

1 Description

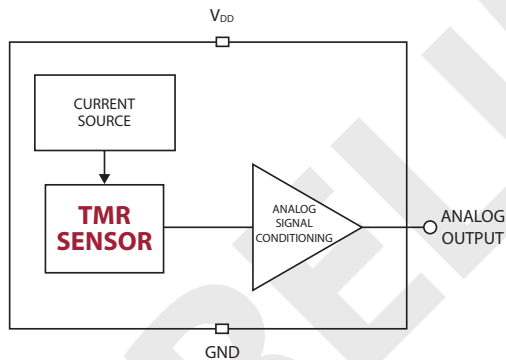
The RedRock™ RR112 Series is an analog magnetic sensor with a proportional linear voltage output ideal for use in medical, industrial, automotive, and consumer applications. Based on patented Tunneling Magnetoresistance (TMR) technology with seamless CMOS integration, the RR112 offers multiple configurations of several parameters to enable applications like proximity sensing, rotary sensing, and level detection.

The RR112 features a magnetic sensitivity range from -80 to +80 G (-8 mT to +8 mT) with a typical sensitivity of -5mV/V/G (-50 mV/V/mT). It is rated to operate across a wide temperature range of -40°C up to 125°C. It offers 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.

Device Information

Part Series	Package	Body Size (mm)
RR112	SOT-23-3	2.9 x 1.6 x 1.2
	LGA-4	1.4 x 1.4 x 0.45

Functional Block Diagram for Analog Output



2 Features

- ▶ Operate sensitivity range from -80 G to +80 G
- ▶ Low Average Current < 3 μ A
- ▶ Wide Supply Voltage range of 1.7V – 5.5V
- ▶ Linear Analog Voltage Response
- ▶ Operating Frequencies of 100 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
- ▶ Consumer Electronics

Device Packages



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4 Specifications

4.1 Absolute Environmental Ratings¹

Parameters	Units	Min	Typ	Max
Operating Temperature (T_{OP})	°C	-40		+125
Storage Temperature (T_{STG})	°C	-65		+150
Junction Temperature (T_J)	°C	-40		+150
Soldering Temperature (3 cycles, 1 min.) (T_{SOL})	°C			+260
ESD Level Human Body Model per JESD22-A114	V	±2000		
Magnetic Field Exposure	G			500

4.2 Absolute Electrical Ratings¹

Parameters	Units	Min	Typ	Max
Supply Voltage (V_{DD})	V	-0.3		+6.0
Input and Output Current (V_{IN}/I_{OUT})	mA	-10		+10

4.3 Operating Electrical Characteristics for all RR112 Series Sensors²

Parameters	Units	Min	Typ	Max
Supply Voltage (V_{DD})	V	+1.7	3.0	+5.5
Power-On Time (t_{ON})($V_{DD} > 1.7V$)	μs		50	75
Under Voltage Lockout Threshold Rising V_{DD} ($V_{UVLO-RISE}$)	V		+1.6	+1.65
Under Voltage Lockout Threshold Falling V_{DD} ($V_{UVLO-FALL}$)	V	+1.40	+1.55	
Under Voltage Lockout Hysterisis ($V_{UV-HYST}$)	mV		+50	

Notes:

- Exceeding Absolute Ratings may cause permanent damage to the device. Exposure at the maximum rated conditions for extended periods of time may also affect device reliability.
- Unless otherwise specified, all characteristics are measured at 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 RR112-1G42-531 & RR112-1G42-532¹

Parameters	Units	Min	Typ	Max
Operating Temperature (T _A)	°C	-40		+85
Average Supply Current (I _{DD(AVG)}) ²	μA		3	
Sampling Frequency (f _s)	Hz		100	
Idle Mode Time (t _{idle})	ms		10	
Maximum Drive Capability (I _{DRV(MAX)}) (V _{ANA} covers 20% V _{DD} to 80% V _{DD} span)	μA	-10		+10
Output Capacitive Load (C _L)	pF			10
Analog Output Magnetic Field Range (B _{ANA})	G		±80	
Analog Output Voltage Range (V _{ANA})	V	0.1 x V _{DD}		0.9 x V _{DD}
Voltage Output Quiescent (V _{OQ}) ²	%V _{DD}	45	50	55
Sensitivity @ T = +25°C (T _A = +25°C)	mV/V/G	-3.5	-5	-6.5
Sensitivity @ Full Temperature Range (S _{FULL_RANGE}) (T _A = -40°C to +85°C)	mV/V/G		-5	

4.5 Operating Characteristics for RR112-1G43-531 & RR112-1G43-532¹

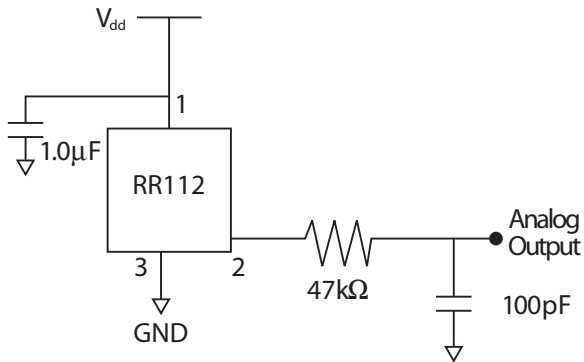
Parameters	Units	Min	Typ	Max
Operating Temperature (T _A)	°C	-40		+125
Average Supply Current (I _{DD(AVG)}) ²	μA		3	
Sampling Frequency (f _s)	Hz		100	
Idle Mode Time (t _{idle})	ms		10	
Maximum Drive Capability (I _{DRV(MAX)}) (V _{ANA} covers 20% V _{DD} to 80% V _{DD} span)	μA	-10		+10
Output Capacitive Load (C _L)	pF			10
Analog Output Magnetic Field Range (B _{ANA})	G		±80	
Analog Output Voltage Range (V _{ANA})	V	0.1 x V _{DD}		0.9 x V _{DD}
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Notes:

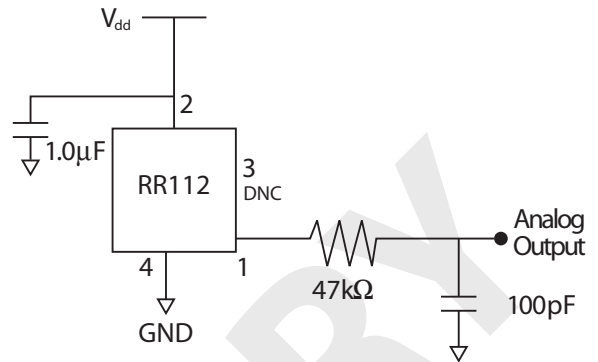
1. Unless otherwise specified, V_{DD} = 1.7 V to 5.5 V, T_A = -40°C to +125°C. Typical values are V_{DD} = 3.0 V and T_A = +25°C.
2. Conditions: t = 10 seconds
3. Conditions: B_{HYST} = B_{OP} - B_{RP}
4. For V_{DD} = 1.7V, T_A = +25°C
5. See "Magnetic Field vs. Output Status" for more details.

5 Application Information

5.1 Application Circuit (SOT-23-3)



5.2 Application Circuit (LGA-4)



RR112 Output Application Circuit

The output voltage can be connected to an analog I/O pin on a microcontroller. A decoupling capacitor between the supply voltage and ground is required with placement close to the magnetic sensor. A typical capacitor value of 1.0 μF will suffice. The analog output voltage is proportional to the strength of an applied magnetic field. A simple RC filter is recommended at the output. A resistor value of 47k Ω and a capacitor value of 100 pF should suffice.

6 Part Selection and Ordering Information

6.1 Part Selection Table

Part Number	Magnetic Polarity Response	Frequency (Hz)	I_{avg} (μA)	Temp. Rating ($^{\circ}\text{C}$)	Supply Voltage (V_{dd})	Output Response	Package
RR112-1G42-531	Omnipolar	100	3	-40 - +85	1.7 - 5.5	Analog	SOT-23-3
RR112-1G42-532	Omnipolar	100	3	-40 - +85	1.7 - 5.5	Analog	LGA-4
RR112-1G43-531	Omnipolar	100	3	-40 - +125	1.7 - 5.5	Analog	SOT-23-3
RR112-1G43-532	Omnipolar	100	3	-40 - +125	1.7 - 5.5	Analog	LGA-4

6.2 Device Nomenclature

Ordering Information

RR112-1 G 4 X-5 3 X

Series
Magnetic Polarity Response
 1 = Omnipolar

Magnetic Sensitivity
 G: -5 mV/V/G

Clock Frequency (Hz)
 4: 100

Package

1: SOT-23-3
 2: LGA-4

Output Response

3: Analog

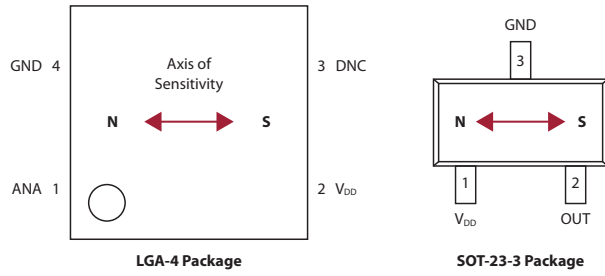
Supply Voltage

5: 1.7-5.5 V

Temp Rating ($^{\circ}\text{C}$)

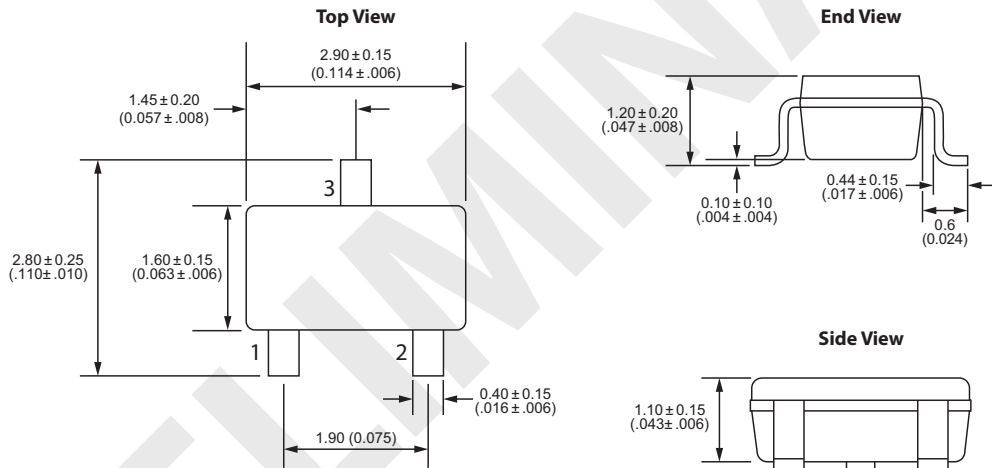
2: -40-+85
 3: -40-+125

7 Axis of Sensitivity (Top View)

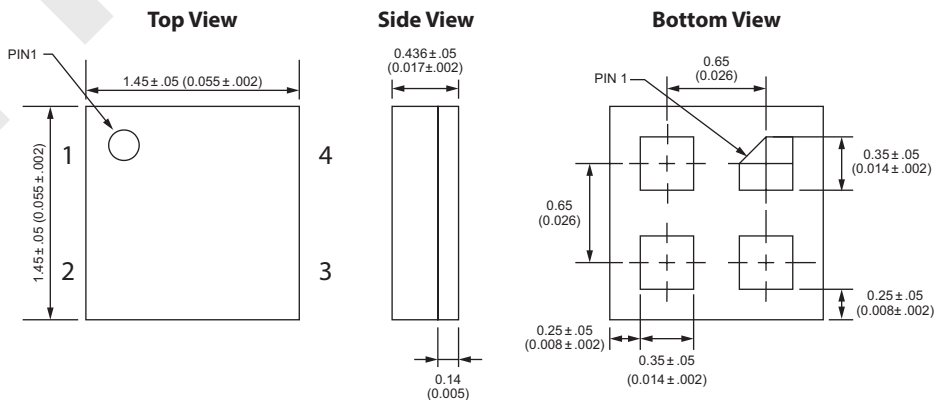


8 Dimensions Millimeters (Inches)

8.1 SOT-23-3 Package

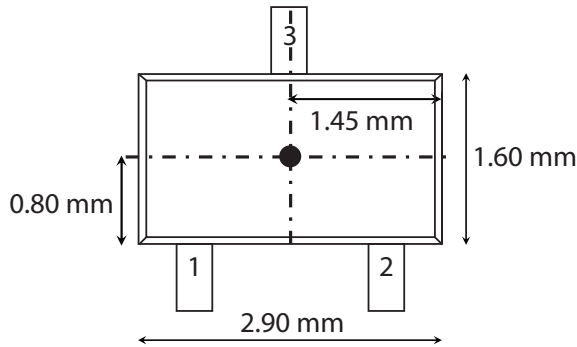


8.2 LGA-4 Package

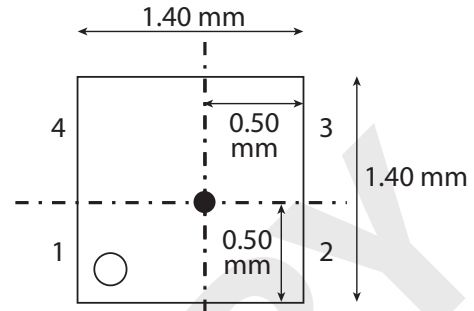


9 TMR Sensor Location

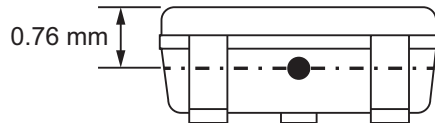
9.1 SOT-23-3 Package



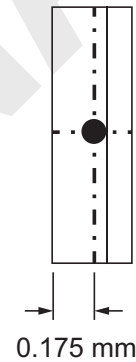
9.2 LGA-4 Package



9.3 SOT Package - Side View

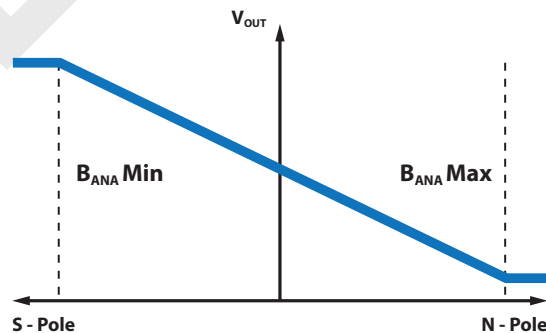


9.4 LGA Package - Side View

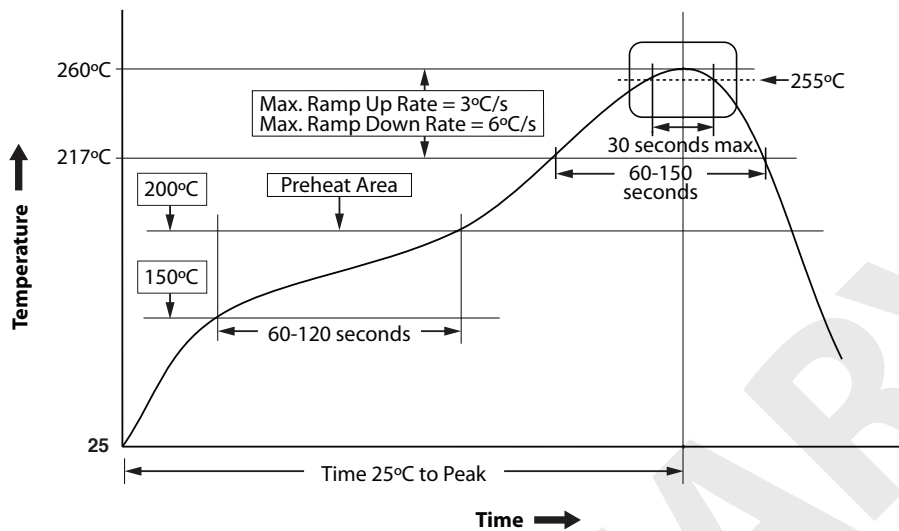


10 Magnetic Flux Response Diagram

Analog Magnetic Flux Response



11 Suggested Pb-Free Reflow Profile

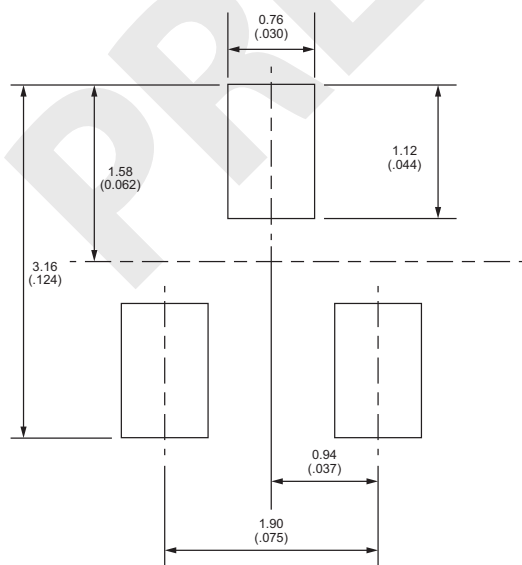


Notes:

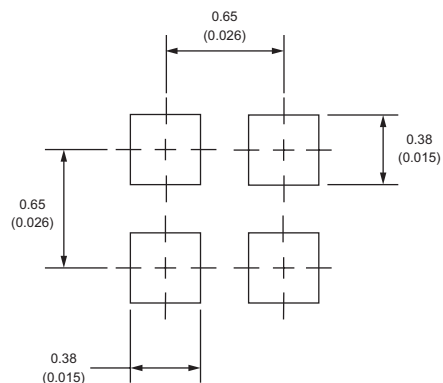
1. Fully compatible with standard no-lead solder profile, 260 °C for 1 minute max (3 cycles max).
2. Profile shown as example. Users are advised to develop their own board-level profile.
3. Suggested Pb-free reflow profile derived from IPC/JEDEC J-STD-020E.
4. Temperature tolerance: +0 °C, as measured 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. MSL rating of 3 (LGA-4 only) compatible with J-STD-020 or equivalent.
7. 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), Tp shall be within ± 2 °C of the live bug Tp and still meet the Tc 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.
8. 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.

12 Suggested Solder Pad Layout

12.1 SOT-23-3 Solder Pad Layout



12.2 LGA-4 Solder Pad Layout



13 TMR Sensor & Switch Packaging

13.1 SOT-23-3 Tape & Reel Packaging

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

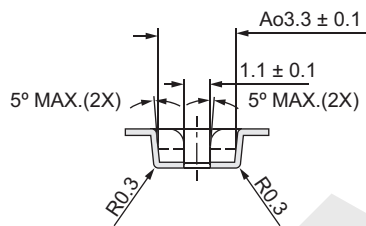
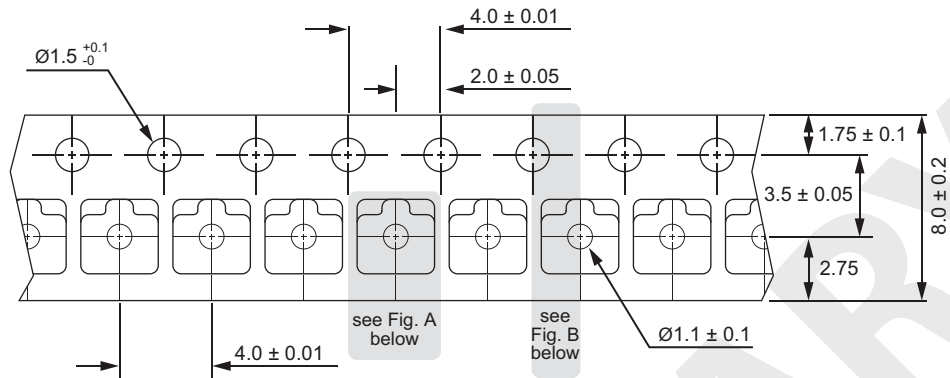


Fig. A

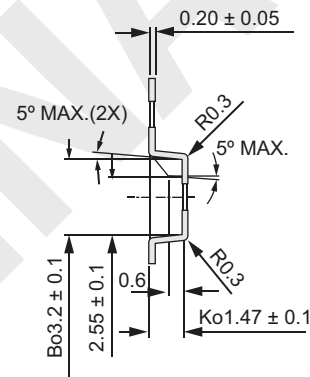
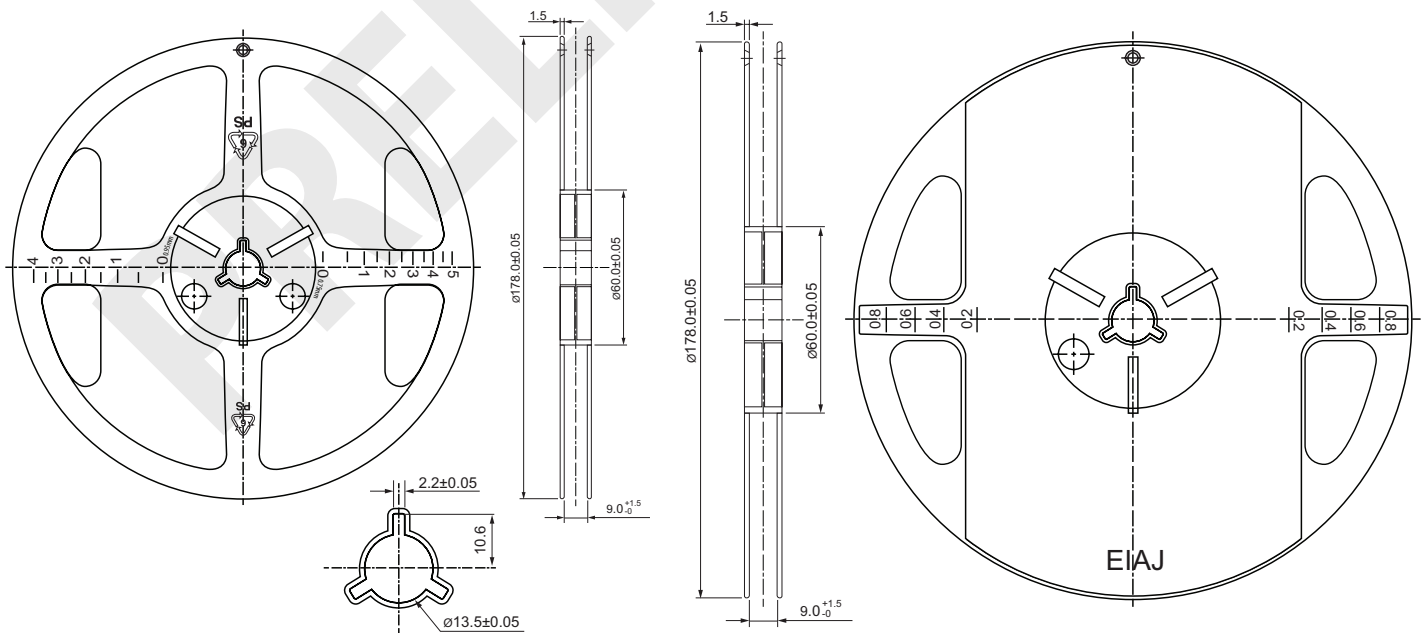


Fig. B



13 TMR Sensor & Switch Packaging

13.3 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

PRELIMINARY