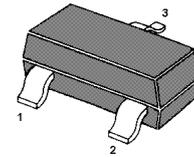


## NPN Silicon Epitaxial Planar Transistor

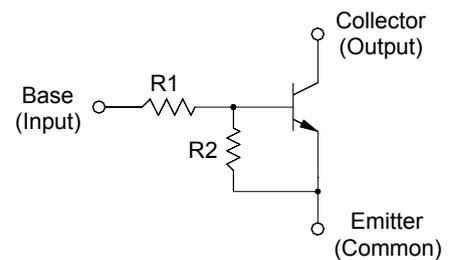
for switching and interface circuit and drive circuit applications

### 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	∞



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



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

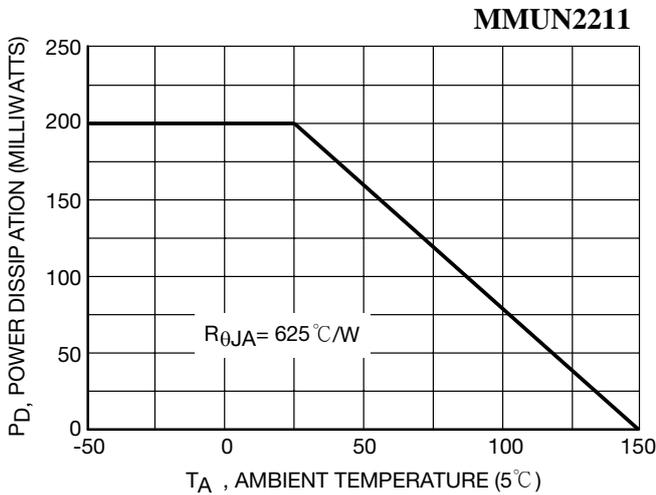
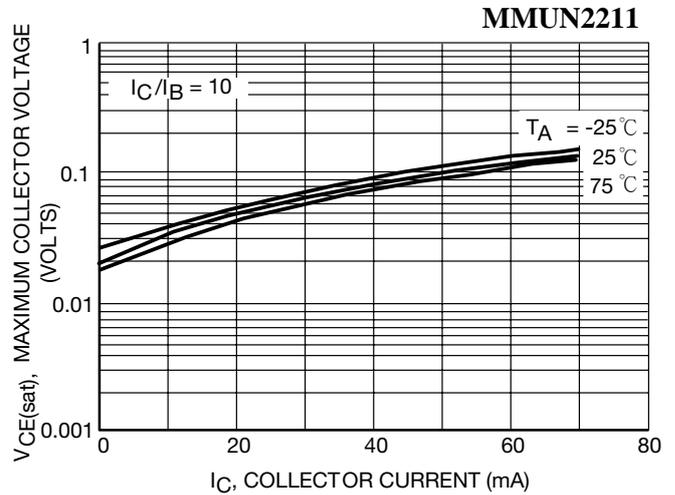
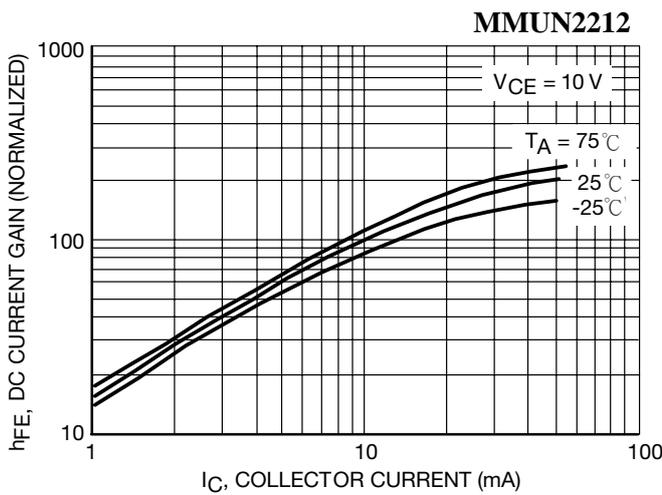
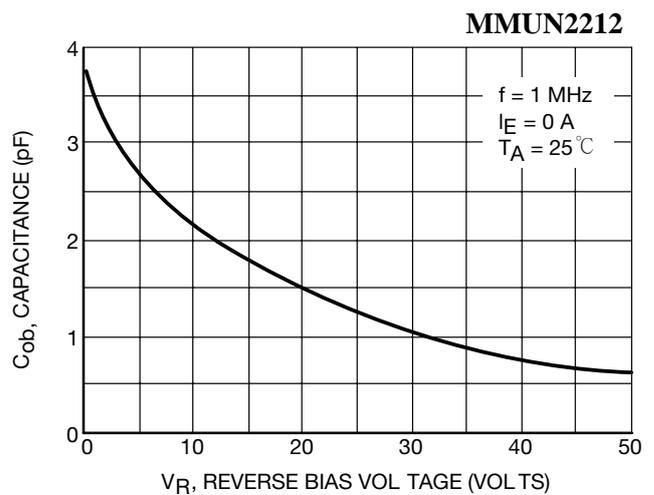
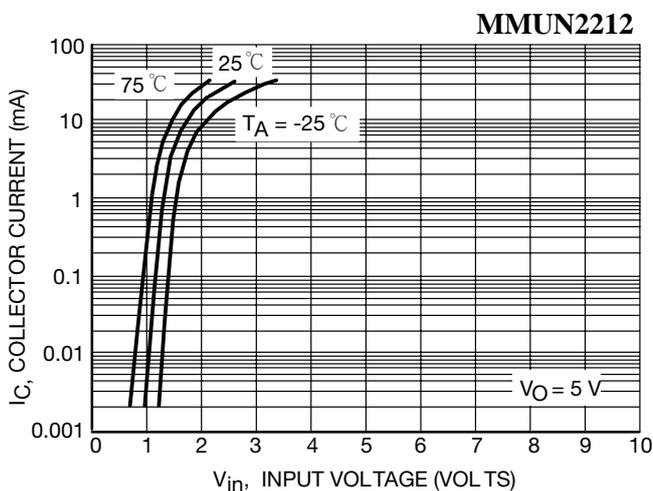
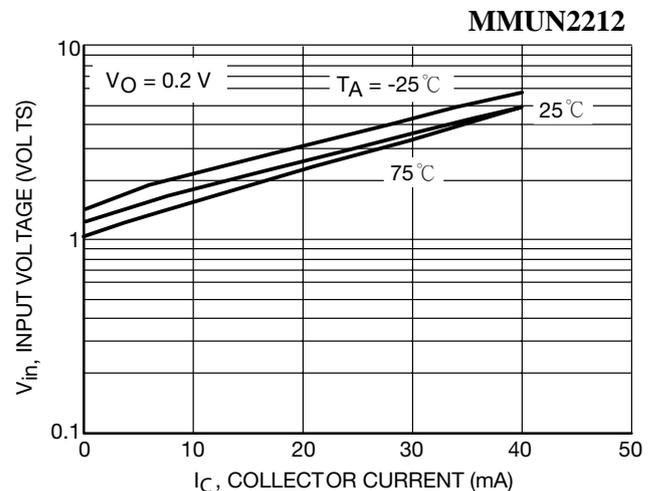
Parameter	Symbol	Value	Unit
Collector Base Voltage	$V_{CBO}$	50	V
Collector Emitter Voltage	$V_{CEO}$	50	V
Collector Current	$I_C$	100	mA
Total Power Dissipation	$P_{tot}$	200	mW
Junction Temperature	$T_j$	150	$^\circ\text{C}$
Storage Temperature Range	$T_s$	- 55 to + 150	$^\circ\text{C}$

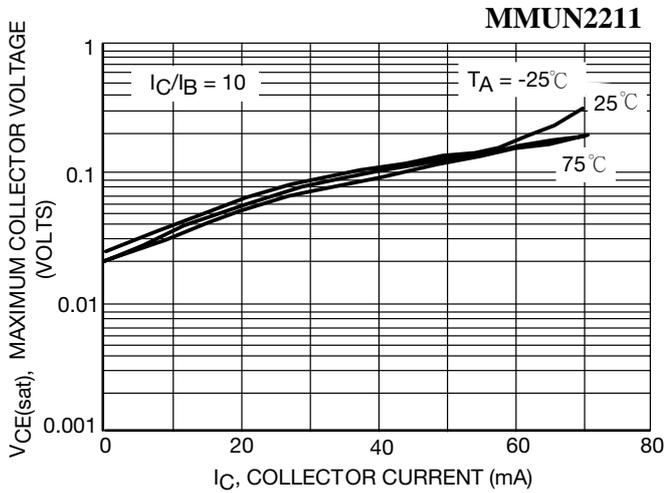
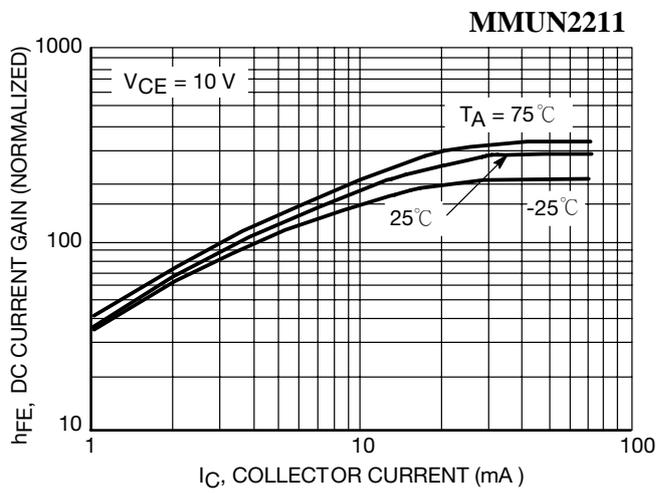
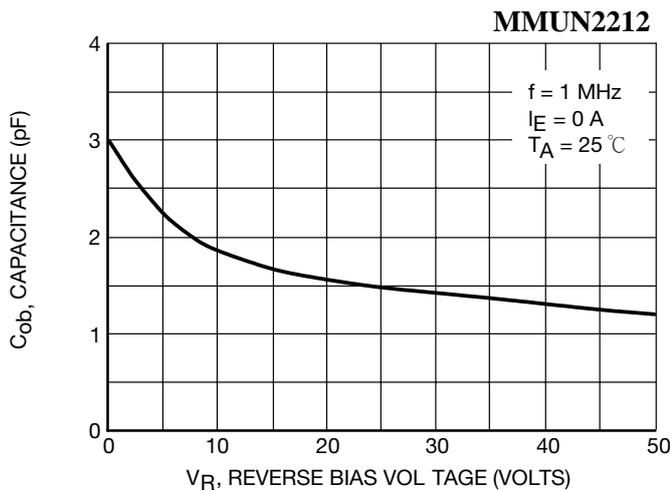
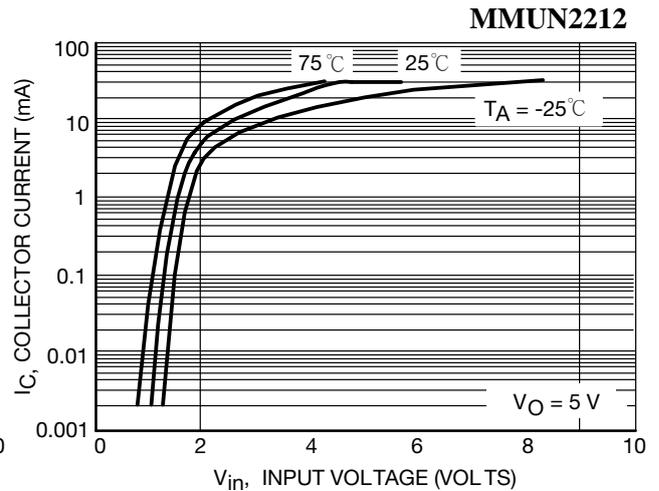
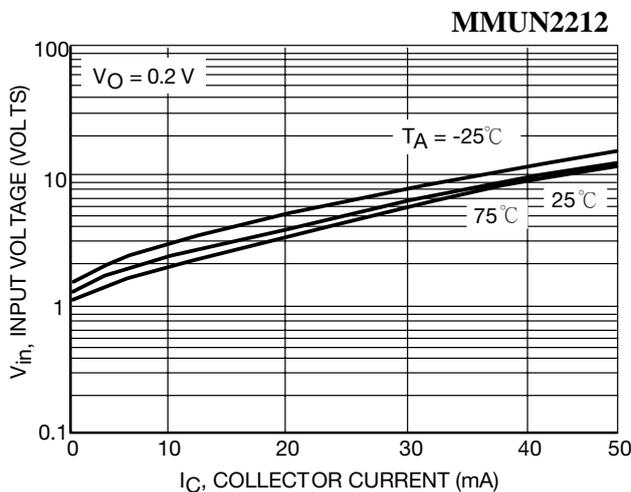
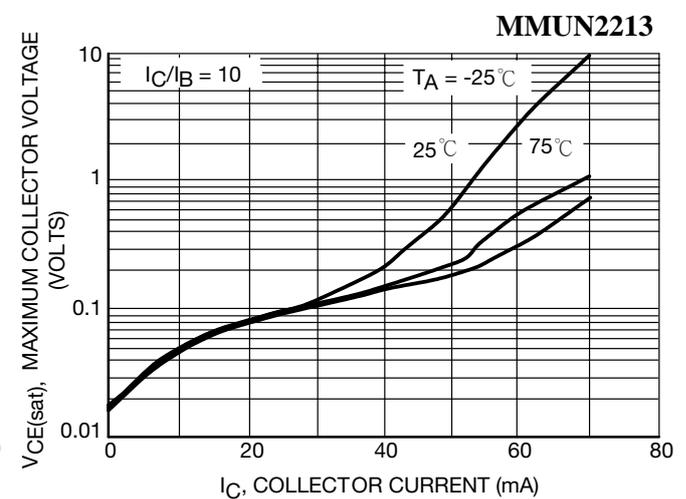
**Characteristics at  $T_a = 25\text{ }^\circ\text{C}$** 

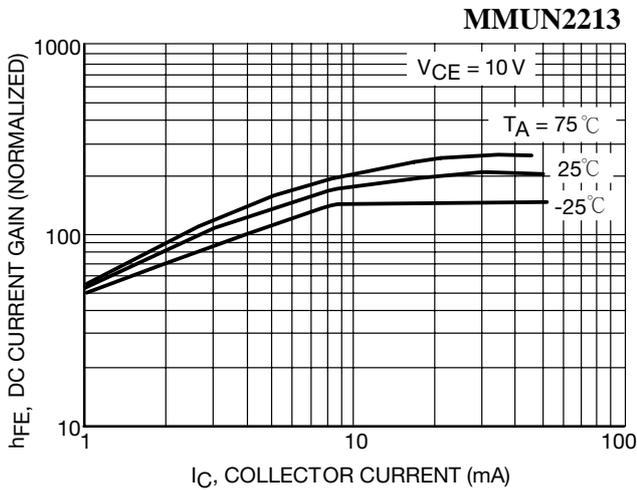
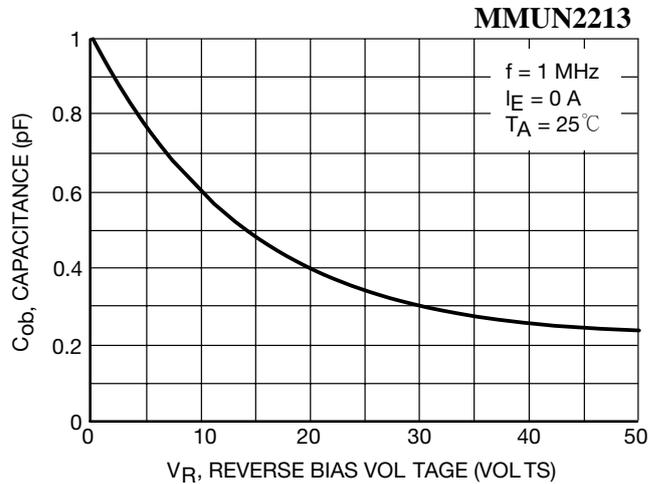
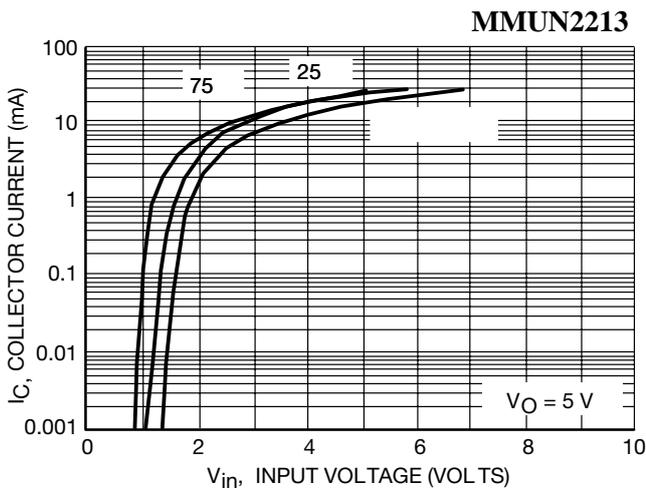
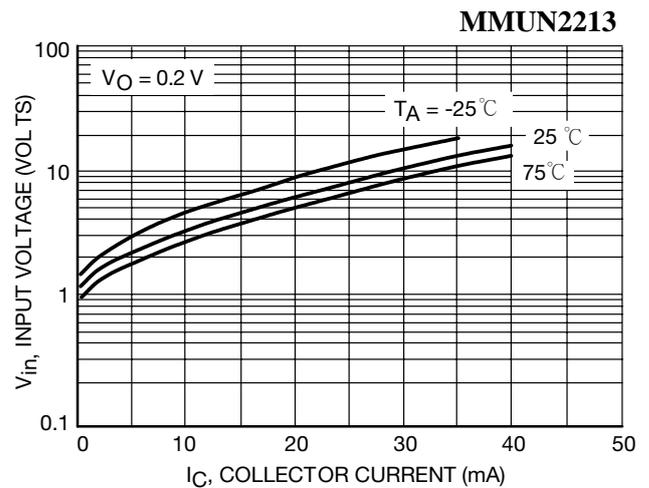
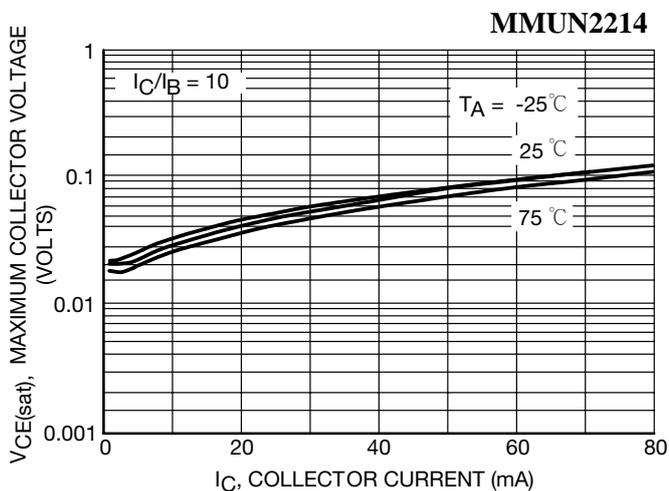
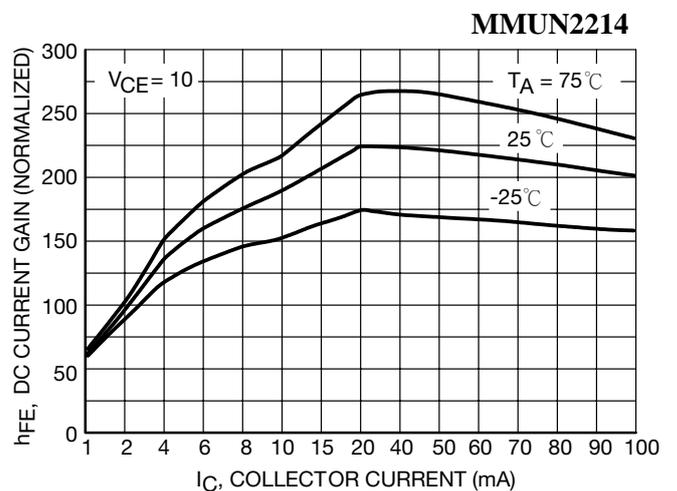
Parameter	Symbol	Min.	Max.	Unit	
DC Current Gain at $V_{CE} = 10\text{ V}$ , $I_C = 5\text{ mA}$	MMUN2211	$h_{FE}$	35	-	-
	MMUN2212	$h_{FE}$	60	-	-
	MMUN2213	$h_{FE}$	80	-	-
	MMUN2214	$h_{FE}$	80	-	-
	MMUN2215	$h_{FE}$	160	-	-
	MMUN2216	$h_{FE}$	160	-	-
	MMUN2230	$h_{FE}$	3	-	-
	MMUN2231	$h_{FE}$	8	-	-
	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 $V_{CB} = 50\text{ V}$	$I_{CBO}$	-	100	nA
Collector Emitter Cutoff Current at $V_{CE} = 50\text{ V}$	$I_{CEO}$	-	500	nA	
Emitter Base Cutoff Current at $V_{EB} = 6\text{ V}$	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 $I_C = 10\text{ }\mu\text{A}$	$V_{(BR)CBO}$	50	-	V	
Collector Emitter Breakdown Voltage at $I_C = 2\text{ mA}$	$V_{(BR)CEO}$	50	-	V	
Collector Emitter Saturation Voltage at $I_C = 10\text{ mA}$ , $I_B = 0.3\text{ mA}$ at $I_C = 10\text{ mA}$ , $I_B = 5\text{ mA}$  at $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$	MMUN2230	$V_{CEsat}$	-	0.25	V
	MMUN2231	$V_{CEsat}$	-	0.25	V
	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
	MMUN2238	$V_{CEsat}$	-	0.25	V

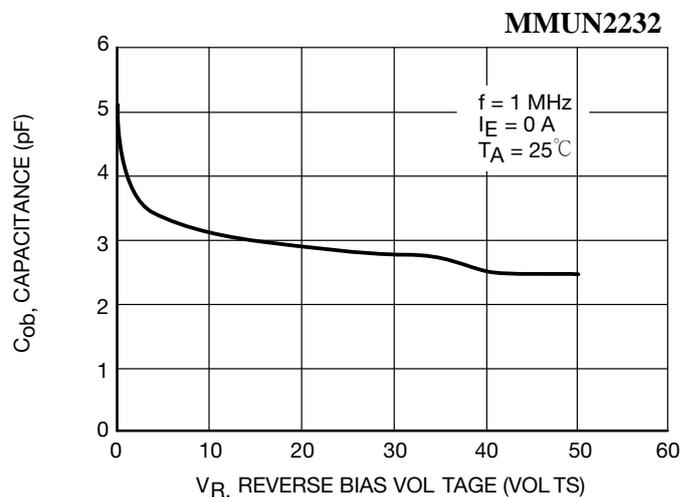
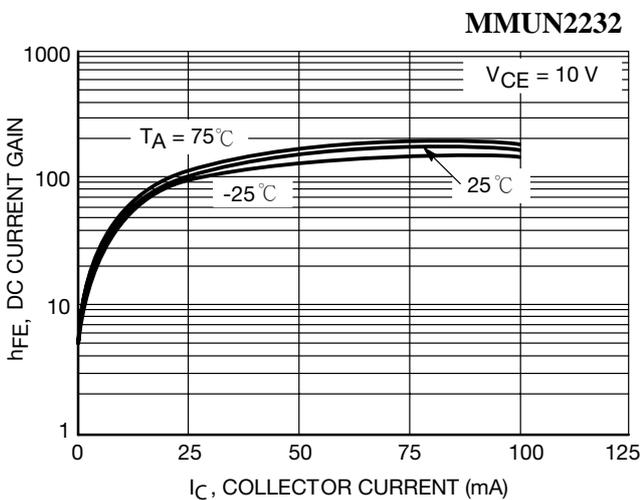
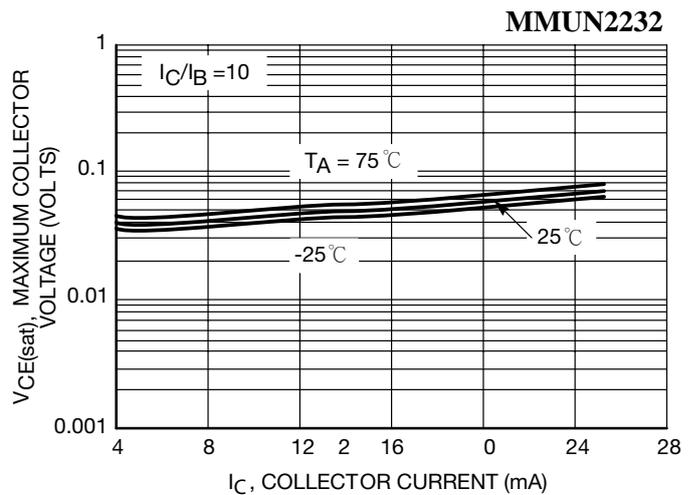
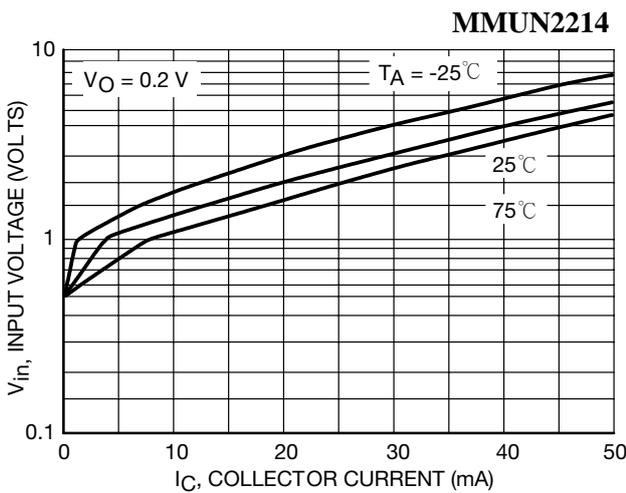
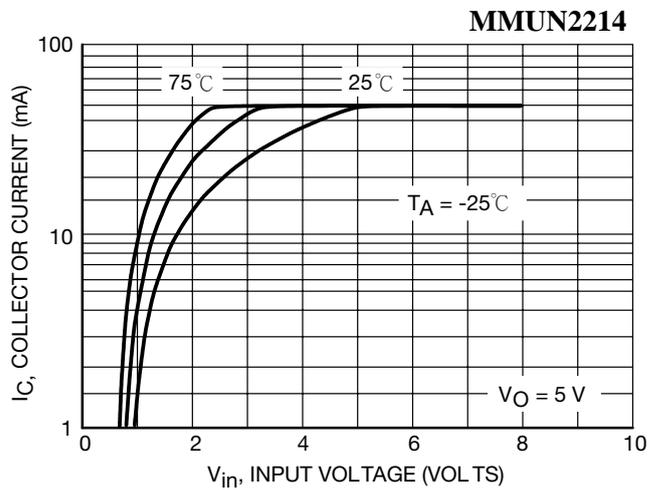
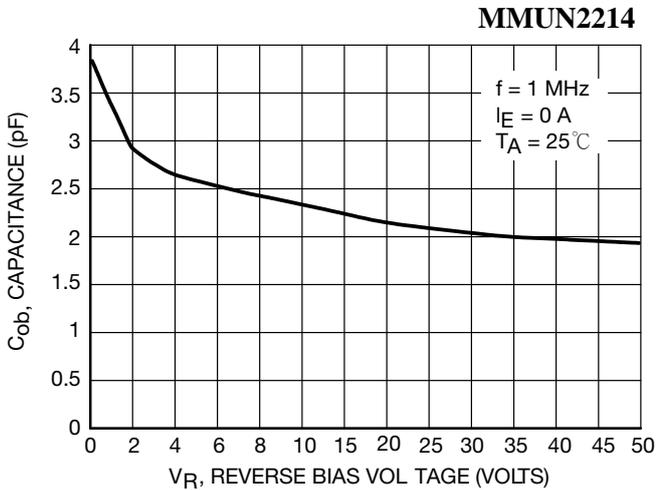
**Characteristics at  $T_a = 25\text{ }^\circ\text{C}$** 

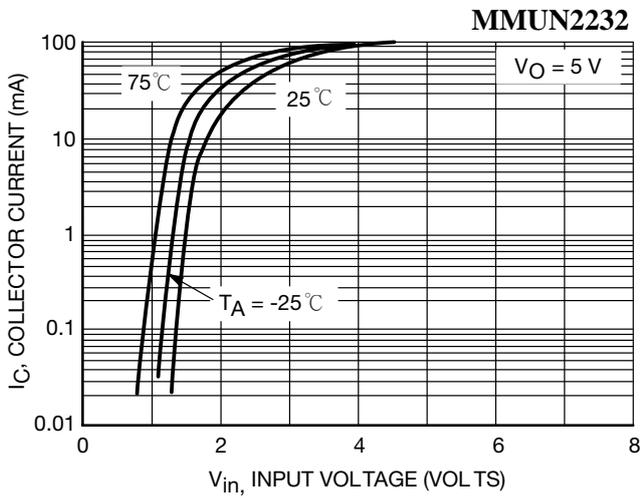
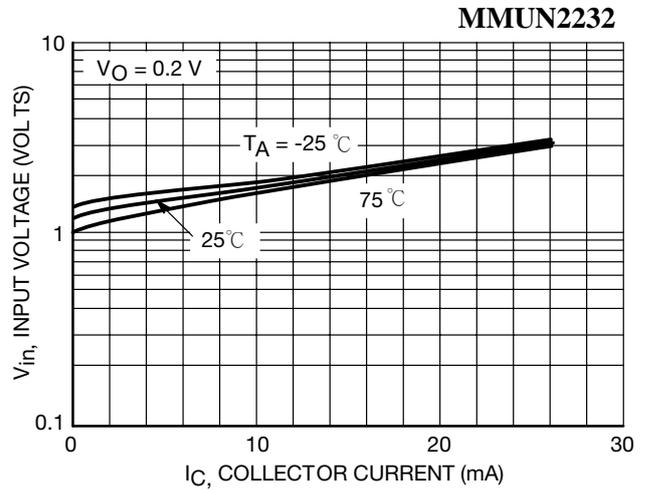
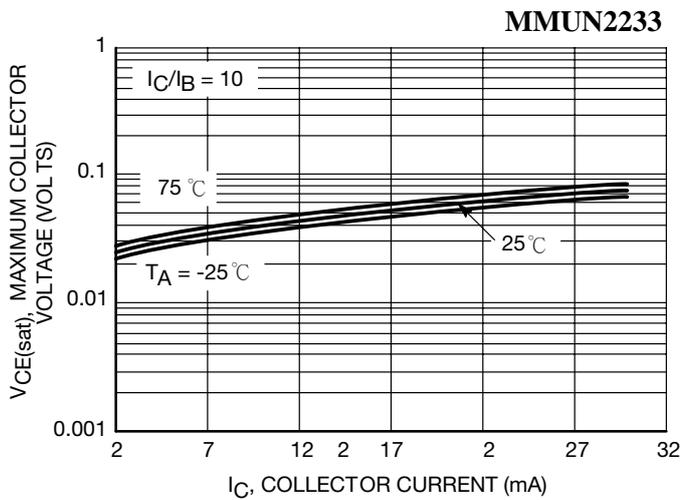
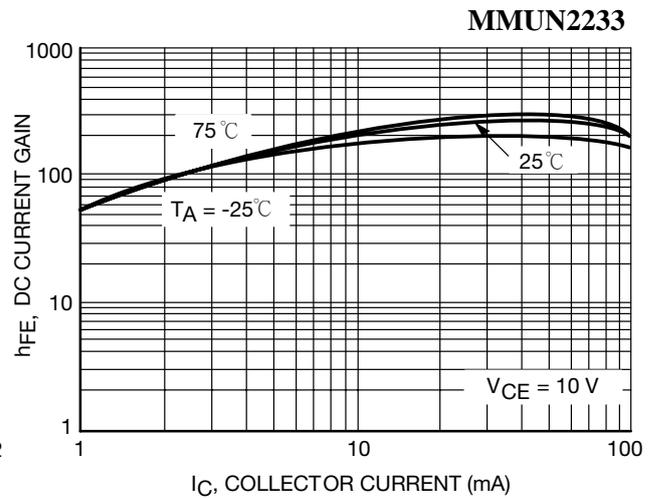
Parameter	Symbol	Min.	Max.	Unit	
Output Voltage (on) at $V_{CC} = 5\text{ V}$ , $V_B = 2.5\text{ V}$ , $R_L = 1\text{ K}\Omega$	MMUN2211	$V_{OL}$	-	0.2	V
	MMUN2212	$V_{OL}$	-	0.2	V
	MMUN2214	$V_{OL}$	-	0.2	V
	MMUN2215	$V_{OL}$	-	0.2	V
	MMUN2216	$V_{OL}$	-	0.2	V
	MMUN2230	$V_{OL}$	-	0.2	V
	MMUN2231	$V_{OL}$	-	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
	MMUN2213	$V_{OL}$	-	0.2	V
	MMUN2241	$V_{OL}$	-	0.2	V
Output Voltage (off) at $V_{CC} = 5\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1\text{ K}\Omega$ at $V_{CC} = 5\text{ V}$ , $V_B = 0.05\text{ V}$ , $R_L = 1\text{ K}\Omega$ at $V_{CC} = 5\text{ V}$ , $V_B = 0.25\text{ V}$ , $R_L = 1\text{ K}\Omega$	MMUN2230	$V_{OH}$	4.9	-	V
	MMUN2215	$V_{OH}$	4.9	-	V
	MMUN2216	$V_{OH}$	4.9	-	V
	MMUN2233	$V_{OH}$	4.9	-	V
	MMUN2238	$V_{OH}$	4.9	-	V
	MMUN2233	$V_{OH}$	4.9	-	V
Input Resistor	MMUN2211	R1	7	13	K $\Omega$
	MMUN2212	R1	15.4	28.6	K $\Omega$
	MMUN2213	R1	32.9	61.1	K $\Omega$
	MMUN2214	R1	7	13	K $\Omega$
	MMUN2215	R1	7	13	K $\Omega$
	MMUN2216	R1	3.3	6.1	K $\Omega$
	MMUN2230	R1	0.7	1.3	K $\Omega$
	MMUN2231	R1	1.5	2.9	K $\Omega$
	MMUN2232	R1	3.3	6.1	K $\Omega$
	MMUN2233	R1	3.3	6.1	K $\Omega$
	MMUN2234	R1	15.4	28.6	K $\Omega$
	MMUN2235	R1	1.54	2.86	K $\Omega$
	MMUN2238	R1	1.54	2.88	K $\Omega$
	MMUN2241	R1	70	130	K $\Omega$
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	-	

**Typical Characteristics**

**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**

**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.  $I_C$**

**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. VCE(sat) vs. IC**

**Figure 18. DC Current Gain**

**Typical Characteristics**


**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**