

# Bias Resistor Transistors

## NPN Silicon Surface Mount Transistors 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-59 package which is designed for low power surface mount applications.

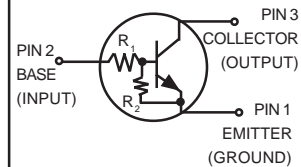
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Moisture Sensitivity Level: 1
- ESD Rating – Human Body Model: Class 1  
– Machine Model: Class B
- The SC-59 package can be soldered using wave or reflow. The modified gull-winged leads absorb thermal stress during soldering 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.

### MUN2211T1 SERIES

### NPN SILICON BIAS RESISTOR TRANSISTORS



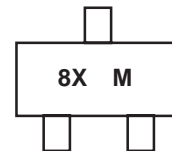
SC-59  
CASE 318D, STYLE 1



#### DEVICE MARKING INFORMATION

\*See specific marking information in the device marking table on page 2 of this data sheet.

#### MARKING DIAGRAM



8X = Specific Device Code\*  
M = Date Code

#### MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CBO</sub>	50	Vdc
Collector-Emitter Voltage	V <sub>CEO</sub>	50	Vdc
Collector Current	I <sub>c</sub>	100	mAdc

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation	P <sub>D</sub>	230(Note 1)	mW
T <sub>A</sub> = 25°C		338(Note 2)	
Derate above 25°C		1.8 (Note 1)	°C/W
		2.7 (Note 2)	
Thermal Resistance – Junction-to-Ambient	R <sub>θJA</sub>	540(Note 1)	°C/W
		370(Note 2)	
Thermal Resistance – Junction-to-Lead	R <sub>θJL</sub>	264(Note 1)	°C/W
		287(Note 2)	
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 x 1.0 inch Pad

**MUN2211T1 Series****DEVICE MARKING AND RESISTOR VALUES**

Device	Package	Marking	R1 (K)	R2 (K)	Shipping
MUN2211T1	SC-59	8A	10	10	3000/Tape & Reel
MUN2212T1	SC-59	8B	22	22	3000/Tape & Reel
MUN2213T1	SC-59	8C	47	47	3000/Tape & Reel
MUN2214T1	SC-59	8D	10	47	3000/Tape & Reel
MUN2215T1 (Note 3)	SC-59	8E	10	∞	3000/Tape & Reel
MUN2216T1 (Note 3)	SC-59	8F	4.7	∞	3000/Tape & Reel
MUN2230T1 (Note 3)	SC-59	8G	1.0	1.0	3000/Tape & Reel
MUN2231T1 (Note 3)	SC-59	8H	2.2	2.2	3000/Tape & Reel
MUN2232T1 (Note 3)	SC-59	8J	4.7	4.7	3000/Tape & Reel
MUN2233T1 (Note 3)	SC-59	8K	4.7	47	3000/Tape & Reel
MUN2234T1 (Note 3)	SC-59	8L	22	47	3000/Tape & Reel
MUN2236T1	SC-59	8N	100	100	3000/Tape & Reel
MUN2237T1	SC-59	8P	47	22	3000/Tape & Reel
MUN2240T1 (Note 3)	SC-59	8T	47	∞	3000/Tape & Reel
MUN2241T1 (Note 3)	SC-59	8U	100	∞	3000/Tape & Reel

3. New devices. Updated curves to follow in subsequent data sheets.

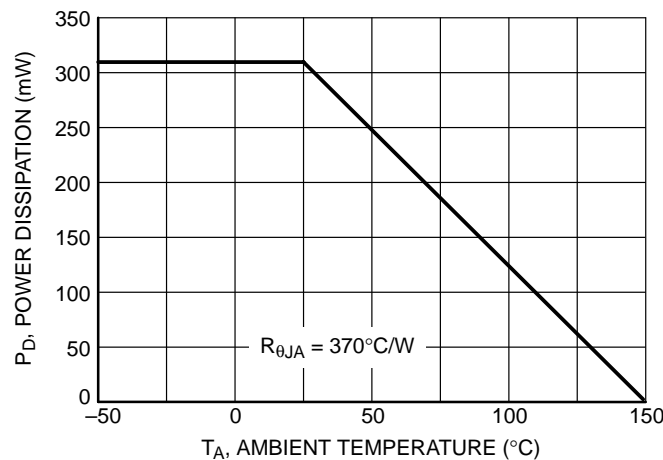


**MUN2211T1 Series**

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>ON CHARACTERISTICS</b> (Note 5) (Continued)					
Output Voltage (off) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.050\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.25\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )	$V_{OH}$	4.9	–	–	Vdc
Input Resistor	$R_1$	7.0	10	13	k $\Omega$
		15.4	22	28.6	
		32.9	47	61.1	
		7.0	10	13	
		7.0	10	13	
		3.3	4.7	6.1	
		0.7	1.0	1.3	
		1.5	2.2	2.9	
		3.3	4.7	6.1	
		3.3	4.7	6.1	
		15.4	22	28.6	
		70	100	130	
		32.9	47	61.1	
		70	100	130	
		32.9	47	61.1	
		70	100	100	
Resistor Ratio	$R_1/R_2$	0.8	1.0	1.2	
	MUN2211T1/MUN2212T1/MUN2213T1/ MUN2236T1	0.17	0.21	0.25	
	MUN2214T1	–	–	–	
	MUN2215T1/MUN2216T1/MUN2240T1/ MUN2241T1	0.8	1.0	1.2	
	MUN2230T1/MUN2231T1/MUN2232T1	0.055	0.1	0.185	
	MUN2233T1	0.38	0.47	0.56	
	MUN2234T1	1.7	2.1	2.6	
	MUN2237T1				

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



**Figure 1. Derating Curve**

MUN2211T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN2211T1

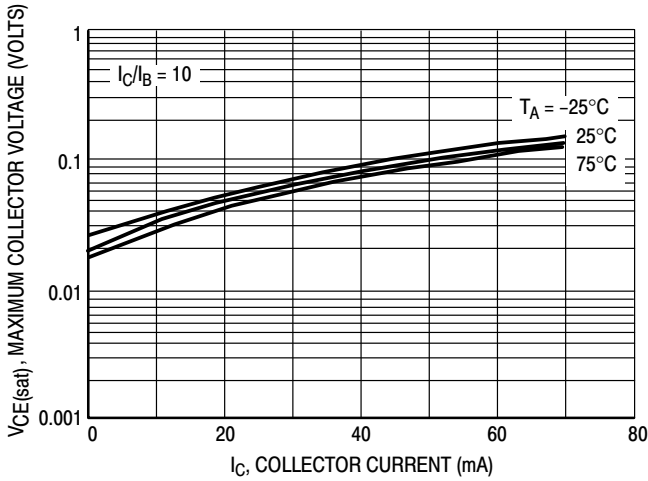


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

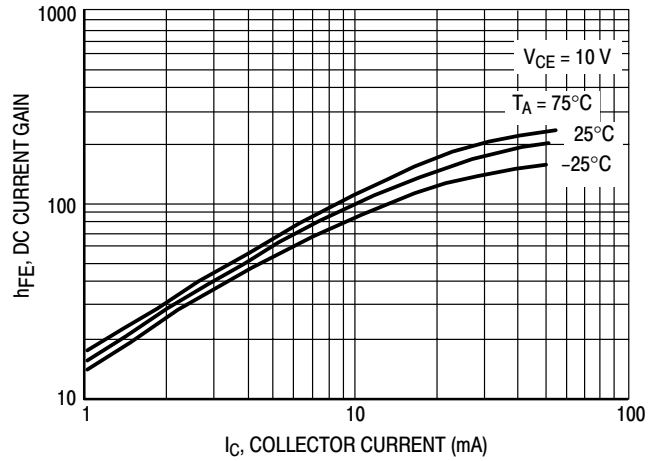


Figure 3. DC Current Gain

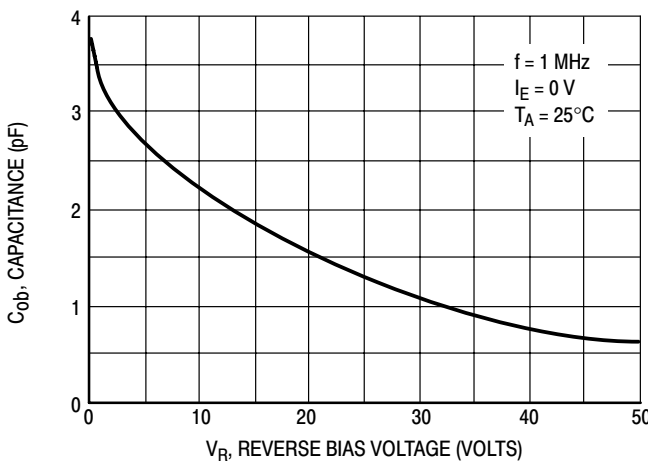


Figure 4. Output Capacitance

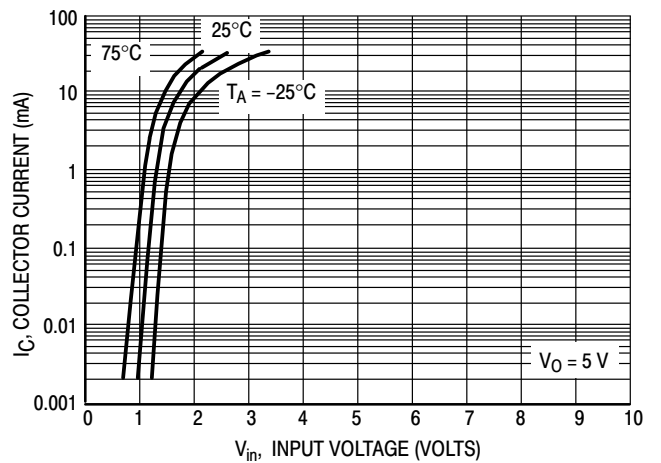


Figure 5. Output Current versus Input Voltage

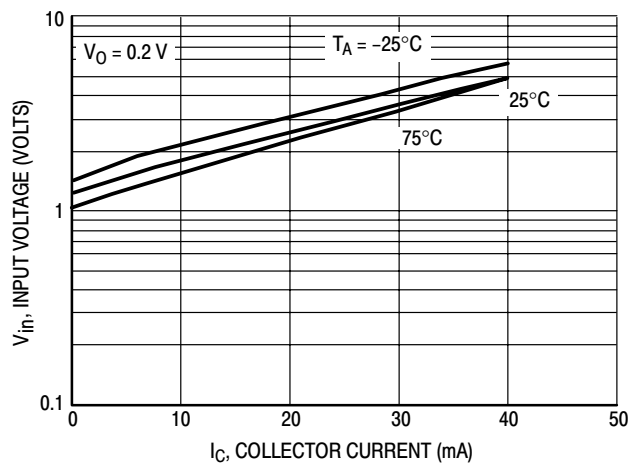


Figure 6. Input Voltage versus Output Current

MUN2211T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN2212T1

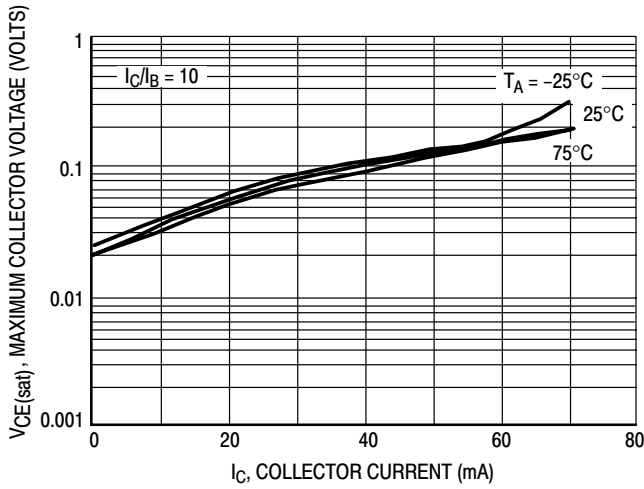


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

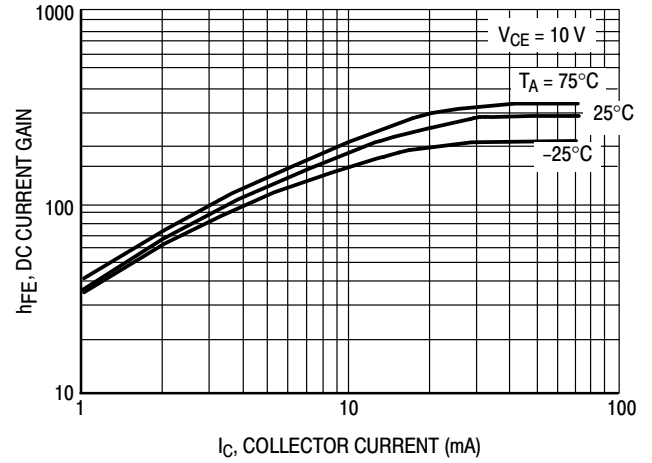


Figure 8. DC Current Gain

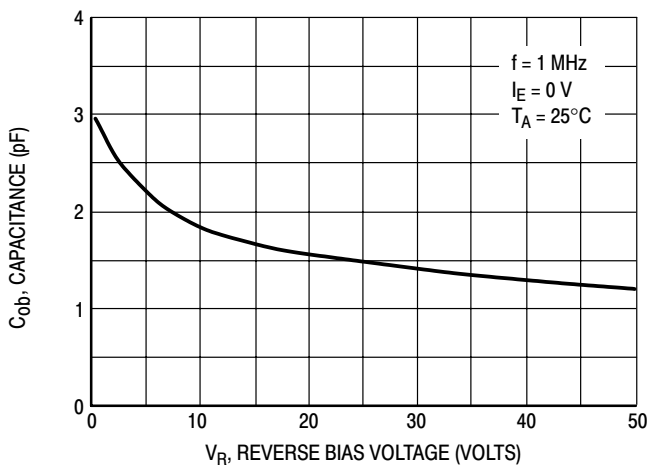


Figure 9. Output Capacitance

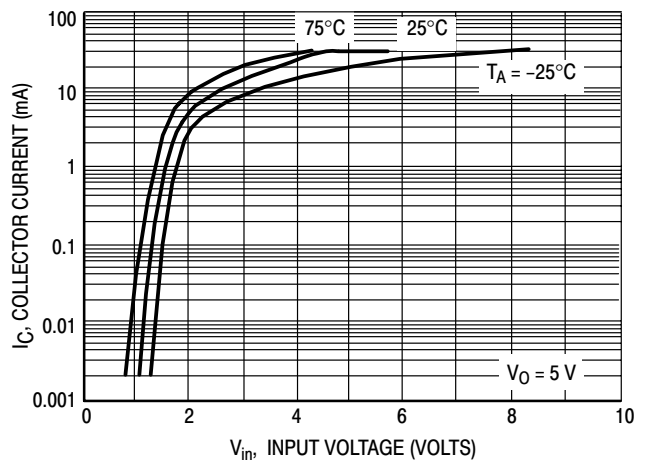


Figure 10. Output Current versus Input Voltage

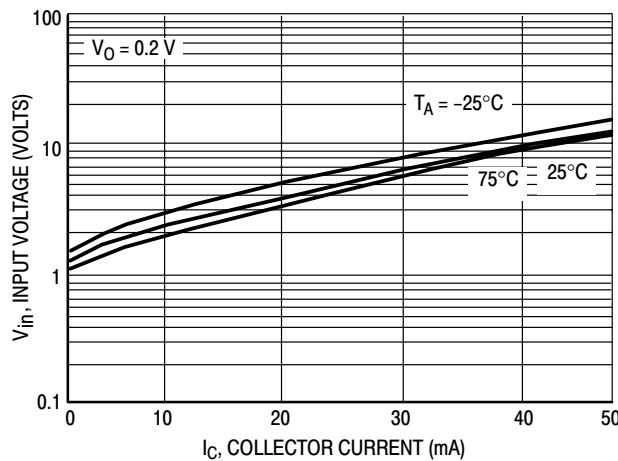


Figure 11. Input Voltage versus Output Current

MUN2211T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN2213T1

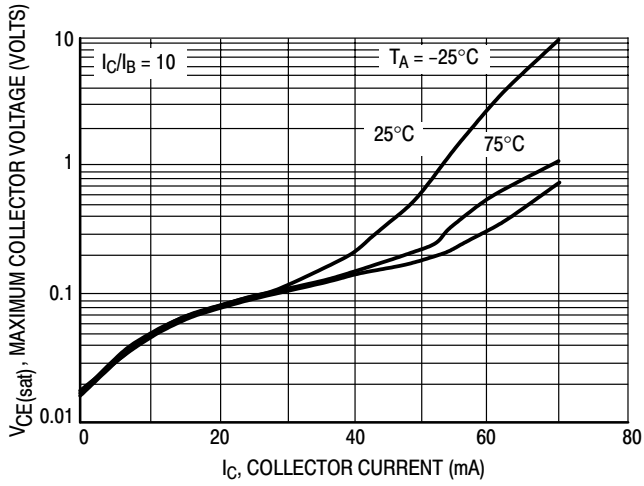


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

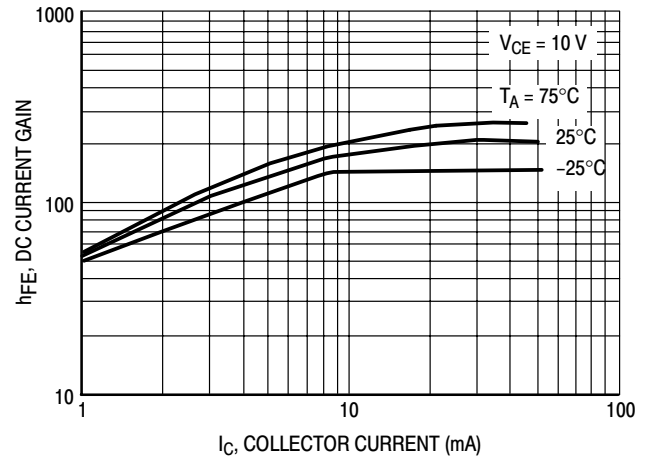


Figure 13. DC Current Gain

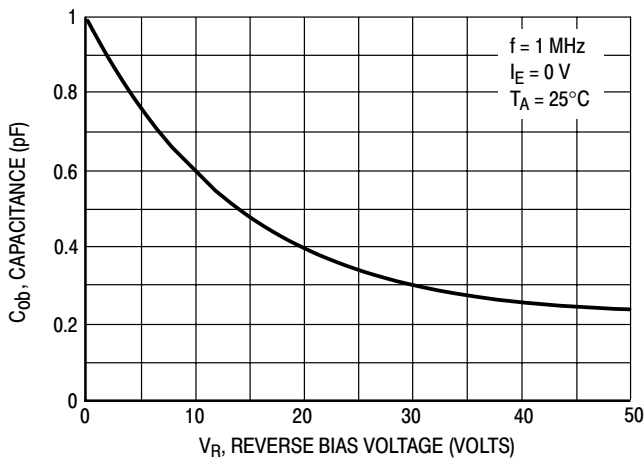


Figure 14. Output Capacitance

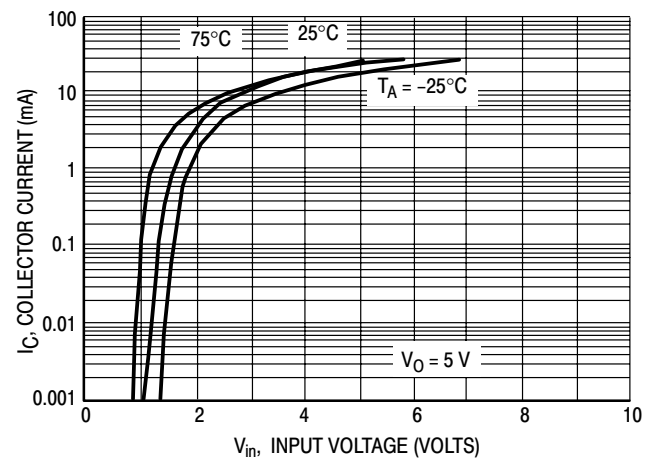


Figure 15. Output Current versus Input Voltage

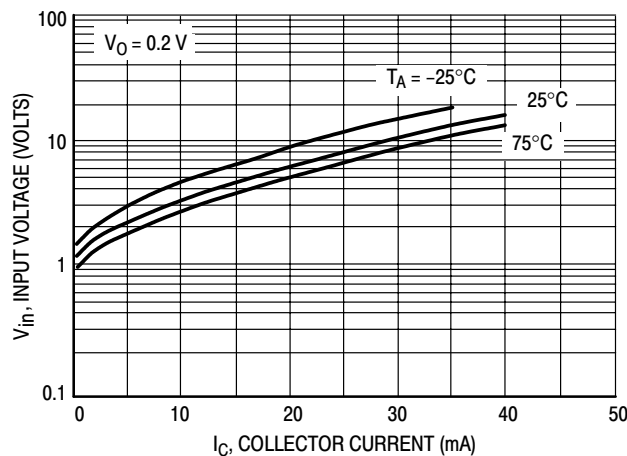


Figure 16. Input Voltage versus Output Current

MUN2211T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN2214T1

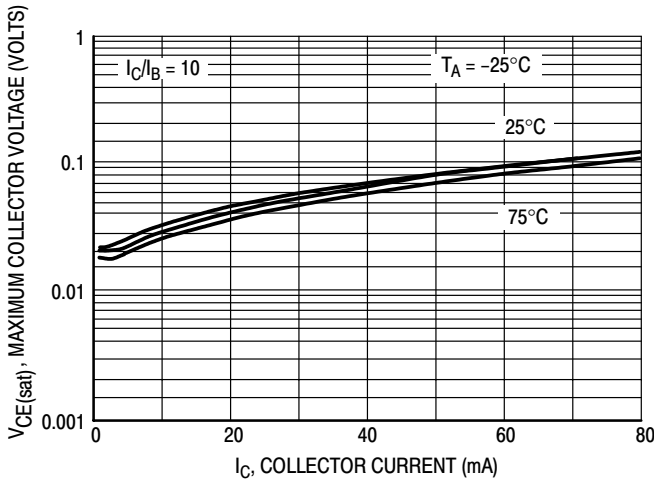


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

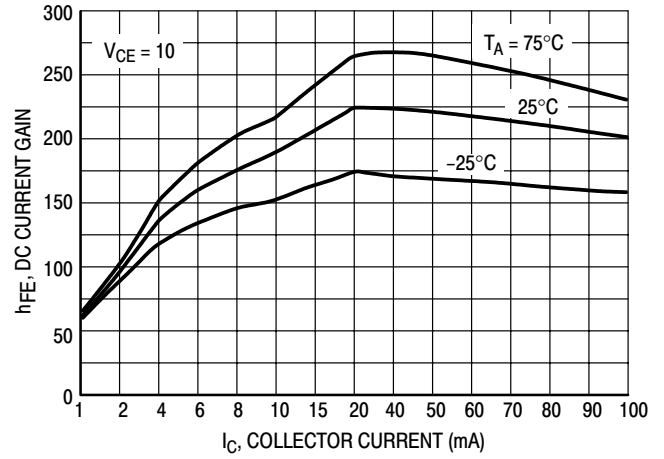


Figure 18. DC Current Gain

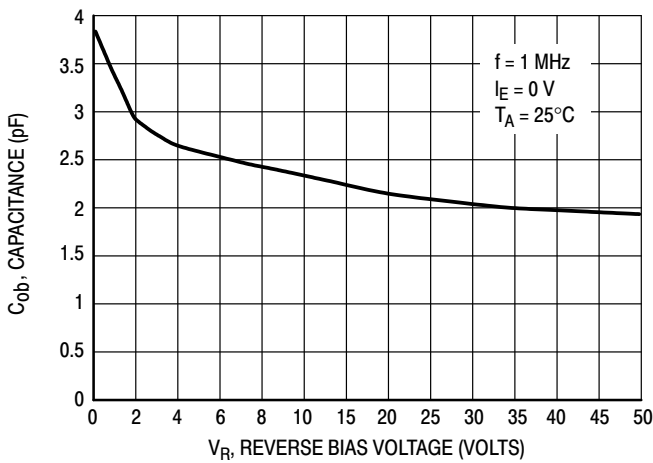


Figure 19. Output Capacitance

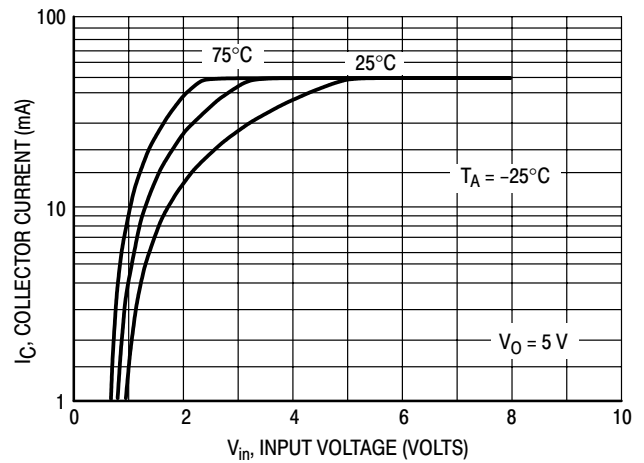


Figure 20. Output Current versus Input Voltage

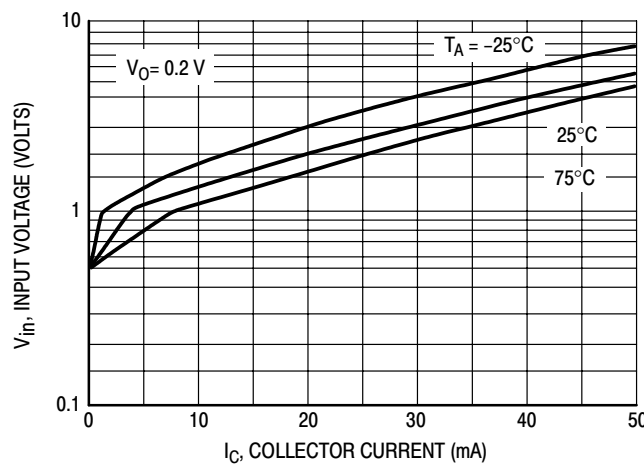


Figure 21. Input Voltage versus Output Current



MUN2211T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN2236T1

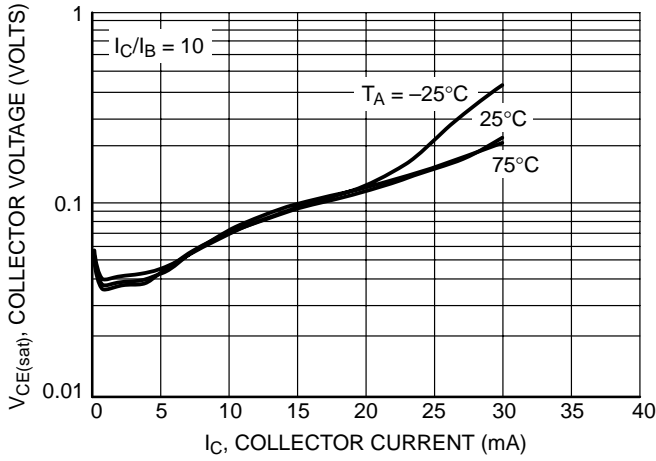


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

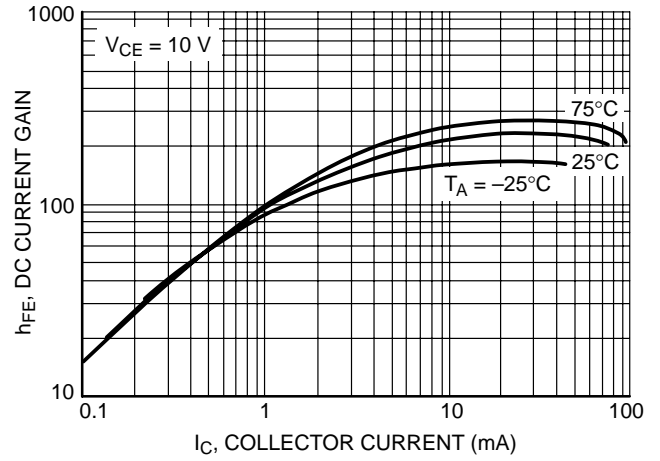


Figure 23. DC Current Gain

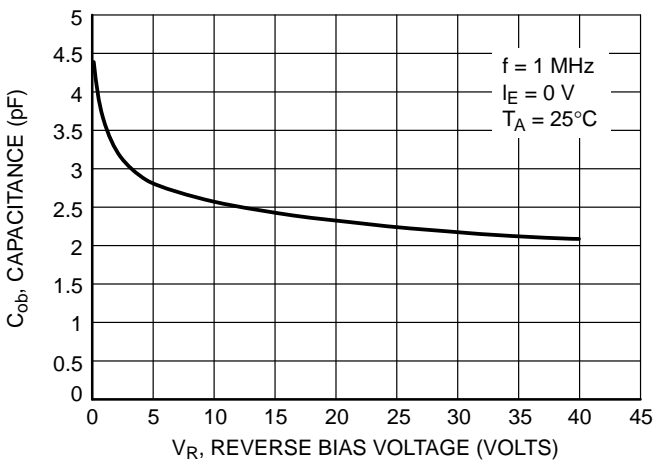


Figure 24. Output Capacitance

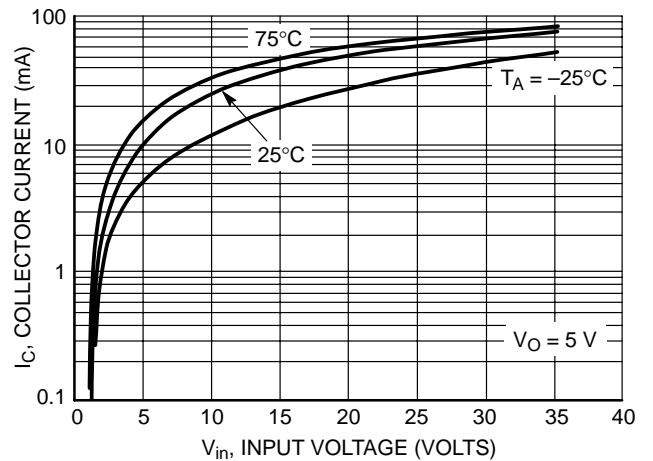


Figure 25. Output Current versus Input Voltage

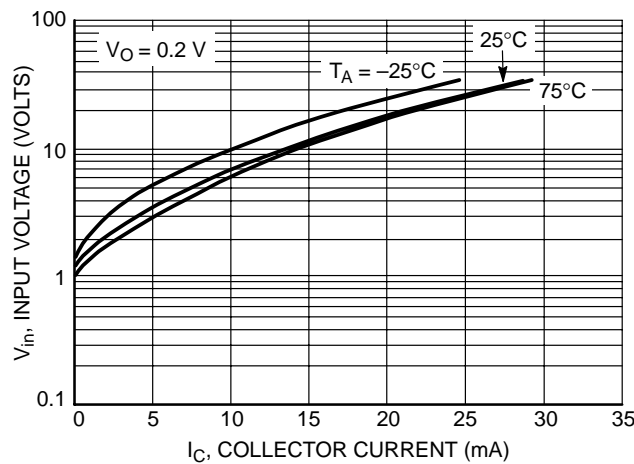


Figure 26. Input Voltage versus Output Current

MUN2211T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN2237T1

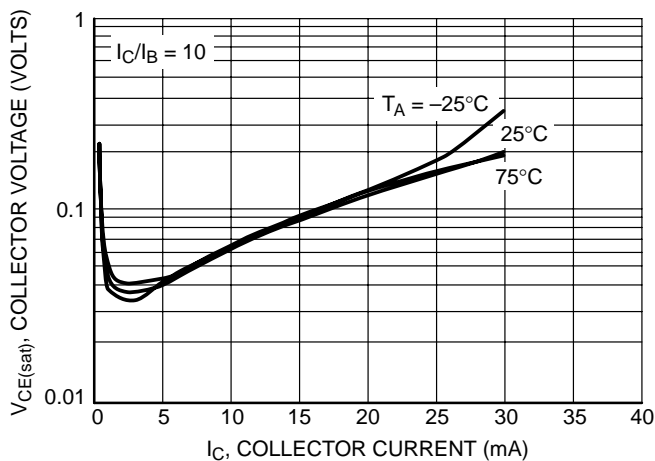


Figure 27.  $V_{CE(sat)}$  versus  $I_C$

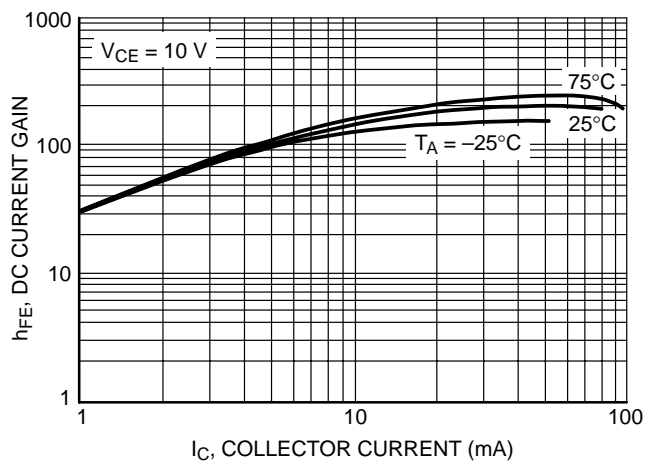


Figure 28. DC Current Gain

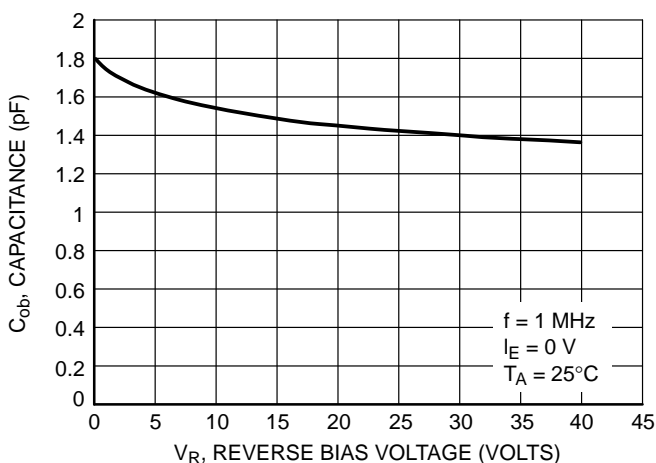


Figure 29. Output Capacitance

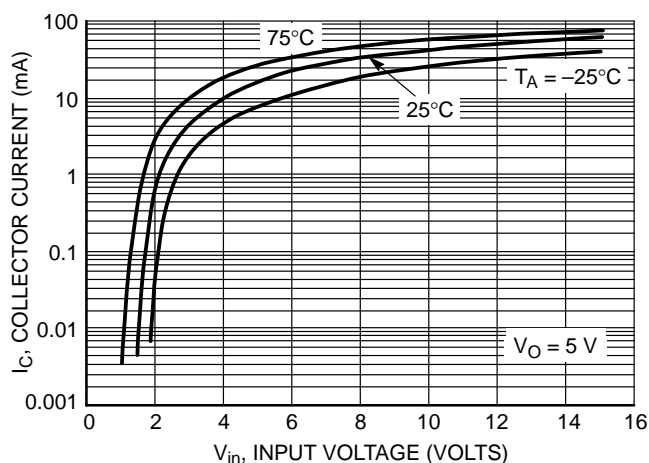


Figure 30. Output Current versus Input Voltage

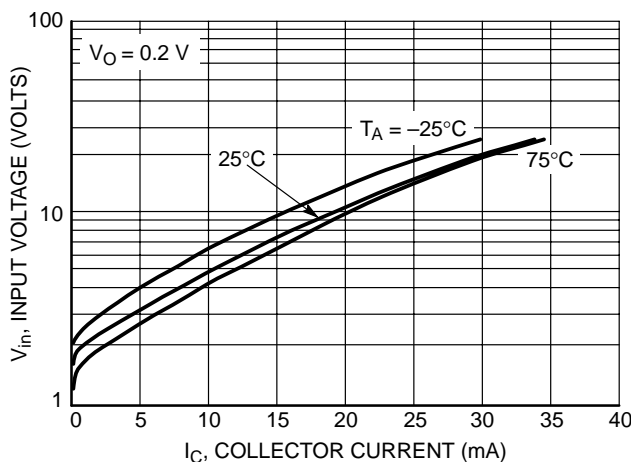


Figure 31. Input Voltage versus Output Current

MUN2211T1 Series

TYPICAL APPLICATIONS FOR NPN BRTs

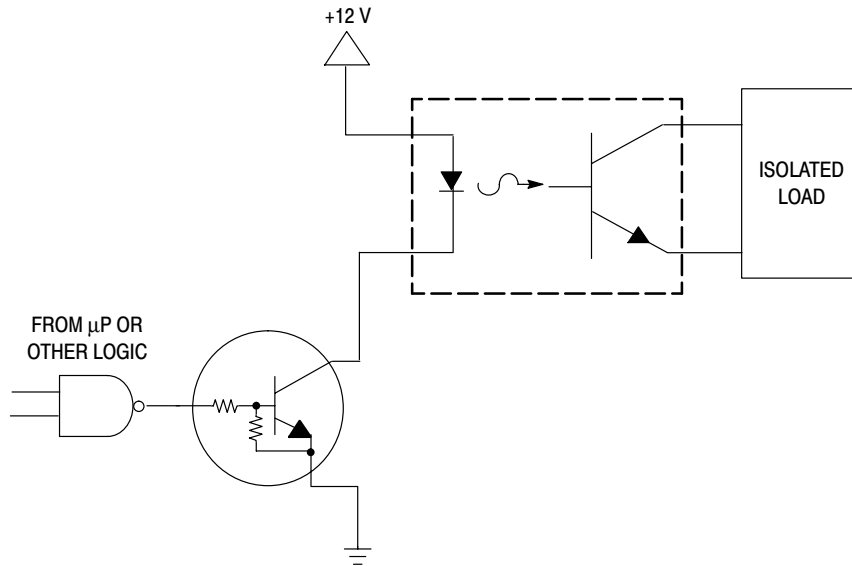


Figure 32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

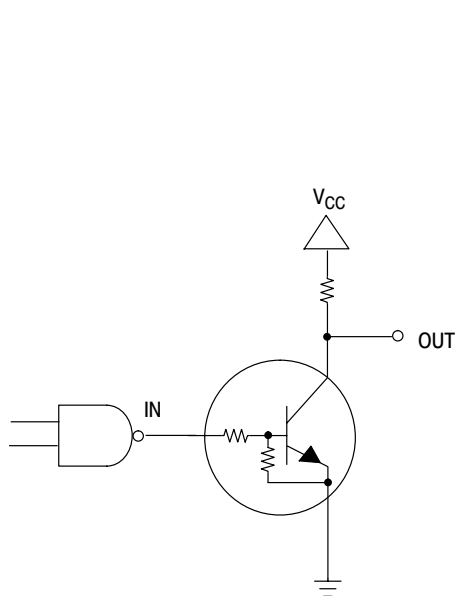


Figure 33. Open Collector Inverter: Inverts the Input Signal

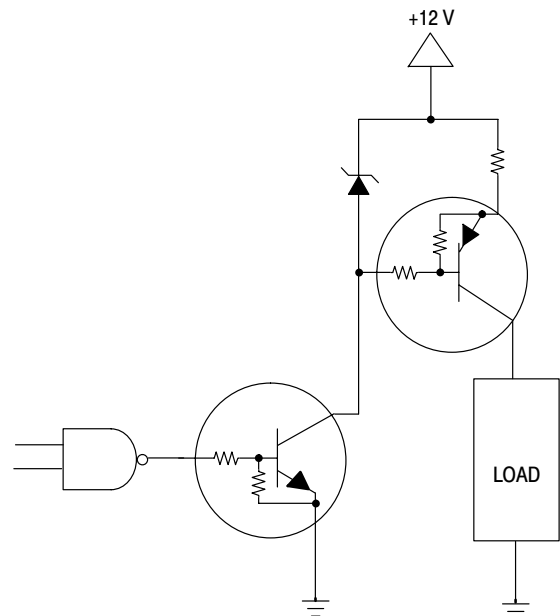


Figure 34. Inexpensive, Unregulated Current Source