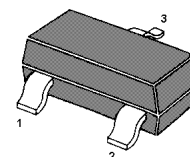


## NPN Silicon Epitaxial Planar Transistor

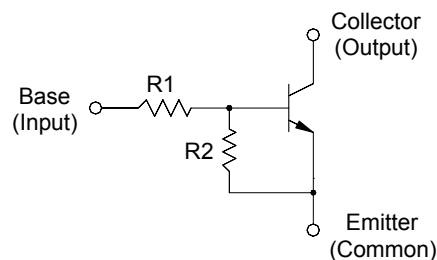
for switching and interface circuit and drive circuit applications

### 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 $T_a = 25^\circ\text{C}$

| Parameter                                                                               | Symbol        | Min. | Max. | Unit |
|-----------------------------------------------------------------------------------------|---------------|------|------|------|
| DC Current Gain<br>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<br>at $V_{CB} = 50\text{ V}$                              | $I_{CBO}$     | -    | 100  | nA   |
| Collector Emitter Cutoff Current<br>at $V_{CE} = 50\text{ V}$                           | $I_{CEO}$     | -    | 500  | nA   |
| Emitter Base Cutoff Current<br>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<br>at $I_C = 10\text{ }\mu\text{A}$                    | $V_{(BR)CBO}$ | 50   | -    | V    |
| Collector Emitter Breakdown Voltage<br>at $I_C = 2\text{ mA}$                           | $V_{(BR)CEO}$ | 50   | -    | V    |
| Collector Emitter Saturation Voltage<br>at $I_C = 10\text{ mA}$ , $I_B = 0.3\text{ mA}$ | $V_{CEsat}$   | -    | 0.25 | V    |
| at $I_C = 10\text{ mA}$ , $I_B = 5\text{ mA}$                                           | $V_{CEsat}$   | -    | 0.25 | V    |
| 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    |

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

| Parameter                                                                                                                                                                                                                                                        |                                                                            | Symbol   | Min.  | Max.  | Unit       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----------|-------|-------|------------|
| Output Voltage (on)<br>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          |
|                                                                                                                                                                                                                                                                  | at $V_{CC} = 5\text{ V}$ , $V_B = 3.5\text{ V}$ , $R_L = 1\text{ K}\Omega$ | MMUN2213 | -     | 0.2   | V          |
|                                                                                                                                                                                                                                                                  | at $V_{CC} = 5\text{ V}$ , $V_B = 5\text{ V}$ , $R_L = 1\text{ K}\Omega$   | MMUN2241 | -     | 0.2   | V          |
| Output Voltage (off)<br>at $V_{CC} = 5\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1\text{ K}\Omega$<br>at $V_{CC} = 5\text{ V}$ , $V_B = 0.05\text{ V}$ , $R_L = 1\text{ K}\Omega$<br>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 | -          |