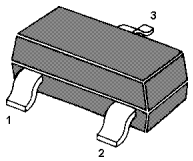
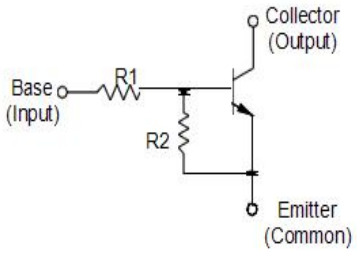
NPN Silicon Epitaxial Planar Transistor

for switching and interface circuit and
drive circuit applications



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



Resistor Values

Type	R1 (K)	R2 (K)	Marking Code
MMUN2211	10	10	11
MMUN2212	22	22	12
MMUN2213	47	47	13
MMUN2214	10	47	14
MMUN2215	10	∞	15
MMUN2216	4.7	∞	16
MMUN2230	1	1	30
MMUN2231	2.2	2.2	31
MMUN2232	4.7	4.7	32
MMUN2233	4.7	47	33
MMUN2234	22	47	34
MMUN2235	2.2	47	35
MMUN2238	2.2	∞	38
MMUN2241	100	∞	41

on)

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

Characteristics at T_a = 25 °C

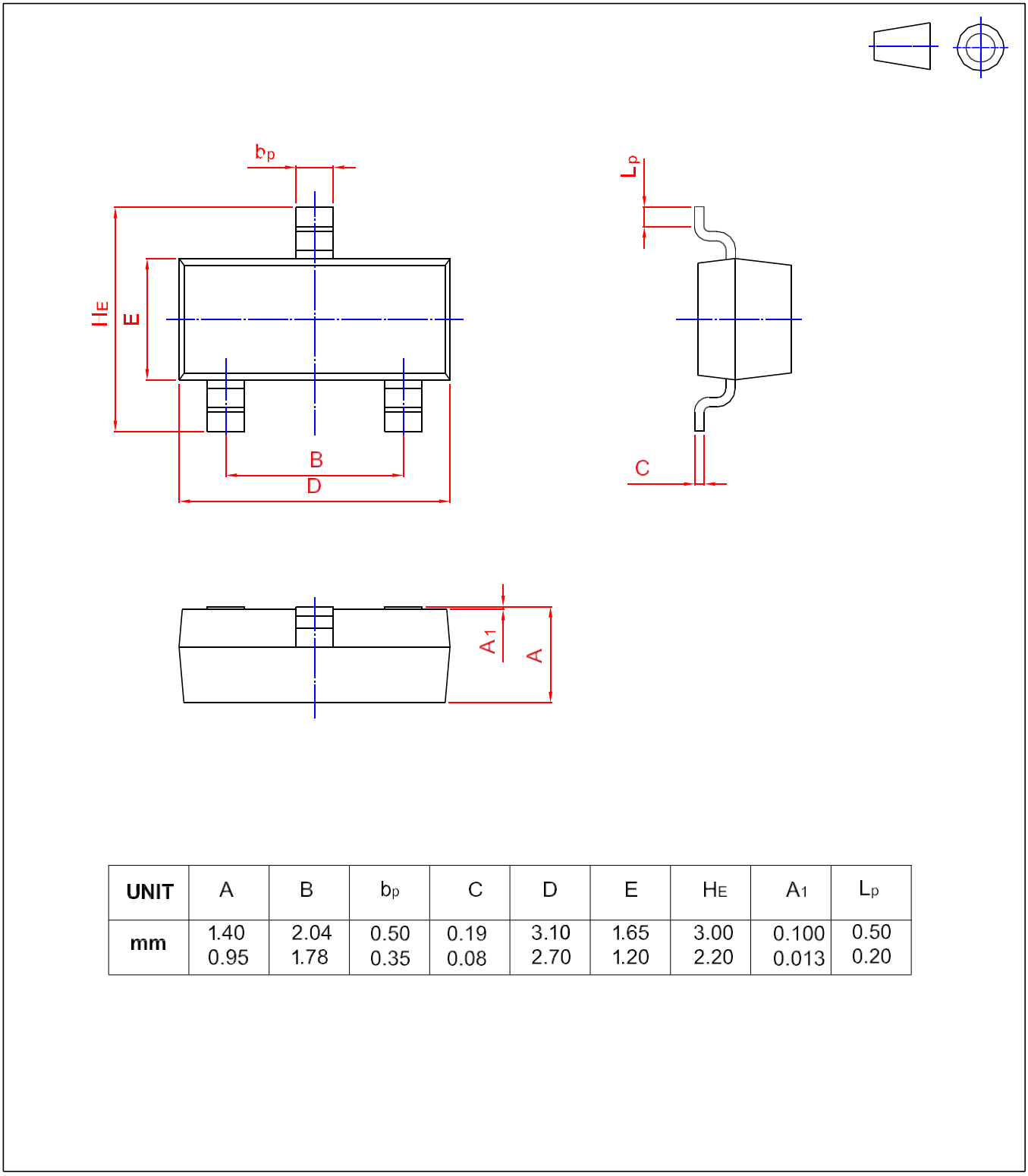
Parameter		Symbol	Min.	Max.	Unit
DC Current Gain					
at V_{CE} = 10 V, I_C = 5 mA	MMUN2211	h_{FE}	35	-	-
	MMUN2212	h_{FE}	60	-	-
	MMUN2213	h_{FE}	80	-	-
	MMUN2214	h_{FE}	80	-	-
	MMUN2215	h_{FE}	160	-	-
	MMUN2216	h_{FE}	160	-	-
	MMUN2230	h_{FE}	3	-	-
	MMUN2231	h_{FE}	8	-	-
	MMUN2232	h_{FE}	15	-	-
	MMUN2233	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

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	-

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads **SOT-23**



UNIT	A	B	bp	C	D	E	HE	A1	Lp
mm	1.40 0.95	2.04 1.78	0.50 0.35	0.19 0.08	3.10 2.70	1.65 1.20	3.00 2.20	0.100 0.013	0.50 0.20