maximum Temperature for Soldering Purposes, Time in Solder Bath | T_L | 260 10 | C Sec |

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, $I_C = 0$) | I_{EBO} | – | – | 1.5 | mAdc |
| DTC101 | | – | – | 0.5 | |
| DTC102 | | – | – | 0.2 | |
| DTC103 | | – | – | 0.1 | |
| DTC104 | | – | – | 0.2 | |
| DTC105 | | – | – | 0.18 | |
| DTC106 | | – | – | 0.2 | |
| DTC107 | | – | – | 0.13 | |
| DTC108 | | – | – | 1.9 | |
| DTC110 | | – | – | 0.9 | |
| DTC111 | | – | – | 0.1 | |
| DTC112 | | – | – | 0.2 | |
| DTC114 | | – | – | 2.3 | |
| DTC117 | | – | – | 4.3 | |
| DTC123 | | – | – | 4.0 | |
| DTC124 | | – | – | | |
| Collector-Base Breakdown Voltage ($I_C = 10\mu A$, $I_E = 0$) | $V_{(BR)CBO}$ | 50 | – | – | Vdc |
| Collector-Emitter Breakdown Voltage (Note 2.), ($I_C = 2.0$ mA, $I_B = 0$) | $V_{(BR)CEO}$ | 50 | – | – | Vdc |
| ON CHARACTERISTICS | | | | | |
| DC Current Gain ($V_{CE} = 10$ V, $I_C = 5.0$ mA) | h_{FE} | 15 | 30 | – | |
| DTC101 | | 35 | 60 | – | |
| DTC102 | | 60 | 100 | – | |
| DTC103 | | 80 | 140 | – | |
| DTC104 | | 80 | 140 | – | |
| DTC105 | | 80 | 200 | – | |
| DTC106 | | 80 | 140 | – | |
| DTC107 | | 80 | 150 | – | |
| DTC108 | | 160 | 350 | – | |
| DTC110 | | 160 | 350 | – | |
| DTC111 | | 160 | 350 | – | |
| DTC112 | | 160 | 350 | – | |
| DTC114 | | 8.0 | 15 | – | |
| DTC117 | | 3.0 | 5.0 | – | |
| DTC123 | | 160 | 350 | – | |
| DTC124 | | | | | |
| Collector-Emitter Saturation Voltage ($I_C = 10$ mA, $I_B = 0.3$ mA) ($I_C = 10$ mA, $I_B = 5$ mA) DTC117 / DTC123 ($I_C = 10$ mA, $I_B = 1$ mA) DTC101 / DTC105 / DTC106 / DTC108 / DTC111 / DTC114 / DTC110 / DTC124 | $V_{CE(sat)}$ | – | – | 0.25 | Vdc |

2. Pulse Test: Pulse Width < 300 μ s, Duty Cycle < 2.0%.



ELECTRICAL CHARACTERISTICS (T_A = 25 C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit | |
|---|--|--------------------------------|--|--|--|-----|
| ON CHARACTERISTICS (Note 3.) | | | | | | |
| Output Voltage (on) (V _{CC} = 5.0 V, V _B = 2.5V, R _L = 1.0KΩ) | DTC101 DTC102 DTC103 DTC105 DTC106 DTC107 DTC108 DTC110 DTC111 DTC117 DTC123 DTC124 (V _{CC} = 5.0 V, V _B = 3.5V, R _L = 1.0KΩ) DTC104 DTC114 (V _{CC} = 5.0 V, V _B = 5.0V, R _L = 1.0KΩ) DTC112 | V _{OL} | – | – | 0.2 | Vdc |
| Output Voltage (off) (V _{CC} = 5.0 V, V _B = 0.5V, R _L = 1.0KΩ) (V _{CC} = 5.0 V, V _B = 0.05V, R _L = 1.0KΩ) (V _{CC} = 5.0 V, V _B = 0.25V, R _L = 1.0KΩ) | DTC123 DTC111 DTC106 DTC110 DTC124 | V _{OH} | 4.9 | – | – | Vdc |
| Input Resistor | DTC101 DTC102 DTC103 DTC104 DTC105 DTC106 DTC107 DTC108 DTC110 DTC111 DTC112 DTC114 DTC117 DTC123 DTC124 | R _I | 3.3 7.0 15.4 32.9 1.54 3.3 7.0 15.4 3.3 7.0 70 32.9 1.5 0.7 1.54 | 4.7 10 22 47 2.2 4.7 10 22 4.7 10 100 47 2.2 1.0 2.2 | 6.1 13 28.6 61.1 2.86 6.1 13 28.6 6.1 13 130 61.1 2.9 1.3 2.88 | KΩ |
| Resistor Ratio | DTC101 / DTC123 / DTC117 DTC102 / DTC103 / DTC104 DTC105 DTC106 DTC107 DTC108 DTC110 / DTC111 / DTC124 DTC112 / DTC114 | R ₁ /R ₂ | 0.8 0.8 0.038 0.055 0.17 0.38 – – | 1.0 1.0 0.047 0.1 0.21 0.47 – – | 1.2 1.2 0.056 0.185 0.25 0.56 – – | |

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

TYPICAL ELECTRICAL CHARACTERISTICS
DTC101

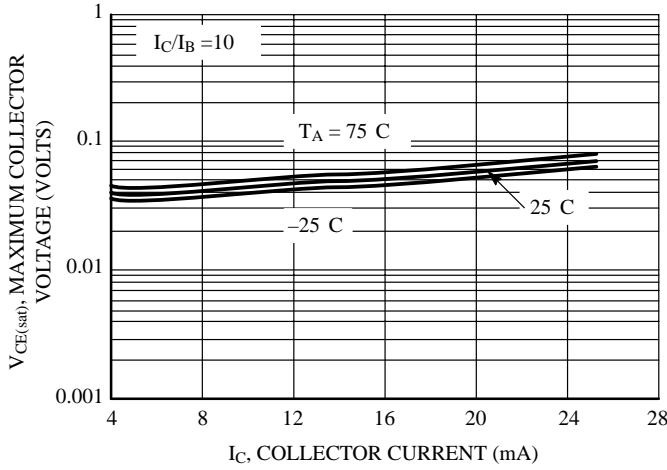


Figure 22. $V_{CE(sat)}$ vs. I_C

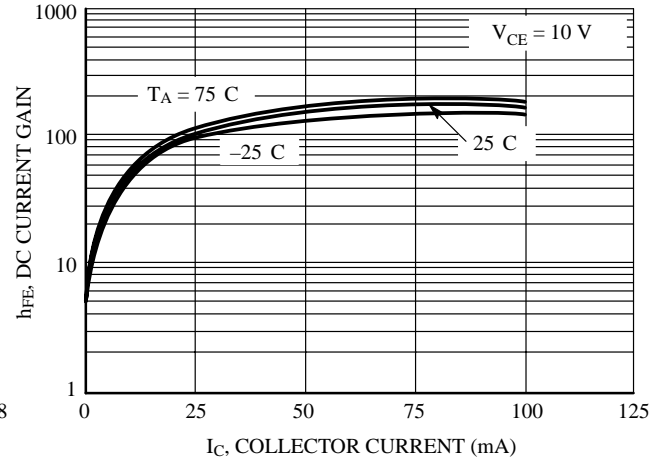


Figure 23. DC Current Gain

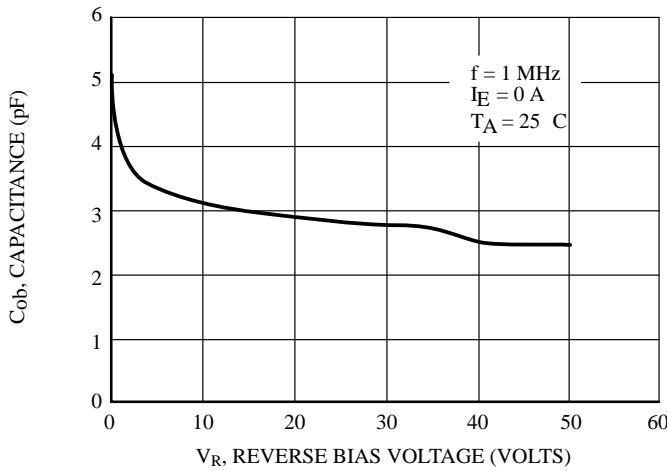


Figure 24. Output Capacitance

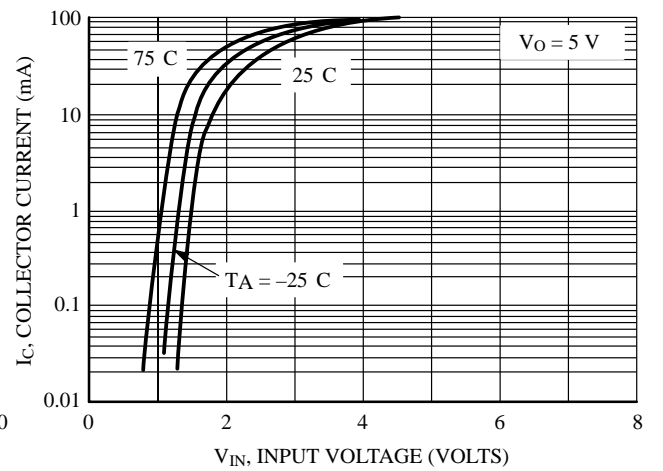


Figure 25. Output Current vs. Input Voltage

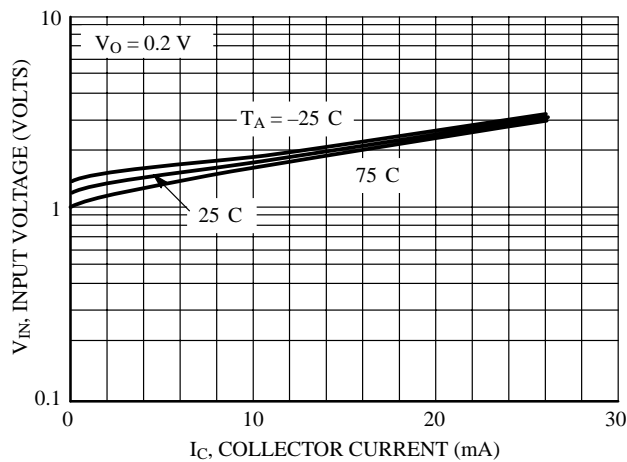
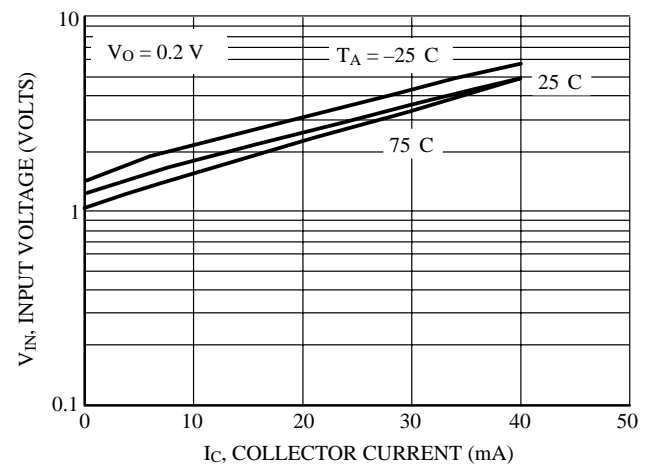
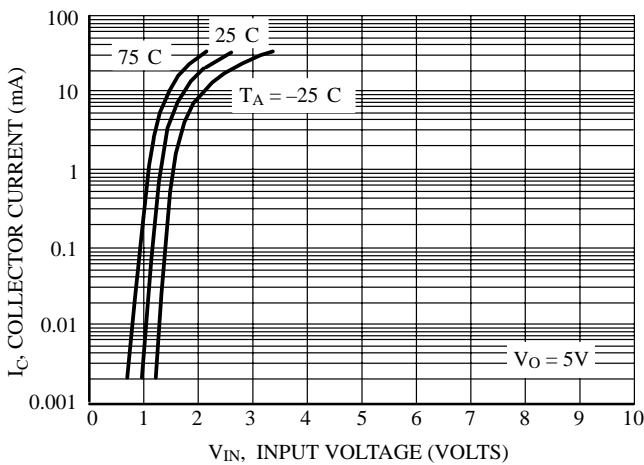
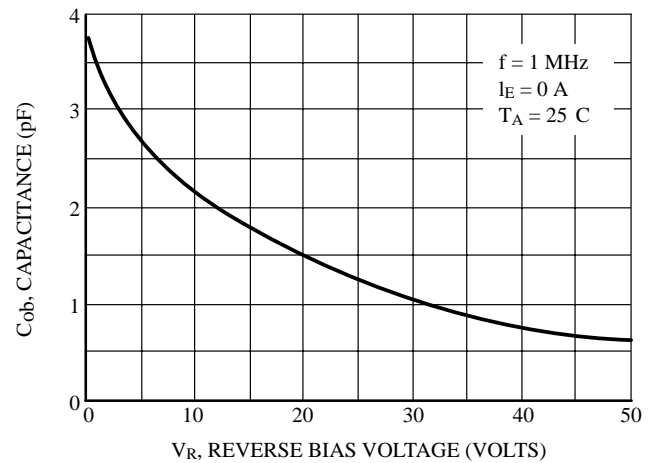
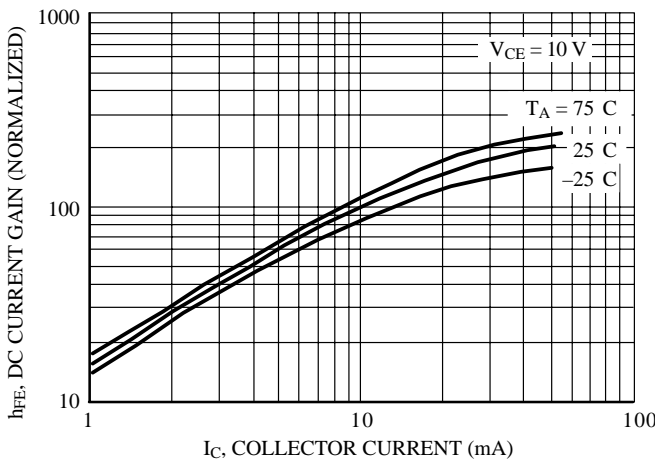
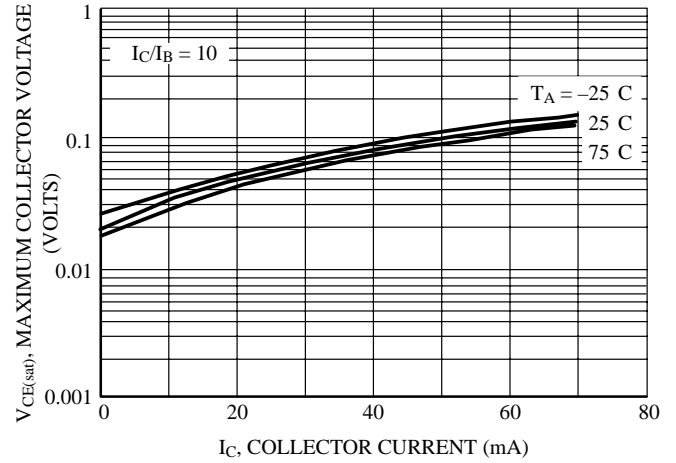
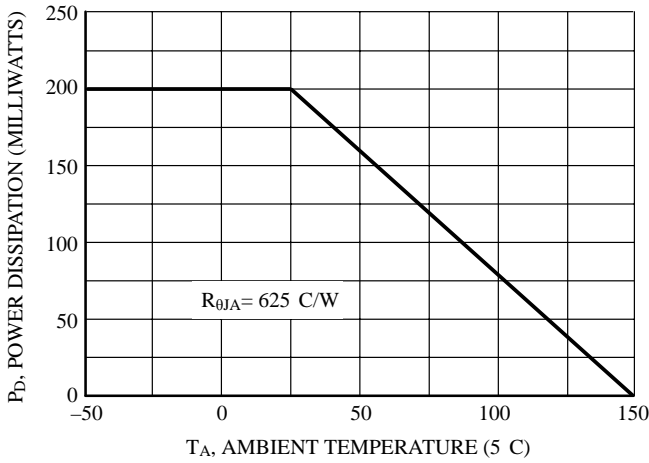


Figure 26. Output Voltage vs. Input Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC102



TYPICAL ELECTRICAL CHARACTERISTICS
DTC103

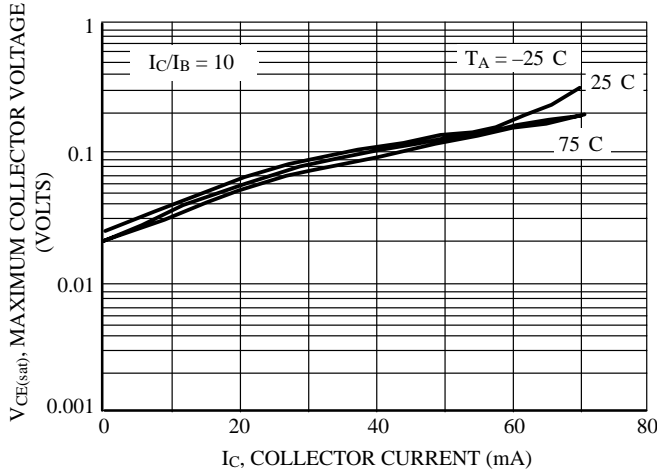


Figure 7. $V_{CE(sat)}$ vs. I_C

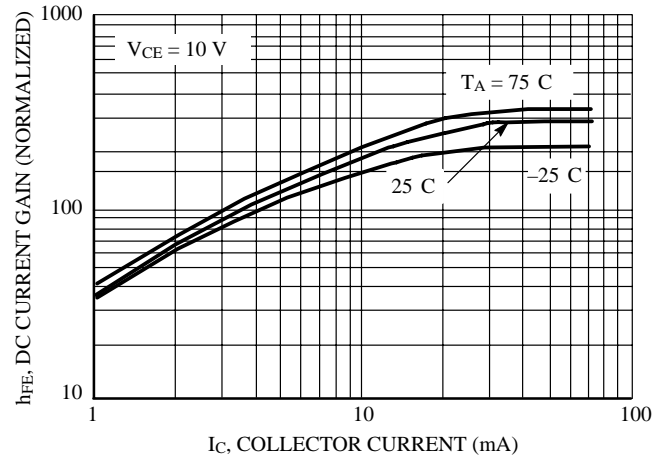


Figure 8. DC Current Gain

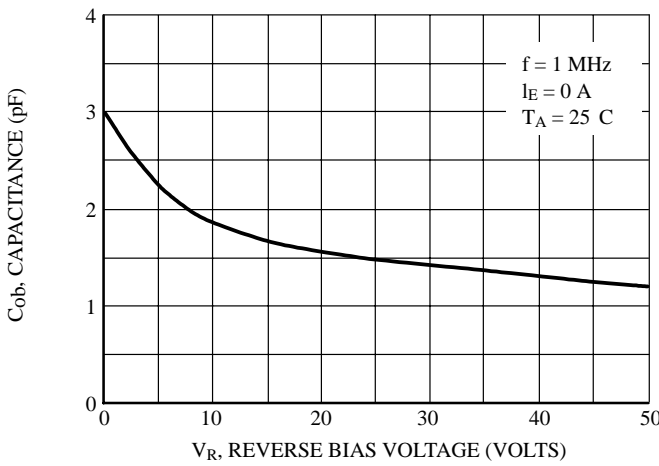


Figure 9. Output Capacitance

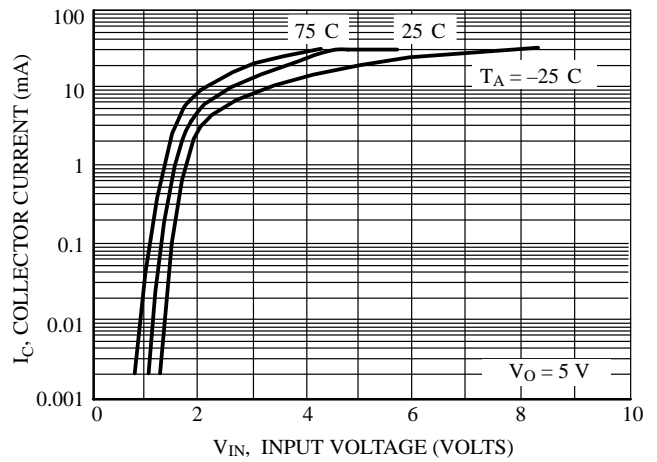


Figure 10. Output Current vs. Input Voltage

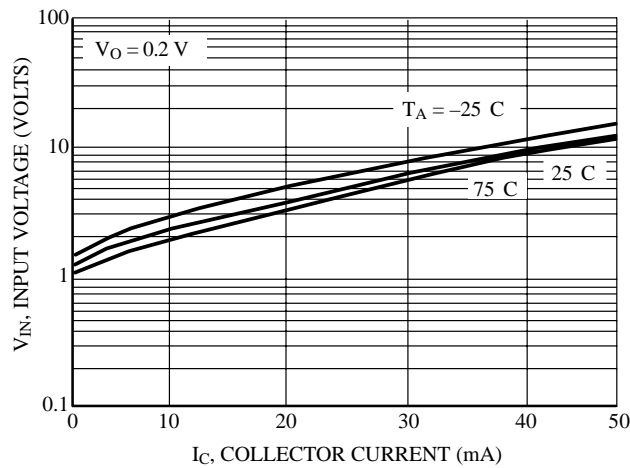


Figure 11. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC104

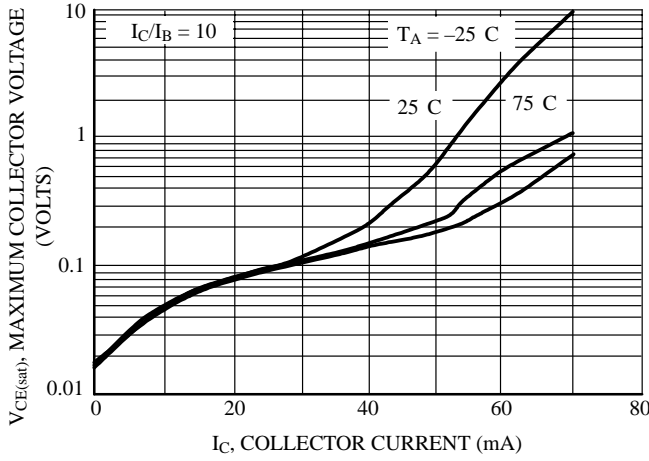


Figure 12. $V_{CE(sat)}$ vs. I_C

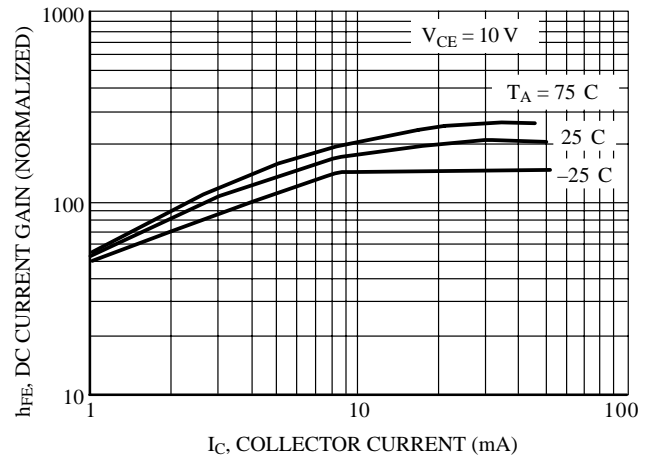


Figure 13. DC Current Gain

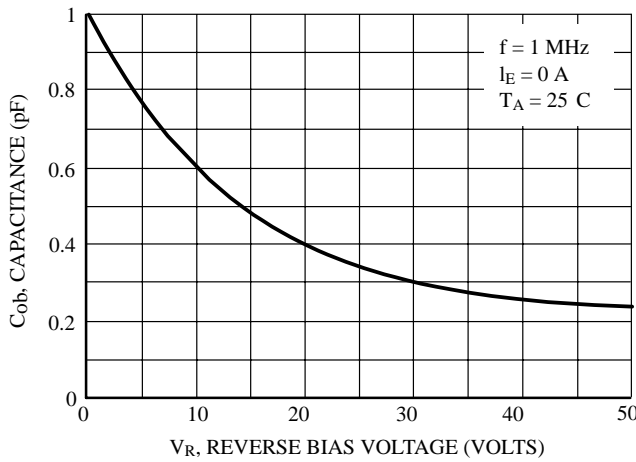


Figure 14. Output Capacitance

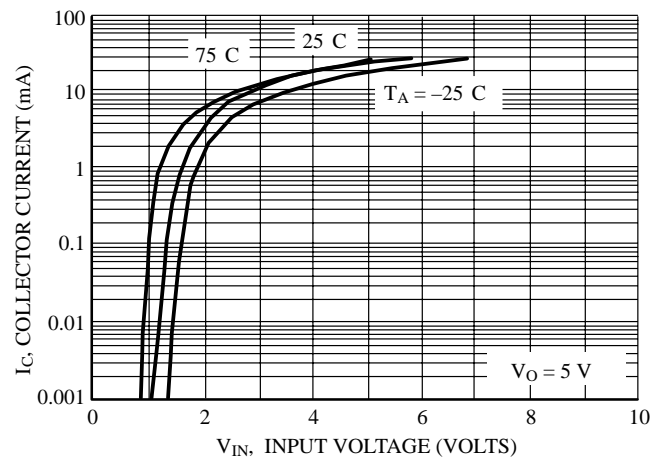


Figure 15. Output Current vs. Input Voltage

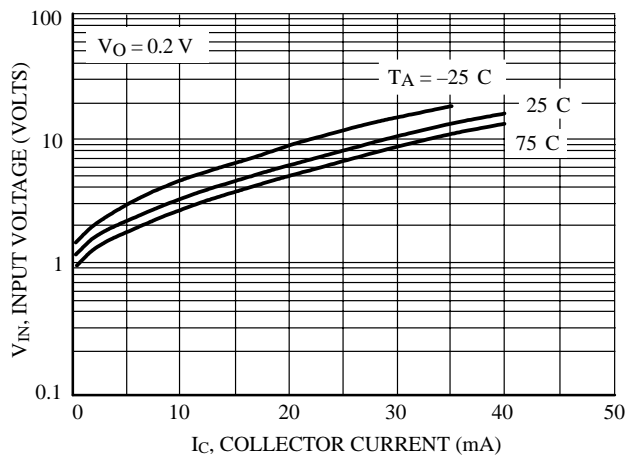


Figure 16. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC106

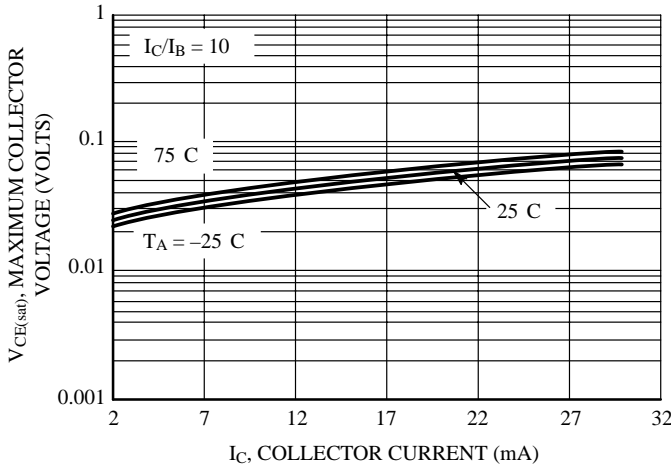


Figure 27. $V_{CE(sat)}$ vs. I_C

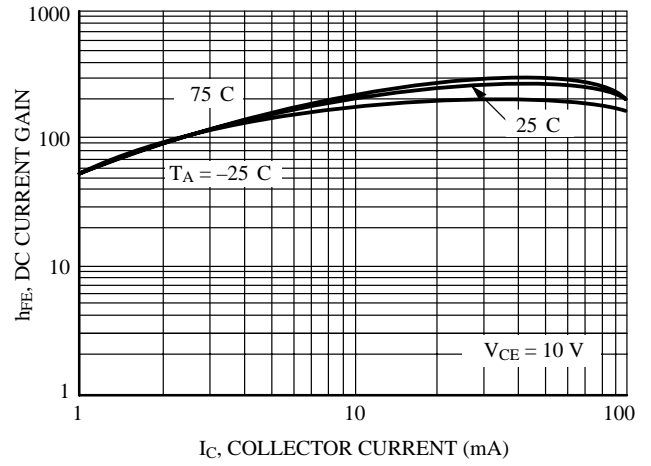


Figure 28. DC Current Gain

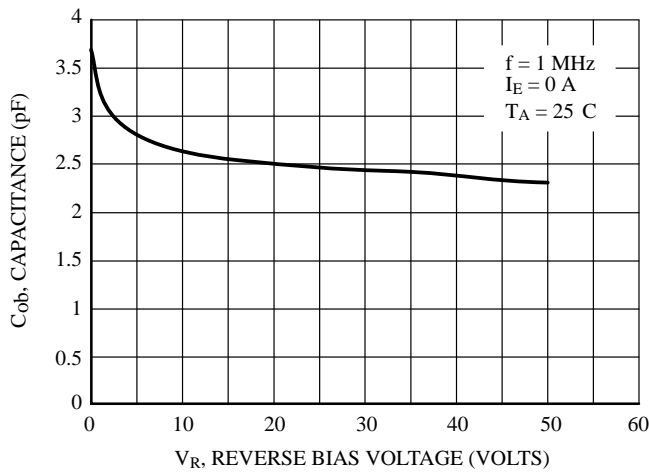


Figure 29. Output Capacitance

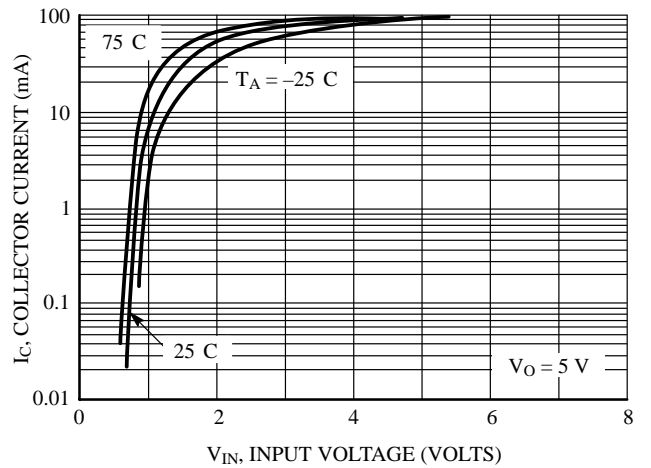


Figure 30. Output Current vs. Input Voltage

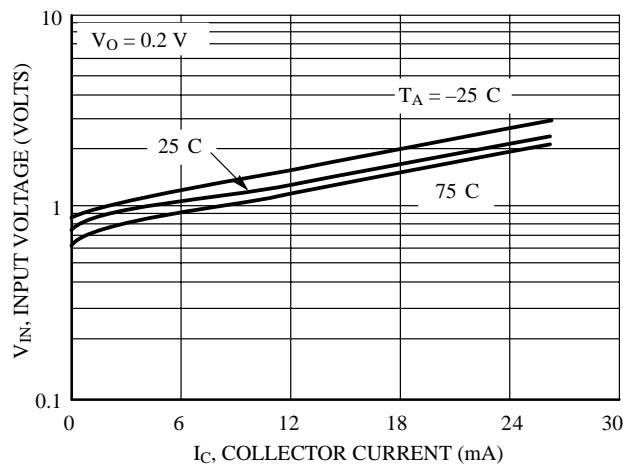


Figure 31. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC107

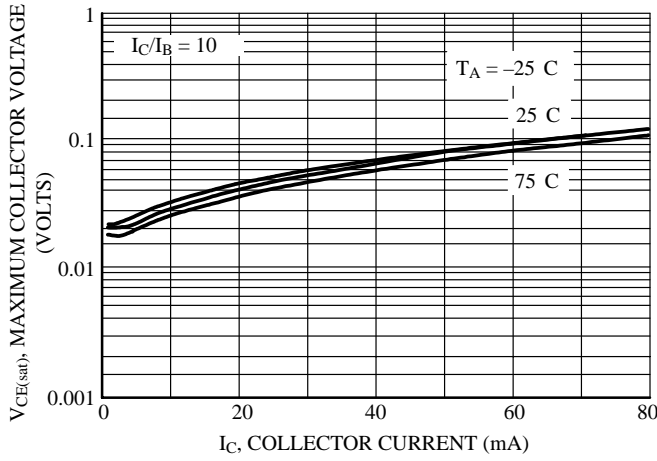


Figure 17. $V_{CE(sat)}$ vs. I_C

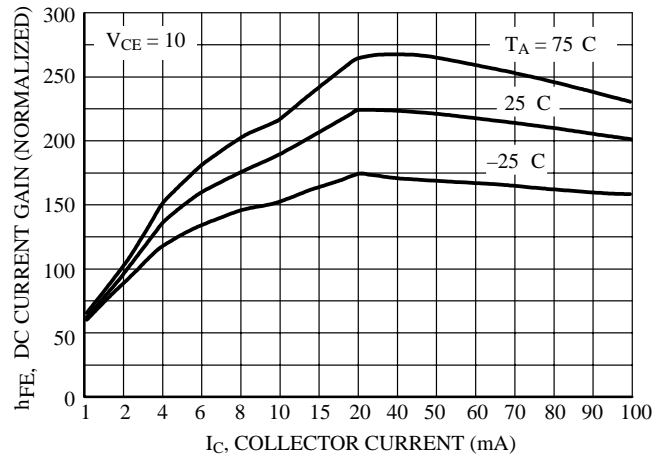


Figure 18. DC Current Gain

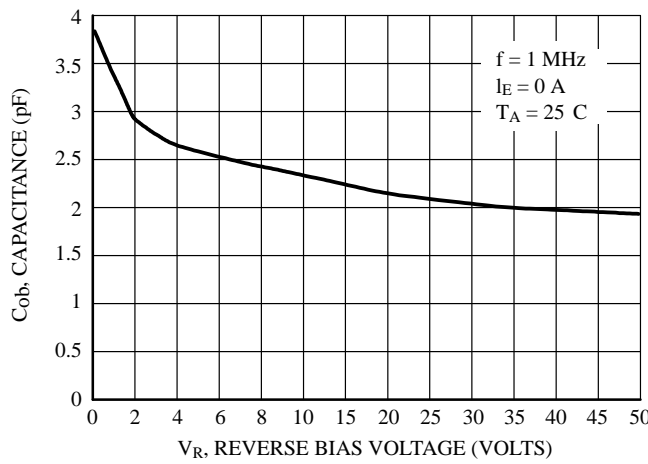


Figure 19. Output Capacitance

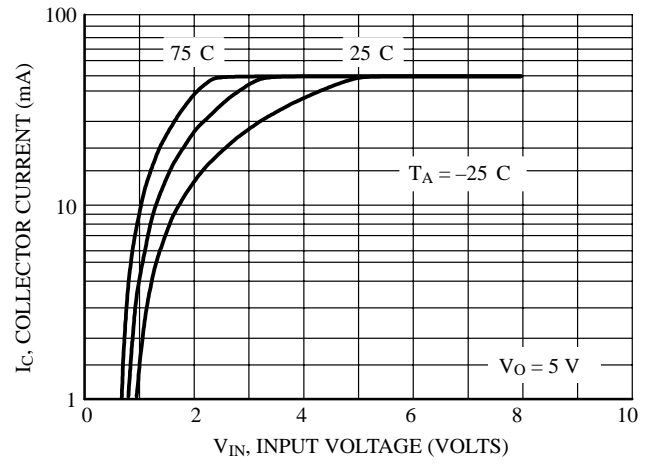


Figure 20. Output Current vs. Input Voltage

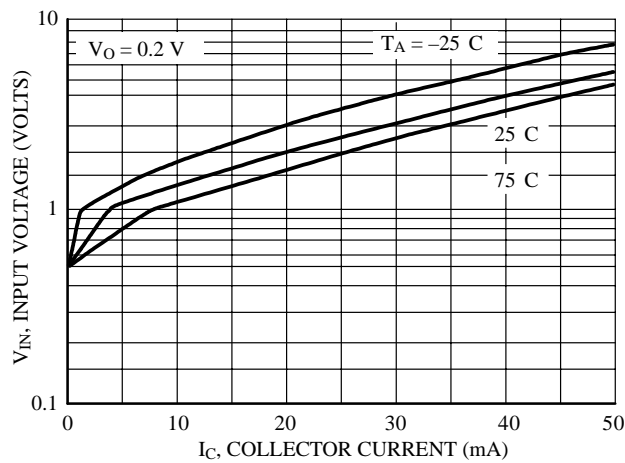


Figure 21. Input Voltage vs. Output Current



TYPICAL ELECTRICAL CHARACTERISTICS
DTC110

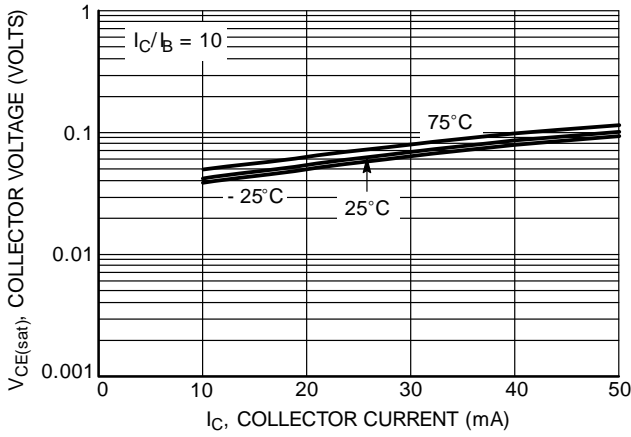


Figure 27. $V_{CE(sat)}$ versus I_C

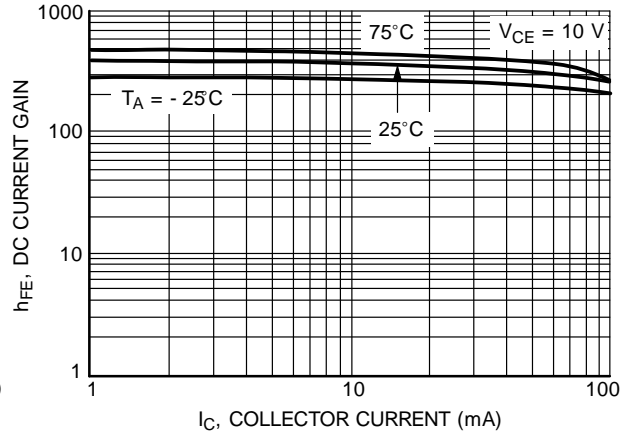


Figure 28. DC Current Gain

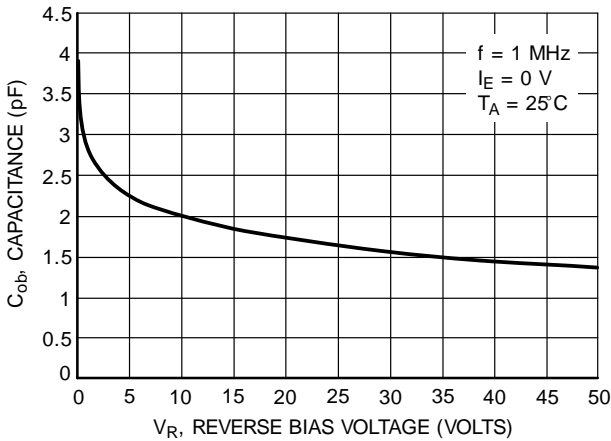


Figure 29. Output Capacitance

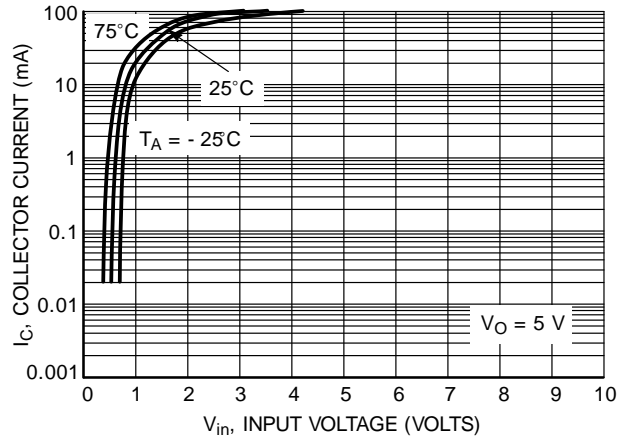


Figure 30. Output Current versus Input Voltage

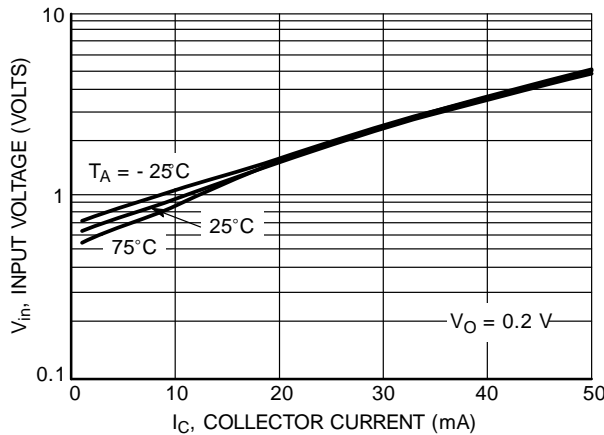


Figure 31. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC111

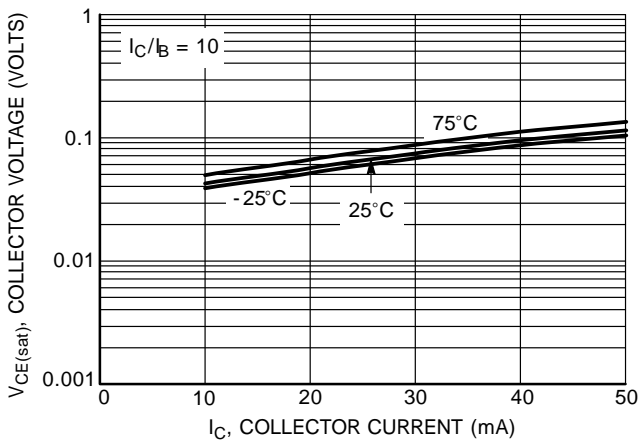


Figure 22. $V_{CE(sat)}$ versus I_C

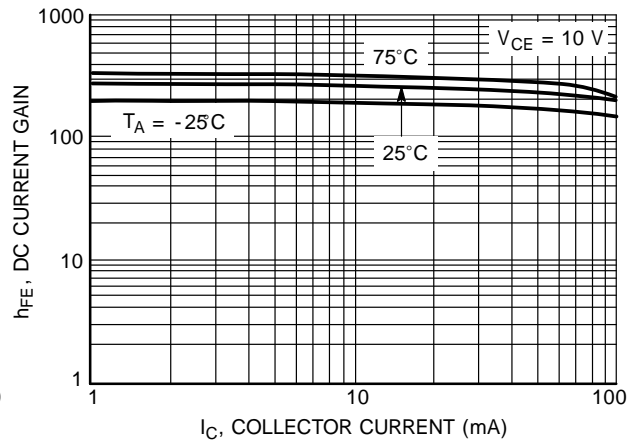


Figure 23. DC Current Gain

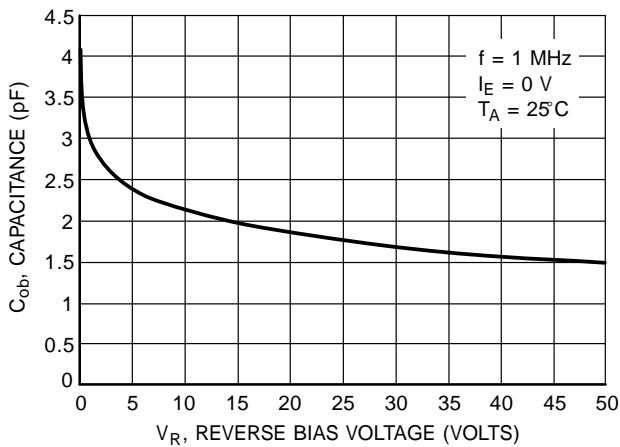


Figure 24. Output Capacitance

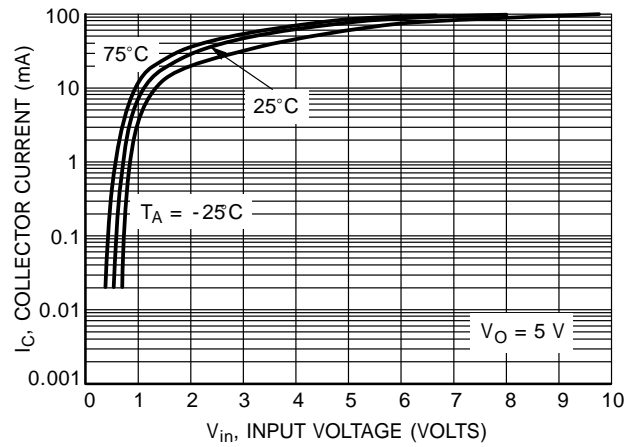


Figure 25. Output Current versus Input Voltage

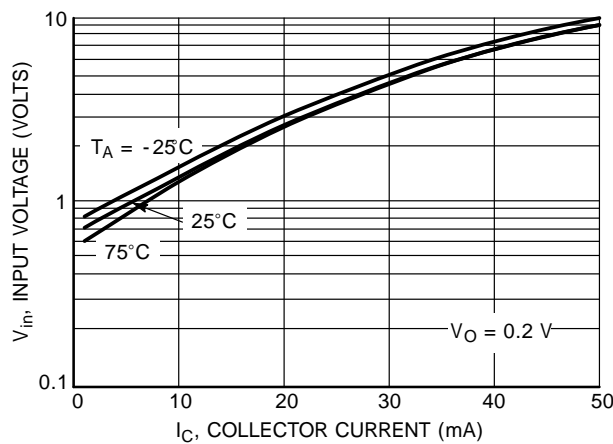


Figure 26. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC117

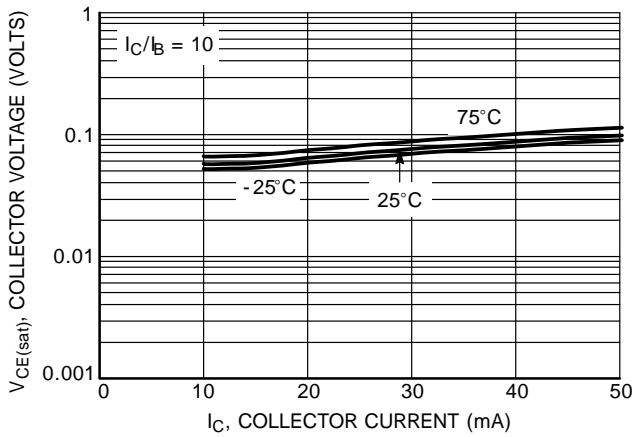


Figure 37. $V_{CE(sat)}$ versus I_C

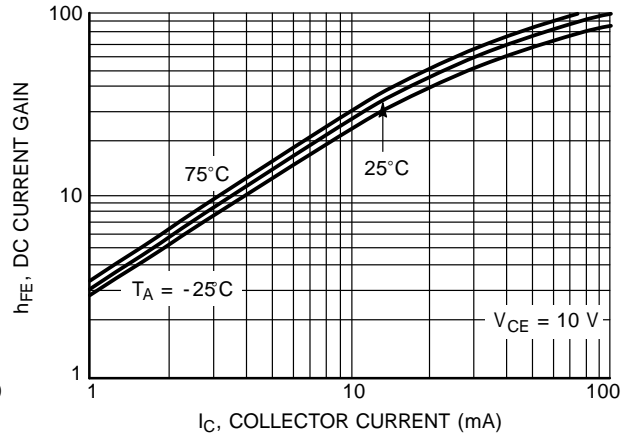


Figure 38. DC Current Gain

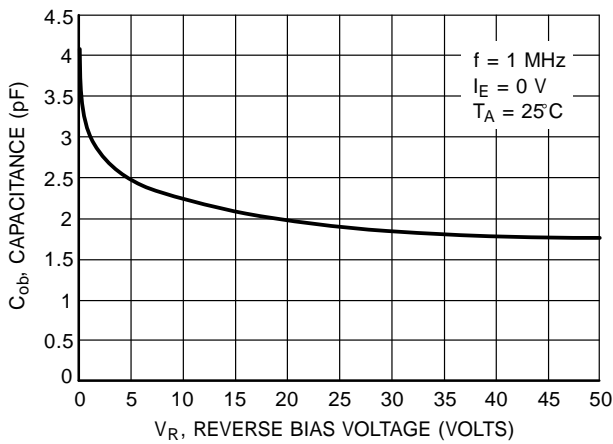


Figure 39. Output Capacitance

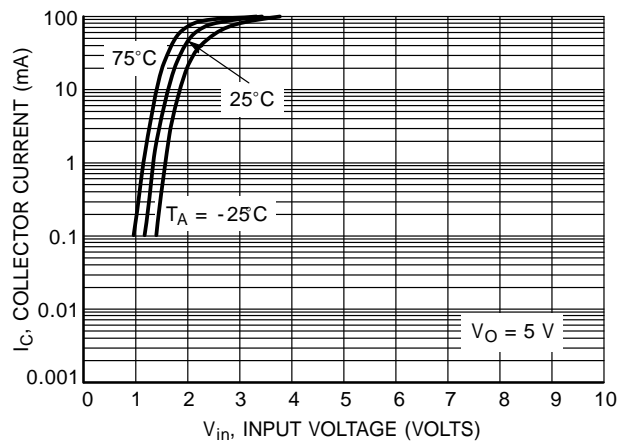


Figure 40. Output Current versus Input Voltage

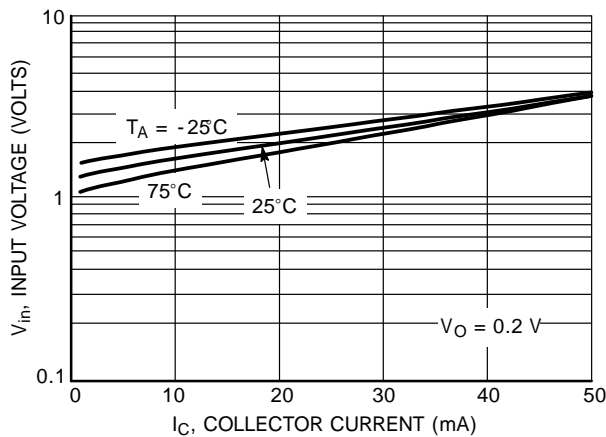


Figure 41. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC108

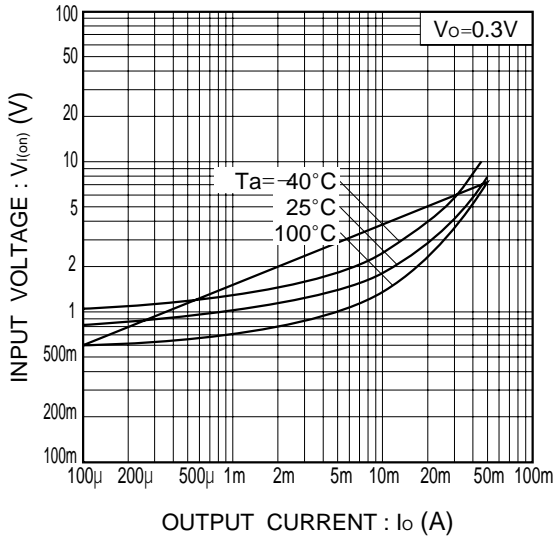


Fig.1 Input voltage vs. output current (ON characteristics)

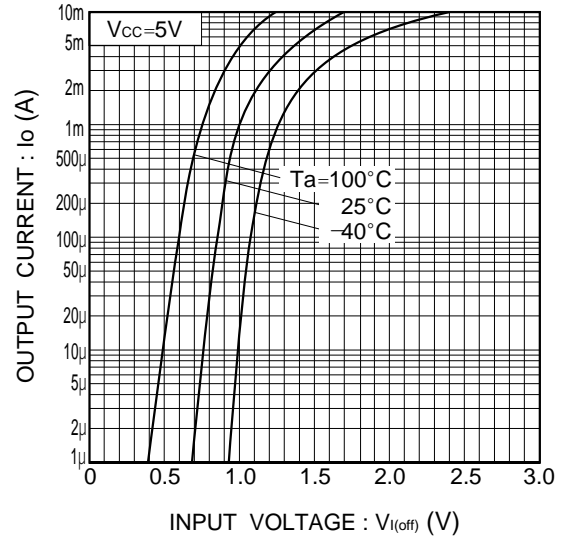


Fig.2 Output current vs. input voltage (OFF characteristics)

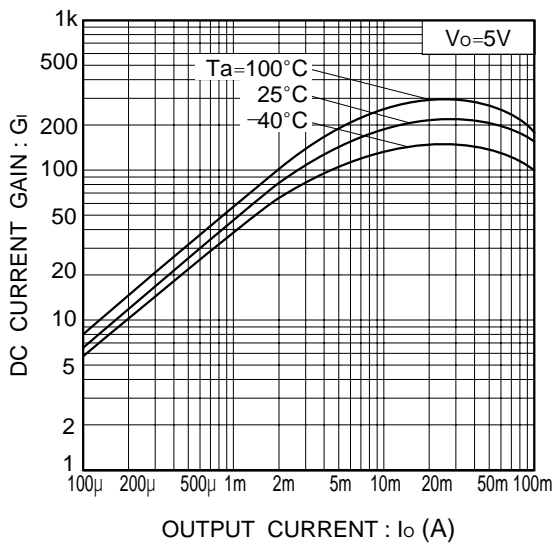


Fig.3 DC current gain vs. output current

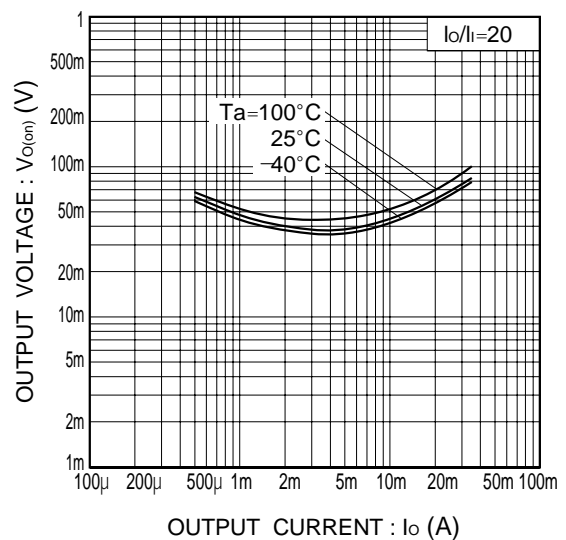


Fig.4 Output voltage vs. output current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC123

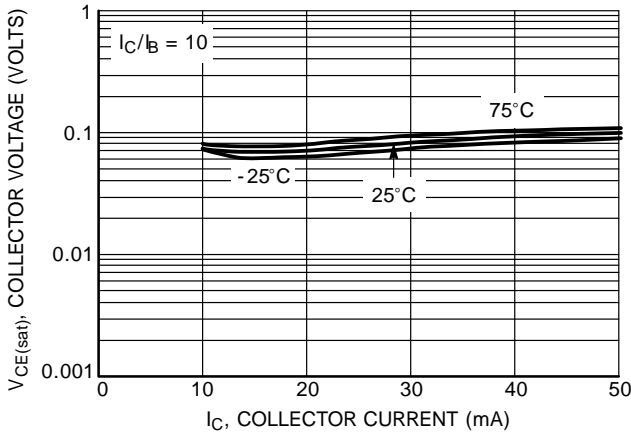


Figure 32. $V_{CE(sat)}$ versus I_C

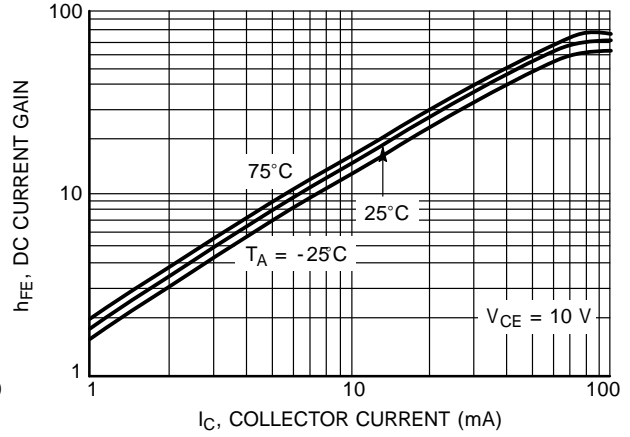


Figure 33. DC Current Gain

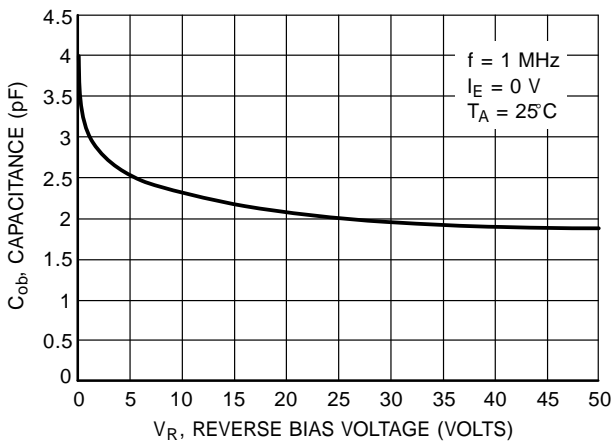


Figure 34. Output Capacitance

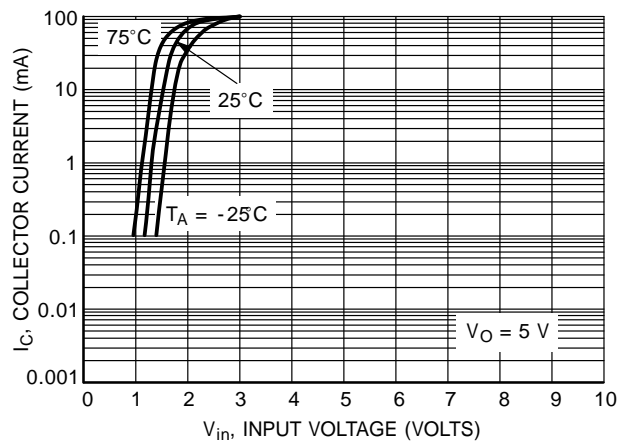


Figure 35. Output Current versus Input Voltage

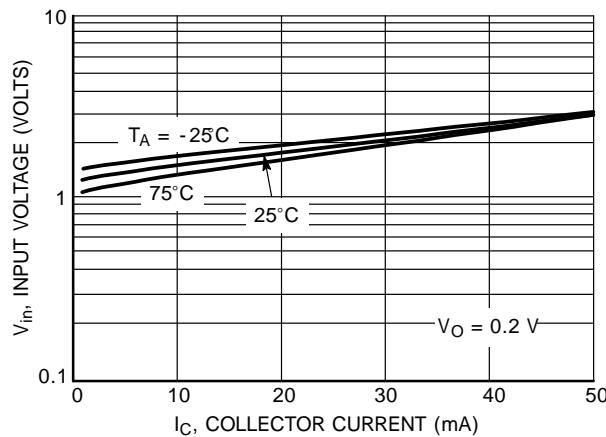


Figure 36. Input Voltage versus Output Current

TYPICAL APPLICATIONS FOR NPN BRTs

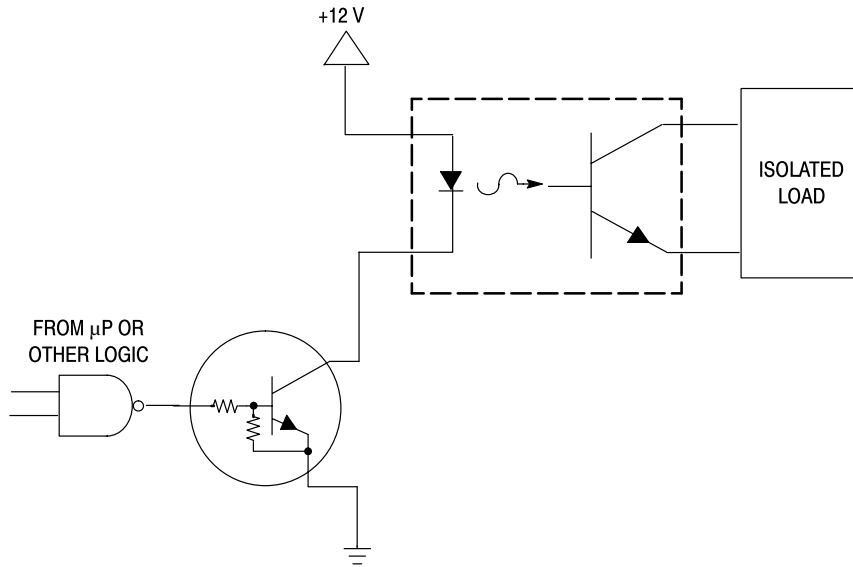


Figure 32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

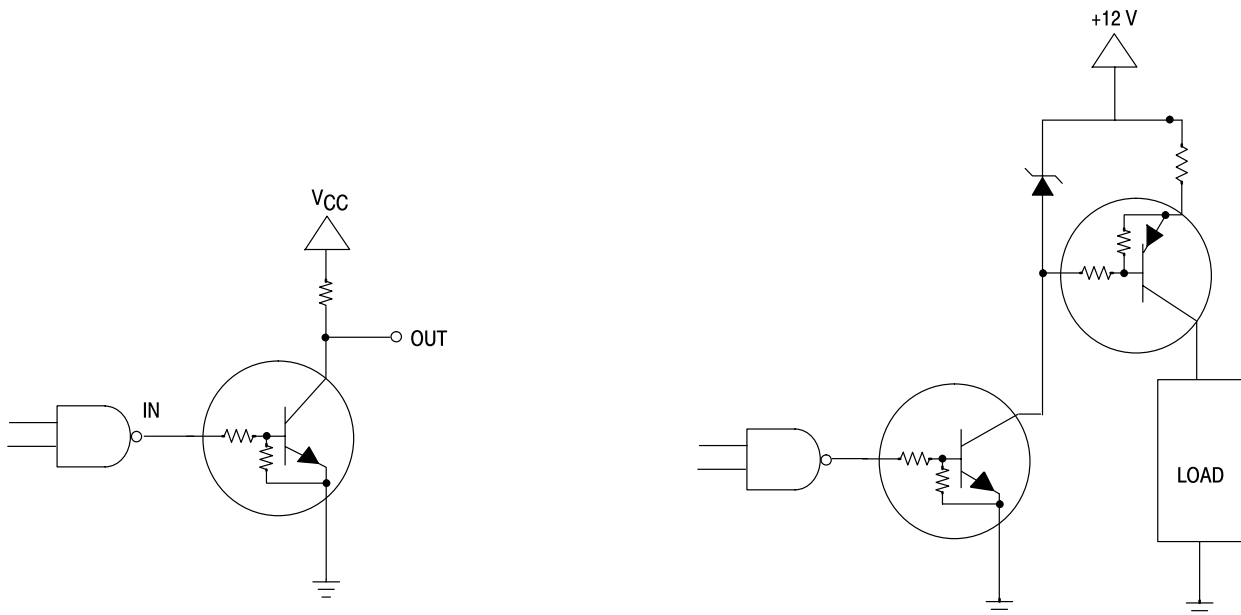
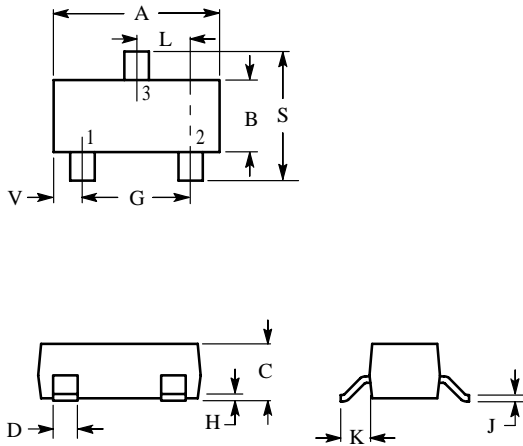


Figure 33. Open Collector Inverter: Inverts the Input Signal

Figure 34. Inexpensive, Unregulated Current Source

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NOTES:

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

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|--------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.1102 | 0.1197 | 2.80 | 3.04 |
| B | 0.0472 | 0.0551 | 1.20 | 1.40 |
| C | 0.0350 | 0.0440 | 0.89 | 1.11 |
| D | 0.0150 | 0.0200 | 0.37 | 0.50 |
| G | 0.0701 | 0.0807 | 1.78 | 2.04 |
| H | 0.0005 | 0.0040 | 0.013 | 0.100 |
| J | 0.0034 | 0.0070 | 0.085 | 0.177 |
| K | 0.0140 | 0.0285 | 0.35 | 0.69 |
| L | 0.0350 | 0.0401 | 0.89 | 1.02 |
| S | 0.0830 | 0.1039 | 2.10 | 2.64 |
| V | 0.0177 | 0.0236 | 0.45 | 0.60 |

