



QPA5389A

DC – 4500 MHz Cascadable SiGe HBT Amplifier

General Description

The QPA5389A is a high performance SiGe HBT MMIC Amplifier. The QPA5389A uses a Darlington configuration which provides flat gain and good linearity over a wide frequency range. The QPA5389A has excellent thermal performance.

The QPA5389A is internally matched to $50\ \Omega$ at input and output requiring only two DC-blocking capacitors, a resistor, and an optional RF choke for operation. The QPA5389A operates from a single supply and has stable bias current. The QPA5389A is cascadable with other amplifiers.



3 Lead SOT-89 Package

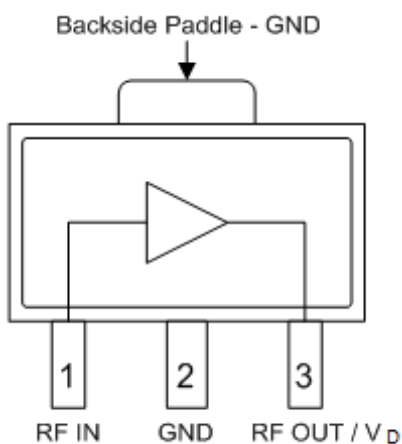
Product Features

- High Gain: 15.9 dB at 1950 MHz
- Cascadable $50\ \Omega$
- Operates from Single Supply
- Low Thermal Resistance Package

Applications

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

Functional Block Diagram



Top View

Ordering Information

Part No.	Description
QPA5389ATR13	3000 pieces on a 13" reel (standard)
QPA5389APCK401	850 MHz, +8 V EVB with 5 Piece Sample Bag

Absolute Maximum Ratings

Parameter	Rating
Storage Temp	-55 to +150 °C
Device Voltage (V_D)	+5 V
Device Current (I_D)	120 mA
RF Input Power	+16 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
Case Temperature (T_C)	-40		+105	°C
Junction Temperature (T_J)			+125	°C
Device Voltage (V_D)	+2.75	+3.5	+4.75	V

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

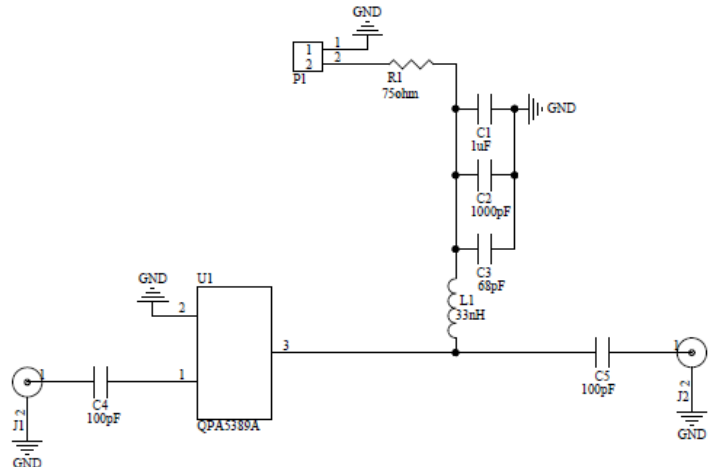
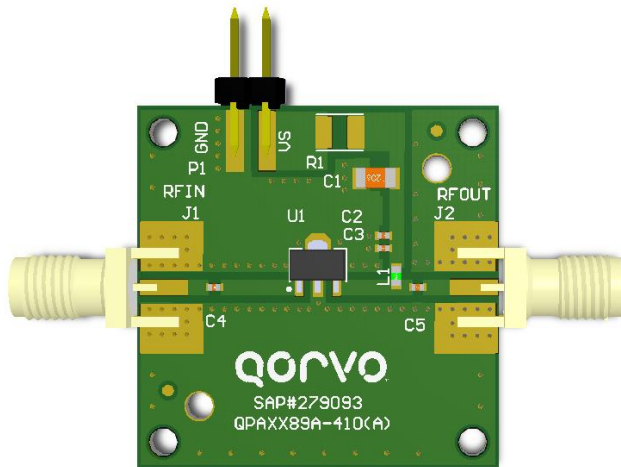
Electrical Specifications

Parameter	Conditions	Min	Typ	Max	Units
Small Signal Gain	850 MHz		16.5		dB
	1950 MHz		15.9		dB
	2400 MHz		15.6		dB
Output Power at 1dB Compression	850 MHz		+17.1		dBm
	1950 MHz		+16.3		dBm
Output Third Intercept Point	850 MHz		+33.3		dBm
	1950 MHz		+30.0		dBm
Input Return Loss	1950 MHz		22.4		dB
Output Return Loss	1950 MHz		14.5		dB
Noise Figure	1950 MHz		3.7		dB
Device Operating Current			60		mA
Thermal Resistance, θ_{jc}			40		°C/W

Notes:

- Test conditions unless otherwise noted: $V_S = +8V$, $I_D = 60mA$ Typ., OIP3 Tone Spacing=1 MHz, P_{OUT} per tone = 0 dBm, $R_1 = 75\Omega$, 50 Ω system, Temp = +25 °C

Evaluation Board and Schematic – 850 MHz Application Circuit



Bill of Material – 850 MHz Application Circuit

Reference	Value	Description	Manufacturer	Part Number
-	-	PCB, QPA5389A	Qorvo	QPAXX89A-410(A)
C1	1 μ F	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	75 Ω	RES, 5%, 1/2W, 1210	Panasonic Industrial Co	ERJ-14NF1400U
L1	33 nH	IND, 5%, M/L, 0603	Murata Electronics	LL1608-FSL33NJ
J1,J2	-	CONN, SMA, EL, FLT, 0.068" SPE-000318	Amphenol RF Asia Corp	901-10426
U1	-	HBT MMIC Amplifier	Qorvo	QPA5389A
J3, J4	-	CONN, HDR, ST, 1x2, 0.100", Hi-temp, T/H	Samtec Inc	HTSW-102-07-G-S

Component Values for Specific Frequencies

Frequency	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

Recommended Bias Resistor Values for Various Supply Voltages

Vsupply	+6 V	+8 V	+10 V	+12 V
R1	43 Ω	75 Ω	110 Ω	150 Ω

Typical Performance – 850 MHz Application Circuit

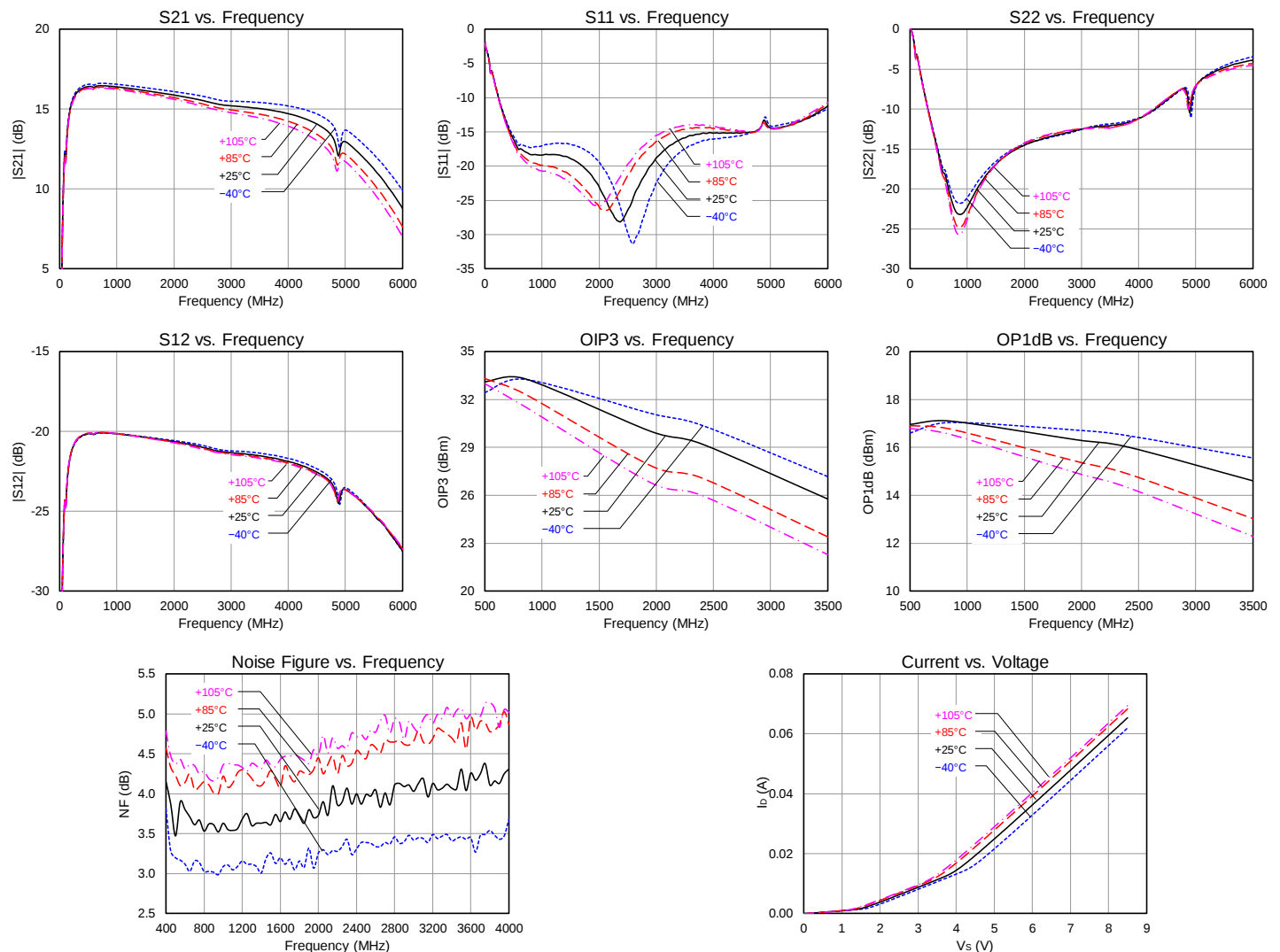
Parameter	Typical Value					Units
Frequency	500	850	1950	2400	3500	MHz
Small Signal Gain	16.4	16.5	15.9	15.6	15.1	dB
Output Third Intercept Point	+33.1	+33.3	+30.0	+29.2	+25.8	dBm
Output Power at 1dB Compression	+17.0	+17.1	+16.3	+16.0	+14.6	dBm
Input Return Loss	16.7	18.3	22.4	28.0	15.9	dB
Output Return Loss	16.1	23.1	14.5	13.2	12.1	dB
Reverse Isolation	20.1	20.1	20.7	21.0	21.5	dB
Noise Figure	3.5	3.6	3.7	4.0	4.3	dB

Notes:

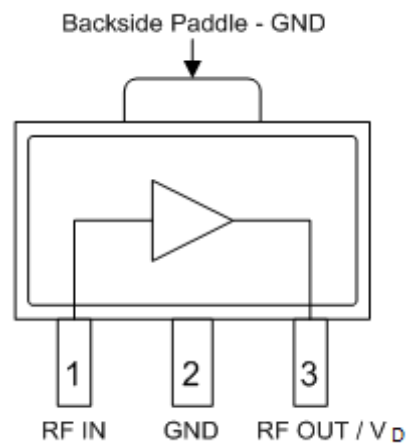
- Test conditions: $V_S = +8\text{ V}$, $I_D = 60\text{ mA}$ Typ., OIP3 Tone Spacing=1 MHz, P_{OUT} per tone = 0 dBm, $R_1 = 75\ \Omega$, 50 Ω system, Temp = +25 °C

Performance Plots – 850 MHz Application Circuit

Test conditions unless otherwise noted: $V_S = +8.0\text{ V}$, $R_1 = 75\ \Omega$, $I_D = 60\text{ mA}$, Temp.= +25 °C



Pin Configuration and Description

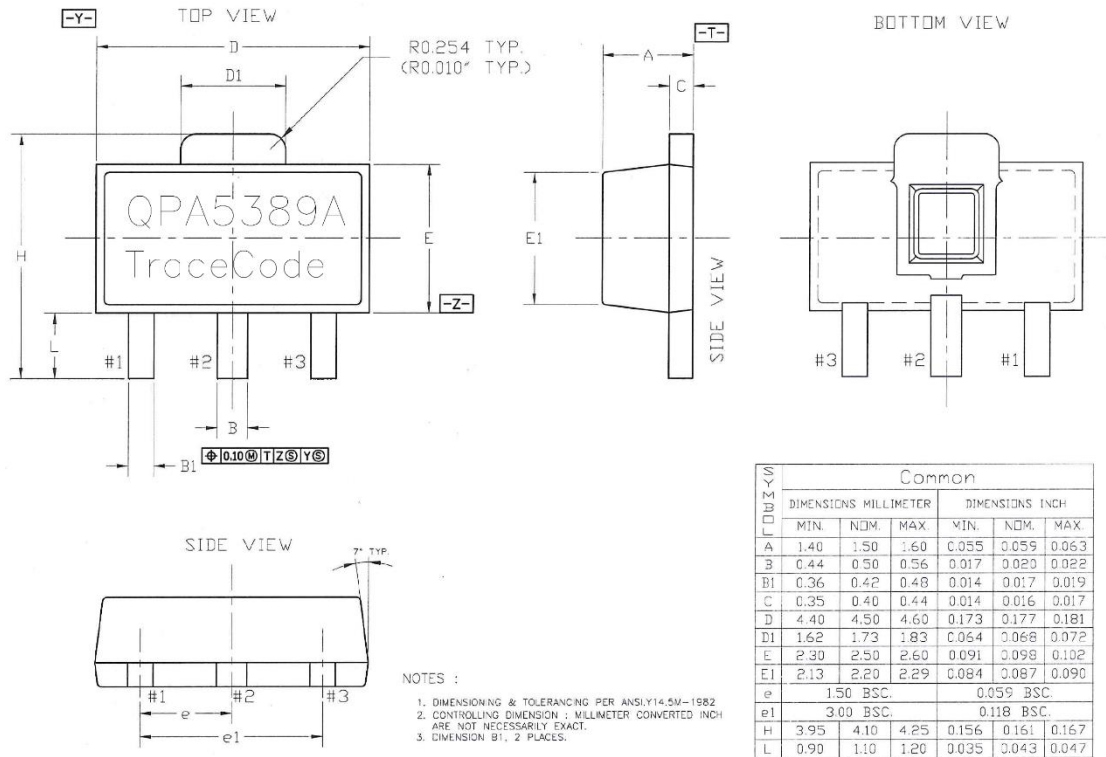


Top View

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, Backside Paddle	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 and Bias Pin. DC voltage is present on this pin, therefore a DC blocking capacitor is necessary for proper operation.

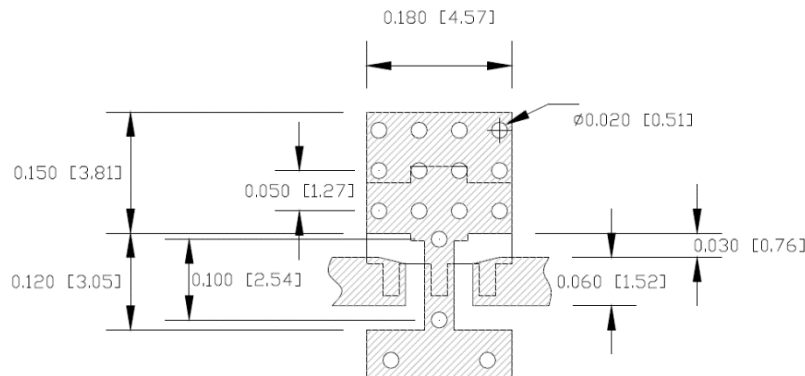
Package Marking and Dimensions

Marking: Part Number – QPA5389A
Trace Code – Assigned by sub-contractor



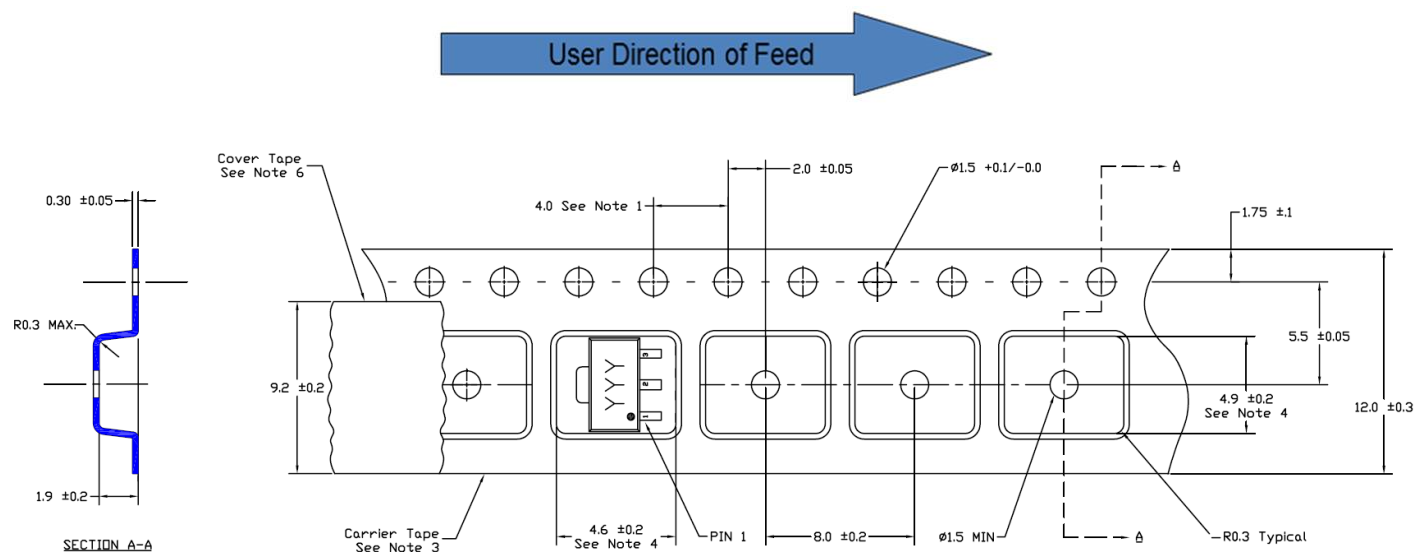
- Notes:
1. All dimensions are in millimeters. Angles are in degrees.
 2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

PCB Mounting Pattern



- Notes:
1. All dimensions are in millimeters. Angles are in degrees.
 2. Use 1 oz. copper minimum for top and bottom layer metal.
 3. 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").
 4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Tape and Reel Information – Carrier and Cover Tape Dimensions

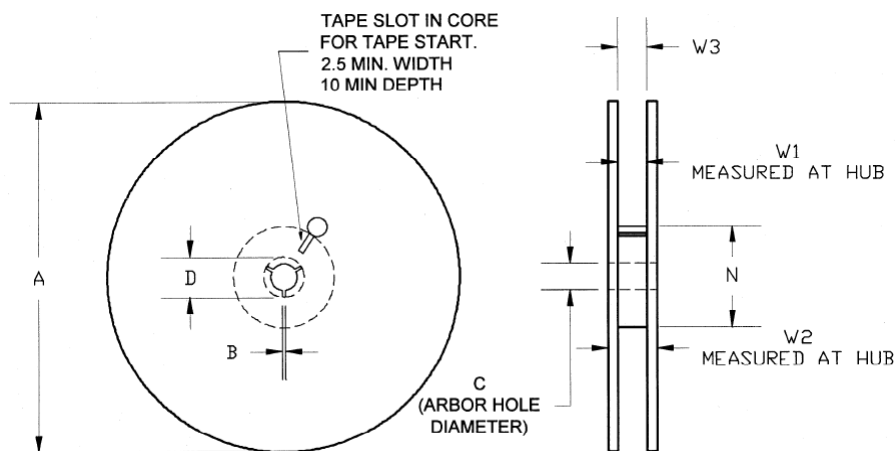


1. 10 sprocket hole pitch cumulative tolerance
2. Camber not to exceed 1mm in 100mm
3. Material: Black Conductive Polystyrene
4. Measured on a plane 0.3mm above the bottom of the pocket.
5. Measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Material: Antistatic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

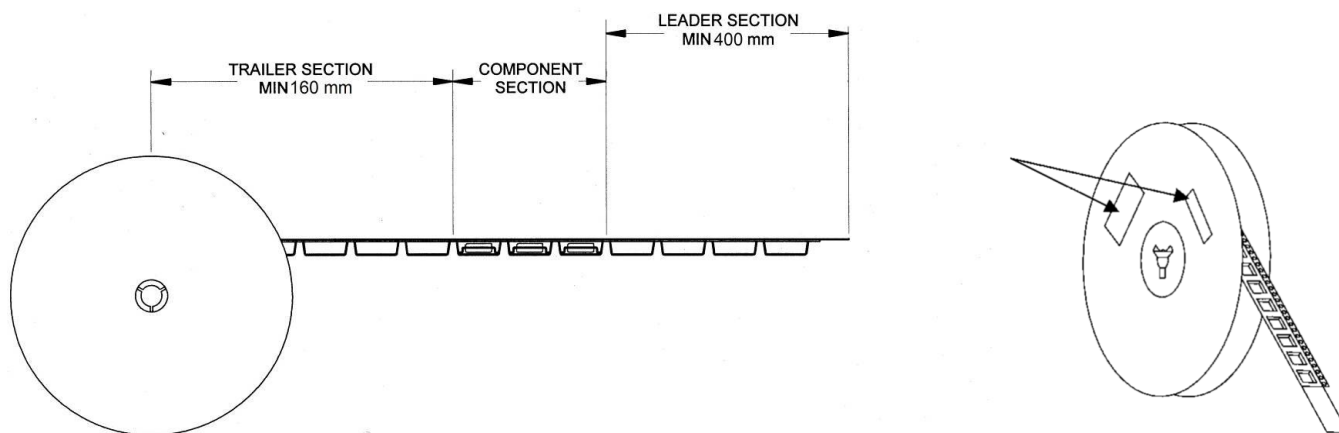
Tape and Reel Information – Reel Dimensions

Standard T/R size = 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:

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