



SBB3089Z

50MHz to 6000MHz Gain Block

Product Overview

The SBB3089Z is a high performance InGaP HBT MMIC amplifier utilizing a Darlington configuration with an active bias network. The active bias network provides stable current over temperature and process Beta variations. The SBB3089Z product is designed for high linearity 5V gain block applications that require excellent gain flatness, small size, and minimal external components. It is internally matched to 50Ω.

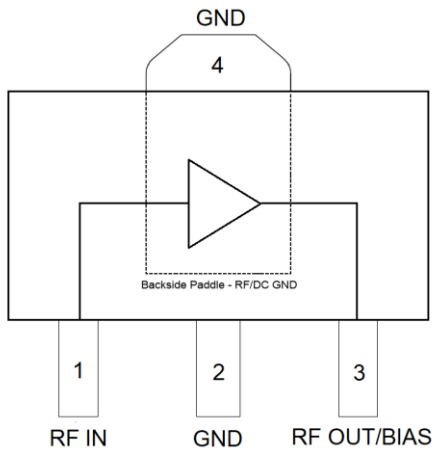


3-pin SOT-89 Package

Key Features

- 50MHz – 6000MHz Operational Frequency
- Patented Thermal Design and Self Bias Circuit
- Gain = 16.4dB at 1950MHz
- P1dB = +15.2dBm at 1950MHz
- OIP3 = +29.5dBm at 1950MHz
- Single Fixed 5V Supply
- Robust 1000V ESD, Class 1C HBM

Functional Block Diagram



Top View

Applications

- PA Driver Amplifier
- Cellular, PCS, GSM, UMTS
- IF Amplifier
- Wireless Data, Satellite
- Wideband Instrumentation

Ordering Information

| Part No. | Description |
|--------------|------------------------------------------------|
| SBB3089Z | 7" Reel with 1000 pieces |
| SBB3089ZPCK1 | 500MHz to 3500MHz PCBA with 5-piece sample bag |

Absolute Maximum Ratings

| Parameter | Rating |
|----------------------------------------|---------------|
| Storage Temperature | -55 to 150 °C |
| RF Input Power, CW, 50 Ω, T=+25 °C | +20 dBm |
| Device Voltage (V _{CC}) | +6 V |
| Device Current (I _{CC}) | 100 mA |
| Junction Temperature (T _J) | +150 °C |

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device.

Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|-------------------|-----|-----|-----|-------|
| T _{CASE} | -40 | | +85 | °C |

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions. Application of conditions to the device outside the Recommended Operating Conditions may reduce device reliability and performance.

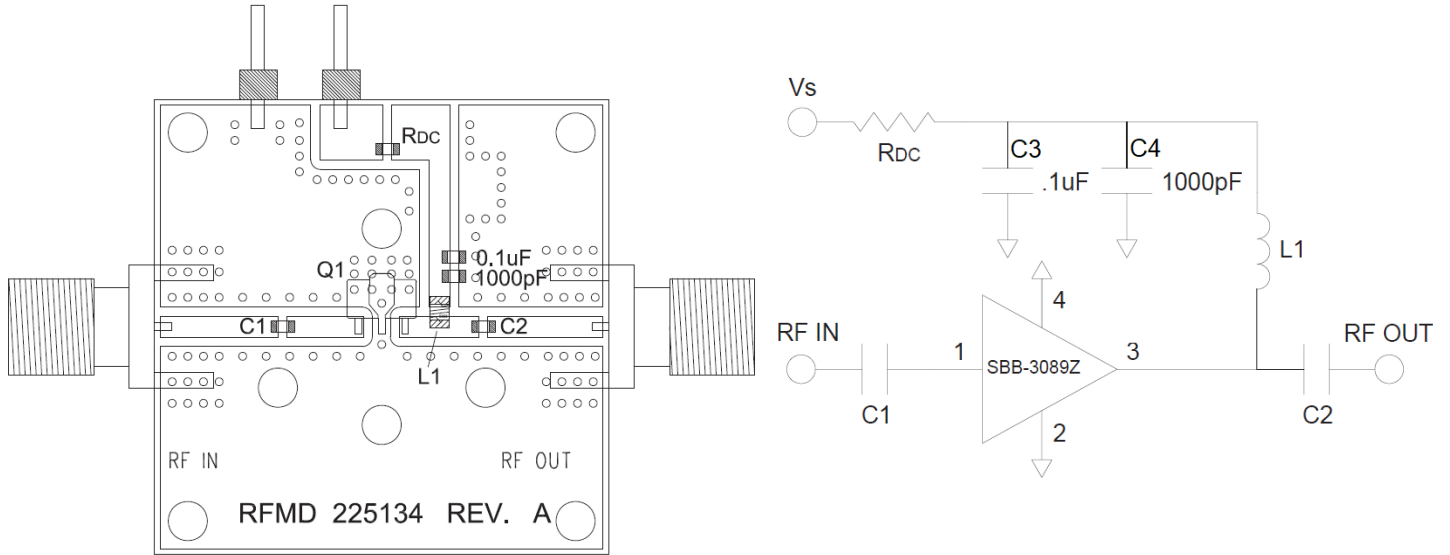
Electrical Specifications

| Parameter | Conditions ⁽¹⁾ | Min | Typ | Max | Units |
|---------------------------------------------|-------------------------------------------------------------------|-------|-------|------|-------|
| Operational Frequency Range | | 50 | | 6000 | MHz |
| Gain | 850MHz | 15.1 | 16.6 | 18.1 | dB |
| | 1950MHz | 14.9 | 16.4 | 17.9 | dB |
| | 2400MHz | | 16.3 | | dB |
| Input Return Loss | 1950MHz | 16 | 21 | | dB |
| Output Return Loss | 1950MHz | 19 | 25.5 | | dB |
| Output P1dB | 850MHz | | +15.6 | | dBm |
| | 1950MHz | +14.2 | +15.2 | | dBm |
| | 2400MHz | | +15.4 | | dBm |
| Output IP3 | P _{out} = -5 dBm/tone, Δf = 1 MHz, Center Freq.= 850MHz | | +30 | | dBm |
| | P _{out} = -5 dBm/tone, Δf = 1 MHz, Center Freq.= 1950MHz | +27.5 | +29.5 | | dBm |
| | P _{out} = -5 dBm/tone, Δf = 1 MHz, Center Freq.= 2400MHz | | +29.5 | | dBm |
| Noise Figure | 1950MHz | | 3.9 | 4.9 | dB |
| Device Operating Voltage (V _{CC}) | R _{DC} =20Ω, V _S =+5.0V | | 4.2 | 4.3 | V |
| Device Operating Current (I _{CC}) | R _{DC} =20Ω, V _S =+5.0V | 38 | 42 | 46 | mA |
| Thermal Resistance, θ _{Jc} | Junction to case | | 80 | | °C/W |

Notes:

1. Test conditions unless otherwise noted: V_S= +5.0V, V_{CC}= +4.2 V, I_{CC}= 42mA, R_{DC}=20Ω, Temp= +25 °C , 50 Ω system.
2. Supply voltage (V_S) and bias resistor (R_{DC}) values are related by: R_{DC}=(V_S-V_{CC})/I_{CC}

Evaluation Board



Bill of Material

| Reference Des. | Value | Description | Manuf. | Part Number |
|-----------------|---------|--------------------------|-----------|----------------|
| n/a | n/a | Printed Circuit Board | Qorvo | |
| Q1 | n/a | HBT Gain Block Amplifier | Qorvo | SBB3089Z |
| C1, C4 | 1000 pF | CAP, 0603, 10%, 50V, X7R | various | |
| C2 | 68 pF | CAP, 0603, 5%, 50V, C0G | various | |
| C3 | 0.1 uF | CAP, 0805, 10%, 50V, X7R | various | |
| L1 | 48 nH | IND, 0805, 5%, W/W | Coilcraft | 0805HQ-48NXJRC |
| R _{DC} | 20 Ω | RES, 0805, 5%, 1/10W | various | |

Recommended R_{DC} Resistor Values for I_{CC}=42mA

| Supply Voltage (V _S) | 5V | 6V | 8V | 10V | 12V |
|----------------------------------|-----|-----|-----|------|------|
| R _{DC} | 20Ω | 43Ω | 91Ω | 139Ω | 187Ω |

Notes:

- Supply voltage (V_S) and bias resistor (R_{DC}) values are related by: $R_{DC} = (V_S - V_{CC}) / I_{CC}$

Typical Performance – with Bias Tee

Test conditions unless otherwise noted: $V_S = +5.0V$, $V_{CC} = +4.2V$, $I_{CC} = 42mA$, $R_{DC} = 20\Omega$, Temp = $+25^\circ C$, 50Ω system.

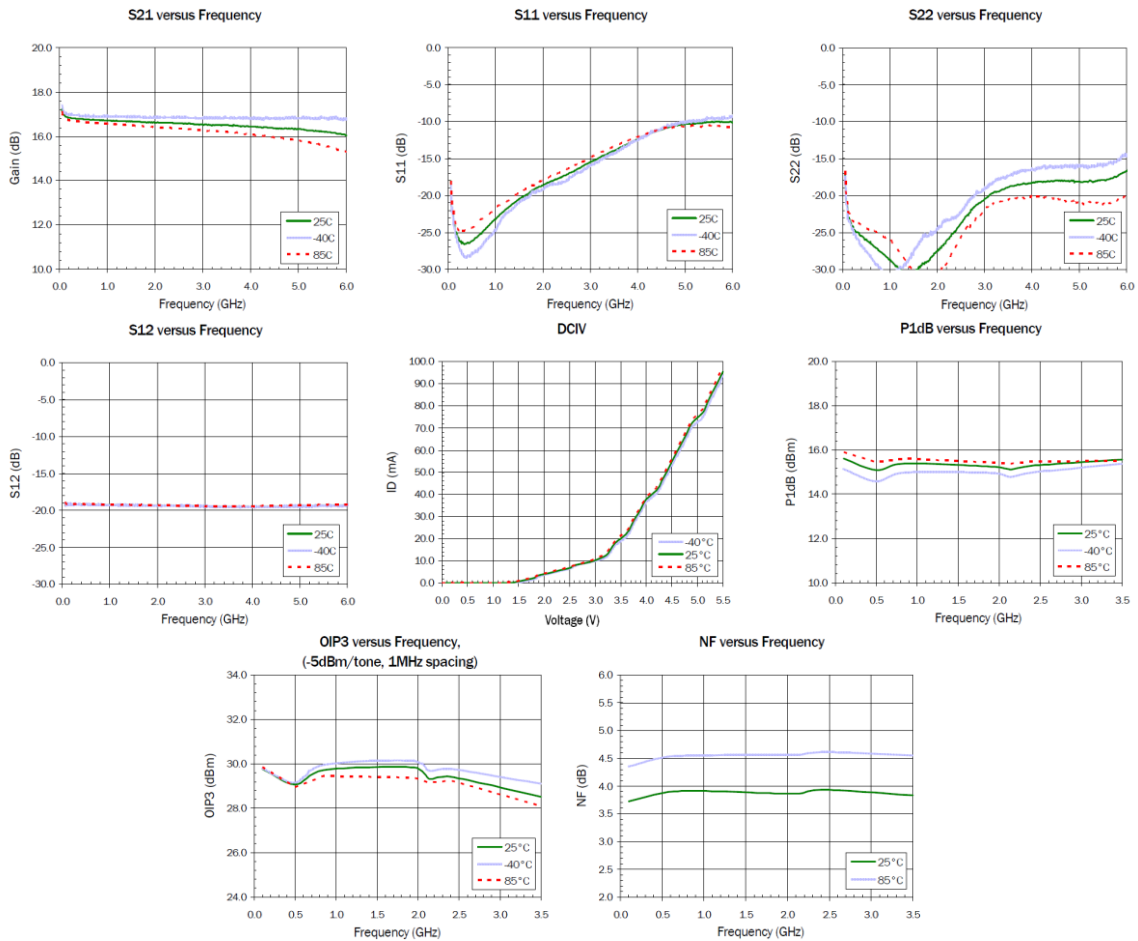
| Parameter | Typical Value | | | | | | | Units |
|---------------------|---------------|-------|-------|-------|------|-------|-------|-------|
| Frequency | 100 | 500 | 850 | 1950 | 2140 | 2400 | 3500 | MHz |
| Gain | 16.9 | 16.6 | 16.6 | 16.4 | 16.4 | 16.3 | 16.1 | dB |
| Input Return Loss | 24 | 26.5 | 24.5 | 21 | 20.5 | 20 | 15.5 | dB |
| Output Return Loss | 21.5 | 26 | 26 | 25.5 | 25.5 | 27.5 | 21 | dB |
| Reverse Isolation | 19.5 | 19 | 19.5 | 19.5 | 19.5 | 19.5 | 19.5 | dB |
| Output P1dB | +15.6 | +16 | +15.6 | +15.2 | +15 | +15.4 | +15.2 | dBm |
| OIP3 ⁽¹⁾ | +29.5 | +30.5 | +30 | +29.5 | +29 | +29.5 | +27 | dBm |
| Noise Figure | 3.7 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 4 | dB |

Notes:

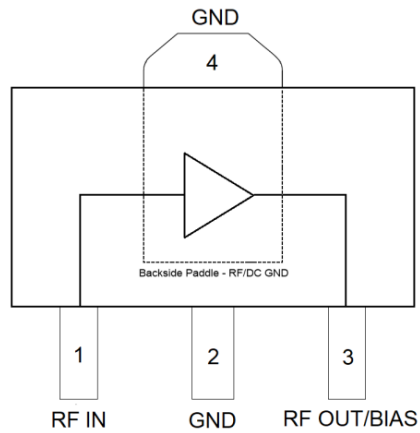
1. $P_{out} = -5$ dBm/tone, $\Delta f = 1$ MHz

Performance Plots – with Bias Tee

Test conditions unless otherwise noted: $V_S = +5.0V$, $V_{CC} = +4.2V$, $I_{CC} = 42mA$, $R_{DC} = 20\Omega$, Temp = $+25^\circ C$, 50Ω system.



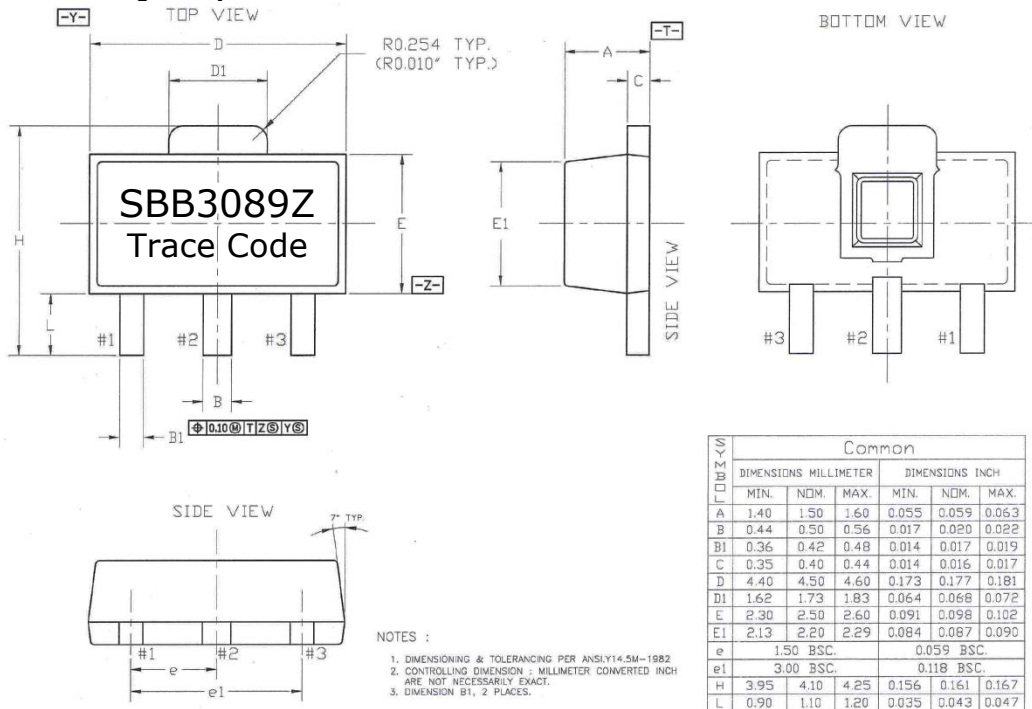
Pin Configuration and Description



| Pin No. | Label | Description |
|---------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | RF IN | RF input. External DC Block capacitor required. |
| 2, 4 | GND | RF/DC ground. Use recommended via hole pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint. |
| 3 | RF OUT / BIAS | RF output and DC Supply input. External DC Block capacitor and bias voltage required. |

Package Marking and Dimensions

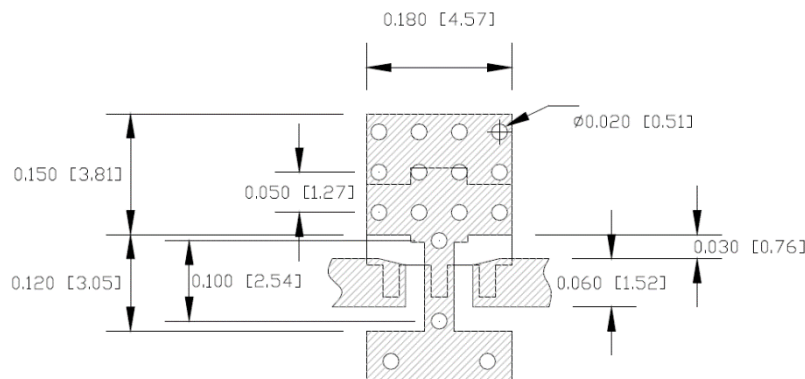
Marking: Part Identifier – SBB3089Z
Trace Code – Assigned by sub-contractor



Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

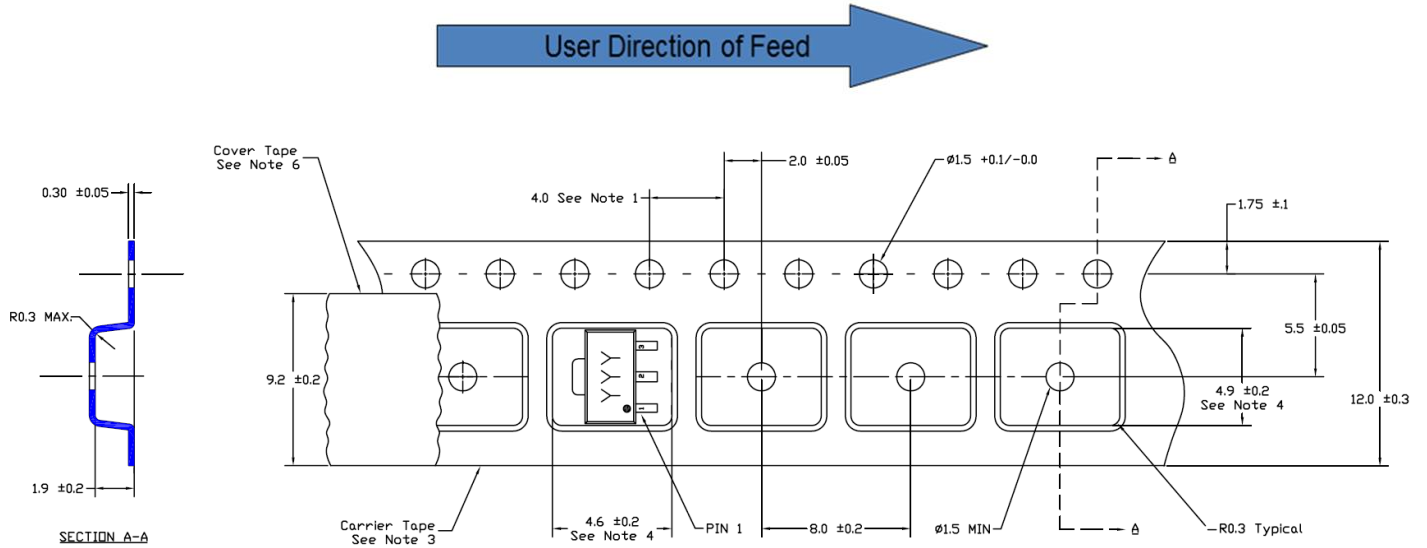
PCB Mounting Pattern



NOTES:

1. All dimensions are in millimeters [inches]. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25mm (0.01").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Tape and Reel Information – Carrier and Cover Tape Dimensions

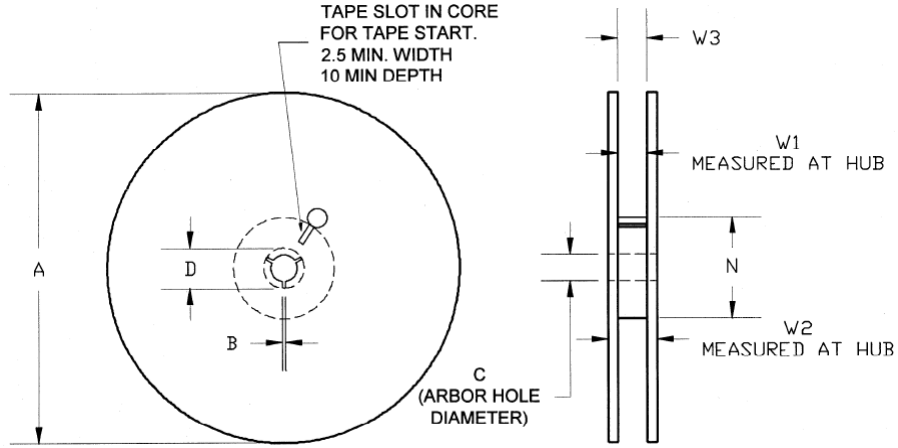


- 1. 10 sprocket hole pitch cumulative tolerance
- 2. Camber not to exceed 1mm in 100mm
- 3. Material: Black Conductive Polystyrene
- 4. Measured on a plane 0.3mm above the bottom of the pocket
- 5. Measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
- 6. Material: Antistatic Polyester Film

| Feature | Measure | Symbol | Size (in) | Size (mm) |
|---------------------|------------------------------------------|--------|-----------|-----------|
| Cavity | Length | A0 | 0.181 | 4.60 |
| | Width | B0 | 0.193 | 4.90 |
| | Depth | K0 | 0.075 | 1.90 |
| | Pitch | P1 | 0.315 | 8.00 |
| Centerline Distance | Cavity to Perforation - Length Direction | P2 | 0.079 | 2.00 |
| | Cavity to Perforation - Width Direction | F | 0.217 | 5.50 |
| Cover Tape | Width | C | 0.362 | 9.20 |
| Carrier Tape | Width | W | 0.472 | 12.0 |

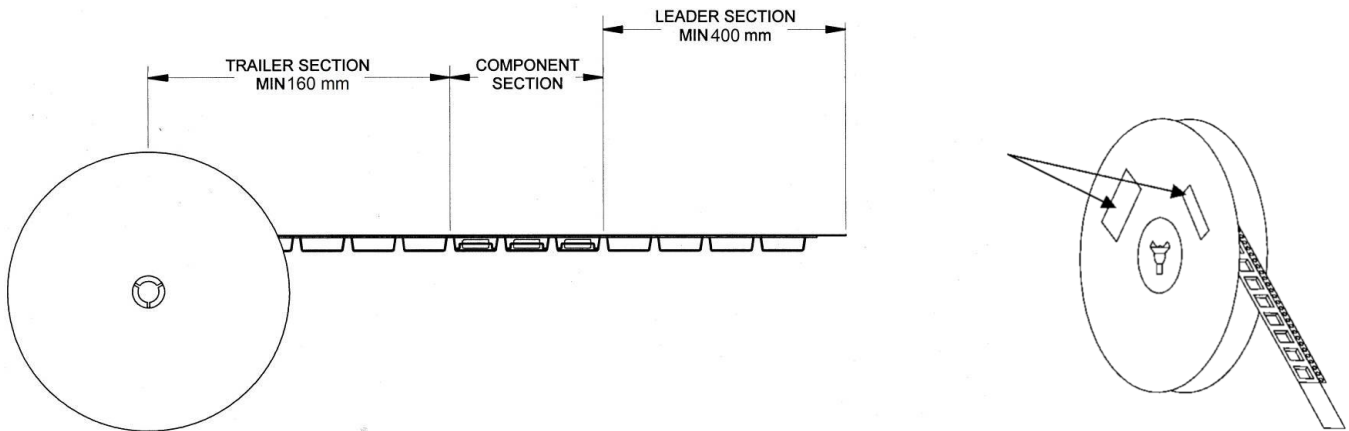
Tape and Reel Information – Reel Dimensions

Standard T/R size = 1,000 pieces on a 7" reel.



| Feature | Measure | Symbol | Size (in) | Size (mm) |
|---------|----------------------|--------|-----------|-----------|
| Flange | Diameter | A | 6.969 | 177.0 |
| | Thickness | W2 | 0.717 | 18.2 |
| | Space Between Flange | W1 | 0.504 | 12.8 |
| Hub | Outer Diameter | N | 2.283 | 58.0 |
| | Arbor Hole Diameter | C | 0.512 | 13.0 |
| | Key Slit Width | B | 0.079 | 2.0 |
| | Key Slit Diameter | D | 0.787 | 20.0 |

Tape and Reel Information – Tape Length and Label Placement



- Notes:
1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481-1-A.
 2. Labels are placed on the flange opposite the sprockets in the carrier tape.

Handling Precautions

| Parameter | Rating | Standard |
|----------------------------------|----------|---------------------------|
| ESD – Human Body Model (HBM) | Class 1C | ESDA / JEDEC JESDC22-A114 |
| MSL – Moisture Sensitivity Level | Level 3 | IPC/JEDEC J-STD-020 |



Caution!
 ESD-Sensitive Device

Solderability

Compatible with both lead-free (260°C max. reflow temp.) and tin/lead (245°C max. reflow temp.) soldering processes. Solder profiles available upon request.

Contact plating: NiPdAu

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free



Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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