MMUN2211T1G - MMUN2241T1G

Bias Resistor Transistor
NPN Silicon Surface Mount Transistor
with Monolithic Bias Resistor Network

Features

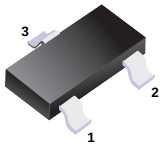
Simplifies Circuit Design

Reduces Board Space and Component Count

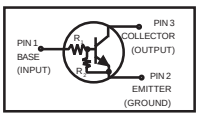
The SOT-23 package can be soldered using wave or reflow. The modified gull-winged leads absorb thermal stress during soldering eliminating the possibility of damage to the die.

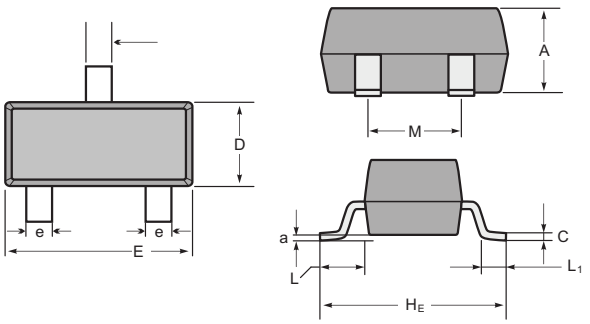
Available in 8 mm embossed tape and reel. Use the Device Number to order the 7 inch/3000 unit reel. Replace “T1” with “T3” in the Device Number to order the13 inch/10,000 unit reel.

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



■ **Simplified outline(SOT-23)**





SOT-23 mechanical data

UNIT		A	C	D	E	HE	e	M	L	L1	a
mm	max	1.1	0.15	1.4	3.0	2.6	0.5	1.95	0.55 (ref)	0.36 (ref)	0.0
	min	0.9	0.08	1.2	2.8	2.2	0.3	1.7			0.15
mil	max	43	6	55	118	102	20	77	22 (ref)	14 (ref)	0.0
	min	35	3	47	110	87	12	67			6

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	200 1.6	mW mW/°C
Thermal Resistance – Junction-to-Ambient (surface mounted)	$R_{\theta JA}$	625	°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

MMUN2211T1G - MMUN2241T1G

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
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)	MMUN2211LT1G	I_{EBO}	–	–	0.5	mAdc
	MMUN2212LT1G		–	–	0.2	
	MMUN2213LT1G		–	–	0.1	
	MMUN2214LT1G		–	–	0.2	
	MMUN2215LT1G		–	–	0.9	
	MMUN2216LT1G		–	–	1.9	
	MMUN2230LT1G		–	–	4.3	
	MMUN2231LT1G		–	–	2.3	
	MMUN2232LT1G		–	–	1.5	
	MMUN2233LT1G		–	–	0.18	
	MMUN2234LT1G		–	–	0.13	
	MMUN2235LT1G		–	–	0.2	
	MMUN2238LT1G		–	–	4.0	
	MMUN2241LT1G		–	–	0.1	
Collector-Base Breakdown Voltage (I_C = 10 μA, 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 (Note 2.)

DC Current Gain (V_{CE} = 10 V, I_C = 5.0 mA)	MMUN2211LT1G	h_{FE}	35	60	–	
	MMUN2212LT1G		60	100	–	
	MMUN2213LT1G		80	140	–	
	MMUN2214LT1G		80	140	–	
	MMUN2215LT1G		160	350	–	
	MMUN2216LT1G		160	350	–	
	MMUN2230LT1G		3.0	5.0	–	
	MMUN2231LT1G		8.0	15	–	
	MMUN2232LT1G		15	30	–	
	MMUN2233LT1G		80	200	–	
	MMUN2234LT1G		80	150	–	
	MMUN2235LT1G		80	140	–	
	MMUN2238LT1G		160	350	–	
	MMUN2241LT1G		160	350	–	
Collector-Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.3 mA) (I_C = 10 mA, I_B = 5 mA) MMUN2230LT1G/MMUN2231LT1G (I_C = 10 mA, I_B = 1 mA) MMUN2215LT1G/MMUN2216LT1G MMUN2232LT1G/MMUN2233LT1G/MMUN2234LT1G/ MMUN2235LT1G/MMUN2238LT1G		$V_{CE(sat)}$	–	–	0.25	Vdc

2. 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
ON CHARACTERISTICS (Note 3.)						
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 k Ω)	MMUN2211LT1G		–	–	0.2	
	MMUN2212LT1G		–	–	0.2	
	MMUN2213LT1G		–	–	0.2	
	MMUN2214LT1G		–	–	0.2	
	MMUN2215LT1G		–	–	0.2	
	MMUN2216LT1G		–	–	0.2	
	MMUN2230LT1G		–	–	0.2	
	MMUN2231LT1G		–	–	0.2	
	MMUN2232LT1G		–	–	0.2	
	MMUN2233LT1G		–	–	0.2	
	MMUN2234LT1G		–	–	0.2	
	MMUN2235LT1G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 k Ω)	MMUN2238LT1G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 5.0 V, R_L = 1.0 k Ω)	MMUN2241LT1G		–	–	0.2	
Output Voltage (off) (V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 k Ω)		V_{OH}	4.9	–	–	Vdc
(V_{CC} = 5.0 V, V_B = 0.050 V, R_L = 1.0 k Ω)	MMUN2230LT1G					
(V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 k Ω)	MMUN2215LT1G					
	MMUN2216LT1G					
	MMUN2233LT1G					
	MMUN2238LT1G					
Input Resistor	MMUN2211LT1G	R_1	7.0	10	13	kΩ
	MMUN2212LT1G		15.4	22	28.6	
	MMUN2213LT1G		32.9	47	61.1	
	MMUN2214LT1G		7.0	10	13	
	MMUN2215LT1G		7.0	10	13	
	MMUN2216LT1G		3.3	4.7	6.1	
	MMUN2230LT1G		0.7	1.0	1.3	
	MMUN2231LT1G		1.5	2.2	2.9	
	MMUN2232LT1G		3.3	4.7	6.1	
	MMUN2233LT1G		3.3	4.7	6.1	
	MMUN2234LT1G		15.4	22	28.6	
	MMUN2235LT1G		1.54	2.2	2.86	
	MMUN2238LT1G		1.54	2.2	2.88	
	MMUN2241LT1G		70	100	130	
Resistor Ratio	MMUN2211LT1G/MMUN2212LT1G/MMUN2213LT1G	R_1/R_2	0.8	1.0	1.2	
	MMUN2214LT1G		0.17	0.21	0.25	
	MMUN2215LT1G/MMUN2216LT1G/MMUN2238LT1G		–	–	–	
	MMUN2241LT1G		–	–	–	
	MMUN2230LT1G/MMUN2231LT1G/MMUN2232LT1G		0.8	1.0	1.2	
	MMUN2233LT1G		0.055	0.1	0.185	
	MMUN2234LT1G		0.38	0.47	0.56	
	MMUN2235LT1G		0.038	0.047	0.056	

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

RATING AND CHARACTERISTIC CURVES (MMUN2211LT1G - MMUN2241LT1G)

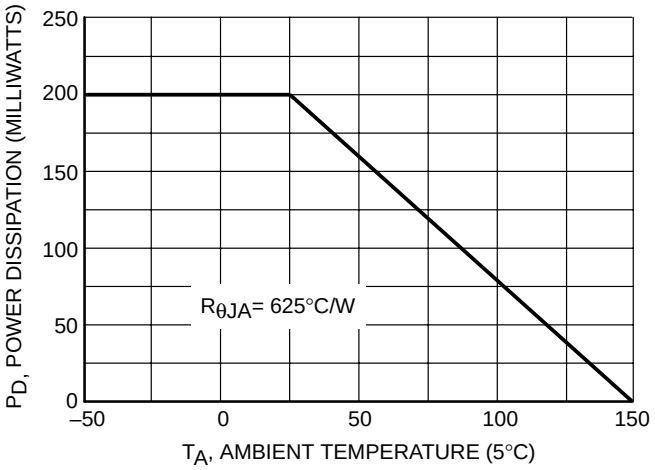


Figure 1. Derating Curve

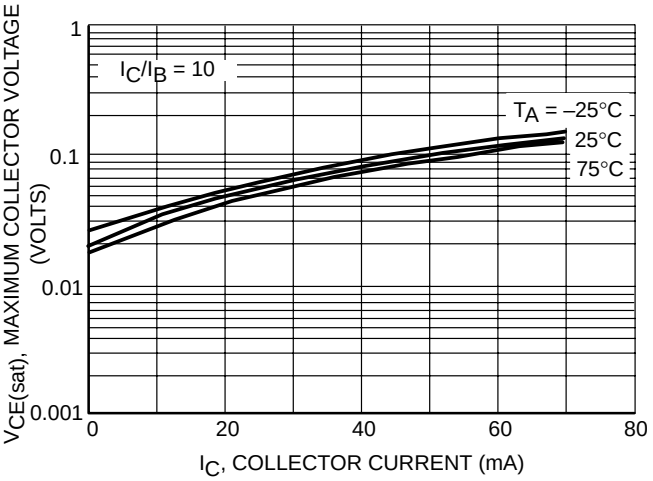


Figure 2. $V_{CE(sat)}$ vs. I_C

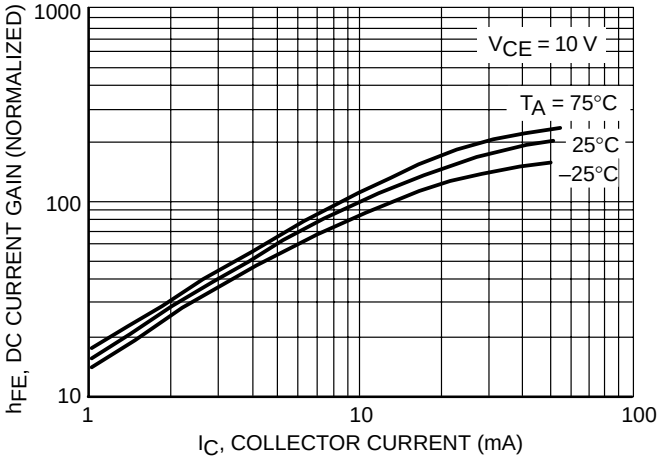


Figure 3. DC Current Gain

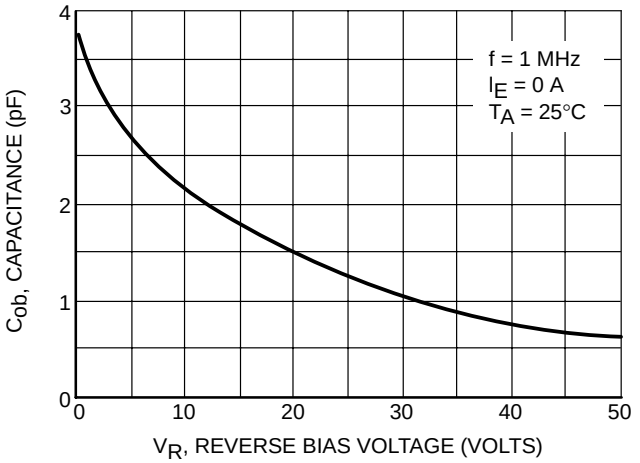


Figure 4. Output Capcitance

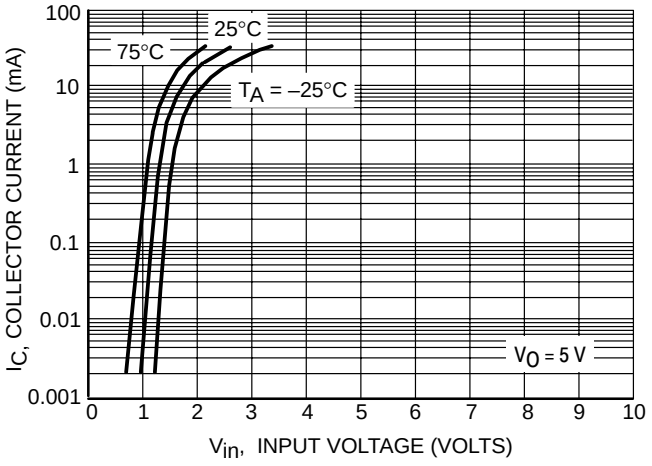


Figure 5. Output Current vs. Input Voltage

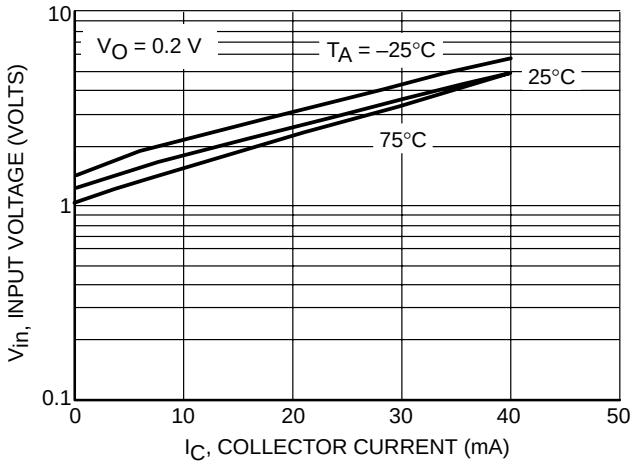


Figure 6. Input Voltage vs. Output Current

RATING AND CHARACTERISTIC CURVES (MMUN2211LT1G - MMUN2241LT1G)

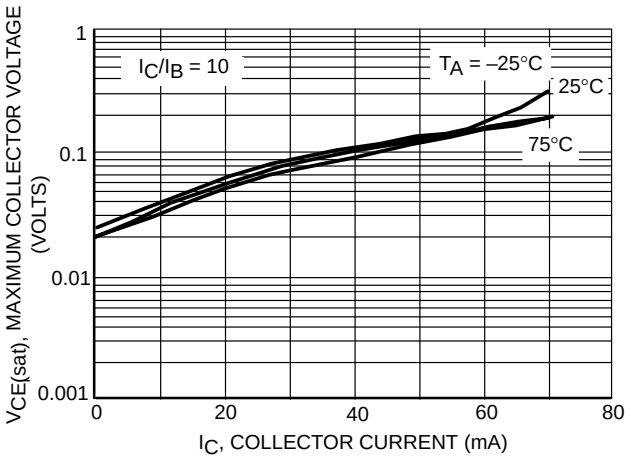


Figure 7. $V_{CE(sat)}$ vs. I_C

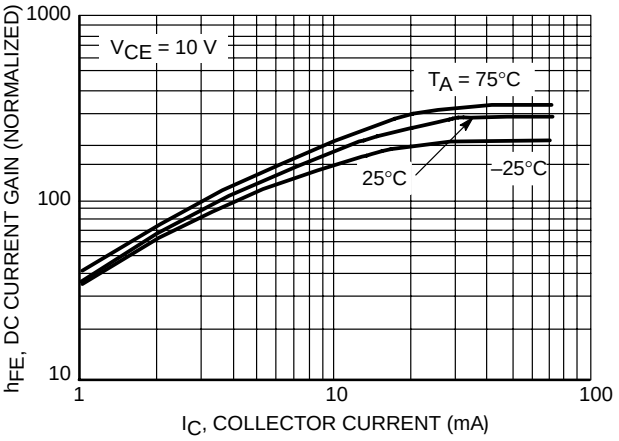


Figure 8. DC Current Gain

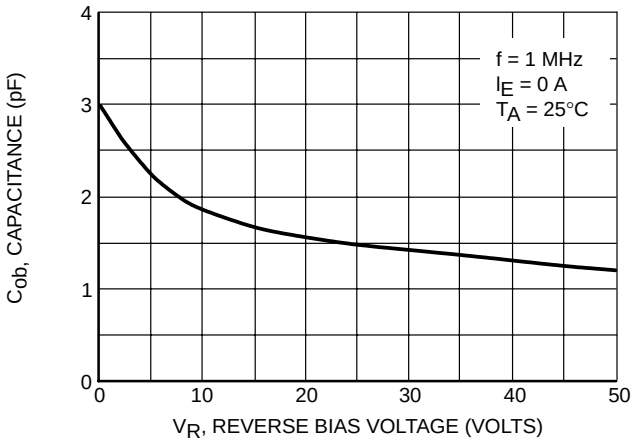


Figure 9. Output Capacitance

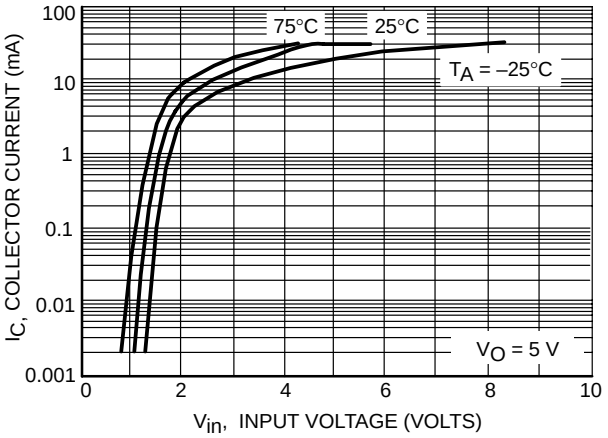


Figure 10. Output Current vs. Input Voltage

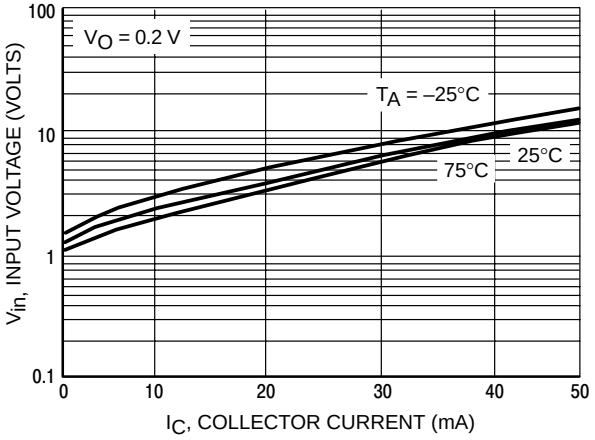


Figure 11. Input Voltage vs. Output Current

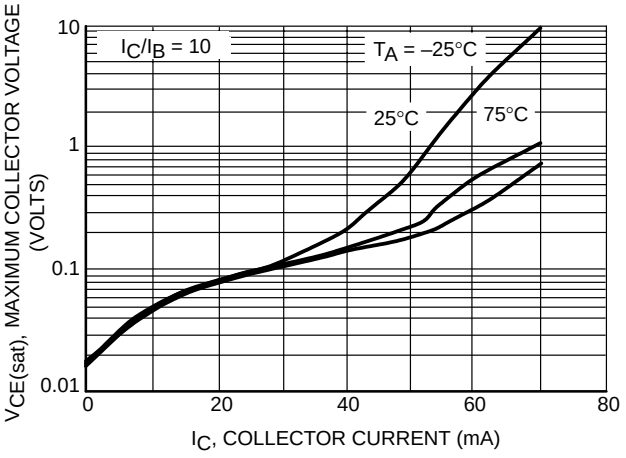


Figure 12. $V_{CE(sat)}$ vs. I_C

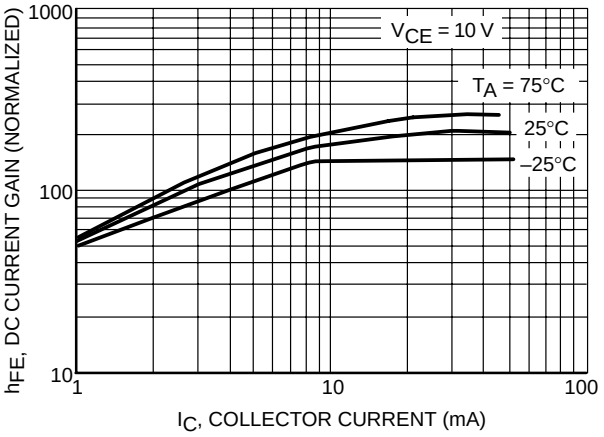


Figure 13. DC Current Gain

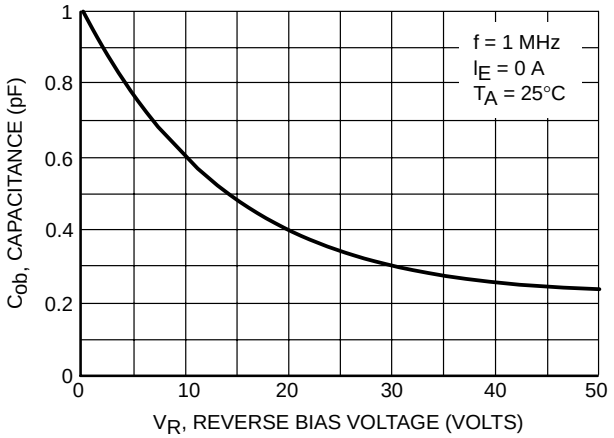


Figure 14. Output Capacitance

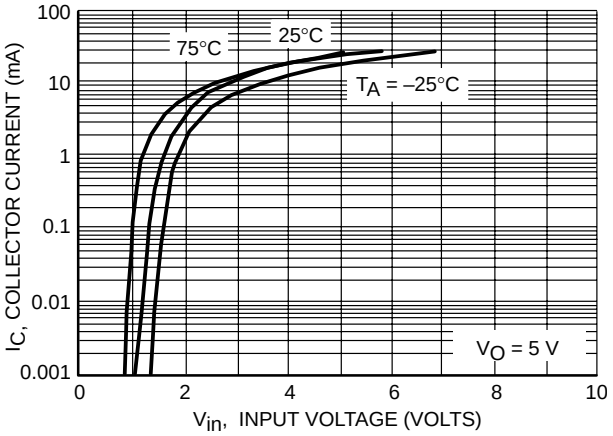


Figure 15. Output Current vs. Input Voltage

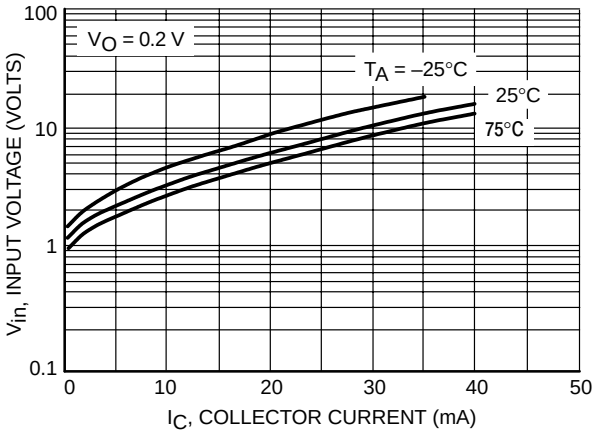


Figure 16. Input Voltage vs. Output Current

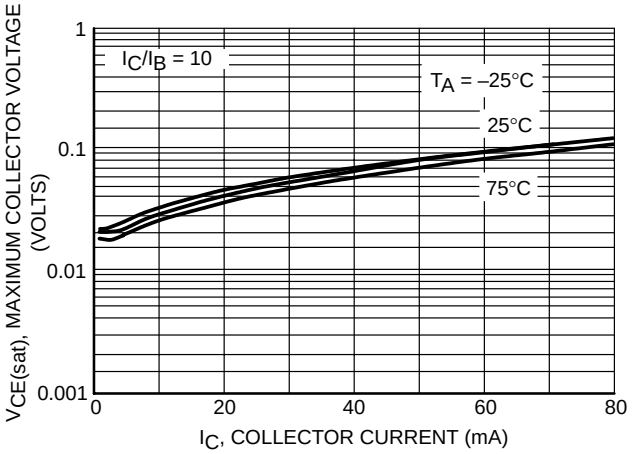


Figure 17. $V_{CE(sat)}$ vs. I_C

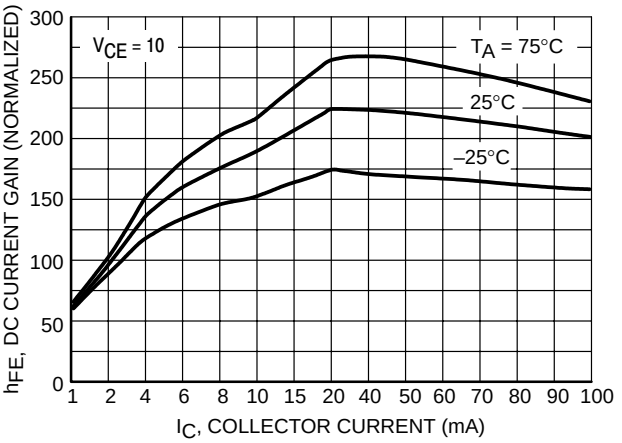


Figure 18. DC Current Gain

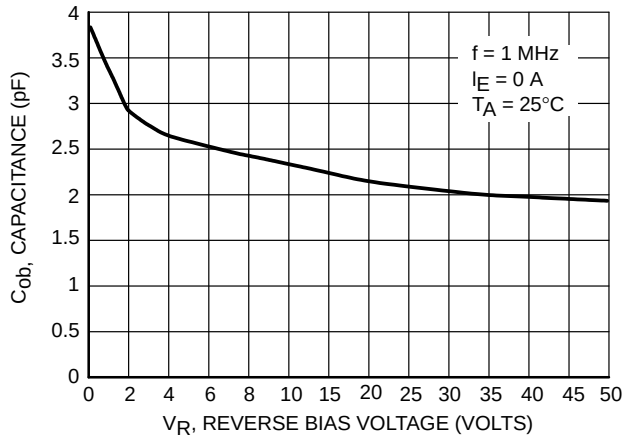


Figure 19. Output Capacitance

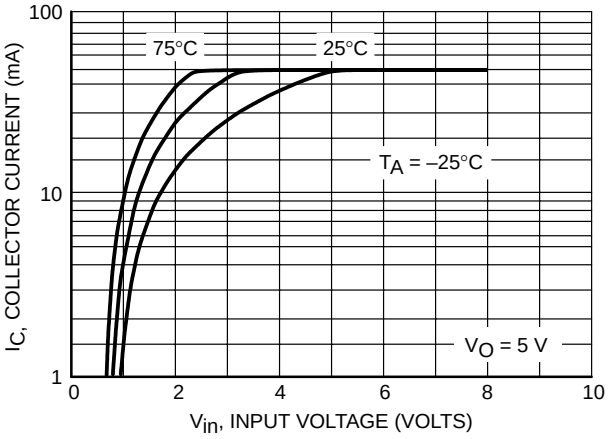


Figure 20. Output Current vs. Input Voltage

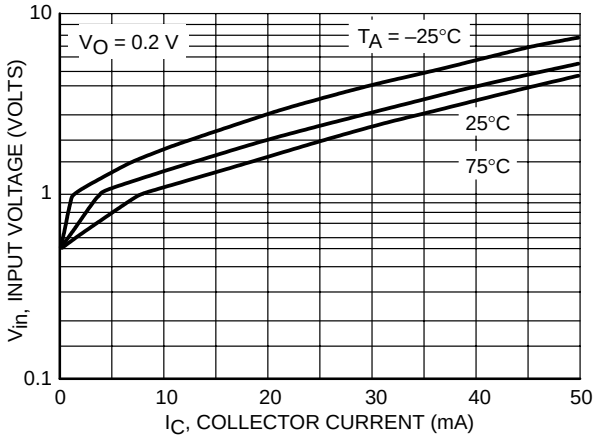


Figure 21. Input Voltage vs. Output Current

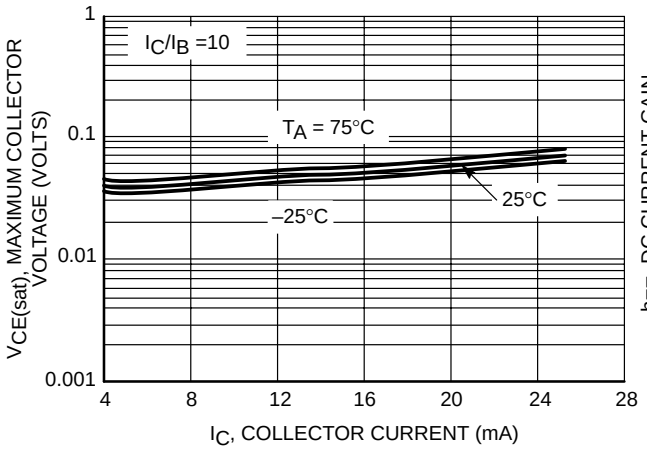


Figure 22. $V_{CE(sat)}$ vs. I_C

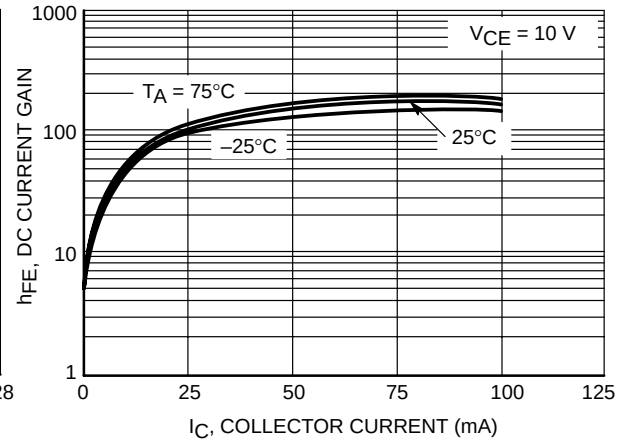


Figure 23. DC Current Gain

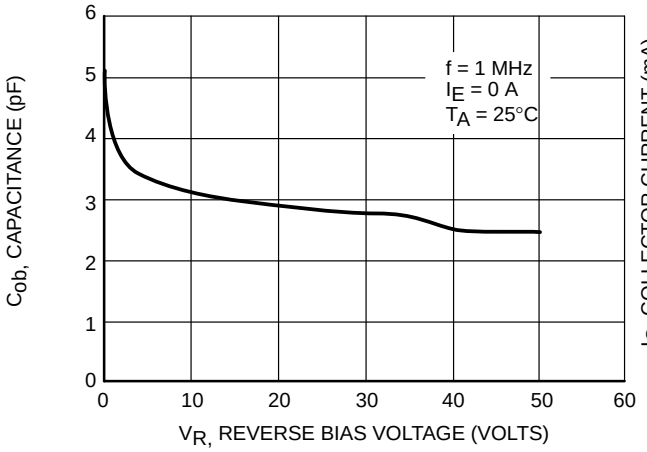


Figure 24. Output Capacitance

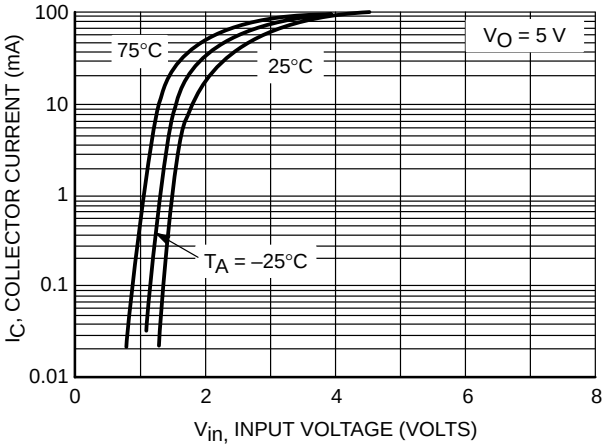


Figure 25. Output Current vs. Input Voltage

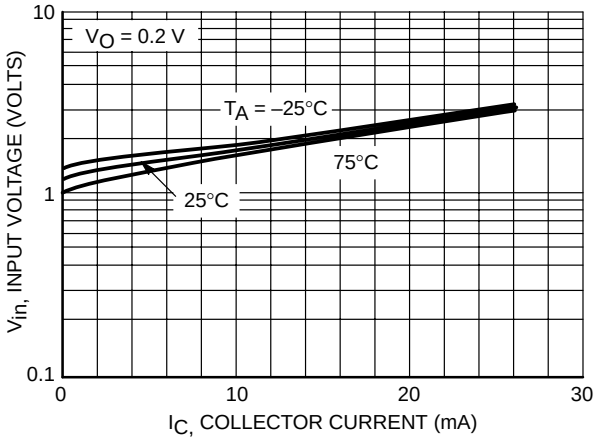


Figure 26. Output Voltage vs. Input Current

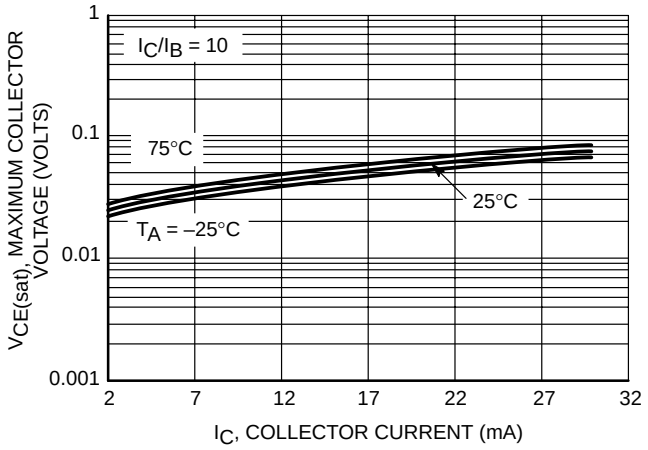


Figure 27. $V_{CE(sat)}$ vs. I_C

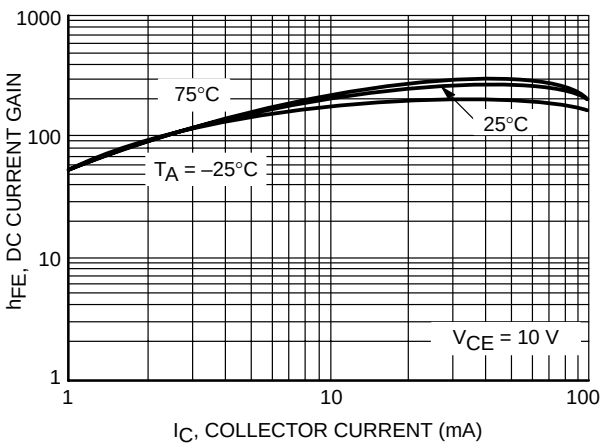


Figure 28. DC Current Gain

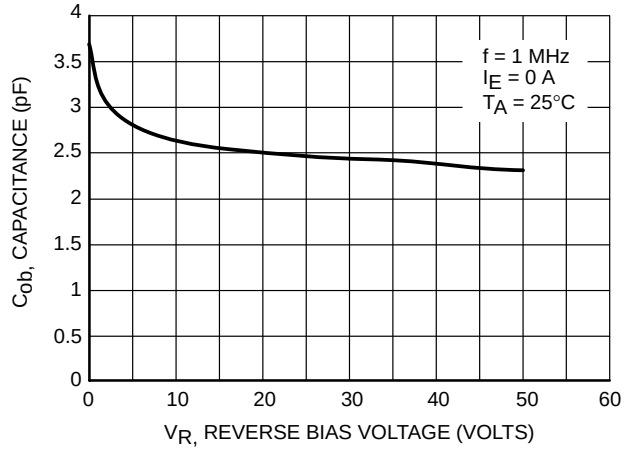


Figure 29. Output Capacitance

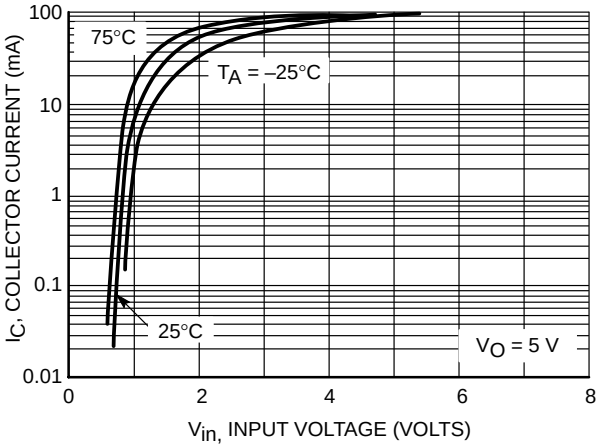


Figure 30. Output Current vs. Input Voltage

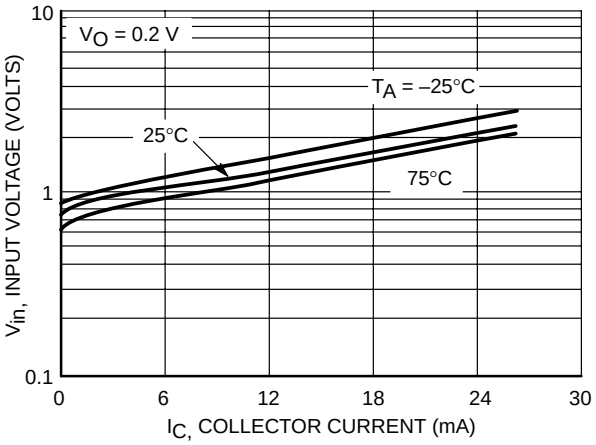


Figure 31. Input Voltage vs. Output Current

TYPICAL APPLICATIONS FOR NPN BRTs

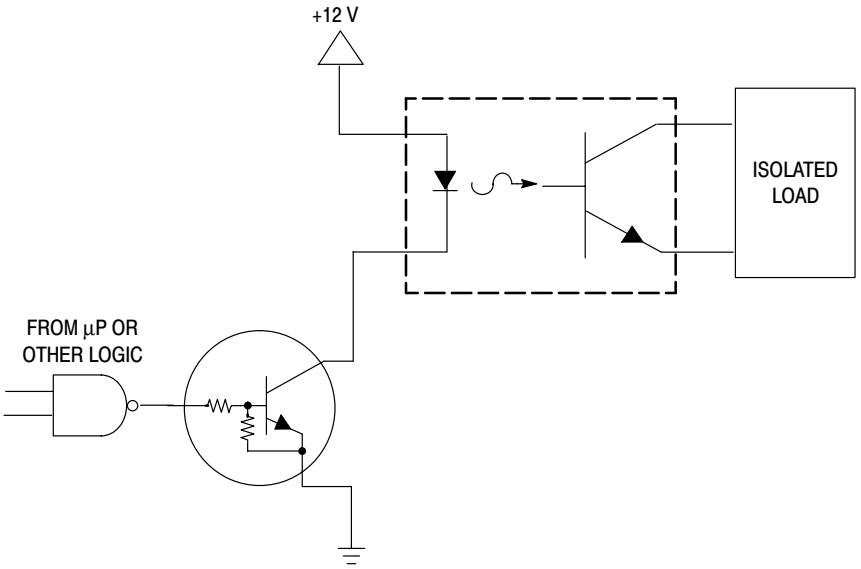


Figure 32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

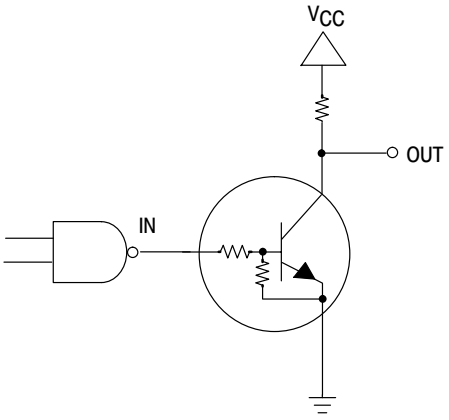


Figure 33. Open Collector Inverter: Inverts the Input Signal

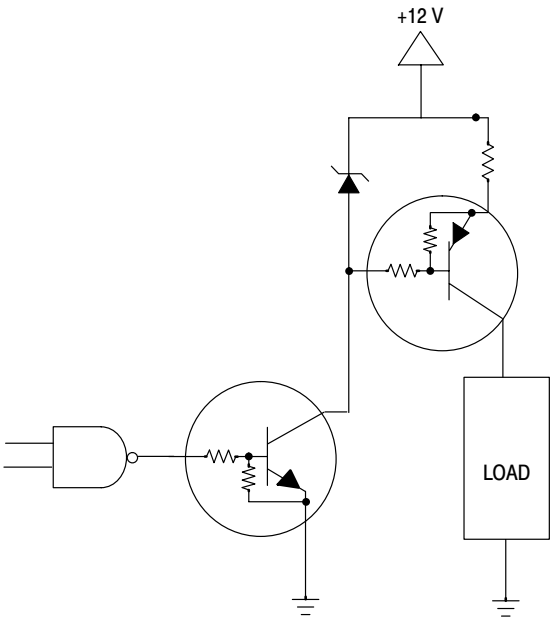


Figure 34. Inexpensive, Unregulated Current Source