



TQP369185

DC – 6 GHz Gain Block

Product Description

The TQP369185 is a general-purpose buffer amplifier that offers high dynamic range in a low-cost surface-mount package. At 1.9 GHz, the amplifier typically provides 19 dB gain, +31.7 dBm OIP3, and 4.6 dB Noise Figure while drawing 75 mA current. The device combines dependable performance with consistent quality to maintain MTTF values exceeding 100 years at mounting temperatures of +85°C. The device is housed in a lead-free/green/RoHS-compliant industry-standard SOT-89 package.

The TQP369185 consists of a Darlington-pair amplifier using Qorvo's high reliability InGaP/GaAs HBT process technology. Internal active bias enables operation with only DC-blocking capacitors and an RF choke on the DC bias feed. This broadband MMIC amplifier can be directly applied to various current and next generation wireless technologies such as CDMA, W-CDMA, and LTE. In addition, the TQP369185 will work for other various applications within the DC to 6 GHz frequency range.

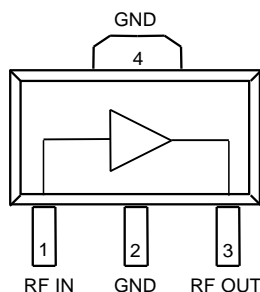


SOT-89 Package

Product Features

- DC-6000 MHz
- 19 dB Gain at 1.9 GHz
- 4.7 dB Noise Figure at 1.9 GHz
- +31.7 dBm Output IP3 at 1.9 GHz
- +19.6 dBm P1dB at 1.9 GHz
- 50 Ohm Cascadable Gain Block
- Internal active bias
- SOT-89 Package

Functional Block Diagram



Applications

- Mobile Infrastructure
- LTE / WCDMA / CDMA
- CATV
- Point to Point
- General Purpose Wireless

Ordering Information

| Part No. | Description |
|---------------|----------------------------|
| TQP369185 | InGaP/GaAs HBT Gain Block |
| TQP369185-PCB | 0.5-4 GHz Evaluation Board |

Standard T/R size = 2500 pieces on a 13" reel

Absolute Maximum Ratings

| Parameter | Rating |
|---|---------------|
| Storage Temperature | -55 to +150°C |
| RF Input Power, CW, 50 Ω , T=25 °C | +25 dBm |
| Device Voltage (V _{CC}) | +7 V |

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

Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|--|-----|-----|------|-------|
| T _{CASE} | -40 | | +105 | °C |
| T _j for >10 ⁶ hours MTTF | | | +170 | °C |

Electrical specifications are measured under bias, signal and temperature conditions as specified. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

| Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------------|--|------|-------|------|--------|
| Operational Frequency Range | | DC | | 6000 | MHz |
| Test Frequency | | | 1900 | | MHz |
| Gain | | 17.5 | 19 | 20.5 | dB |
| Input Return Loss | | | -13.5 | | dB |
| Output Return Loss | | | -9.6 | | dB |
| Output P1dB | | | +19.6 | | dBm |
| Output IP3 | P _{out} =0 dBm/tone, Δf = 1 MHz | +28 | +31.7 | | dBm |
| Noise Figure | | | 4.6 | | dB |
| Device Voltage, V _{CC} | | 3.0 | 5 | | V |
| Device Current, I _{CC} | | 55 | 75 | 92 | mA |
| Thermal Resistance, θ_{jc} | Junction to case | | | 82 | °C / W |

Notes:

1. Test conditions unless otherwise noted: V_{CC}=+5 V, Temp=+25 °C, 50 Ω system
2. OIP3 is measured with two tones at an output power of 4 dBm / tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the OIP3 using 2:1 rule. 2:1 rule gives relative value with respect to fundamental tone.

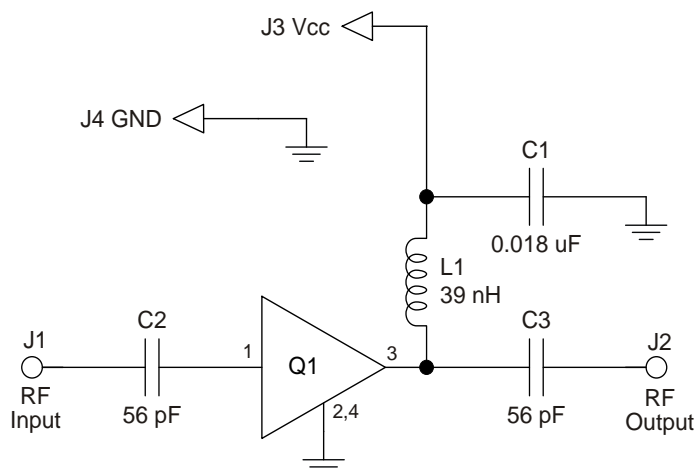
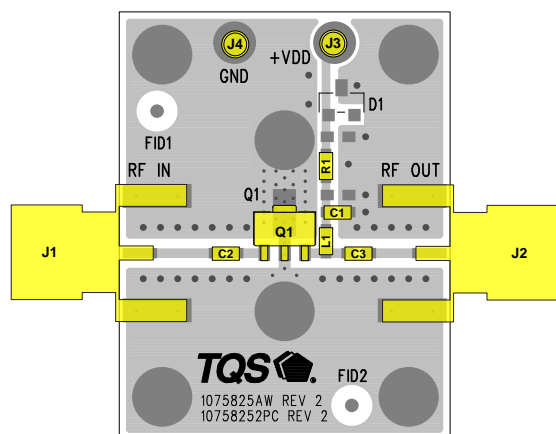
S-Parameters

| Freq (MHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 10 | -19.3 | -178.5 | 21.3 | 179.4 | -26.2 | 0.5 | -14.3 | 3.2 |
| 20 | -19.0 | -177.3 | 21.4 | 178.6 | -26.1 | 0.5 | -14.0 | 1.0 |
| 50 | -18.6 | -175.6 | 21.4 | 177.6 | -26.0 | -0.4 | -14.3 | -2.7 |
| 100 | -18.4 | -176.9 | 21.3 | 174.5 | -26.1 | -0.3 | -14.4 | -8.5 |
| 200 | -17.9 | -170.6 | 21.3 | 169.7 | -26.1 | -0.6 | -14.0 | -16.2 |
| 500 | -16.9 | -169.8 | 21.0 | 155.4 | -26.0 | -2.7 | -13.4 | -43.7 |
| 1000 | -14.3 | -173.6 | 20.5 | 132.9 | -25.6 | -6.1 | -12.0 | -83.8 |
| 1500 | -12.3 | 178.7 | 20.0 | 110.6 | -25.1 | -10.7 | -10.4 | -119.2 |
| 2000 | -10.7 | 163.5 | 19.3 | 89.1 | -24.5 | -18.4 | -8.9 | -149.9 |
| 2500 | -9.1 | 148.7 | 18.5 | 68.1 | -24.2 | -26.3 | -7.9 | -177.8 |
| 3000 | -7.8 | 136.2 | 17.7 | 49.2 | -23.8 | -34.8 | -7.0 | 160.8 |
| 3500 | -6.9 | 125.7 | 16.8 | 30.8 | -23.5 | -44.4 | -6.3 | 141.0 |
| 4000 | -6.5 | 115.7 | 15.8 | 12.5 | -23.5 | -53.7 | -5.3 | 122.0 |
| 4500 | -6.7 | 101.4 | 14.7 | -4.6 | -23.7 | -62.5 | -5.0 | 104.1 |
| 5000 | -5.8 | 89.6 | 13.7 | -19.6 | -23.5 | -69.4 | -4.7 | 90.3 |
| 5500 | -4.8 | 80.2 | 13.1 | -36.1 | -23.5 | -79.2 | -4.1 | 78.6 |
| 6000 | -4.3 | 69.8 | 12.1 | -52.3 | -23.7 | -89.4 | -4.0 | 66.0 |

Notes:

1. Test Conditions: $V_{CC}=+5$ V (typ.), $I_{CC}=72$ mA (typ.), $T=+25$ °C, unmatched 50 ohm system, calibrated to device leads

TQP369185-PCB Evaluation Board



Notes:

1. See PC Board Layout, under Application Information section, for more information.
2. All components are of 0603 size unless stated on the schematic.
3. Zero Ohm resistor R1 is used to bridge a trace gap on PCB 1075825 and is not required in end user applications.

Bill of Material – TQP369185-PCB

| Reference Des. | Value | Description | Manuf. | Part Number |
|----------------|------------|--------------------------------|-----------|-------------|
| Q1 | n/a | High Linearity LNA Gain Block | Qorvo | TQP369185 |
| C1 | 0.018 uF | Cap, Chip, 0603, 16V, X7R, 10% | various | |
| C2, C3 | 56 pF | Cap, Chip, 0603, 50V, NPO, 5% | various | |
| L1 | 39 nH | Inductor, 0603, 5%, CS Series | Coilcraft | |
| R1 | 0 Ω | Res, Chip, 603, 1/10W, 5% | various | |

Component Values for Specific Frequencies

Use the component values in this table for optimal operation at specific frequencies.

| Reference Designator | Frequency (MHz) | | | | | | |
|----------------------|-----------------|---------|--------|-------|-------|-------|-------|
| | 50 | 500 | 900 | 1900 | 2200 | 2500 | 3500 |
| L1 | 820 nH | 220 nH | 68 nH | 27 nH | 22 nH | 18 nH | 15 nH |
| C2, C3 | .018 uF | 1000 pF | 100 pF | 68 pF | 68 pF | 56 pF | 39 pF |

Typical Performance – TQP369185-PCB

Test conditions unless otherwise noted: $V_{SUPPLY} = +5\text{ V}$, $I_{CC} = 75\text{ mA}$, $T_{CASE} = +25^{\circ}\text{C}$

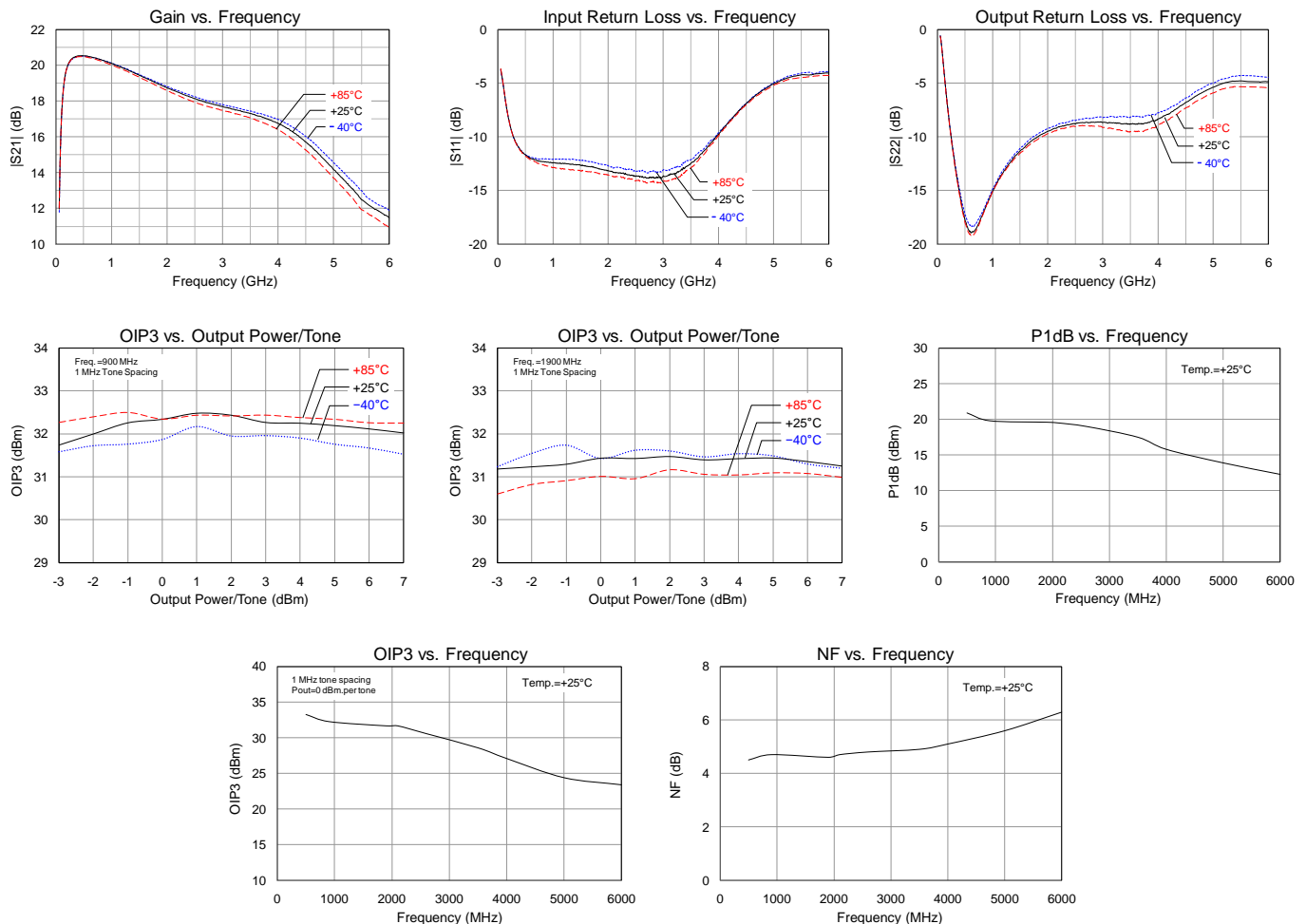
| Parameter | Typical Value | | | | | | | | | Units |
|--------------------|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Frequency | 500 | 900 | 1900 | 2100 | 2600 | 3500 | 4000 | 5000 | 6000 | MHz |
| Gain | 20.5 | 20.4 | 19.0 | 18.6 | 18.0 | 16.8 | 15.8 | 13.7 | 12.1 | dB |
| Input Return Loss | 11.7 | 12.4 | 12.3 | 13.3 | 13.7 | -6.9 | -6.5 | -5.8 | -4.3 | dB |
| Output Return Loss | 17.8 | 15.9 | 10 | 9.3 | 8.7 | -6.3 | -5.3 | -4.7 | -4 | dB |
| Output P1dB | 20.9 | +19.8 | +19.6 | +19.5 | +19 | +17.5 | +15.8 | +13.9 | +12.3 | dBm |
| OIP3 | +33.3 | +32.3 | +31.7 | +31.7 | +30.6 | +28.6 | +27.1 | +24.4 | +23.4 | dBm |
| Noise Figure | 4.5 | 4.7 | 4.6 | 4.7 | 4.8 | 4.9 | 5.1 | 5.6 | 6.3 | dB |

Notes:

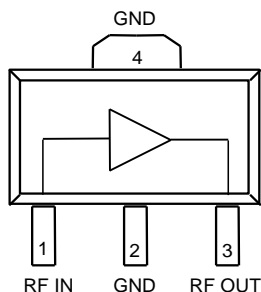
1. OIP3 measured with two tones at an output power of 0 dBm / tone separated by 1 MHz.

Performance Plots – TQP369185-PCB

Test conditions unless otherwise noted: $V_{SUPPLY} = +5\text{ V}$, $I_{CC} = 75\text{ mA}$, $T_{CASE} = +25^{\circ}\text{C}$



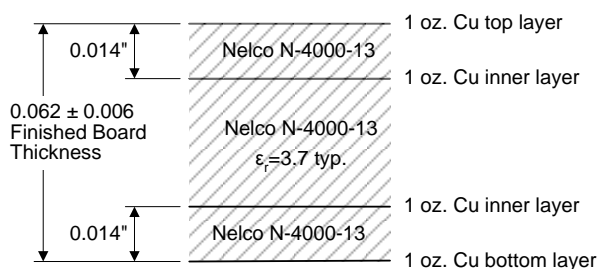
Pin Configuration and Description



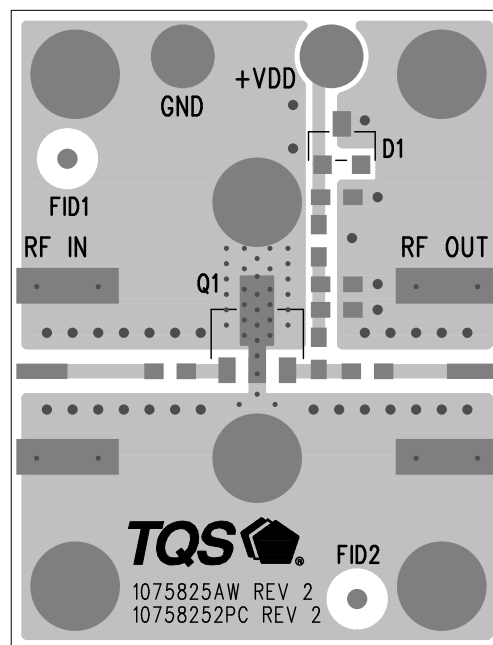
| Pin No. | Label | Description |
|-----------------------|------------|--|
| 1 | RF IN | RF Input, matched to 50 ohms. External DC Block is required. |
| 3 | RFOUT | RF output / DC supply, matched to 50 ohms. External DC Block and bias choke, are required. |
| 2, 4, Backside Paddle | GND Paddle | RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint. |

Applications Information

Qorvo PCB 1075825 Material and Stack-up

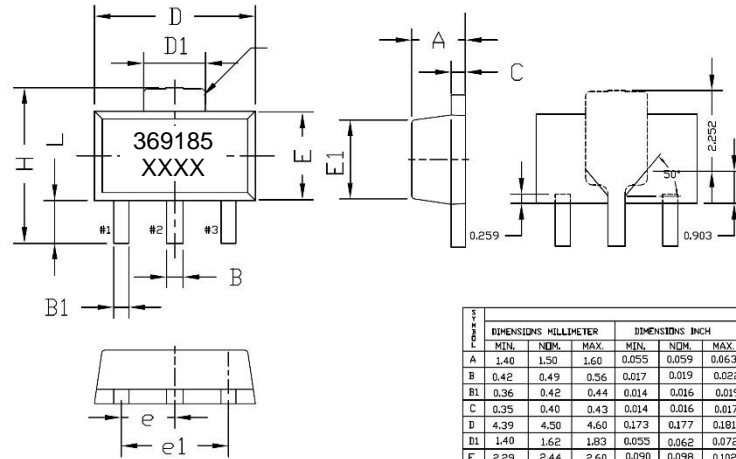


50 Ohm Line Dimensions: width=0.028"
spacing=0.028"



Package Marking and Dimensions

Marking: Part number – 369185
Lot code – XXXX

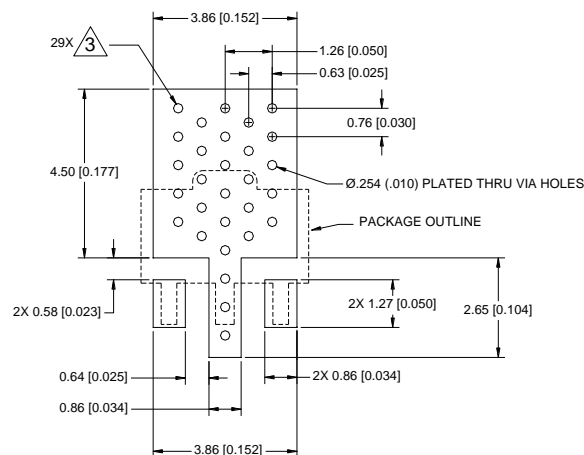


| | DIMENSIONS MILLIMETER | | | DIMENSIONS INCH | | |
|----|-----------------------|------|------|-----------------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| B | 0.42 | 0.49 | 0.56 | 0.017 | 0.019 | 0.022 |
| B1 | 0.36 | 0.42 | 0.44 | 0.014 | 0.016 | 0.019 |
| C | 0.35 | 0.40 | 0.43 | 0.014 | 0.016 | 0.017 |
| D | 4.39 | 4.50 | 4.60 | 0.173 | 0.177 | 0.181 |
| D1 | 1.40 | 1.62 | 1.83 | 0.055 | 0.062 | 0.072 |
| E | 2.29 | 2.44 | 2.60 | 0.090 | 0.098 | 0.102 |
| E1 | 1.77 | 2.03 | 2.29 | 0.070 | 0.074 | 0.090 |
| e | 1.50 BSC | | | 0.059 BSC | | |
| e1 | 3.00 BSC | | | 0.118 BSC | | |
| H | 3.84 | 4.04 | 4.25 | 0.151 | 0.155 | 0.167 |
| L | 0.74 | 0.97 | 1.20 | 0.029 | 0.041 | 0.047 |

Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.
4. Contact plating: Matte Tin

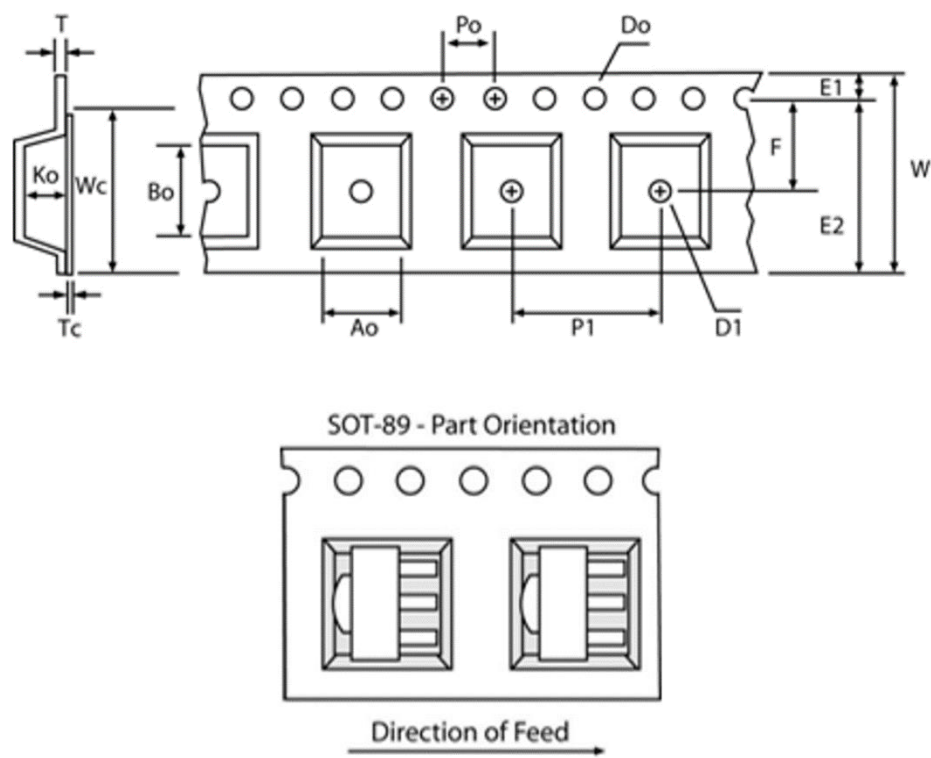
PCB Mounting Pattern



Notes:

1. All dimensions are in millimeters. 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.
4. Do not remove or minimize via hole structure in the PCB. Thermal and RF grounding is critical.
5. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.01").
6. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

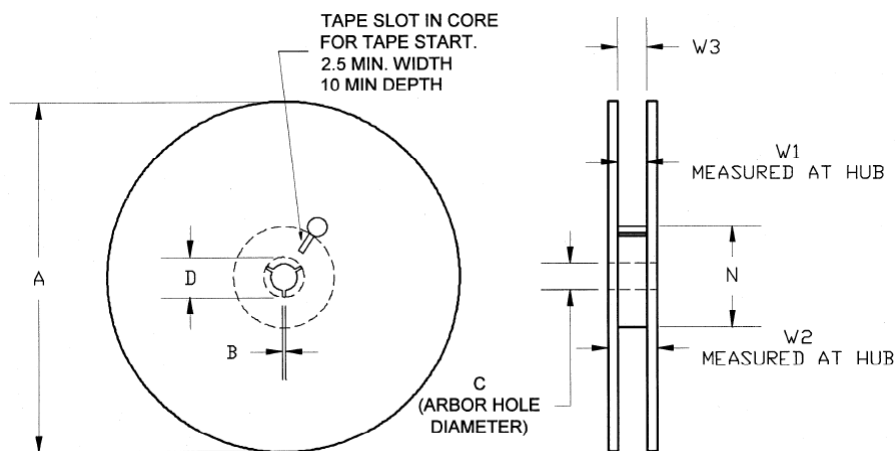
Tape and Reel Information – Carrier and Cover Tape Dimensions



| 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 |

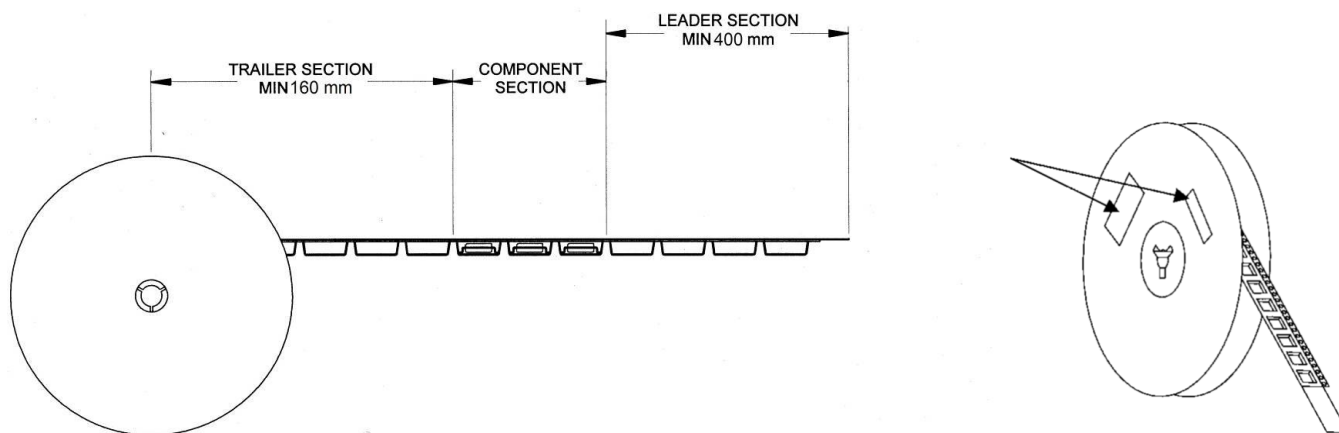
Tape and Reel Information – Reel Dimensions

Standard T/R size = 2,500 pieces on a 13" reel.



| Feature | Measure | Symbol | Size (in) | Size (mm) |
|---------|----------------------|--------|-----------|-----------|
| Flange | Diameter | A | 6.969 | 170.0 |
| | 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 2 | JEDEC Standard JESD22-A114 |
| ESD – Charged Device Model (CDM) | Class C3 | JEDEC Standard JESD22-C101 |
| MSL – Moisture Sensitivity Level | Level 1 | 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: Annealed Matte Tin

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

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