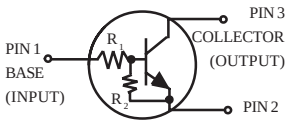
Bias Resistor Transistor

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.

SOT–23 (TO–236AB)



- 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_{CBO}	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	DTC101	I_{EBO}	–	–	1.5	mAdc
(V_{EB}= 6.0 V, I_C=0)	DTC102		–	–	0.5	
	DTC103		–	–	0.2	
	DTC104		–	–	0.1	
	DTC105		–	–	0.2	
	DTC106		–	–	0.18	
	DTC107		–	–	0.2	
	DTC108		–	–	0.13	
	DTC110		–	–	1.9	
	DTC111		–	–	0.9	
	DTC112		–	–	0.1	
	DTC114		–	–	0.2	
	DTC117		–	–	2.3	
	DTC123		–	–	4.3	
	DTC124		–	–	4.0	
Collector-Base Breakdown Voltage (I_C = 10µA, 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	DTC101	h_{FE}	15	30	–	
(V_{CE}= 10 V, I_C=5.0mA)	DTC102		35	60	–	
	DTC103		60	100	–	
	DTC104		80	140	–	
	DTC105		80	140	–	
	DTC106		80	200	–	
	DTC107		80	140	–	
	DTC108		80	150	–	
	DTC110		160	350	–	
	DTC111		160	350	–	
	DTC112		160	350	–	
	DTC114		160	350	–	
	DTC117		8.0	15	–	
	DTC123		3.0	5.0	–	
	DTC124		160	350	–	
Collector-Emitter Saturation Voltage (I_C= 10 mA, I_B = 0.3 mA)		$V_{CE(sat)}$	–	–	0.25	Vdc
(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					

2. Pulse Test: Pulse Width < 300µs, 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)	DTC101	V_{OL}	–	–	0.2	Vdc
(V_{CC} = 5.0 V, V_B = 2.5V, R_L = 1.0KΩ)	DTC102		–	–	0.2	
	DTC103		–	–	0.2	
	DTC105		–	–	0.2	
	DTC106		–	–	0.2	
	DTC107		–	–	0.2	
	DTC108		–	–	0.2	
	DTC110		–	–	0.2	
	DTC111		–	–	0.2	
	DTC117		–	–	0.2	
	DTC123		–	–	0.2	
	DTC124		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 3.5V, R_L = 1.0KΩ)	DTC104		–	–	0.2	
	DTC114					
(V_{CC} = 5.0 V, V_B = 5.0V, R_L = 1.0KΩ)	DTC112		–	–	0.2	
Output Voltage (off) (V_{CC} = 5.0 V, V_B = 0.5V, R_L = 1.0KΩ)		V_{OH}	4.9	–	–	Vdc
(V_{CC} = 5.0 V, V_B = 0.05V, R_L = 1.0KΩ)	DTC123					
(V_{CC} = 5.0 V, V_B = 0.25V, R_L = 1.0KΩ)	DTC111					
	DTC106					
	DTC110					
	DTC124					
Input Resistor	DTC101	R_1	3.3	4.7	6.1	KΩ
	DTC102		7.0	10	13	
	DTC103		15.4	22	28.6	
	DTC104		32.9	47	61.1	
	DTC105		1.54	2.2	2.86	
	DTC106		3.3	4.7	6.1	
	DTC107		7.0	10	13	
	DTC108		15.4	22	28.6	
	DTC110		3.3	4.7	6.1	
	DTC111		7.0	10	13	
	DTC112		70	100	130	
	DTC114		32.9	47	61.1	
	DTC117		1.5	2.2	2.9	
	DTC123		0.7	1.0	1.3	
	DTC124		1.54	2.2	2.88	
Resistor Ratio	DTC101 / DTC123 / DTC117	R_1/R_2	0.8	1.0	1.2	
	DTC102 / DTC103 / DTC104		0.8	1.0	1.2	
	DTC105		0.038	0.047	0.056	
	DTC106		0.055	0.1	0.185	
	DTC107		0.17	0.21	0.25	
	DTC108		0.38	0.47	0.56	
	DTC110 / DTC111 / DTC124		–	–	–	
	DTC112 / DTC114		–	–	–	

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

TYPICAL ELECTRICAL CHARACTERISTICS
DTC101

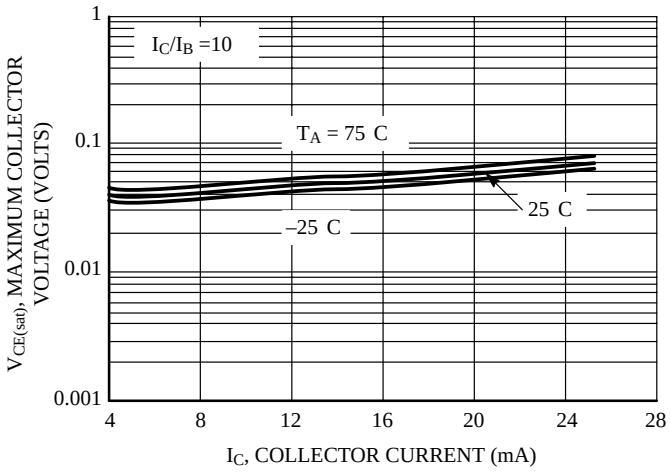


Figure 22. $V_{CE(sat)}$ vs. I_C

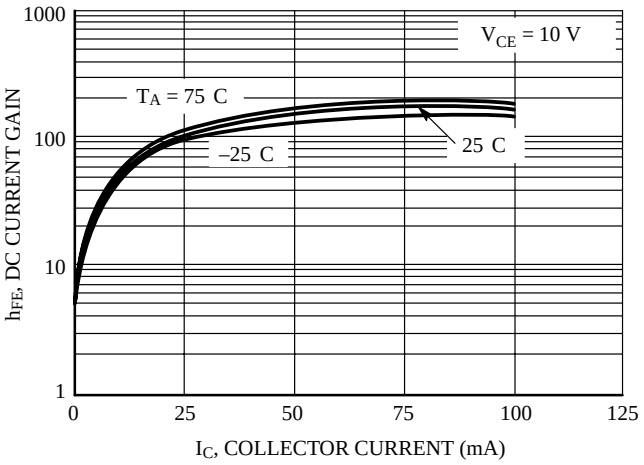


Figure 23. DC Current Gain

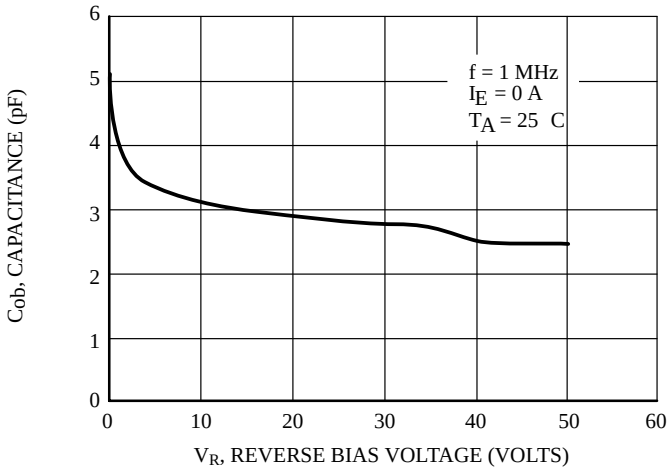


Figure 24. Output Capacitance

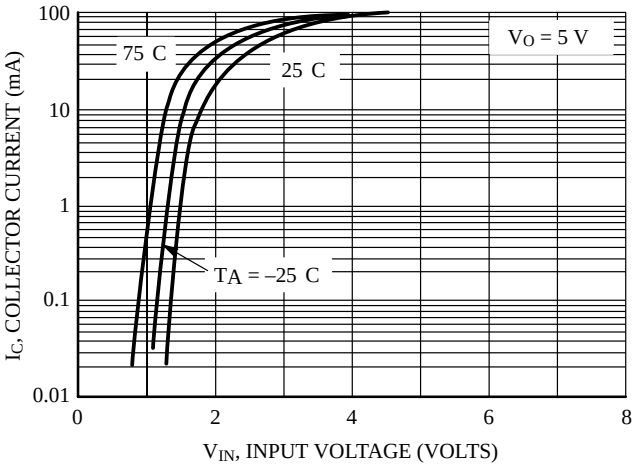


Figure 25. Output Current vs. Input Voltage

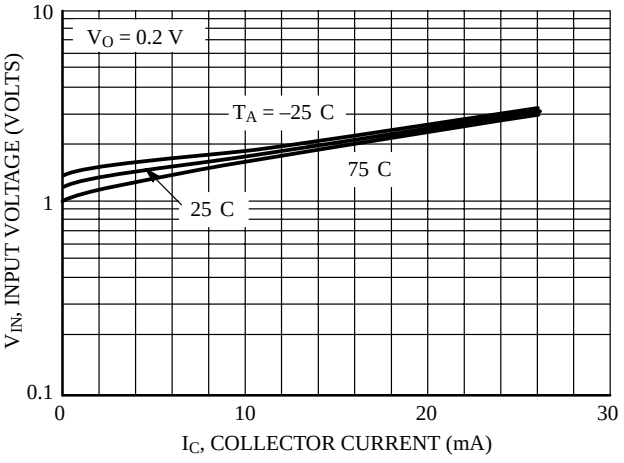


Figure 26. Output Voltage vs. Input Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC102

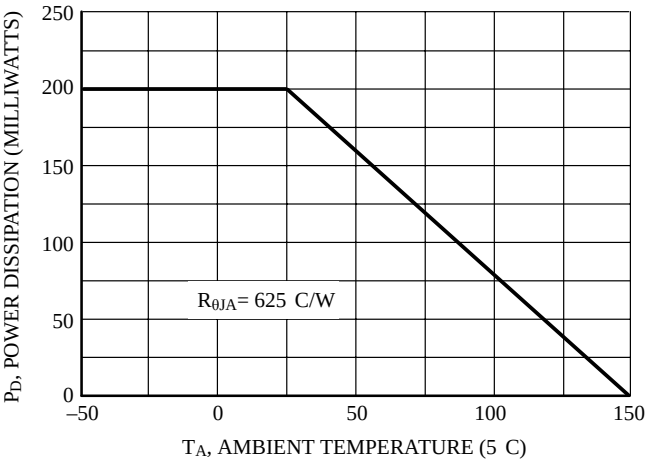


Figure 1. Derating Curve

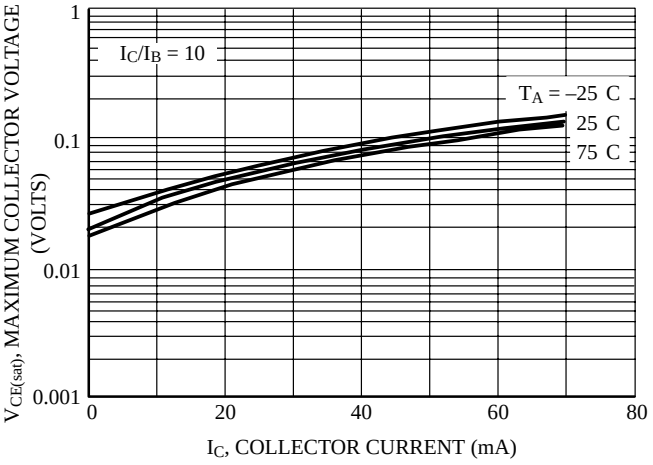


Figure 2. $V_{CE(sat)}$ vs. I_C

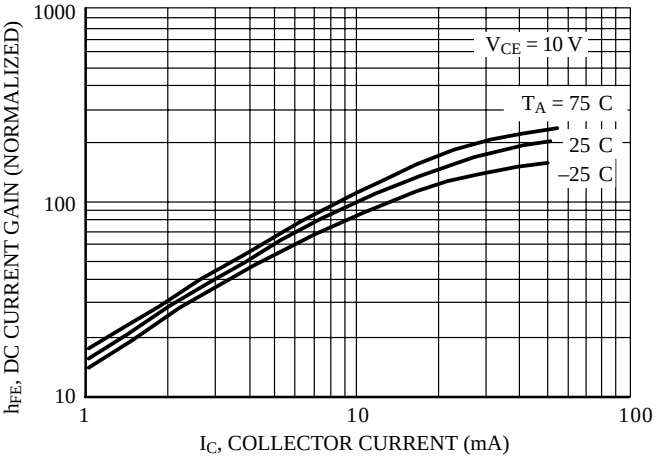


Figure 3. DC Current Gain

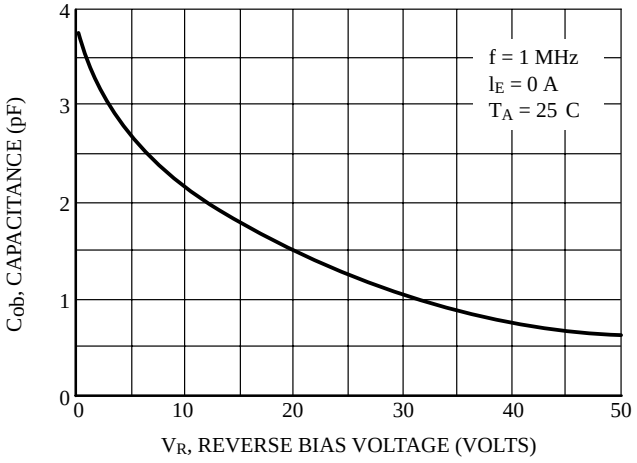


Figure 4. Output Capcitance

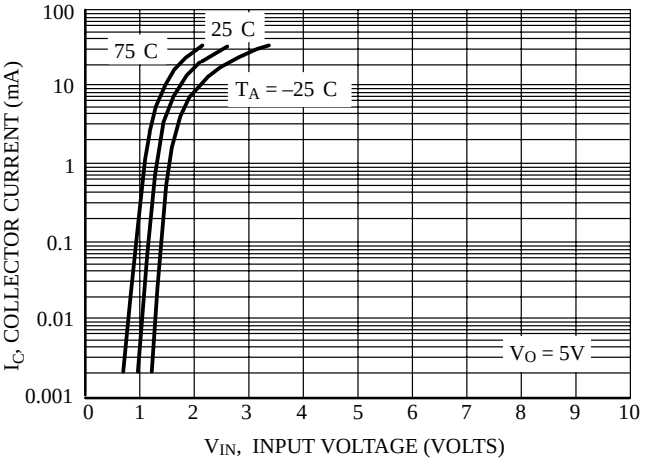


Figure 5. Output Current vs. Input Voltage

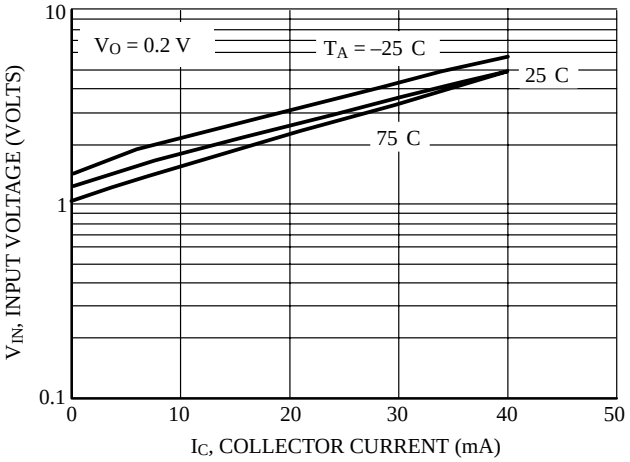


Figure 6. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC103

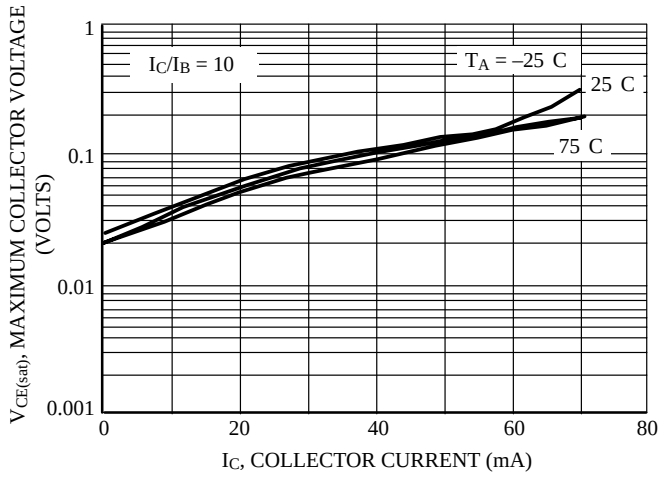


Figure 7. $V_{CE(sat)}$ vs. I_C

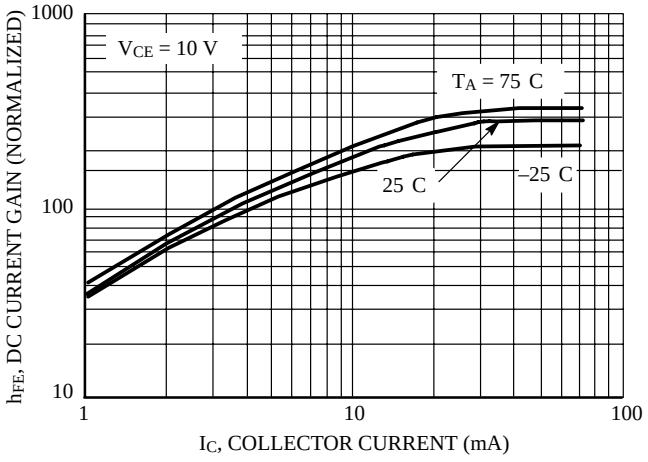


Figure 8. DC Current Gain

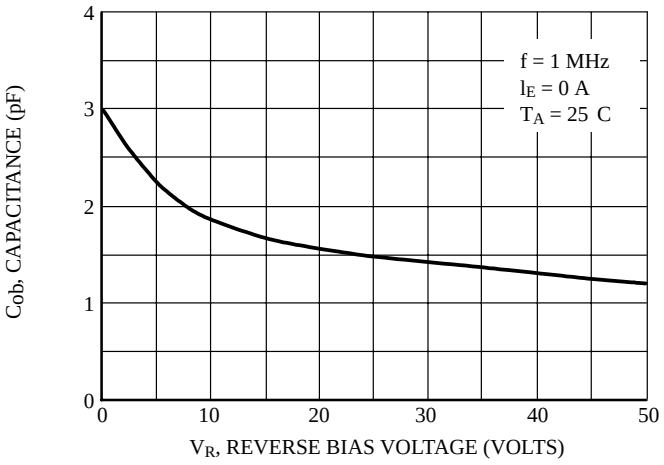


Figure 9. Output Capacitance

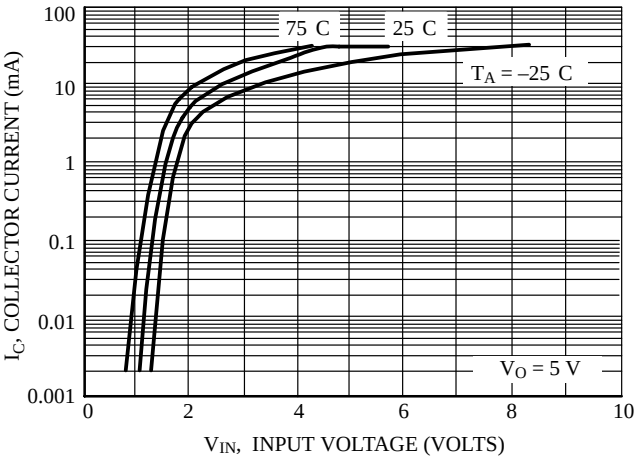


Figure 10. Output Current vs. Input Voltage

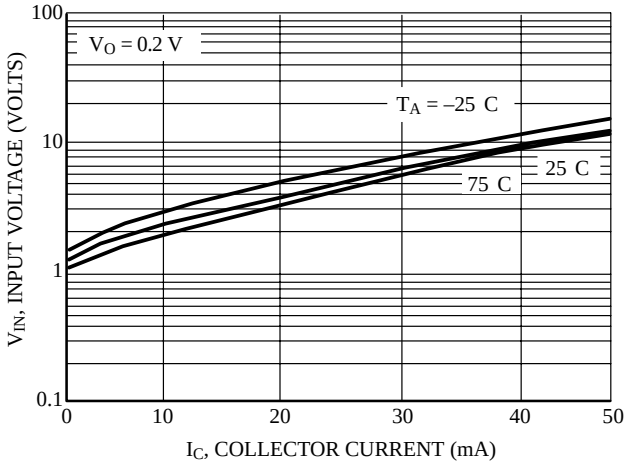


Figure 11. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC104

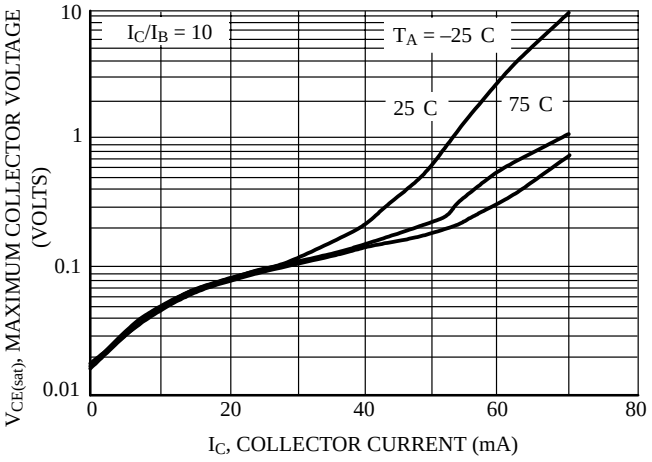


Figure 12. $V_{CE(sat)}$ vs. I_C

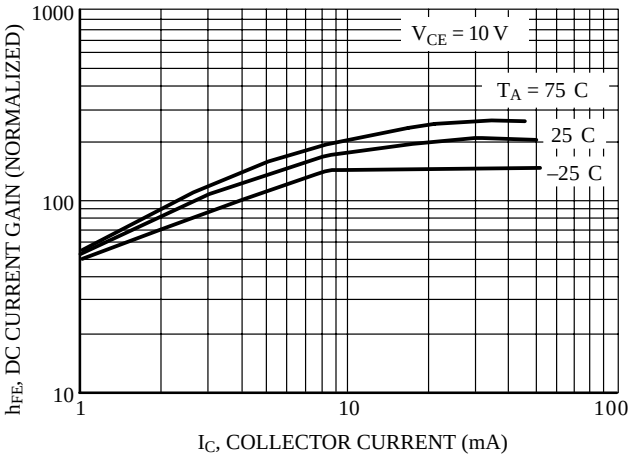


Figure 13. DC Current Gain

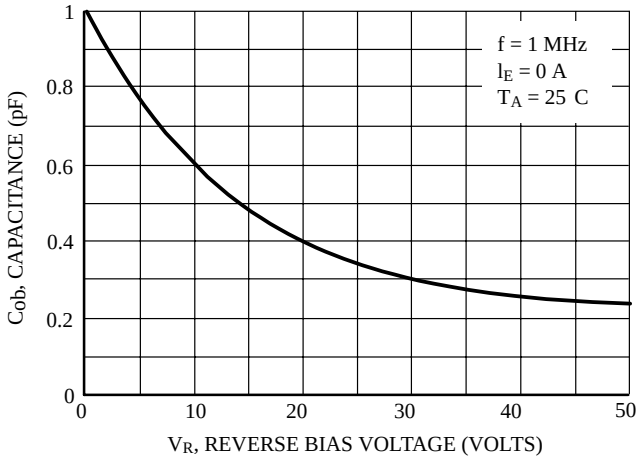


Figure 14. Output Capacitance

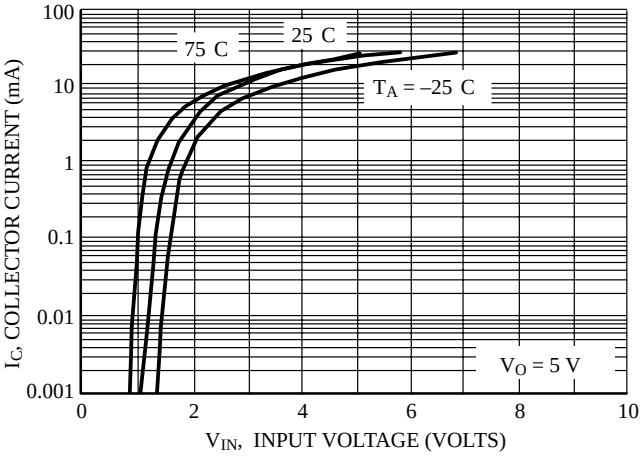


Figure 15. Output Current vs. Input Voltage

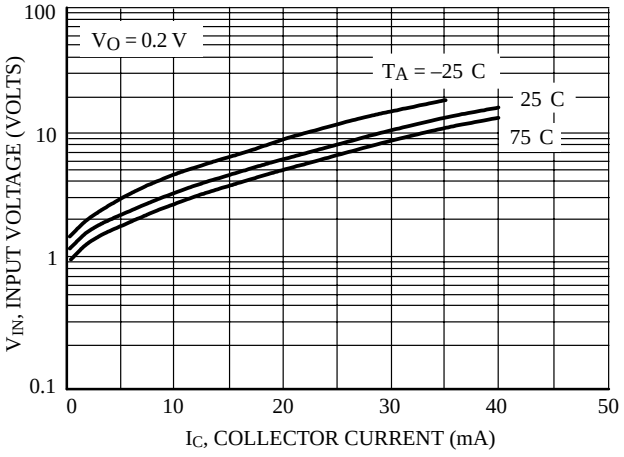


Figure 16. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC106

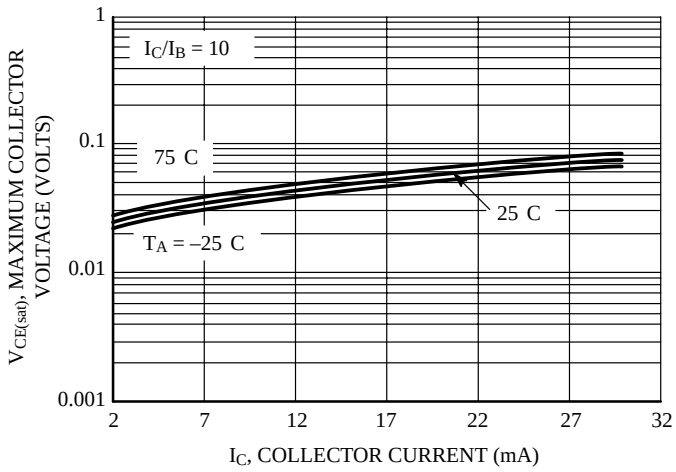


Figure 27. $V_{CE(sat)}$ vs. I_C

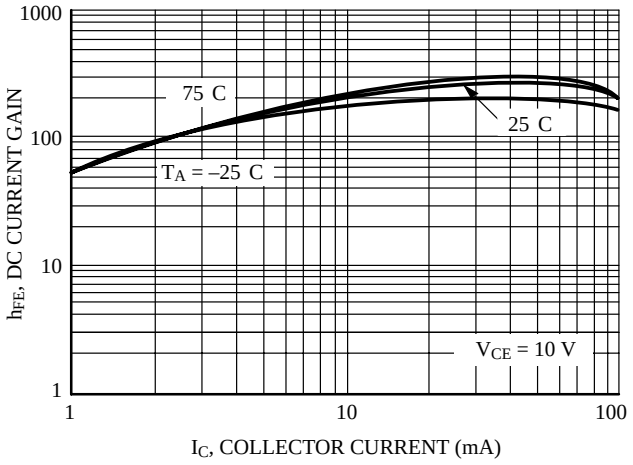


Figure 28. DC Current Gain

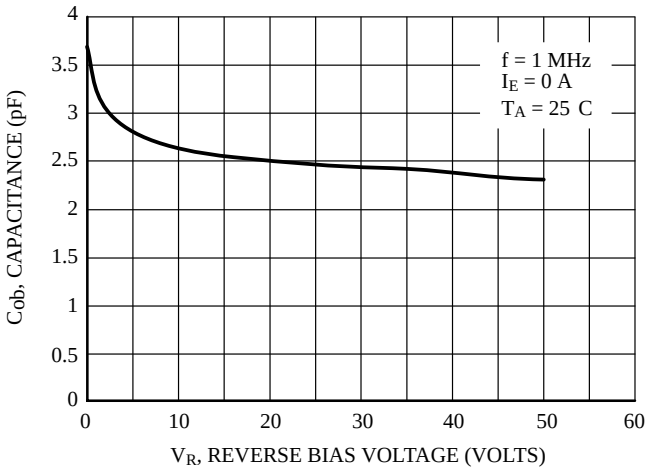


Figure 29. Output Capacitance

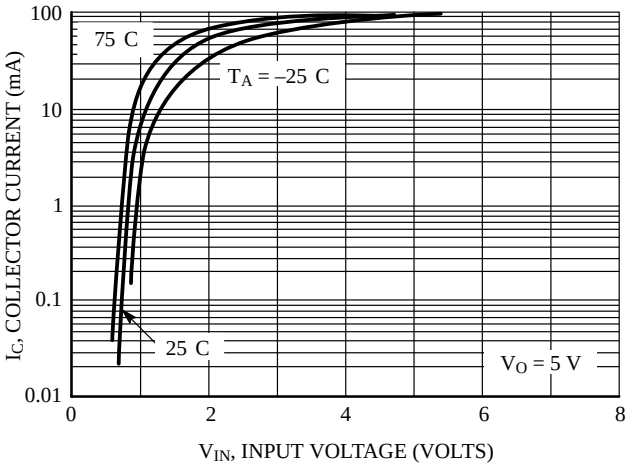


Figure 30. Output Current vs. Input Voltage

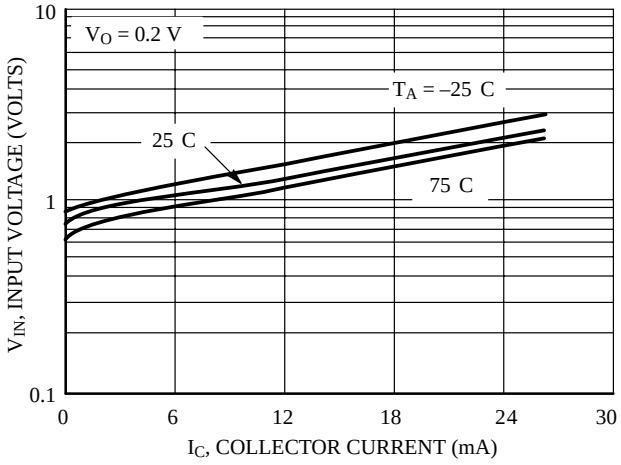


Figure 31. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC107

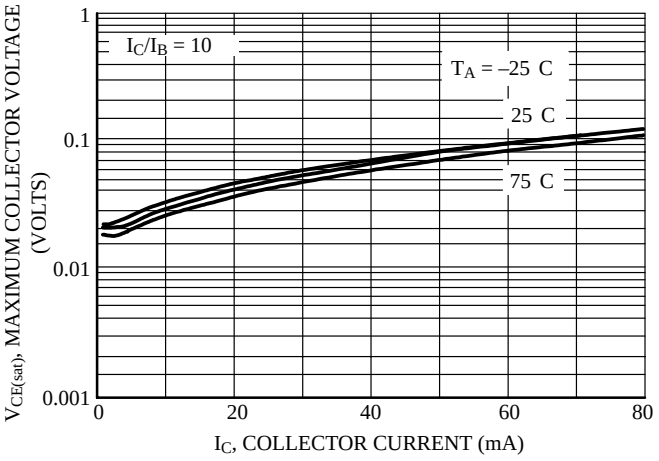


Figure 17. VCE(sat) vs. IC

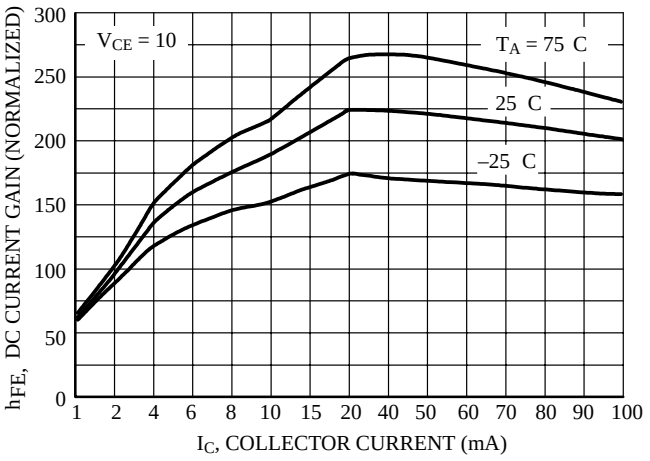


Figure 18. DC Current Gain

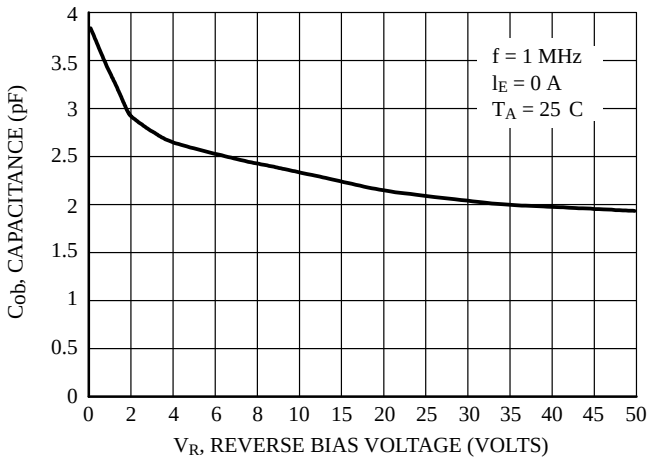


Figure 19. Output Capacitance

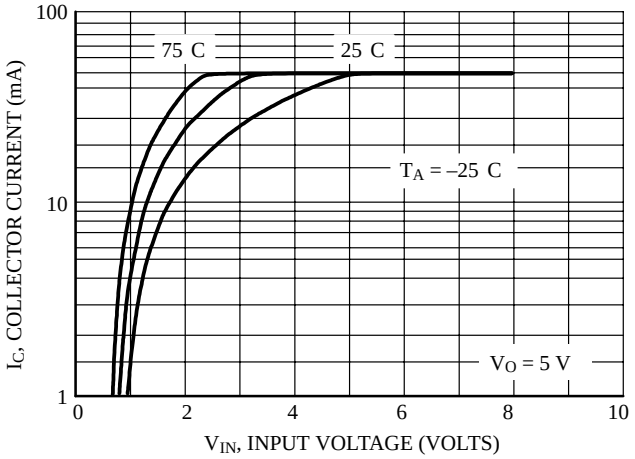


Figure 20. Output Current vs. Input Voltage

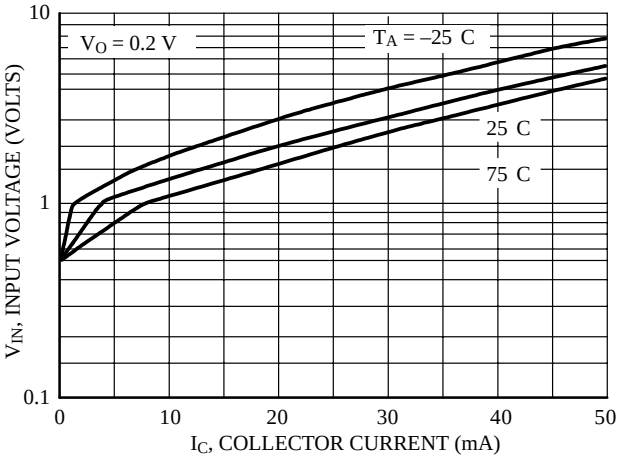


Figure 21. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC110

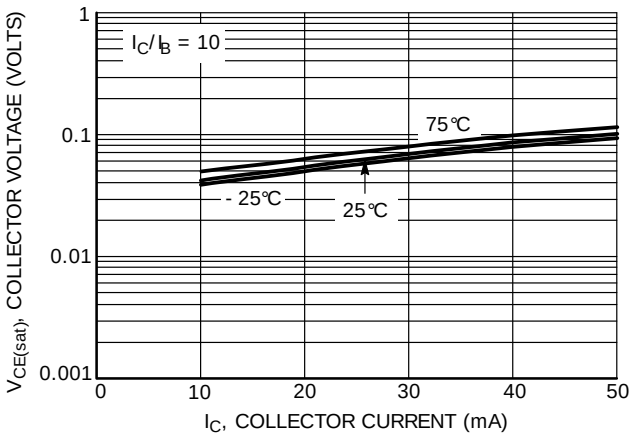


Figure 27. $V_{CE(sat)}$ versus I_C

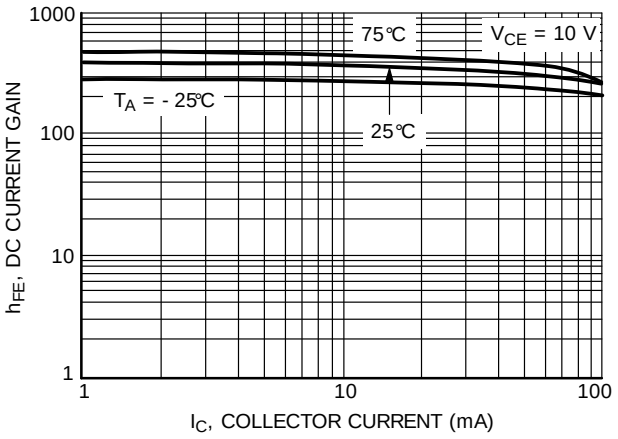


Figure 28. DC Current Gain

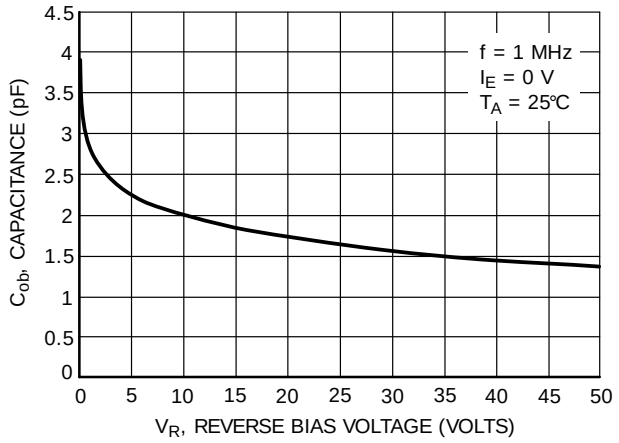


Figure 29. Output Capacitance

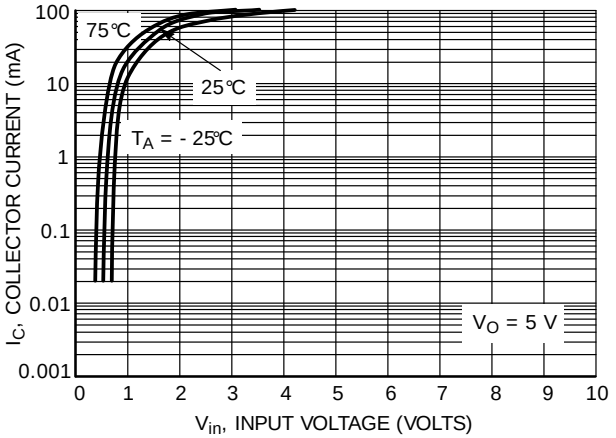


Figure 30. Output Current versus Input Voltage

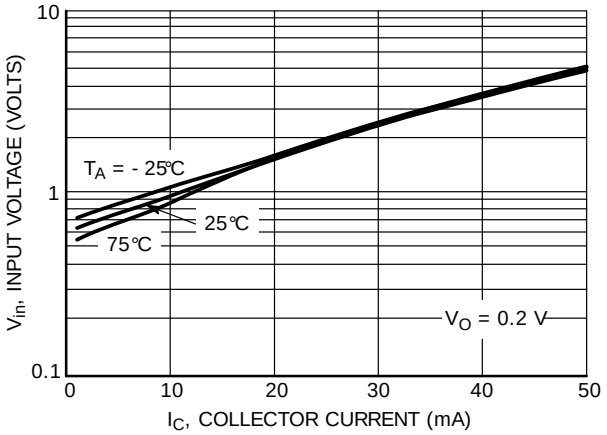


Figure 31. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC111

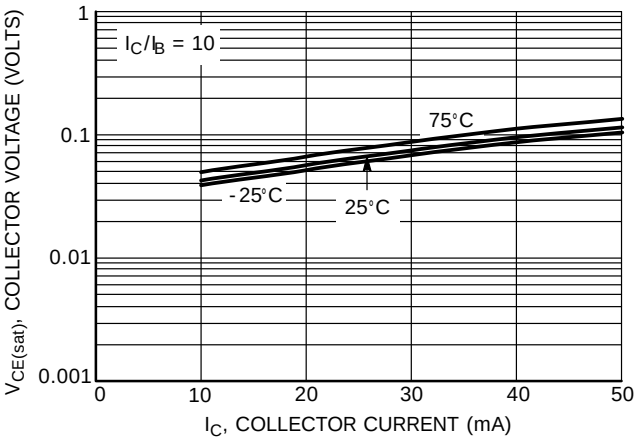


Figure 22. $V_{CE(sat)}$ versus I_C

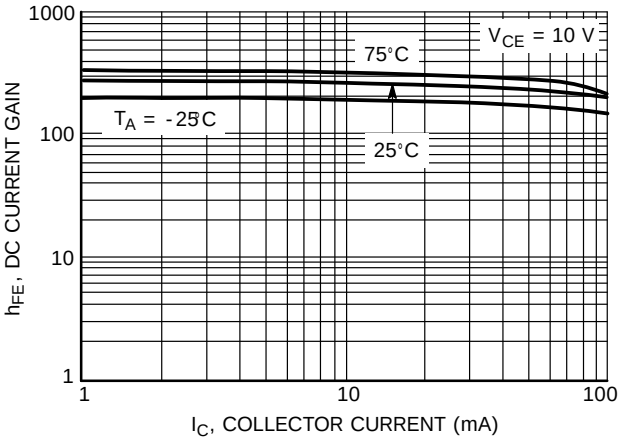


Figure 23. DC Current Gain

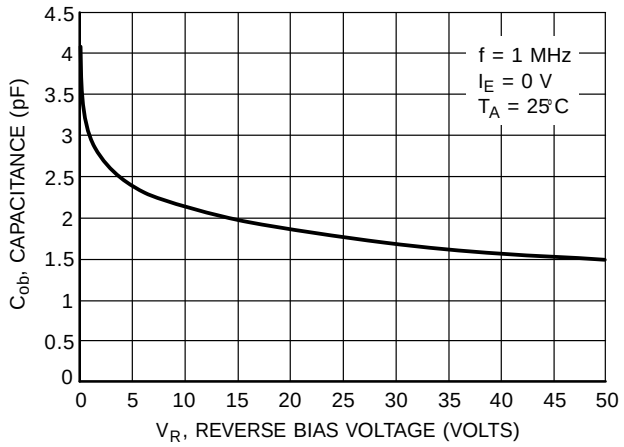


Figure 24. Output Capacitance

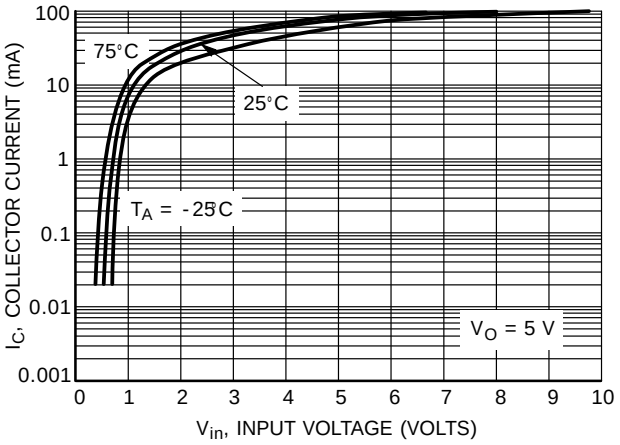


Figure 25. Output Current versus Input Voltage

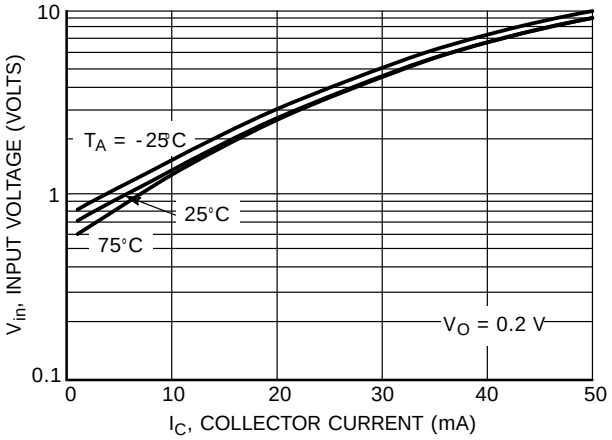


Figure 26. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC117

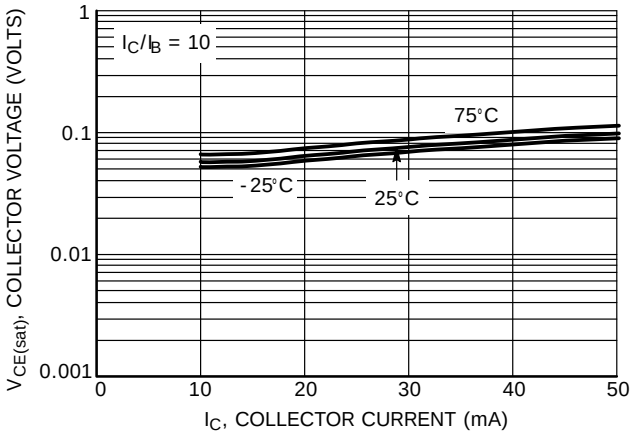


Figure 37. $V_{CE(sat)}$ versus I_C

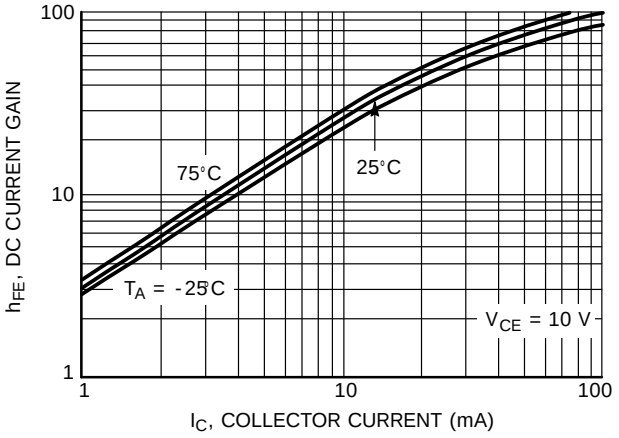


Figure 38. DC Current Gain

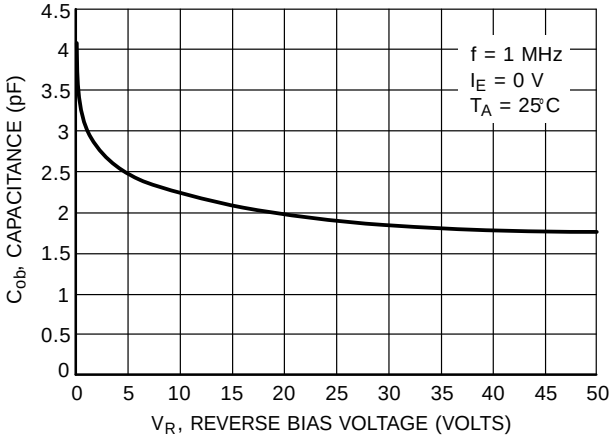


Figure 39. Output Capacitance

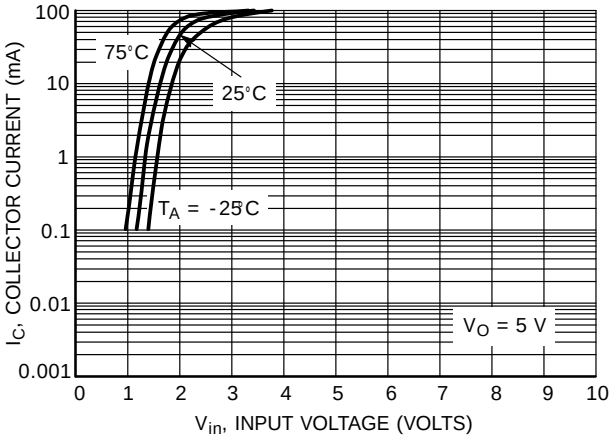


Figure 40. Output Current versus Input Voltage

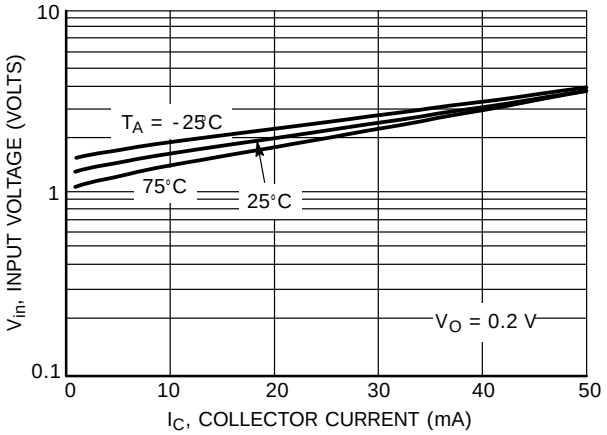


Figure 41. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC108

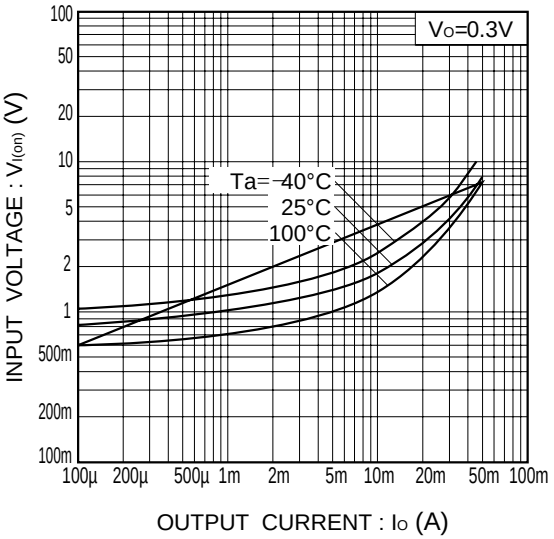


Fig.1 Input voltage vs. output current (ON characteristics)

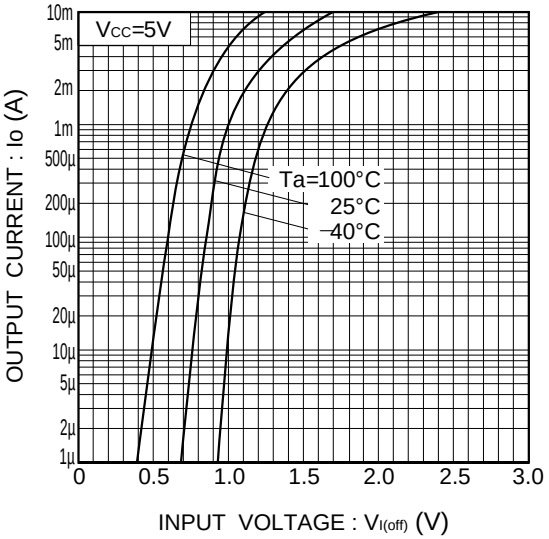


Fig.2 Output current vs. input voltage (OFF characteristics)

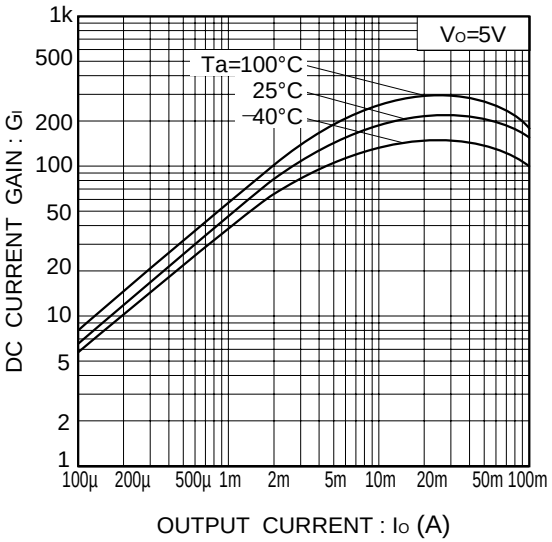


Fig.3 DC current gain vs. output current

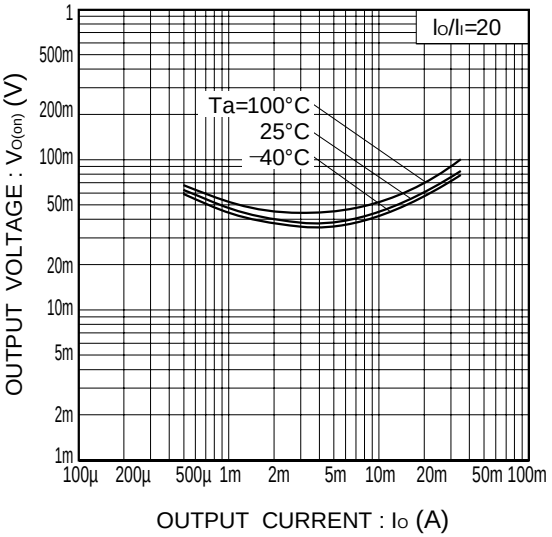


Fig.4 Output voltage vs. output current

TYPICAL ELECTRICAL CHARACTERISTICS
DTC123

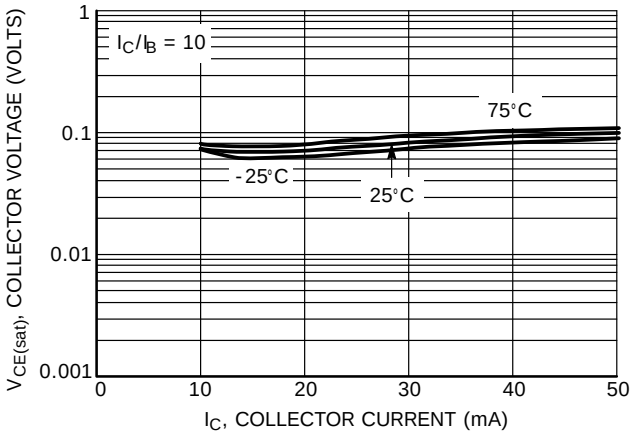


Figure 32. $V_{CE(sat)}$ versus I_C

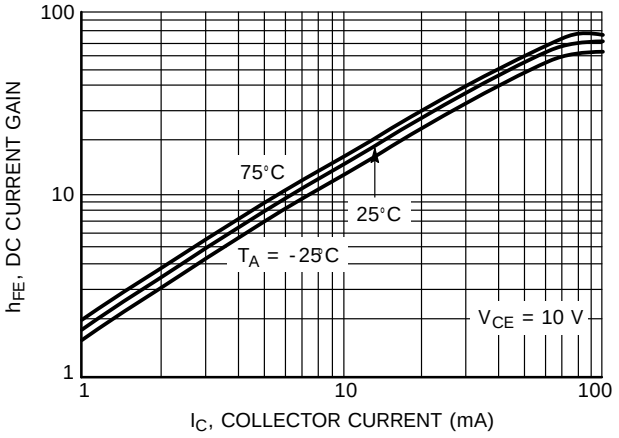


Figure 33. DC Current Gain

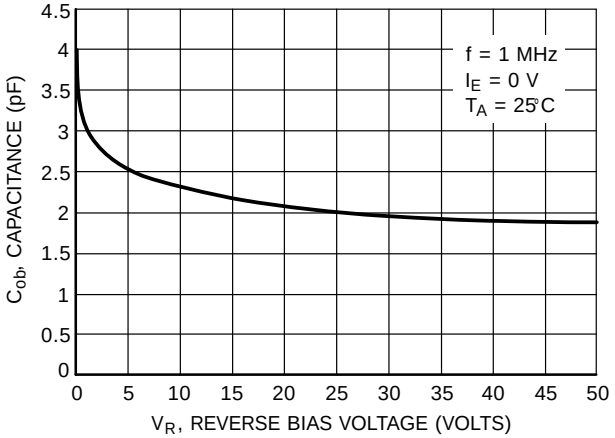


Figure 34. Output Capacitance

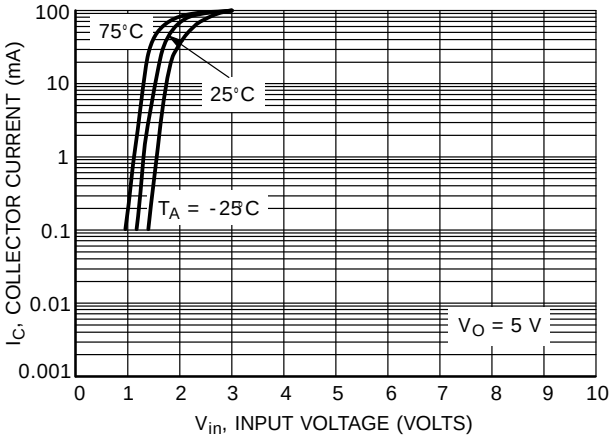


Figure 35. Output Current versus Input Voltage

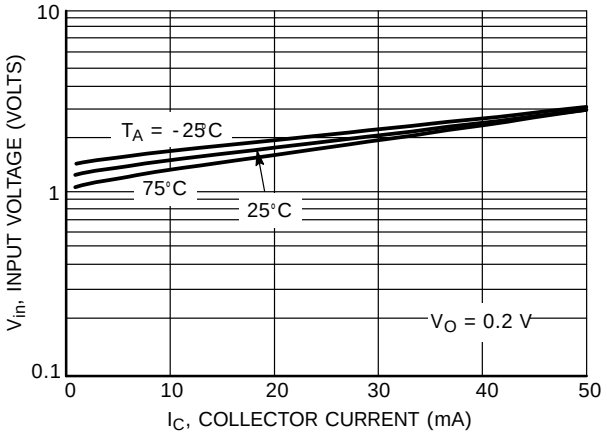


Figure 36. Input Voltage versus Output Current

TYPICAL APPLICATIONS FOR NPN BRTs

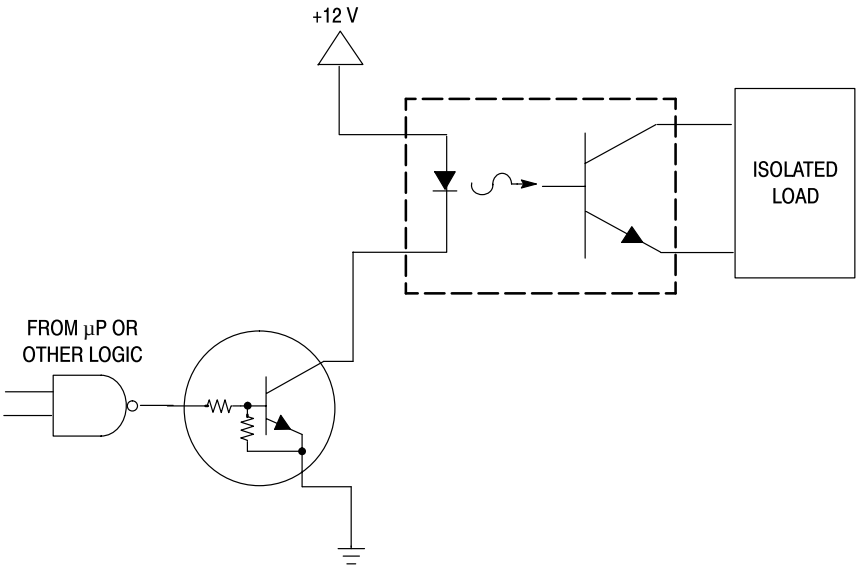


Figure 32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

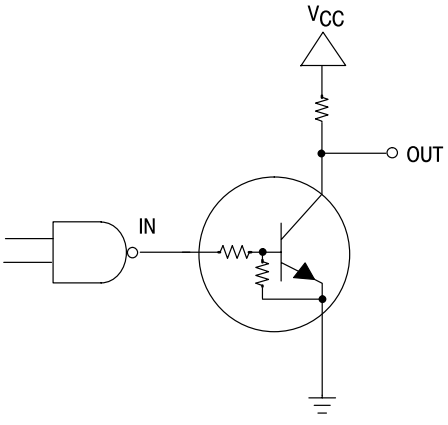


Figure 33. Open Collector Inverter: Inverts the Input Signal

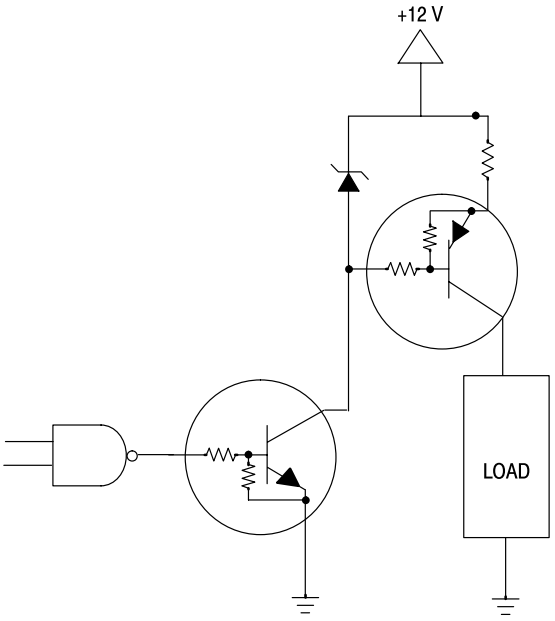
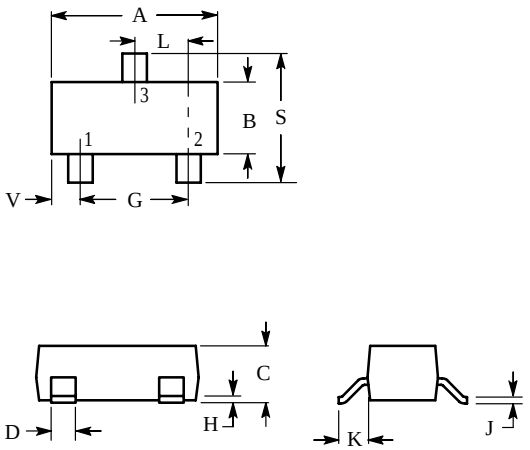


Figure 34. Inexpensive, Unregulated Current Source

SOT-23



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