

Organic Packaging for 5G and 40 GHz Applications

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TOPICS

- WHAT IS 5G?
- WHAT IS ORGANIC PACKAGING?
- WHAT IS A QFN?
- WHAT IS AN AIR CAVITY PACKAGE?
- EVALUATING AIR CAVITY PACKAGES AT
MILLI-METER WAVE (40GHz)

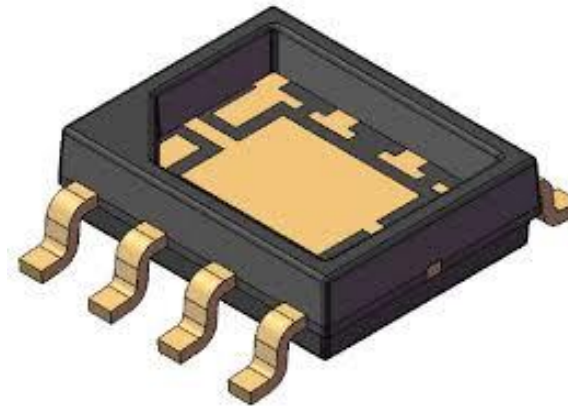
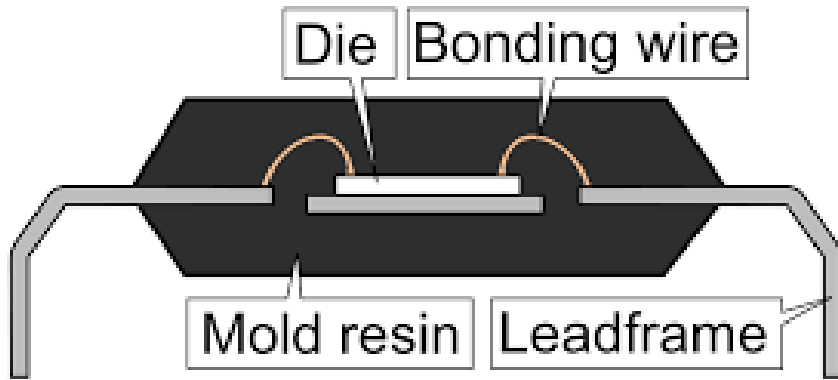


- WHAT IS 5G?
- "5G is the 5th generation mobile network.
- New global wireless standard after 1G, 2G, 3G, & 4G.
- A new network designed to connect virtually everyone & everything together including machines, objects, & devices.
- 5G uses spectrum better than 4G.—from low bands below ~1 GHz, to mid bands from 1 GHz to 6 GHz, to high bands known as millimeter wave (mmWave). (>30GHZ)
- 5G is significantly faster, has more capacity, lower latency, a unified more capable platform and uses spectrum better than 4G" ₁

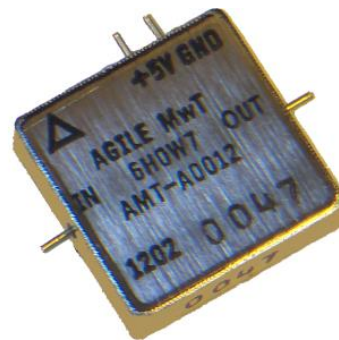
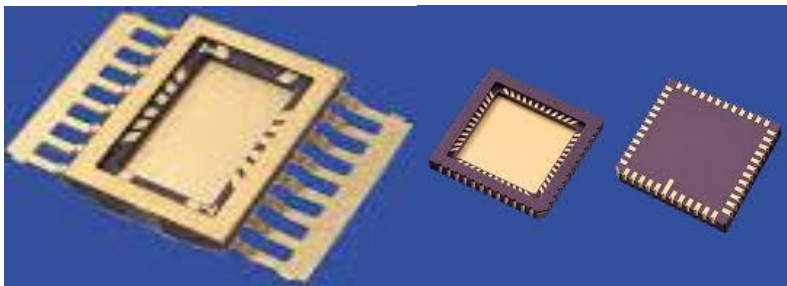
PURPOSE OF THIS PRESENTATION-Organic Packaging for 5G and 40Ghz Applications



- WHAT IS ORGANIC PACKAGING?
 - Plastic, Molded, Pre-Molded (Air Cavity)



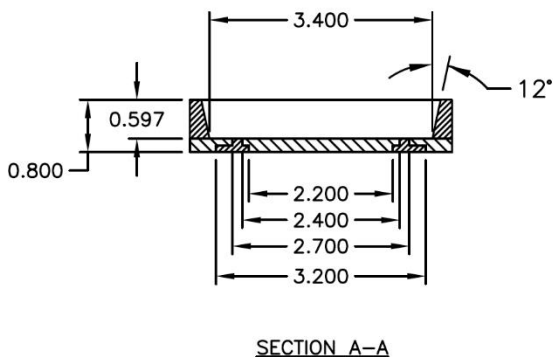
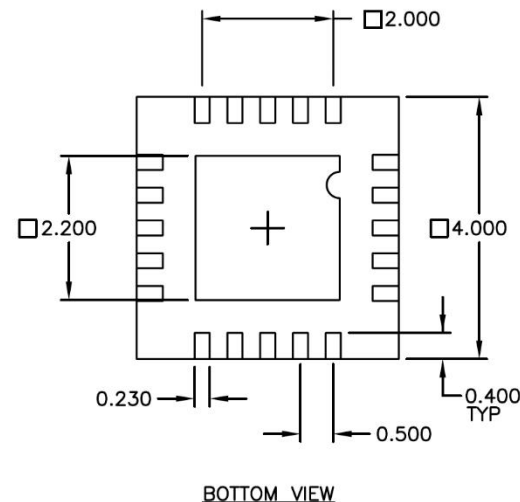
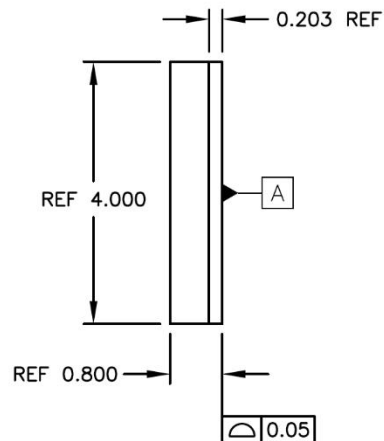
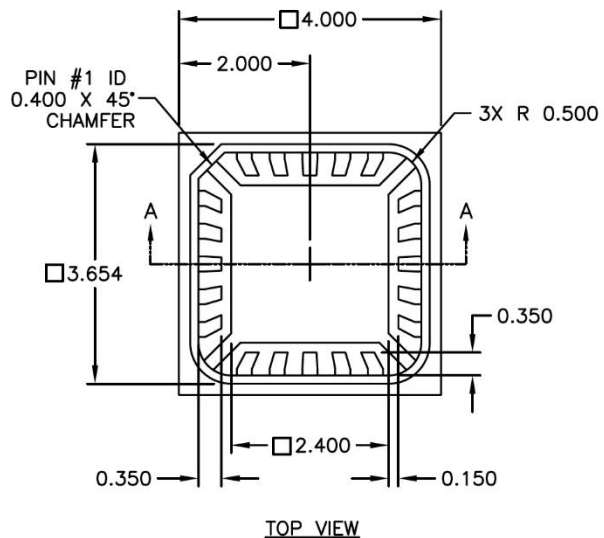
- Not Metal, Ceramic, Glass,



- WHAT IS A QFN?
 - Quad-Flat package No-leads
 - Fours sided package with no leads
- QFP Quad Flat Pack QFN



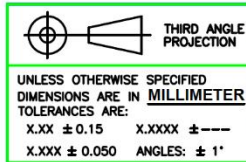
QUIK-PAK QFN 20LEAD 4MM X 4MM 20 LEAD



NOTES

- MATERIALS:**
LEAD FRAME: COPPER 194FH, THK = 0.203 ± 0.008
BODY: SEMICONDUCTOR MOLDING EPOXY, CONTACT QUIK-PAK FOR DETAILS.
- FINISH:**
LEAD FRAME: ELECTROLESS NICKEL PER MIL-C-26074, CLASS 1, 100 TO 300 MICROINCHES (2.5um - 7.6um) THICK.
GOLD PLATE PER MIL-G-45204, TYPE 3, GRADE A, CLASS 1 (40 TO 80 MICROINCHES (1um - 2um) THICK).
BODY SURFACE FINISH: VDI 21-24 (1.12-1.6 Ra).
- PACKAGE MISMATCH:** BODY OFFSET TO LEAD FRAME = 0.076mm MAX
- UNLESS OTHERWISE SPECIFIED, RADIUS ON ALL MOLDED EDGES AND CORNERS = 0.25mm MAX.**
- PACKAGE CONFORMS TO JEDEC MO-220.**

SEE NOTE 3 FOR WEB LINK FOR THIS DRAWING



THIRD ANGLE PROJECTION	DRAWN BY CAD DEPT.	DATE 4/19/10
	APP BY STEVE S.	DATE 4/19/10
CUSTOMER ---		
THIS DOCUMENT CONTAINS INFORMATION PROPRIETARY TO QUIK-PAK, AND REPRODUCTION IN ANY FORM IS NOT PERMITTED WITHOUT WRITTEN AUTHORIZATION		

QUIK-PAK www.icproto.com 10987 VIA FRONTERA SAN DIEGO, CA. 92127 PHONE: (858) 674-4676 FAX: (858) 674-4681		
4mm X 4mm QFN 20 LEAD 0mPP		
SIZE A	PART NO. QP-QFN20-4MM-.5MM	REV A1

AIR CAVITY PACKAGE CROSSECTION

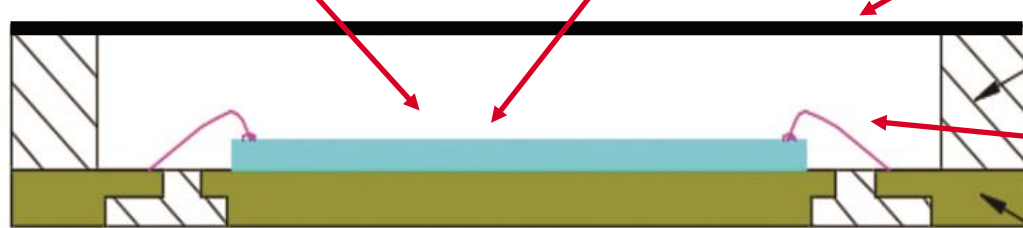


AIR DIELECTRIC

SEMICONDUCTOR DIE AND CONDUCTIVE DIE ATTACH EPOXY

PLASTIC (NON-METAL)

LID AND EPOXY



Overmold Material

WIRE BOND OR RIBBON BOND

Copper Lead Frame

HEAT SINK AND RF-MICROWAVE & POWER GROUND₂

WAVELENGTH AND FREQUENCY

Frequency
 GHz

Wavelength
 Inches

Wave Velocity
 m/s

SHORT LOW INDUCTIVE CONNECTION

$$\frac{\lambda}{6} = \frac{.300}{6} = 0.050''$$

$$\frac{\lambda}{10} = \frac{.300}{10} = 0.030''$$



PRODUCT DATASHEET

CGY2144UH/C2

DC-54GHz, Medium Gain Broadband Amplifier

DESCRIPTION

The CGY2144UH/C2 is a broadband distributed amplifier designed especially for OC-768 (43 Gb/s) based fiber optic networks. The amplifier can be used as a Transimpedance Amplifier (TIA) or either as a driver amplifier for Electro-Absorption Modulator (EAM). The CGY2144UH/C2 can also be used as a flexible multi-purpose gain block.

The CGY2144UH/C2 features single ended RF input and output and operates with a power consumption of typically 500 mW. It requires only a single +5.0 V via on-chip bias network and a minimum number of external components.

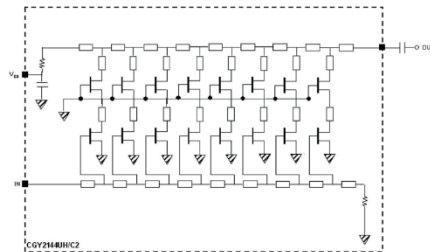
The MMIC is manufactured using OMMIC's qualified 0.13 μm PHEMT GaAs D01PH technology. The D01PH process is one of the European Space Agency (ESA) european preferred part list (EPPL) technologies.

APPLICATIONS

- ▶ 43 Gb/s OC-768 Receiver
- ▶ 43 Gb/s OC-768 EAM Driver
- ▶ Instrumentation, EW Systems
- ▶ General purpose wide band amplifier

FEATURES

- ▶ Wide frequency range : DC – 54 GHz
- ▶ Suitable for 43 Gb/s optical fibre links
- ▶ Gain S21 : 13 dB
- ▶ Fast rise/fall time < 10 ps
- ▶ Low noise figure: typical 2.5 dB @ 20 GHz
- ▶ Transimpedance gain : 280 Ω , (49 dB Ω)
- ▶ Input current density : 10 pA/Hz^{1/2} @ 30 GHz
- ▶ Overload > 3.5 mApp
- ▶ Low group delay variation: ± 7 ps @ 25 GHz
- ▶ Single positive supply voltage +5.0 V
- ▶ Chip size = 1490 x 2170 μm
- ▶ Tested, Inspected Known Good Die (KGD)
- ▶ Samples Available
- ▶ Space and MIL-STD Available



Block Diagram of the CGY2144UH Broadband Amplifier



DIE SIZE: 2170 x 1490 μm (Tolerance : ± 15 μm).

Die thickness: 0.1 mm.

DATA SHEET AT

<https://www.ommic.com/datasheets/>

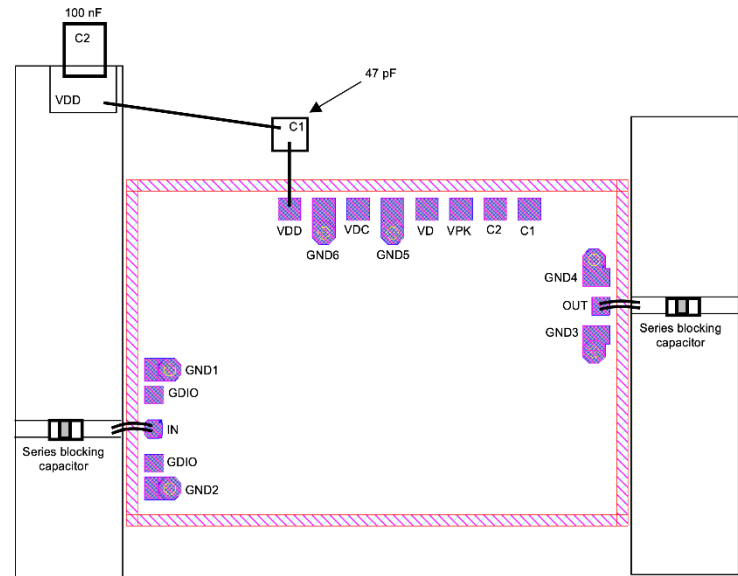
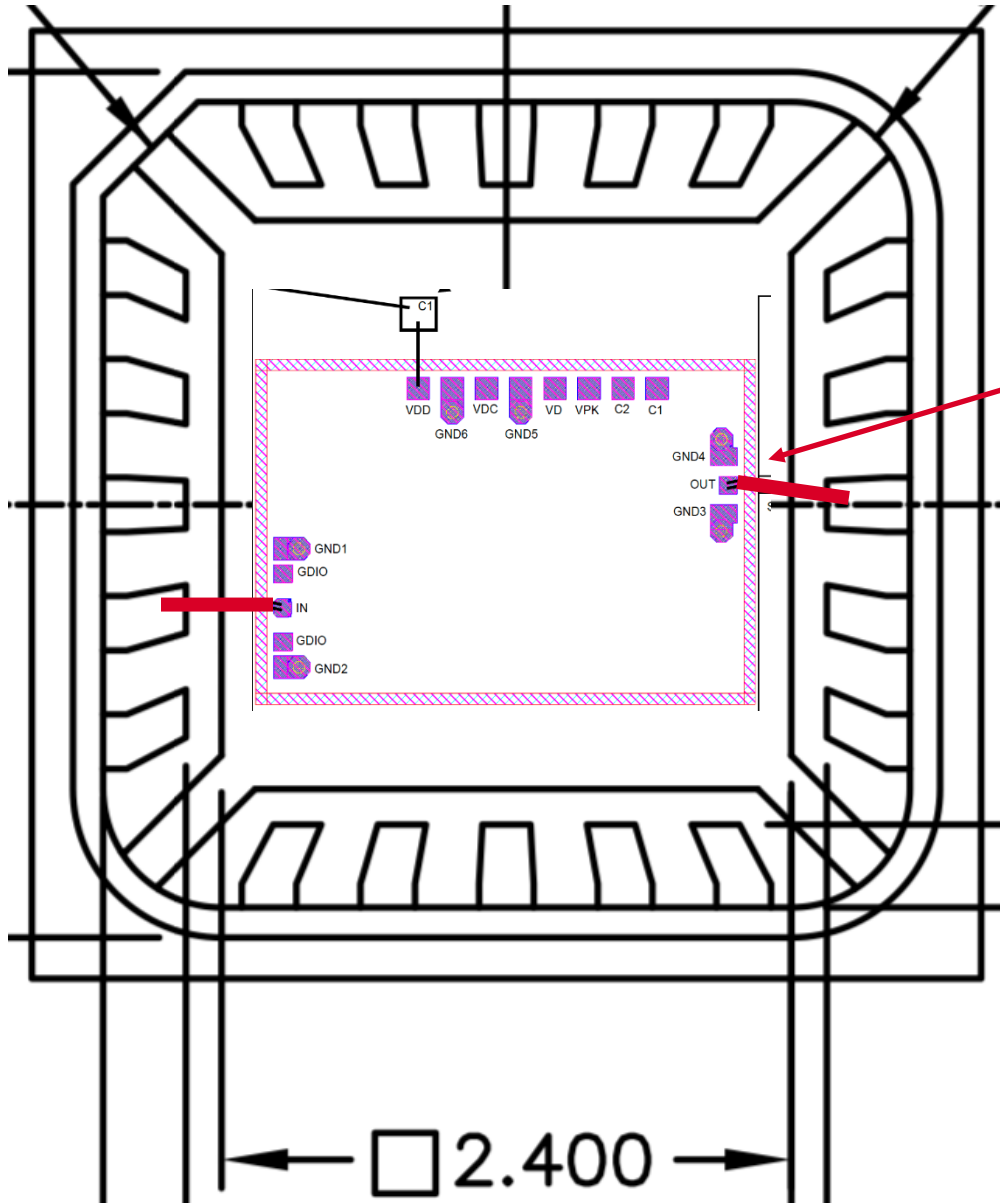


Figure 2: CGY2144UH/C2 module layout : other applications cases

DIE IN 4MM AIR CAVITY QFN PACKAGE



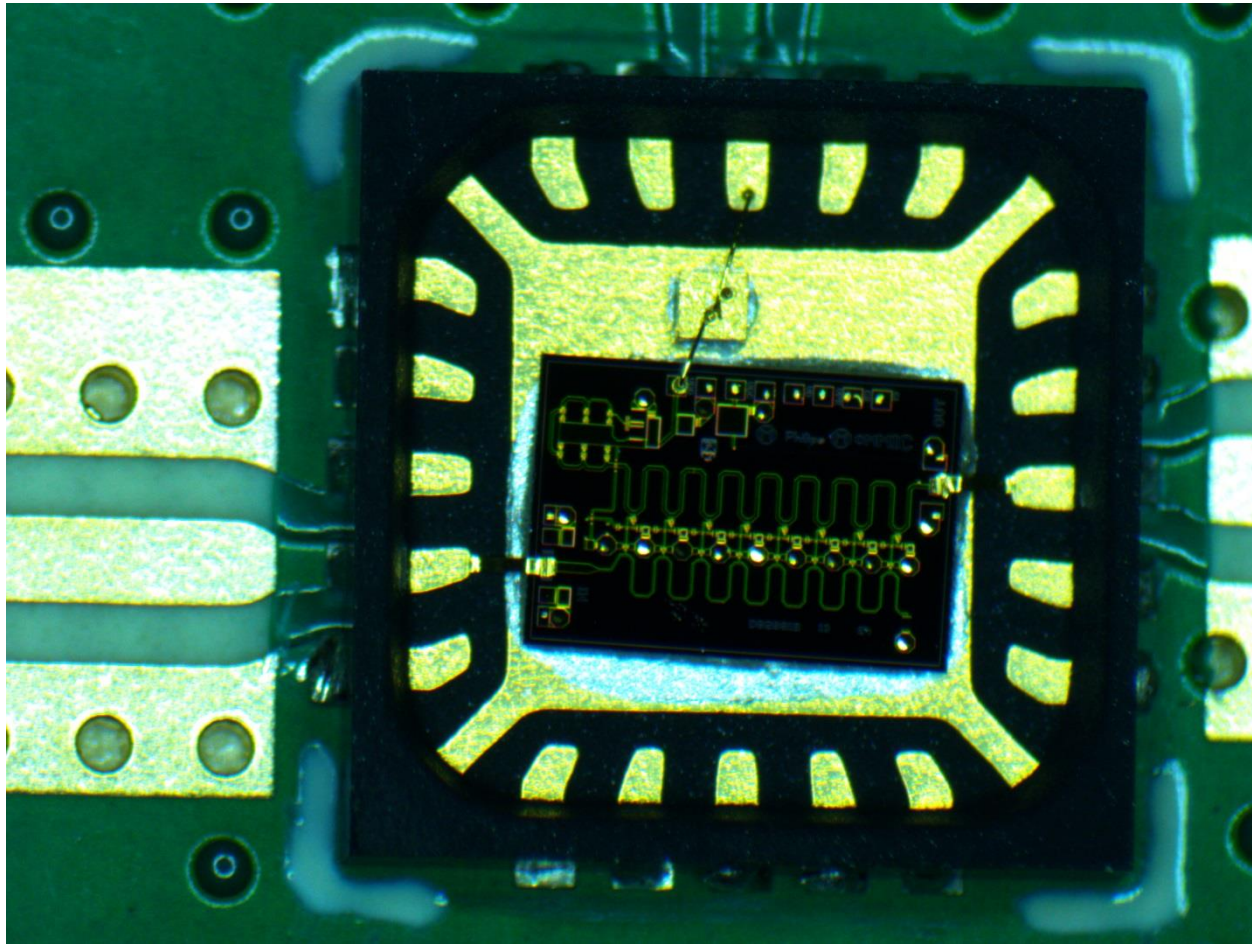
**SHORT CONNECTION
RIBBON BOND
~10 MILS LONG**

← 2.400 →

OMMIC CGY2144 Amplifier Die mounted in 4mm package with 3 mil wide -0.5 mil thick Ribbon bonds

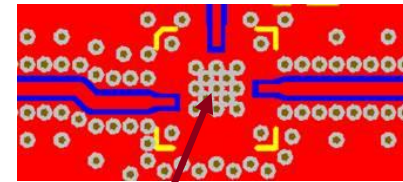
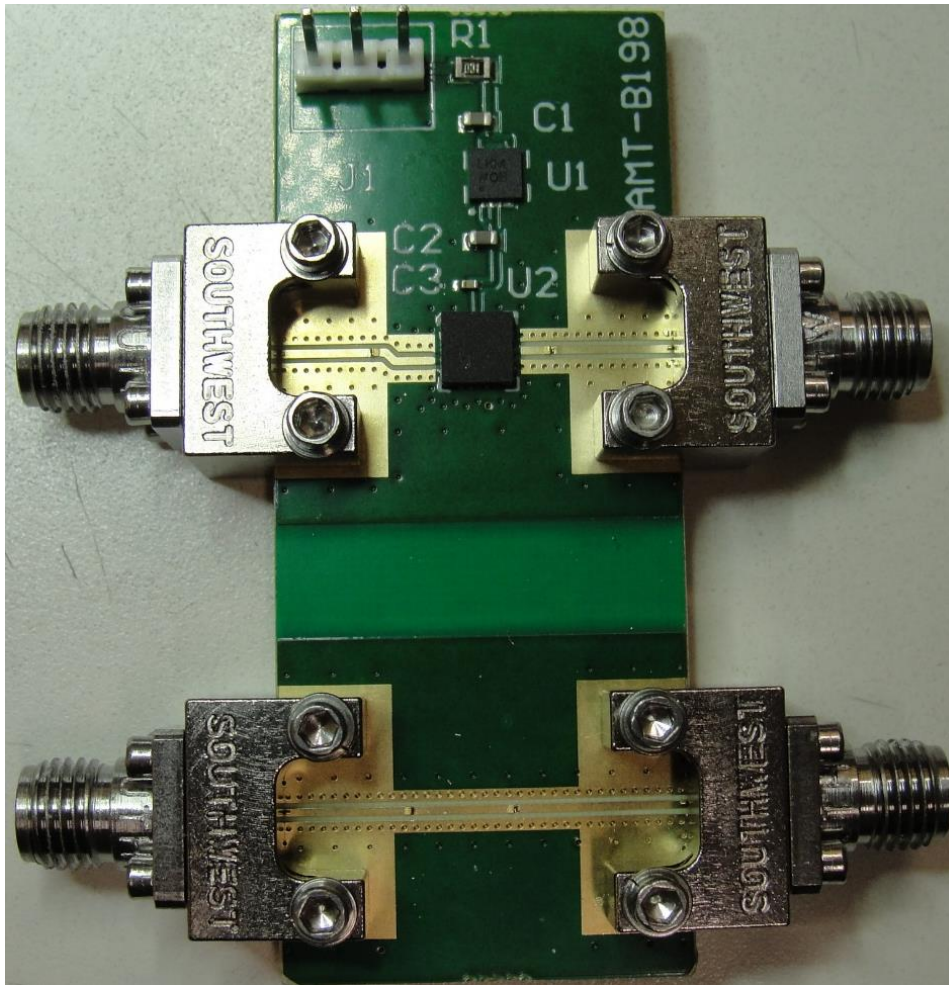


OMMIC CGY2144 Amplifier Die mounted in 4mm package with 3 mil Ribbon bonds

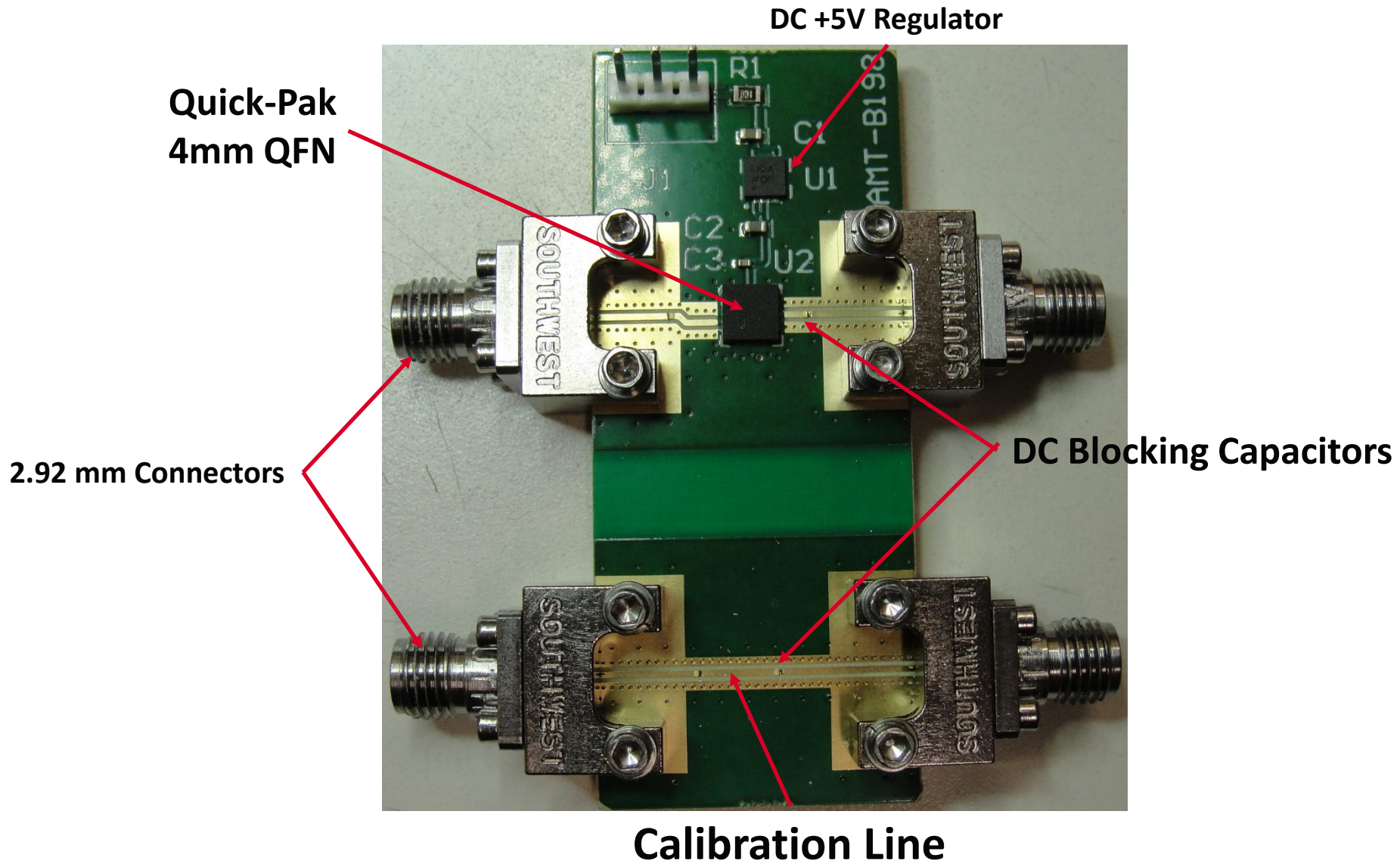


Quick-Pak 4mm QFN Package Performance

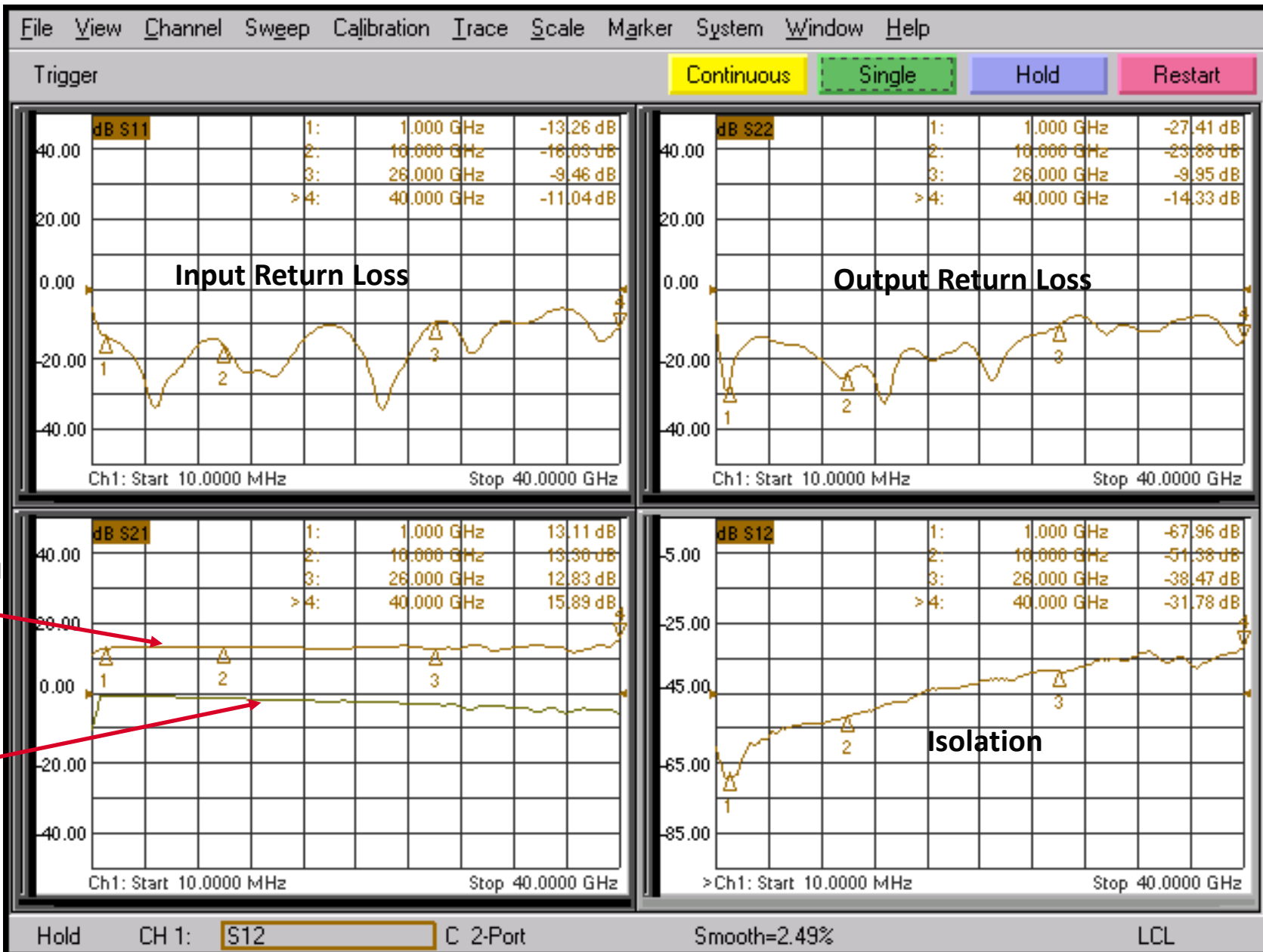
4 mm Package mounted on a Rogers Test board



Grounding Via pattern
For 40 GHz performance



TEST DATA Measured On Agilent PNA E8363B 10 MHz to 40 GHz



1. <https://www.qualcomm.com/invention/5g/what-is-5g>
2. <https://www.mpdigest.com/2020/02/20/advancements-in-high-frequency-plastic-air-cavity-packaging/>
3. https://www.icproto.com/pdf/QFN_pdf/QP-QFN4X4-20-500%20PACKAGE.pdf