

SOT-23 Bias Resistor Transistor (NPN)

Description

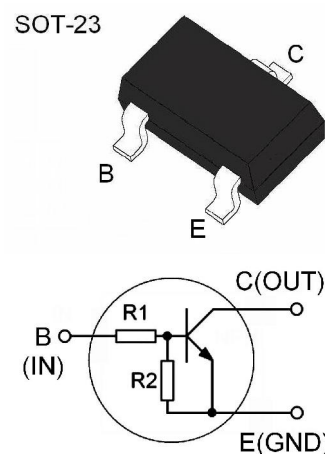
This new series of digital transistors is designed to replace a single device and its external resistor bias network. The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The BRT 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.

Feature

- Simplifies circuit design
- Reduces board space and component count
- Pb-Free packages are available

Absolute Maximum Ratings ($T_A=25^{\circ}\text{C}$)

Parameter	Symbol	Value	Unit
Collector-Base Voltage	BV_{CBO}	50	V
Collector-Emitter Voltage	BV_{CEO}	50	V
Collector Current	I_C	100	mA



Device Marking and Resistor Values

Part Number	Marking	Resistor (K Ω)	
		R1	R2
MMUN2211LT1G	A8A	10	10
MMUN2212LT1G	A8B	22	22
MMUN2213LT1G	A8C	47	47
MMUN2214LT1G	A8D	10	47
MMUN2215LT1G	A8E	10	∞
MMUN2216LT1G	A8F	4.7	∞
MMUN2230LT1G	A8G	1.0	1.0
MMUN2231LT1G	A8H	2.2	2.2
MMUN2232LT1G	A8J	4.7	4.7
MMUN2233LT1G	A8K	4.7	47
MMUN2234LT1G	A8L	22	47
MMUN2235LT1G	A8M	2.2	47
MMUN2236LT1G	A8N	100	100
MMUN2237LT1G	A8P	47	22
MMUN2238LT1G	A8R	2.2	∞
MMUN2240LT1G	A8T	47	∞
MMUN2241LT1G	A8U	100	∞

Electrical Characteristics (T_A=25°C unless otherwise specified)

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Off Characteristics							
Collector-Base Breakdown Voltage		BV _{CBO}	I _C = 10μA, I _E = 0				
Collector-Emitter Breakdown Voltage		BV _{CEO}	I _C = 2.0mA, I _B = 0				
Collector-Base cut-off current		I _{CBO}	V _{CB} = 50V, I _E = 0			100	nA
Collector-Emitter cut-off current		I _{CEO}	V _{CE} = 50V, I _E = 0			500	nA
Emitter-base cut-off current	MMUN2211LT1G	I _{EBO}	V _{EB} = 6V, I _C = 0			0.5	mA
	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	
	MMUN2236LT1G					0.05	
	MMUN2237LT1G					0.13	
	MMUN2238LT1G					4.0	
	MMUN2240LT1G					0.2	
	MMUN2241LT1G					0.1	
DC current gain	MMUN2211LT1G	h _{FE}	V _{CE} = 10V, I _C = 5.0mA	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		
	MMUN2236LT1G			80	150		
	MMUN2237LT1G			50	150		
	MMUN2238LT1G			160	140		
	MMUN2240LT1G			160	350		
	MMUN2241LT1G			160	350		
Collector-emitter saturation voltage	MMUN2213LT1G/MMUN2214LT1G MMUN2215LT1G/MMUN2216LT1G MMUN2233LT1G/MMUN2234LT1G MMUN2235LT1G/MMUN2236LT1G MMUN2238LT1G/MMUN2240LT1G MMUN2241LT1G	V _{CE(sat)}	I _C = 10mA, I _B = 0.3mA			0.25	V
	MMUN2211LT1G MMUN2212LT1G MMUN2237LT1G		I _C = 10mA, I _B = 1.0mA			0.25	
	MMUN2230LT1G MMUN2231LT1G MMUN2232LT1G		I _C = 10mA, I _B = 5.0mA			0.25	

Electrical Characteristics (T_A=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
On Characteristics (Note 3)							
Output Voltage (on)	MMUN2211LT1G	V _{OL}	V _{CC} = 5.0V,V _B = 2.5V R _L = 1.0KΩ			0.2	
	MMUN2212LT1G					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	
MMUN2238LT1G	0.2						
	MMUN2213LT1G		V _{CC} = 5.0V,V _B = 3.5V R _L = 1.0KΩ			0.2	
	MMUN2241LT1G		V _{CC} = 5.0V,V _B = 5.0V R _L = 1.0KΩ			0.2	
Output Voltage (off)	MMUN2211LT1G	V _{OH}	V _{CC} = 5.0V,V _B = 0.5V R _L = 1.0KΩ	4.9		V	
	MMUN2212LT1G						
	MMUN2213LT1G						
	MMUN2214LT1G						
	MMUN2231LT1G						
	MMUN2232LT1G						
	MMUN2234LT1G						
	MMUN2241LT1G						
		MMUN2230LT1G					V _{CC} = 5.0V,V _B = 0.05V R _L = 1.0KΩ
		MMUN2215LT1G	V _{CC} = 5.0V,V _B = 0.25V R _L = 1.0KΩ				
MMUN2216LT1G							
MMUN2233LT1G							
MMUN2238LT1G							
Input Resistor	MMUN2211LT1G	R1		7	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	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			70	100	130	
	MMUN2236LT1G			70	100	130	
	MMUN2237LT1G			32.9	47	61.1	
	MMUN2238LT1G			32.9	47	61.1	
	MMUN2241LT1G			70	100	130	

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

Electrical Characteristics (T_A=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
On Characteristics (Note 4)						
Resistor Ratio	MMUN2211LT1G	R1/R2	0.8	1.0	1.2	
	MMUN2212LT1G					
	MMUN2213LT1G					
	MMUN2230LT1G					
	MMUN2231LT1G					
	MMUN2232LT1G					
	MMUN2236LT1G					
	MMUN2214LT1G		0.17	0.21	0.25	
	MMUN2215LT1G		-	-	-	
	MMUN2216LT1G					
	MMUN2238LT1G					
	MMUN2240LT1G					
	MMUN2241LT1G					
	MMUN2233LT1G		0.055	0.1	0.185	
	MMUN2234LT1G		0.38	0.47	0.56	
	MMUN2235LT1G		0.038	0.047	0.056	
	MMUN2237LT1G		1.7	2.1	2.6	

4. Pulse Test: Pulse Width < 300 s, Duty Cycle < 2.0%.



Typical Characteristics

MMUN2212LT1G

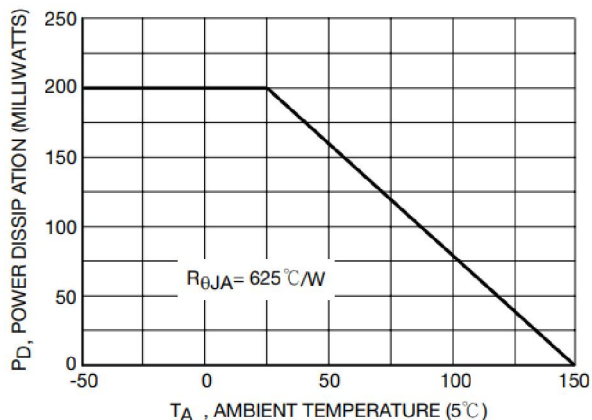


Figure 1. Derating Curve

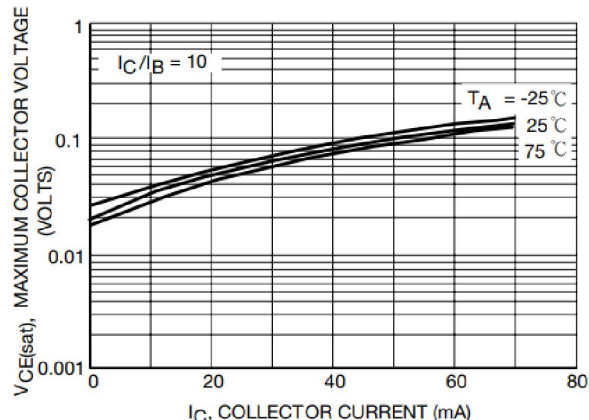


Figure 2. $V_{CE(sat)}$ vs. I_C

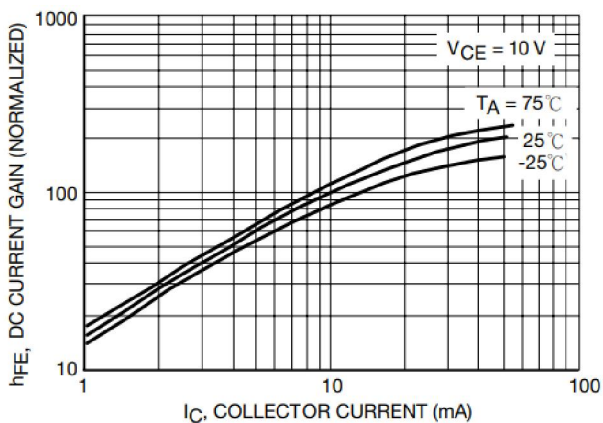


Figure 3. DC Current Gain

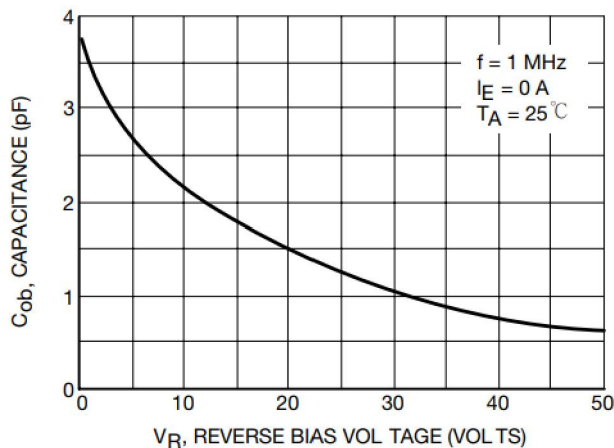


Figure 4. Output Capacitance

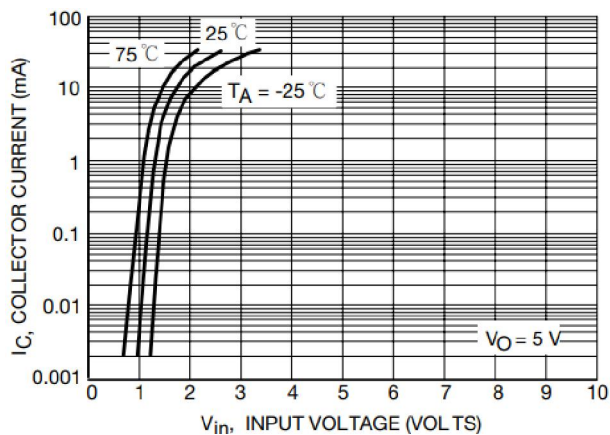


Figure 5. Output Current vs. Input Voltage

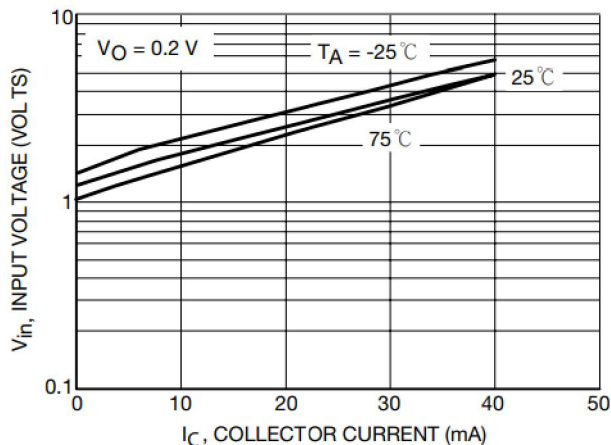


Figure 6. Input Voltage vs. Output Current



MMUN2211LT1G

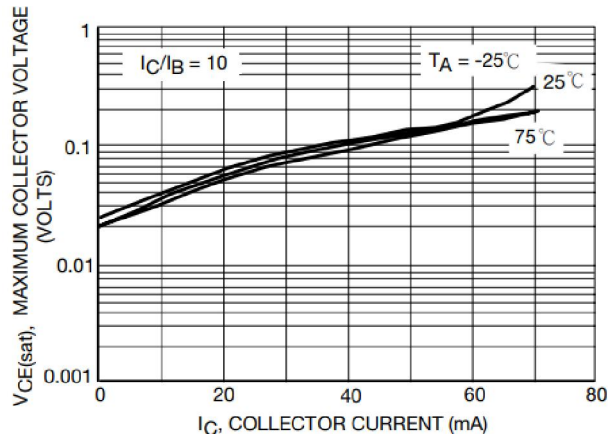


Figure 7. $V_{CE(sat)}$ vs. I_C

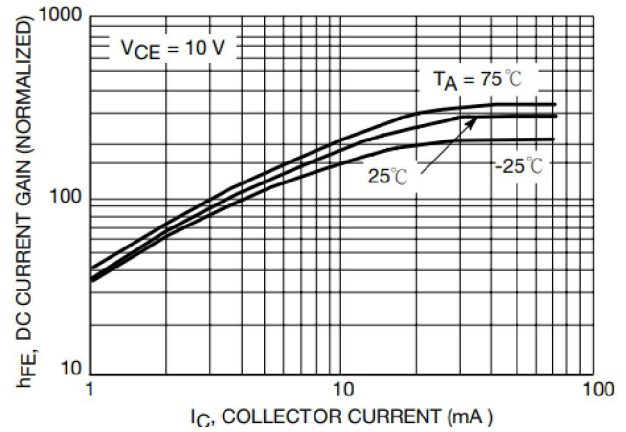


Figure 8. DC Current Gain

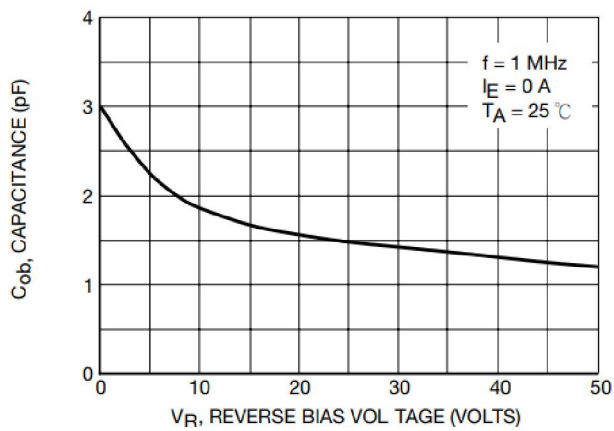


Figure 9. Output Capacitance

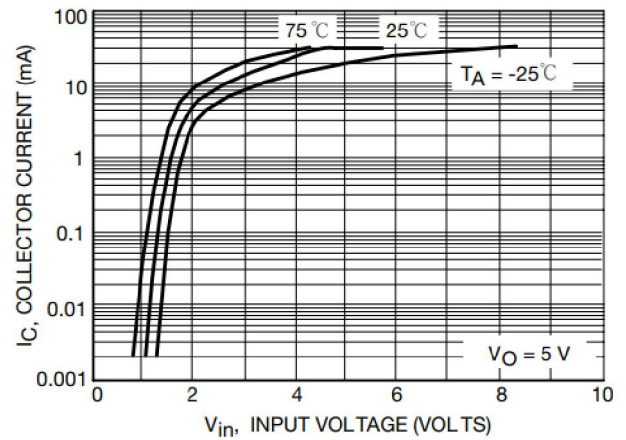


Figure 10. Output Current vs. Input Voltage

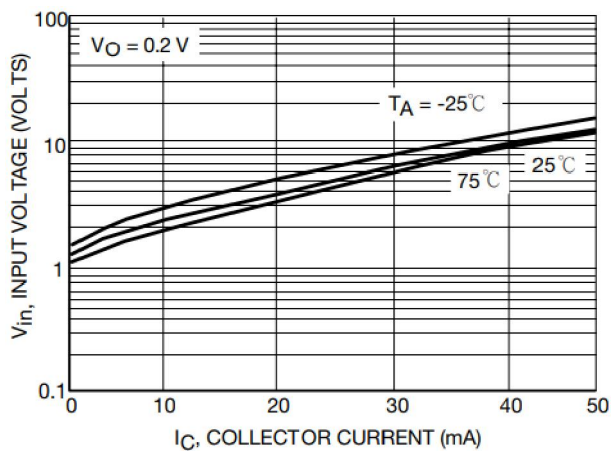


Figure 11. Input Voltage vs. Output Current



MMUN2213LT1G

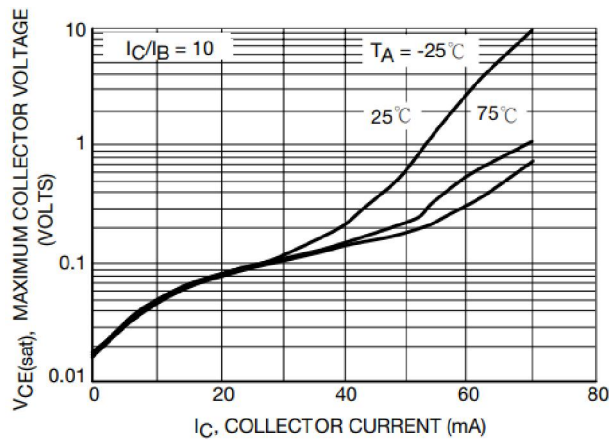


Figure 12. $V_{CE(sat)}$ vs. I_C

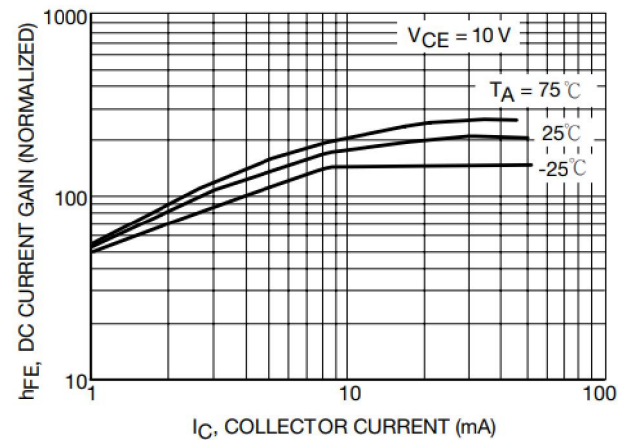


Figure 13. DC Current Gain

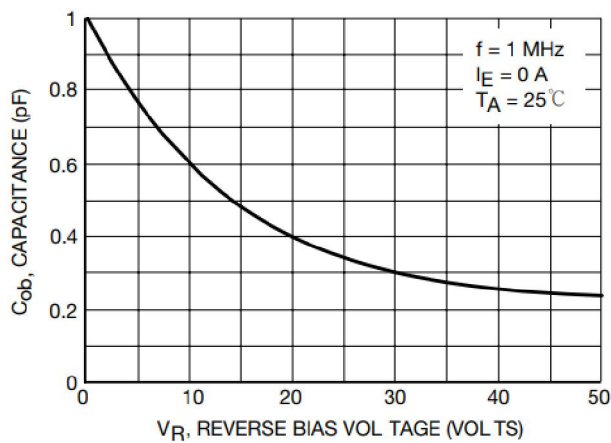


Figure 14. Output Capacitance

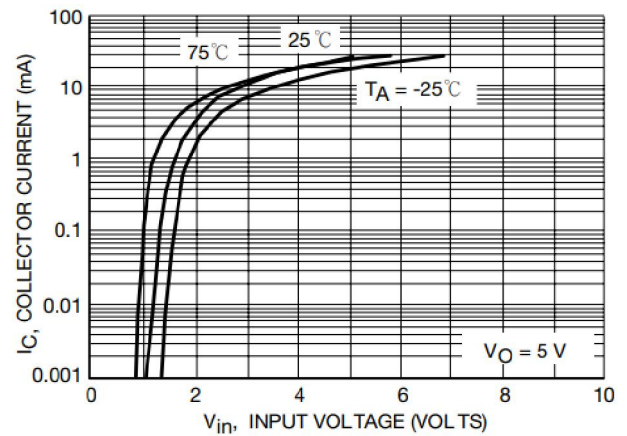


Figure 15. Output Current vs. Input Voltage

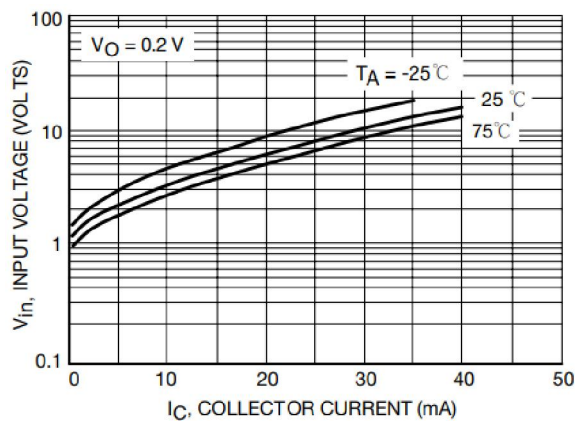


Figure 16. Input Voltage vs. Output Current



MMUN2214LT1G

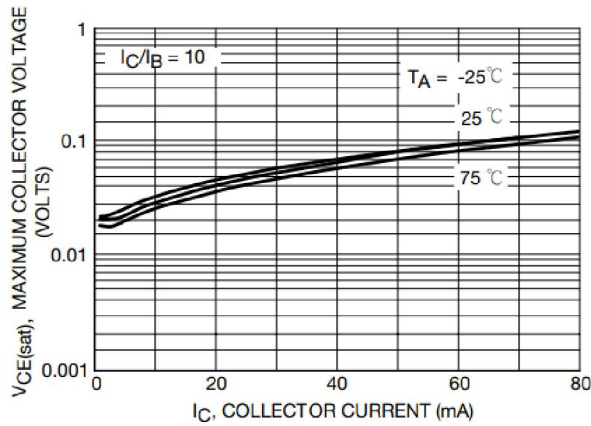


Figure 17. $V_{CE(sat)}$ vs. I_C

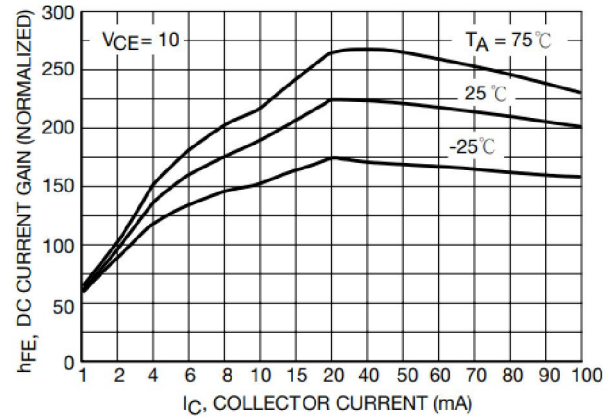


Figure 18. DC Current Gain

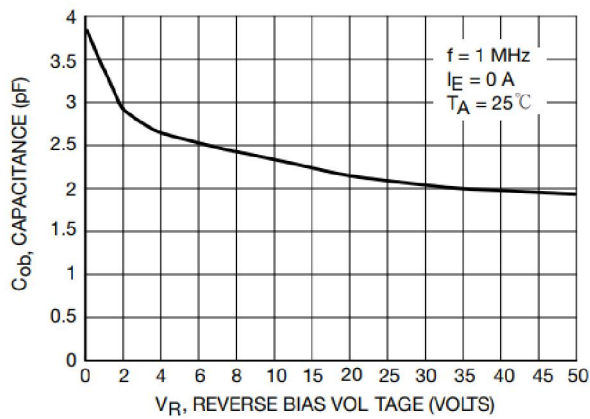


Figure 19. Output Capacitance

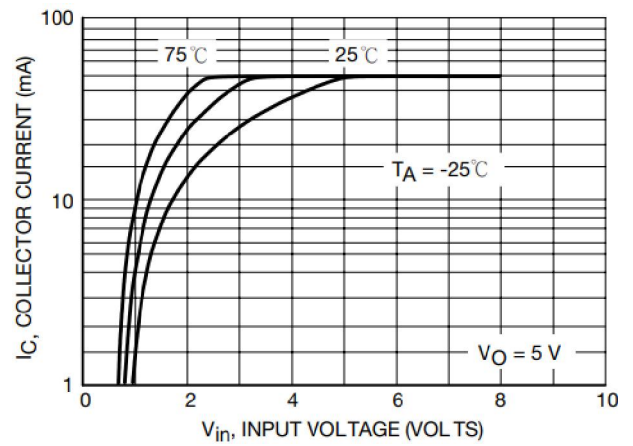


Figure 20. Output Current vs. Input Voltage

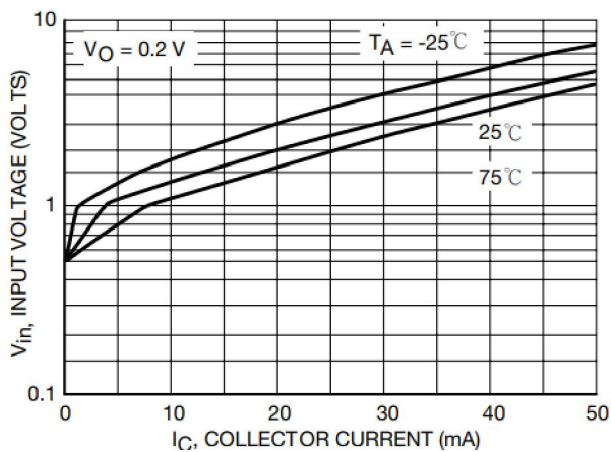


Figure 21. Input Voltage vs. Output Current



MMUN2232LT1G

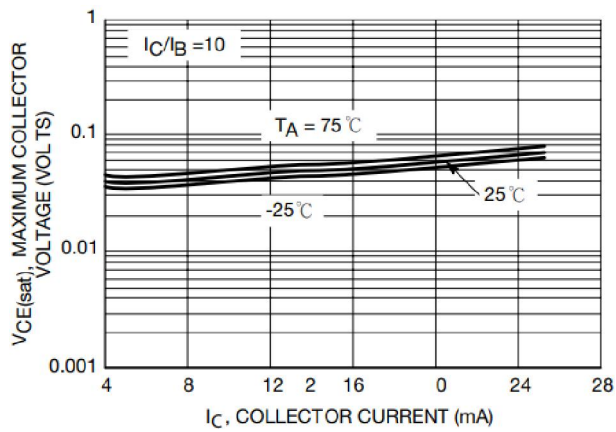


Figure 22. $V_{CE(sat)}$ vs. I_C

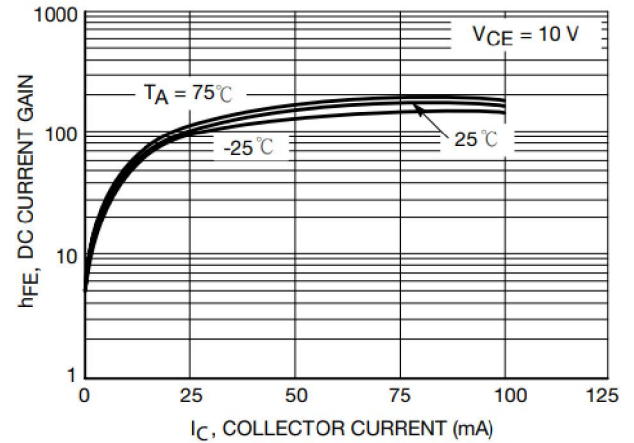


Figure 23. DC Current Gain

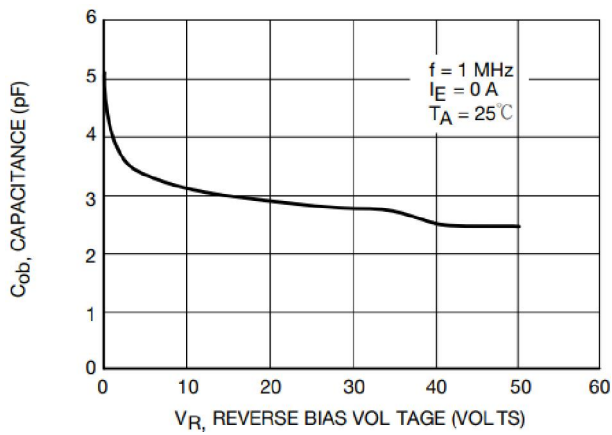


Figure 24. Output Capacitance

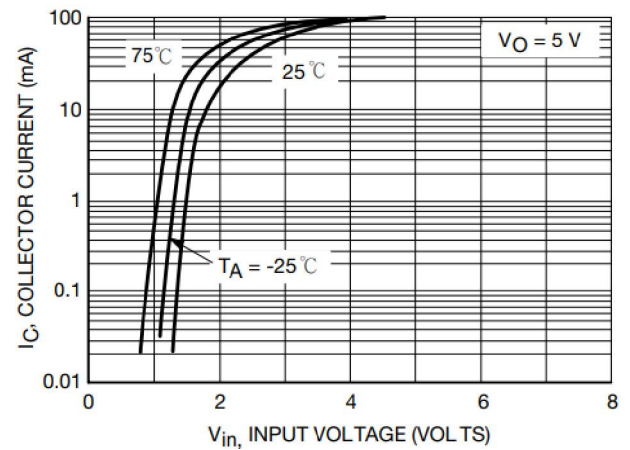


Figure 25. Output Current vs. Input Voltage

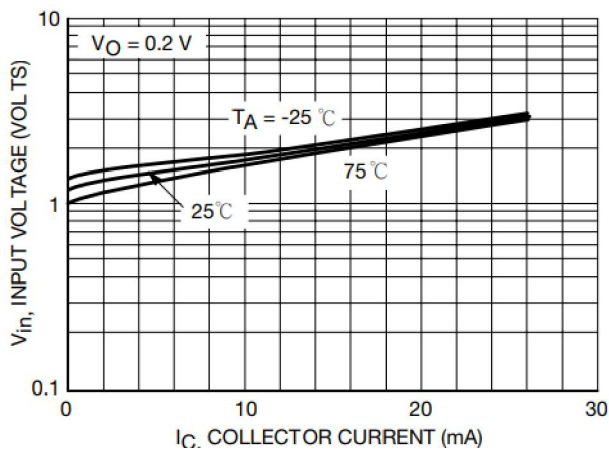


Figure 26. Input Voltage vs. Output Current

MMUN2233LT1G

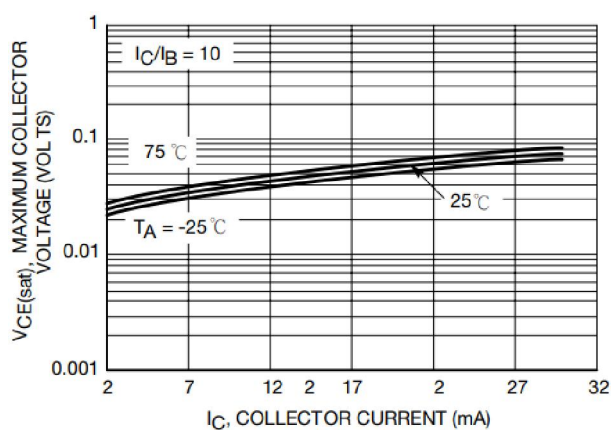


Figure 27. $V_{CE(sat)}$ vs. I_C

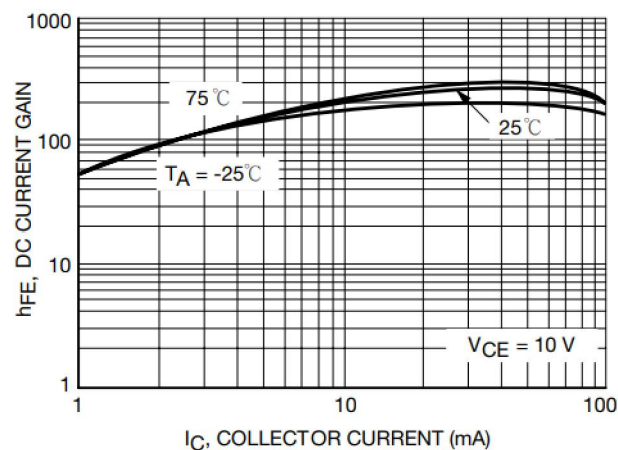
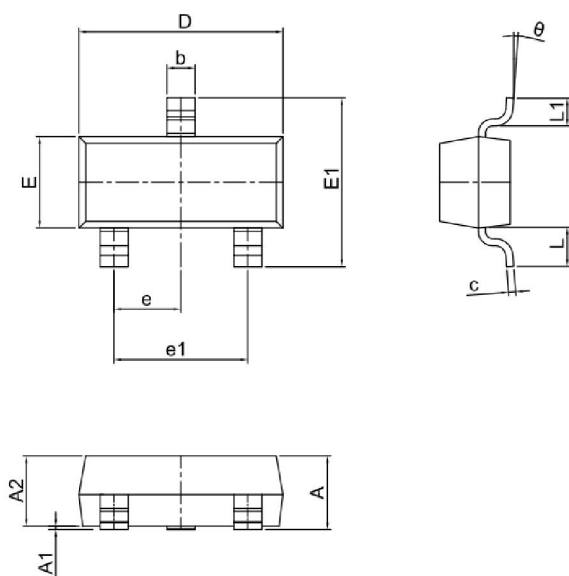


Figure 28. DC Current Gain

Package Dimensions



Symbol	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.15	0.035	0.045
A1	0.00	0.10	0.000	0.004
A2	0.90	1.05	0.035	0.041
b	0.30	0.50	0.012	0.020
c	0.08	0.15	0.003	0.006
D	2.80	3.00	0.110	0.118
E	1.20	1.40	0.047	0.055
E1	2.25	2.55	0.089	0.100
e	0.90	1.00	0.035	0.039
e1	1.80	2.00	0.071	0.079
L	0.50	0.60	0.020	0.024
L1	0.30	0.50	0.012	0.020
θ	0°	8°	0°	8°