AMGP6434

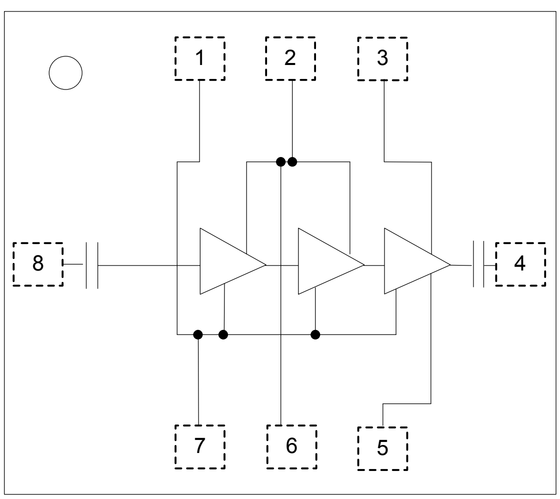
28-31GHz 4W Power Amplifier

Preliminary Data Sheet Feb 2011

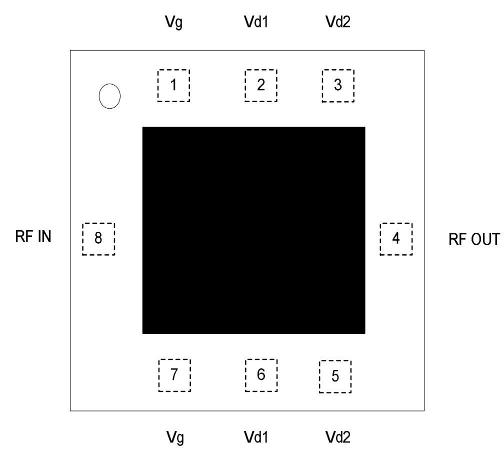
Description

The AMGP-6434 MMIC is a 4-Watt power amplifier in a surface mount package designed for use in transmitters that operate at frequencies between 28GHz and 31GHz. In the operational frequency band, it provides 35.5dBm of output power (P-1dB) and 19dB of small-signal gain. This PA is also designed for high linear applications, and the PA shows more than -40dBc OIM3 level at 20dBm/tone output power level.

Functional Block Diagram



Package Diagram



Applications

- Microwave Radio systems
- Satellite Up/Down Link
- LMDS & Pt-Pt mmW Long Haul
- Broadband Wireless Access
- WLL and MMDS loops

Features

- Lg=0.15um D-mode GaAs pHEMT using intternal Fab.
- 50 Ω RF ports
- ESD protection all ports above 50V MM and 250V HBM
- 5 x 5 mm SMT package
- -40°C to +85°C operation

ELECTRICAL SPECIFICATIONS

Absolute Minimum and Maximum Ratings

Table 1 Minimum and Maximum Ratings

Parameter		Specifications			Comments
Description	**Pin**	**Min.**	**Max.**	**Unit**	
Drain Supply Voltage	Vd1 Vd2		6.5	V	
Gate Supply Voltage	Vg1 Vg2	-2	0	V	
RF Input Power (Pin)	RFIN		20	dBm	CW
Power Dissipation (Pd)			20	W	Pd=Vd1xId1+Vd2xId2+Pin-Pout
MSL			MSL2		
Channel Temperature			150	°C	
Storage Temperature		-65	150	°C	
ESD	Human Body Model		250	V	
ESD	Machine Model		50	V	

Table 2 Recommended Operating Range

Parameter		Specifications				Comments
Description	**Pin**	**Min.**	**Typical**	**Max.**	**Unit**	
Drain Supply Voltage	Vd1 Vd2		6.0	6.5	V	
Gate Supply Voltage	Vg1 Vg2	-0.85	-0.75	-0.65	V	REVISIT POST-MPV
Maximum Gate Current	Ig, max		-5	mA		Ig, max occurs at highest RF Pout condition.
Quiescent Drain Supply Current (Idq)	Vd1 Vd2		600 800		mA	Idq=Id1+Id2
RF Output Power (Pout)	RFOUT		36	38	dBm	CW
Frequency Range		28		31	GHz	
Thermal Resistance, θ_{ch-b}			4.0		°C/W	Channel to board
Base Plate Temperature		-40		+85	°C	

Electrical Specifications

All data measured on a 2.4mm connector based evaluation board (Rogers 4350B) at Vdd1 = Vdd2 = 6V, Idq = 1.4A (Id1+Id2), Tc = 25 ^{o}C, and 50 Ω at all ports.

Table 3 RF Electrical Characteristics

Parameter	Performance				Comments
	Min.	Typical	Max.	Unit	
Input Return Loss S11(dB)		-8		dB	Small Signal
Output Return Loss S22(dB)		-10		dB	Small Signal
Gain S21(dB)	17	19		dB	Small Signal
Reverse Isolation S12(dB)		-40		dB	Small Signal
P1dB	34	35.5		dBm	
IM3 Level		-20		dBm	Δf=20MHz, Po=20dBm/tone
Total Drain Current		3.3		A	Pout=P-3

Selected performance plots

All data measured on a 2.4mm connector based evaluation board at Vdd1 = Vdd2 = 6V, Idq = 1.4A (Id1+Id2), Ta = 25 °C, and 50 Ω at all ports.

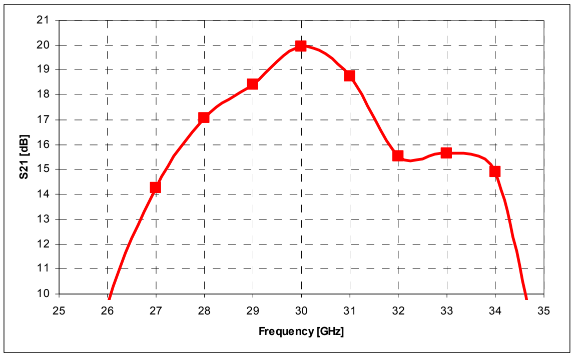


Fig.1 S21(dB) Frequency Sweep

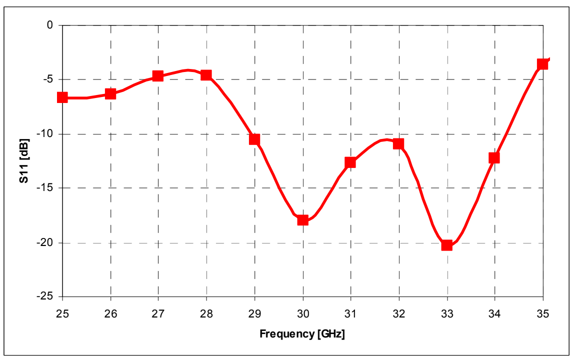


Fig.2 S11(dB) Frequency Sweep

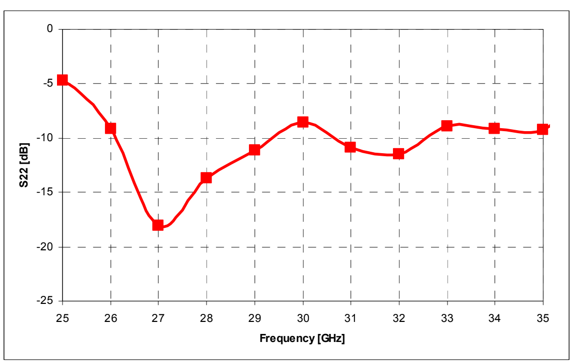


Fig.3 S22(dB) Frequency sweep

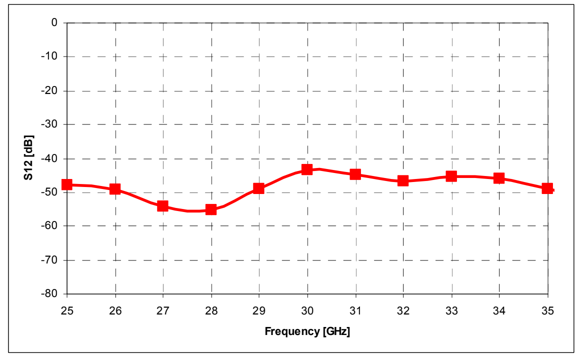


Fig.4 S12(dB) Frequency Sweep

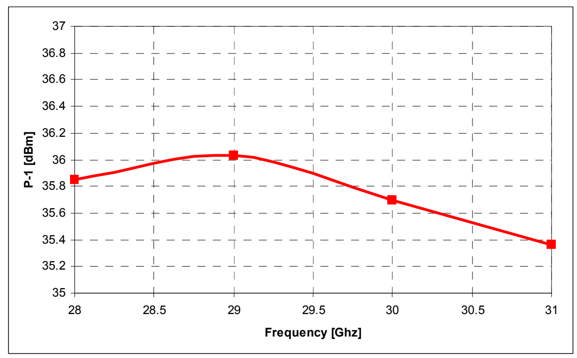


Fig.5 P-1(dBm) Frequency Sweep

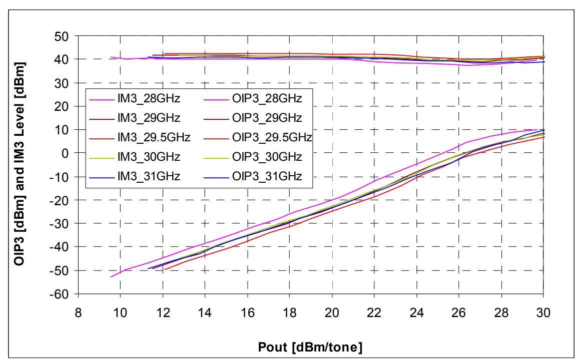


Fig.6 OIP3 and IM3 level vs. Output power/tone

Over Temperature Performance Plots

All data measured on a 2.4mm connector based evaluation board at Vdd1 = Vdd2 = 6V, Idq = 1.4A (Id1+Id2), and 50 Ω at all ports. Idg has been maintained at 1.4A under different temperature conditions.

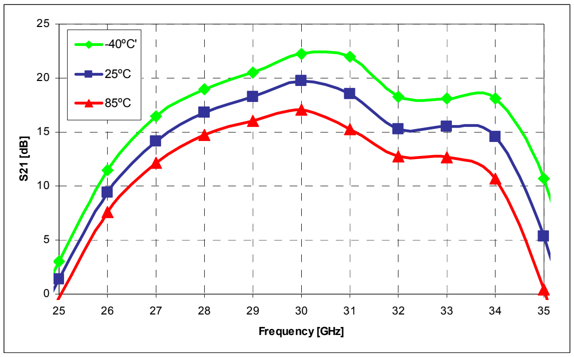


Fig.7 S21(dB) Frequency Sweep over Temperature

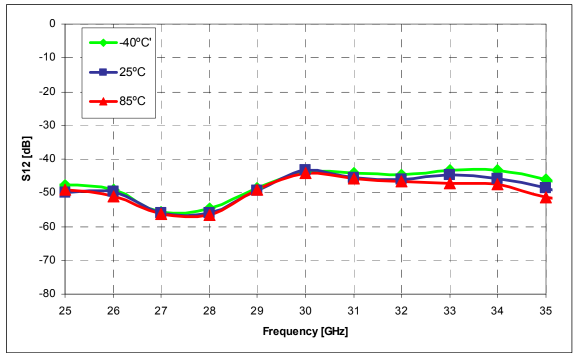


Fig.10 S12(dB) Frequency Sweep over Temperature

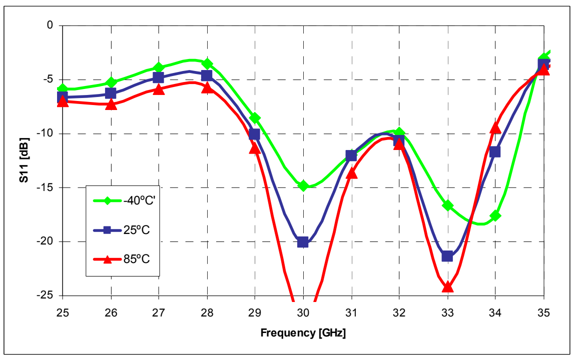


Fig.8 S11(dB) Frequency Sweep over Temperature

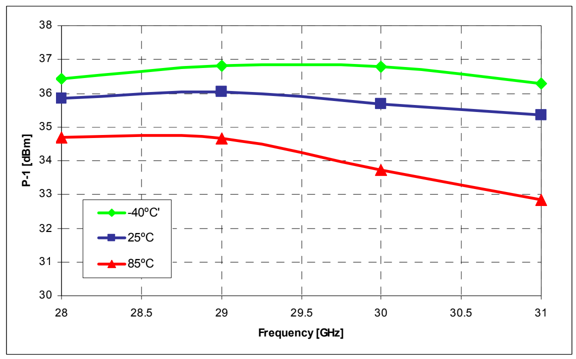


Fig.11 P-1(dBm) Frequency Sweep over Temperature

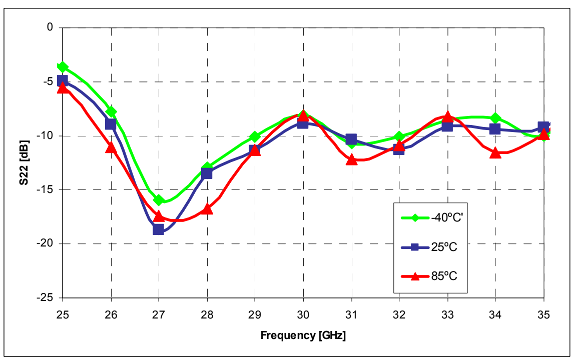


Fig.9 S22(dB) Frequency Sweep over Temperature

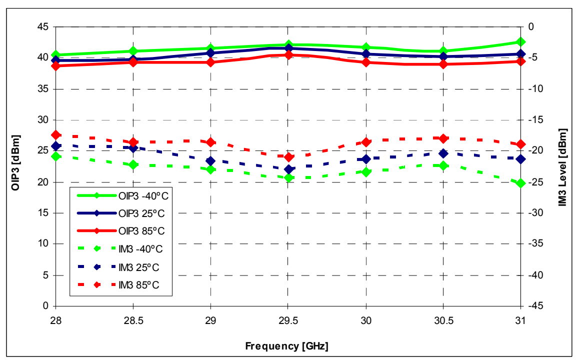


Fig.12 OIP3(dBm) and IM3 level (dBm) Frequency Sweep over Temperature @Po=20dBm/tone

Over Voltage plots

All data measured on a 2.4mm connector based evaluation board at Ta = 25 °C, and 50 Ω at all ports.

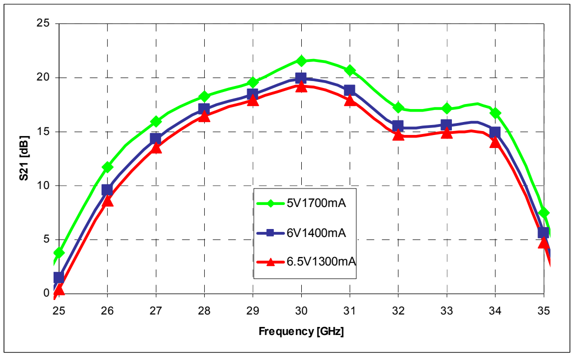


Fig.13 S21(dB) Frequency Sweep

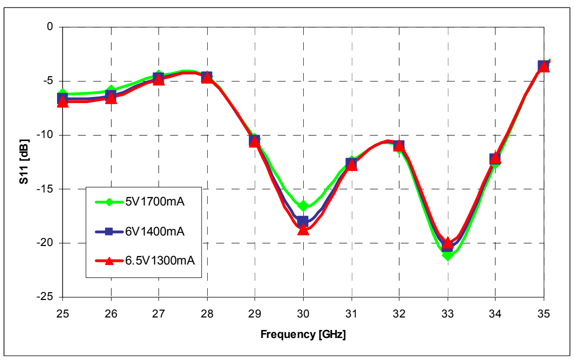


Fig.14 S11(dB) Frequency Sweep

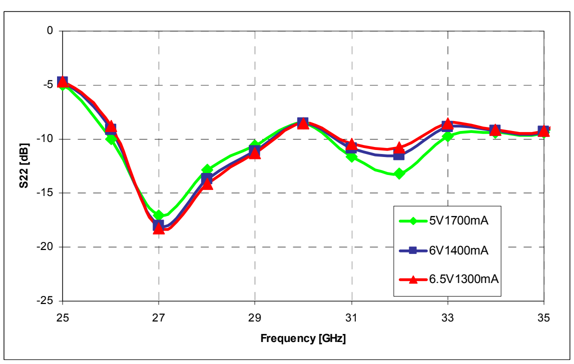


Fig.15 S22(dB) Frequency sweep

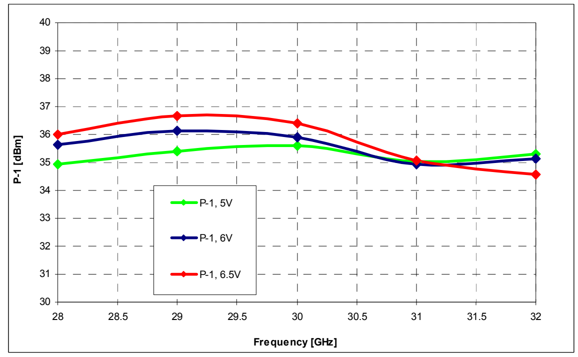


Fig.16 P-1(dBm) Frequency Sweep

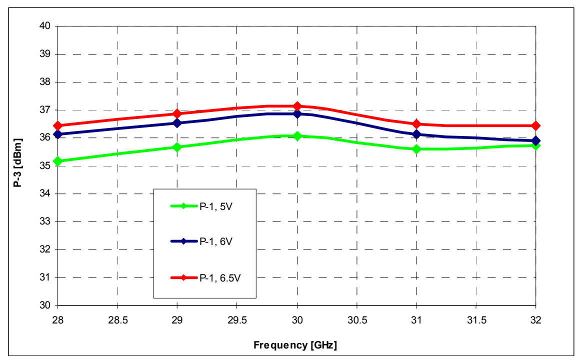


Fig.17 P-3(dBm) Frequency Sweep

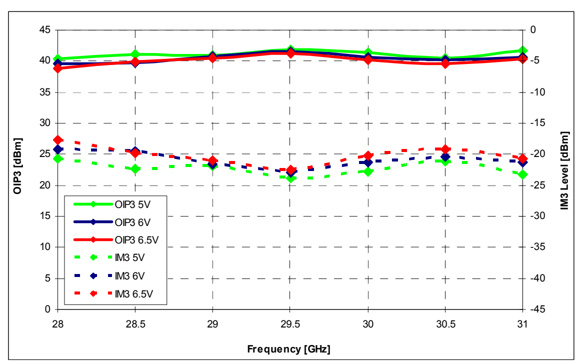


Fig.18 OIP3 and IM3 level vs. Frequency sweep @Po=20dVm/tone

Evaluation Board Description

Table 4. Pin Description:

Pin No.	Function
1	Vg
2	Vd1
3	Vd2
4	RF_OUT
5	Vd2
6	Vd1
7	Vg
8	RF_IN

Recommended turn on sequence

- Apply Vg at -1.5V
- Apply Vd1 and Vd2 at 0V
- Increase Vd to 6V
- Increase Vg of -1.5V to approximately -0.7V to obtain Idsq=1.4A
- Apply RF Input not to exceed 20dBm

Turn off in reverse order

Table 5. Typical Test Conditions:

PIN		
Vd1, 2	6V	Drain Supply Voltage
Idq= Id1+Id2	1400mA	Quiescent Drain Current
Vg1, 2	-0.7	Gate Supply Voltage

Notes: Vg1 and Vg2 of -0.7V may need be adjusted to obtain Idsq=1.4A.

Demo-board Pins

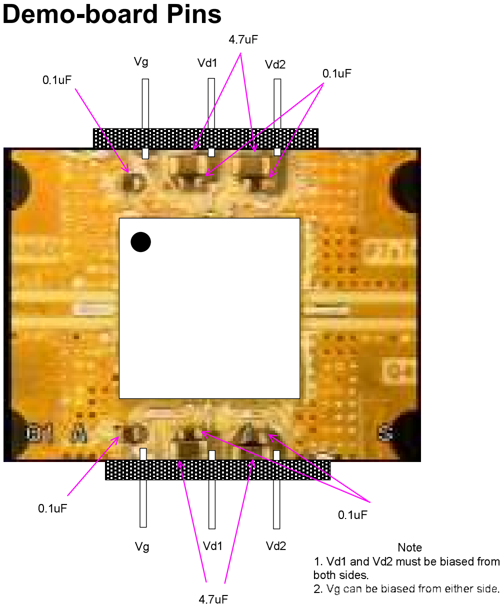
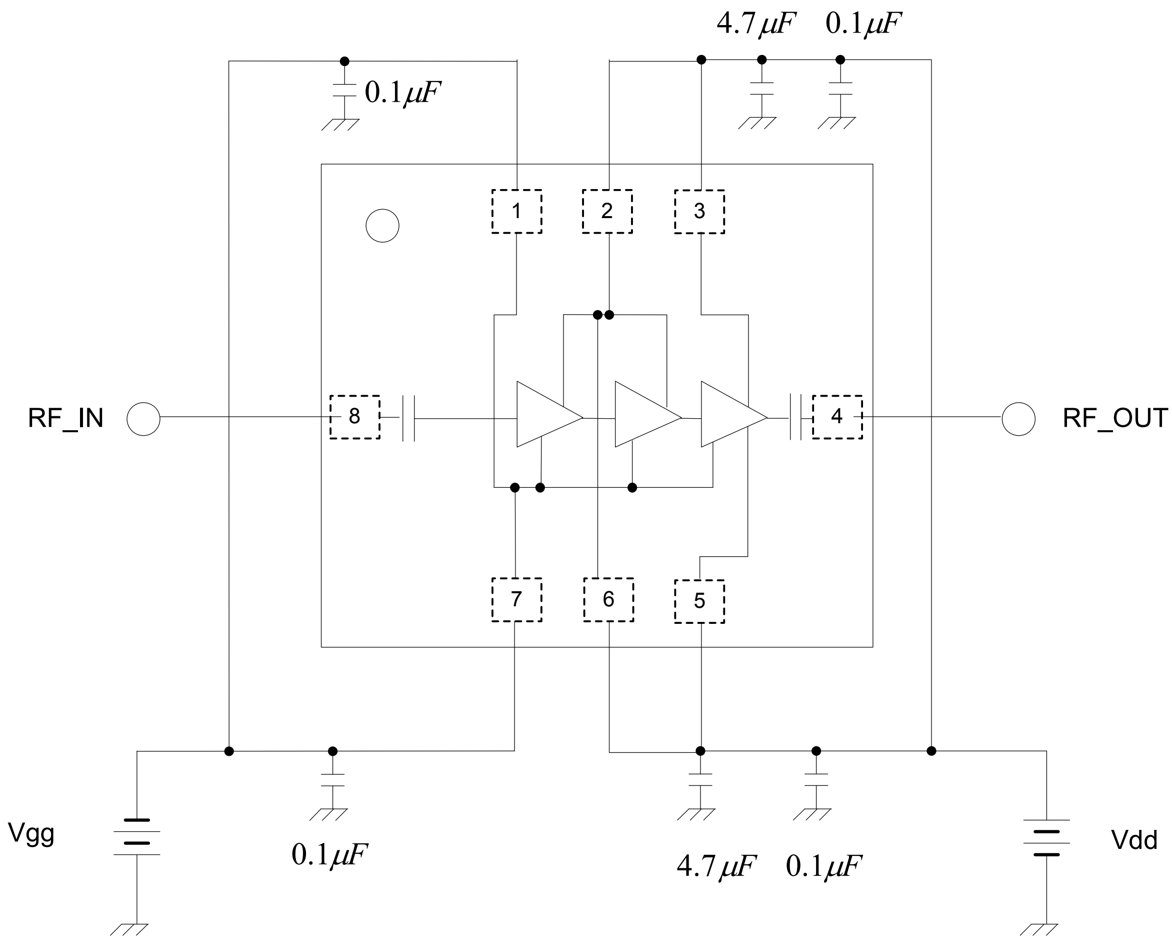


Fig. 19

Application Circuit



Notes
1. Vg pins can be biased from either side.
2. Vd pins must be biased from both sides.

Fig. 20

Land Pattern

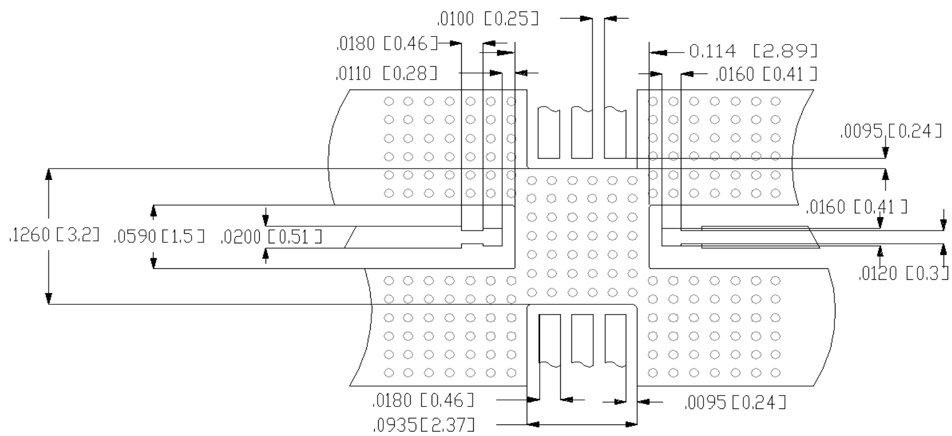


Fig. 21a Suggested PCB Land Pattern and Stencil Layout

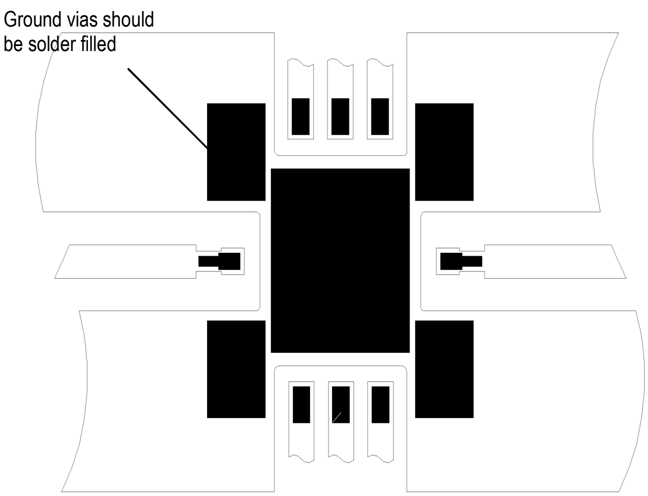


Fig. 21b. PCB Land Pattern and Stencil Layouts

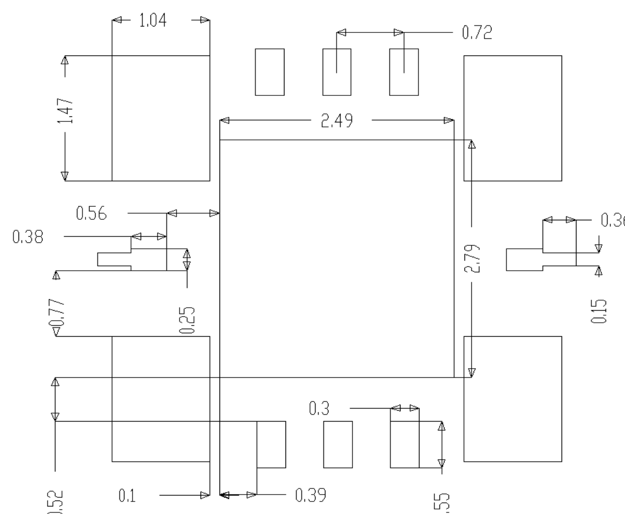


Fig. 21c Stencil Outline Drawing(mm)

The AMMP Packaged Devices are compatible with high volume surface mount PCB assembly processes.

The PCB material and mounting pattern, as defined in the data sheet, optimizes RF performance and is strongly recommended. An electronic drawing of the land pattern is available upon request from Avago Sales & Application Engineering.

Manual Assembly

- Follow ESD precautions while handling packages.
- Handling should be along the edges with tweezers.
- Recommended attachment is conductive solder paste. Please see recommended solder reflow profile. Neither Conductive epoxy or hand soldering is recommended.
- Apply solder paste using a stencil printer or dot placement. The volume of solder paste will be dependent on PCB and component layout and should be controlled to ensure consistent mechanical and electrical performance.
- Follow solder paste and vendor's recommendations when developing a solder reflow profile. A standard profile will have a steady ramp up from room temperature to the pre-heat temp. to avoid damage due to thermal shock.
- Packages have been qualified to withstand a peak temperature of 260°C for 20 seconds. Verify that the profile will not expose device beyond these limits.

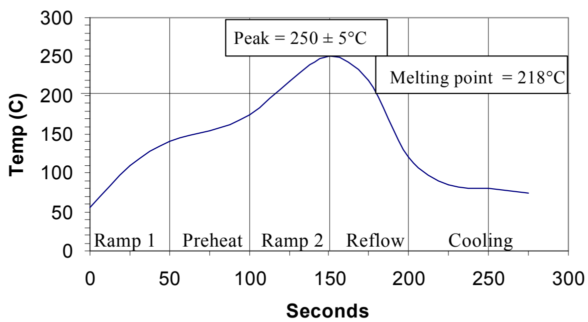


Fig. 22: Suggested Lead-Free Reflow Profile for SnAgCu Solder Paste

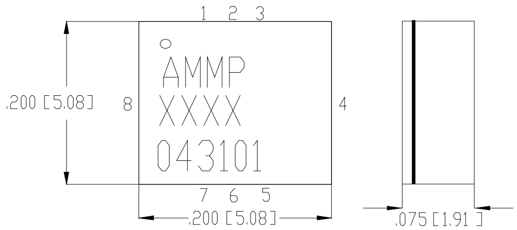
QMMP-64xx Part Number Ordering Information

Part Number	Devices Per Container	Container
AMMP-64xx-BLK	10	Antistatic bag
AMMP-64xx-TR1	100	7" Reel
AMMP-64xx-TR2	500	7" Reel

A properly designed solder screen or stencil is required to ensure optimum amount of solder paste is deposited onto the PCB pads. The recommended stencil layout is shown in **Fig. 21b**. The stencil has a solder paste deposition opening approximately 70% to 90% of the PCB pad. Reducing stencil opening can potentially generate more voids underneath. On the other hand, stencil openings larger than 100% will lead to excessive solder paste smear or bridging across the I/O pads. Considering the fact that solder paste thickness will directly affect the quality of the solder joint, a good choice is to use a laser cut stencil composed of 0.127mm (5 mils) thick stainless steel which is capable of producing the required fine stencil outline.

The most commonly used solder reflow method is accomplished in a belt furnace using convection heat transfer. The suggested reflow profile for automated reflow processes is shown in **Fig. 22**. This profile is designed to ensure reliable finished joints. However, the profile indicated in **Fig. 22** will vary among different solder pastes from different manufacturers and is shown here for reference only.

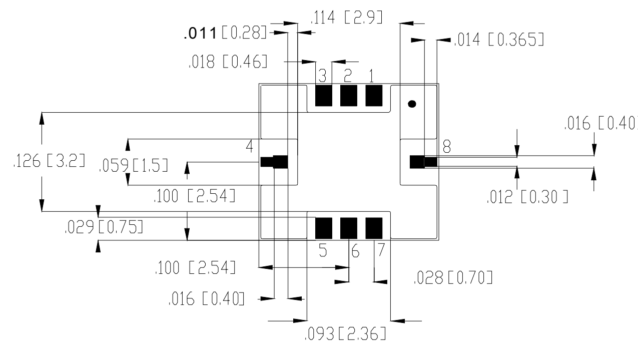
Package, Tape & Reel, and Ordering Information



Top View **Side View**

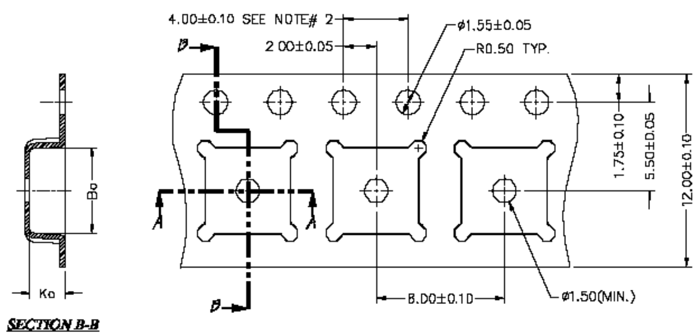
NOTES:
1. DIMENSIONS ARE IN INCHES [MILIMETERS]
2. ALL GROUNDS MUST BE SOLDERED TO PCB RF
3. Material is Rogers RO4350, 0.010" thick

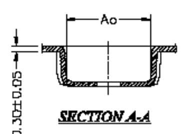
Carrier Tape and Pocket Dimensions

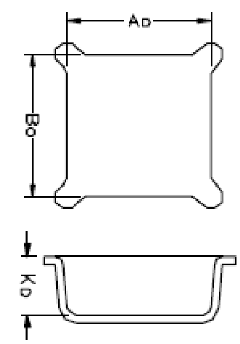


Dimensional Tolerances: 0.002" [0.05mm]

Back View







NOTES:
1. Ao & Bo measured at 0.3mm above base of pocket.
2. 10 pitches cumulative tol. ±0.2mm

Ao: *5.30*
Bo: *5.30*
Ko: *2.20*
Pitch: *8.00*
Width: *12.00*

Item	Ao	Bo	Ko
Min.	5.20	5.20	2.10
Nom.	5.30	5.30	2.20
Max	5.40	5.40	2.30