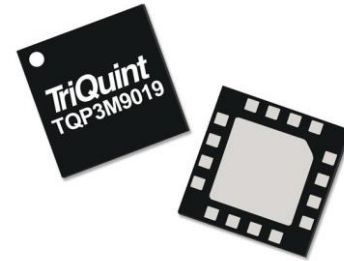


### Product Overview

The TQP3M9019 is a cascade-able, high linearity gain block amplifier in a low-cost surface-mount package. At 1.9 GHz, the amplifier typically provides 22 dB gain, +39.5 dBm OIP3, and 1.3 dB Noise Figure while only drawing 125 mA current. The device is housed in a leadfree / green / RoHS-compliant industry-standard 16-pin 3 x 3 mm QFN package.

The TQP3M9019 has the benefit of having high gain across a broad range of frequencies while also providing very low noise. This allows the device to be used in both receiver and transmitter chains for high performance systems. The amplifier is internally matched using a high-performance E-pHEMT process and only requires an external RF choke and blocking/bypass capacitors for operation from a single +5 V supply. The internal active bias circuit also enables stable operation over bias and temperature variations.

The TQP3M9019 covers the 0.02 – 4 GHz frequency band and is targeted for wireless infrastructure or other applications requiring high linearity and / or low noise figure.

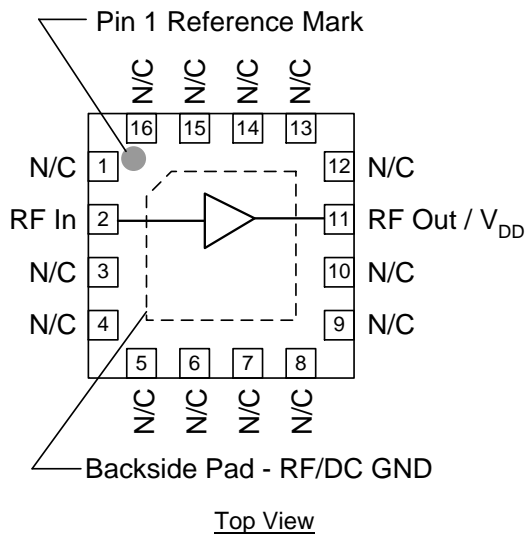


16 Pin 3X3 mm QFN Package

### Key Features

- 20-4000 MHz
- 22 dB Gain at 1900 MHz
- 1.3 dB Noise Figure at 1900 MHz
- +39.5 dBm Output IP3
- 50 Ohm cascade-able Gain Block
- Unconditionally Stable
- High Input Power Capability
- +5 V Single Supply, 85mA Current
- 3x3 mm QFN Package

### Functional Block Diagram



### Applications

- Repeaters
- Mobile Infrastructure
- LTE / WCDMA / CDMA / EDGE
- General Purpose Wireless

### Ordering Information

Part No.	Description
TQP3M9019	2500 pieces on a 7" reel
TQP3M9019-PCB_IF	50-500 MHz Evaluation Board
TQP3M9019-PCB_RF	0.5-4 GHz Evaluation Board

## Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-65 to 150°C
RF Input Power, CW, 50Ω, T=25°C	+23 dBm
Supply Voltage (V <sub>DD</sub> )	+7 V
Reverse Supply Voltage	-0.3 V

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
Supply Voltage (V <sub>DD</sub> )	+4.75	+5.0	+5.25	V
T <sub>CASE</sub>	-40		+105	°C
T <sub>ch</sub> (for >10 <sup>6</sup> hours MTTF)			+190	°C

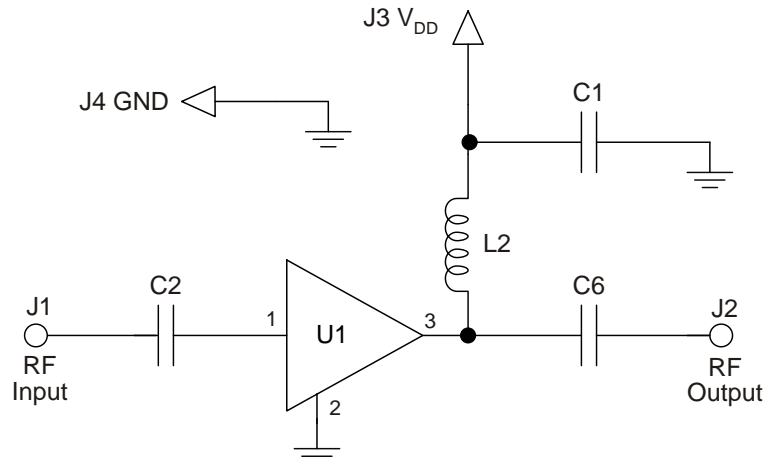
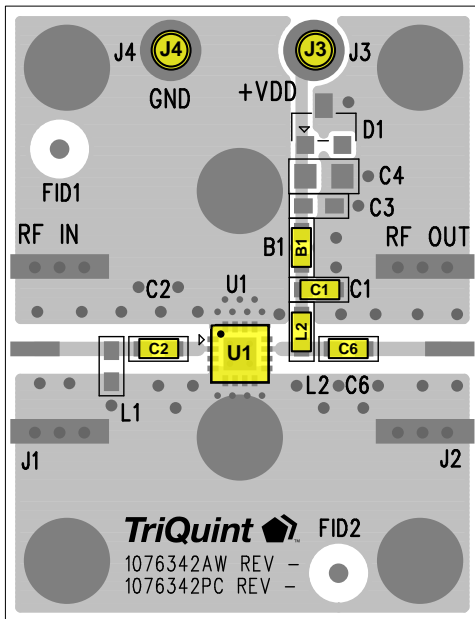
Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions. Application of conditions to the device outside the Recommended Operating Conditions may reduce device reliability and performance.

## Electrical Specifications

Test conditions unless otherwise noted: V<sub>DD</sub>=+5 V, Temp.=+25 °C, 50 Ω system

Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		20		4000	MHz
Test Frequency			1900		MHz
Gain		20	22	23	dB
Input Return Loss			10		dB
Output Return Loss			13		dB
Output P1dB			+22		dBm
Output IP3	P <sub>out</sub> =+3 dBm/tone, Δf = 1 MHz	+36	+39.5		dBm
Noise Figure			1.3		dB
Current, I <sub>DD</sub>			125	150	mA
Thermal Resistance, θ <sub>jc</sub>	Module (junction to case)			34	°C/W

## Evaluation Board – TQP3M9019-PCB\_RF



**Notes:**

1. See Evaluation Board PCB Information section for material and stack-up.
2. Components shown on the silkscreen but not on the schematic are not used.
3. B1 (0  $\Omega$  jumper) is not shown on the schematic and may be replaced with copper trace in the target application layout.
4. The recommended component values are dependent upon the frequency of operation.
5. All components are of 0603 size unless otherwise specified.

## Bill of Material – TQP3M9019-PCB\_RF

Reference Des.	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board	Qorvo	
U1	n/a	High Linearity LNA Gain Block	Qorvo	TQP3M9019
C2, C6	100 pF	CAP, 0603, 5%, 100V, NPO/COG	various	
C1	0.01 $\mu$ F	CAP, 0603, 5%, 50V, X7R	various	
L2	68 nH	IND, 0603, 5%	CoilCraft	0603CS-68NXJL
B1	0 $\Omega$	RES, 0603	various	
L1, D1, C3, C4	DNP	n/a	n/a	n/a

**Notes:**

1. Performances can be optimized at frequency of interest by using recommended component values shown in the table below. Inductors are wirewound Coilcraft

Reference Des.	Frequency (MHz)					
	50	200	500	2000	2500	3500
C2, C6	0.01 $\mu$ F	1000 pF	100 pF	22 pF	22 pF	22 pF
L2	470 nH	220 nH	82 nH	22 nH	18 nH	15 nH

### Typical Performance – TQP3M9019-PCB\_RF

Test conditions unless otherwise noted:  $V_{DD} = +5\text{ V}$ ,  $I_{DD} = 125\text{ mA (typ.)}$ , Temp =  $+25^\circ\text{C}$

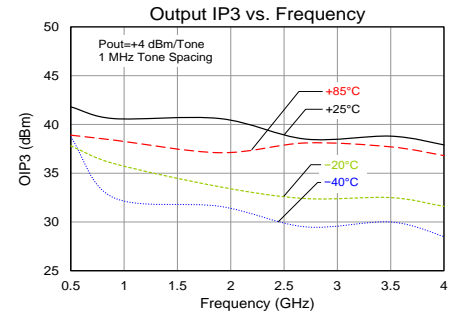
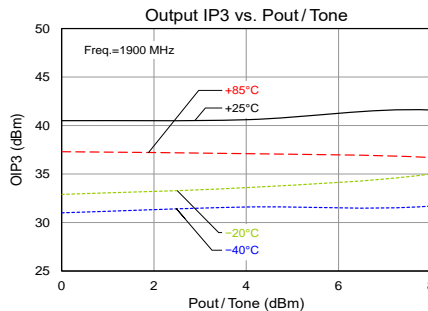
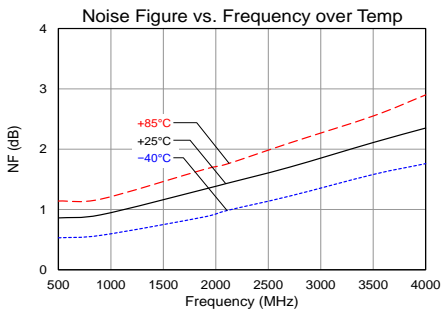
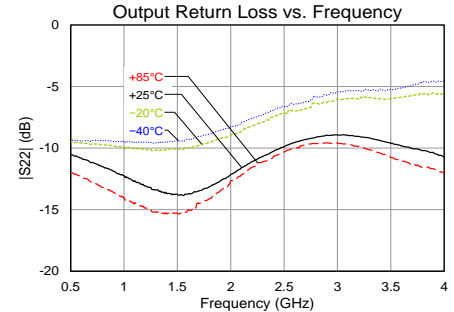
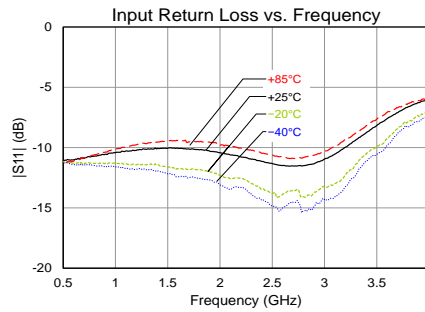
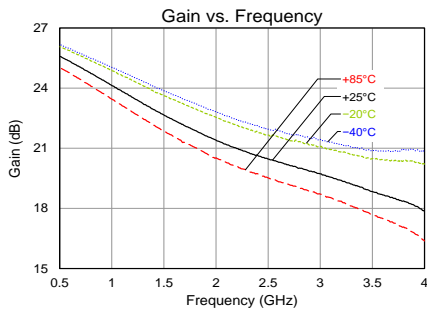
Parameter	Typical Value						Units
Frequency	500	900	1900	2700	3500	4000	MHz
Gain	25.6	24.6	22	20.5	19	18.3	dB
Input Return Loss	11	10.5	10	11.5	8	6	dB
Output Return Loss	10.5	12	13	9	10	11	dB
Output P1dB	+22.4	+22.3	+22	+21.7	+21.4	+20.8	dBm
OIP3 (1)	+41.8	+40.6	+40.6	+38.5	+38.8	+37.9	dBm
Noise figure (2)	0.9	0.9	1.3	1.7	2.1	2.4	dB

Notes:

- OIP3 measured with two tones at an output power of +3 dBm / tone separated by 1 MHz.
- Noise figure data listed in the table above includes PCB losses.  $\sim 0.1\text{ dB @ } 2\text{ GHz}$ .

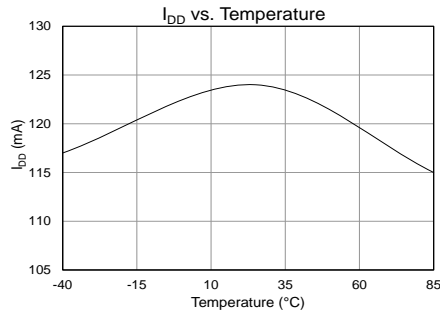
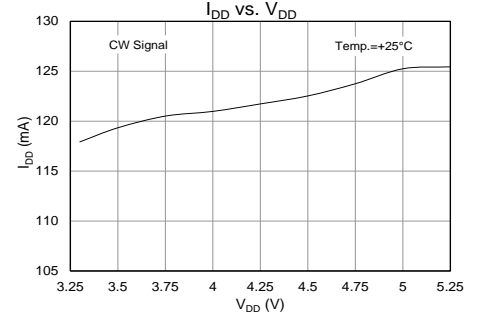
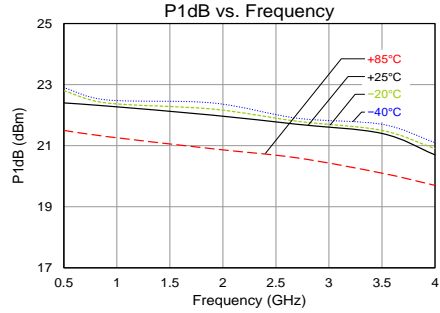
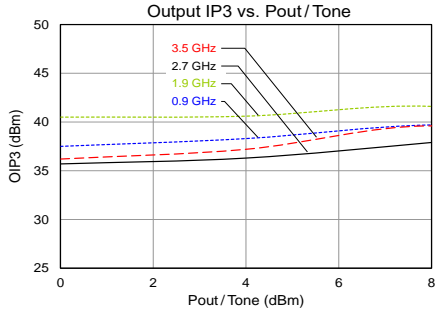
### Performance Plots – TQP3M9019-PCB\_RF

Test conditions unless otherwise noted:  $V_{DD} = +5\text{ V}$ ,  $I_{DD} = 85\text{ mA typ.}$ , Temp =  $+25^\circ\text{C}$

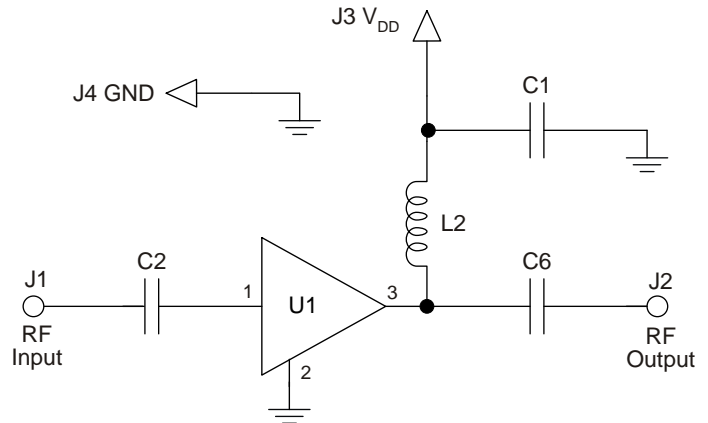
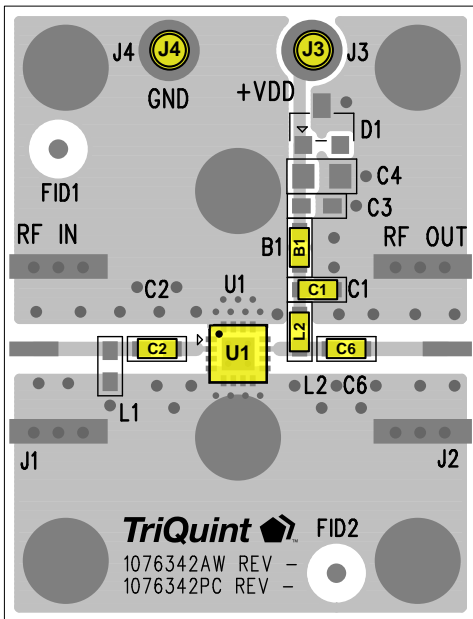


**Performance Plots – TQP3M9019-PCB\_RF**

Test conditions unless otherwise noted:  $V_{DD}=+5V$ ,  $I_{DD}=125\text{ mA typ.}$ , Temp=  $+25^{\circ}\text{C}$ .



## Evaluation Board – TQP3M9019-PCB\_IF



**Notes:**

1. See Evaluation Board PCB Information section for material and stack-up.
2. Components shown on the silkscreen but not on the schematic are not used.
3. B1 (0 Ω jumper) is not shown on the schematic and may be replaced with copper trace in the target application layout.
4. The recommended component values are dependent upon the frequency of operation.
5. All components are of 0603 size unless stated on the schematic.

## Bill of Material – TQP3M9019-PCB\_IF

Reference Des.	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board	Qorvo	
U1	n/a	High Linearity LNA Gain Block	Qorvo	TQP3M9019
C2, C6	1000 pF	CAP, 0603, 5%, 50V, X7R	various	
C1	0.01 uF	CAP, 0603, 5%, 50V, X7R	various	
L2	330 nH	IND, 0603, 5%	CoilCraft	0603CS-R33XJL
B1	0 Ω	RES, 0603	various	
L1, D1, C3, C4	DNP	n/a	n/a	n/a

**Notes:**

1. Performances can be optimized at frequency of interest by using recommended component values shown in the table below. Inductors are wirewound Coilcraft

Reference Des.	Frequency (MHz)					
	50	200	500	2000	2500	3500
C2, C6	0.01 uF	1000 pF	100 pF	22 pF	22 pF	22 pF
L2	470 nH	220 nH	82 nH	22 nH	18 nH	15 nH

## Typical Performance – TQP3M9019-PCB\_IF

Test conditions unless otherwise noted:  $V_{DD} = +5\text{ V}$ ,  $I_{DD} = 125\text{ mA}$  (typ.), Temp =  $+25^\circ\text{C}$

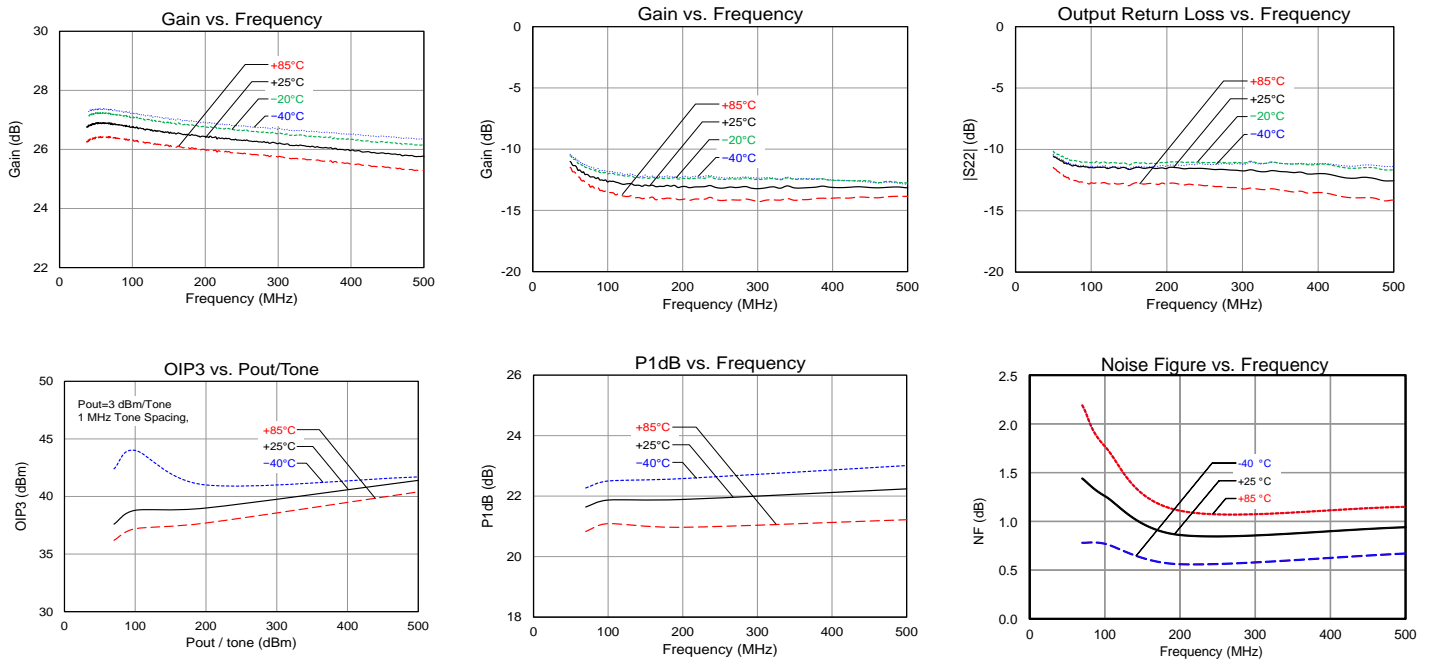
Parameter	Typical Value				Units
Frequency	70	100	200	500	MHz
Gain	27	26.8	26.4	25.8	dB
Input Return Loss	12	13	13	13	dB
Output Return Loss	11	11	12	13	dB
Output P1dB	+21.6	+21.9	+21.9	+22.2	dBm
OIP3	+37.6	+38.8	+39	+41.4	dBm
Noise figure	1.4	1.3	0.9	0.9	dB

Notes:

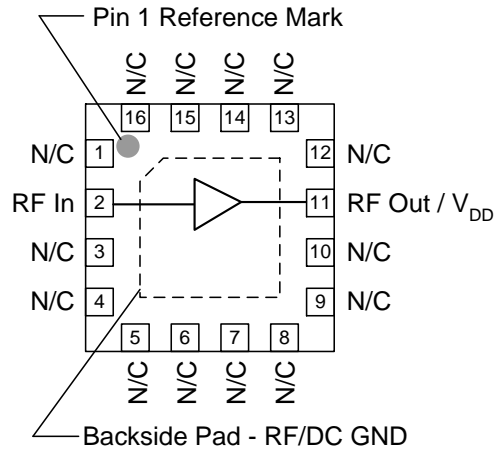
- OIP3 measured with two tones at an output power of +3 dBm / tone separated by 1 MHz.
- Noise figure data listed in the table above includes PCB losses.  $\sim 0.1\text{ dB}$  @ 2 GHz.

## Performance Plots – TQP3M9019-PCB\_IF

Test conditions unless otherwise noted:  $V_{DD} = +5\text{ V}$ ,  $I_{DD} = 125\text{ mA}$  typ., Temp =  $+25^\circ\text{C}$



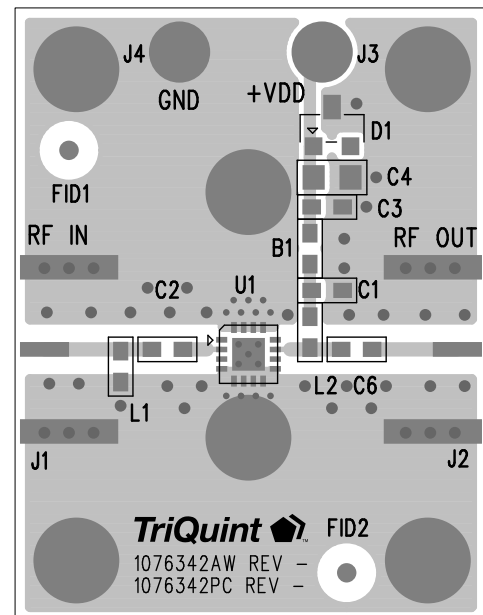
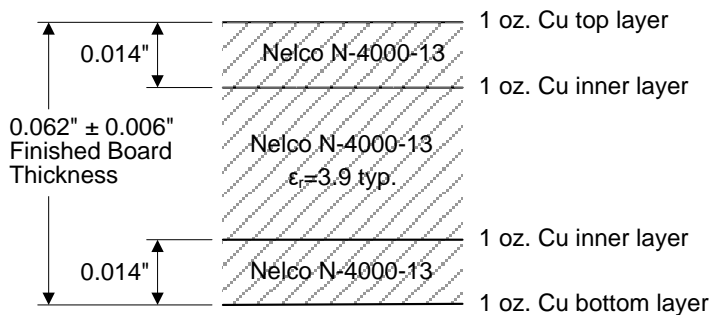
## Pad Configuration and Description



Top View

Pad No.	Label	Description
2	RF In	RF input matched to 50 ohms. External DC Block is required.
11	RF Out / V <sub>DD</sub>	RF output matched to 50 ohms. Bias voltage and external DC Block required.
All other pins	N/C	No internal connection. Provide grounded PCB land pads for optimal isolation and mounting integrity.
Backside Pad	RF/DC GND	RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern.

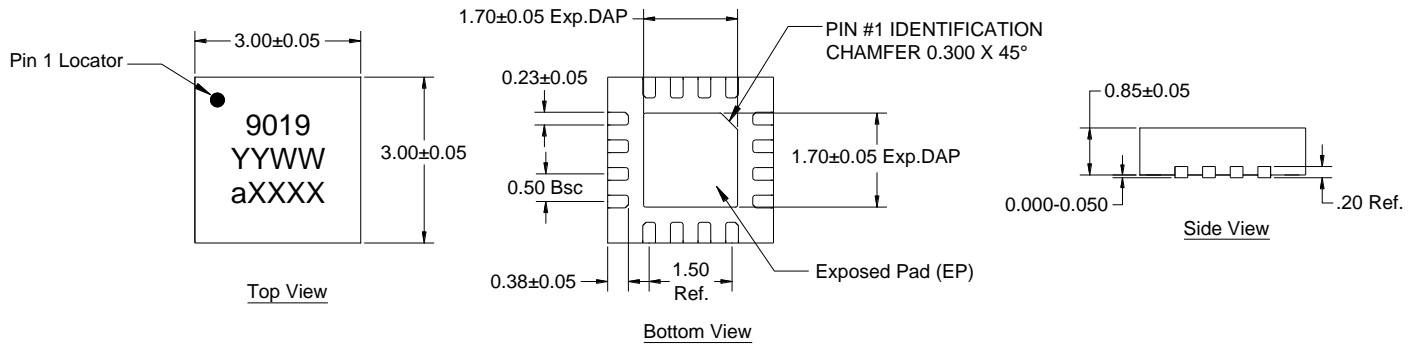
## Evaluation Board PCB Information





## Package Marking and Dimensions

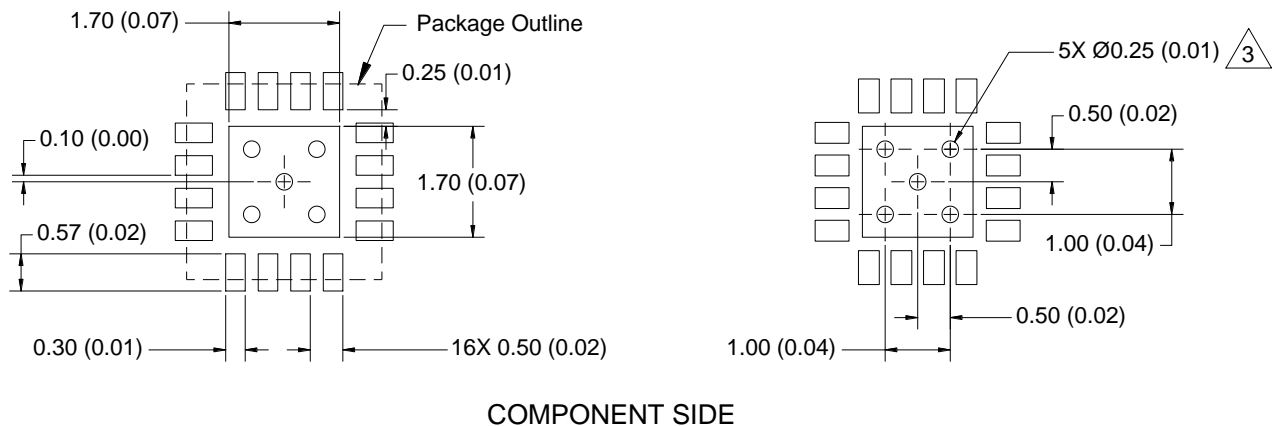
Package Marking: Part number – 9019  
Year/week/country code – YYWW  
Lot code – aXXXX



**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.

## Recommended PCB Layout Pattern

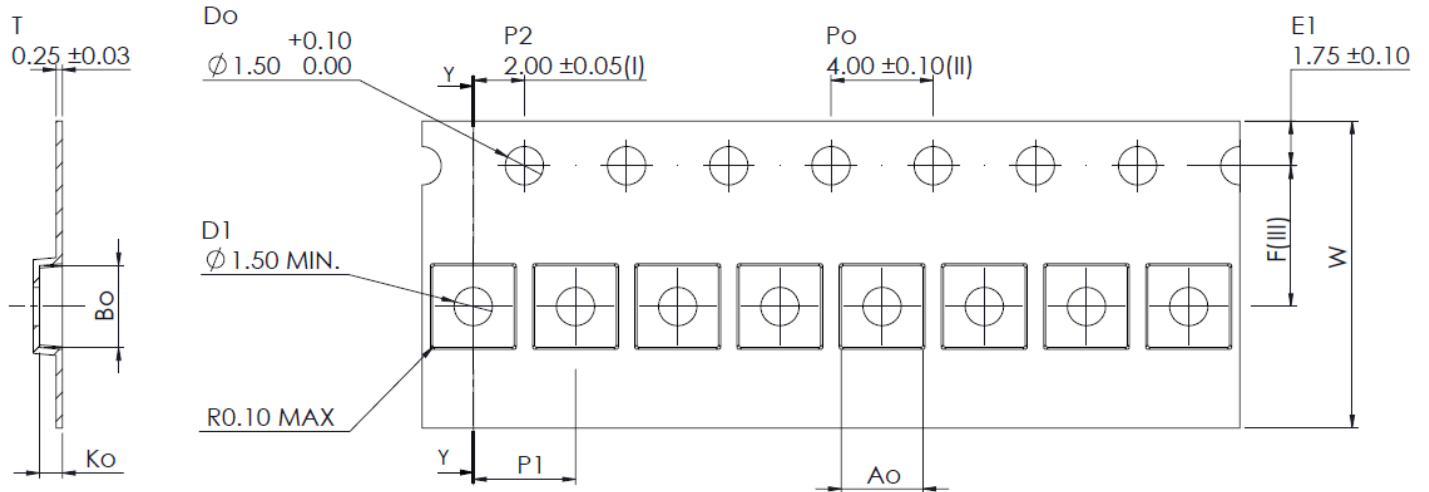


**COMPONENT SIDE**

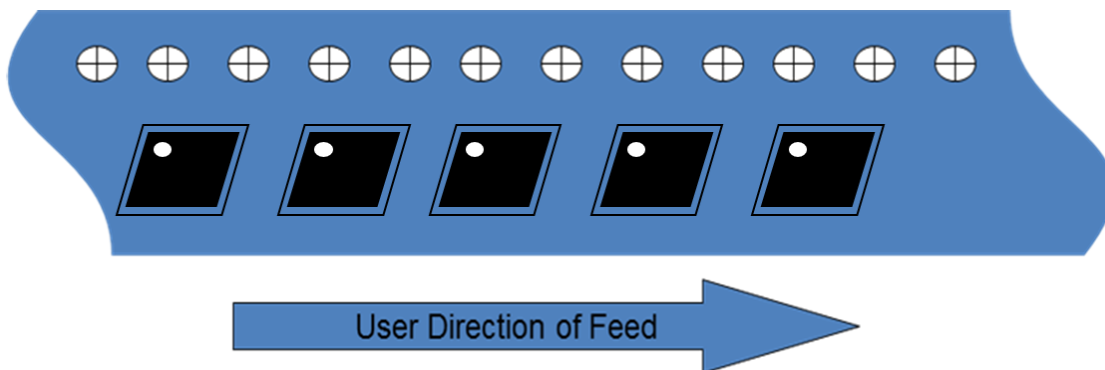
**Notes:**

1. All dimensions are in millimeters (inches). Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. Ground/thermal vias are required for the proper operation of this device. We recommend a  $0.35\text{mm}$  (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of  $0.25\text{mm}$  (0.10").
4. Ensure good package backside exposed pad (EP) solder attach for best electrical and thermal performance.

Tape and Reel Information – Carrier and Cover Tape Dimensions



Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.125	3.20
	Width	B0	0.125	3.20
	Depth	K0	0.039	1.00
	Pitch	P1	0.157	4.00
Centerline Distance	Cavity to Perforation - Length Direction	P2	0.079	2.00
	Cavity to Perforation - Width Direction	F	0.217	5.50
Carrier Tape	Width	W	0.472	12.0



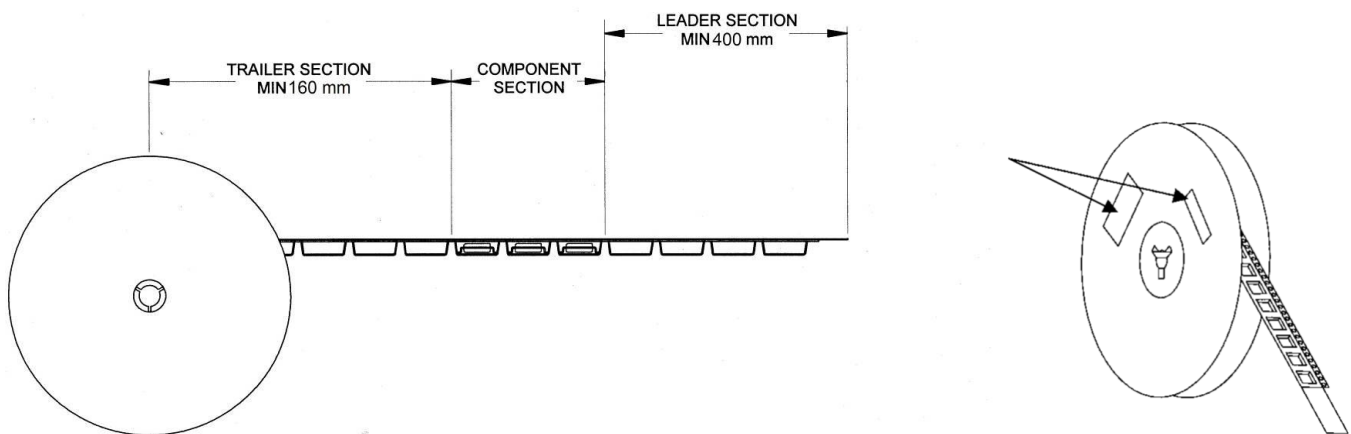
**Tape and Reel Information – Reel Dimensions**

Standard T/R size = 2,500 pieces on a 7" reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	6.969	177.00
	Thickness	W2	0.717	18.20
	Space Between Flange	W1	0.504	12.80
Hub	Outer Diameter	N	2.283	58.00
	Arbor Hole Diameter	C	0.512	13.00
	Key Slit Width	B	0.079	2.00
	Key Slit Diameter	D	0.787	20.00

**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.