

MUN2211 Series Bias Resistor Transistor

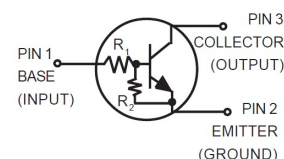
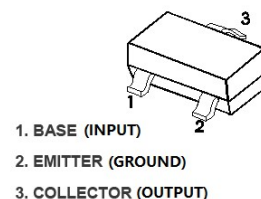
NPN Silicon Surface Mount Transistors

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 resistor. The BRT eliminates these individual components by integrating them into a single device. The sue 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.

SOT-23



Maximum Ratings & Thermal Characteristics (Ratings at 25°C ambient temperature unless otherwise specified.)

Parameters	Symbol	Value	Unit
Collector-Base Voltage	V_{CB0}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Collector Current	I_C	100	mA
Peak Collector Current	I_{CM}	200	mA
Total Power Dissipation @TA=25°C	P_C	246	mW
(Note 1.)Derate above 25°C		1.5	°C/W
Thermal Resistance – Junction to Ambient (Note 1.)	$R_{\theta JA}$	508	°C/W
Operating and Storage Temperature Range	T_j, T_{stg}	150	°C
Maximum Temperature for Soldering Purposes, Time in Solder Bath	T_{stg}	-55-+150	°C

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

Electrical Characteristics (Ratings at 25°C ambient temperature unless otherwise specified).

Parameter		Symbols	Test Condition	Limits			Unit
				Min	Typ	Max	
OFF CHARACTERISTICS							
Collector-Base breakdown voltage		V(BR)CBO	IC=10uA, IE=0	50			V
Collector-Emitter breakdown voltage (Note2.)		V(BR)CEO	IC=2.0mA, IB=0	50			V
Collector-Base cutoff current		ICBO	VCB=50V, IE=0			100	nA
Collector-Emitter cutoff current		ICEO	VCE=50V, IB=0			500	nA
Emitter-Base Cutoff current	MUN2211	IEBO	VEB=6.0V, IC=0			0.50	mA
	MUN2212					0.20	
	MUN2213					0.10	
	MUN2214					0.20	
	MUN2215					0.90	
	MUN2216					1.90	
	MUN2230					4.30	
	MUN2231					2.30	
	MUN2232					1.50	
	MUN2233					0.18	
	MUN2234					0.13	
	MUN2235					0.20	
	MUN2236					0.05	
	MUN2237					0.13	
	MUN2238					4.00	
	MUN2240					0.20	
	MUN2241					0.10	

Parameter		Symbols	Test Condition	Limits			Unit
				Min	Typ	Max	
ON CHARACTERISTICS (Note 2.)							
DC current gain	MUN2211	hFE	VCE=10V, IC=5mA	35	60		
	MUN2212			60	100		
	MUN2213			80	140		
	MUN2214			80	140		
	MUN2215			160	350		
	MUN2216			160	350		
	MUN2230			3.0	5.0		
	MUN2231			8.0	15		
	MUN2232			15	30		
	MUN2233			80	200		
	MUN2234			80	150		
	MUN2235			80	140		
	MUN2236			80	150		
	MUN2237			80	140		
	MUN2238			160	350		
	MUN2240			160	350		
	MUN2241			160	350		
Collector-emitter saturation voltage	MUN2211	VCE(sat)	IC=10mA, IB=0.3mA			0.25	V
	MUN2212						
	MUN2213						
	MUN2214						
	MUN2236		IC=10mA, IB=5mA				
	MUN2241						
	MUN2230						
	MUN2231						
	MUN2237		IC=10mA, IB=1mA				
	MUN2215						
	MUN2216						
	MUN2232						
	MUN2233						
	MUN2234						
	MUN2235						
	MUN2238						
	MUN2240						
2. Pulse Test: Pulse Width <300us, Duty Cycle <2.0%							
ON CHARACTERISTICS (Note 3.)							
Output voltage(on)	MUN2211	VOL	VCC=5.0V, VB=2.5V RL=1.0K Ω			0.2	V
	MUN2212						
	MUN2214						
	MUN2215						
	MUN2216						
	MUN2230						
	MUN2231						
	MUN2232						
	MUN2233		VCC=5.0V, VB=5.5V RL=1.0K Ω			0.2	
	MUN2234						
	MUN2235						
	MUN2238						
	MUN2236		VCC=5.0V, VB=5.5V RL=1.0K Ω			0.2	
	MUN2237		VCC=5.0V, VB=4.0V RL=1.0K Ω			0.2	
	MUN2213		VCC=5.0V, VB=3.5V RL=1.0K Ω			0.2	
	MUN2240						
	MUN2241		VCC=5.0V, VB=5.0V RL=1.0K Ω			0.2	

MUN2211 Series

Parameter		Symbols	Test Condition	Limits			Unit				
				Min	Typ	Max					
Output voltage(off)	MUN2211	V _{OH}	V _{CC} =5.0V, V _B =0.5V R _L =1.0K Ω	4.9			V				
	MUN2212										
	MUN2213										
	MUN2214										
	MUN2231										
	MUN2232										
	MUN2234										
	MUN2235										
	MUN2241										
	MUN2230		V _{CC} =5.0V, V _B =0.05V R _L =1.0K Ω	4.9							
	MUN2215		V _{CC} =5.0V, V _B =0.25V R _L =1.0K Ω	4.9							
	MUN2216										
	MUN2233										
	MUN2236										
	MUN2237										
	MUN2238										
	MUN2240										
Input resistor	MUN2211	R _I	-	7.0	10	13	kΩ				
	MUN2212			15.4	22	28.6					
	MUN2213			32.9	47	61.1					
	MUN2214			7.0	10	13					
	MUN2215			7.0	10	13					
	MUN2216			3.3	4.7	6.1					
	MUN2230			0.7	1.0	1.3					
	MUN2231			1.5	2.2	2.9					
	MUN2232			3.3	4.7	6.1					
	MUN2233			3.3	4.7	6.1					
	MUN2234			15.4	22	28.6					
	MUN2235			1.54	2.2	2.86					
	MUN2238			1.54	2.2	2.86					
	MUN2241			70	100	130					
	MUN2236			70	100	130					
	MUN2237			32.9	47	61.1					
	MUN2240			32.9	47	61.1					
	Resistor ratio			MUN2211	R ₁ /R ₂	-		0.8	1.0	1.2	
				MUN2212							
MUN2213											
MUN2230											
MUN2231											
MUN2232											
MUN2236		0.17	0.21	0.25							
MUN2214											
MUN2215											
MUN2216		--	--	--							
MUN2238											
MUN2240											
MUN2241											
MUN2233		0.055	0.1	0.185							
MUN2234		0.38	0.47	0.56							
MUN2235		0.038	0.047	0.056							
MUN2237		1.7	2.15	2.6							

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

DEVICE MARKING AND RESISTOR VALUES

Device	Marking	R1(K)	R2(K)
MUN2211	A8A	10	10
MUN2212	A8B	22	22
MUN2213	A8C	47	47
MUN2214	A8D	10	47
MUN2215	A8E	10	∞
MUN2216	A8F	4.7	∞
MUN2230	A8G	1.0	1.0
MUN2231	A8H	2.2	2.2
MUN2232	A8J	4.7	4.7
MUN2233	A8K	4.7	47
MUN2234	A8L	22	47
MUN2235	A8M	2.2	47
MUN2236	A8N	100	100
MUN2237	A8P	47	22
MUN2238	A8R	2.2	∞
MUN2240	A8T	47	∞
MUN2241	A8U	100	∞

Typical characteristics

MUN2211

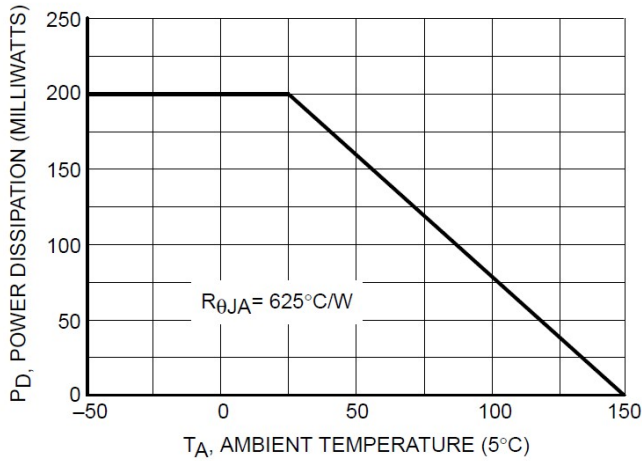


Figure 1. Derating Curve

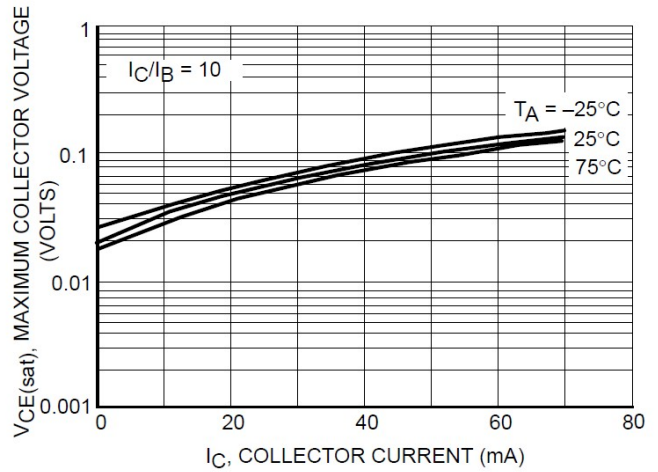


Figure 2. $V_{CE(sat)}$ vs. I_C

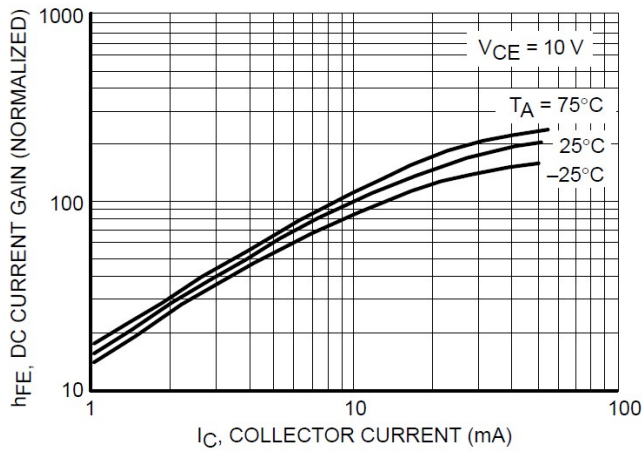


Figure 3. DC Current Gain

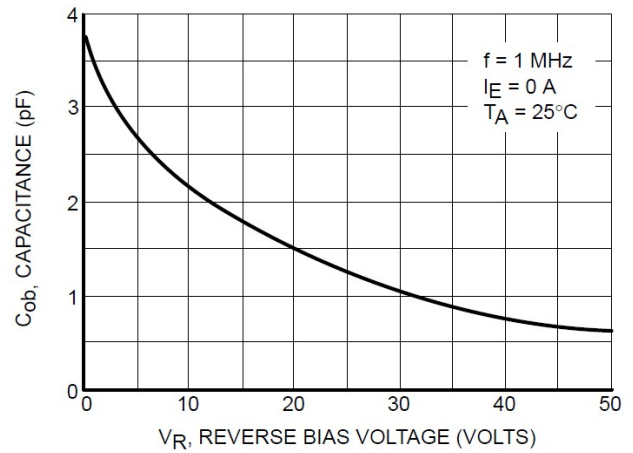


Figure 4. Output Capacitance

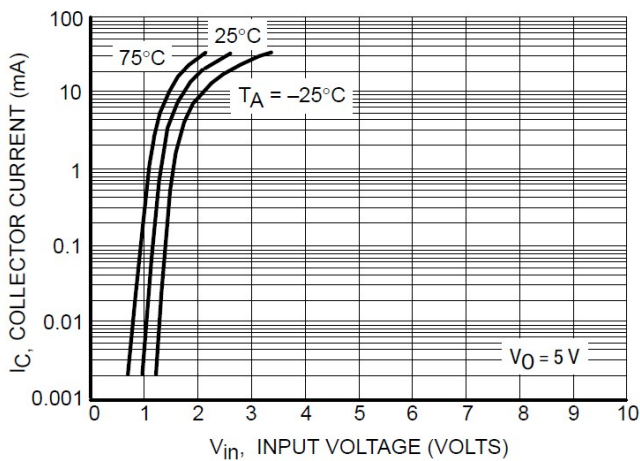


Figure 5. Output Current vs. Input Voltage

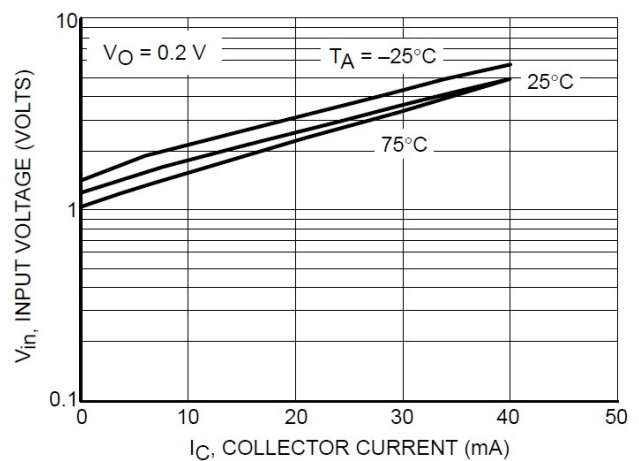


Figure 6. Input Voltage vs. Output Current

Typical characteristics

MUN2212

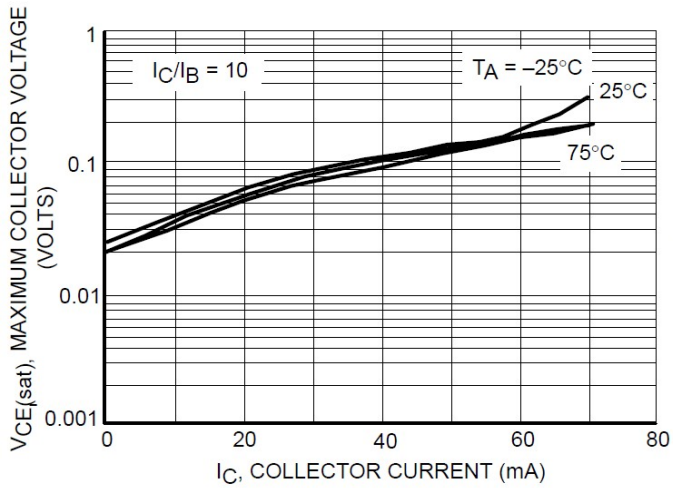


Figure 7. $V_{CE(sat)}$ vs. I_C

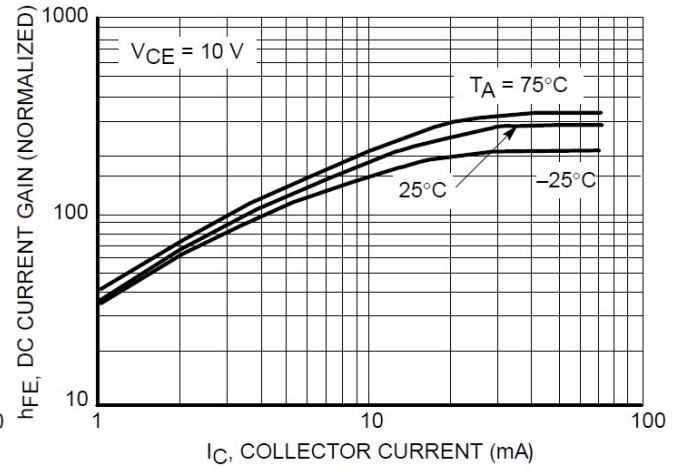


Figure 8. DC Current Gain

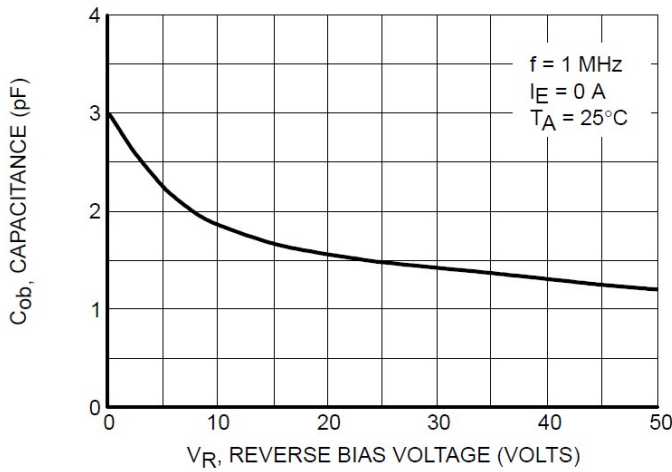


Figure 9. Output Capacitance

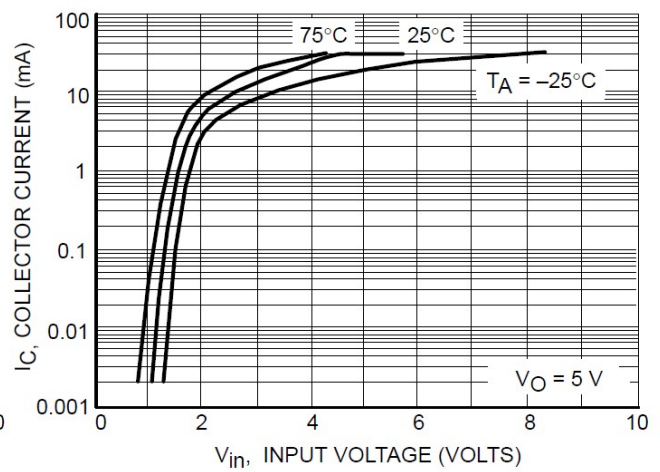


Figure 10. Output Current vs. Input Voltage

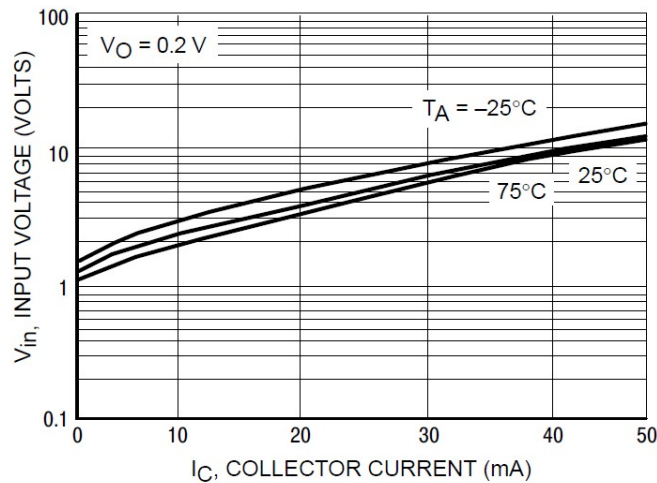


Figure 11. Input Voltage vs. Output Current

Typical characteristics

MUN2213

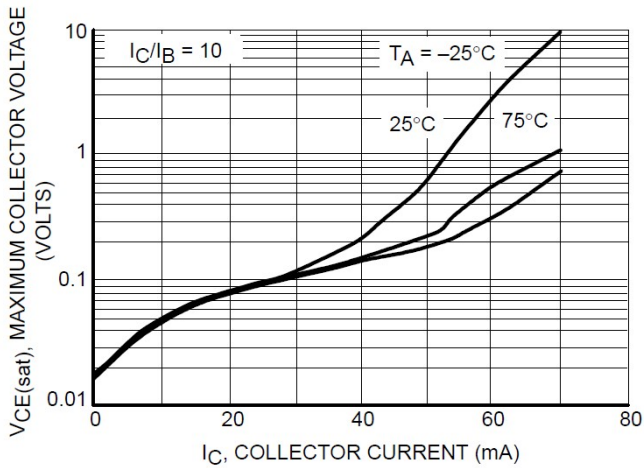


Figure 12. $V_{CE(sat)}$ vs. I_C

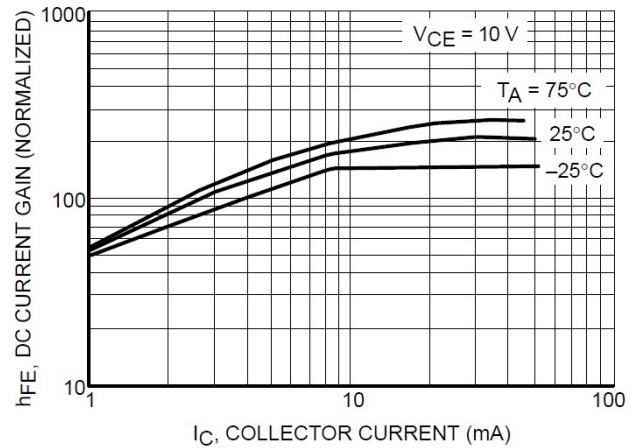


Figure 13. DC Current Gain

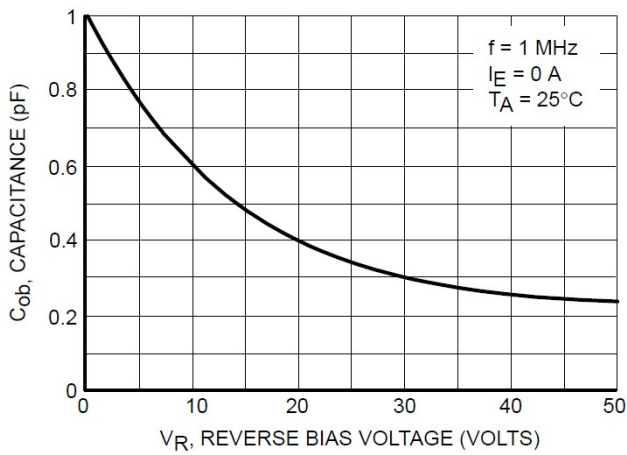


Figure 14. Output Capacitance

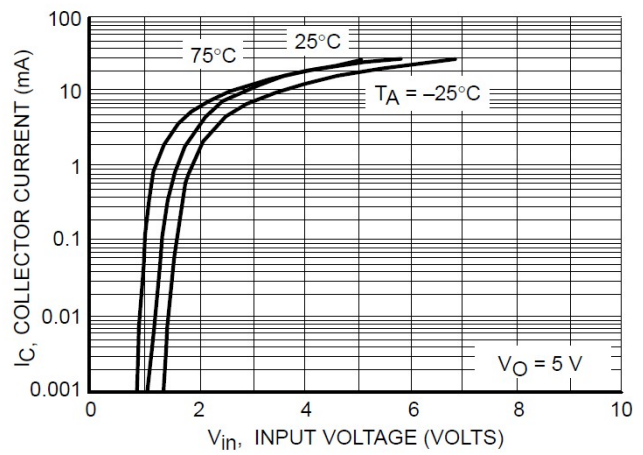


Figure 15. Output Current vs. Input Voltage

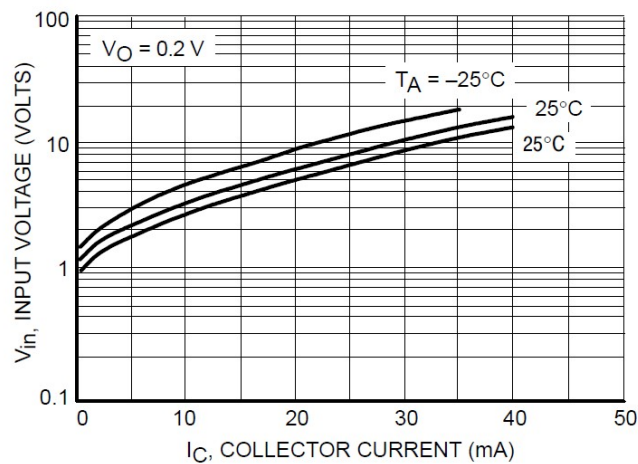


Figure 16. Input Voltage vs. Output Current

Typical characteristics

MUN2214

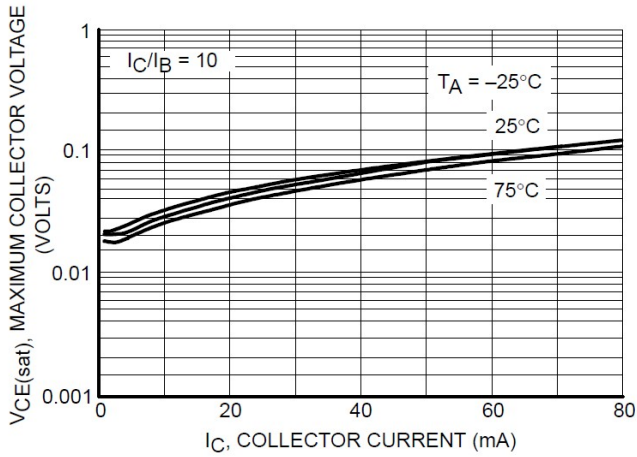


Figure 17. $V_{CE(sat)}$ vs. I_C

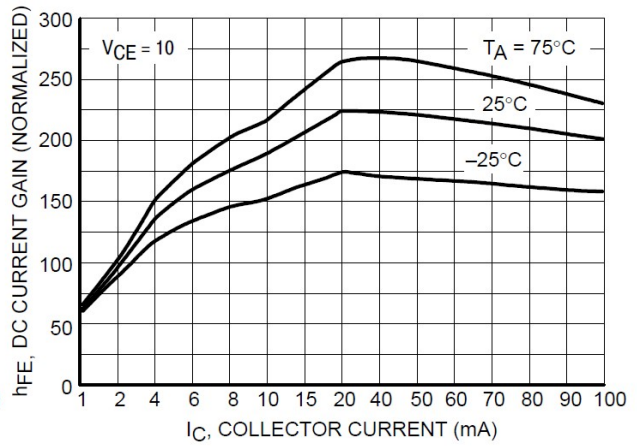


Figure 18. DC Current Gain

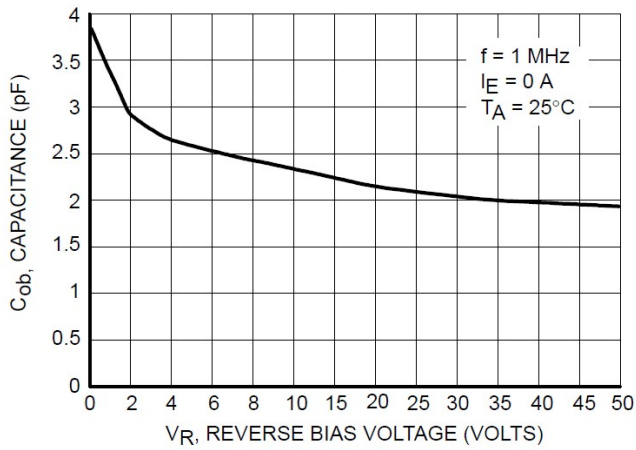


Figure 19. Output Capacitance

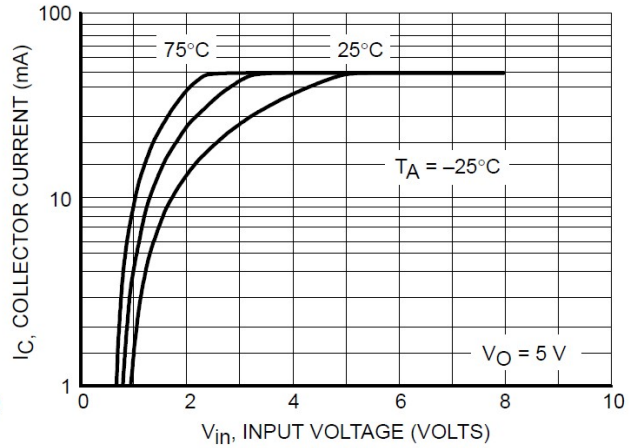


Figure 20. Output Current vs. Input Voltage

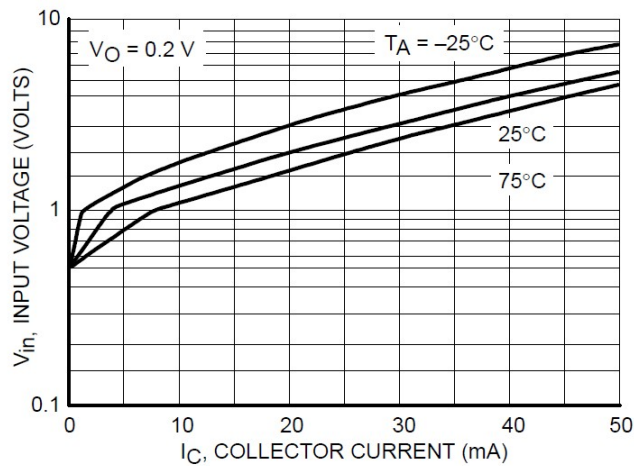


Figure 21. Input Voltage vs. Output Current

Typical characteristics

MUN2215

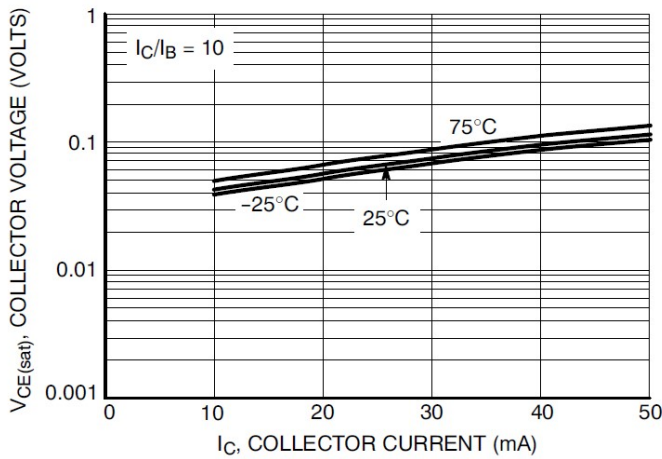


Figure 22. $V_{CE(sat)}$ versus I_C

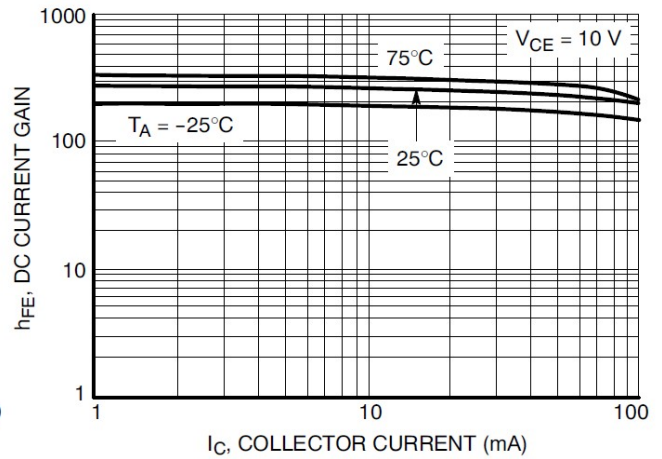


Figure 23. DC Current Gain

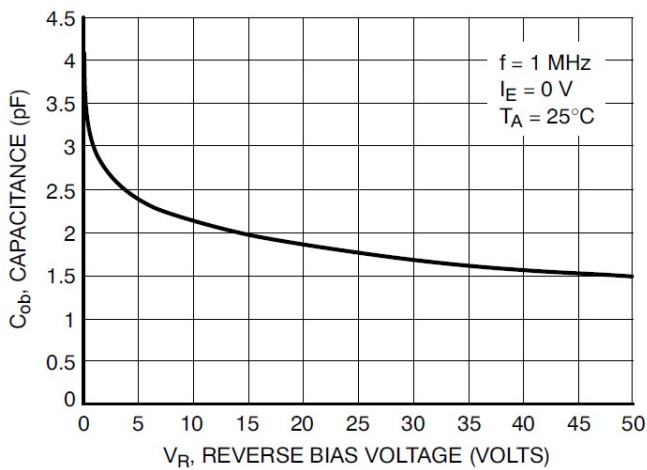


Figure 24. Output Capacitance

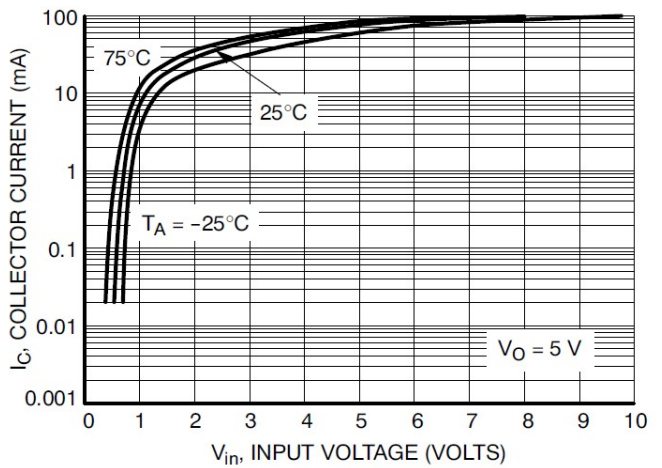


Figure 25. Output Current versus Input Voltage

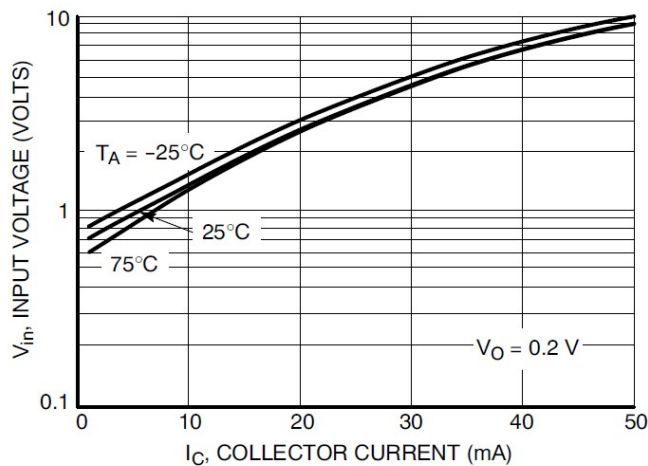


Figure 26. Input Voltage versus Output Current

Typical characteristics

MUN2216

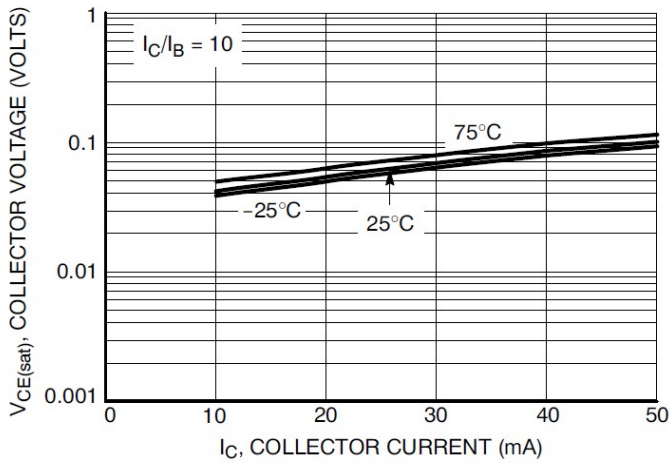


Figure 27. $V_{CE(sat)}$ versus I_C

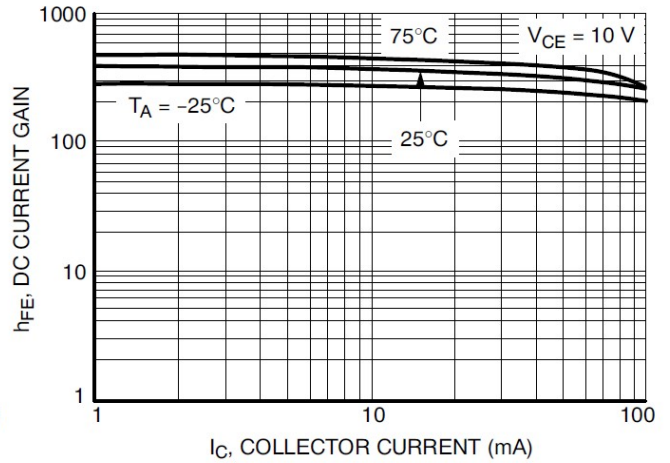


Figure 28. DC Current Gain

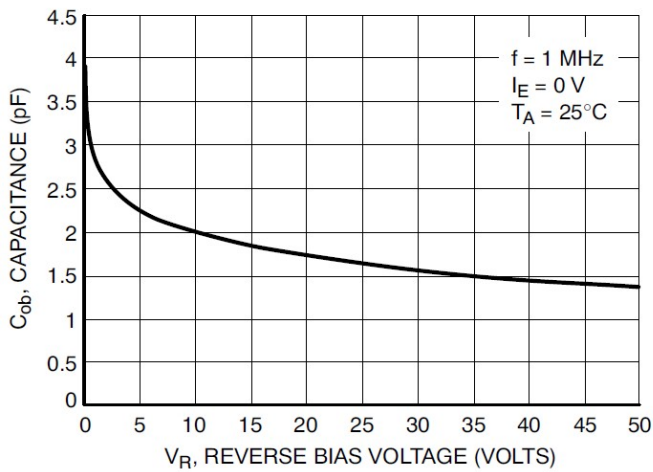


Figure 29. Output Capacitance

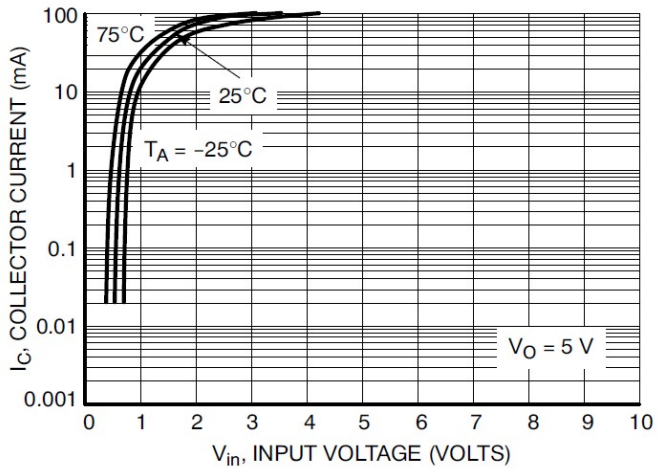


Figure 30. Output Current versus Input Voltage

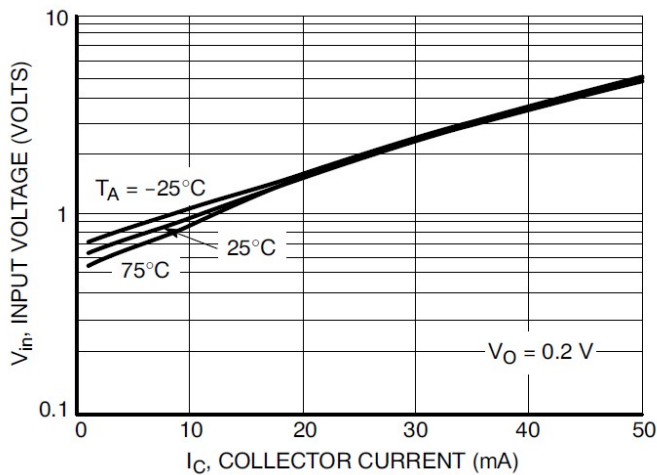


Figure 31. Input Voltage versus Output Current

Typical characteristics

MUN2230

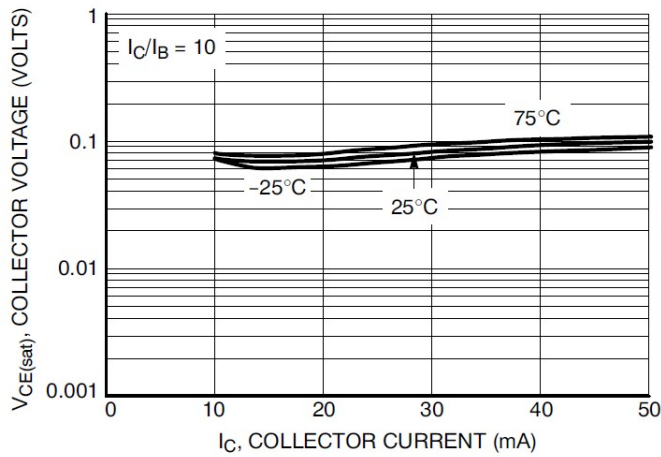


Figure 32. $V_{CE(sat)}$ versus I_C

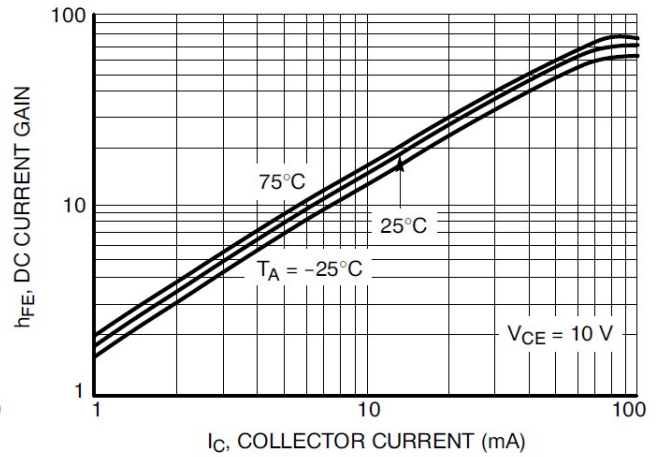


Figure 33. DC Current Gain

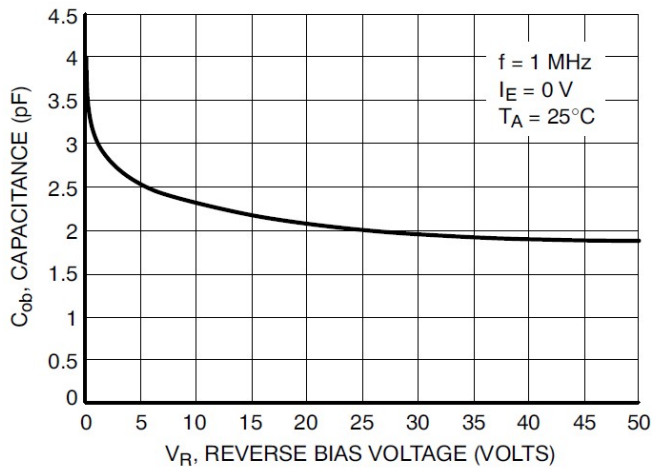


Figure 34. Output Capacitance

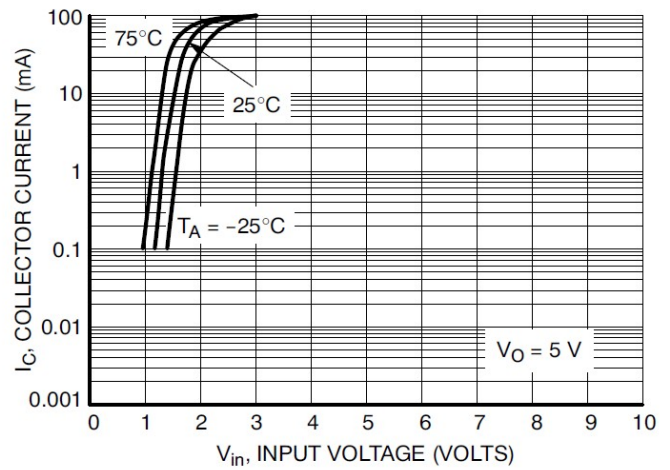


Figure 35. Output Current versus Input Voltage

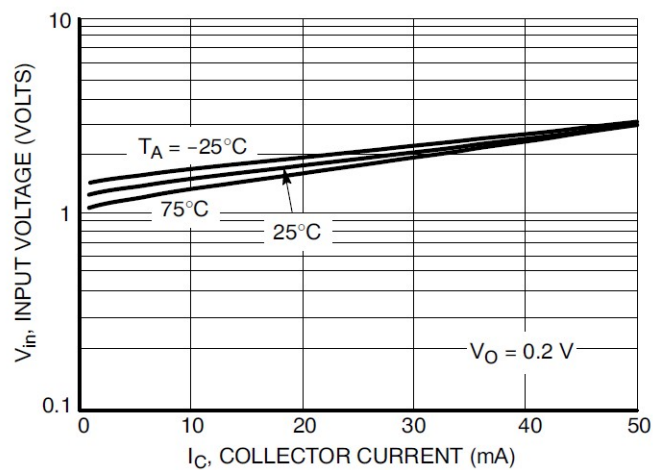


Figure 36. Input Voltage versus Output Current

Typical characteristics

MUN2231

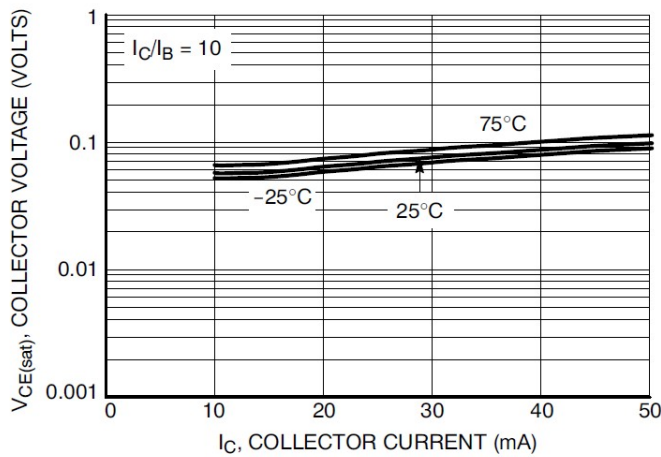


Figure 37. $V_{CE(sat)}$ versus I_C

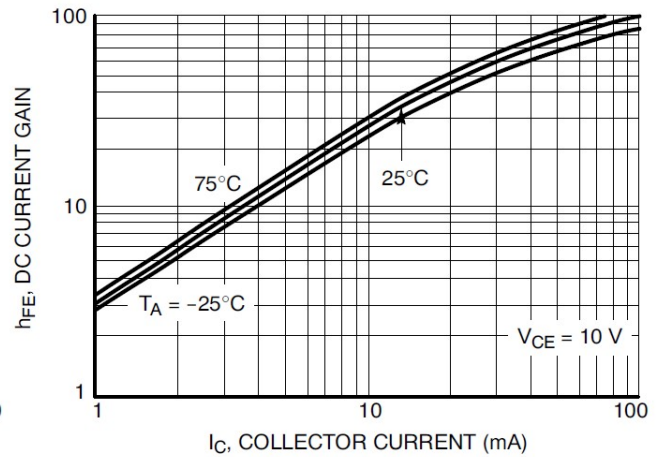


Figure 38. DC Current Gain

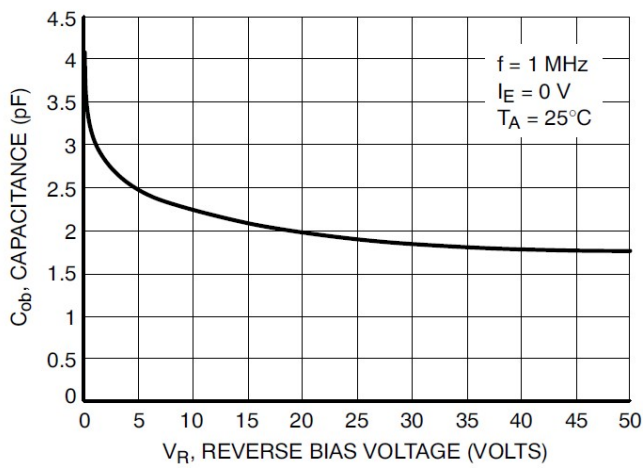


Figure 39. Output Capacitance

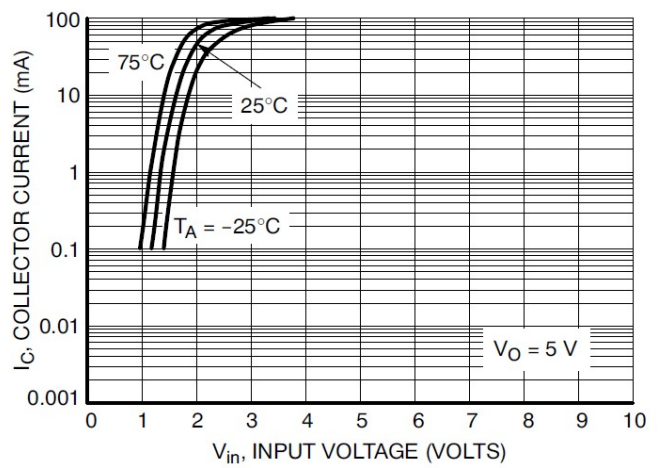


Figure 40. Output Current versus Input Voltage

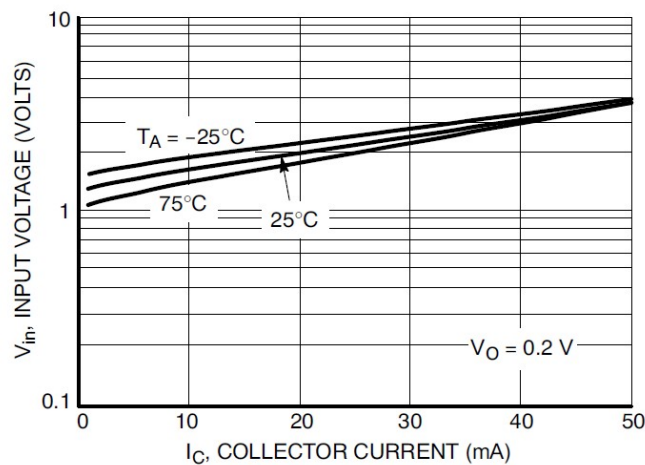


Figure 41. Input Voltage versus Output Current

Typical characteristics

MUN2232

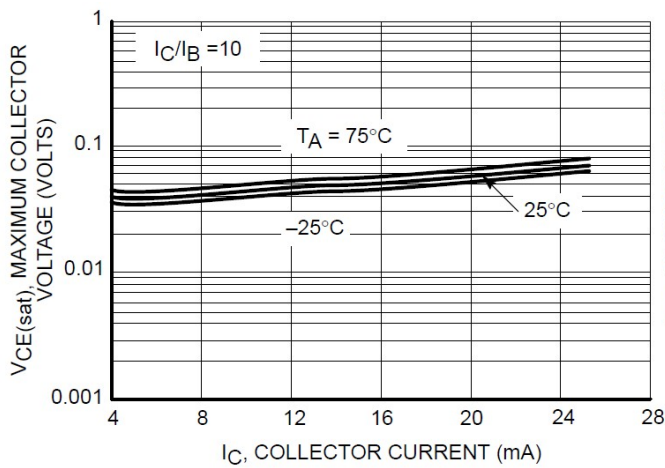


Figure 22. $V_{CE(sat)}$ vs. I_C

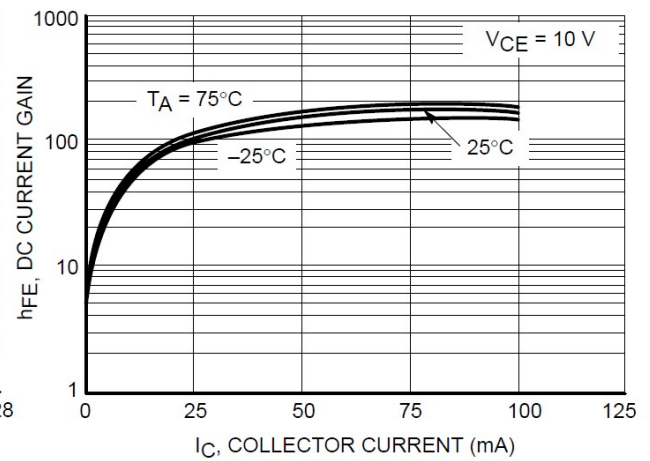


Figure 23. DC Current Gain

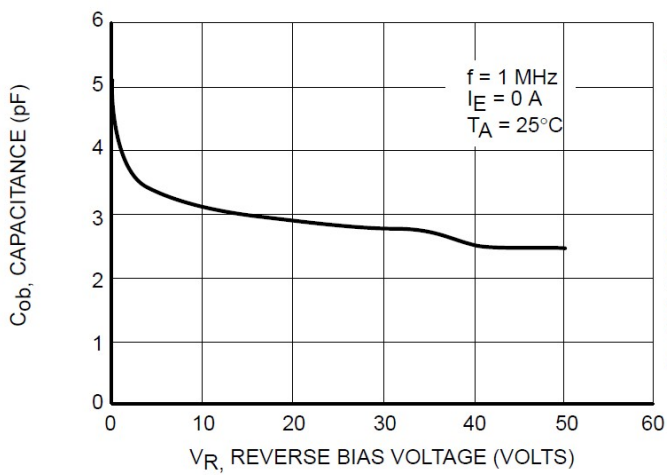


Figure 24. Output Capacitance

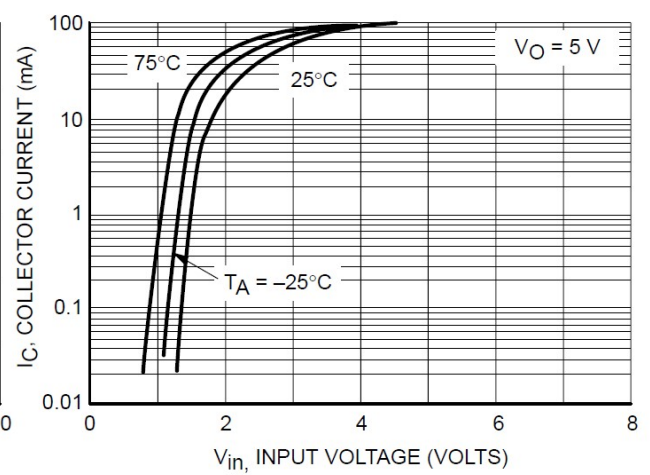


Figure 25. Output Current vs. Input Voltage

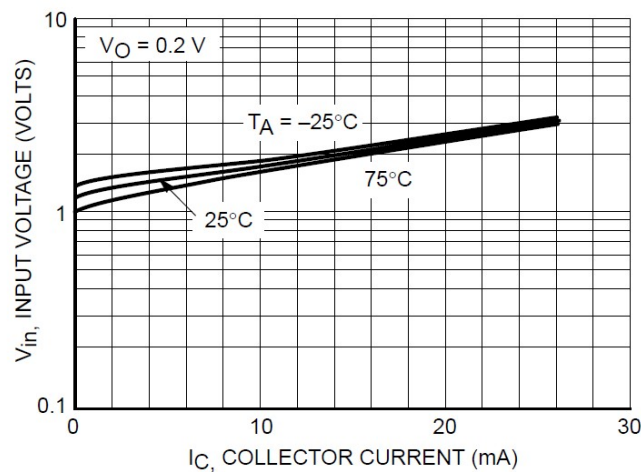


Figure 26. Output Voltage vs. Input Current

Typical characteristics

MUN2233

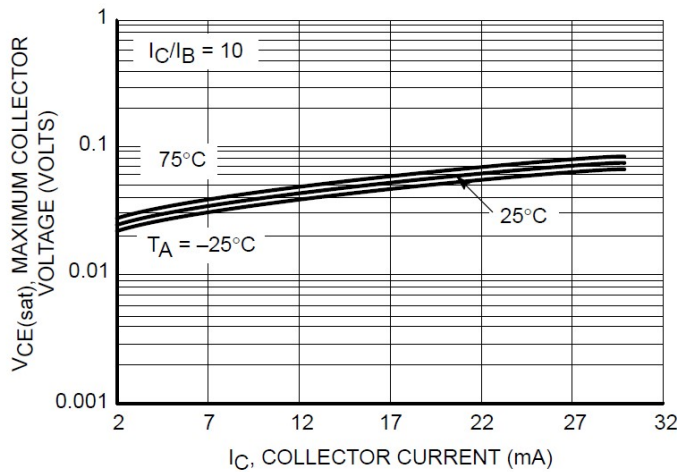


Figure 27. $V_{CE(sat)}$ vs. I_C

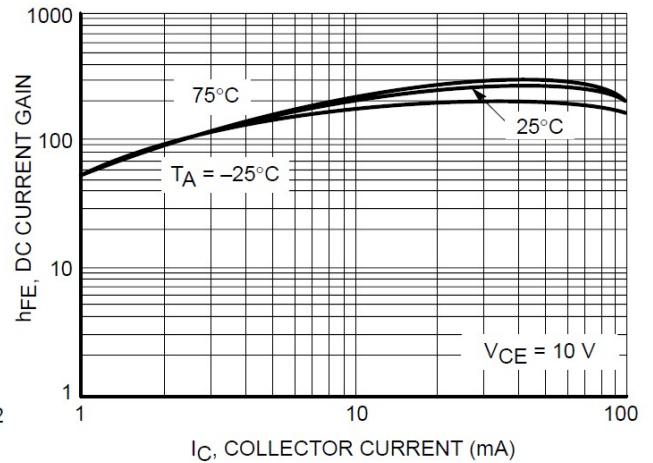


Figure 28. DC Current Gain

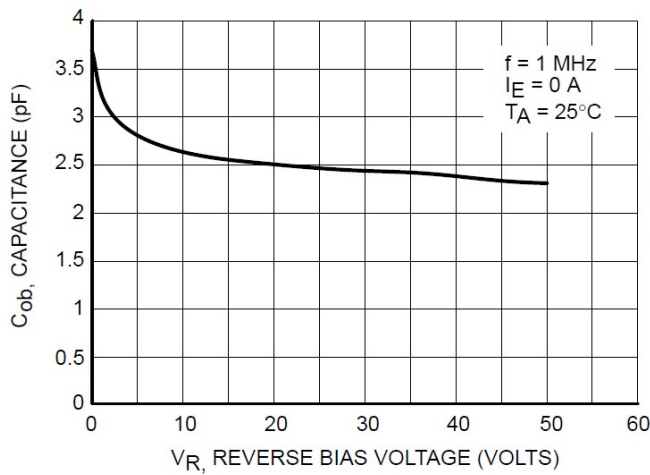


Figure 29. Output Capacitance

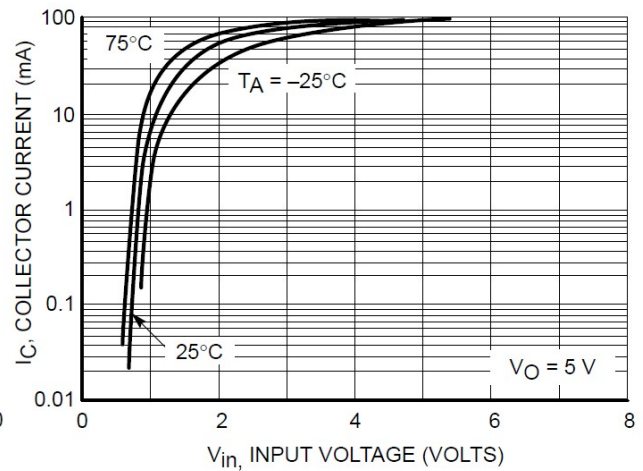


Figure 30. Output Current vs. Input Voltage

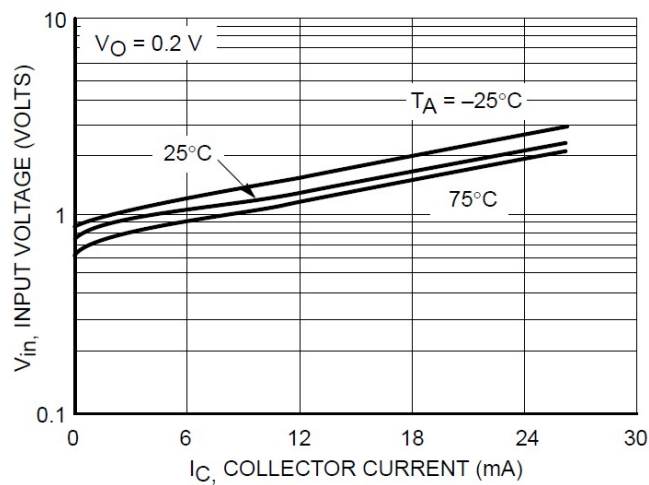


Figure 31. Input Voltage vs. Output Current

Typical characteristics

MUN2234

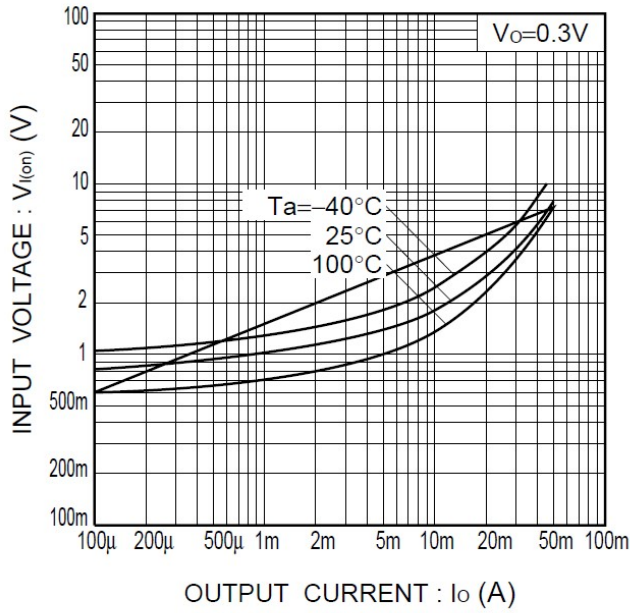


Fig.1 Input voltage vs. output current (ON characteristics)

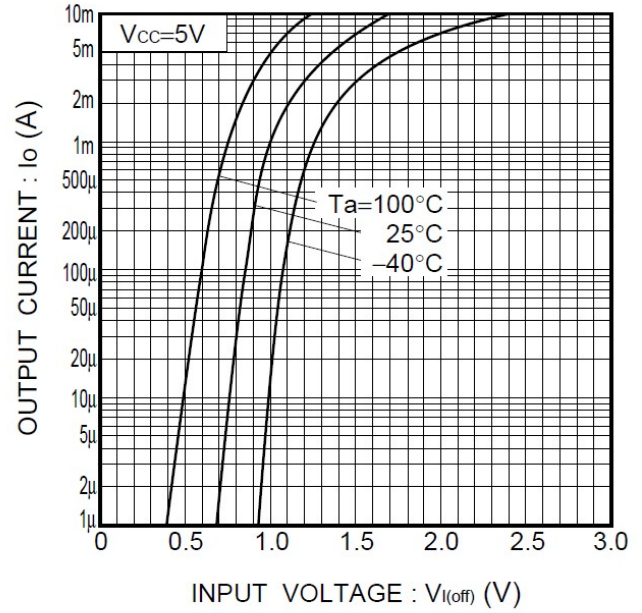


Fig.2 Output current vs. input voltage (OFF characteristics)

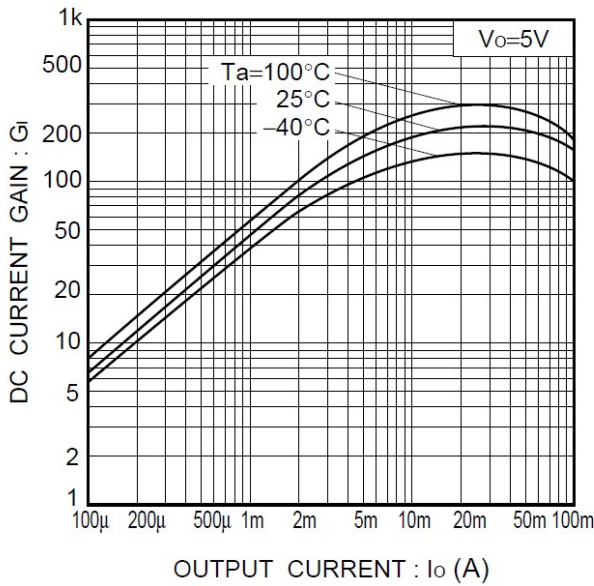


Fig.3 DC current gain vs. output current

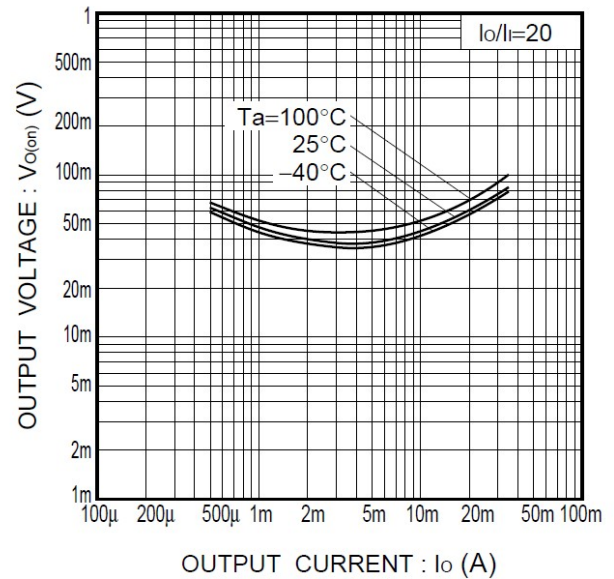


Fig.4 Output voltage vs. output current

TYPICAL APPLICATIONS FOR NPN BRTs

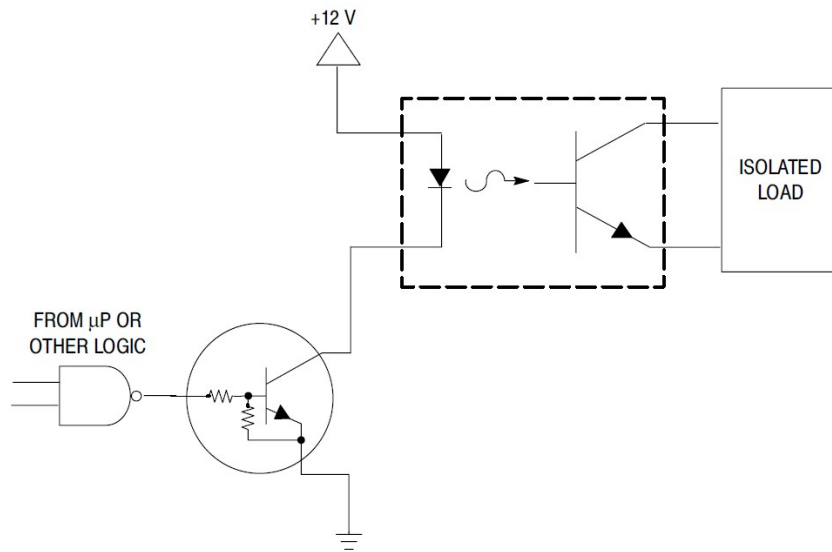


Figure 32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

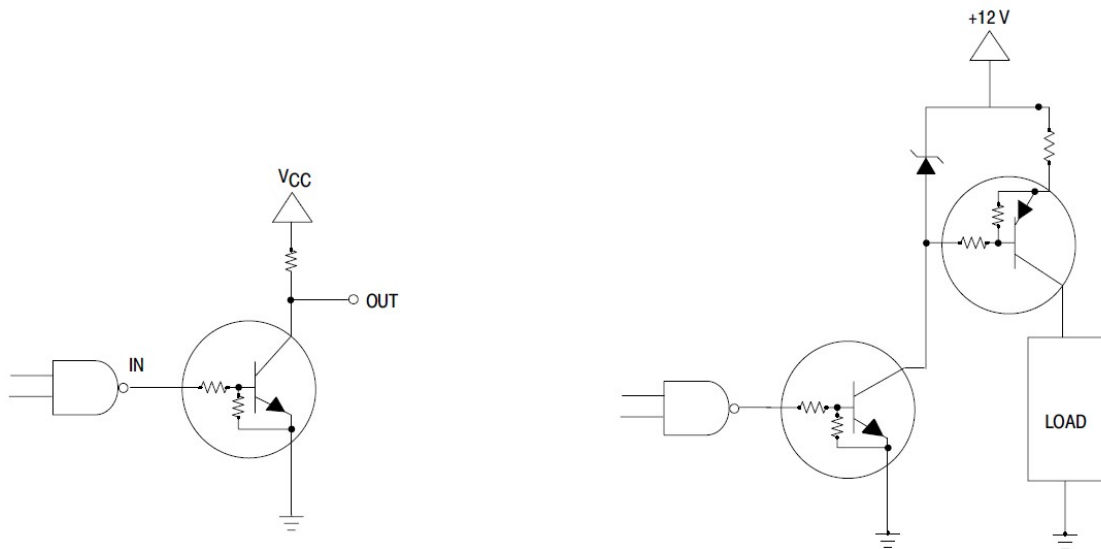
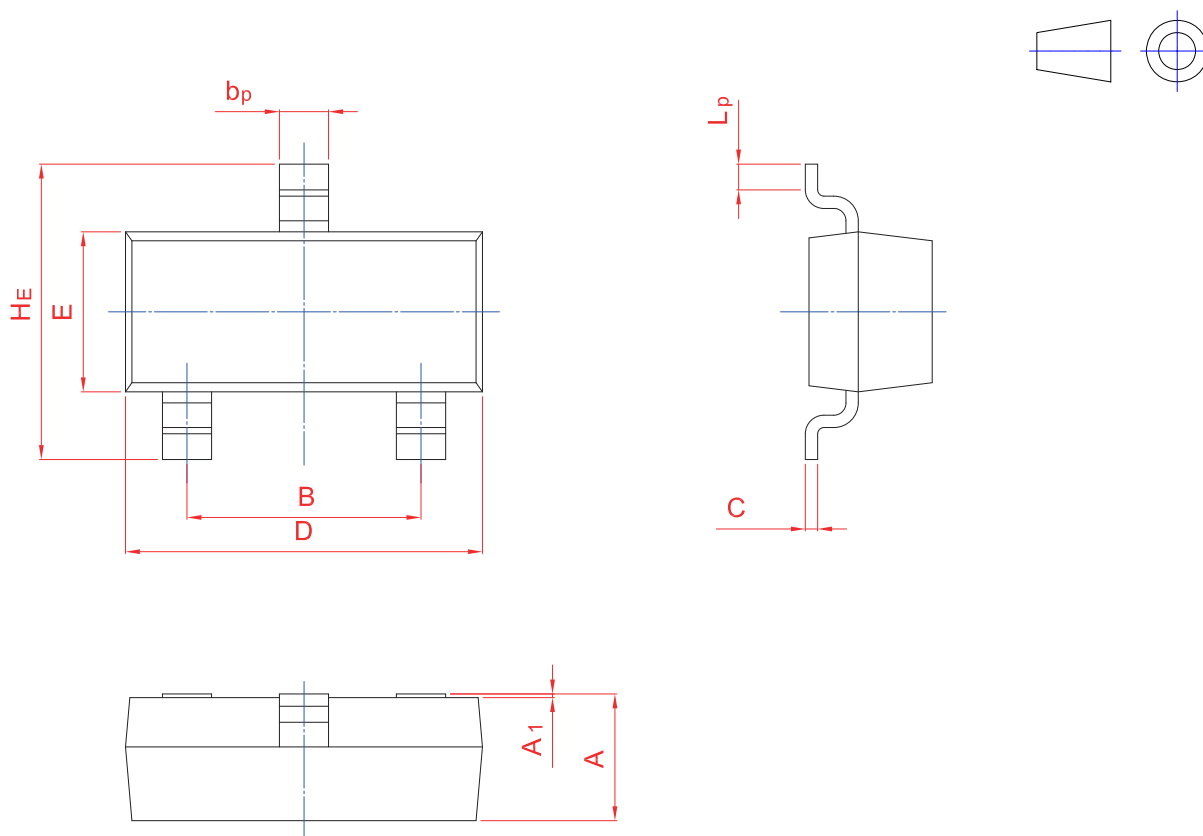


Figure 33. Open Collector Inverter: Inverts the Input Signal

Figure 34. Inexpensive, Unregulated Current Source

SOT-23 PACKAGE OUTLINE Plastic surface mounted package



UNIT	A	B	b_p	C	D	E	H_E	A_1	L_p
mm	1.40 0.89	2.04 1.78	0.51 0.30	0.19 0.08	3.10 2.70	1.65 1.20	3.00 2.20	0.100 0.013	0.50 0.20