Bias Resistor Transistor

NPN Silicon Surface Mount Transistor with Monolithic Bias Resistor Network

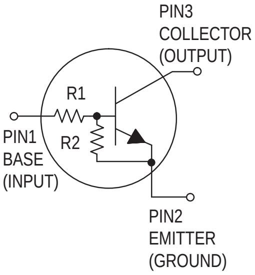
MUN5211T1 SERIES

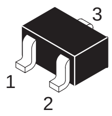
Motorola Preferred Devices

NPN SILICON
BIAS RESISTOR
TRANSISTORS

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-70/SOT-323 package which is designed for low power surface mount applications.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SC-70/SOT-323 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 embossed tape and reel
  Use the Device Number to order the 7 inch/3000 unit reel.
  Replace “T1” with “T3” in the Device Number to order the 13 inch/10,000 unit reel.





CASE 419-02, STYLE 3
SC-70/SOT-323

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(1) Derate above 25°C	P_D	150 1.2	mW mW/°C

THERMAL CHARACTERISTICS

Thermal Resistance — Junction-to-Ambient (surface mounted)	$R_{\theta JA}$	833	°C/W
Operating and Storage Temperature Range	T_J, T_{stg}	–65 to +150	°C
Maximum Temperature for Soldering Purposes, Time in Solder Bath	T_L	260 10	°C Sec

DEVICE MARKING AND RESISTOR VALUES

Device	Marking	R1 (K)	R2 (K)
MUN5211T1	8A	10	10
MUN5212T1	8B	22	22
MUN5213T1	8C	47	47
MUN5214T1	8D	10	47
MUN5215T1(2)	8E	10	∞
MUN5216T1(2)	8F	4.7	∞
MUN5230T1(2)	8G	1.0	1.0
MUN5231T1(2)	8H	2.2	2.2
MUN5232T1(2)	8J	4.7	4.7
MUN5233T1(2)	8K	4.7	47
MUN5234T1(2)	8L	22	47

1. Device mounted on a FR-4 glass epoxy printed circuit board using the minimum recommended footprint.
2. New devices. Updated curves to follow in subsequent data sheets.

Preferred devices are Motorola recommended choices for future use and best overall value.

REV 2

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 MUN5211T1	I_{EBO}	—	—	0.5	mAdc
(V_{EB} = 6.0 V, I_C = 0) MUN5212T1		—	—	0.2	
MUN5213T1		—	—	0.1	
MUN5214T1		—	—	0.2	
MUN5215T1		—	—	0.9	
MUN5216T1		—	—	1.9	
MUN5230T1		—	—	4.3	
MUN5231T1		—	—	2.3	
MUN5232T1		—	—	1.5	
MUN5233T1		—	—	0.18	
MUN5234T1		—	—	0.13	
Collector-Base Breakdown Voltage (I_C = 10 µA, I_E = 0)	$V_{(BR)CBO}$	50	—	—	Vdc
Collector-Emitter Breakdown Voltage(3) (I_C = 2.0 mA, I_B = 0)	$V_{(BR)CEO}$	50	—	—	Vdc
ON CHARACTERISTICS(3)					
DC Current Gain MUN5211T1	h_{FE}	35	60	—	
(V_{CE} = 10 V, I_C = 5.0 mA) MUN5212T1		60	100	—	
MUN5213T1		80	140	—	
MUN5214T1		80	140	—	
MUN5215T1		160	350	—	
MUN5216T1		160	350	—	
MUN5230T1		3.0	5.0	—	
MUN5231T1		8.0	15	—	
MUN5232T1		15	30	—	
MUN5233T1		80	200	—	
MUN5234T1		80	150	—	
Collector-Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.3 mA) (I_C = 10 mA, I_B = 5 mA) MUN5230T1/MUN5231T1 (I_C = 10 mA, I_B = 1 mA) MUN5215T1/MUN5216T1 MUN5232T1/MUN5233T1/MUN5234T1	$V_{CE(sat)}$	—	—	0.25	Vdc
Output Voltage (on)	V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ) MUN5211IT1		—	—	0.2	
MUN5212T1		—	—	0.2	
MUN5214T1		—	—	0.2	
MUN5215T1		—	—	0.2	
MUN5216T1		—	—	0.2	
MUN5230T1		—	—	0.2	
MUN5231T1		—	—	0.2	
MUN5232T1		—	—	0.2	
MUN5233T1		—	—	0.2	
MUN5234T1		—	—	0.2	
(V_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 kΩ) MUN5213T1		—	—	0.2	

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
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 = 0.050 V, R_L = 1.0 kΩ) (V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	 MUN5230T1 MUN5215T1 MUN5216T1 MUN5233T1	V_{OH}	4.9	—	—	Vdc
Input Resistor	MUN5211T1	R1	7.0	10	13	k Ω
	MUN5212T1		15.4	22	28.6	
	MUN5213T1		32.9	47	61.1	
	MUN5214T1		7.0	10	13	
	MUN5215T1		7.0	10	13	
	MUN5216T1		3.3	4.7	6.1	
	MUN5230T1		0.7	1.0	1.3	
	MUN5231T1		1.5	2.2	2.9	
	MUN5232T1		3.3	4.7	6.1	
	MUN5233T1		3.3	4.7	6.1	
	MUN5234T1		15.4	22	28.6	
Resistor Ratio	MUN5211T1/MUN5212T1/MUN5213T1	R1/R2	0.8	1.0	1.2	
	MUN5214T1		0.17	0.21	0.25	
	MUN5215T1/MUN5216T1		—	—	—	
	MUN5230T1/MUN5231T1/MUN5232T1		0.8	1.0	1.2	
	MUN5233T1		0.055	0.1	0.185	
	MUN5234T1		0.38	0.47	0.56	

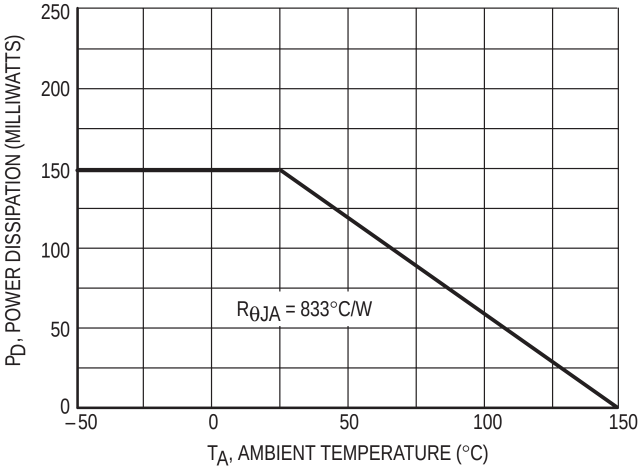


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5211T1

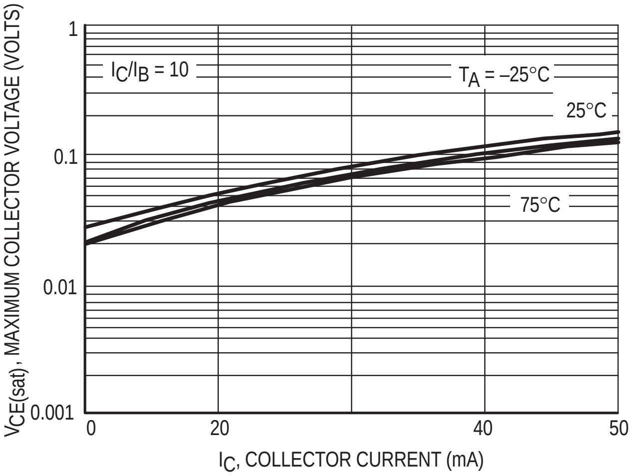


Figure 2. $V_{CE(sat)}$ versus I_C

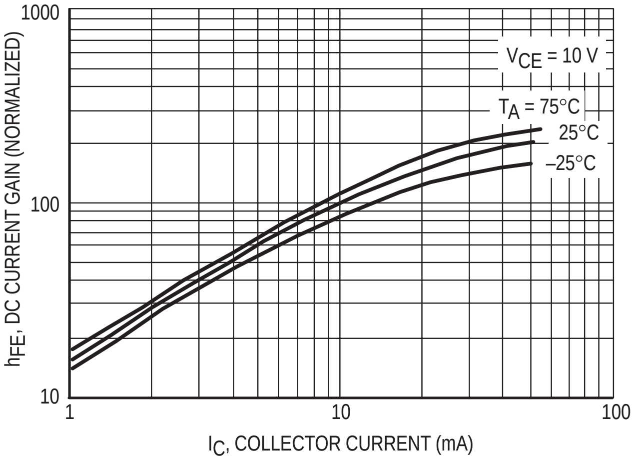


Figure 3. DC Current Gain

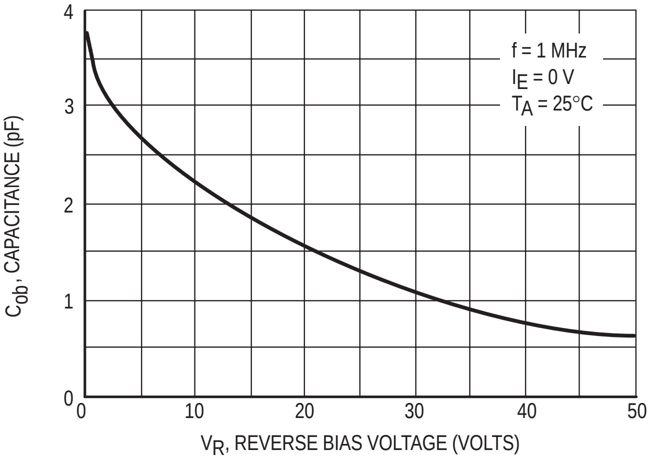


Figure 4. Output Capacitance

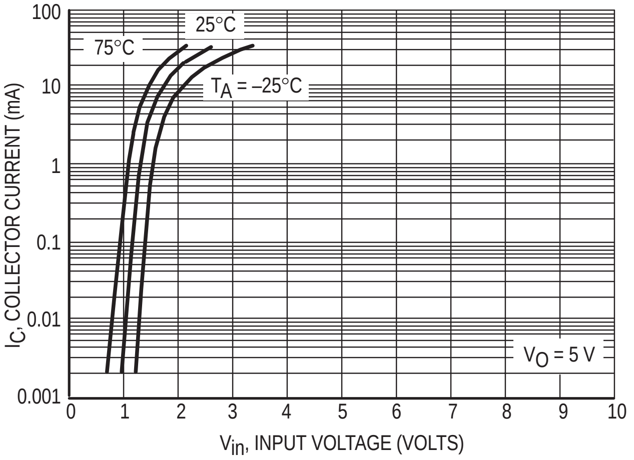


Figure 5. Output Current versus Input Voltage

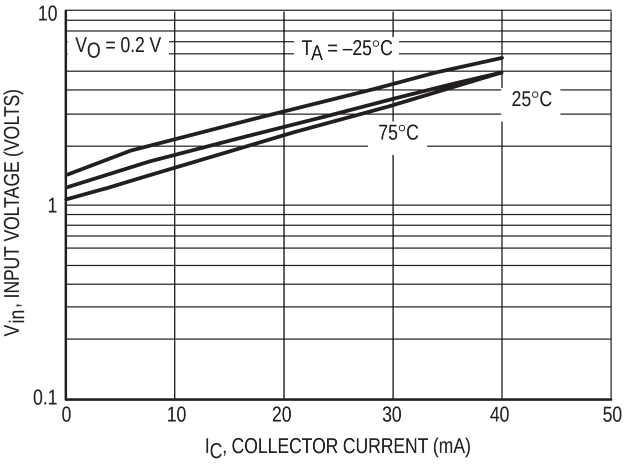


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5212T1

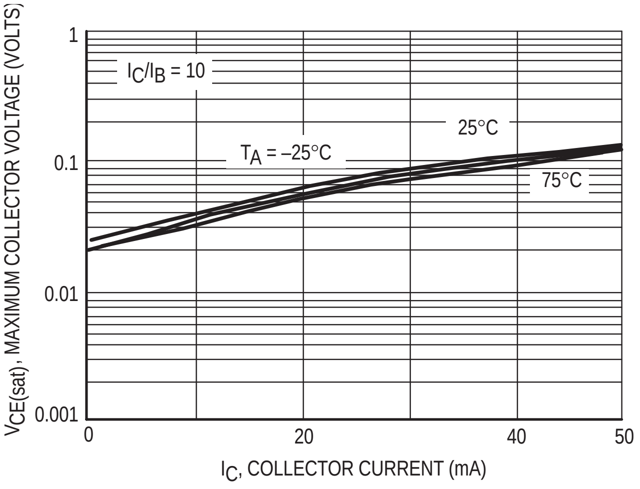


Figure 7. $V_{CE(sat)}$ versus I_C

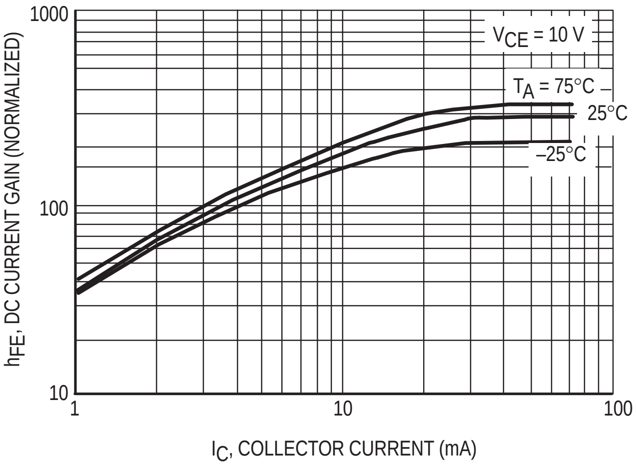


Figure 8. DC Current Gain

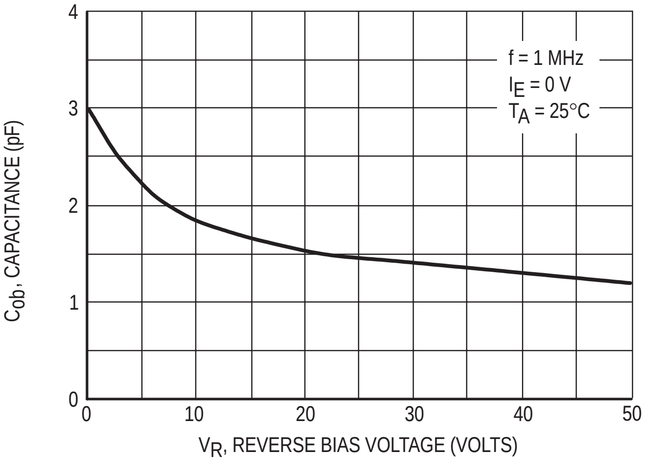


Figure 9. Output Capacitance

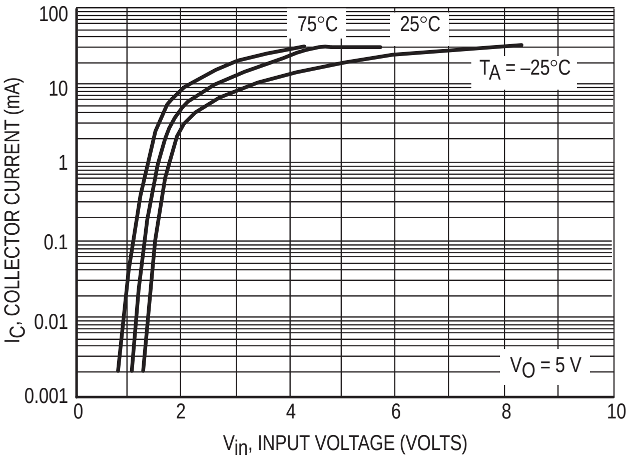


Figure 10. Output Current versus Input Voltage

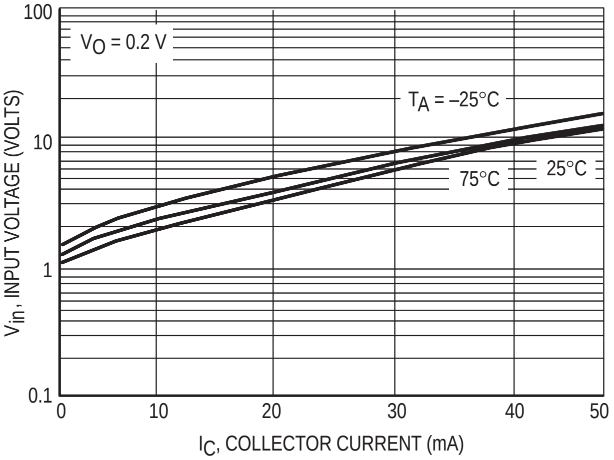


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5213T1

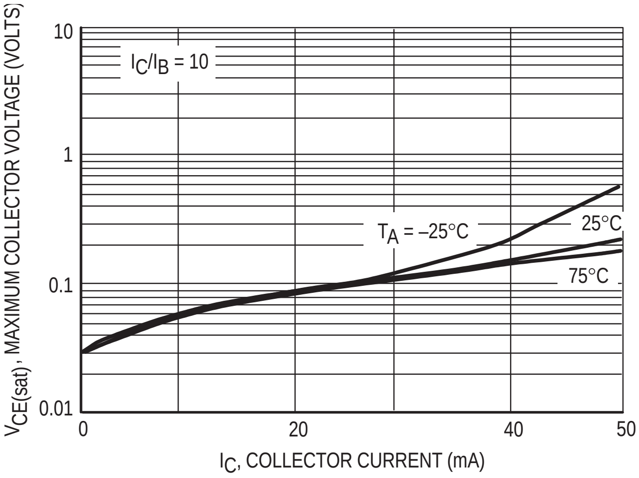


Figure 12. $V_{CE(sat)}$ versus I_C

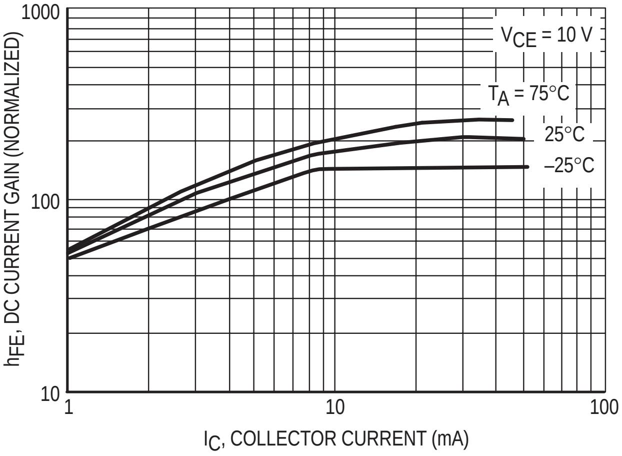


Figure 13. DC Current Gain

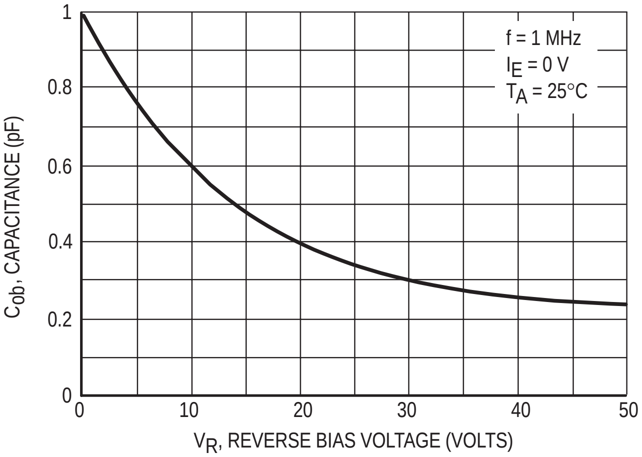


Figure 14. Output Capacitance

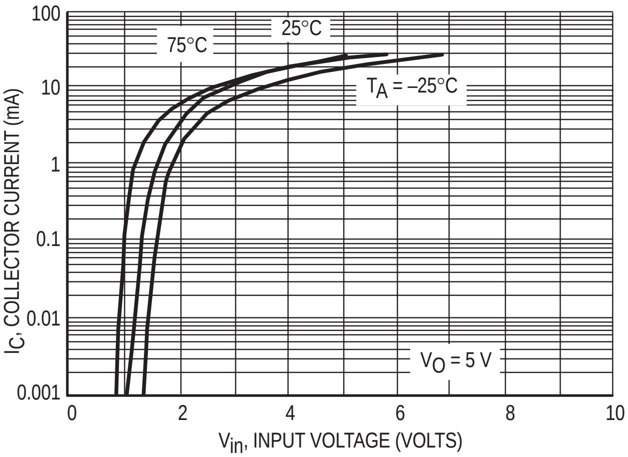


Figure 15. Output Current versus Input Voltage

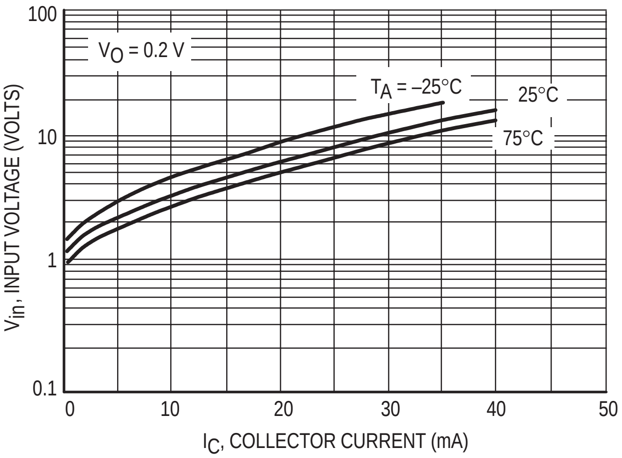


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5214T1

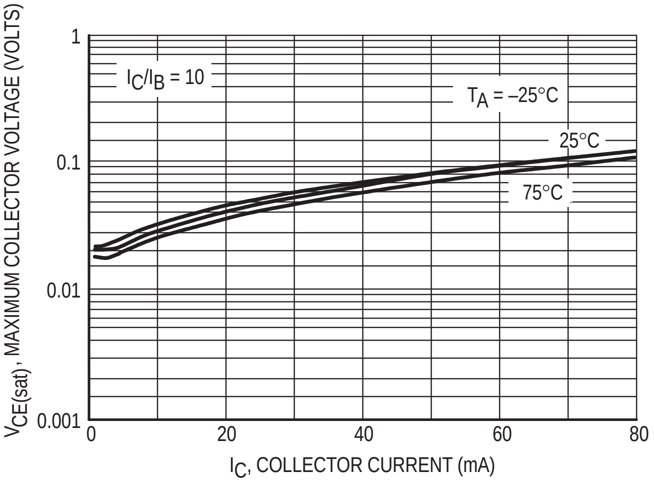


Figure 17. $V_{CE(sat)}$ versus I_C

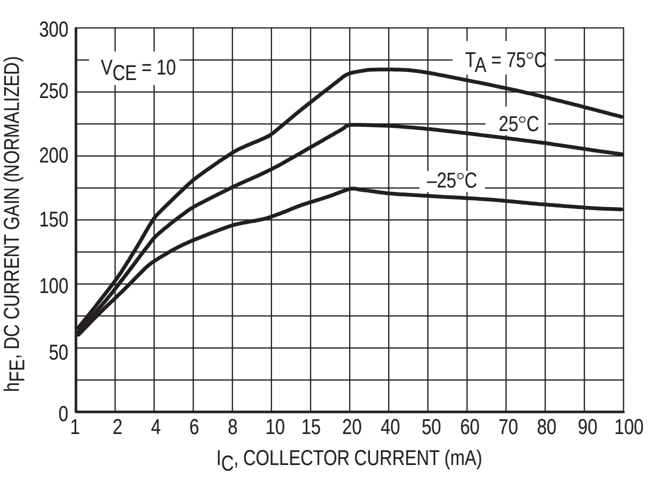


Figure 18. DC Current Gain

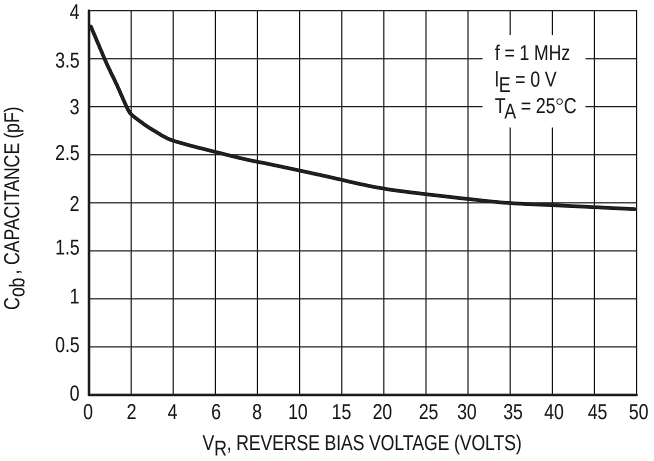


Figure 19. Output Capacitance

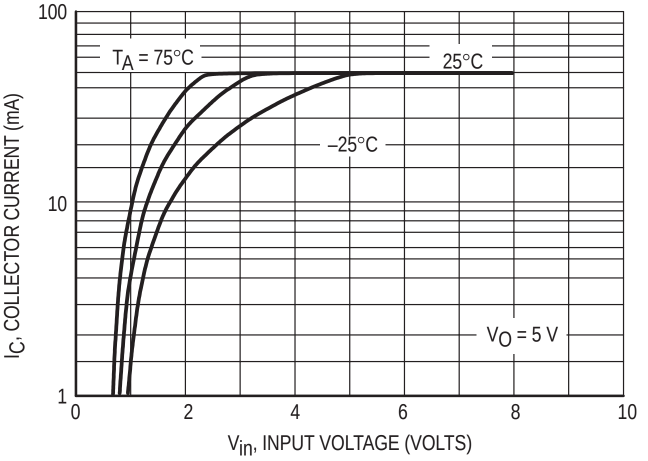


Figure 20. Output Current versus Input Voltage

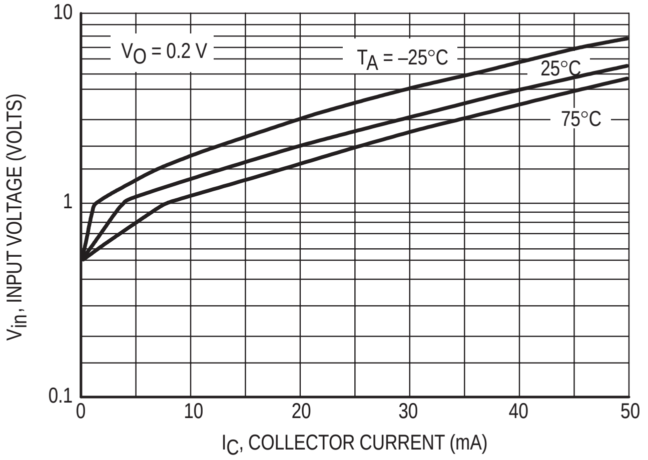


Figure 21. Input Voltage versus Output Current

TYPICAL APPLICATIONS FOR NPN BRTs

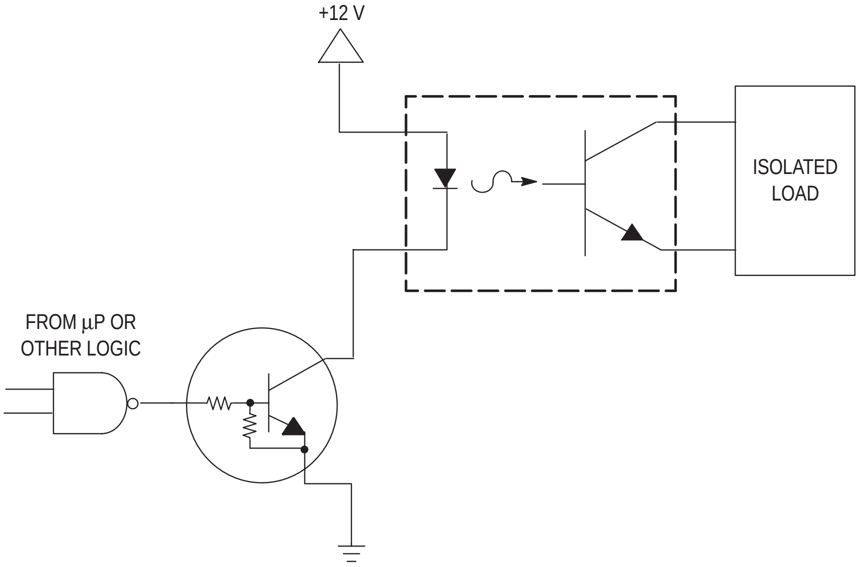


Figure 22. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

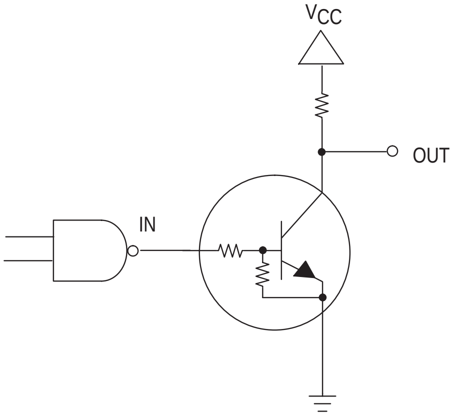


Figure 23. Open Collector Inverter: Inverts the Input Signal

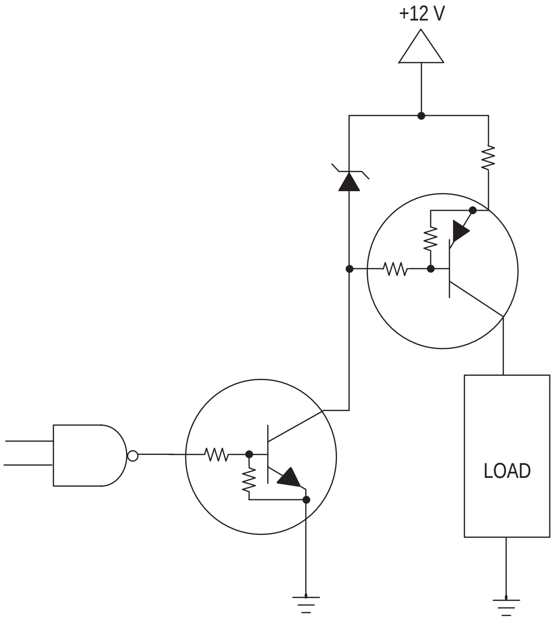


Figure 24. Inexpensive, Unregulated Current Source