

Product Overview

The QPA6489A is a high performance SiGe HBT MMIC amplifier. The QPA6489A uses a Darlington configuration which provides flat gain and good linearity over a wide frequency range. The QPA6489A has excellent thermal performance.

The QPA6489A is internally matched to 50 Ω at input and output only requiring two DC-blocking capacitors, a resistor, and an optional RF choke for operation. The QPA6489A operates from a single supply and has stable bias current. The QPA6489A is cascadable with other amplifiers.

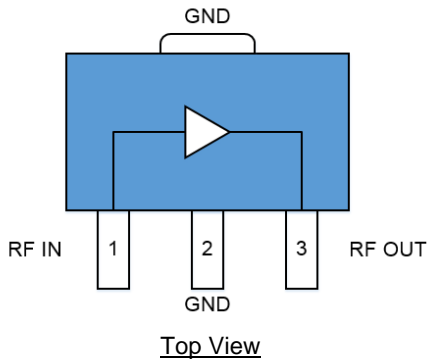


3 Lead SOT-89 Package

Key Features

- DC to 3500 MHz Operation
- Single Positive Voltage Supply
- Cascadable 50 Ω
- High Gain: 19.2 dB at 1950 MHz
- Output IP3: +31.9 dBm typical at 1950 MHz
- Noise Figure: 3.4 dB Typical at 1950 MHz
- Robust 1000 V Class 1C HBM ESD Rating
- Low Thermal Resistance SOT-89 Package
- Lead-free / RoHS-Compliant

Functional Block Diagram



Applications

- Cellular, PCS, GSM, UMTS
- Power Amplifier Driver
- IF/RF Buffer Amplifier
- Wireless Data, Satellite

Ordering Information

Part No.	Description
QPA6489ATR13	3000 pieces on a 13" reel
QPA6489APCK401	850 MHz EVB with a 5 piece sample Bag

Absolute Maximum Ratings

Parameter	Rating
Storage Temp	-55 to +150 °C
Device Voltage (V _D)	+7 V
Device Current (I _D)	150 mA
RF Input Power (Z _L = 50 Ω)	+18 dBm

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
Operating Temperature	-40		+105	°C
Junction Temperature (T _J)			+125	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

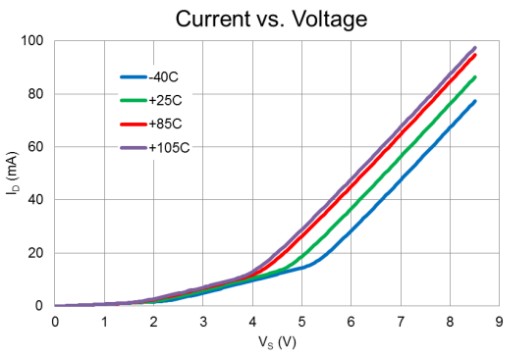
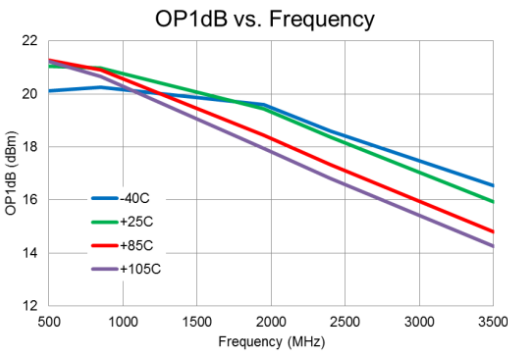
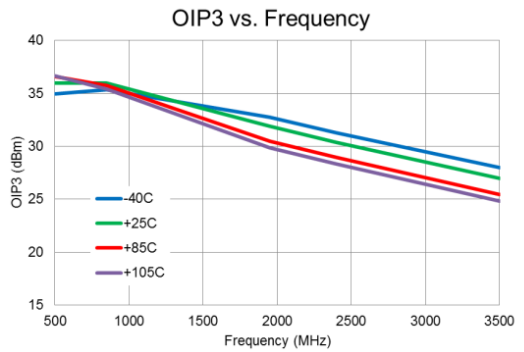
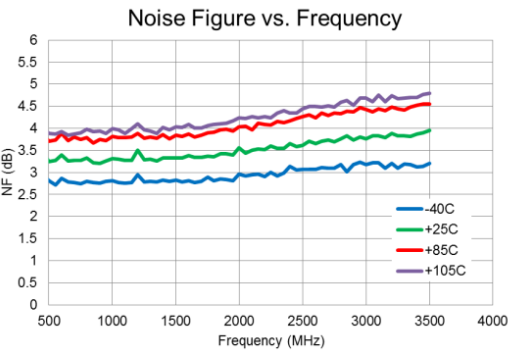
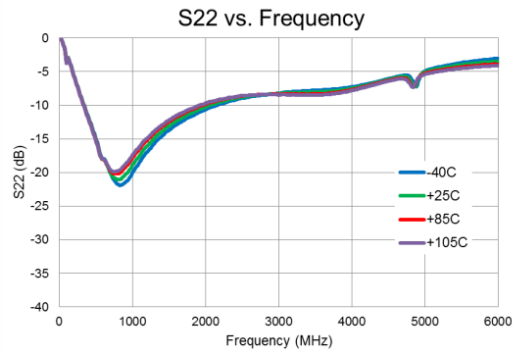
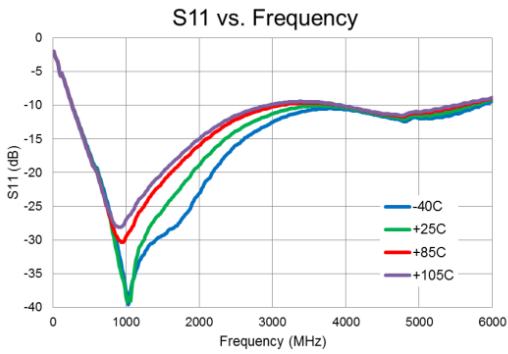
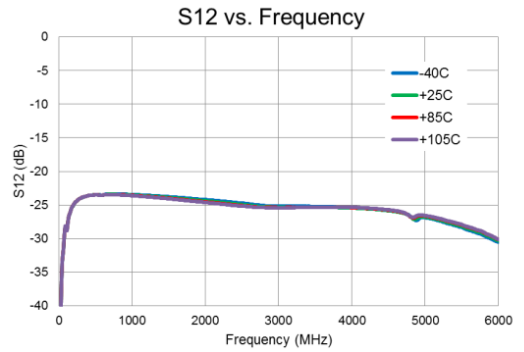
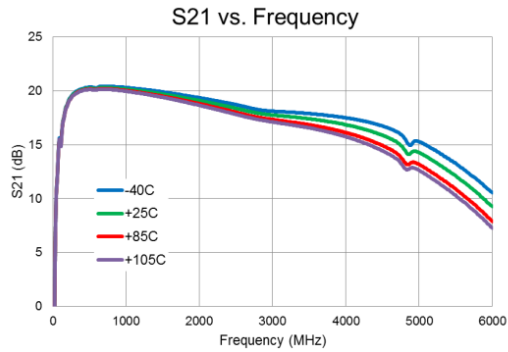
Parameter	Conditions	Min	Typ	Max	Units
Small Signal Gain, dB(S21)	850 MHz		20.3		dB
	1950 MHz		19.2		
	2400 MHz		18.5		
Output Power at 1dB Compression	850 MHz		+20.1		dBm
	1950 MHz		+19.4		
	2400 MHz		+18.4		
Output Third Intercept Point	500 MHz		+36.0		dBm
	850 MHz		+36.0		
	1950 MHz		+31.9		
Input Return Loss, dB(S11)	850 MHz		30.7		dB
	1950 MHz		19.4		
	2400 MHz		14.7		
Output Return Loss, dB(S22)	850 MHz		20.9		dB
	1950 MHz		10.4		
	2400 MHz		9.0		
Reverse Isolation, dB(S12)	850 MHz		23.5		dB
	1950 MHz		24.3		
	2400 MHz		24.8		
Noise Figure	850 MHz		3.2		dB
	1950 MHz		3.4		
	2400 MHz		3.7		
Device Operating Voltage		+4.7	+5.1	+5.5	V
Device Operating Current			75		mA
Thermal Resistance			37		°C/W

Notes:

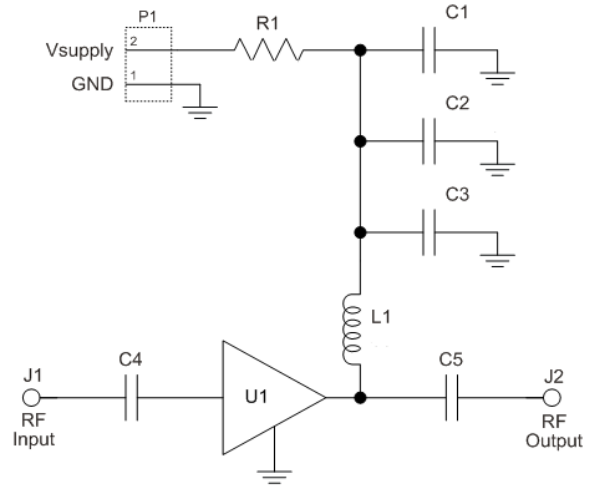
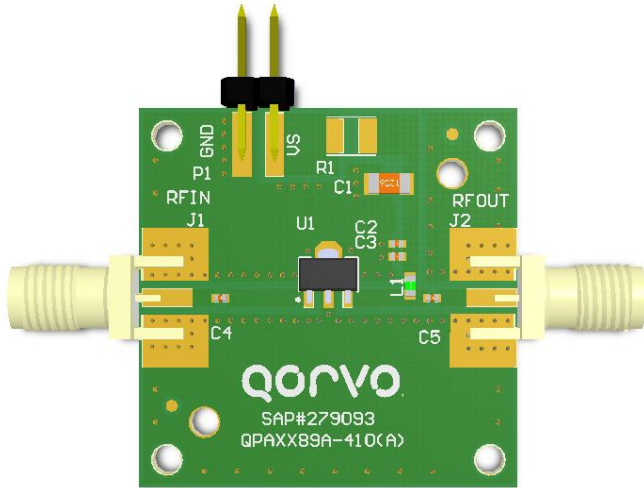
- Test conditions unless otherwise noted: V_S = +8 V, R_{BIAS} = 39 Ω, I_D = 75 mA Typ., OIP3 Tone Spacing = 1 MHz, P_{OUT} per tone = 0 dBm, T_{LEAD} = +25°C, Z_S = Z_L = 50 Ω

Performance Plots – 850 MHz Application Circuit

Test conditions unless otherwise noted: $V_S = +8\text{ V}$, $R_{BIAS} = 39\ \Omega$, $I_D = 75\text{ mA Typ.}$



Evaluation Board and Schematic – 850 MHz Application Circuit



Bill of Material – 850 MHz Application Circuit

Reference	Value	Description	Manufacturer	Part Number
n/a	n/a	PCB	Qorvo	QPAXX89X-410(A)
U1	n/a	HBT MMIC Amplifier	Qorvo	QPA6489A
C1	1 uF	CAP, 10%, 25V, X7R, 1206	Murata Electronics	GRM31MR71E105KA01L
C2	1000 pF	CAP, 10%, 50V, X7R, 0402	Murata Electronics	GRM155R71H102KA01D
C3	68 pF	CAP, 5%, 50V, C0G, 0402	Murata Electronics	GRM1555C1H680JA01D
C4, C5	100 pF	CAP, 5%, 50V, C0G, 0402	Murata Electronics	GRM1555C1H101JA01D
R1	39 Ω	RES, 5%, 1/2W, 1210	Panasonic Industrial Devices	ERJ-P14F39R0U
L1	33 nH	IND, 5%, M/L, 0603	Murata Electronics	LL1608-FSL33NJ
J1, J2	n/a	CONN, SMA, EL, FLT, 0.068" SPE-000318	Amphenol RF Asia Corp	901-10426
P1	n/a	CONN, HDR, ST, 1x2, 0.100", Hi-temp, T/H	Samtec Inc	HTSW-102-07-G-S

Component Values for Specific Frequencies

Reference Designator	500 MHz	850 MHz	1950 MHz	2400 MHz	3500 MHz
C4, C5	220 pF	100 pF	68 pF	56 pF	39 pF
C3	100 pF	68 pF	22 pF	22 pF	15 pF
L1	68 nH	33 nH	22 nH	18 nH	15 nH

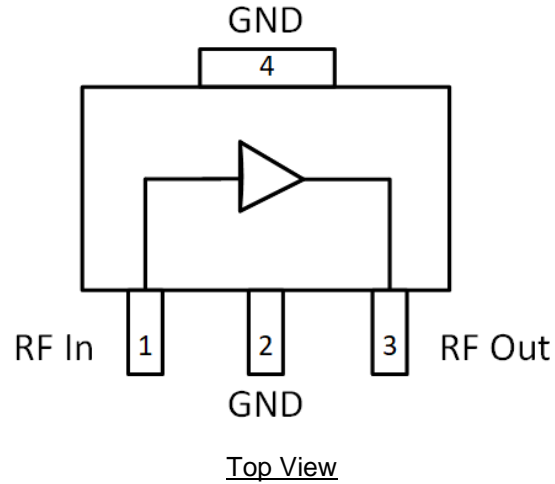
Bias Resistor Values for Specific Supply Voltages

Reference Designator	V _S =+6 V	V _S =+8 V	V _S =+10 V	V _S =+12 V
R1 (R _{BIAS}) ^(1,2)	12 Ω	39 Ω	62 Ω	91 Ω

Notes:

1. Bias resistor improves current stability over temperature
2. Bias Resistance = $R_{BIAS} + R_{LDC} = (V_S - V_D) / I_D$

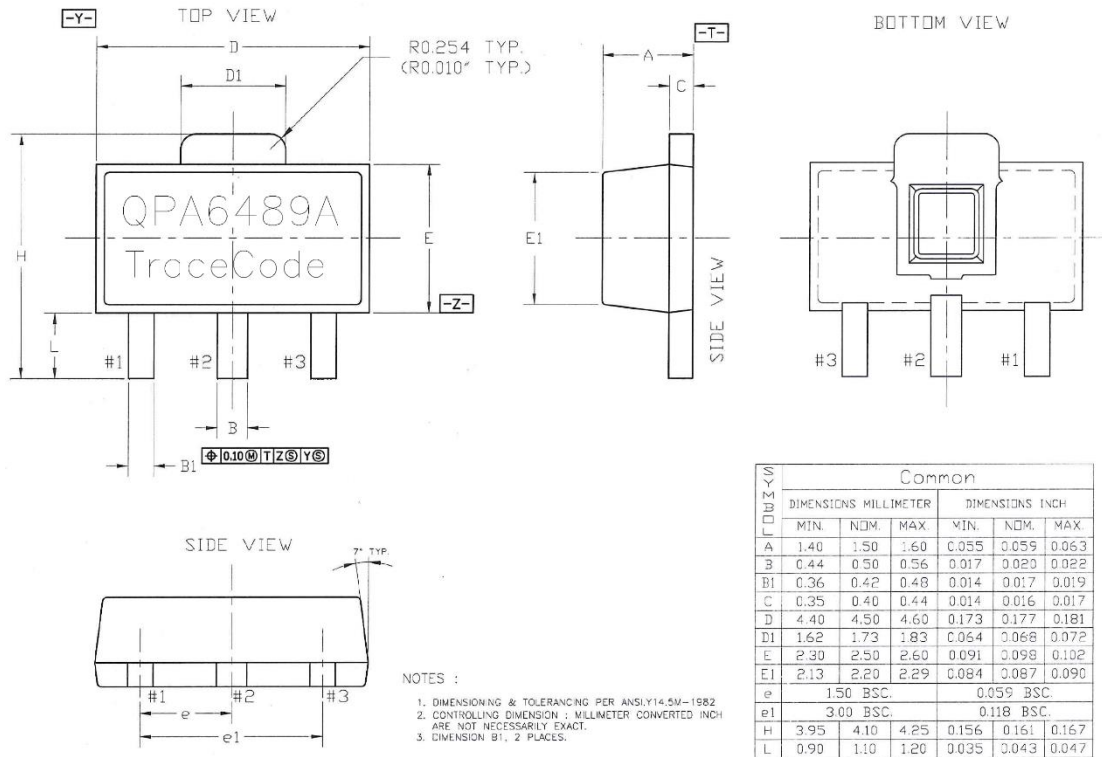
Pin Configuration and Description



Pad No.	Label	Description
1	RF In	RF Input Pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
2	GND	Connection to ground. Use via holes in PCB for best performance to reduce lead inductance as close to ground leads as possible
3	RF Out	RF Output & DC voltage input Pin. DC blocking capacitor is necessary for proper operation.
Backside Paddle	GND	Exposed area on the bottom side of the package needs to be soldered to the ground plane of the board for optimum thermal and RF performance.

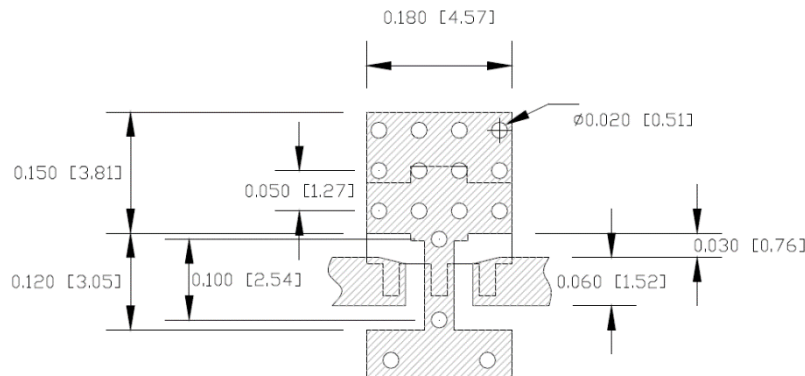
Package Marking and Dimensions

Marking: Part Number – QPA6489A
Trace Code – Assigned by sub-contractor



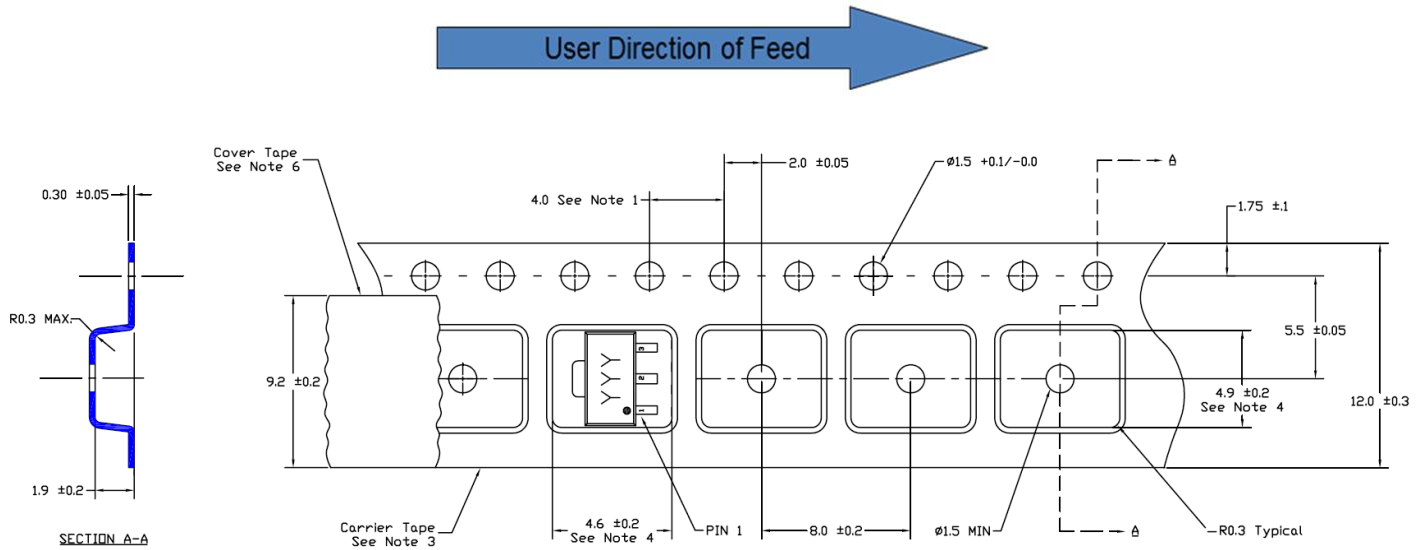
- Notes:
- All dimensions are in millimeters. Angles are in degrees.
 - The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

PCB Mounting Pattern



- Notes:
- All dimensions are in millimeters. Angles are in degrees.
 - Use 1 oz. copper minimum for top and bottom layer metal.
 - Via holes 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 0.25 mm (0.01").
 - Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Tape and Reel Information – Carrier and Cover Tape Dimensions

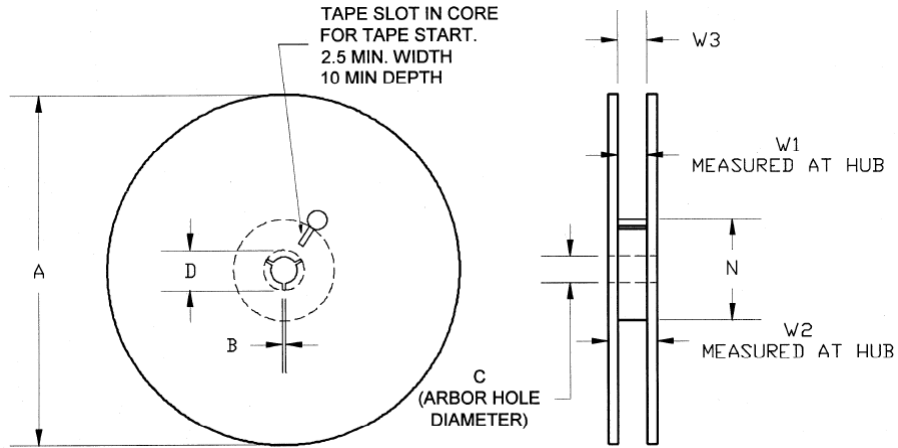


1. 10 sprocket hole pitch cumulative tolerance
2. Camber not to exceed 1mm in 100mm
3. Material: Black Conductive Polystyrene
4. Measured on a plane 0.3mm above the bottom of the pocket
5. Measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Material: Antistatic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

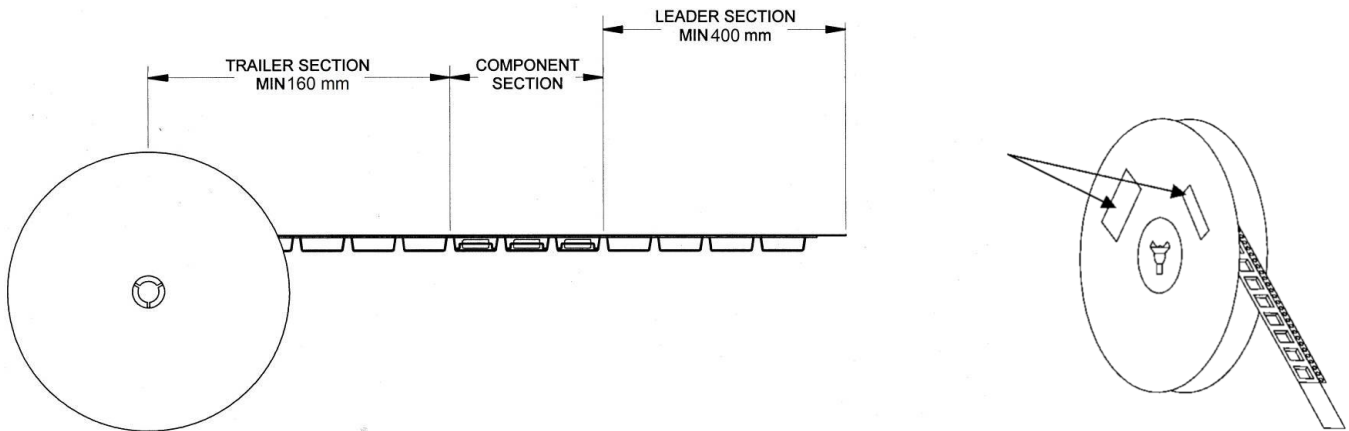
Tape and Reel Information – Reel Dimensions

Standard T/R size = 3,000 pieces on a 13" reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	12.992	330.0
	Thickness	W2	0.717	18.2
	Space Between Flange	W1	0.504	12.8
Hub	Outer Diameter	N	4.016	102.0
	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 JS-001-2014
ESD – Charged Device Model (CDM)	Class C3	ESDA / JEDEC JS-002-2014
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

Solderability

Compatible with lead-free (260°C max. reflow temp.) soldering process.
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:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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