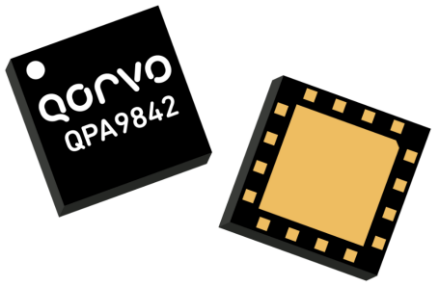
QPA9842

2700 – 3800 MHz 1/4W Balanced Amplifier

General Description

The QPA9842 is a balanced amplifier module with embedded hybrid couplers to convert to single ended input and output ports. The module has an enable pin to allow for shutting down of the amplifier. The module requires minimal external components which are VCC choke inductors, decoupling caps and resistors for bias control.

The QPA9842 provides 25 dBm P1dB with 18.7 dB gain and +38.2 dBm OIP3 across a wide frequency range of 2700-3800 MHz to cover the 3GPP Bands 42 and 43. The linear driver amplifier is targeted for use in wireless infrastructure where high linearity, medium power and high integration is required. The balanced amplifier configuration provides very good input and output VSWR and is especially ideal as the output stage in a macrocell transceiver board that connects to the high power amplifier (HPA) board through a long cable or microstrip trace. The QPA9842 is packaged in a small 5 x 5 mm leadless package that is internally matched to 50 Ω on all RF ports.

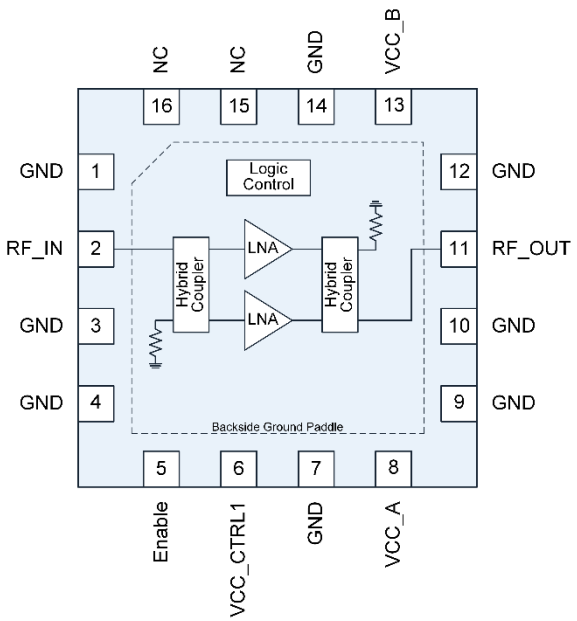


16 Pad 5 x 5 mm leadless SMT Package

Product Features

- 2700 – 3800 MHz
- Balanced Amplifier with integrated 3 dB hybrids
- Internally Matched 50 Ω Input / Output
- Shutdown Mode with 1.8V logic control
- 18.7 dB Gain
- +38.2 dBm OIP3
- +25.0 dBm P1dB
- Good gain flatness across Bands 42, 43

Functional Block Diagram



Top View

Applications

- Wireless Infrastructure
- Macro BTS Transceivers
- Booster Amps, Repeaters

Ordering Information

Part No.	Description
QPA9842TR13	2,500 pieces on a 13” reel (standard)
QPA9842EVB-01	2700 − 3800 MHz Evaluation Board

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−40 to +150 °C
RF Input Power, CW, 50 Ω, T=25 °C	+22 dBm
Supply Voltage (VCC)	+6 V
Enable Voltage (Enable)	VCC_A&B + 0.5 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
Device Voltage (VCC_A&B)	+3.30	+5	+5.25	V
Enable (High)	+1.17	+1.8	+3.6	V
Enable (Low)	0		+0.63	V
T_{CASE}	−40		+105	°C
Tj for >10^6 hours MTTF			+190	°C

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

Electrical Specifications

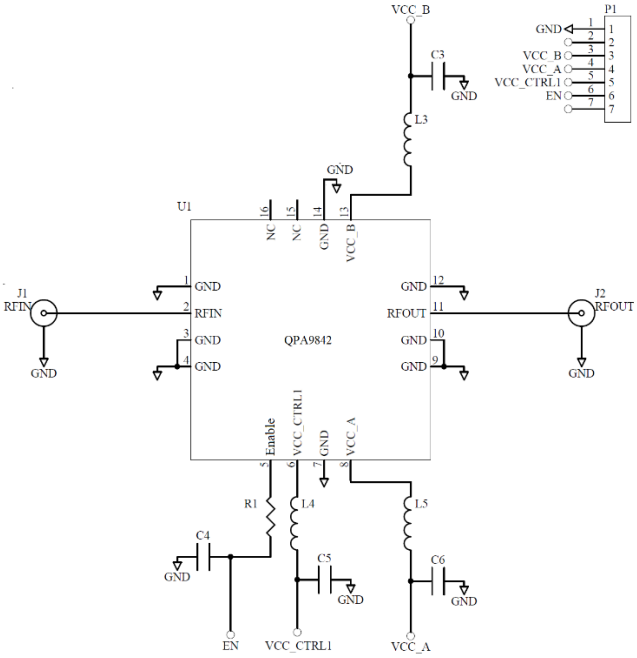
Parameter	Conditions(1)	Min	Typ	Max	Units
Operational Frequency Range		2700		3800	MHz
Test Frequency			3600		MHz
Gain		17.5	18.7	20.5	dB
Gain Slope (peak to peak)	Fc ± 100 MHz		0.1		dB
	Fc ± 250 MHz		0.3		dB
	Fc ± 350 MHz		0.6		dB
	Fc ± 500 MHz		1.1		dB
Output IP3	Pout = +10 dBm/tone, Δf = 1 MHz	+35.5	+38.2		dBm
Output P1dB		+24.0	+25.0		dBm
Noise Figure			2.3		dB
Input Return Loss			36		dB
Output Return Loss			27		dB
Control Current	I_{VCC_CTRL1} (Pin 6)		3		mA
Total Current	I_{VCC_A} (Pin 8) and I_{VCC_B} (Pin 13)		284	350	mA
Shutdown Current	Enable Low		7		mA
Enable Time	50% Enable to 90% RF		150		ns
Disable Time	50% Enable to 10% RF		60		ns
Thermal Resistance, θjc	Module (junction to backside ground paddle)		34.4		°C/W

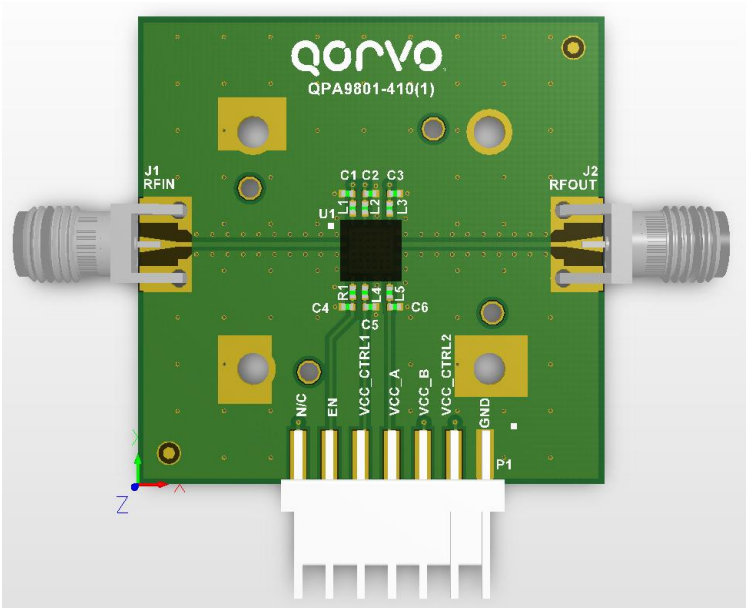
Notes:
1. Test conditions unless otherwise noted: VCC_A&B = VCC_CTRL1 = +5.0 V, Enable = +1.8V, Temp = +25 °C, 50 Ω system.

Logic Table

Parameter	High	Low
Enable	Active	Shutdown

Application Circuit Schematic and Layout





Bill of Material – QPA9842EVB-01

Reference Des.	Value	Description	Manuf.	Part Number
-	-	Printed Circuit Board		
U1	-	¼ Watt Balanced Amplifier	Qorvo	QPA9842
L3, L5	18 nH	Inductor, wire wound	Coilcraft	0402CS-18NXGRW
R1, L4	0 Ω	Resistor, Chip, Jumper	Various	
C3, C6	1 µF	Capacitor, Chip, 10%, 10V, X5R	Various	
C5	100 pF	Capacitor, Chip, NPO, 5%, 50V, NPO/C0G	Various	
C4	-	DNI		

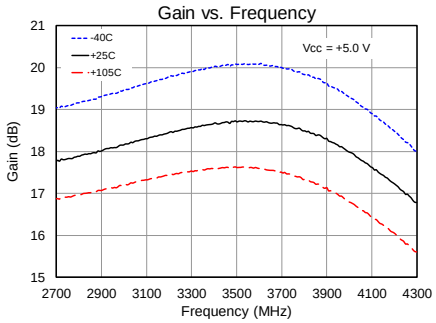
Typical Performance – VCC +5V

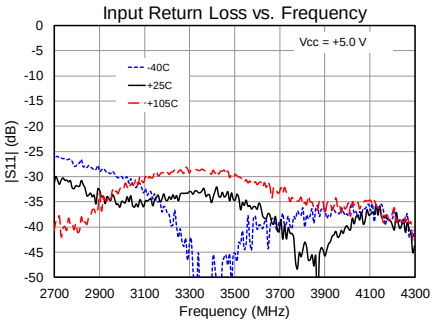
Parameter	Conditions[1]	Typical Value					Units
Frequency		2700	3100	3400	3600	3800	MHz
Gain		17.8	18.3	18.7	18.7	18.5	dB
Gain Slope (peak to peak)	Fc ± 100 MHz	0.2	0.3	0.2	0.1	0.3	dB
	Fc ± 250 MHz	0.5	0.7	0.3	0.3	0.9	dB
	Fc ± 350 MHz	0.7	0.9	0.5	0.6	1.3	dB
	Fc ± 500 MHz	0.9	1.0	0.7	1.1	1.9	dB
Input Return Loss		30	35	33	36	45	dB
Output Return Loss		29	35	36	27	22	dB
Output IP3	Pout = +10 dBm/tone, Δf = 1 MHz	+38.3	+38.6	+38.7	+38.2	+37.3	dBm
Output P1dB		+25.2	+25.2	+24.9	+25.0	+25.5	dBm
Noise Figure		1.7	1.9	2.1	2.3	2.4	dB
Total Quiescent Current		284					mA

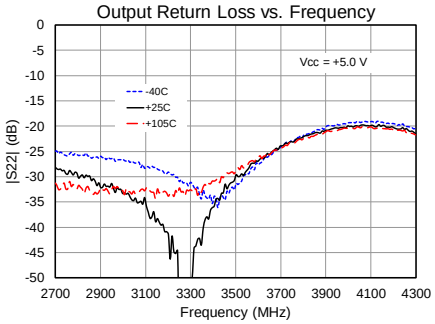
Notes:
1. Test conditions unless otherwise noted: VCC_A&B = VCC_CTRL1 = +5.0 V, Enable = +1.8V, Temp.=+25 °C

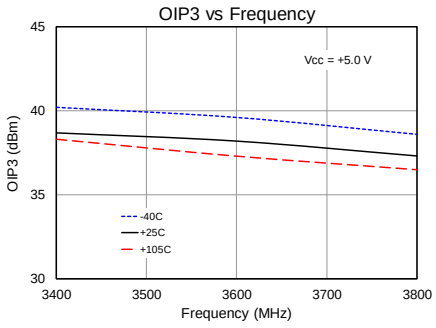
Performance Plots – VCC +5V

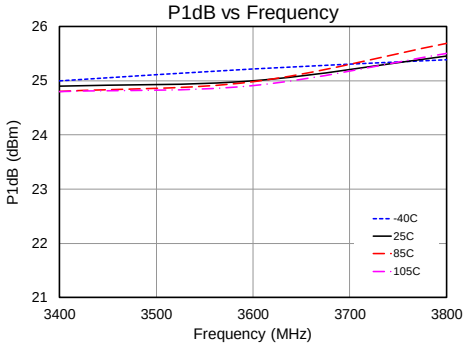
Test conditions unless otherwise noted: VCC_A&B = VCC_CTRL1 = +5V, Enable = +1.8 V, Temp.=+25 °C

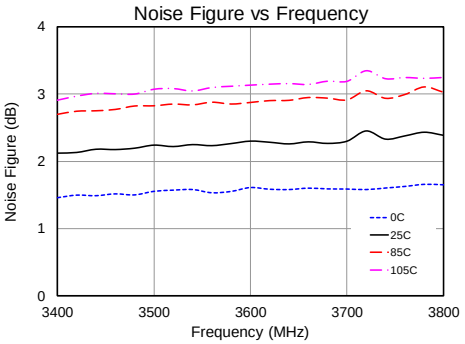






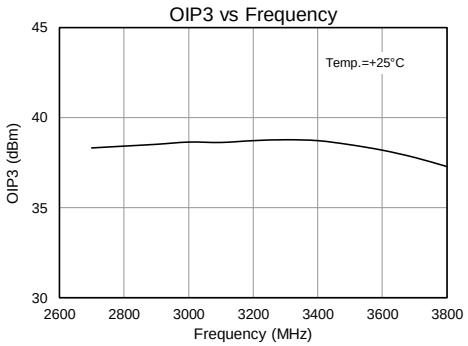


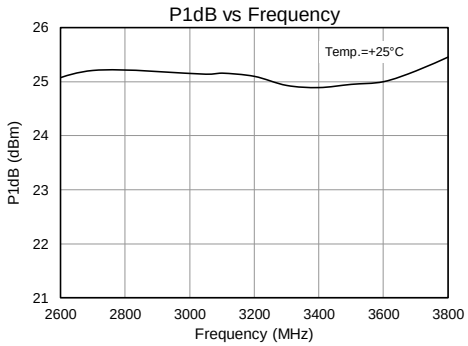


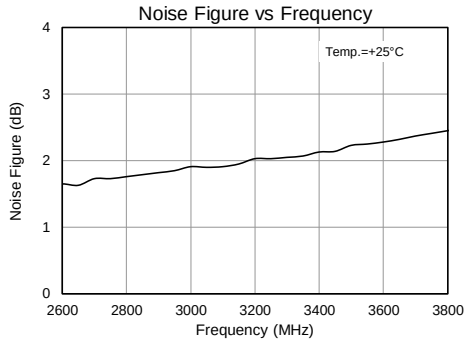


Performance Plots – VCC +5V (continued)

Test conditions unless otherwise noted: VCC_A&B = VCC_CTRL1 = +5V, Enable = +1.8 V, Temp.=+25 °C







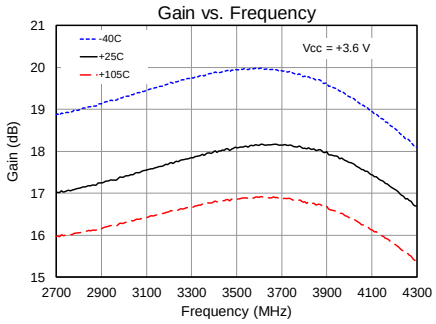
Typical Performance – VCC +3.6 V

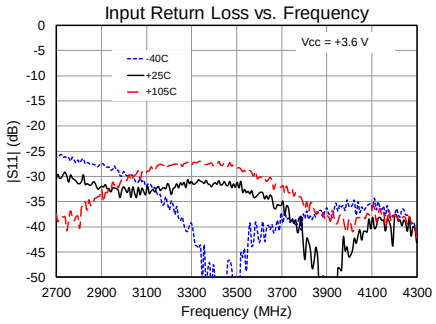
Parameter	Conditions[1]	Typical Value			Units
Frequency		3400	3600	3800	MHz
Gain		18.0	18.1	18.1	dB
Gain Slope (peak to peak)	Fc ± 100 MHz	0.2	0.1	0.2	dB
	Fc ± 250 MHz	0.5	0.2	0.6	dB
	Fc ± 350 MHz	0.7	0.4	0.9	dB
	Fc ± 500 MHz	0.9	0.7	1.5	dB
Input Return Loss		32	34	43	dB
Output Return Loss		34	27	22	dB
Output IP3	Pout = +10 dBm/tone, Δf = 1 MHz	+37.2	+37.5	+37.5	dBm
Output P1dB		+21.7	+22.1	+22.3	dBm
Noise Figure		2.1	2.2	2.3	dB
Total Quiescent Current		210			mA

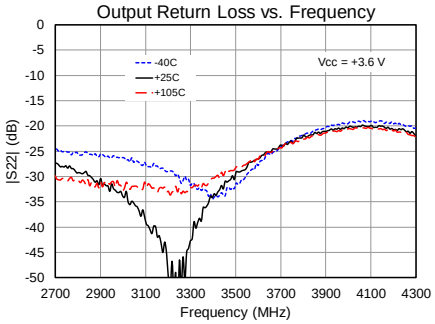
Notes:
1. Test conditions unless otherwise noted: VCC_A&B = VCC_CTRL1 = +3.6 V, Enable = +1.8V, Temp.=+25 °C

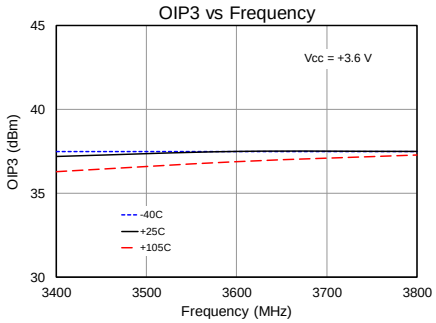
Performance Plots – VCC +3.6 V

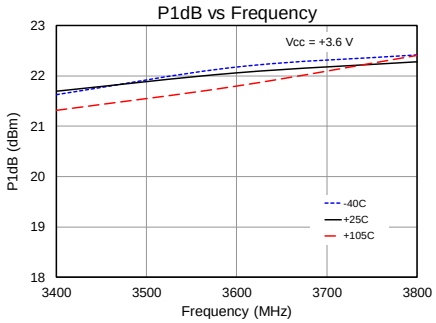
Test conditions unless otherwise noted: VCC_A&B = VCC_CTRL1 = +3.6V, Enable = +1.8 V, Temp.=+25 °C

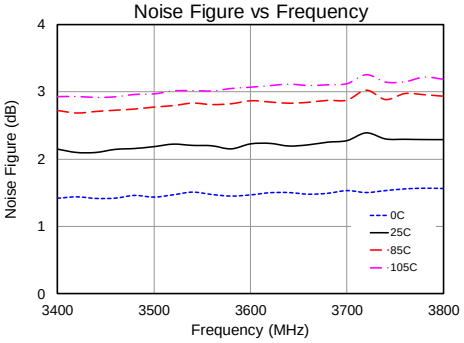




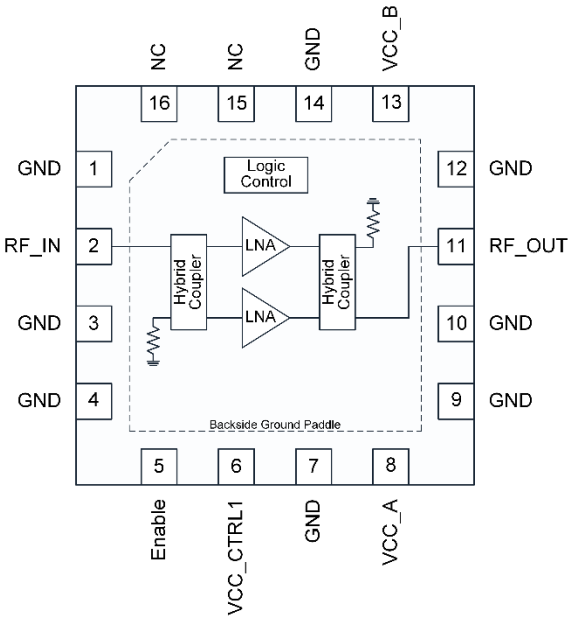








Pin Configuration and Description



Top View

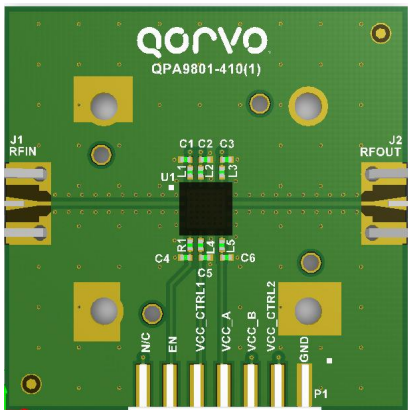
Pad No.	Label	Description
1, 3, 4, 7, 9, 10, 12, 14	GND	RF and DC Ground
2	RF_IN	RF Input, 50 Ω resistance presents, DC blocking capacitor requited when cascading with non-zero DC voltage external circuitry
5	Enable	Enable Input, Logic “1” – Amplifiers ON; Logic “0” – Amplifiers OFF
6	VCC_CTRL1	DC Supply Voltage Input, BIAS control
8	VCC_A	DC Supply Voltage Input, Amplifier A
11	RF_OUT	RF Output, 50 Ω resistance presents, DC blocking capacitor requited when cascading with non-zero DC voltage external circuitry
13	VCC_B	DC Supply Voltage Input, Amplifier B
15	NC	Not connected
16	NC	Not connected
Backside Paddle		RF/DC ground. See PCB Mounting Pattern for suggested footprint.

Evaluation Board PCB Information

PC Board Layout

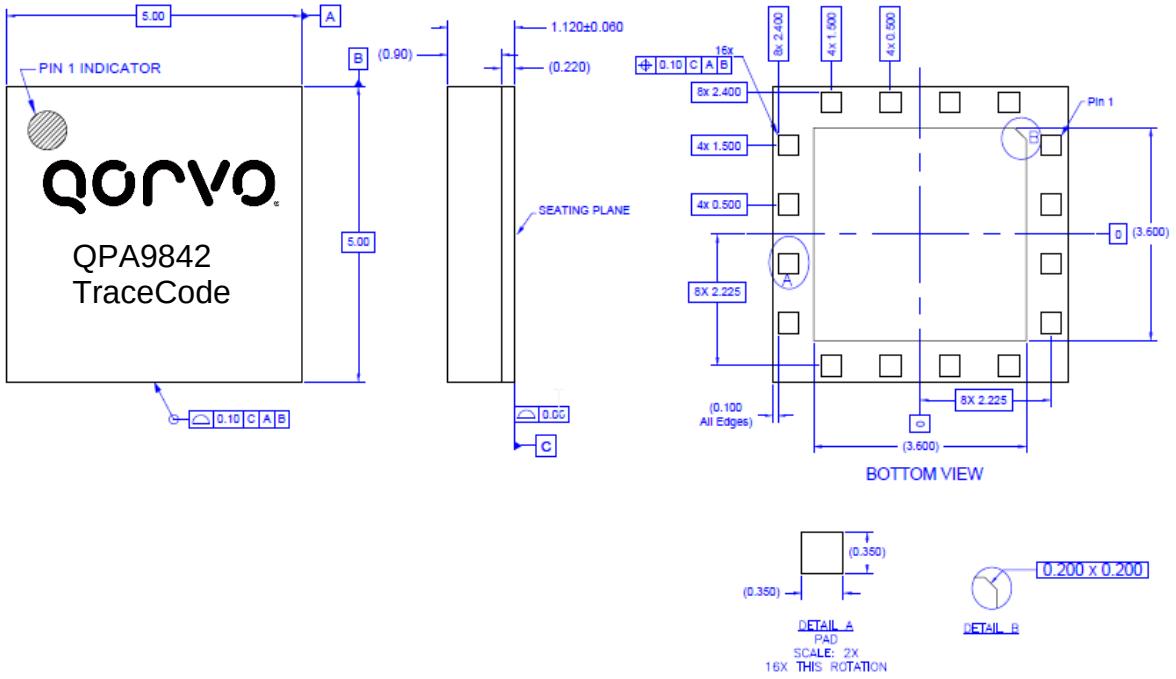
PCB Material (stackup):

1/2 oz. Cu top layer
0.008 Inch FR-4
1 oz. Cu middle layer 1
.012 Inch FR-4
1 oz. Cu middle layer 2
0.008 Inch FR-4
1/2 oz. Cu bottom layer
Finished board thickness is 0.034±.003



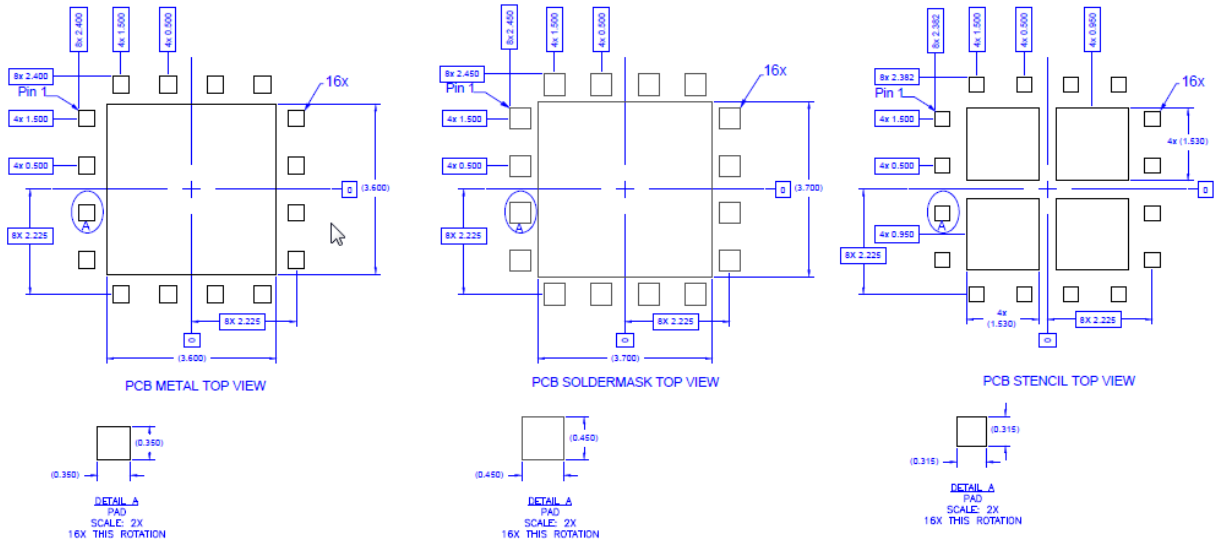
Package Marking and Dimensions

Marking: Part Number – QPA9842



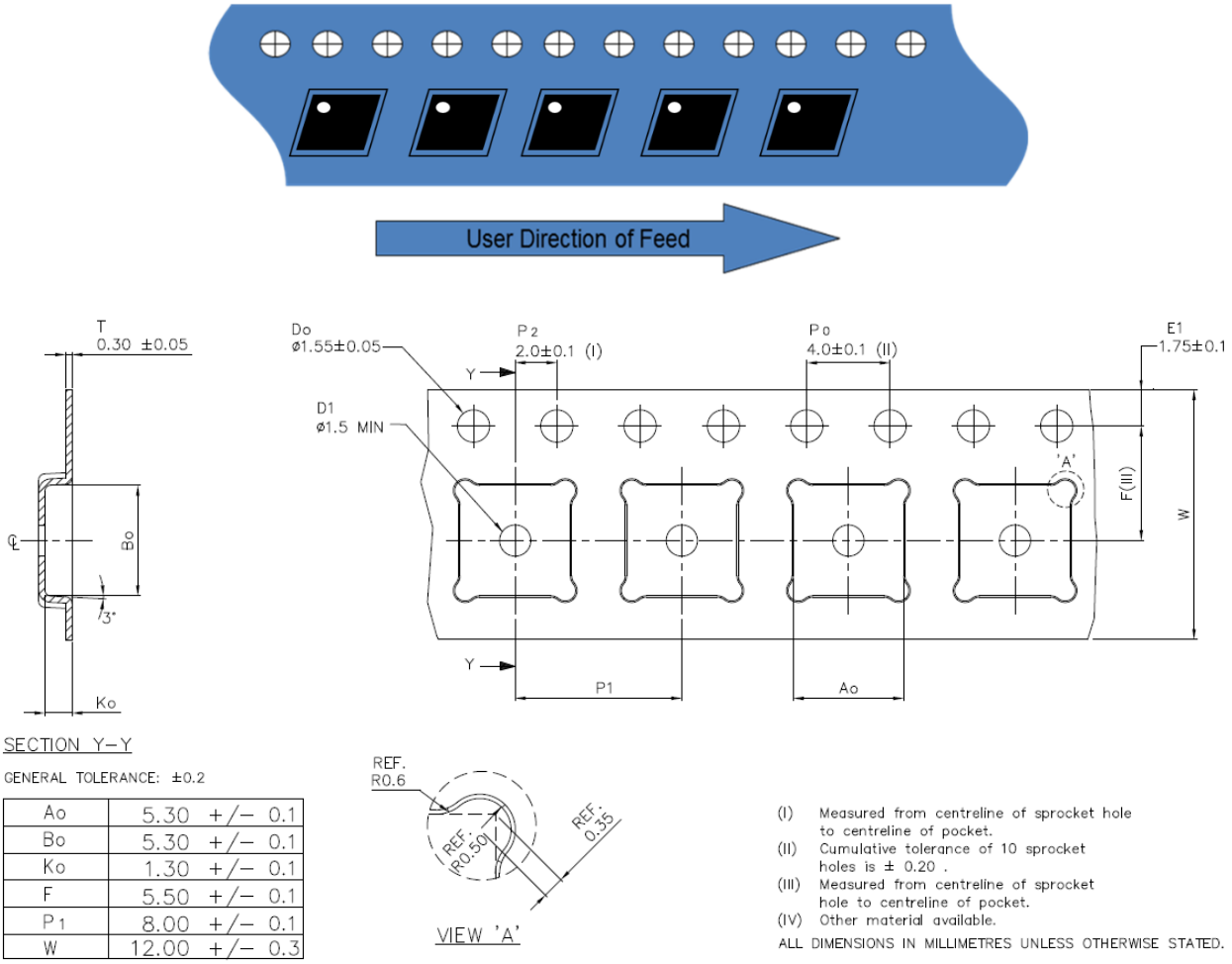
Notes:
1. All dimensions are in millimeters. Angles are in degrees.
2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.
3. Contact plating: ENEPIG

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. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.010").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Tape and Reel Information – Carrier and Cover Tape Dimensions

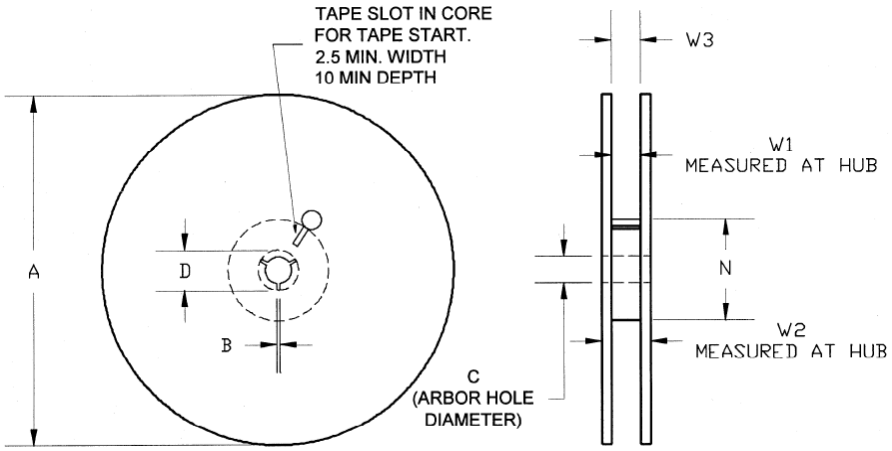


Ao	5.30 +/– 0.1
Bo	5.30 +/– 0.1
Ko	1.30 +/– 0.1
F	5.50 +/– 0.1
P1	8.00 +/– 0.1
W	12.00 +/– 0.3

Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.209	5.30
	Width	B0	0.209	5.30
	Depth	K0	0.051	1.30
	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	12.00

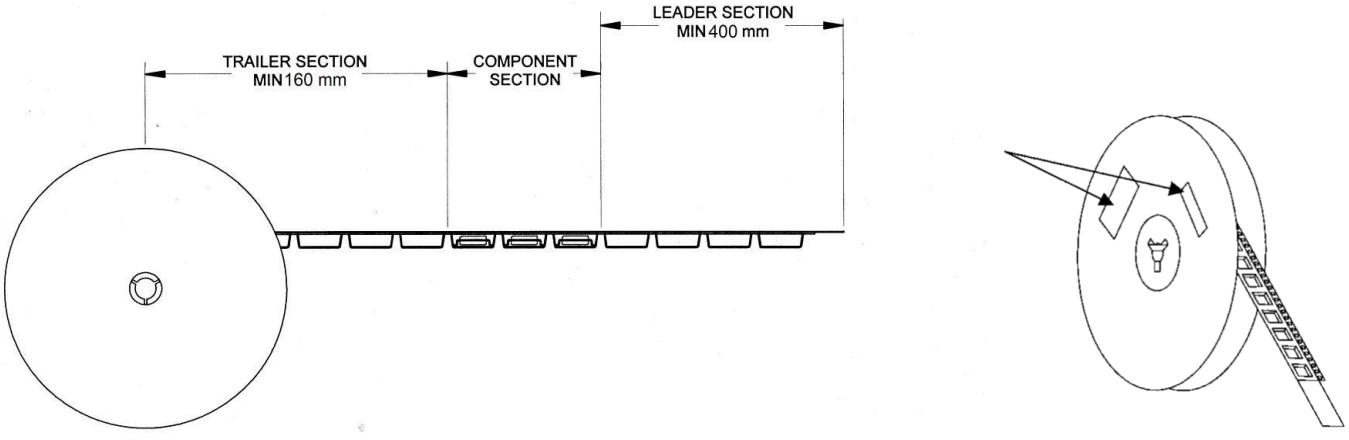
Tape and Reel Information – Reel Dimensions

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



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	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.