

MMUN2211LT1 Series

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 (V _{EB} = 6.0 V, I _C = 0)	I _{EBO}	-	-	0.5	mAdc
MMUN2211LT1, G		-	-	0.2	
MMUN2212LT1, G		-	-	0.1	
MMUN2213LT1, G		-	-	0.2	
MMUN2214LT1, G		-	-	0.9	
MMUN2215LT1, G		-	-	1.9	
MMUN2216LT1, G		-	-	4.3	
MMUN2230LT1, G		-	-	2.3	
MMUN2231LT1, G		-	-	1.5	
MMUN2232LT1, G		-	-	0.18	
MMUN2233LT1, G		-	-	0.13	
MMUN2234LT1, G		-	-	4.0	
MMUN2238LT1, G		-	-	0.1	
MMUN2241LT1, G		-	-		
Collector-Base Breakdown Voltage (I _C = 10 μA, I _E = 0)	V _{(BR)CBO}	50	-	-	Vdc
Collector-Emitter Breakdown Voltage (Note 3), (I _C = 2.0 mA, I _B = 0)	V _{(BR)CEO}	50	-	-	Vdc

ON CHARACTERISTICS (Note 3)

DC Current Gain (V _{CE} = 10 V, I _C = 5.0 mA)	MMUN2211LT1, G	h _{FE}	35	60	-	
	MMUN2212LT1, G		60	100	-	
	MMUN2213LT1, G		80	140	-	
	MMUN2214LT1, G		80	140	-	
	MMUN2215LT1, G		160	350	-	
	MMUN2216LT1, G		160	350	-	
	MMUN2230LT1, G		3.0	5.0	-	
	MMUN2231LT1, G		8.0	15	-	
	MMUN2232LT1, G		15	30	-	
	MMUN2233LT1, G		80	200	-	
	MMUN2234LT1, G		80	150	-	
	MMUN2238LT1, G		160	350	-	
	MMUN2241LT1, G		160	350	-	
Collector-Emitter Saturation Voltage (I _C = 10 mA, I _B = 0.3 mA)	MMUN2211LT1, G	V _{CE(sat)}	-	-	0.25	Vdc
	MMUN2212LT1, G		-	-	0.25	
	MMUN2213LT1, G		-	-	0.25	
	MMUN2214LT1, G		-	-	0.25	
	MMUN2233LT1, G		-	-	0.25	
	MMUN2234LT1, G		-	-	0.25	
(I _C = 10 mA, I _B = 1 mA)	MMUN2215LT1, G		-	-	0.25	
	MMUN2216LT1, G		-	-	0.25	
	MMUN2232LT1, G		-	-	0.25	
	MMUN2238LT1, G		-	-	0.25	
(I _C = 10 mA, I _B = 5 mA)	MMUN2230LT1, G		-	-	0.25	
	MMUN2231LT1, G		-	-	0.25	
	MMUN2241LT1, G		-	-	0.25	

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

MMUN2211LT1 Series

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 4)					
Output Voltage (on) (V _{CC} = 5.0 V, V _B = 2.5 V, R _L = 1.0 kΩ)	V _{OL}	-	-	0.2	Vdc
MMUN2211LT1, G		-	-	0.2	
MMUN2212LT1, G		-	-	0.2	
MMUN2214LT1, G		-	-	0.2	
MMUN2215LT1, G		-	-	0.2	
MMUN2216LT1, G		-	-	0.2	
MMUN2230LT1, G		-	-	0.2	
MMUN2231LT1, G		-	-	0.2	
MMUN2232LT1, G		-	-	0.2	
MMUN2233LT1, G		-	-	0.2	
MMUN2234LT1, G		-	-	0.2	
MMUN2238LT1, G		-	-	0.2	
(V _{CC} = 5.0 V, V _B = 3.5 V, R _L = 1.0 kΩ)		-	-	0.2	
MMUN2213LT1, G		-	-	0.2	
(V _{CC} = 5.0 V, V _B = 5.0 V, R _L = 1.0 kΩ)		-	-	0.2	
MMUN2241LT1, G		-	-	0.2	
Output Voltage (off) (V _{CC} = 5.0 V, V _B = 0.5 V, R _L = 1.0 kΩ)	V _{OH}	4.9	-	-	Vdc
MMUN2211LT1, G		4.9	-	-	
MMUN2212LT1, G		4.9	-	-	
MMUN2213LT1, G		4.9	-	-	
MMUN2214LT1, G		4.9	-	-	
MMUN2233LT1, G		4.9	-	-	
(V _{CC} = 5.0 V, V _B = 0.05 V, R _L = 1.0 kΩ)		4.9	-	-	
MMUN2230LT1, G		4.9	-	-	
MMUN2234LT1, G		4.9	-	-	
(V _{CC} = 5.0 V, V _B = 0.25 V, R _L = 1.0 kΩ)		4.9	-	-	
MMUN2215LT1, G		4.9	-	-	
MMUN2216LT1, G		4.9	-	-	
MMUN2231LT1, G		4.9	-	-	
MMUN2232LT1, G		4.9	-	-	
MMUN2238LT1, G		4.9	-	-	
MMUN2241LT1, G		4.9	-	-	
Input Resistor	R1	7.0	10	13	kΩ
MMUN2211LT1, G		15.4	22	28.6	
MMUN2212LT1, G		32.9	47	61.1	
MMUN2213LT1, G		7.0	10	13	
MMUN2214LT1, G		7.0	10	13	
MMUN2215LT1, G		3.3	4.7	6.1	
MMUN2216LT1, G		0.7	1.0	1.3	
MMUN2230LT1, G		1.5	2.2	2.9	
MMUN2231LT1, G		3.3	4.7	6.1	
MMUN2232LT1, G		3.3	4.7	6.1	
MMUN2233LT1, G		3.3	4.7	6.1	
MMUN2234LT1, G		15.4	22	28.6	
MMUN2238LT1, G		1.54	2.2	2.88	
MMUN2241LT1, G		70	100	130	
Resistor Ratio	R1/R2	0.8	1.0	1.2	
MMUN2211LT1, G		0.8	1.0	1.2	
MMUN2212LT1, G		0.8	1.0	1.2	
MMUN2213LT1, G		0.8	1.0	1.2	
MMUN2214LT1, G		0.17	0.21	0.25	
MMUN2215LT1, G		-	-	-	
MMUN2216LT1, G		-	-	-	
MMUN2230LT1, G		0.8	1.0	1.2	
MMUN2231LT1, G		0.8	1.0	1.2	
MMUN2232LT1, G		0.8	1.0	1.2	
MMUN2233LT1, G		0.055	0.1	0.185	
MMUN2234LT1, G		0.38	0.47	0.56	
MMUN2238LT1, G		-	-	-	
MMUN2241LT1, G		-	-	-	

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

TYPICAL ELECTRICAL CHARACTERISTICS - MMUN2211LT1

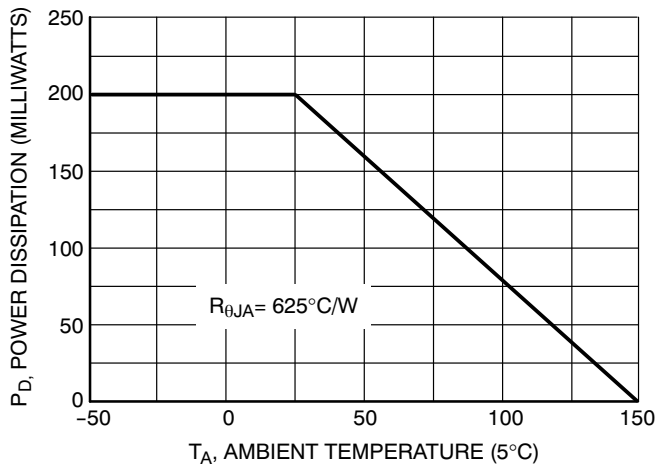


Figure 1. Derating Curve

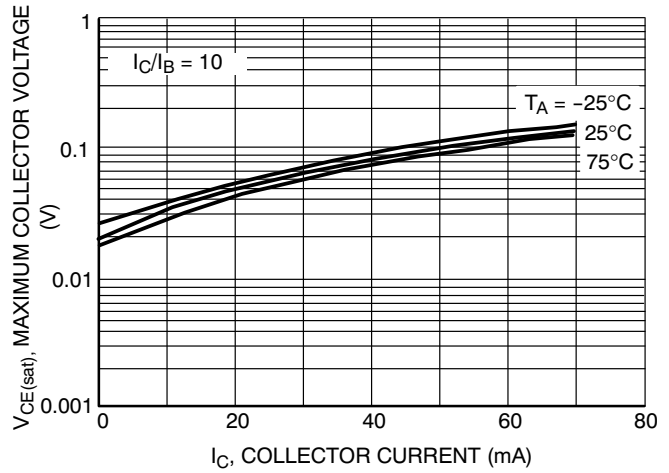


Figure 2. $V_{CE(sat)}$ vs. I_C

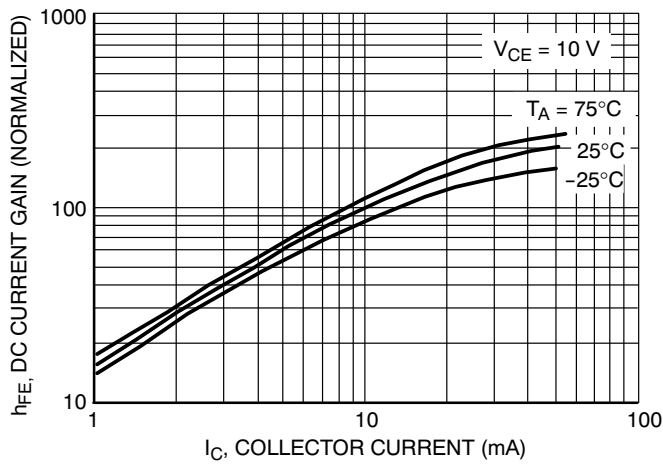


Figure 3. DC Current Gain

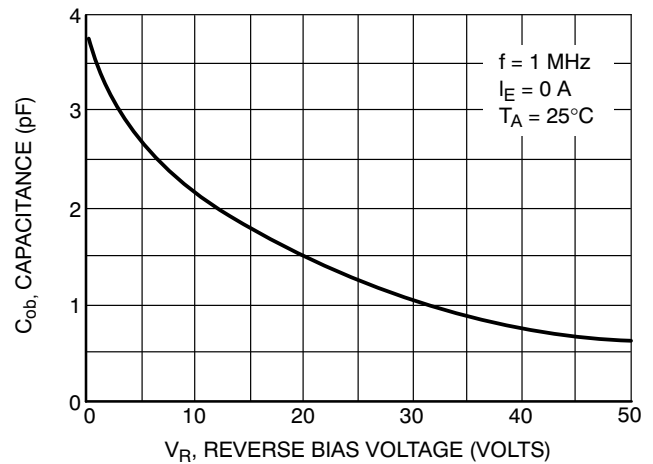


Figure 4. Output Capacitance

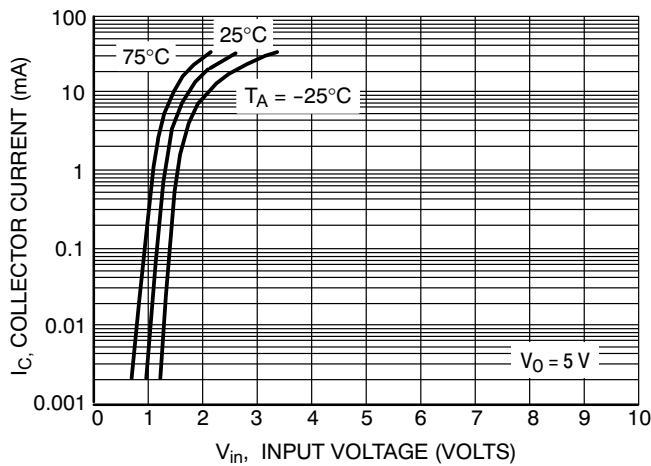


Figure 5. Output Current vs. Input Voltage

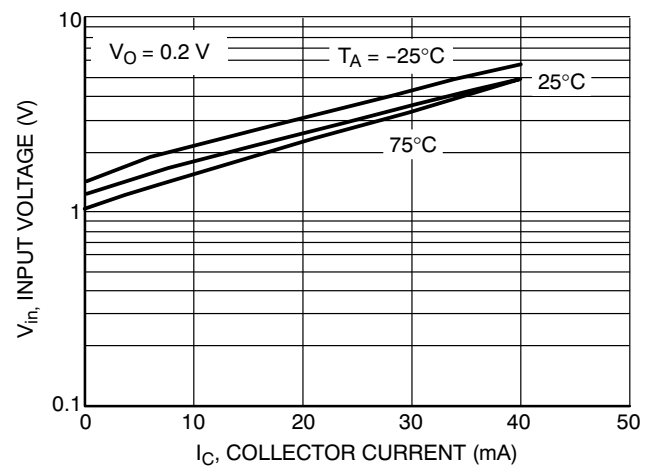


Figure 6. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MMUN2212LT1

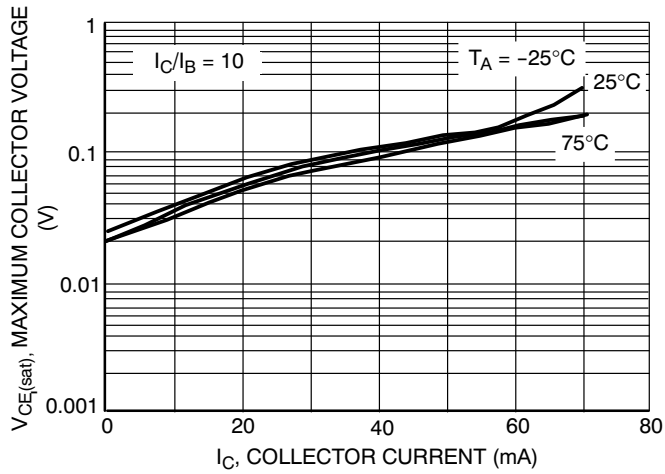


Figure 7. $V_{CE(sat)}$ vs. I_C

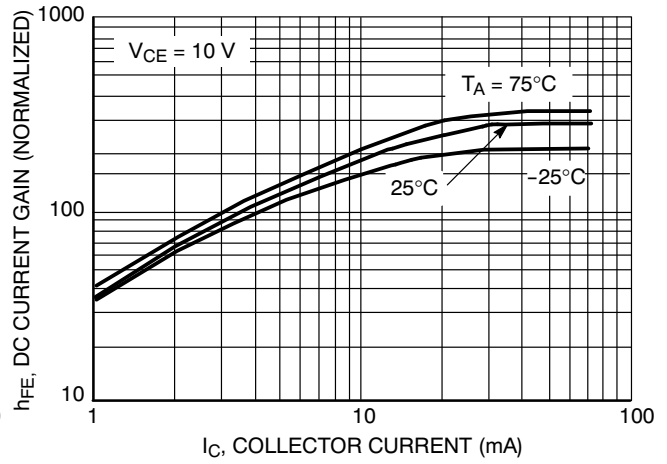


Figure 8. DC Current Gain

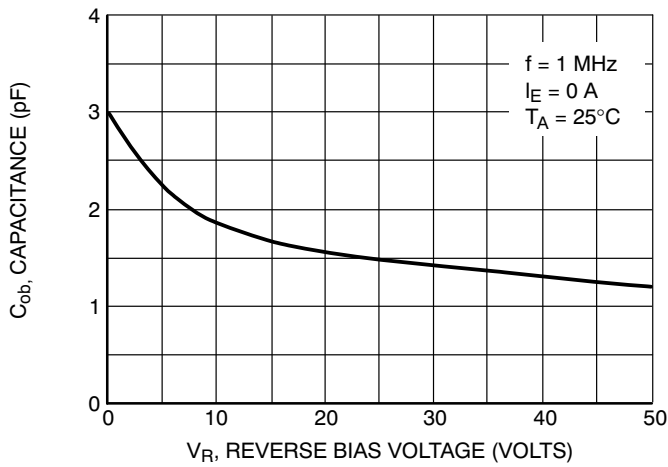


Figure 9. Output Capacitance

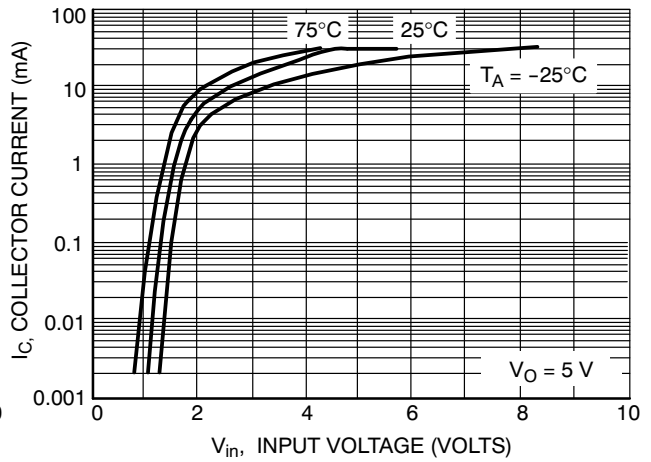


Figure 10. Output Current vs. Input Voltage

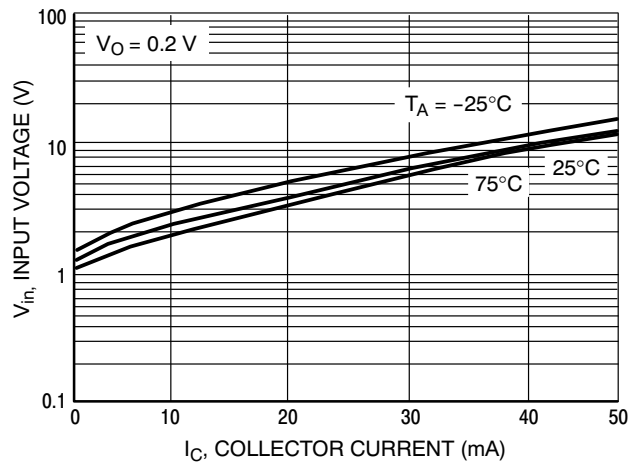


Figure 11. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MMUN2213LT1

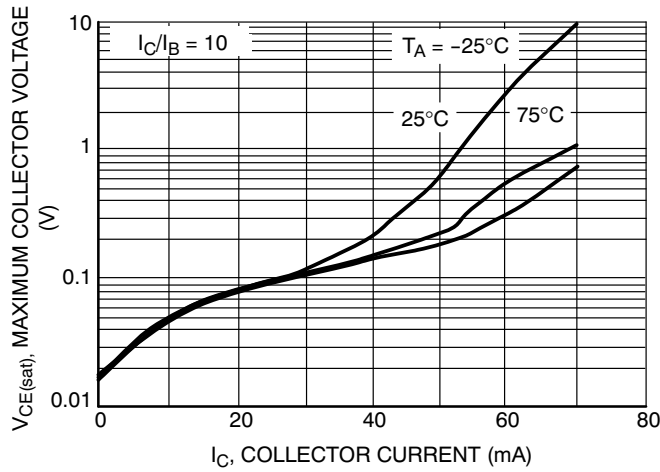


Figure 12. $V_{CE(sat)}$ vs. I_C

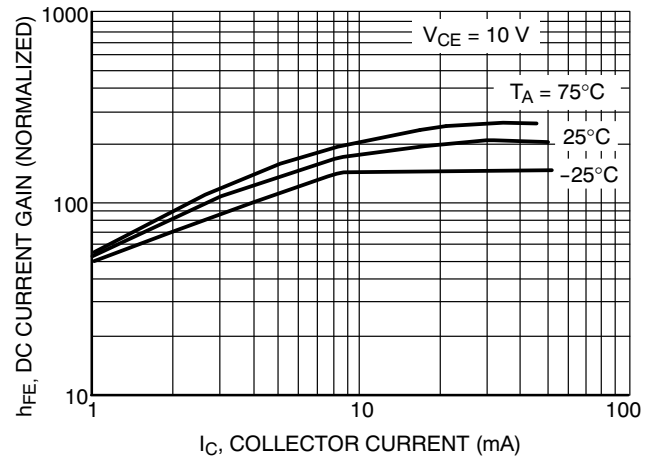


Figure 13. DC Current Gain

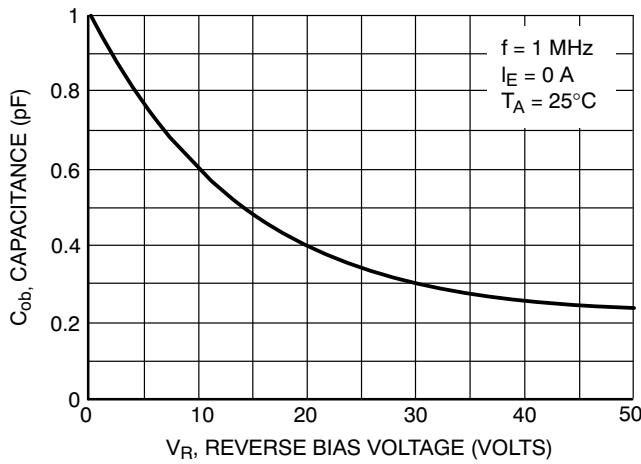


Figure 14. Output Capacitance

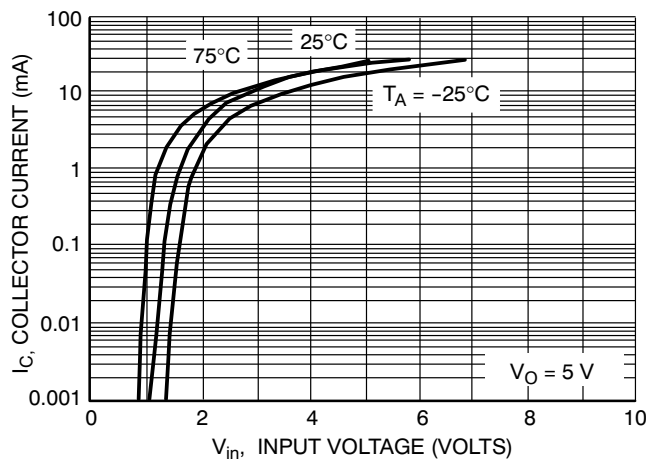


Figure 15. Output Current vs. Input Voltage

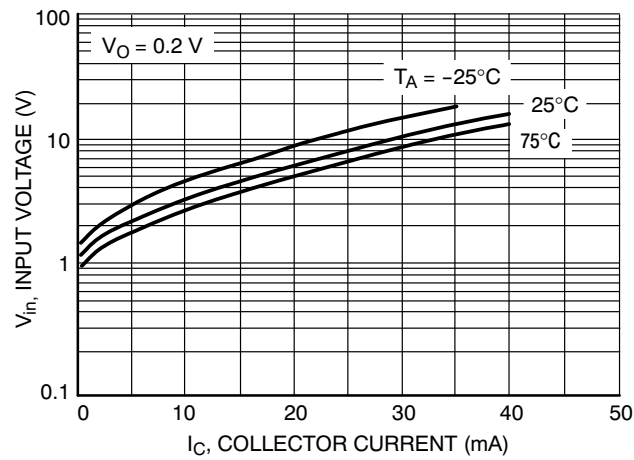


Figure 16. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS - MMUN2214LT1

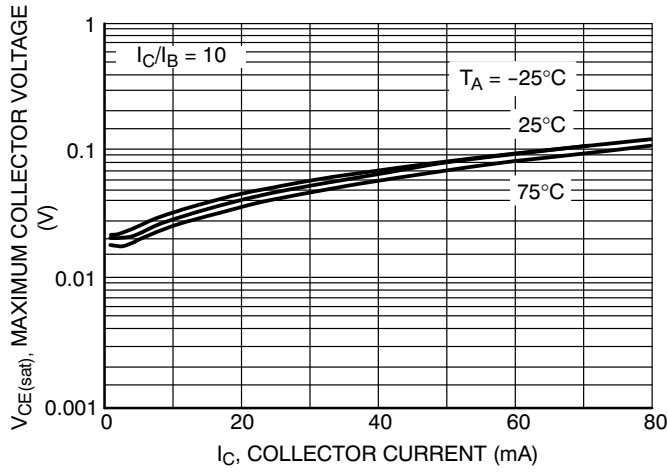


Figure 17. $V_{CE(sat)}$ vs. I_C

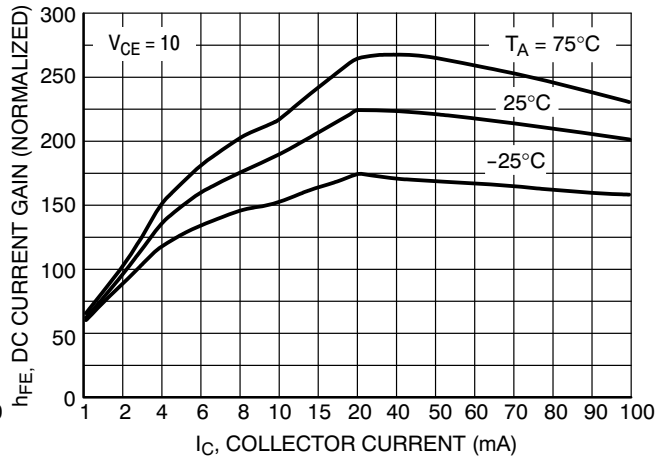


Figure 18. DC Current Gain

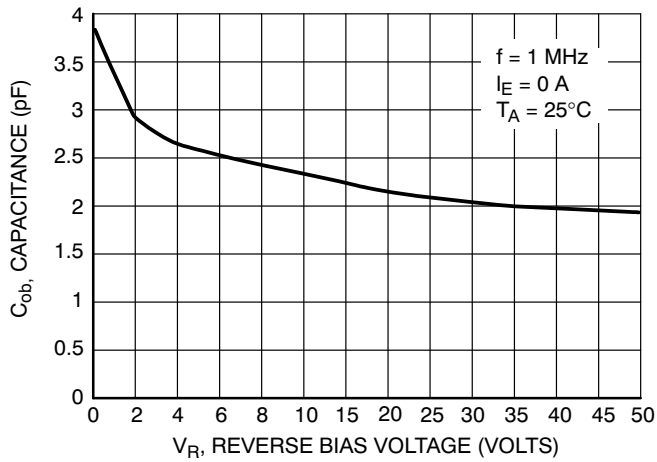


Figure 19. Output Capacitance

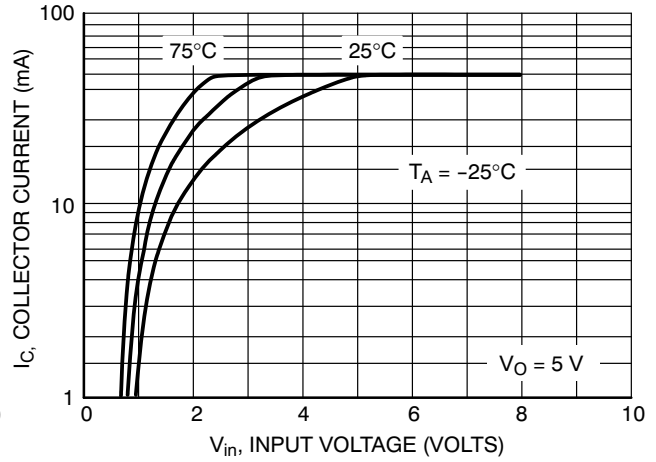


Figure 20. Output Current vs. Input Voltage

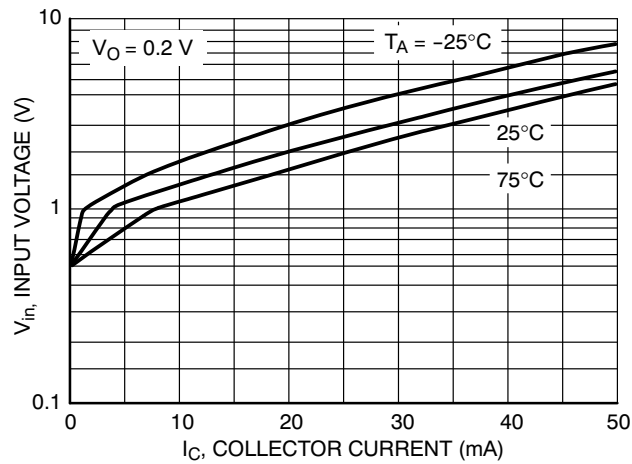


Figure 21. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS - MMUN2215LT1

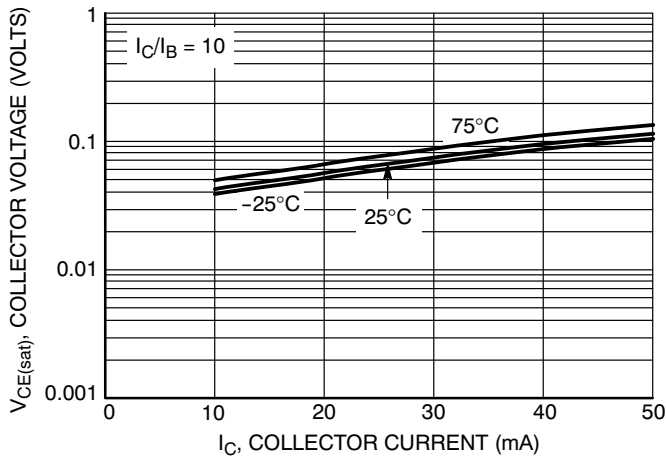


Figure 22. $V_{CE(sat)}$ versus I_C

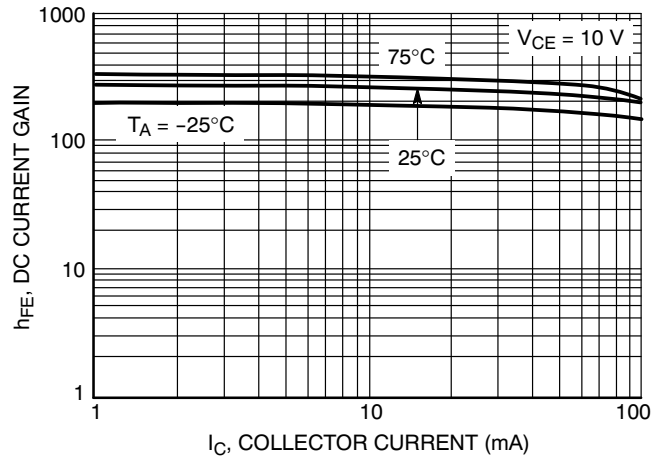


Figure 23. DC Current Gain

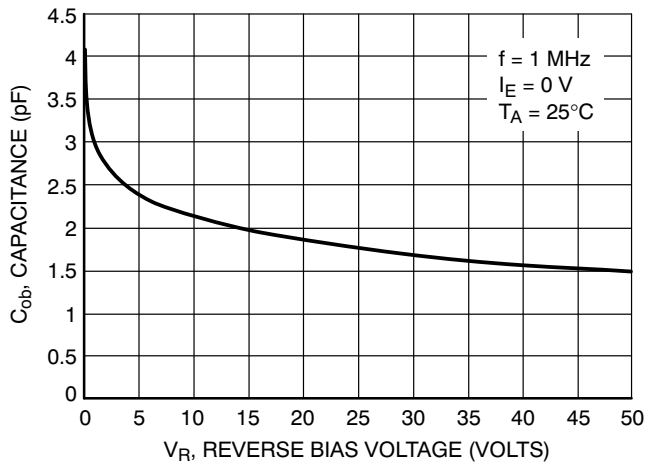


Figure 24. Output Capacitance

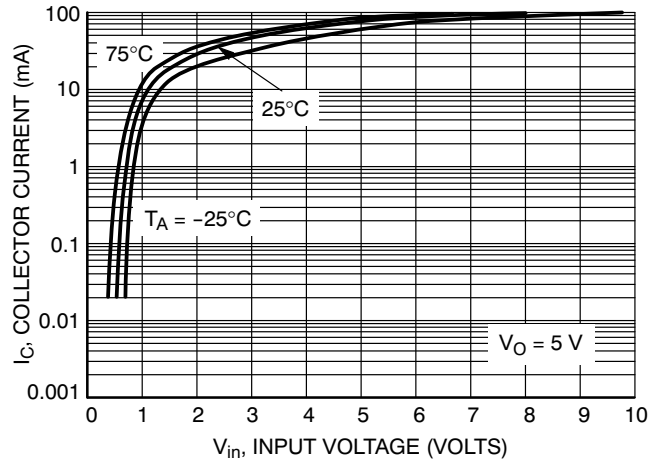


Figure 25. Output Current versus Input Voltage

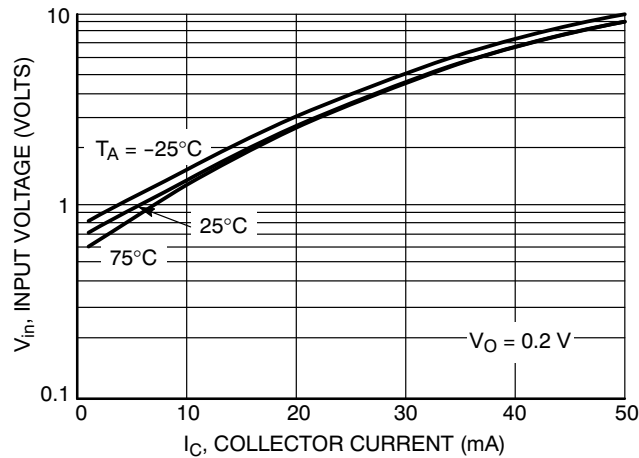


Figure 26. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MMUN2216LT1

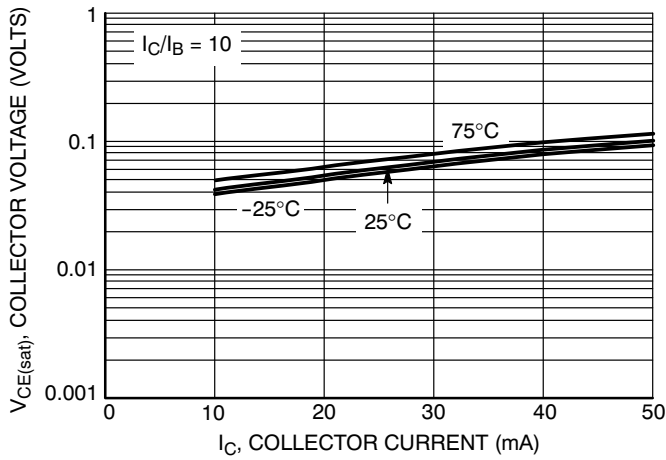


Figure 27. $V_{CE(sat)}$ versus I_C

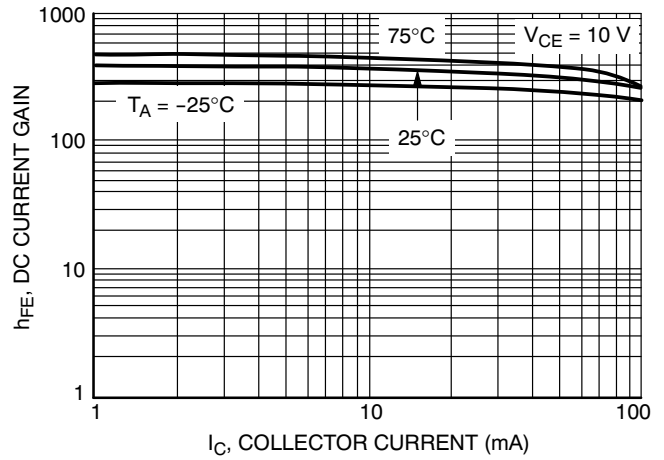


Figure 28. DC Current Gain

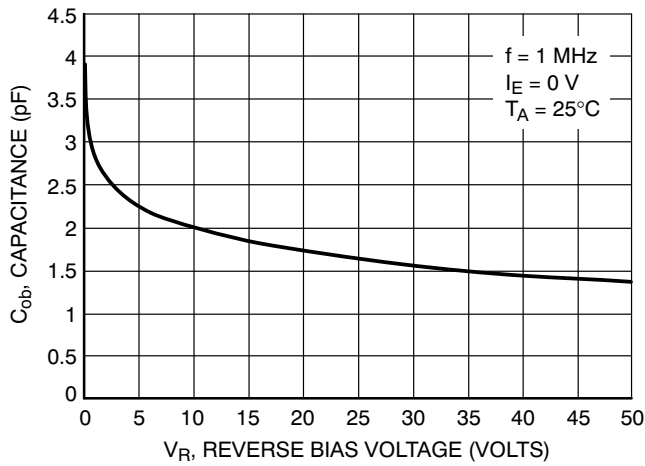


Figure 29. Output Capacitance

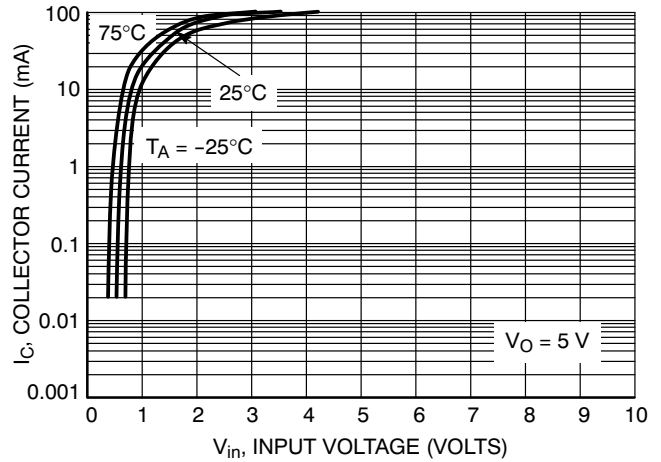


Figure 30. Output Current versus Input Voltage

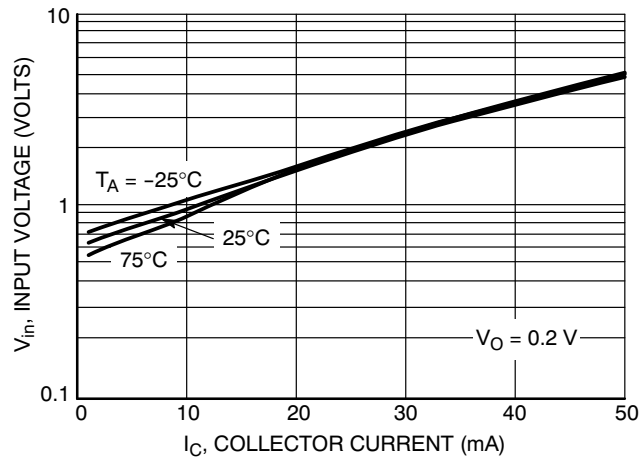


Figure 31. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MMUN2230LT1

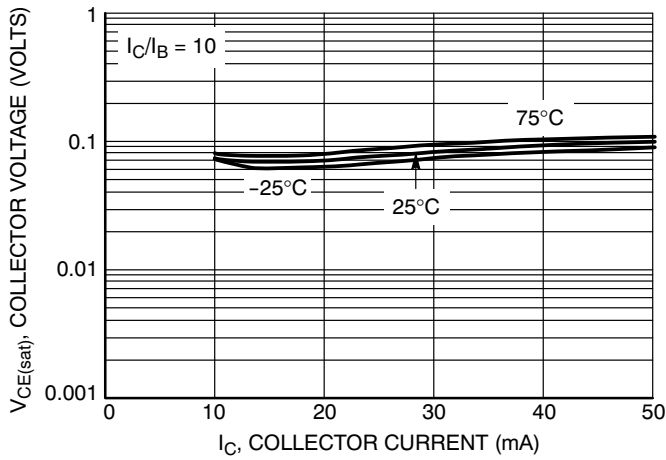


Figure 32. $V_{CE(sat)}$ versus I_C

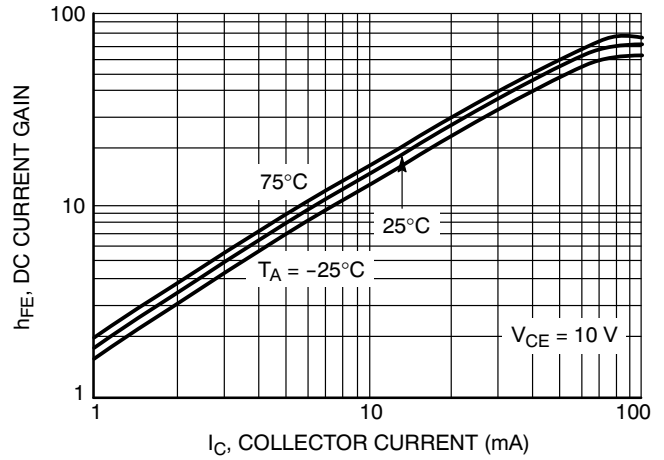


Figure 33. DC Current Gain

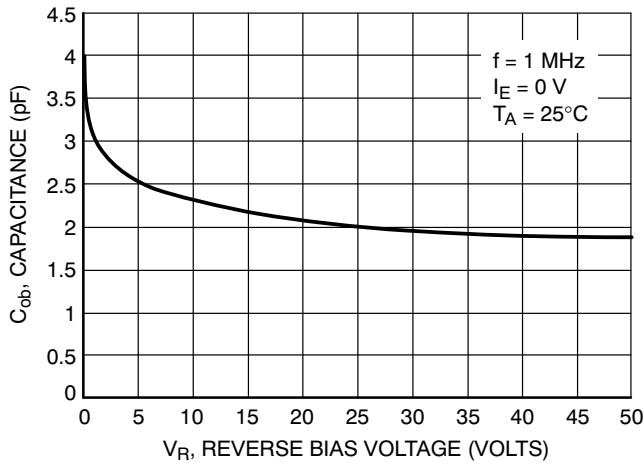


Figure 34. Output Capacitance

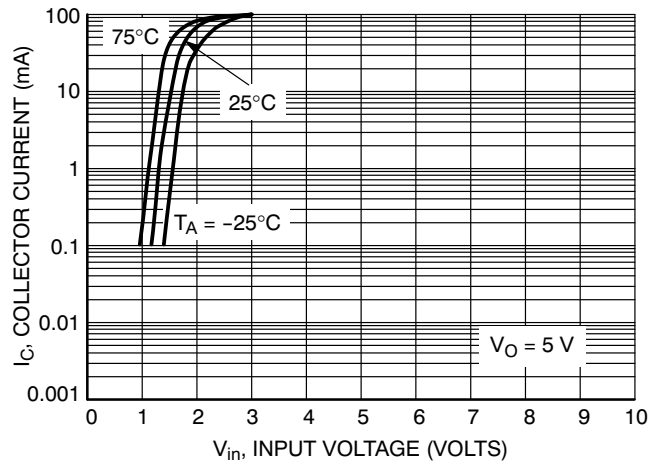


Figure 35. Output Current versus Input Voltage

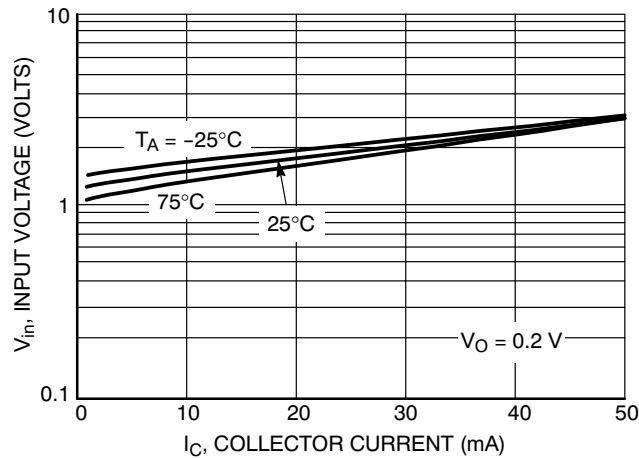


Figure 36. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MMUN2231LT1

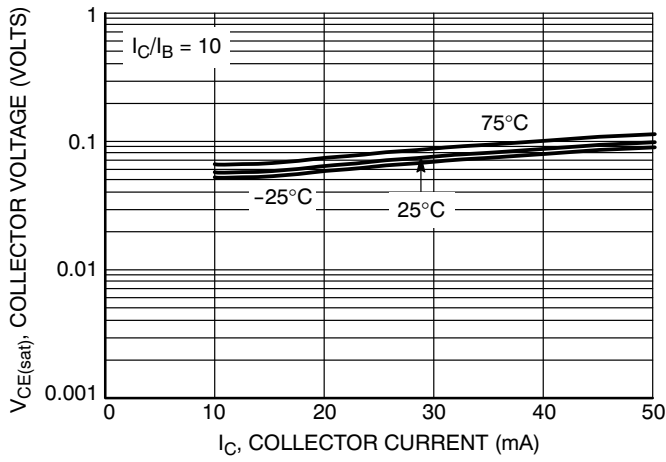


Figure 37. $V_{CE(sat)}$ versus I_C

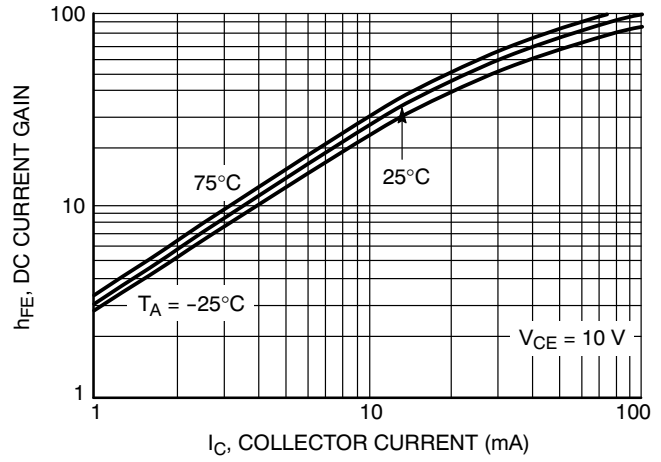


Figure 38. DC Current Gain

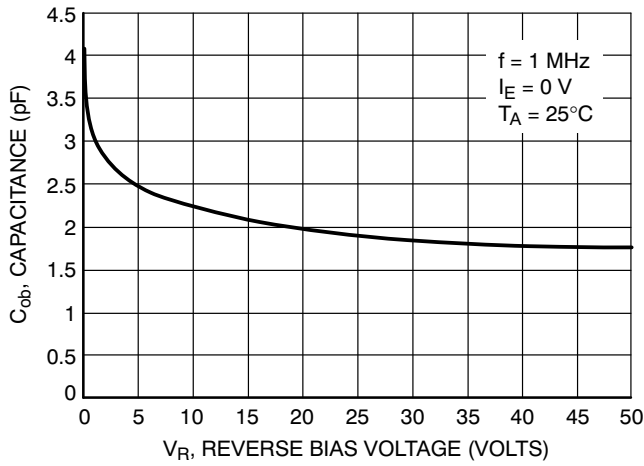


Figure 39. Output Capacitance

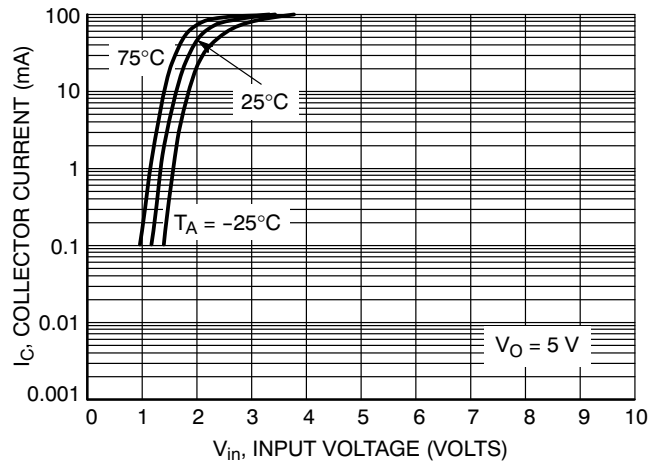


Figure 40. Output Current versus Input Voltage

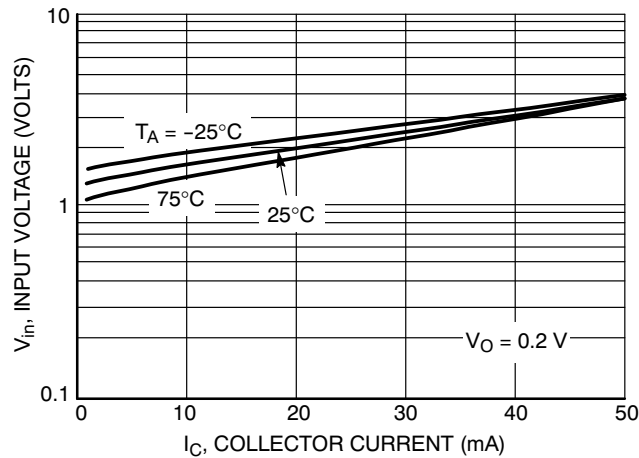


Figure 41. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MMUN2232LT1

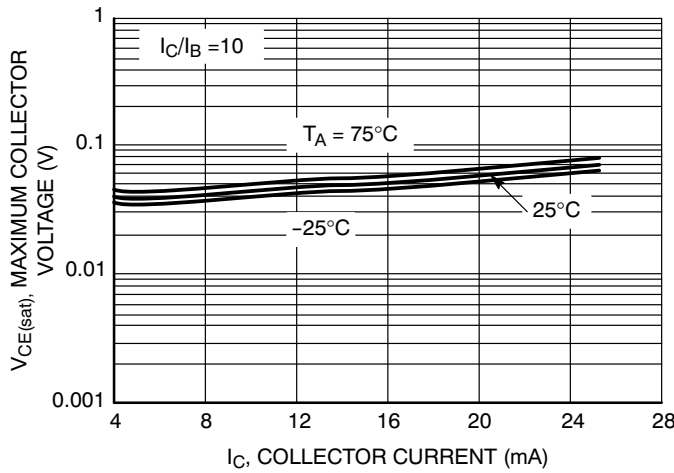


Figure 42. $V_{CE(sat)}$ vs. I_C

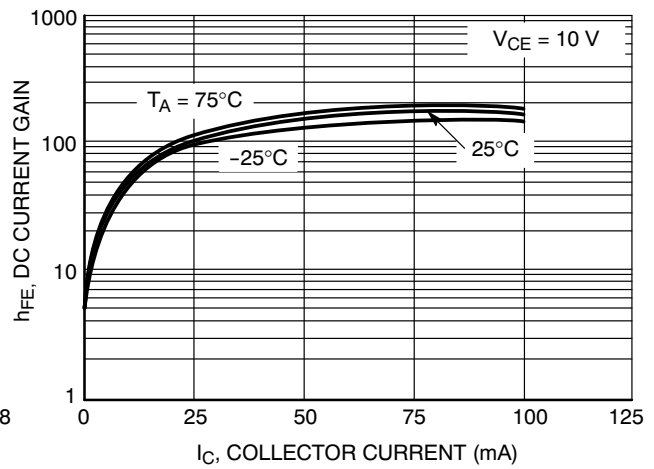


Figure 43. DC Current Gain

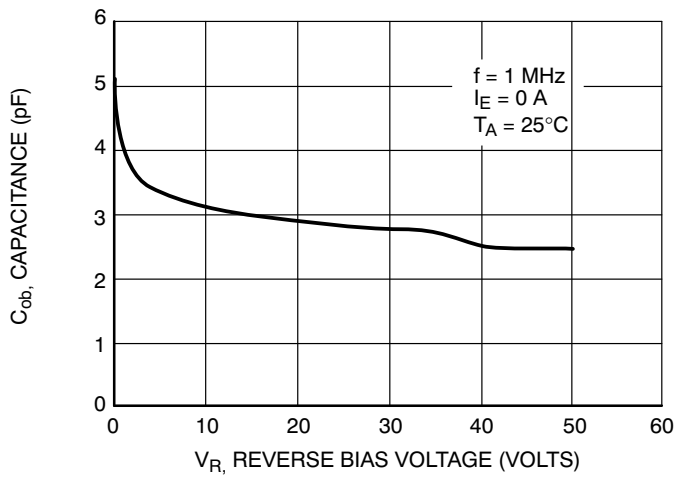


Figure 44. Output Capacitance

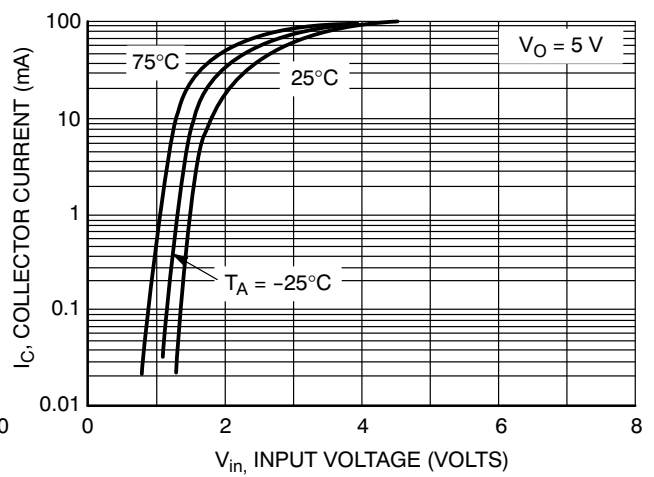


Figure 45. Output Current vs. Input Voltage

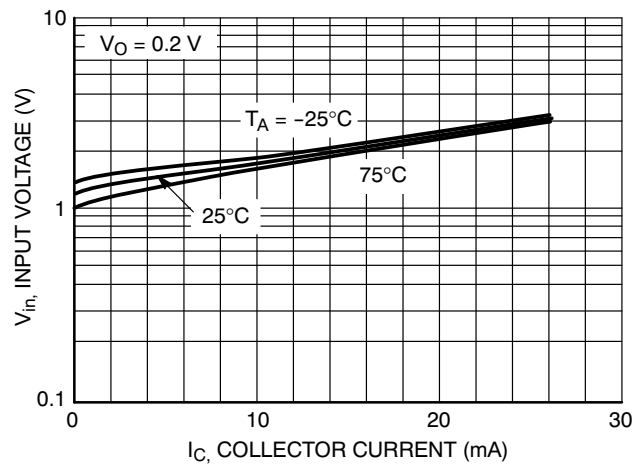


Figure 46. Output Voltage vs. Input Current

TYPICAL ELECTRICAL CHARACTERISTICS – MMUN2233LT1

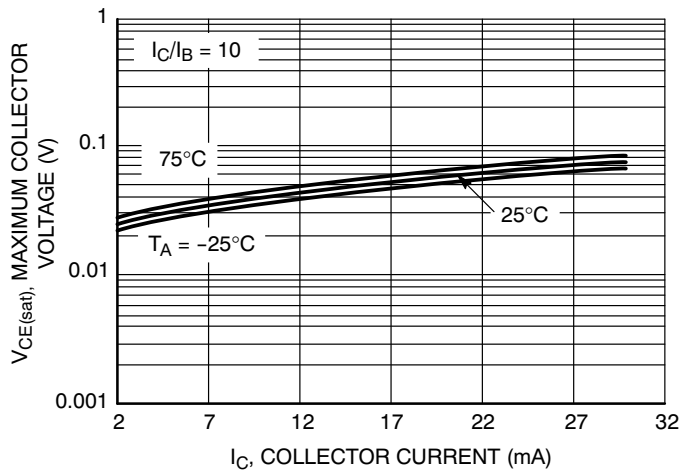


Figure 47. $V_{CE(sat)}$ vs. I_C

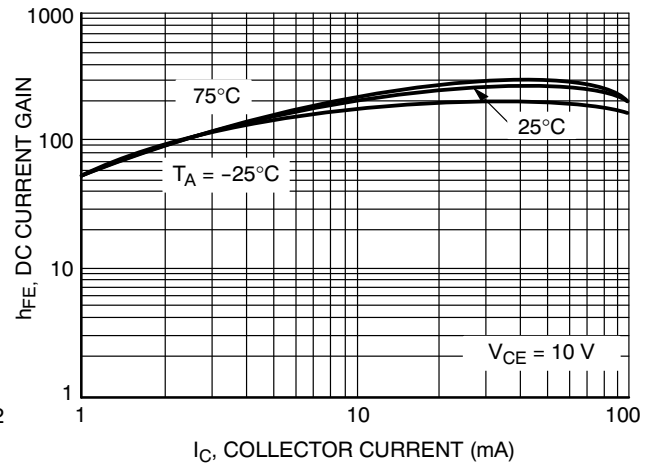


Figure 48. DC Current Gain

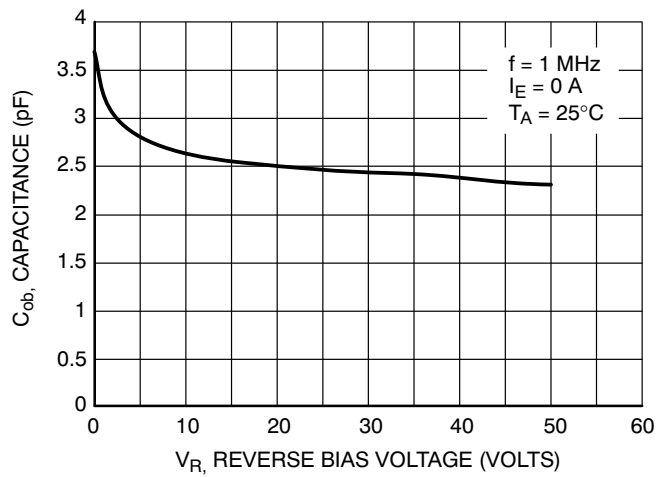


Figure 49. Output Capacitance

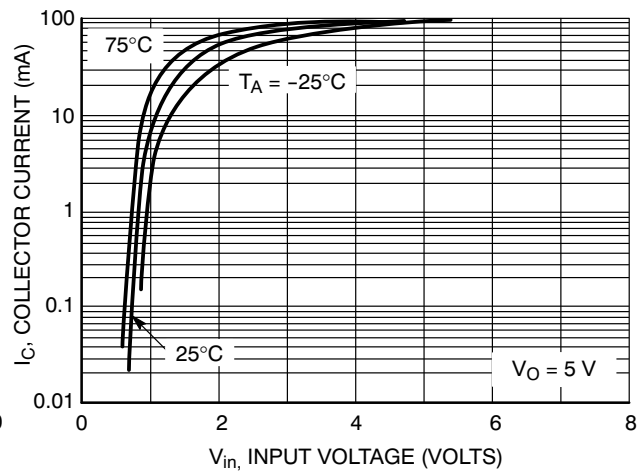


Figure 50. Output Current vs. Input Voltage

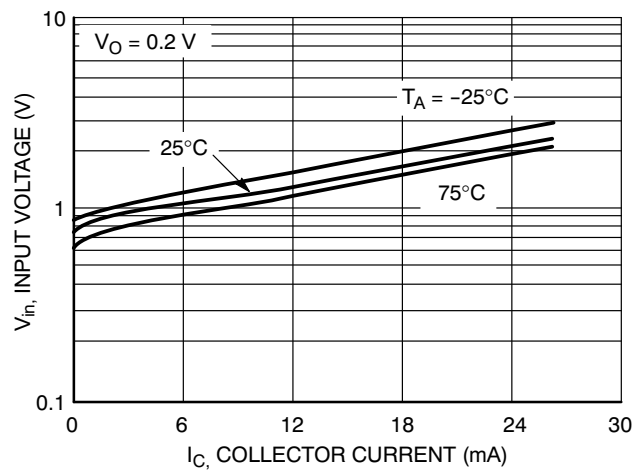


Figure 51. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MMUN2234LT1

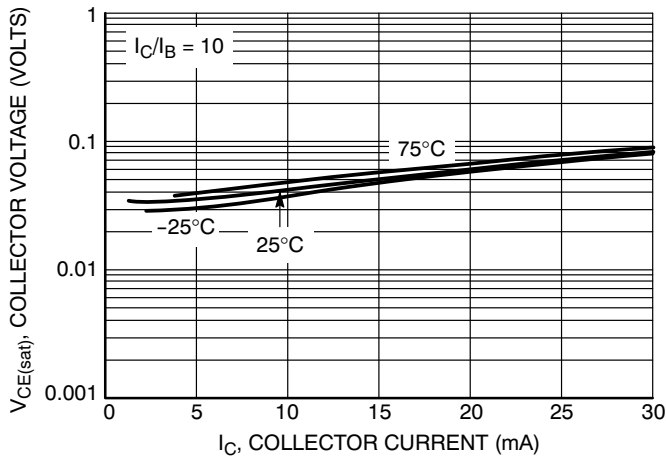


Figure 52. $V_{CE(sat)}$ versus I_C

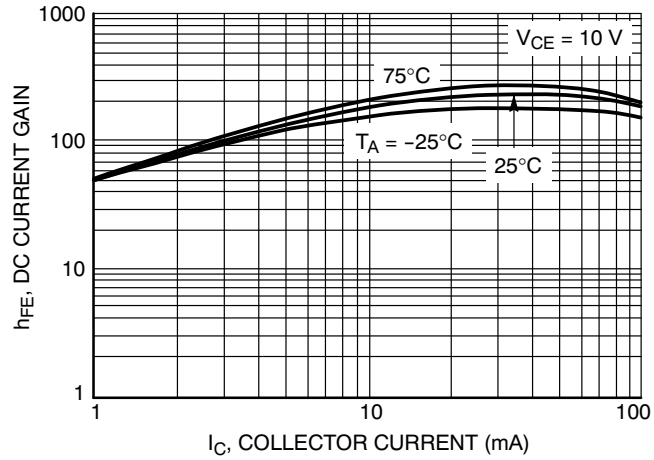
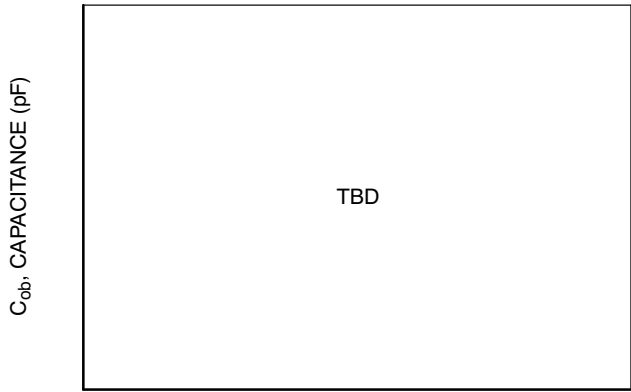
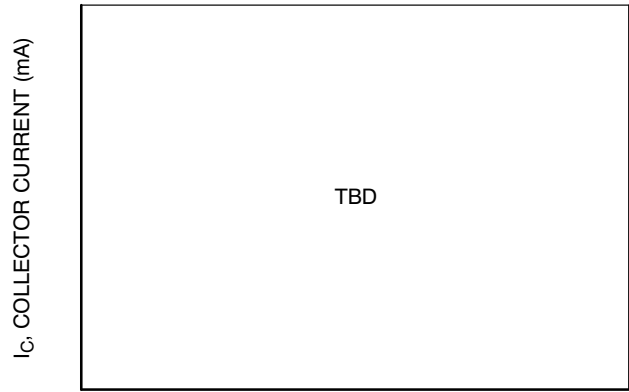


Figure 53. DC Current Gain



V_R , REVERSE BIAS VOLTAGE (VOLTS)

Figure 54. Output Capacitance



V_{in} , INPUT VOLTAGE (VOLTS)

Figure 55. Output Current versus Input Voltage

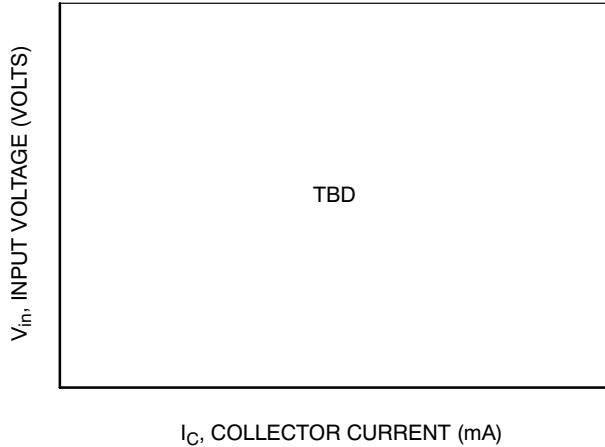


Figure 56. Input Voltage versus Output Current

MMUN2211LT1 Series

TYPICAL APPLICATIONS FOR NPN BRTs

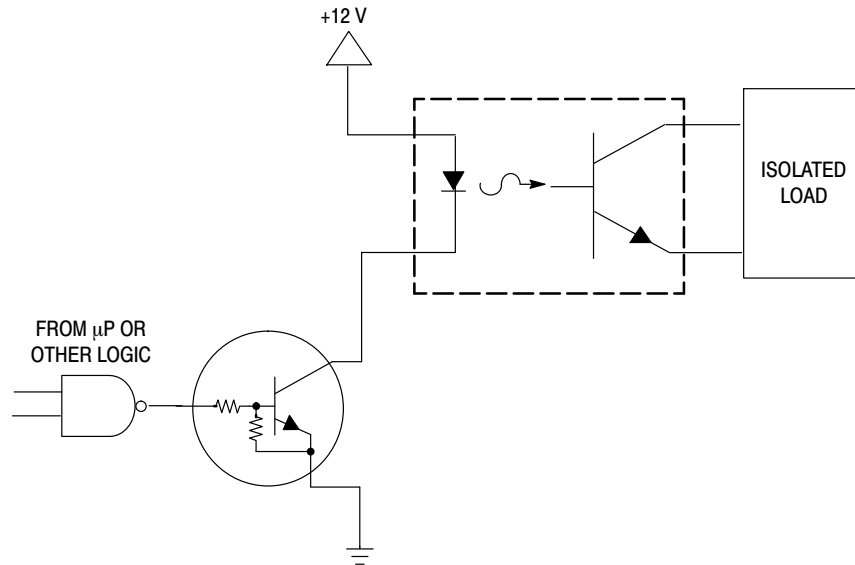


Figure 57. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

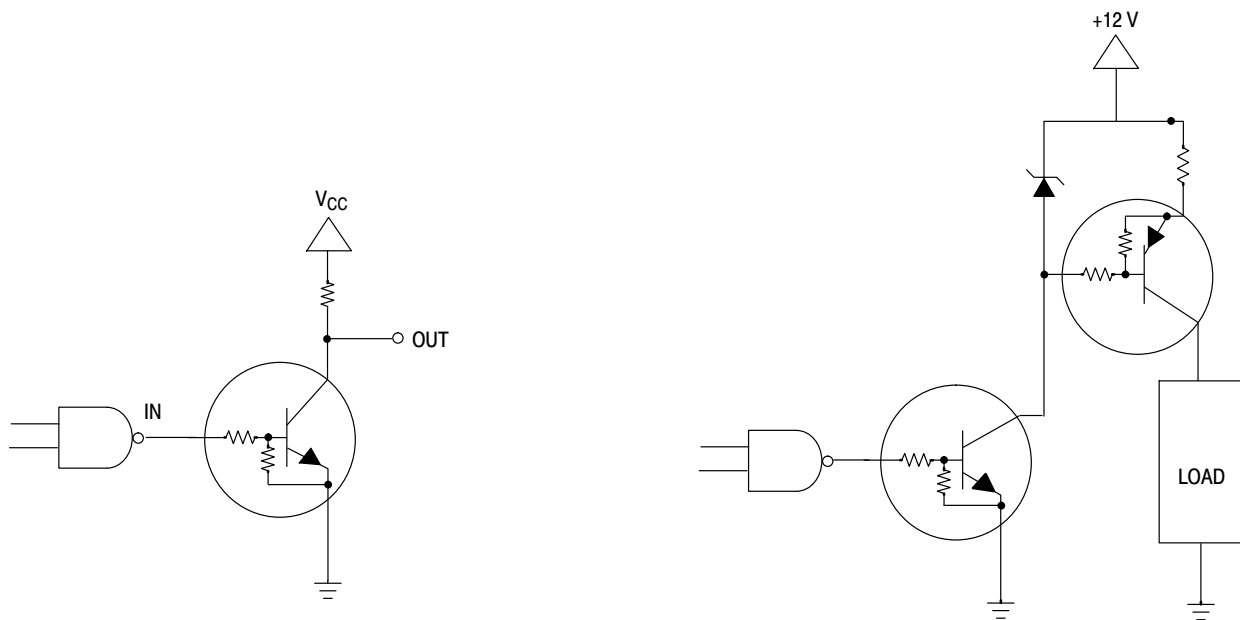


Figure 58. Open Collector Inverter: Inverts the Input Signal

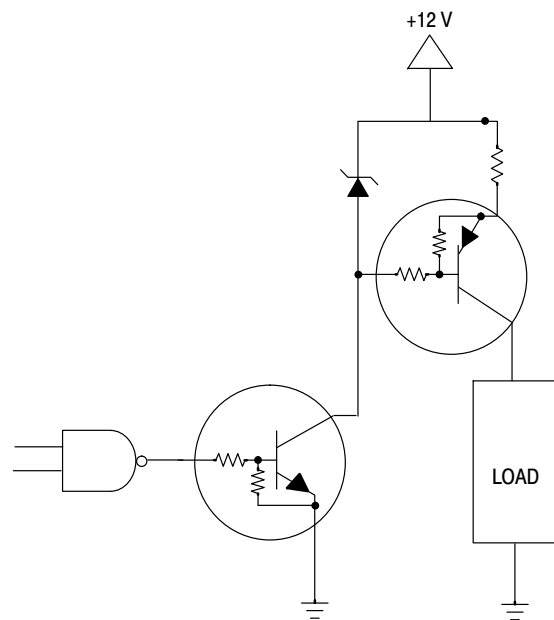


Figure 59. Inexpensive, Unregulated Current Source

MMUN2211LT1 Series

ORDERING INFORMATION

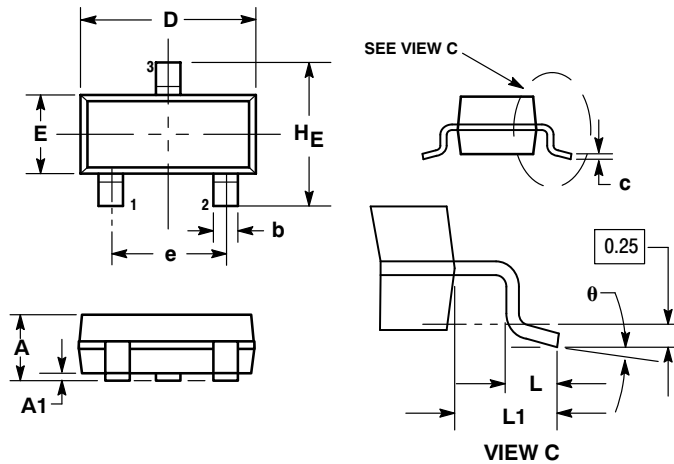
Device	Marking	R1(k)	R2(k)	Package	Shipping [†]
MMUN2211LT1	A8A	10	10	SOT-23	3000 / Tape & Reel
MMUN2211LT1G		10	10	SOT-23 (Pb-Free)	
MMUN2211LT3		10	10	SOT-23	10,000 / Tape & Reel
MMUN2211LT3G		10	10	SOT-23 (Pb-Free)	
MMUN2212LT1	A8B	22	22	SOT-23	3000 / Tape & Reel
MMUN2212LT1G		22	22	SOT-23 (Pb-Free)	
MMUN2213LT1	A8C	47	47	SOT-23	
MMUN2213LT1G		47	47	SOT-23 (Pb-Free)	
MMUN2214LT1	A8D	10	47	SOT-23	
MMUN2214LT1G		10	47	SOT-23 (Pb-Free)	
MMUN2215LT1	A8E	10	∞	SOT-23	
MMUN2215LT1G		10	∞	SOT-23 (Pb-Free)	
MMUN2216LT1	A8F	4.7	∞	SOT-23	
MMUN2216LT1G		4.7	∞	SOT-23 (Pb-Free)	
MMUN2230LT1	A8G	1.0	1.0	SOT-23	
MMUN2230LT1G		1.0	1.0	SOT-23 (Pb-Free)	
MMUN2231LT1	A8H	2.2	2.2	SOT-23	
MMUN2231LT1G		2.2	2.2	SOT-23 (Pb-Free)	
MMUN2232LT1	A8J	4.7	4.7	SOT-23	
MMUN2232LT1G		4.7	4.7	SOT-23 (Pb-Free)	
MMUN2233LT1	A8K	4.7	47	SOT-23	
MMUN2233LT1G		4.7	47	SOT-23 (Pb-Free)	
MMUN2234LT1	A8L	22	47	SOT-23	
MMUN2234LT1G		22	47	SOT-23 (Pb-Free)	
MMUN2234LT3		22	47	SOT-23	10,000 / Tape & Reel
MMUN2234LT3G		22	47	SOT-23 (Pb-Free)	
MMUN2238LT1	A8R	2.2	∞	SOT-23	3000 / Tape & Reel
MMUN2238LT1G		2.2	∞	SOT-23 (Pb-Free)	
MMUN2241LT1	A8U	100	∞	SOT-23	
MMUN2241LT1G		100	∞	SOT-23 (Pb-Free)	

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MMUN2211LT1 Series

PACKAGE DIMENSIONS

SOT-23 (TO-236) CASE 318-08 ISSUE AN



NOTES:

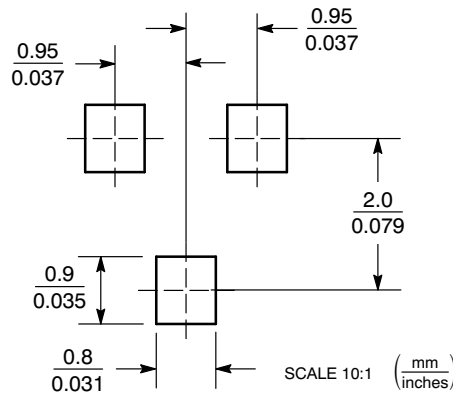
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
HE	2.10	2.40	2.64	0.083	0.094	0.104

STYLE 6:

- PIN 1. BASE
- EMITTER
- COLLECTOR

SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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