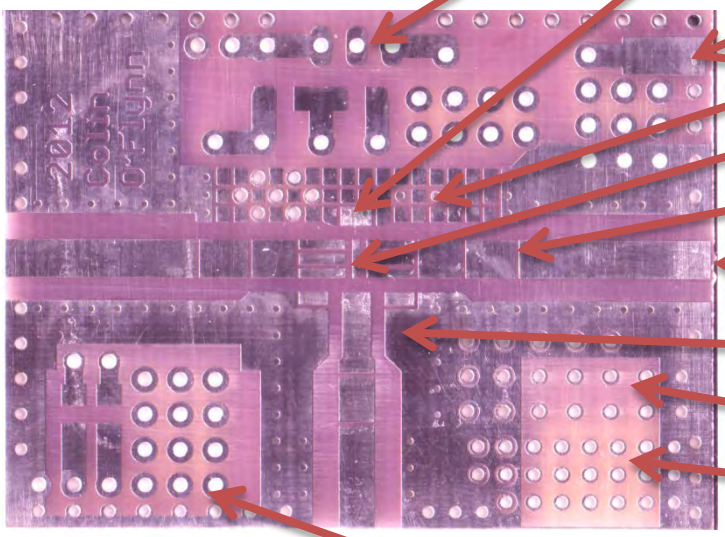
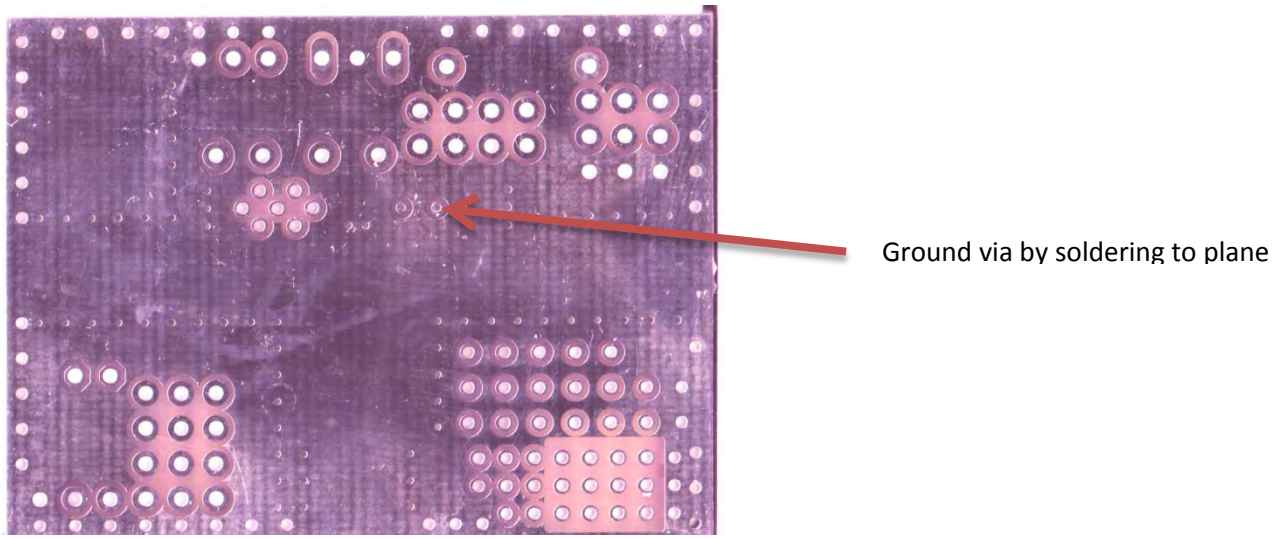
MouldyRF: Universal RF Development Board

- 50-ohm Microstrip
- Fits SOT-23, SOT-363, SOT-343, SOT-89, 4-pin plastic, SOIC-8, 0603, 0805, 1206, and custom package parts thanks to unique 'Multi-Package Layout Area'
- Add up to 3 edge-launch SMA Connector
- Solder boards together along edges
- Through-hole prototyping areas
- Broken microstrip allows mounting of discrete parts (e.g.: caps for DC coupling, matching circuits, preamp) or jumper microstrip with solder
- Usable from DC-4.5 GHz
- Low Cost & Reusable

Top Side (Viewed from Top)

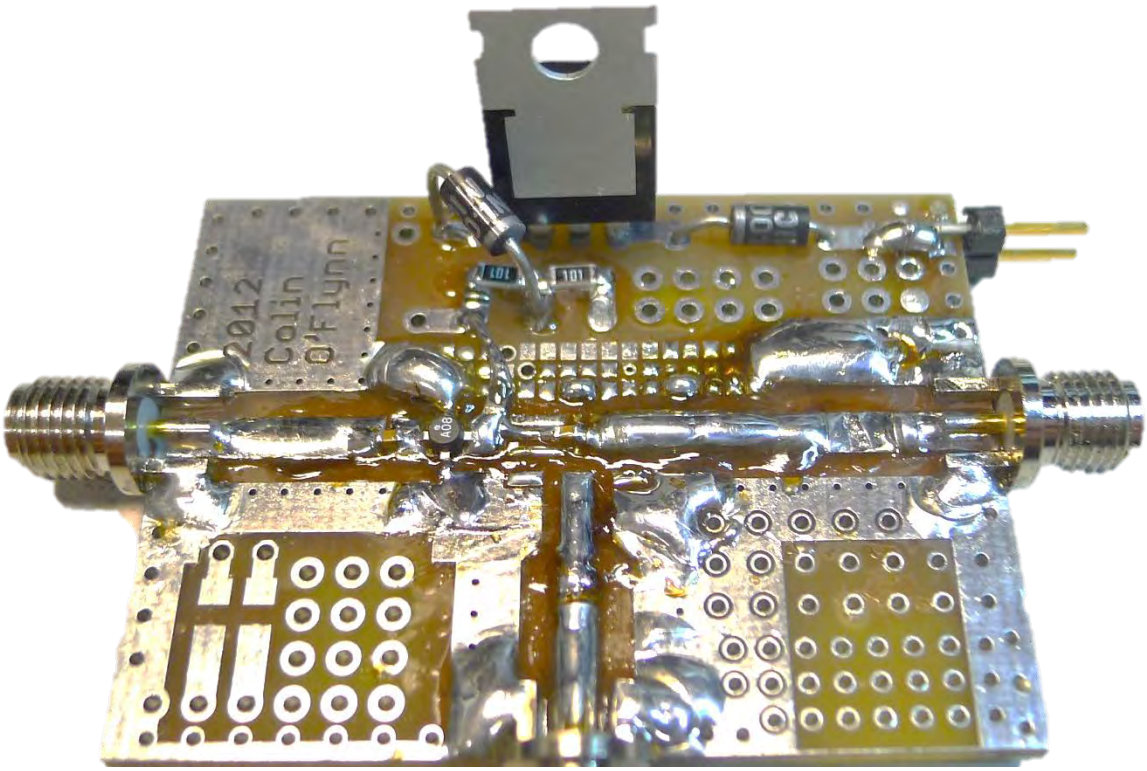


Bottom Side (Viewed from Top)



MouldyRF simplifies your development of RF devices. Rather than using expensive device-specific development boards or purchasing expensive ‘brick’ building blocks with SMA connectors, you can just stock a supply of MouldyRF boards. A selection of mixers, amplifiers, filters, and discrete components can be purchased for a low cost, all of which are compatible with the same MouldyRF board.

Here is an example of a wideband RF amplifier built on the board, including a voltage regulator and protection diodes. Decoupling capacitors are mounted on the underside of the board. A complete circuit can be built involving many different devices (amplifiers, filters, mixers, etc).

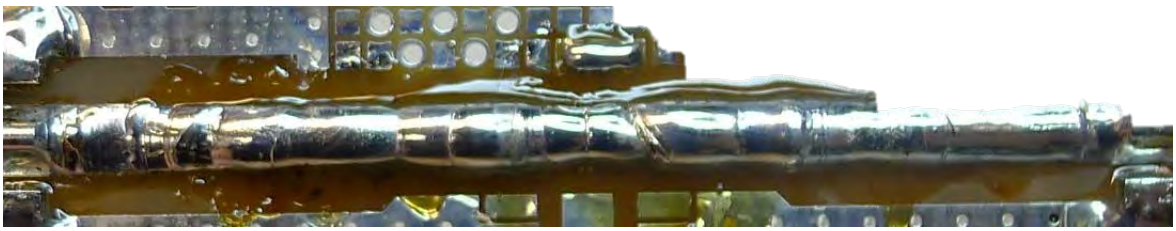


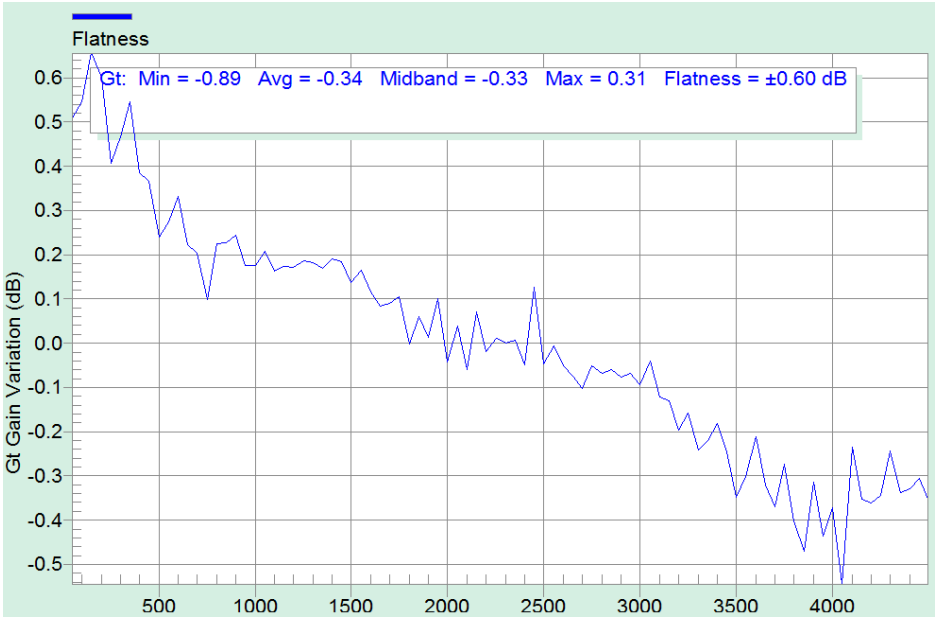
The following section shows examples of mounting a variety of packages on the board. When using the board, here are a few hints:

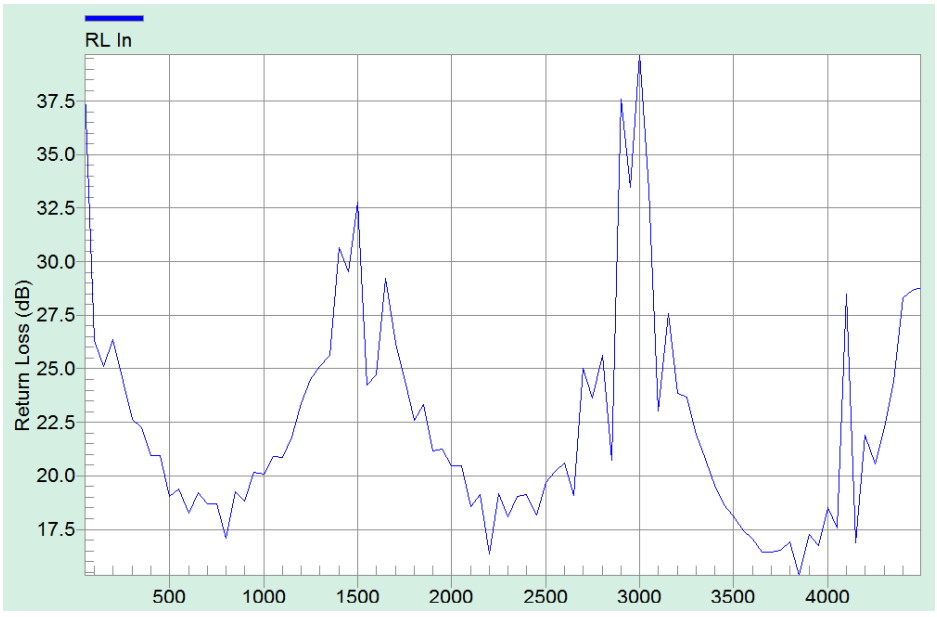
- You will get better performance with packages such as SOIC-8, SOT-363, and SOT23-6 if you either remove the centre vertical pad or short it to ground. Leaving it ‘floating’ will provide coupling between the various pins on the device.

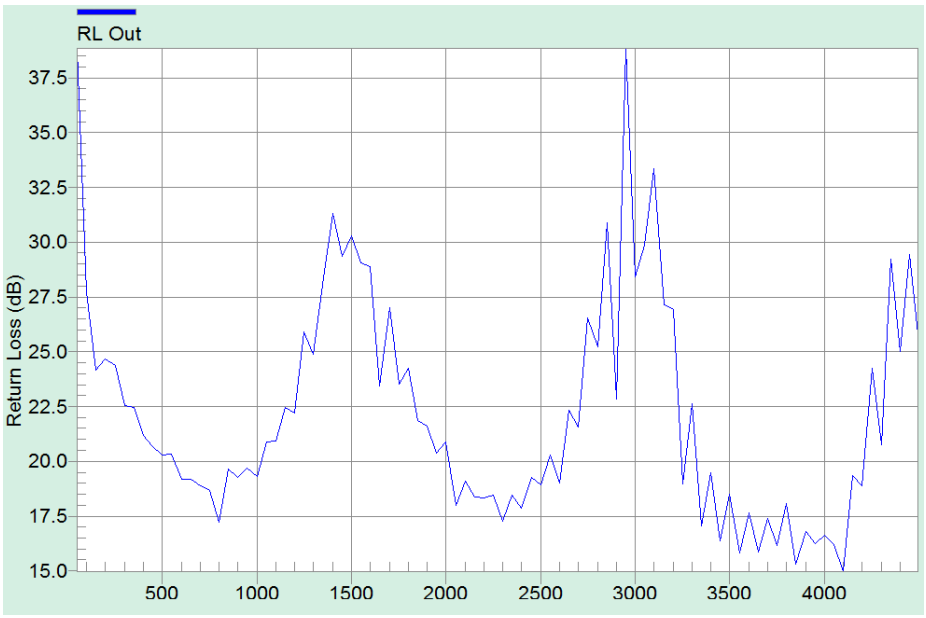
- At higher frequencies the breaks in the microstrip will be too thin if you require high isolation. Carefully increase the gap using a knife or rotary tool.

Straight Through (All Breaks Jumpered with Solder)



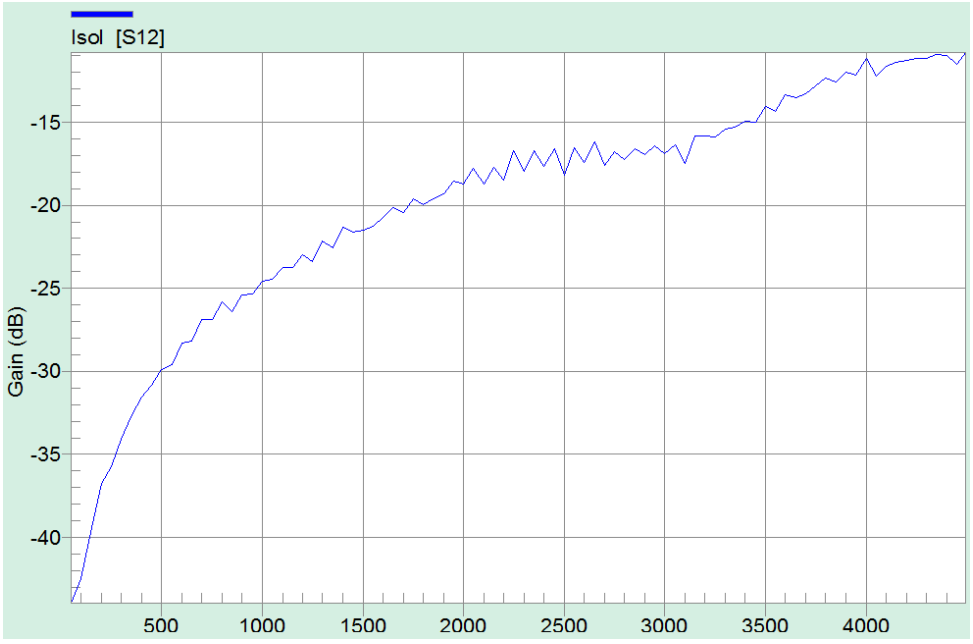





RL Out
Return Loss (dB)
37.5
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
500
1000
1500
2000
2500
3000
3500
4000

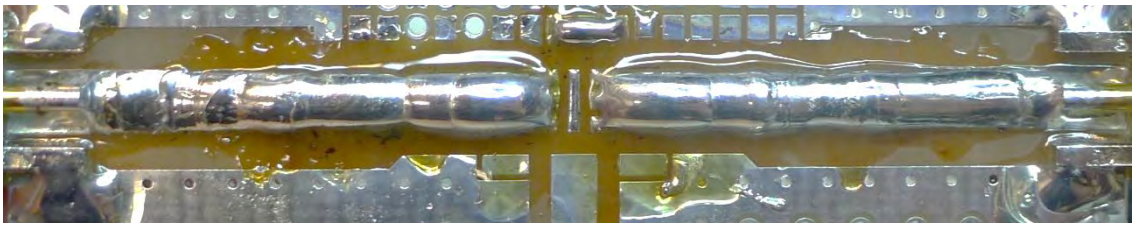
Small Break (Off-Center)

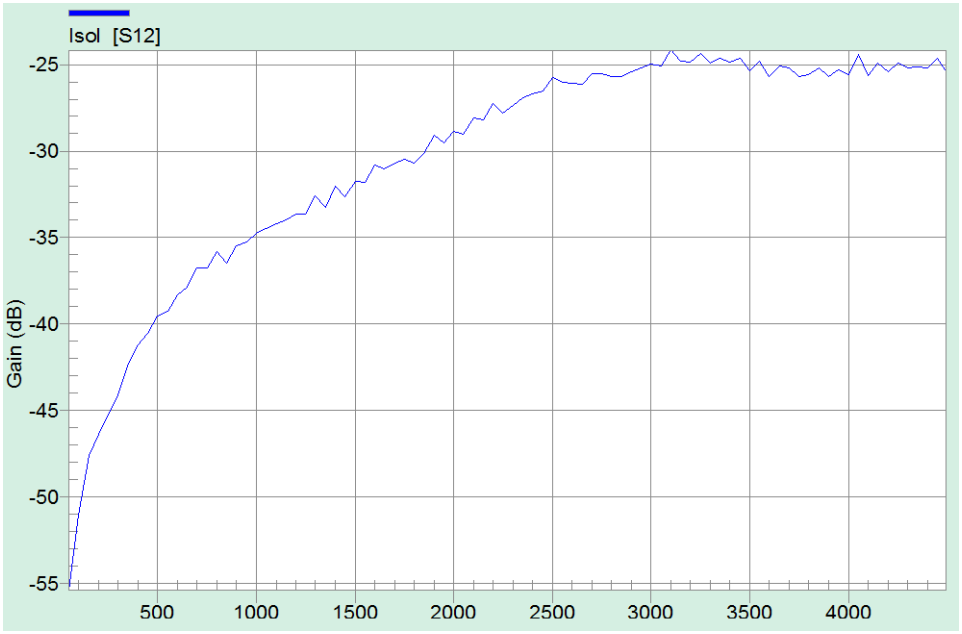
The following shows the isolation when using one of the single small breaks available on the board. If higher isolation is required it is advised to increase the gap by carefully cutting away some copper with a suitable instrument (e.g.: knife, rotary tool).



Large Break (Centre, including pad)

If using the centre, the isolation can be increased by removing the island of copper in-between the two halves. This can be accomplished with a hot soldering iron used to scrape the piece of copper off.

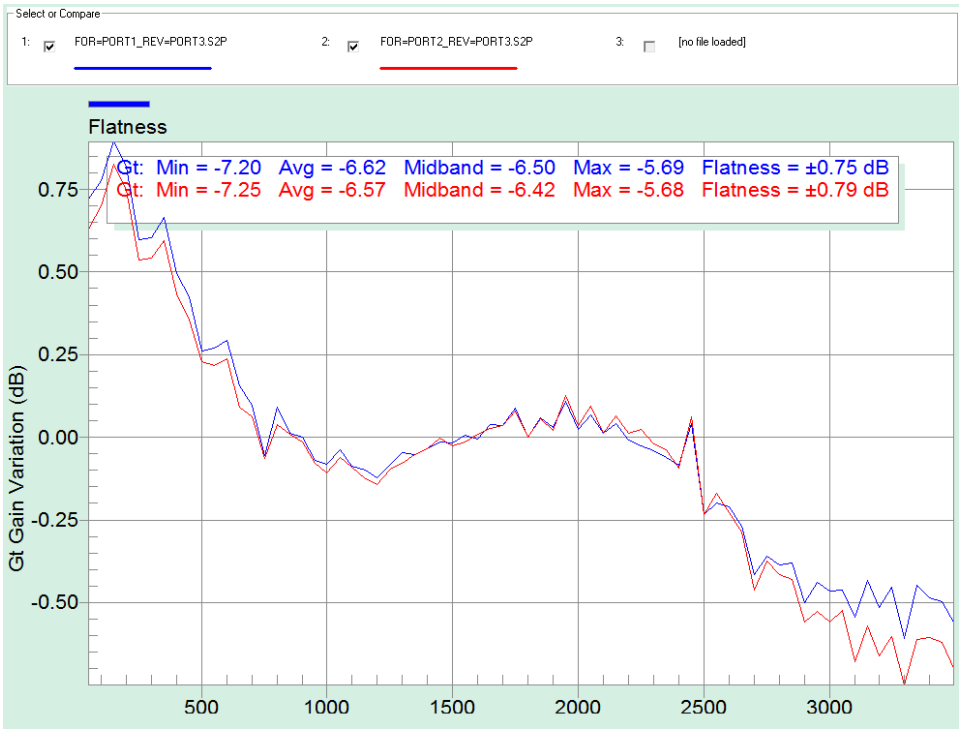




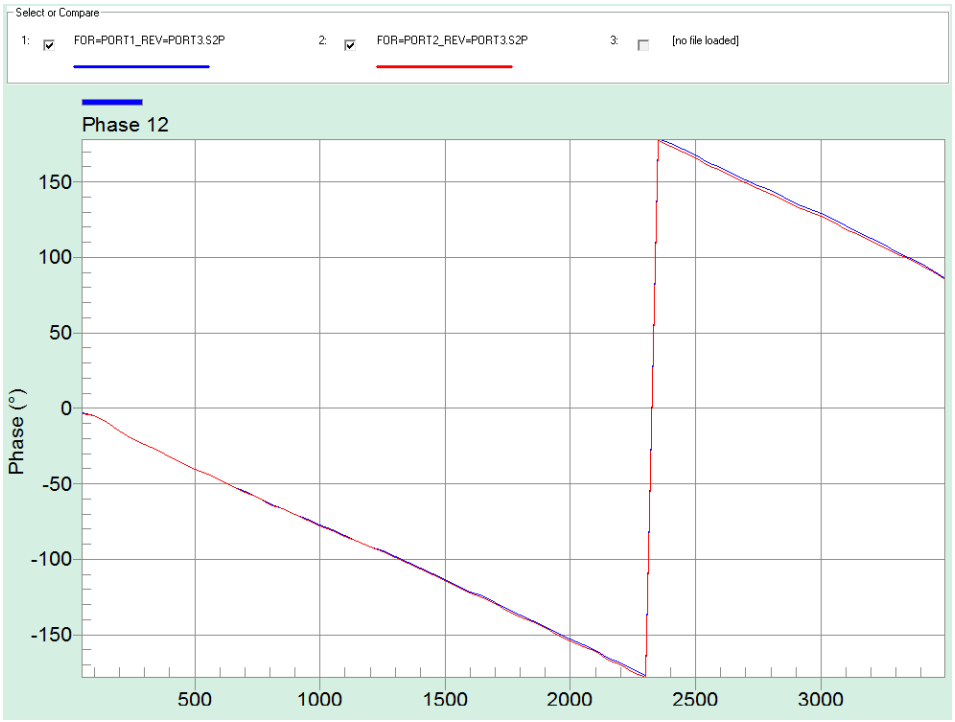
Resistive Delta-Wye Power Divider

This delta-wye resistive divider is made from 100-ohm 0603 size resistors. Note that two resistors are mounted in parallel to provide a 50-ohm resistance. The resistors on the bottom of the Wye are stacked ontop of each other, thus from the picture is difficult to see this.

Forward (S21) Gain Variation:

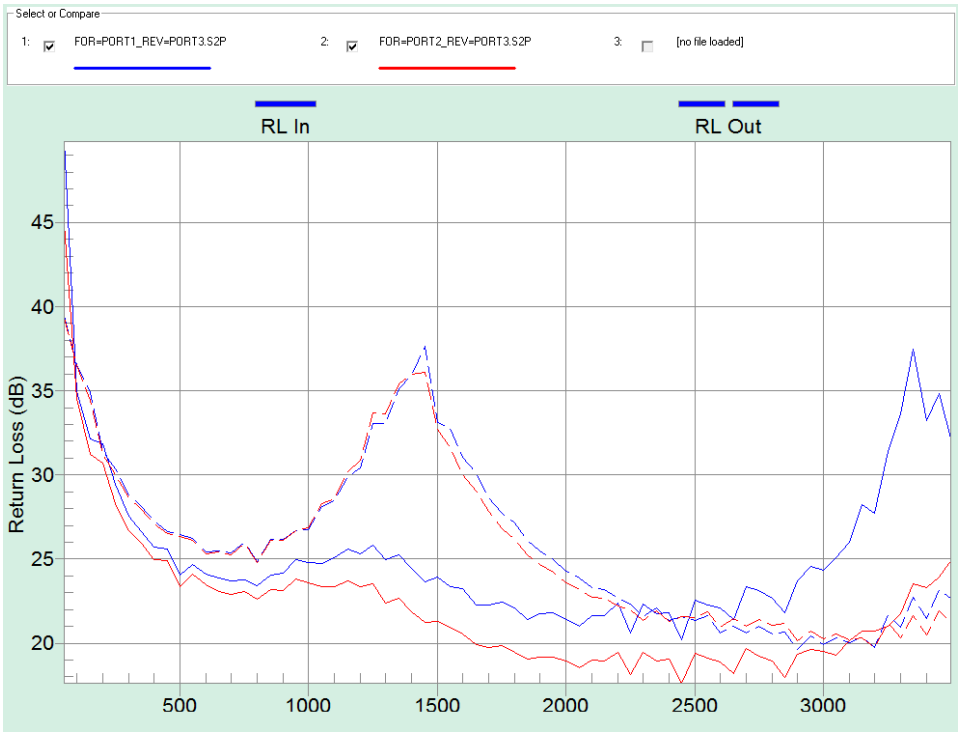


Forward Phase:



Close-up of worst-case phase imbalance @ 2500 MHz (Difference ~1.5 degree)

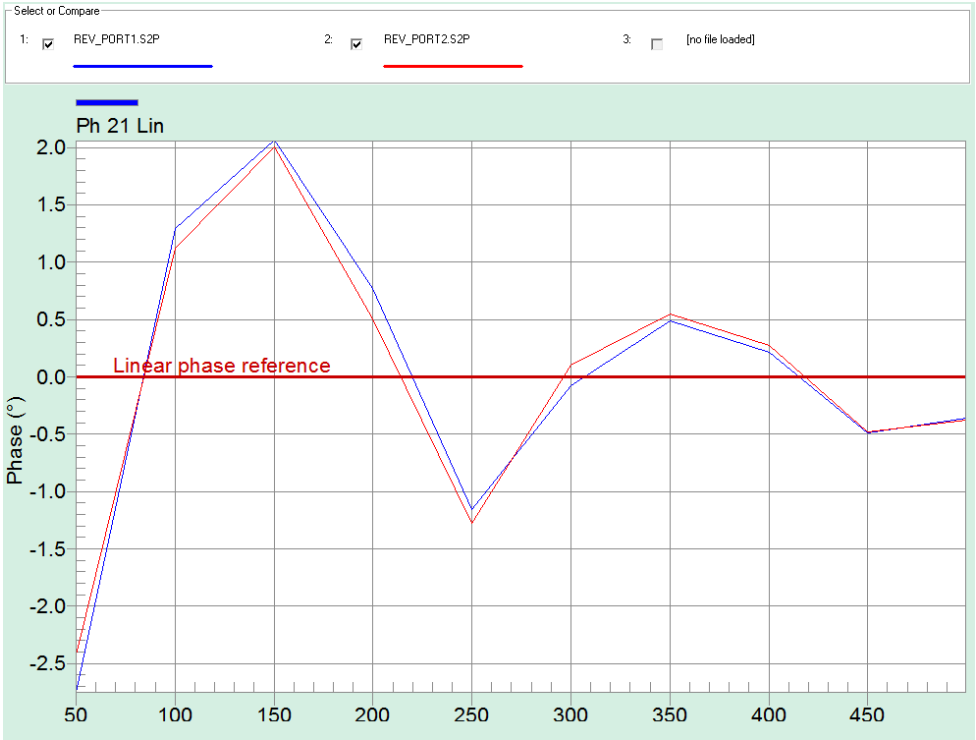
Return Loss (VSWR < 1.3 over entire range)



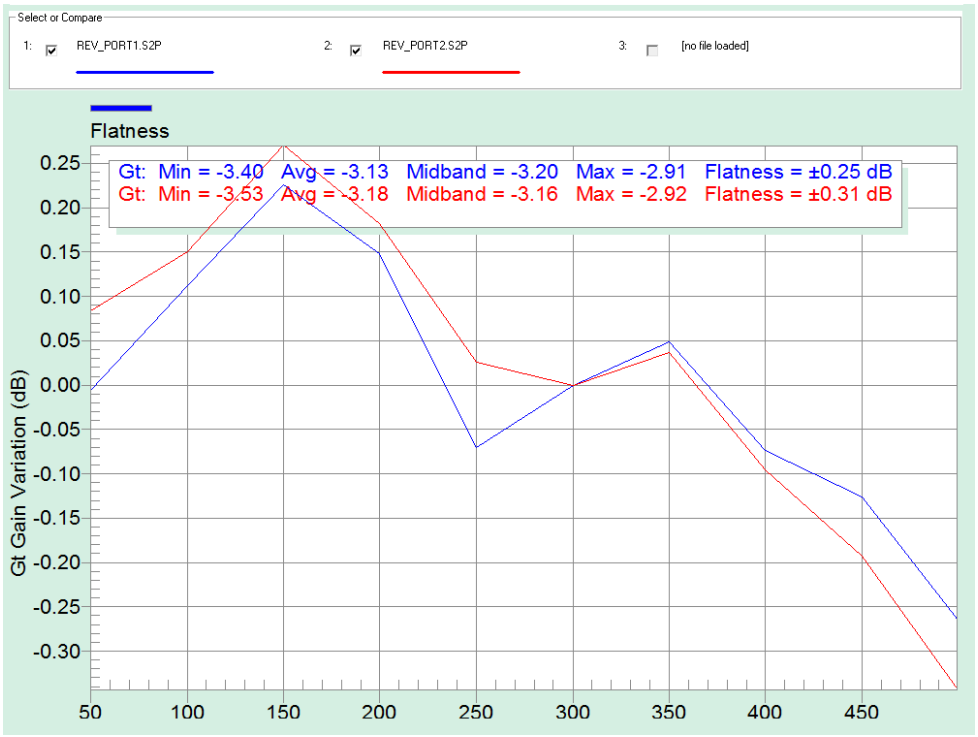
MACOM ESSM-2-16 Power Divider

The MACOM power divider is an example of a special package shape. The bottom SMA connector is used as the 'input', which is evenly split into the two 'outputs'. The outputs are closely phase and magnitude matched. The ESSM-2-16 is rated for use between 5-500 MHz only.

Comparison of Output Phase

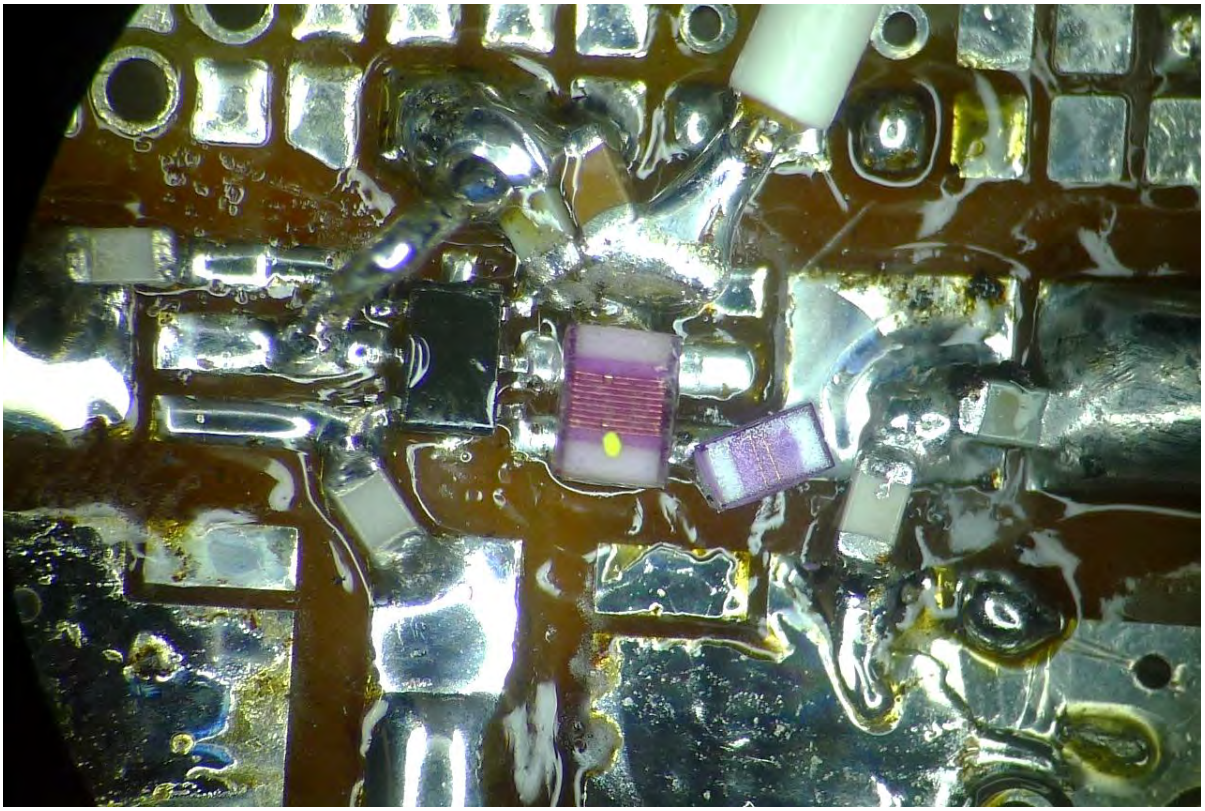


Comparison of Output Flatness

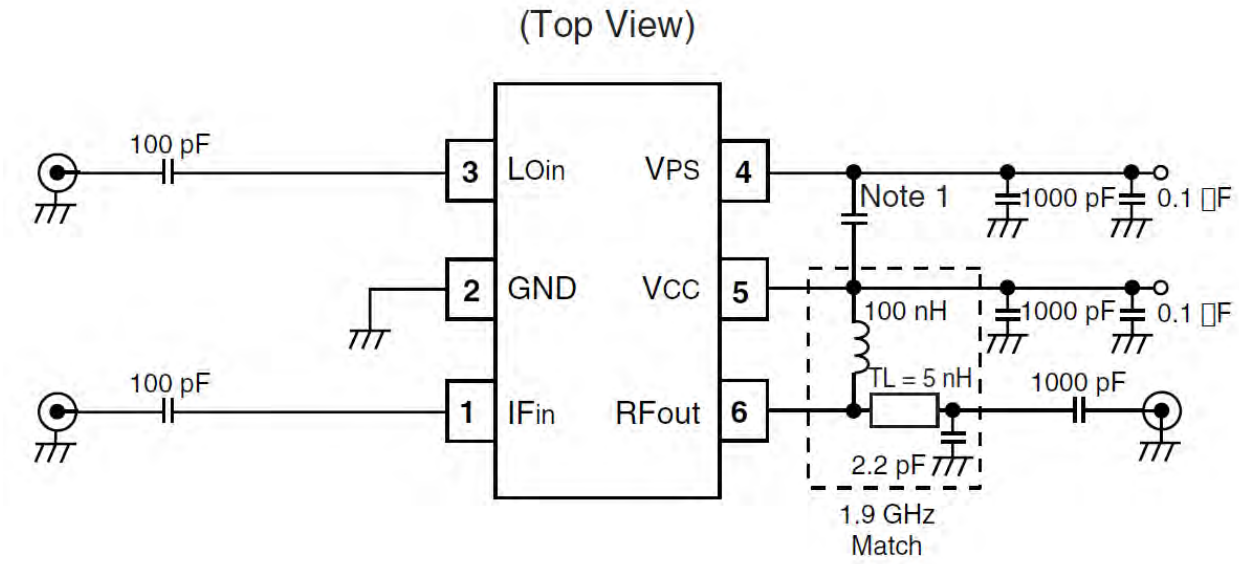


SOT-363 Package Mixer

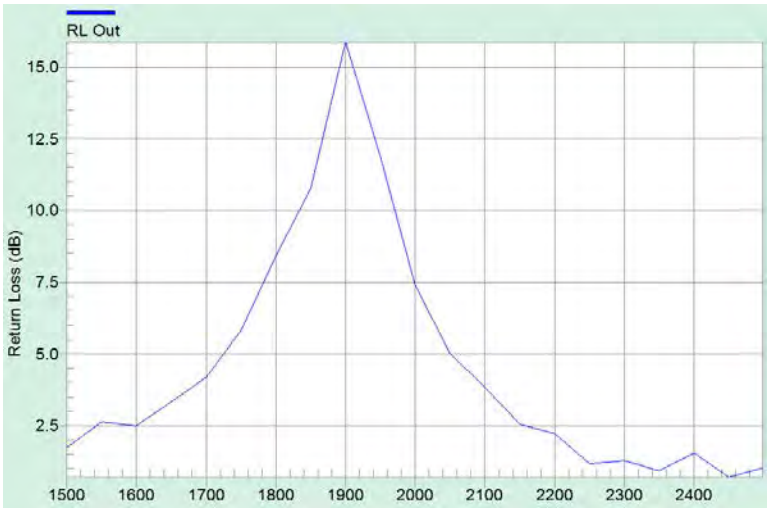
Note you will need to *slightly* bend the four 'corner' leads outward to fit the multi-package pad.



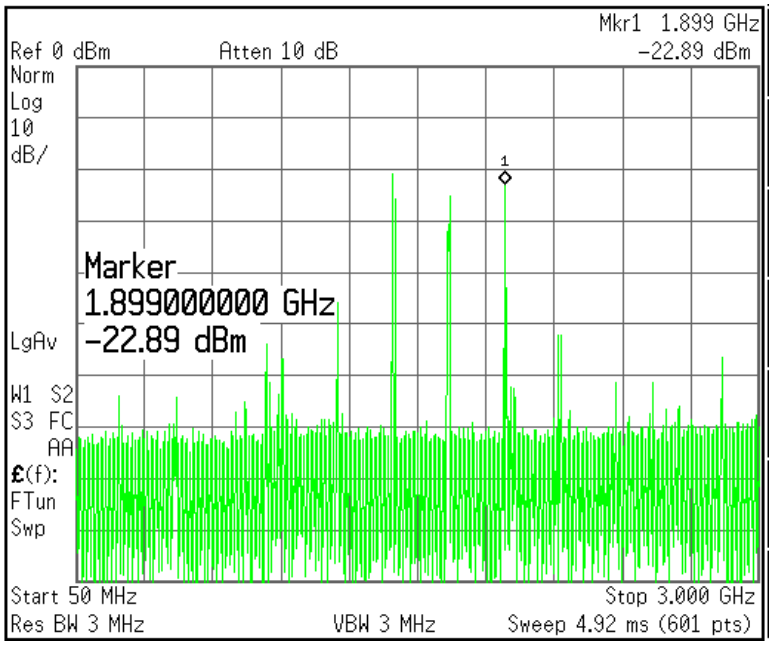
The associated schematic as given in the datasheet for a 1.9 GHz match is shown below. Note that a discrete inductor is used instead of a transmission line.



1.9 GHz Output Matching (-S22)

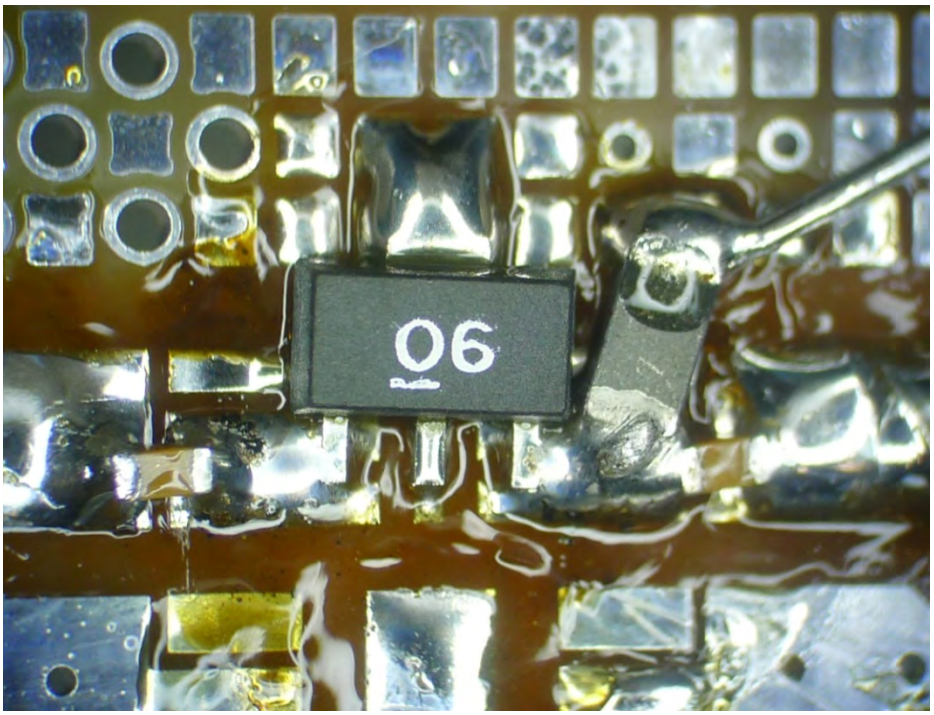


Output spectrum from: LO=1.66 GHz @ -11 dBm, IF=240 MHz @ -20 dBm



SOT-89 Package MMIC Amplifier

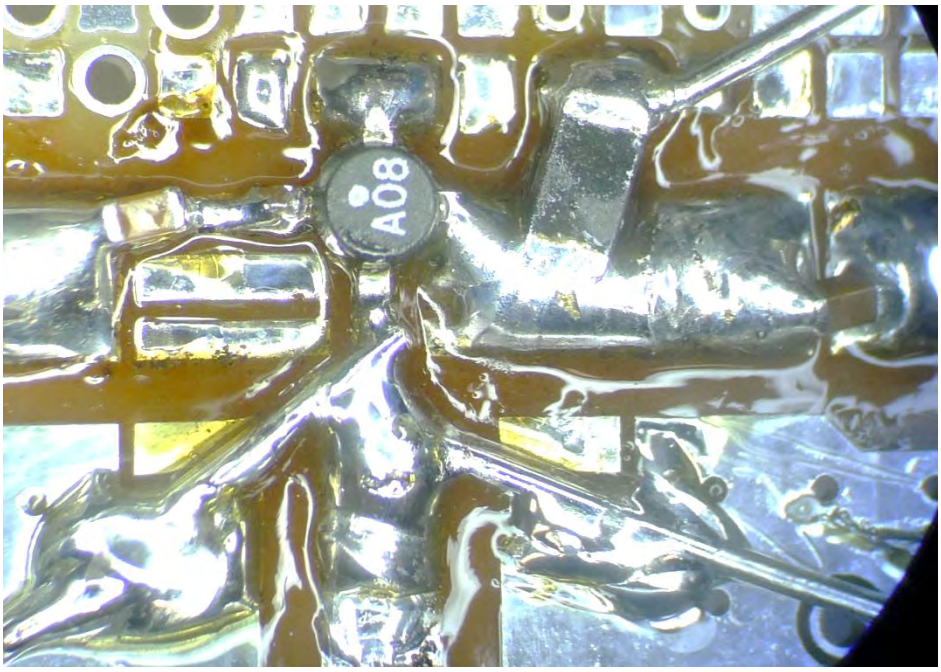
The SOT-89 package provides additional heatsinking. The tab can be soldered to the ground vias above the microstrip to provide better thermal & RF performance. Dedicated evaluation boards for this package often contain many vias underneath the package – for high power dissipation, the smaller number of vias on the generic prototype board may be insufficient.



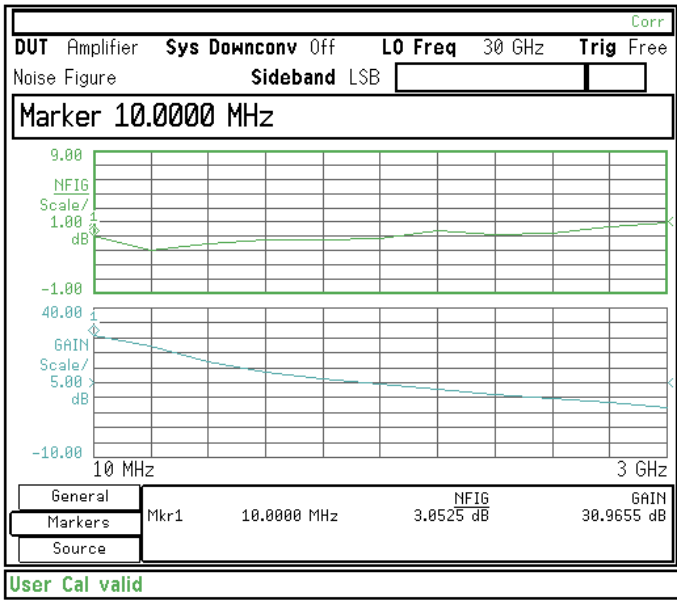
Four-Pin Package Amplifier MMIC (Mini-Circuits, others) – Middle

Many companies make broadband amplifiers in small packages, MiniCircuits or Avango (HP/Agilent) being the most popular.

See http://www.minikits.com.au/doc/MMICSc.pdf for a brief overview of various available parts. Technology vendors (e.g. MiniCircuits) typically have detailed app-notes and example circuits. They can easily be constructed on the prototype board, for example:

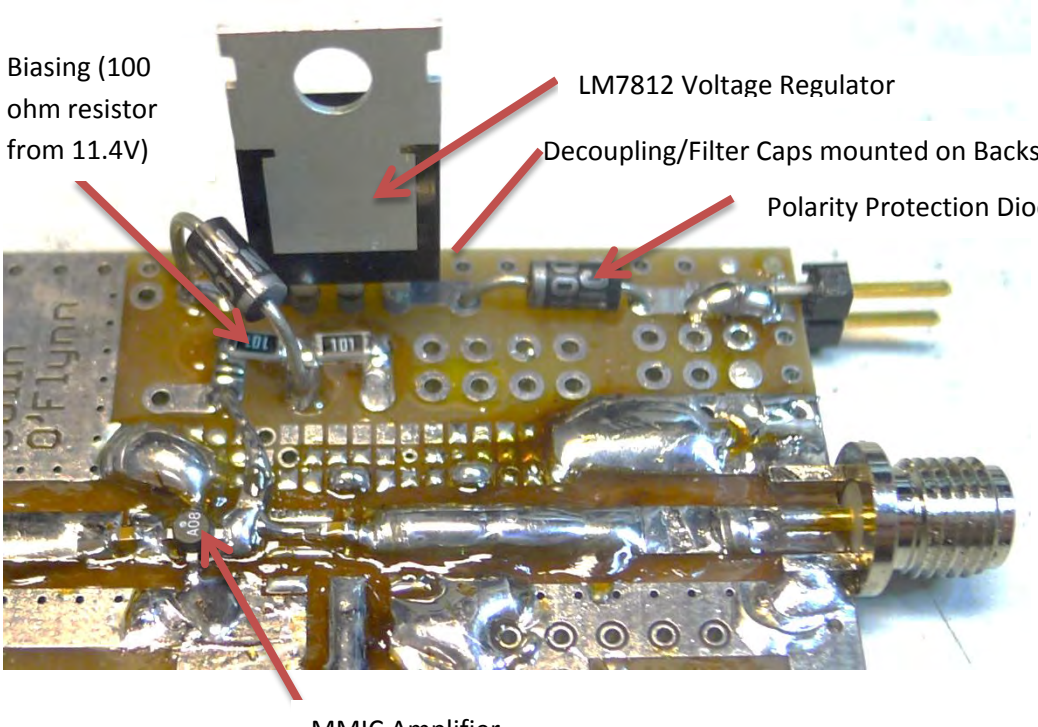


Example gain & Noise Figure for MAR-8SM (with 47nF DC-block capacitors)

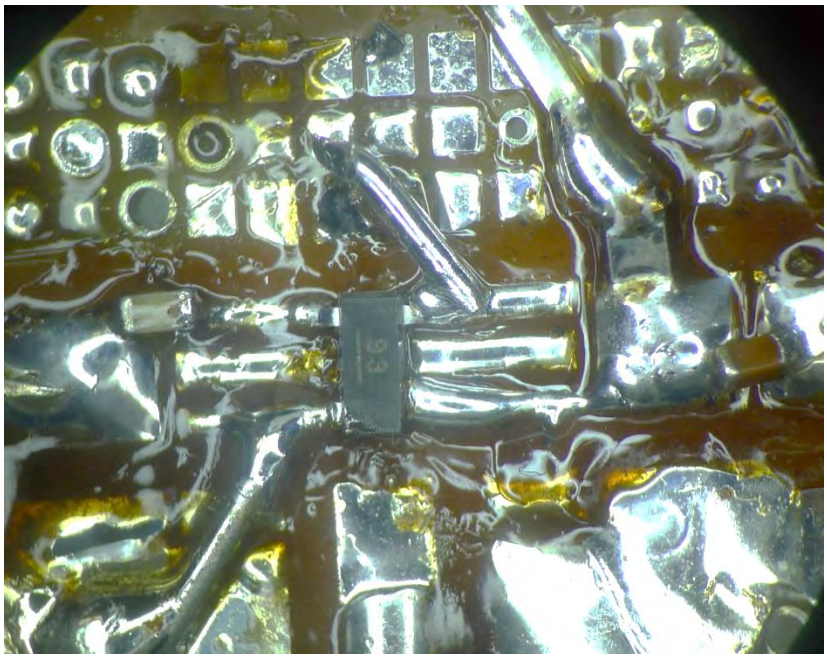


Four-Pin Package Amplifier MMIC (Mini-Circuits, others) – Pre/Post Amp

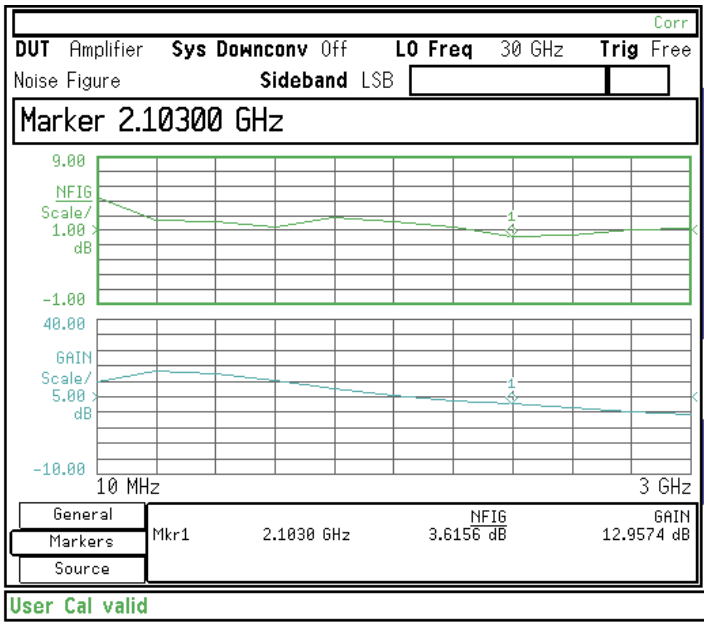
This example shows using the left side of the board for mounting the MMIC, leaving the centre open. This could be used for having a pre-amplifier on the input before passing the signal to a mixer for example.



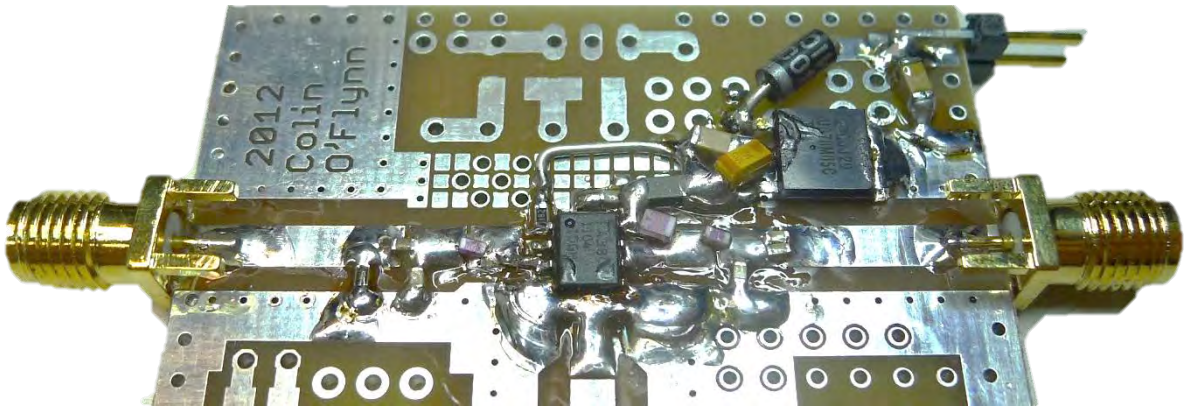
SC-82A/SOT-343 Package Amplifier MMIC



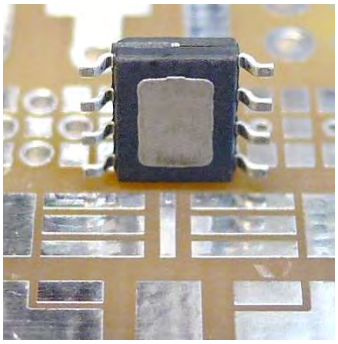
Example gain & noise figure for VAM-93 (with 47nF DC-block capacitors)

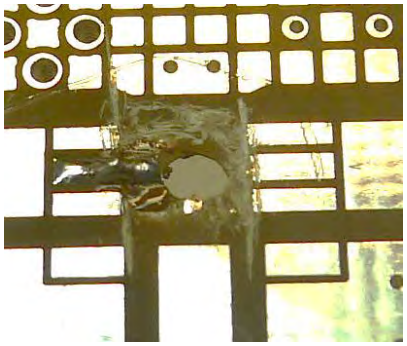


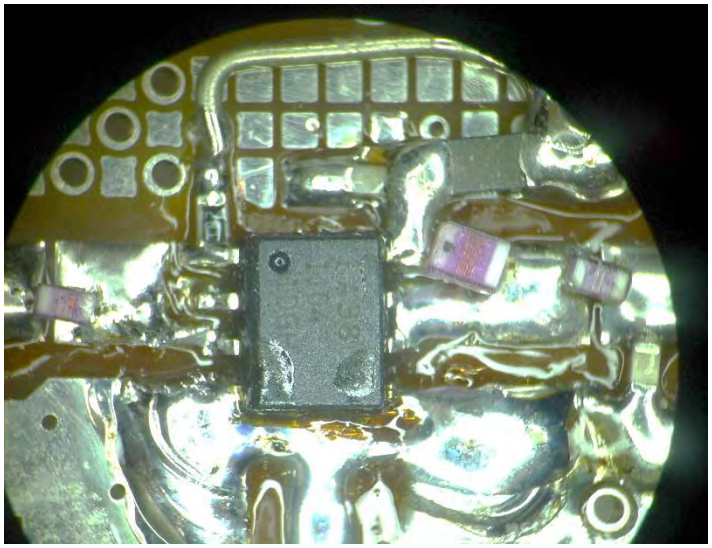
SOIC-8 Package Amplifier (RFMD RFPA3807, 400-2700 MHz, 1/4W)



This example amplifier uses a SOIC8 package with a thermal slug. The following image shows the bottom of the SOIC8 package, along with a modified MouldyRF board. The drilled hole will be filled with wire braid (e.g.: solder wick) to form a good electrical connection between the bottom of the package and the ground plane. Alternatively, use the MouldyRF-GND board which contains vias connecting the centre vertical pad to ground.



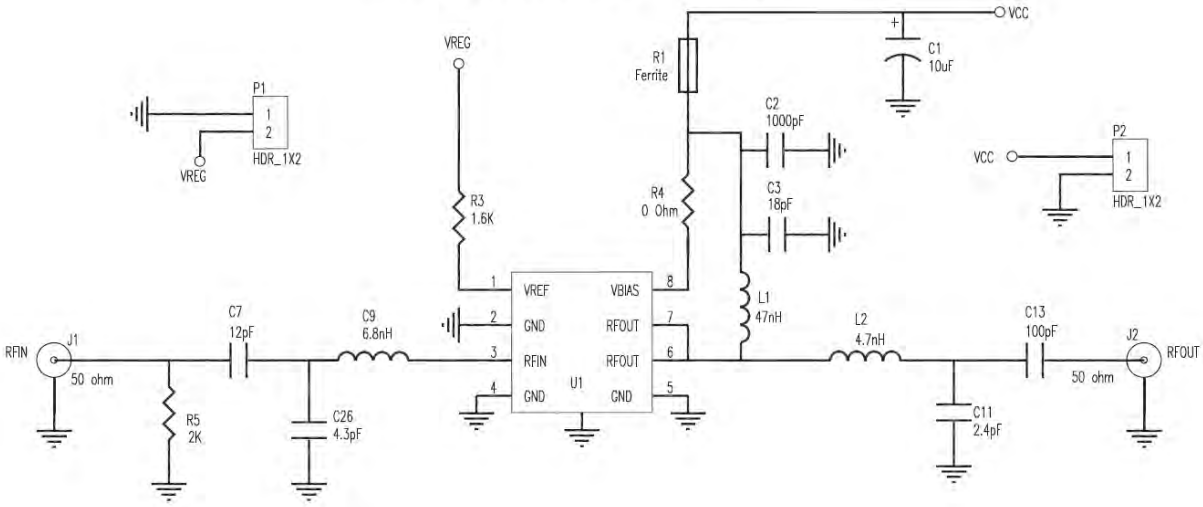




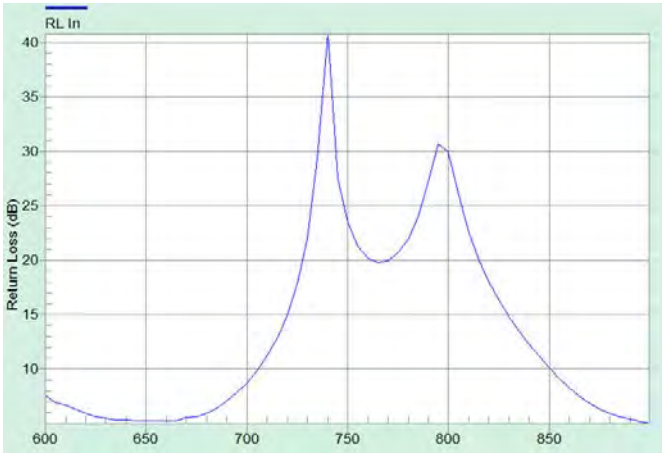
The schematic diagram for the demo board from the manufacture is given below. The example built here uses 4.7 pF for C26 and 2.2 pF for C11. Using the amplifier on the MouldyRF will require tuning the matching circuit for the desired frequency band, the results below are given for an untuned amplifier.

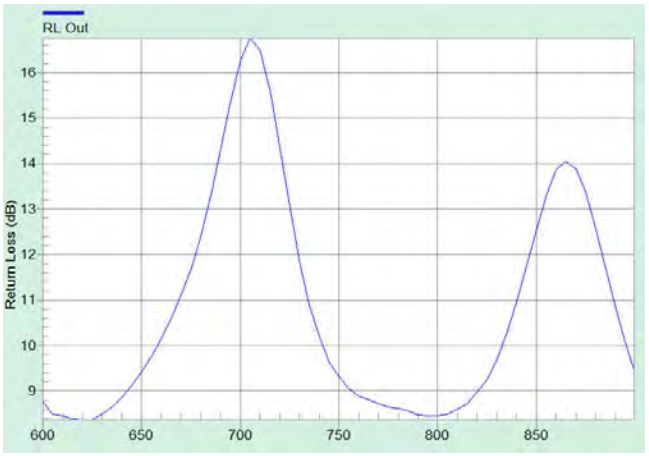
Evaluation Board Schematic

(869 MHz to 960 MHz Application Circuit)



Gain(S21), Isolation (S12), Return Loss Input (-S11), Return Loss Output (-S22)





The input should be tuned for better matching at 700 MHz. This basic circuit can be adjusted to operate in another frequency band, see the datasheet for more information. This could include for example a low-cost 2.4 GHz amplifier for Bluetooth, Zigbee, or WiFi research.