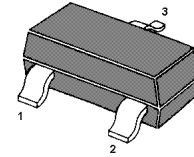


NPN Silicon Epitaxial Planar Transistor

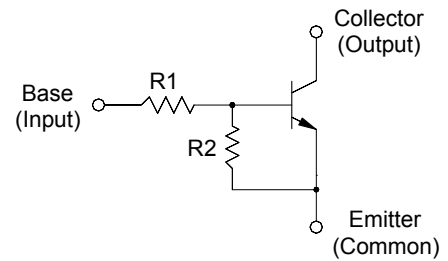
for switching and interface circuit and drive circuit applications

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 |



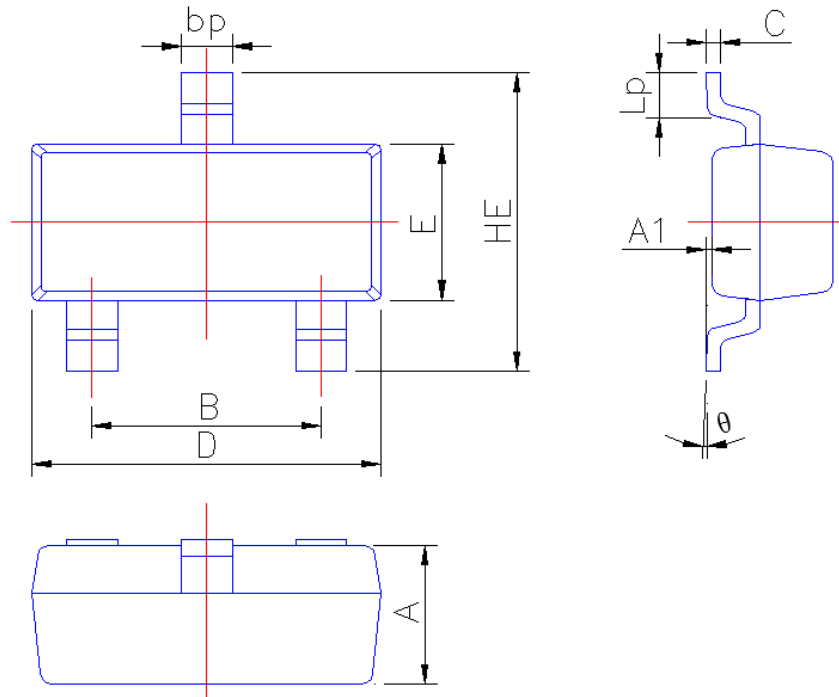
Characteristics at T_a = 25 °C

| 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 | MMUN2230 | V _{OH} | 4.9 | - | V | |
| | at V _{CC} = 5 V, V _B = 0.05 V, R _L = 1 KΩ | MMUN2215 | V _{OH} | 4.9 | - | V |
| | at V _{CC} = 5 V, V _B = 0.25 V, R _L = 1 KΩ | MMUN2216 | V _{OH} | 4.9 | - | V |
| | MMUN2233 | V _{OH} | 4.9 | - | V | |
| | MMUN2238 | 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



| Symbol | Dimension in Millimeters | |
|--------|--------------------------|-------|
| | Min | Max |
| A | 0.90 | 1.10 |
| A1 | 0.013 | 0.100 |
| B | 1.80 | 2.00 |
| bp | 0.35 | 0.50 |
| C | 0.09 | 0.150 |
| D | 2.80 | 3.00 |
| E | 1.20 | 1.40 |
| HE | 2.20 | 2.80 |
| Lp | 0.20 | 0.50 |
| θ | 0° | 5° |