

1 Description

The RedRock® RR132-2E22-551 and RR132-2E23-551 are digital magnetic sensors ideal for use in medical, industrial, automotive, and consumer applications. They are based on patented Tunneling Magnetoresistance (TMR) technology with seamless CMOS integration.

The RR132-2E22-551 and RR132-2E23-551 feature an operate sensitivity of 15 G (1.5 mT), with a unipolar magnetic field response. They offer a wide supply voltage range from 1.7 up to 5.5 V, ideal for applications ranging from small battery-powered electronics to industrial machinery. They have the world's lowest average current drain (70nA) for an active magnetic sensor operating at 10 Hz and high operating temperature range from -40°C up to +125°C.

2 Features

- ▶ Operate sensitivity of 15 G
- ▶ Lowest Average Current of 70 nA
- ▶ Wide Supply Voltage range of 1.7V – 5.5V
- ▶ Unipolar Open-Drain Response
- ▶ Operating Frequency of 10 Hz
- ▶ Temperature Rated up to +125°C
- ▶ RoHS & REACH Compliant

3 Applications

- ▶ Proximity Detection
- ▶ Rotary Sensing
- ▶ Fluid Level Detection
- ▶ Door & Lid Closure Detection
- ▶ Utility Meters
- ▶ Portable Medical Devices
- ▶ Motor Controllers
- ▶ Consumer Electronics
- ▶ Wake-Up μ Processor

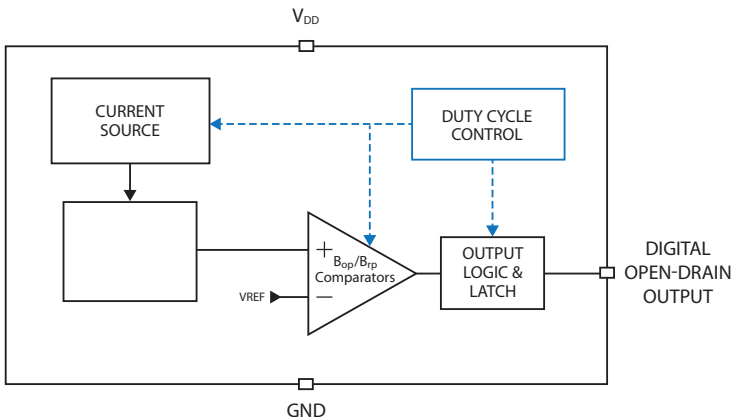
Device Information

| Part Series | Package | Body Size (mm) | Temp Rating °C |
|-----------------------|----------|-----------------|----------------|
| RR132-2E22-551 | SOT-23-3 | 2.9 x 1.6 x 1.2 | -40 to +85 |
| RR132-2E23-551 | SOT-23-3 | 2.9 x 1.6 x 1.2 | -40 to +125 |

Device Packages



**Functional Block Diagram
for Digital Open-Drain Output**



Device Nomenclature

Ordering Information

RR132-X X X X-YYY

| Series | Package |
|-----------------------------------|---------------------------|
| Magnetic Polarity Response | 1: SOT-23-3 |
| 1 = Omnipolar | 2: LGA-4 |
| 2 = Unipolar | 5: SOT-23-5 |
| 3 = Bipolar/Latch | Output Response |
| Magnetic Sensitivity (G) | 5: Open Drain |
| A: Op 9, Rel 5 | Supply Voltage (V) |
| B: Op 30, Rel 20 | 5: 1.7 – 5.5 |
| C: Op 10, Rel -10 | Temp Rating (°C) |
| Clock Frequency (Hz) | 2: -40 – +85 |
| 1: 2 | 3: -40 – +125 |
| 5: 250 | |
| 9: 10000 | |
| 2: 10 | |
| 6: 500 | |
| U: 100+Turbo (10000) | |
| 3: 20 | |
| 7: 2500 | |

4 Specifications

4.1 Absolute Environmental Ratings^{1,2}

| Parameters | Units | Min | Typ | Max |
|--|-------|-------|-----|-------|
| Operating Temperature (T _{OP}) (RR132-1B12-551) | °C | -40 | | +85 |
| Operating Temperature (T _{OP}) (RR132-1B13-551) | °C | -40 | | +125 |
| Storage Temperature (T _{STG}) | °C | -65 | | +150 |
| Junction Temperature (T _J) | °C | | | +150 |
| Soldering Temperature (3 cycles, 1 min.) (T _{SOL}) | °C | | | +260 |
| ESD Level Human Body Model per JESD22-A114 | V | ±4000 | | |
| ESD Level Charged Device Model (CDM) per JESD22-C1010 | V | ±500 | | |
| Junction-to-Ambient Thermal Resistance (SOT-23-3) | °C/W | | 202 | |
| Maximum Magnetic Field Exposure (B _{MAX}) | G | | | ±2000 |

4.2 Absolute Electrical Ratings^{1,2}

| Parameters | Units | Min | Typ | Max |
|---|-------|------|-----|-----|
| Supply Voltage (V _{DD}) | V | -0.3 | | 6.0 |
| Open-Drain Output Voltage (Active Low)(V _{OUT-OD}) ³ | V | -0.3 | | 6.0 |
| Input and Output Current (I _{IN} /I _{OUT}) | mA | | | ±20 |

4.3 Operating Electrical Characteristics for RR132-2E22-551 and RR132-2E23-551⁴

| Parameters | Units | Min | Typ | Max |
|---|-------|---------------------|------|---------------------|
| Supply Voltage (V _{DD}) | V | 1.7 | 3.0 | 5.5 |
| Power-On Time (t _{ON})(V _{DD} > 90%) | μs | | 50 | 75 |
| Peak Power-On Current | mA | | | 1.4 |
| Output Voltage (High) (V _{OUTH}) | V | 90% V _{DD} | | |
| Output Voltage (Low) (V _{OUTL}) | V | | | 10% V _{DD} |
| Under Voltage Lockout Threshold Rising V _{DD} (V _{UVLO-RISE}) | V | | 1.60 | 1.64 |
| Under Voltage Lockout Threshold Falling V _{DD} (V _{UVLO-FALL}) | V | 1.44 | 1.53 | |
| Under Voltage Lockout Hysteresis (V _{UV-HYST}) | mV | | 70 | |
| Average Supply Current @ V _{DD} =1.7 V, f _{SW} =10 Hz (I _{DD} _{AVG}) | nA | | 70 | |
| Average Supply Current @ V _{DD} =3.0 V, f _{SW} =10 Hz (I _{DD} _{AVG}) | nA | | 85 | |

Notes:

- Exceeding Absolute Ratings may cause permanent damage to the device.
- Unless otherwise specified, all characteristics are measured at 25°C.
- V_{SYS} (Voltage source) for open-drain output should not exceed V_{DD} + 0.3V.
- Unless otherwise specified, V_{DD} = 1.7 V to 5.5 V, T_A = -40°C to +85°C (2E22), -40°C to +125°C (2E23). Typical values are V_{DD} = 3.0 V and T_A = +25°C.




ESD Note: This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, proper ESD precautions should be taken to avoid performance degradation or loss of functionality. Damage due to inappropriate handling is not covered under warranty.

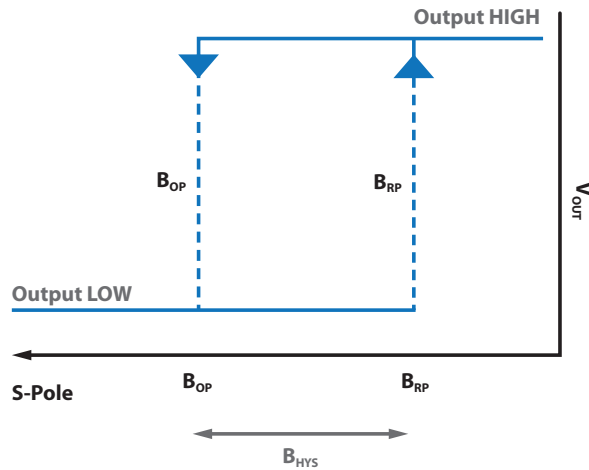
4 Specifications (cont.)

4.4 Operating Characteristics for RR132-2E22-551 and RR132-2E23-551¹

| Parameters | Units | Min | Typ | Max |
|--|---------|-----|-----|-----|
| Switching Frequency (f_{SW}) | Hz | 6 | 10 | 14 |
| Active Mode Time (t_{ACT}) | μs | | 2.6 | |
| Idle Mode Time @ $f_{SW}=10$ Hz (t_{IDLE}) | ms | 71 | 100 | 166 |
| Operate Point (B_{OPS}) | G | -19 | -15 | -11 |
| Release Point (B_{RPS}) | G | -14 | -10 | -6 |
| Hysteresis (B_{HYST}) ² | G | 3 | 5 | |

- Notes:**
- Unless otherwise specified, $V_{DD} = 1.7$ V to 5.5 V, $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ (2E22), -40°C to $+125^\circ\text{C}$ (2E23). Typical values are $V_{DD} = 3.0$ V and $T_A = +25^\circ\text{C}$.
 - Conditions: $B_{HYST} = |B_{OP} - B_{RP}|$
-  ESD Note: This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, proper ESD precautions should be taken to avoid performance degradation or loss of functionality. Damage due to inappropriate handling is not covered under warranty.

5 Output Response vs. Magnetic Flux

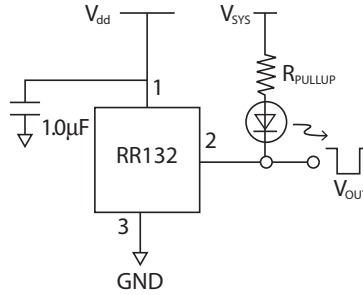


6 Application Information

RR132 Application Circuit

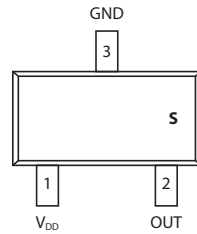
The output voltage of the RR132 is active low, meaning that while a sufficiently strong magnetic field is present, the output voltage is low. With the open-drain output, the system voltage can range from ($V_{dd} + 0.3V$) up to absolute max of 6.0Vdc. A decoupling capacitor between the supply voltage and ground is required with placement close to the magnetic sensor. A capacitor with a value of $1.0\mu F$, placed not more than 10 mm from the sensor, is required.

Application Circuit (SOT-23-3)



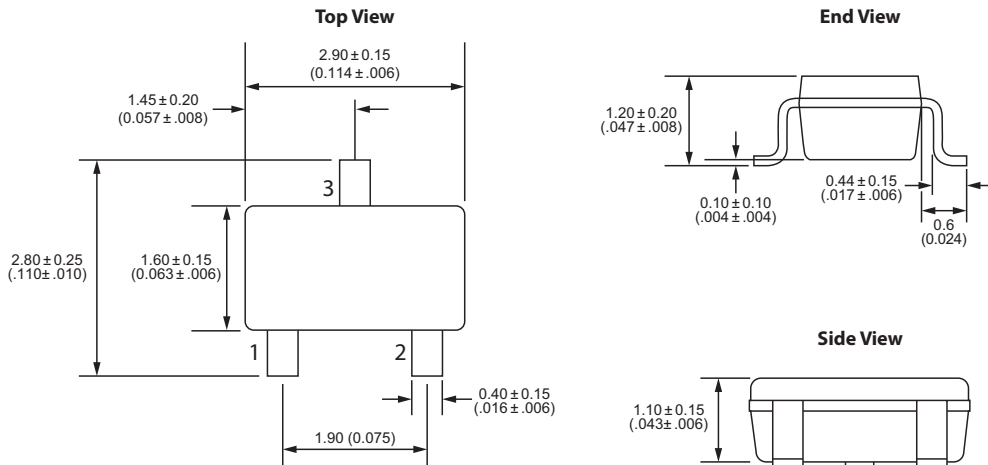
7 Axis of Sensitivity

SOT-23-3



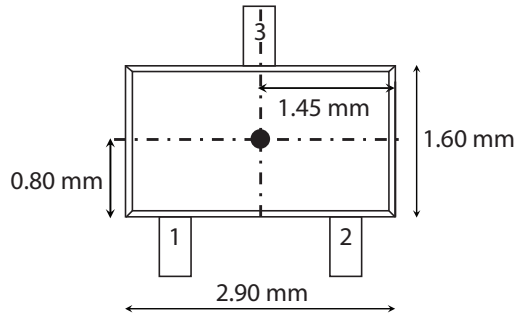
8 Dimensions *Millimeters (Inches)*

SOT-23-3 Package

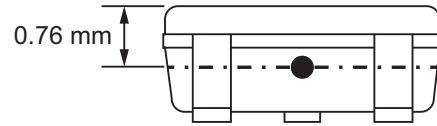


9 TMR Sensor Location

9.1 SOT-23-3 Package



9.2 SOT Package - Side View



10 Output Behavior vs. Magnetic Field Diagrams

Output Behavior vs. Magnetic Field - Unipolar

| Characteristics | Conditions | Output |
|-----------------|------------------------------------|------------------------|
| South Pole | $B < B_{OPS}$ $0 > B > B_{RPS}$ | Low (ON) High (OFF) |

11 TMR Sensor & Switch Packaging

11.1 SOT-23-3 Tape & Reel Packaging

Standard packaging is Tape & Reel containing 3,000 pieces. MSL Rating is 1.

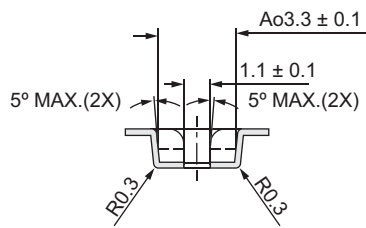
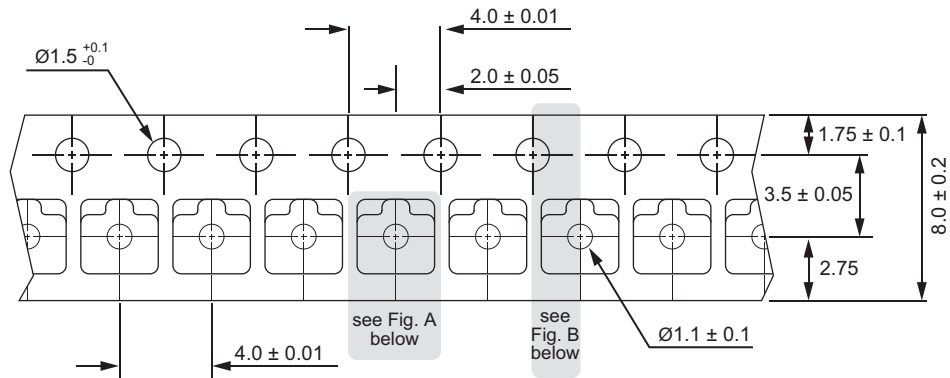


Fig. A

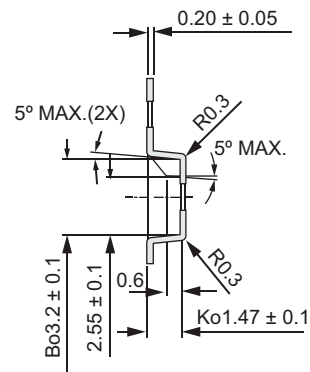
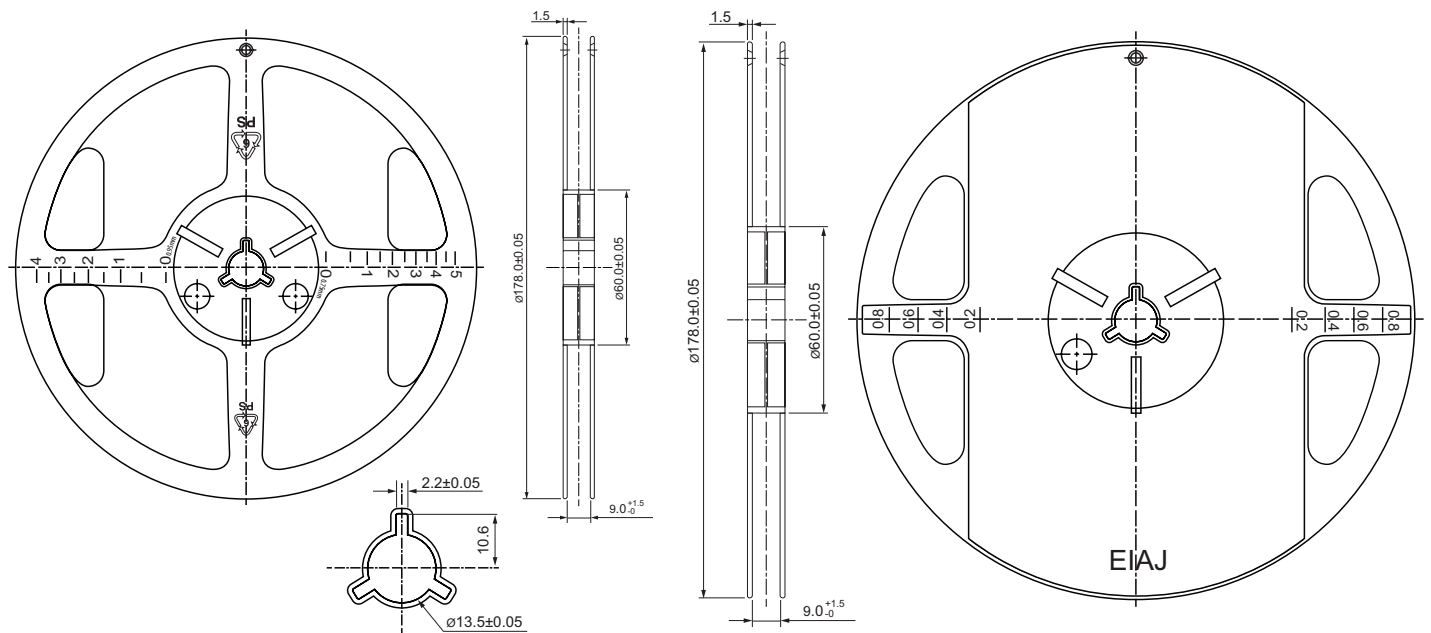


Fig. B



11 TMR Sensor & Switch Packaging

11.3 RedRock TMR Packaging

Box Dimensions – 14x10x6 inches

- Fits 1 to 3 reels = 3000 to 9000 pcs
- Weight for 3000 pcs = 0.90 kilos
- Weight for 9000 pcs = 1.00 kilos

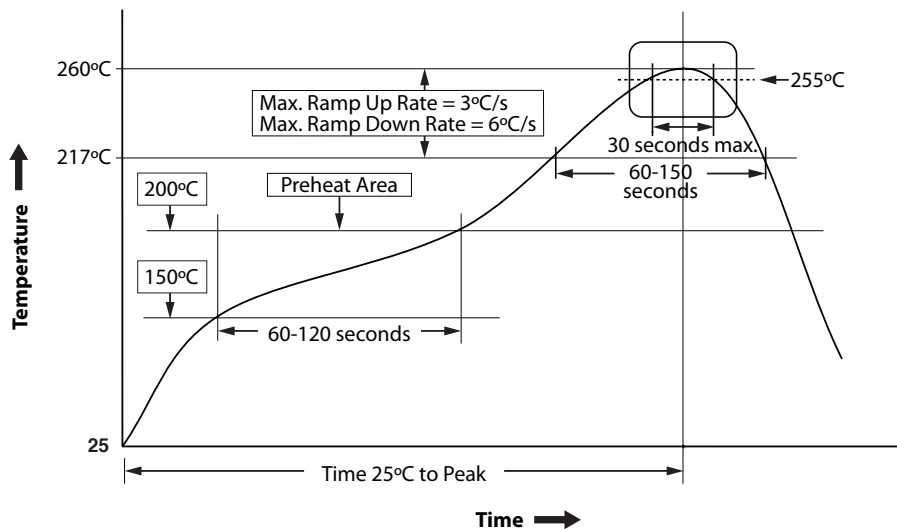
Box Dimensions – 18x14x12 inches

- Fits 4 to 24 reels = 12000 to 72000 pcs
- Weight for 12000 pcs = 1.50 kilos
- Weight for 72000 pcs = 4.90 kilos

12 Suggested Pb-Free Reflow Profile

Notes:

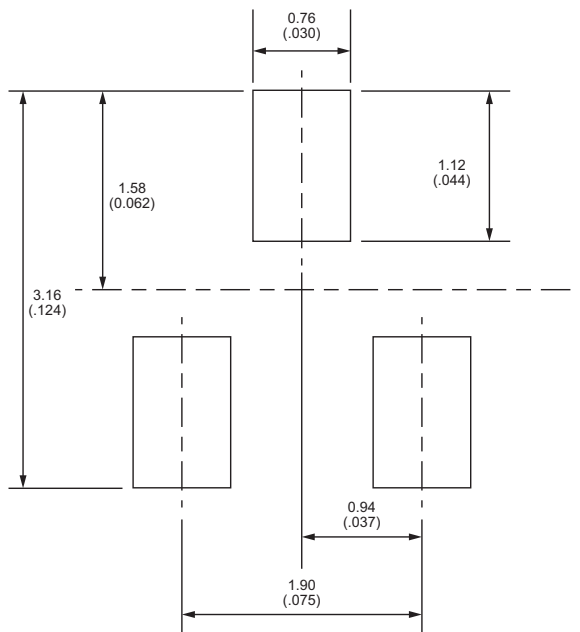
1. Fully compatible with standard no-lead solder profile, 260°C for 30 seconds max (3 cycles max).
2. Profile shown as example. Users are advised to develop their own board-level profile.
3. Suggested Pb-free reflow profile derived from IPC/JEDEC J-STD-020E.
4. Temperature tolerance: +0°C, as measured at any point on the package or leads
5. MSL rating of 1 (SOT-23-3 only) compatible with J-STD-020 or equivalent.
6. All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow (e.g., live-bug). If parts are reflowed in other than the normal live bug assembly reflow orientation (i.e., dead-bug), T_p shall be within $\pm 2^\circ\text{C}$ of the live bug T_p and still meet the T_c requirements, otherwise, the profile shall be adjusted to achieve the latter. To accurately measure actual peak package body temperatures, refer to JEP140 for recommended thermocouple use.
7. Reflow profiles in this document are for classification/preconditioning and are not meant to specify board assembly profiles. Actual board assembly profiles should be developed based on specific process needs and board designs and should not exceed the parameters in this table.



13 Suggested Solder Pad Layout

Dimensions in mm (inches)

SOT-23-3 Solder Pad Layout





Revision History

| | Date | Description |
|---|------------|--|
| 1 | 12/14/2021 | Corrected Misleading Elements in Table 4.3 |
| | | |