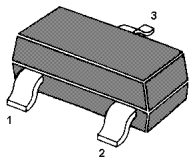
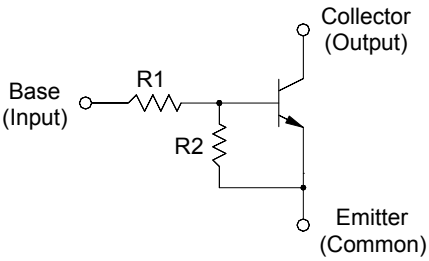
NPN Silicon Epitaxial Planar Transistor

for switching and interface circuit and
drive circuit applications



1.Base 2.Emitter 3.Collector
SOT-23 Plastic Package



Resistor Values

Type	Marking	R1 (K)	R2 (K)
MMUN2211	A8A	10	10
MMUN2212	A8B	22	22
MMUN2213	A8C	47	47
MMUN2214	A8D	10	47
MMUN2215	A8E	10	∞
MMUN2216	A8F	4.7	∞
MMUN2230	A8G	1	1
MMUN2231	A8H	2.2	2.2
MMUN2232	A8J	4.7	4.7
MMUN2233	A8K	4.7	47
MMUN2234	A8L	22	47
MMUN2235	A8M	2.2	47
MMUN2238	A8R	2.2	∞
MMUN2241	A8U	100	∞

Absolute Maximum Ratings (T_a = 25 °C)

Parameter	Symbol	Value	Unit
Collector Base Voltage	V_{CBO}	50	V
Collector Emitter Voltage	V_{CEO}	50	V
Collector Current	I_C	100	mA
Total Power Dissipation	P_{tot}	200	mW
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_S	- 55 to + 150	°C

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Characteristics at T_a = 25 °C

Parameter		Symbol	Min.	Max.	Unit
DC Current Gain					
at V_{CE} = 10 V, I_C = 5 mA	MMUN2211	h_{FE}	35	-	-
	MMUN2212	h_{FE}	60	-	-
	MMUN2213	h_{FE}	80	-	-
	MMUN2214	h_{FE}	80	-	-
	MMUN2215	h_{FE}	160	-	-
	MMUN2216	h_{FE}	160	-	-
	MMUN2230	h_{FE}	3	-	-
	MMUN2231	h_{FE}	8	-	-
	MMUN2232	h_{FE}	15	-	-
	MMUN2233	h_{FE}	80	-	-
	MMUN2234	h_{FE}	80	-	-
	MMUN2235	h_{FE}	80	-	-
	MMUN2238	h_{FE}	160	-	-
	MMUN2241	h_{FE}	160	-	-
Collector Base Cutoff Current at V_{CB} = 50 V		I_{CBO}	-	100	nA
Collector Emitter Cutoff Current at V_{CE} = 50 V		I_{CEO}	-	500	nA
Emitter Base Cutoff Current					
at V_{EB} = 6 V	MMUN2211	I_{EBO}	-	0.5	mA
	MMUN2212	I_{EBO}	-	0.2	mA
	MMUN2213	I_{EBO}	-	0.1	mA
	MMUN2214	I_{EBO}	-	0.2	mA
	MMUN2215	I_{EBO}	-	0.9	mA
	MMUN2216	I_{EBO}	-	1.9	mA
	MMUN2230	I_{EBO}	-	4.3	mA
	MMUN2231	I_{EBO}	-	2.3	mA
	MMUN2232	I_{EBO}	-	1.5	mA
	MMUN2233	I_{EBO}	-	0.18	mA
	MMUN2234	I_{EBO}	-	0.13	mA
	MMUN2235	I_{EBO}	-	0.2	mA
	MMUN2238	I_{EBO}	-	4	mA
	MMUN2241	I_{EBO}	-	0.1	mA
Collector Base Breakdown Voltage at I_C = 10 μA		$V_{(BR)CBO}$	50	-	V
Collector Emitter Breakdown Voltage at I_C = 2 mA		$V_{(BR)CEO}$	50	-	V
Collector Emitter Saturation Voltage					
at I_C = 10 mA, I_B = 0.3 mA		V_{CEsat}	-	0.25	V
at I_C = 10 mA, I_B = 5 mA	MMUN2230	V_{CEsat}	-	0.25	V
	MMUN2231	V_{CEsat}	-	0.25	V
at I_C = 10 mA, I_B = 1 mA	MMUN2215	V_{CEsat}	-	0.25	V
	MMUN2216	V_{CEsat}	-	0.25	V
	MMUN2232	V_{CEsat}	-	0.25	V
	MMUN2233	V_{CEsat}	-	0.25	V
	MMUN2234	V_{CEsat}	-	0.25	V
	MMUN2235	V_{CEsat}	-	0.25	V
	MMUN2238	V_{CEsat}	-	0.25	V

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Characteristics at T_a = 25 °C

Parameter		Symbol	Min.	Max.	Unit
Output Voltage (on)					
at V_{CC} = 5 V, V_B = 2.5 V, R_L = 1 KΩ	MMUN2211	V_{OL}	-	0.2	V
	MMUN2212	V_{OL}	-	0.2	V
	MMUN2214	V_{OL}	-	0.2	V
	MMUN2215	V_{OL}	-	0.2	V
	MMUN2216	V_{OL}	-	0.2	V
	MMUN2230	V_{OL}	-	0.2	V
	MMUN2231	V_{OL}	-	0.2	V
	MMUN2232	V_{OL}	-	0.2	V
	MMUN2233	V_{OL}	-	0.2	V
	MMUN2234	V_{OL}	-	0.2	V
	MMUN2235	V_{OL}	-	0.2	V
	MMUN2238	V_{OL}	-	0.2	V
at V_{CC} = 5 V, V_B = 3.5 V, R_L = 1 KΩ	MMUN2213	V_{OL}	-	0.2	V
at V_{CC} = 5 V, V_B = 5 V, R_L = 1 KΩ	MMUN2241	V_{OL}	-	0.2	V
Output Voltage (off)					
at V_{CC} = 5 V, V_B = 0.5 V, R_L = 1 KΩ		V_{OH}	4.9	-	V
at V_{CC} = 5 V, V_B = 0.05 V, R_L = 1 KΩ	MMUN2230	V_{OH}	4.9	-	V
at V_{CC} = 5 V, V_B = 0.25 V, R_L = 1 KΩ	MMUN2215	V_{OH}	4.9	-	V
	MMUN2216	V_{OH}	4.9	-	V
	MMUN2233	V_{OH}	4.9	-	V
	MMUN2238	V_{OH}	4.9	-	V
Input Resistor	MMUN2211	R1	7	13	KΩ
	MMUN2212	R1	15.4	28.6	KΩ
	MMUN2213	R1	32.9	61.1	KΩ
	MMUN2214	R1	7	13	KΩ
	MMUN2215	R1	7	13	KΩ
	MMUN2216	R1	3.3	6.1	KΩ
	MMUN2230	R1	0.7	1.3	KΩ
	MMUN2231	R1	1.5	2.9	KΩ
	MMUN2232	R1	3.3	6.1	KΩ
	MMUN2233	R1	3.3	6.1	KΩ
	MMUN2234	R1	15.4	28.6	KΩ
	MMUN2235	R1	1.54	2.86	KΩ
	MMUN2238	R1	1.54	2.88	KΩ
	MMUN2241	R1	70	130	KΩ
Resistor Ratio	MMUN2211/MMUN2212/MMUN2213	R1/R2	0.8	1.2	-
	MMUN2214	R1/R2	0.17	0.25	-
	MMUN2215/MMUN2216/MMUN2238	R1/R2	-	-	-
	MMUN2241	R1/R2	-	-	-
	MMUN2230/MMUN2231/MMUN2232	R1/R2	0.8	1.2	-
	MMUN2233	R1/R2	0.055	0.185	-
	MMUN2234	R1/R2	0.38	0.56	-
	MMUN2235	R1/R2	0.038	0.056	-

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Typical Characteristics

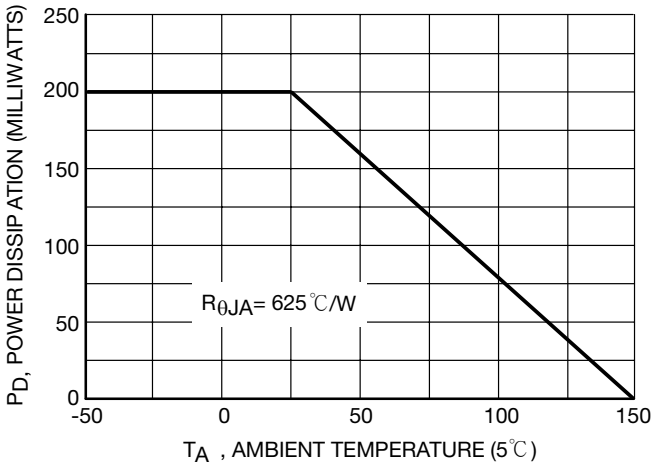


Figure 1. Derating Curve

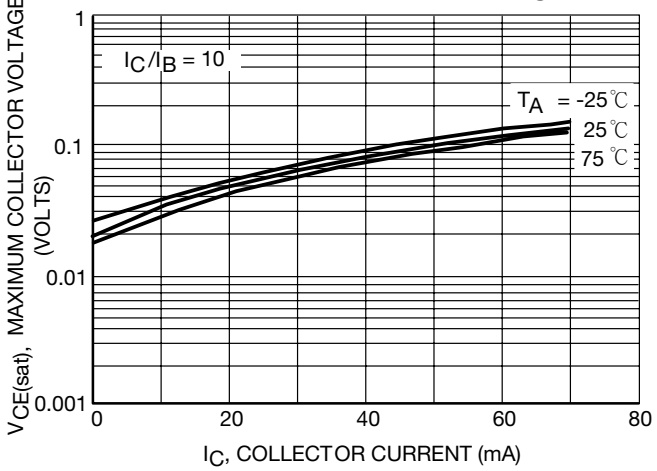


Figure 2. $V_{CE(sat)}$ vs. I_C

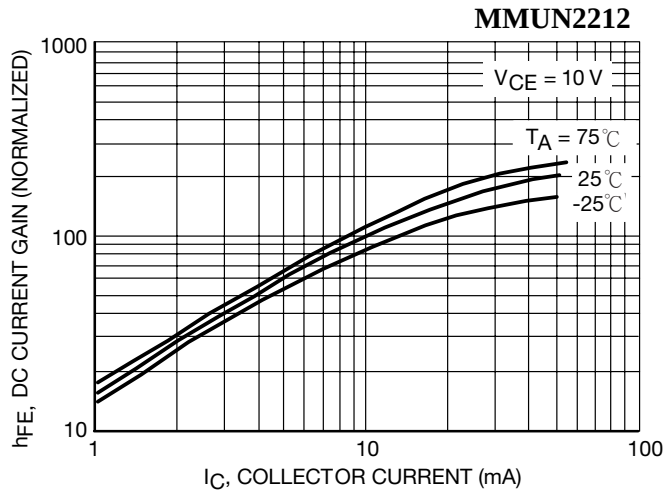


Figure 3. DC Current Gain

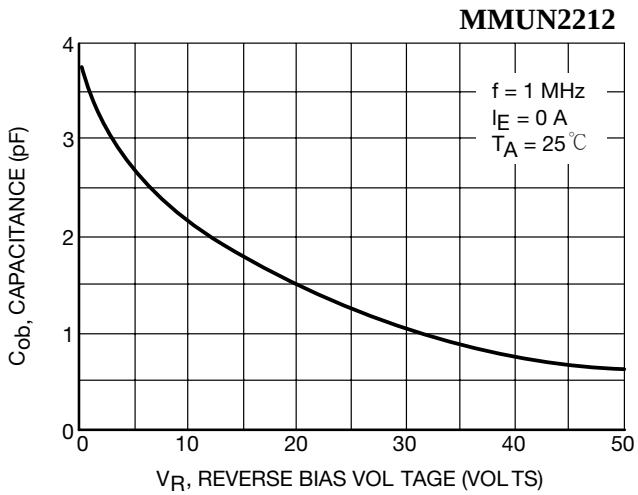


Figure 4. Output Capcitance

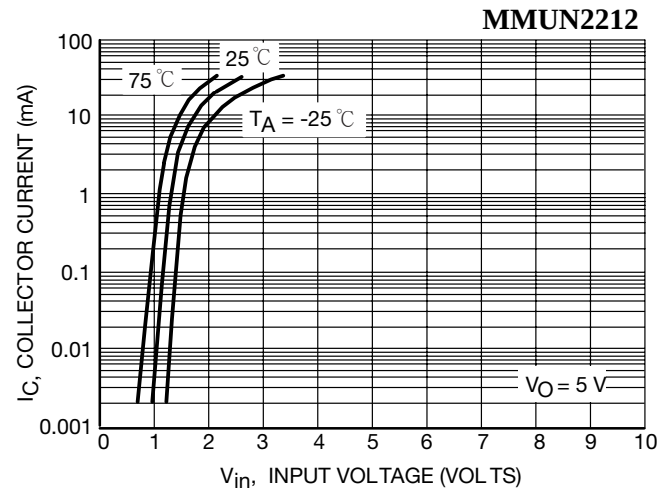


Figure 5. Output Current vs. Input Voltage

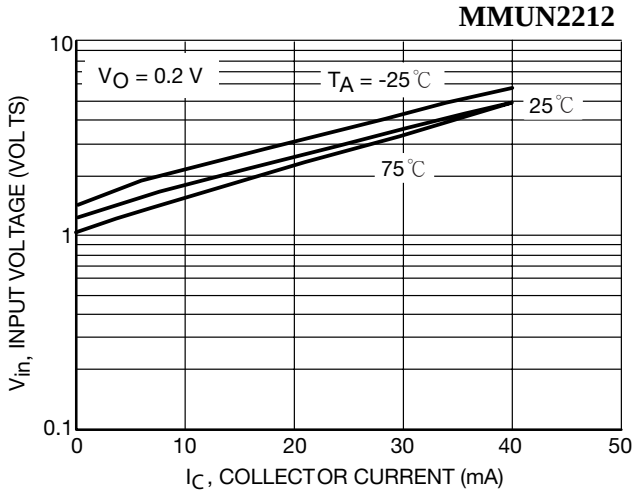


Figure 6. Input Voltage vs. Output Current

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Typical Characteristics

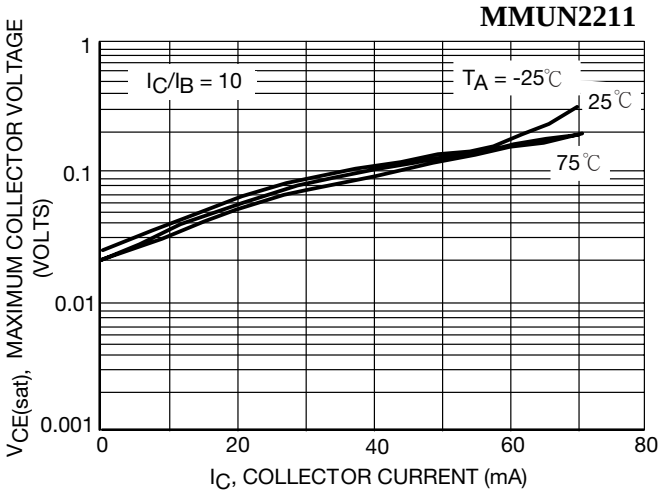


Figure 7. $V_{CE(sat)}$ vs. I_C

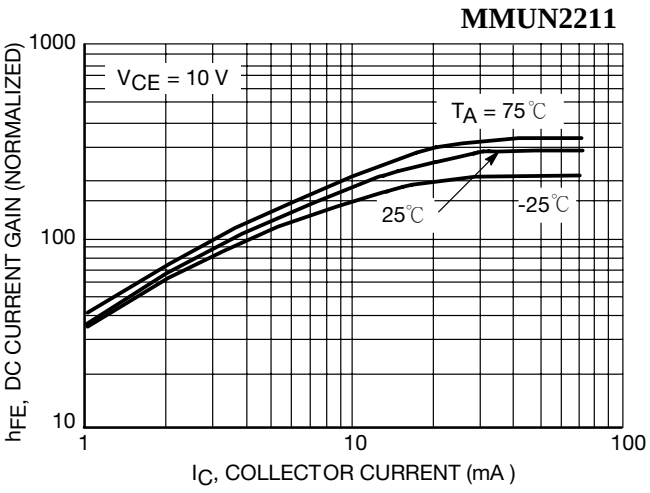


Figure 8. DC Current Gain

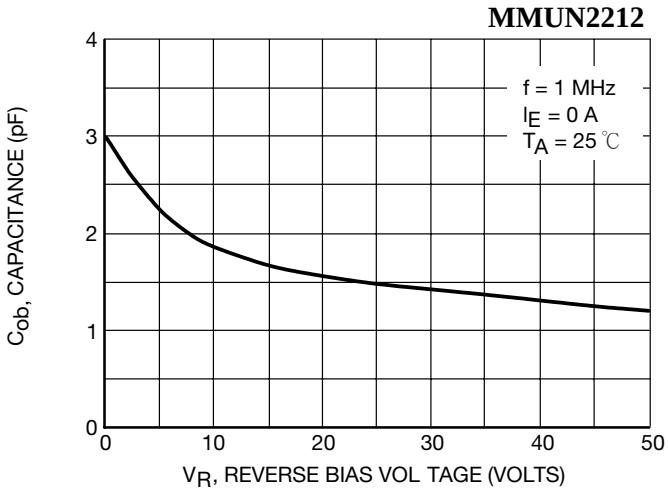


Figure 9. Output Capacitance

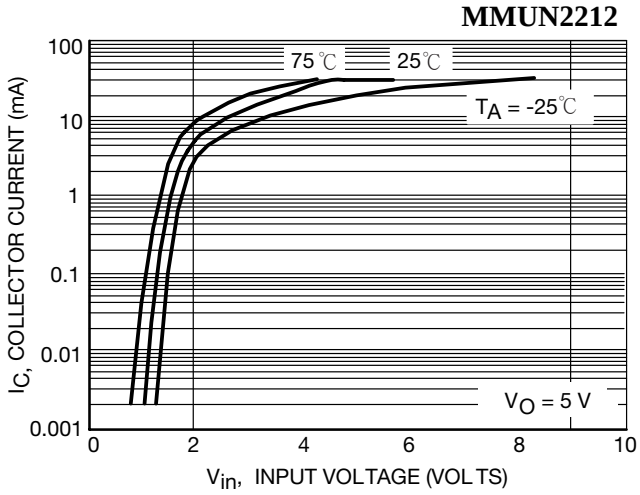


Figure 10. Output Current vs. Input Voltage

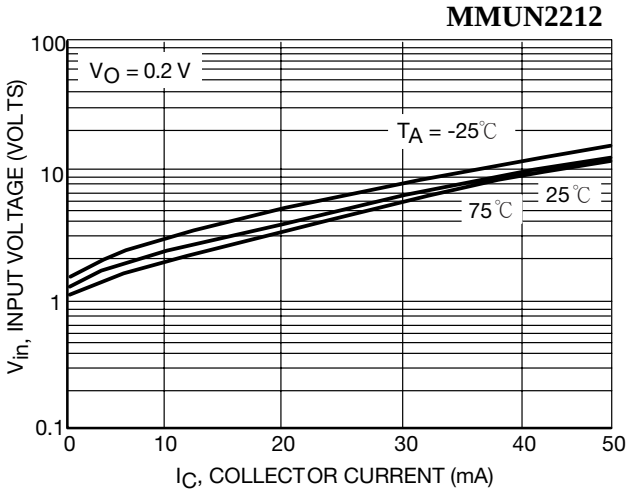


Figure 11. Input V oltage vs. Output Current

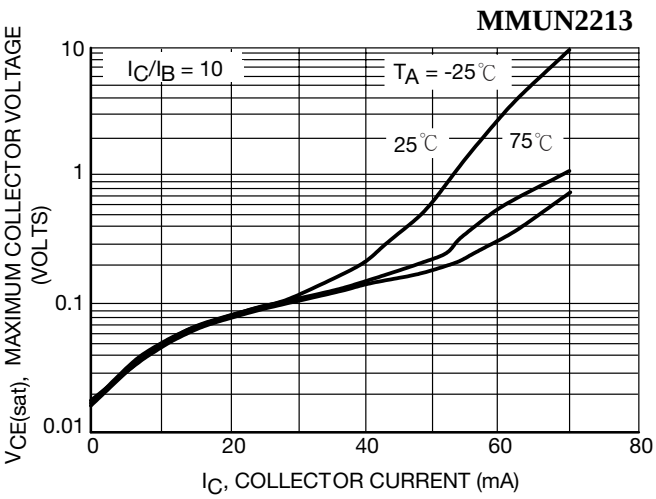


Figure 12. $V_{CE(sat)}$ vs. I_C

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Typical Characteristics

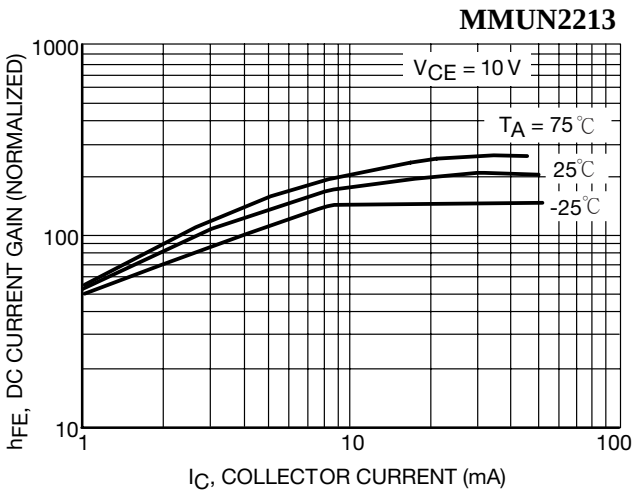


Figure 13. DC Current Gain

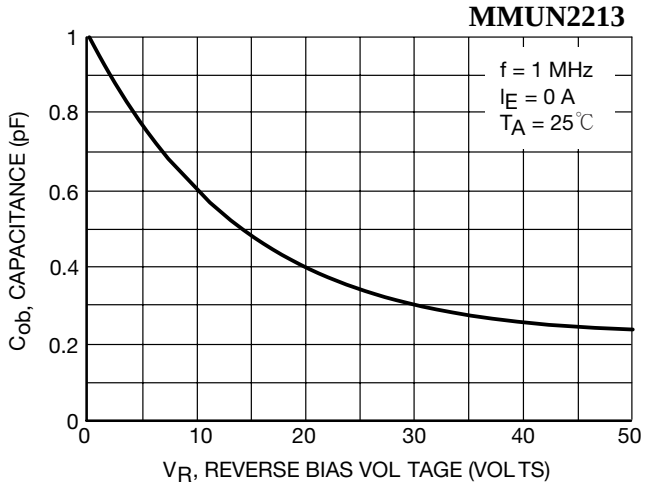


Figure 14. Output Capacitance

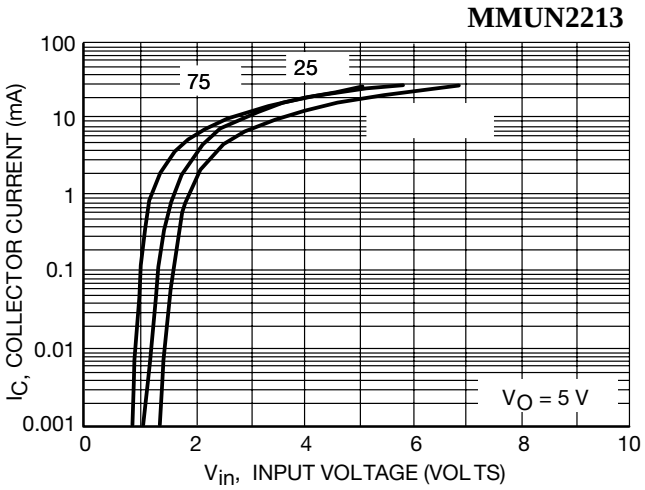


Figure 15. Output Current vs. Input Voltage

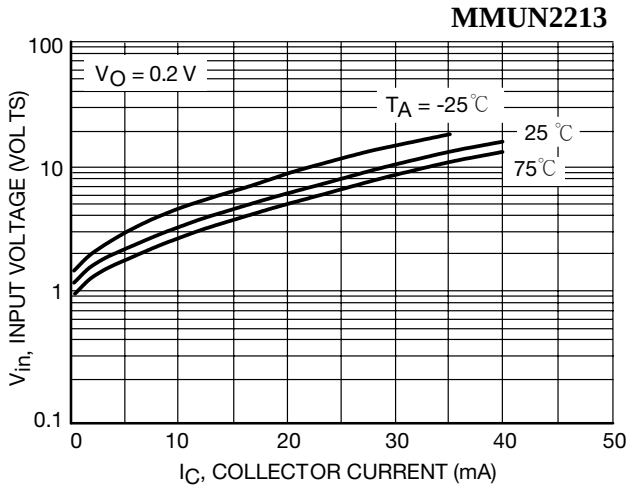


Figure 16. Input Voltage vs. Output Current

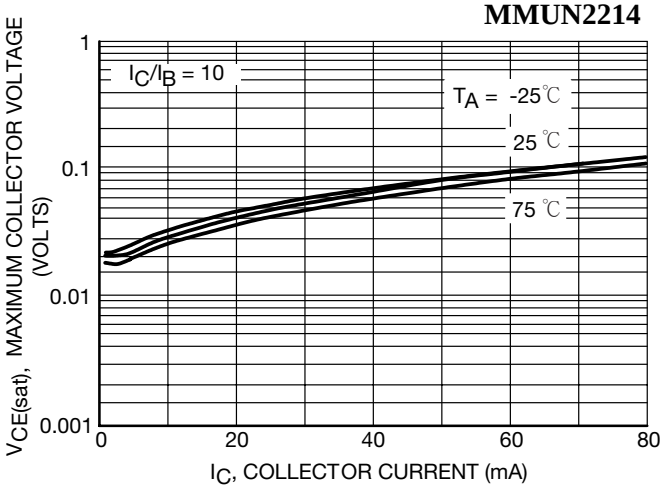


Figure 17. $V_{CE(sat)}$ vs. I_C

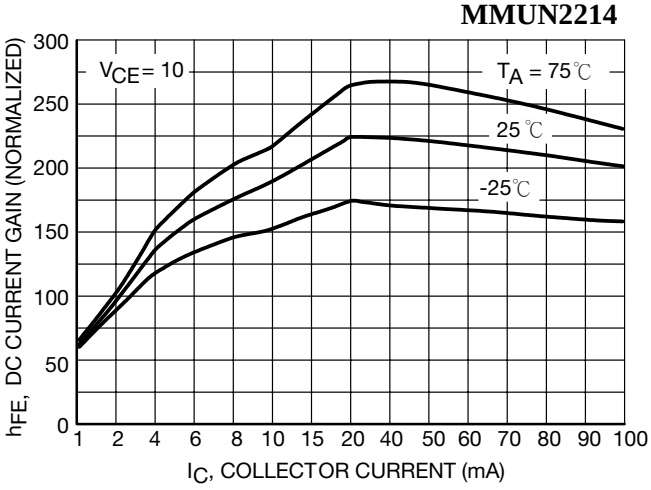


Figure 18. DC Current Gain

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Typical Characteristics

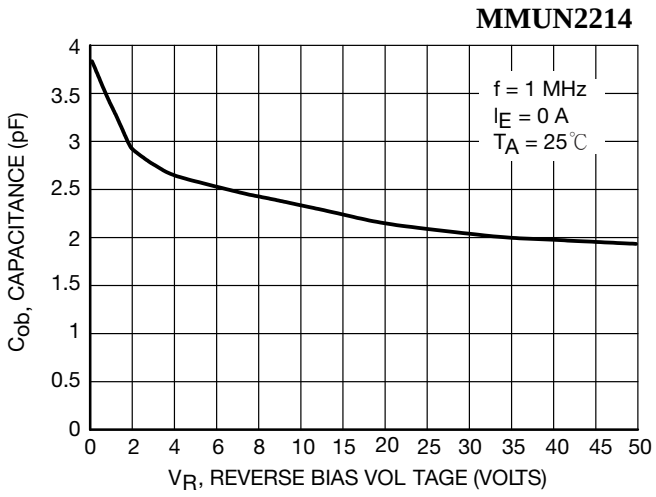


Figure 19. Output Capacitance

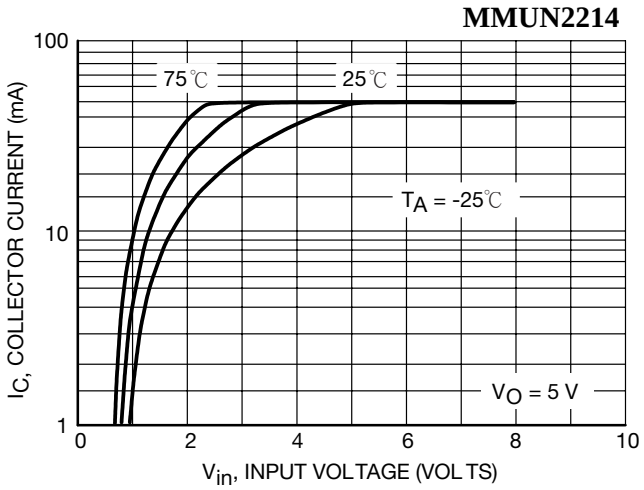


Figure 20. Output Current vs. Input Voltage

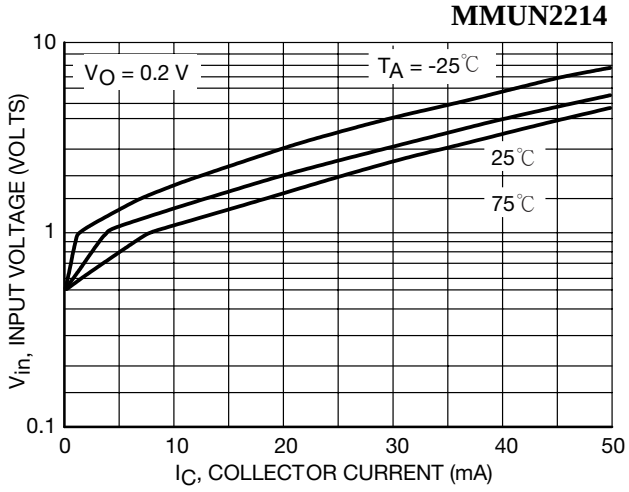


Figure 21. Input Voltage vs. Output Current

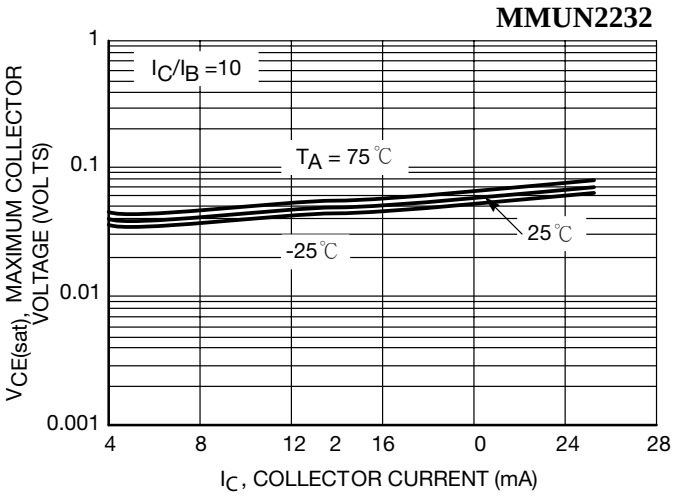


Figure 22. $V_{CE(sat)}$ vs. I_C

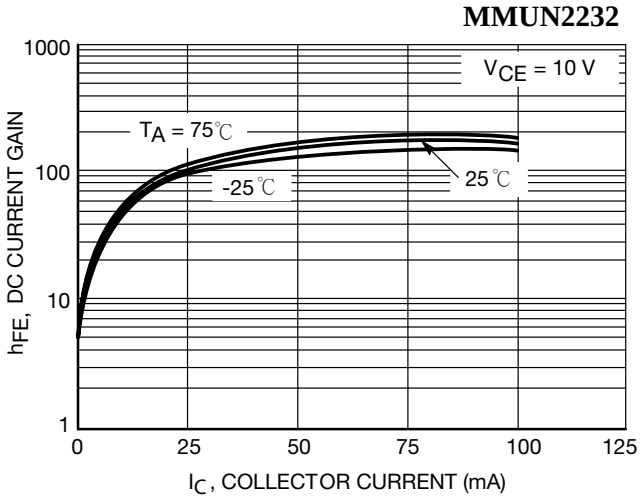


Figure 23. DC Current Gain

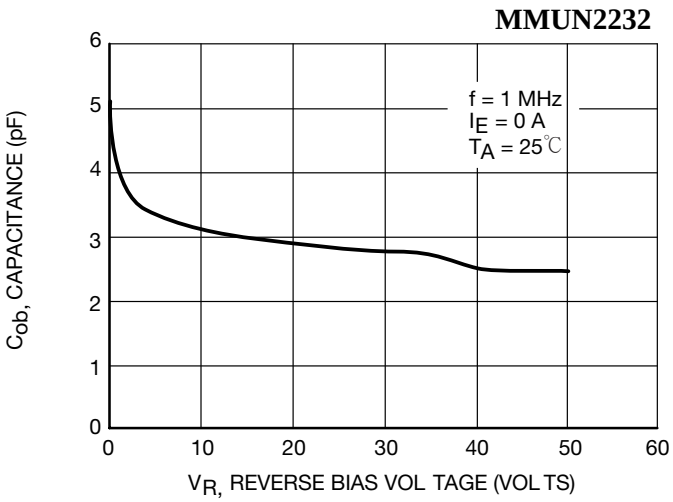


Figure 24. Output Capacitance

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Typical Characteristics

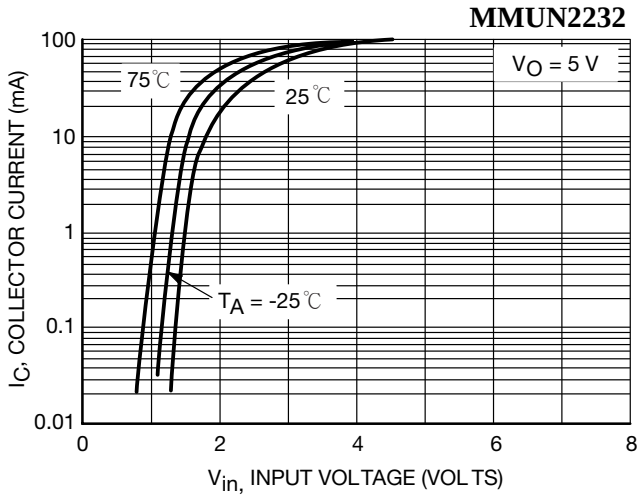


Figure 25. Output Current vs. Input Voltage

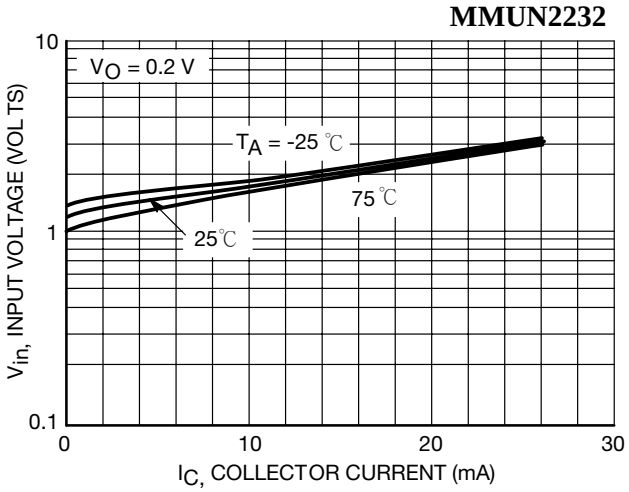


Figure 26. Output Voltage vs. Input Current

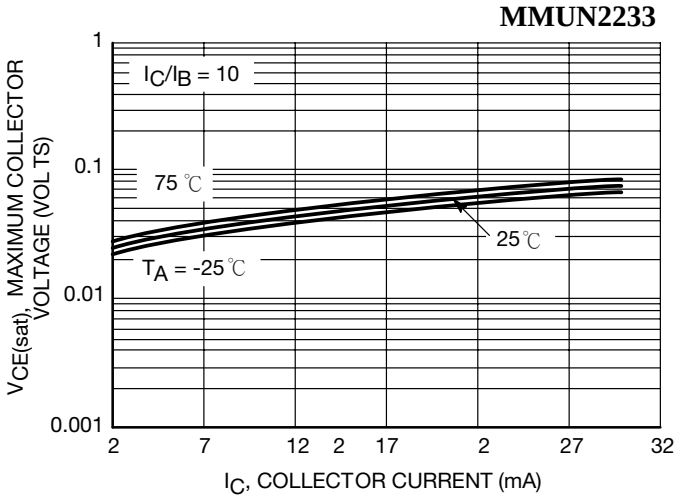


Figure 27. $V_{CE(sat)}$ vs. I_C

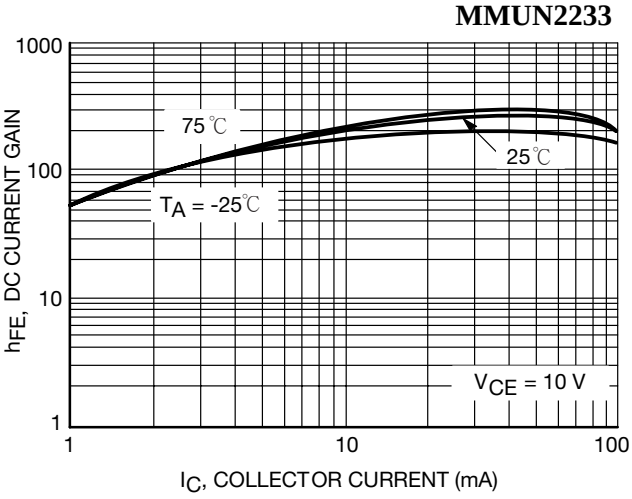


Figure 28. DC Current Gain

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