

Dual Bias Resistor Transistors

NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the MMUN5211 DW series, two BRT devices are housed in the SOT-363 package which is ideal for low power surface mount applications where board space is at a premium.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- We declare that the material of product compliance with RoHS requirements.

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted, common for Q₁ and Q₂)

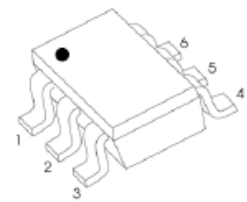
| Rating | Symbol | Value | Unit |
|---------------------------|------------------|-------|------|
| Collector-Base Voltage | V _{CBO} | 50 | Vdc |
| Collector-Emitter Voltage | V _{CEO} | 50 | Vdc |
| Collector Current | I _C | 100 | mAdc |

THERMAL CHARACTERISTICS

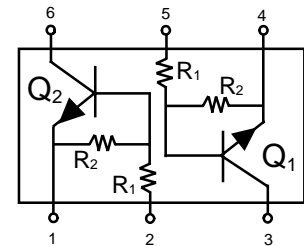
| Characteristic (One Junction Heated) | Symbol | Max | Unit |
|---|-----------------------------------|--------------------------------|-------|
| Total Device Dissipation T _A = 25°C | P _D | 187 (Note 1.) 256 (Note 2.) | mW |
| Derate above 25°C | | 1.5 (Note 1.) 2.0 (Note 2.) | mW/°C |
| Thermal Resistance – Junction-to-Ambient | R _{θJA} | 670 (Note 1.) 490 (Note 2.) | °C/W |
| Characteristic (Both Junctions Heated) | Symbol | Max | Unit |
| Total Device Dissipation T _A = 25°C | P _D | 250 (Note 1.) 385 (Note 2.) | mW |
| Derate above 25°C | | 2.0 (Note 1.) 3.0 (Note 2.) | mW/°C |
| Thermal Resistance – Junction-to-Ambient | R _{θJA} | 493 (Note 1.) 325 (Note 2.) | °C/W |
| Thermal Resistance – Junction-to-Lead | R _{θJL} | 188 (Note 1.) 208 (Note 2.) | °C/W |
| Junction and Storage Temperature | T _J , T _{stg} | -55 to +150 | °C |

1. FR-4 @ Minimum Pad 2. FR-4 @ 1.0 x 1.0 inch Pad

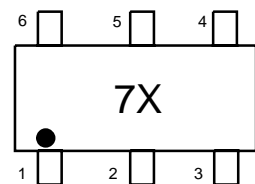
MMUN5211DW Series



SOT-363



MARKING DIAGRAM



7X = Device Marking
(See Page 2)

DEVICE MARKING INFORMATION

See specific marking information in the device marking table on page 2 of this data sheet.

DEVICE MARKING , RESISTOR VALUES AND ORDERING INFORMATION

| Device | Package | Marking | R1(K) | R2(K) | Shipping |
|------------|---------|---------|-------|-------|----------------|
| MMUN5211DW | SOT-363 | 7A | 10 | 10 | 3000/Tape&Reel |
| MMUN5212DW | SOT-363 | 7B | 22 | 22 | 3000/Tape&Reel |
| MMUN5213DW | SOT-363 | 7C | 47 | 47 | 3000/Tape&Reel |
| MMUN5214DW | SOT-363 | 7D | 10 | 47 | 3000/Tape&Reel |
| MMUN5215DW | SOT-363 | 7E | 10 | ∞ | 3000/Tape&Reel |
| MMUN5216DW | SOT-363 | 7F | 4.7 | ∞ | 3000/Tape&Reel |
| MMUN5230DW | SOT-363 | 7G | 1 | 1 | 3000/Tape&Reel |
| MMUN5231DW | SOT-363 | 7H | 2.2 | 2.2 | 3000/Tape&Reel |
| MMUN5232DW | SOT-363 | 7J | 4.7 | 4.7 | 3000/Tape&Reel |
| MMUN5233DW | SOT-363 | 7K | 4.7 | 47 | 3000/Tape&Reel |
| MMUN5234DW | SOT-363 | 7L | 22 | 47 | 3000/Tape&Reel |
| MMUN5235DW | SOT-363 | 7M | 2.2 | 47 | 3000/Tape&Reel |
| MMUN5238DW | SOT-363 | 7Q | 2.2 | ∞ | 3000/Tape&Reel |
| MMUN5241DW | SOT-363 | 7T | 100 | ∞ | 3000/Tape&Reel |



ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted, common for Q_1 and Q_2),(Continued)

| Parameter | Symbol | Min. | Max. | Unit | |
|---|---------------|-------------|------|------|----|
| DC Current Gain at $V_{CE} = 10\text{ V}$, $I_C = 5\text{ mA}$ | MMUN5211DW | h_{FE} | 35 | - | - |
| | MMUN5212DW | h_{FE} | 60 | - | - |
| | MMUN5213DW | h_{FE} | 80 | - | - |
| | MMUN5214DW | h_{FE} | 80 | - | - |
| | MMUN5215DW | h_{FE} | 160 | - | - |
| | MMUN5216DW | h_{FE} | 160 | - | - |
| | MMUN5230DW | h_{FE} | 3 | - | - |
| | MMUN5231DW | h_{FE} | 8 | - | - |
| | MMUN5232DW | h_{FE} | 15 | - | - |
| | MMUN5233DW | h_{FE} | 80 | - | - |
| | MMUN5234DW | h_{FE} | 80 | - | - |
| | MMUN5235DW | h_{FE} | 80 | - | - |
| | MMUN5238DW | h_{FE} | 160 | - | - |
| MMUN5241DW | 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 $V_{EB} = 6\text{ V}$ | MMUN5211DW | I_{EBO} | - | 0.5 | mA |
| | MMUN5212DW | I_{EBO} | - | 0.2 | mA |
| | MMUN5213DW | I_{EBO} | - | 0.1 | mA |
| | MMUN5214DW | I_{EBO} | - | 0.2 | mA |
| | MMUN5215DW | I_{EBO} | - | 0.9 | mA |
| | MMUN5216DW | I_{EBO} | - | 1.9 | mA |
| | MMUN5230DW | I_{EBO} | - | 4.3 | mA |
| | MMUN5231DW | I_{EBO} | - | 2.3 | mA |
| | MMUN5232DW | I_{EBO} | - | 1.5 | mA |
| | MMUN5233DW | I_{EBO} | - | 0.18 | mA |
| | MMUN5234DW | I_{EBO} | - | 0.13 | mA |
| | MMUN5235DW | I_{EBO} | - | 0.2 | mA |
| | MMUN5238DW | I_{EBO} | - | 4 | mA |
| MMUN5241DW | 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 $I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$ | | V_{CEsat} | - | 0.25 | V |
| | MMUN5230DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5231DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5215DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5216DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5232DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5233DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5234DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5235DW | V_{CEsat} | - | 0.25 | V |
| | MMUN5238DW | V_{CEsat} | - | 0.25 | V |



ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted, common for Q₁ and Q₂.) (Continued)

| Parameter | Symbol | Min. | Max. | Unit | | |
|--|--|------------|----------|-------|------------|---|
| Output Voltage (on) at $V_{CC} = 5\text{ V}$, $V_B = 2.5\text{ V}$, $R_L = 1\text{ K}\Omega$ | MMUN5211DW | V_{OL} | - | 0.2 | V | |
| | MMUN5212DW | V_{OL} | - | 0.2 | V | |
| | MMUN5214DW | V_{OL} | - | 0.2 | V | |
| | MMUN5215DW | V_{OL} | - | 0.2 | V | |
| | MMUN5216DW | V_{OL} | - | 0.2 | V | |
| | MMUN5230DW | V_{OL} | - | 0.2 | V | |
| | MMUN5231DW | V_{OL} | - | 0.2 | V | |
| | MMUN5232DW | V_{OL} | - | 0.2 | V | |
| | MMUN5233DW | V_{OL} | - | 0.2 | V | |
| | MMUN5234DW | V_{OL} | - | 0.2 | V | |
| | MMUN5235DW | V_{OL} | - | 0.2 | V | |
| | MMUN5238DW | V_{OL} | - | 0.2 | V | |
| | at $V_{CC} = 5\text{ V}$, $V_B = 3.5\text{ V}$, $R_L = 1\text{ K}\Omega$ | MMUN5213DW | V_{OL} | - | 0.2 | V |
| | at $V_{CC} = 5\text{ V}$, $V_B = 5\text{ V}$, $R_L = 1\text{ K}\Omega$ | MMUN5241DW | 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 $V_{CC} = 5\text{ V}$, $V_B = 0.25\text{ V}$, $R_L = 1\text{ K}\Omega$ | | V_{OH} | 4.9 | - | V | |
| | MMUN5230DW | V_{OH} | 4.9 | - | V | |
| | MMUN5215DW | V_{OH} | 4.9 | - | V | |
| | MMUN5216DW | V_{OH} | 4.9 | - | V | |
| | MMUN5233DW | V_{OH} | 4.9 | - | V | |
| | MMUN5238DW | V_{OH} | 4.9 | - | V | |
| Input Resistor | MMUN5211DW | R1 | 7 | 13 | K Ω | |
| | MMUN5212DW | R1 | 15.4 | 28.6 | K Ω | |
| | MMUN5213DW | R1 | 32.9 | 61.1 | K Ω | |
| | MMUN5214DW | R1 | 7 | 13 | K Ω | |
| | MMUN5215DW | R1 | 7 | 13 | K Ω | |
| | MMUN5216DW | R1 | 3.3 | 6.1 | K Ω | |
| | MMUN5230DW | R1 | 0.7 | 1.3 | K Ω | |
| | MMUN5231DW | R1 | 1.5 | 2.9 | K Ω | |
| | MMUN5232DW | R1 | 3.3 | 6.1 | K Ω | |
| | MMUN5233DW | R1 | 3.3 | 6.1 | K Ω | |
| | MMUN5234DW | R1 | 15.4 | 28.6 | K Ω | |
| | MMUN5235DW | R1 | 1.54 | 2.86 | K Ω | |
| | MMUN5238DW | R1 | 1.54 | 2.88 | K Ω | |
| | MMUN5241DW | R1 | 70 | 130 | K Ω | |
| Resistor Ratio | MMUN5211DW/MMUN5212DW/MMUN5213DW | R1/R2 | 0.8 | 1.2 | - | |
| | MMUN5214DW | R1/R2 | 0.17 | 0.25 | - | |
| | MMUN5215DW/MMUN5216DW/MMUN5238DW | R1/R2 | - | - | - | |
| | MMUN5241DW | R1/R2 | - | - | - | |
| | MMUN5230DW/MMUN5231DW/MMUN5232DW | R1/R2 | 0.8 | 1.2 | - | |
| | MMUN5233DW | R1/R2 | 0.055 | 0.185 | - | |
| | MMUN5234DW | R1/R2 | 0.38 | 0.56 | - | |
| | MMUN5235DW | R1/R2 | 0.038 | 0.056 | - | |

TYPICAL ELECTRICAL CHARACTERISTICS – MMUN5211DW

