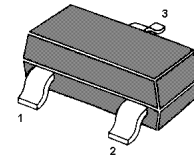


## NPN Silicon Epitaxial Planar Transistor

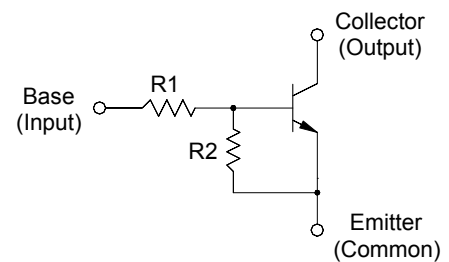
for switching and interface circuit and drive circuit applications

### Resistor Values

| Type     | R1 (K) | R2 (K)   |
|----------|--------|----------|
| MMUN2211 | 10     | 10       |
| MMUN2212 | 22     | 22       |
| MMUN2213 | 47     | 47       |
| MMUN2214 | 10     | 47       |
| MMUN2215 | 10     | $\infty$ |
| MMUN2216 | 4.7    | $\infty$ |
| MMUN2230 | 1      | 1        |
| MMUN2231 | 2.2    | 2.2      |
| MMUN2232 | 4.7    | 4.7      |
| MMUN2233 | 4.7    | 47       |
| MMUN2234 | 22     | 47       |
| MMUN2235 | 2.2    | 47       |
| MMUN2238 | 2.2    | $\infty$ |
| MMUN2241 | 100    | $\infty$ |



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



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

| 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 $I_C = 10\text{ mA}$ , $I_B = 0.3\text{ mA}$<br>at $I_C = 10\text{ mA}$ , $I_B = 5\text{ mA}$<br><br>at $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$ |               |      |      |      |
|                                                                                                                                                                                               | $V_{CEsat}$   | -    | 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    |

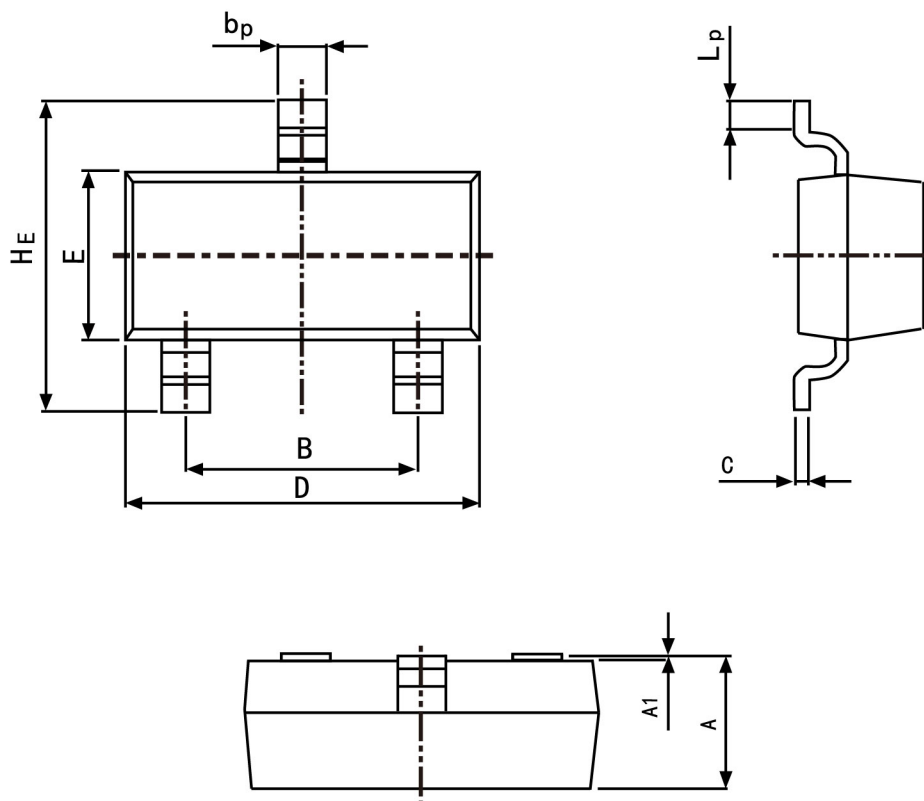
### Characteristics at $T_a = 25^\circ\text{C}$

| 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<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2212<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2214<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2215<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2216<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2230<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2231<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2232<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2233<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2234<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2235<br>$V_{OL}$       | -     | 0.2   | V                |
| at $V_{CC} = 5\text{ V}$ , $V_B = 3.5\text{ V}$ , $R_L = 1\text{ K}\Omega$                         | MMUN2238<br>$V_{OL}$       | -     | 0.2   | V                |
| at $V_{CC} = 5\text{ V}$ , $V_B = 5\text{ V}$ , $R_L = 1\text{ K}\Omega$                           | MMUN2213<br>$V_{OL}$       | -     | 0.2   | V                |
|                                                                                                    | MMUN2241<br>$V_{OL}$       | -     | 0.2   | V                |
| Output Voltage (off)<br>at $V_{CC} = 5\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1\text{ K}\Omega$ | $V_{OH}$                   | 4.9   | -     | V                |
| at $V_{CC} = 5\text{ V}$ , $V_B = 0.05\text{ V}$ , $R_L = 1\text{ K}\Omega$                        | MMUN2230<br>$V_{OH}$       | 4.9   | -     | V                |
| at $V_{CC} = 5\text{ V}$ , $V_B = 0.25\text{ V}$ , $R_L = 1\text{ K}\Omega$                        | MMUN2215<br>$V_{OH}$       | 4.9   | -     | V                |
|                                                                                                    | MMUN2216<br>$V_{OH}$       | 4.9   | -     | V                |
|                                                                                                    | MMUN2233<br>$V_{OH}$       | 4.9   | -     | V                |
|                                                                                                    | MMUN2238<br>$V_{OH}$       | 4.9   | -     | V                |
| Input Resistor                                                                                     | MMUN2211<br>R1             | 7     | 13    | $\text{K}\Omega$ |
|                                                                                                    | MMUN2212<br>R1             | 15.4  | 28.6  | $\text{K}\Omega$ |
|                                                                                                    | MMUN2213<br>R1             | 32.9  | 61.1  | $\text{K}\Omega$ |
|                                                                                                    | MMUN2214<br>R1             | 7     | 13    | $\text{K}\Omega$ |
|                                                                                                    | MMUN2215<br>R1             | 7     | 13    | $\text{K}\Omega$ |
|                                                                                                    | MMUN2216<br>R1             | 3.3   | 6.1   | $\text{K}\Omega$ |
|                                                                                                    | MMUN2230<br>R1             | 0.7   | 1.3   | $\text{K}\Omega$ |
|                                                                                                    | MMUN2231<br>R1             | 1.5   | 2.9   | $\text{K}\Omega$ |
|                                                                                                    | MMUN2232<br>R1             | 3.3   | 6.1   | $\text{K}\Omega$ |
|                                                                                                    | MMUN2233<br>R1             | 3.3   | 6.1   | $\text{K}\Omega$ |
|                                                                                                    | MMUN2234<br>R1             | 15.4  | 28.6  | $\text{K}\Omega$ |
|                                                                                                    | MMUN2235<br>R1             | 1.54  | 2.86  | $\text{K}\Omega$ |
|                                                                                                    | MMUN2238<br>R1             | 1.54  | 2.88  | $\text{K}\Omega$ |
|                                                                                                    | MMUN2241<br>R1             | 70    | 130   | $\text{K}\Omega$ |
| Resistor Ratio                                                                                     | MMUN2211/MMUN2212/MMUN2213 | 0.8   | 1.2   | -                |
|                                                                                                    | MMUN2214                   | 0.17  | 0.25  | -                |
|                                                                                                    | MMUN2215/MMUN2216/MMUN2238 | -     | -     | -                |
|                                                                                                    | MMUN2241                   | -     | -     | -                |
|                                                                                                    | MMUN2230/MMUN2231/MMUN2232 | 0.8   | 1.2   | -                |
|                                                                                                    | MMUN2233                   | 0.055 | 0.185 | -                |
|                                                                                                    | MMUN2234                   | 0.38  | 0.56  | -                |
|                                                                                                    | MMUN2235                   | 0.038 | 0.056 | -                |

## PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT-23



| Symbol | Dimension in Millimeters |       |
|--------|--------------------------|-------|
|        | Min                      | Max   |
| A      | 0.95                     | 1.40  |
| B      | 1.78                     | 2.04  |
| bp     | 0.35                     | 0.50  |
| C      | 0.08                     | 0.19  |
| D      | 2.70                     | 3.10  |
| E      | 1.20                     | 1.65  |
| HE     | 2.20                     | 3.00  |
| A1     | 0.100                    | 0.013 |
| Lp     | 0.20                     | 0.50  |