Sales: 408-778-9952 | General: 408-778-4200 | Fax: 408-778-4300
Sales & Customer Support: sales@markimicrowave.com
Tech Support: support@markimicrowave.com

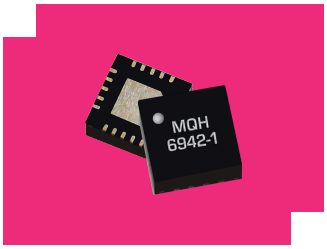
MQS-0218SM

MMIC 2-18GHz 90° Splitter / Combiner

DEVICE OVERVIEW

General Description

The MQS-0218SM is a MMIC 2GHz – 18GHz 90° splitter/combiner. Passive GaAs MMIC technology allows production of smaller constructions that replace larger form factor circuit board constructions. Tight fabrication tolerances allow for less unit to unit variation than traditional splitter/combiner technologies. The MQS-0218SM is available as a 4 x 4 mm QFN package. Evaluation boards are also available. Low variation allows for accurate simulations using the provided S3P file taken from measured production units. The MQS-0218SM is not recommended for applications involving reflected signals.



Download s-parameters here

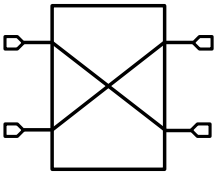
Features

- Designed for S to Ku-band applications
- High amplitude and phase balance
- High isolation
- Low insertion loss
- On-chip 50Ω load termination

Applications

- Single Sideband Upconverters
- Image Rejection Downconverters
- IQ Modulators
- Balanced Amplifiers
- Microwave Correlators

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MQS-0218SM	MMIC 2-18GHz 90° Splitter / Combiner	QFN	REACH RoHS	Released	EAR99
EVAL-MQS-0218	Evaluation Board, MMIC 2-18GHz 90° Splitter / Combiner	EVAL	REACH RoHS	Released	EAR99

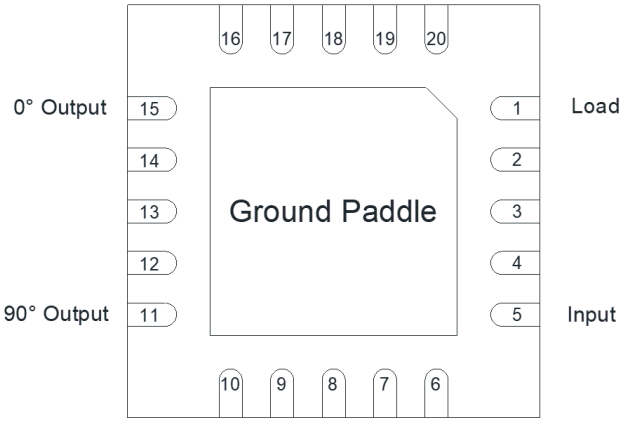
Table Of Contents

Revision History

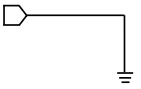
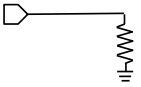
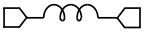
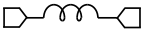
Revision Code	Revision Date	Comment
-	2020-06-01	Initial Datasheet Release

Port Configuration and Functions

Port Diagram



Port Functions

Port	Function	Description	Equivalent Circuit for Package
Pad	Ground	SM package ground path is provided through the ground paddle.	
Pin 11	90° Output	Pin 11 is DC connected to a 50 Ω load.	
Pin 15	0° Output	Pin 15 is DC short to pin 5 and open to ground.	
Pin 5	Input	Pin 5 is DC short to pin 15 and open to ground.	

Specifications

Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Unit
Maximum Operating Temperature	100	°C
Maximum Storage Temperature	-65	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-55	°C
RF Power Handling	10	W

Package Information

Parameter	Details	Rating
Dimensions	-	4 x 4 mm
Moisture Sensitivity Level	-	MSL 1

Electrical Specifications

The electrical specifications apply at TA=+25°C in a 50Ω system. Min and Max limits are guaranteed at TA=+25°c. All measured data is taken from the eval board without de-embedding of the connectors and traces.

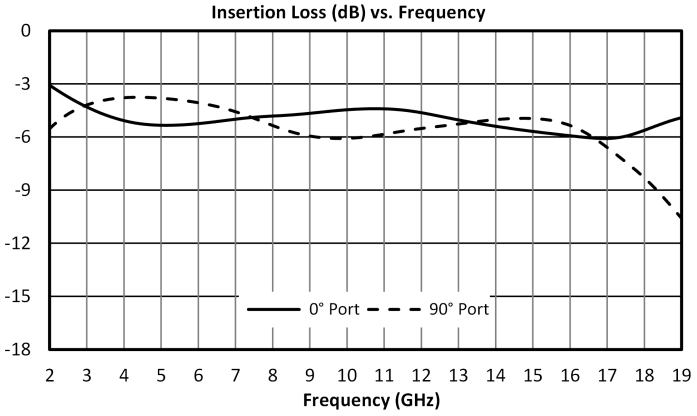
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Amplitude Balance	-	2	18	-	1	5	dB
Excess Through Line Insertion Loss [1]	-	2	18	-	4	-	dB
Impedance	-	2	18	-	50	-	Ω
Isolation	-	2	18	10	15	-	dB
Mean Coupling	-	2	18	-	3	-	dB
Nominal Phase Shift	-	2	18	-	90	-	°
Phase Balance	-	17	18	-	6	-	°
Phase Balance	-	2	17	-	3	12	°
VSWR	-	2	18	-	1.25	-	

[1] Excess Insertion Loss = (Input Port to Common Port Insertion Loss) – 3 dB.

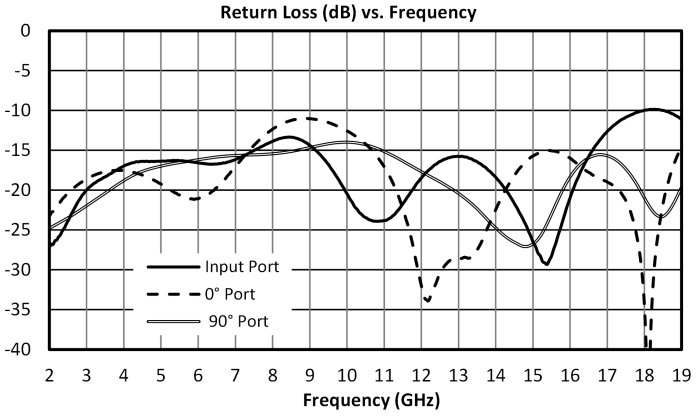
Typical Performance Plots

All measured data is de-embedded using AFR.

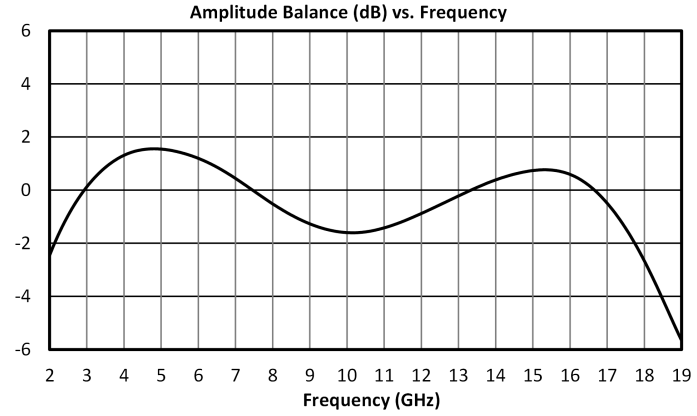
Insertion Loss (dB) vs. Frequency



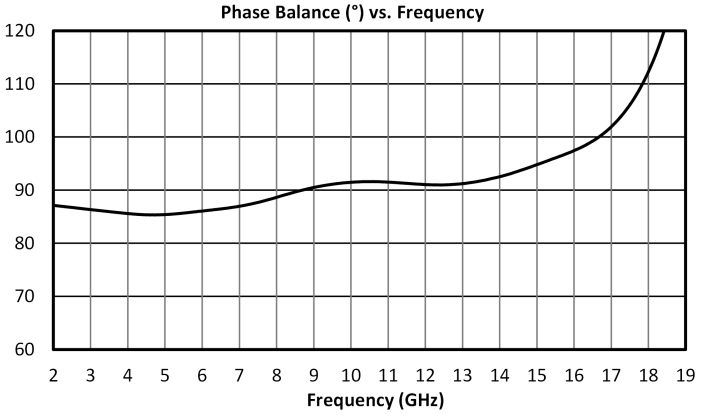
Return Loss (dB) vs. Frequency



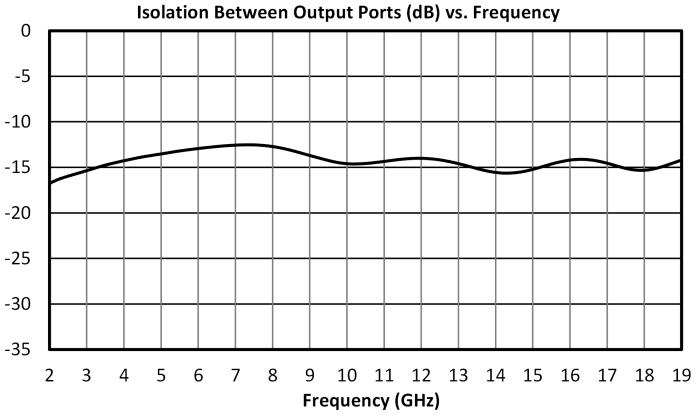
Amplitude Balance (dB) vs. Frequency



Phase Balance (°) vs. Frequency

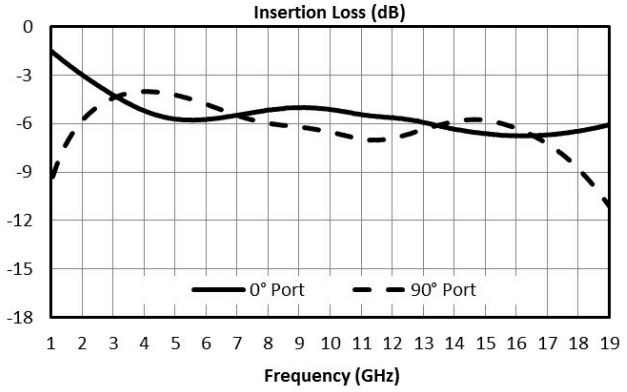


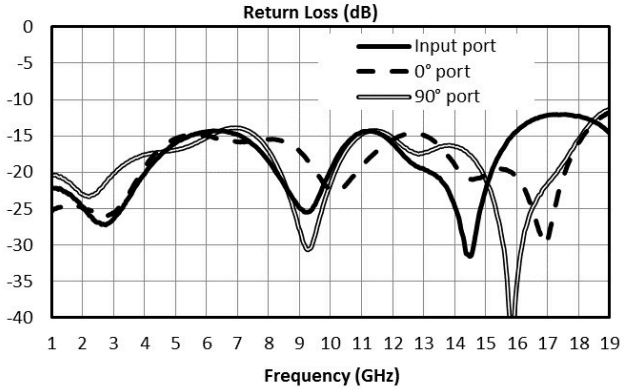
Isolation Between Output Ports (dB) vs. Frequency

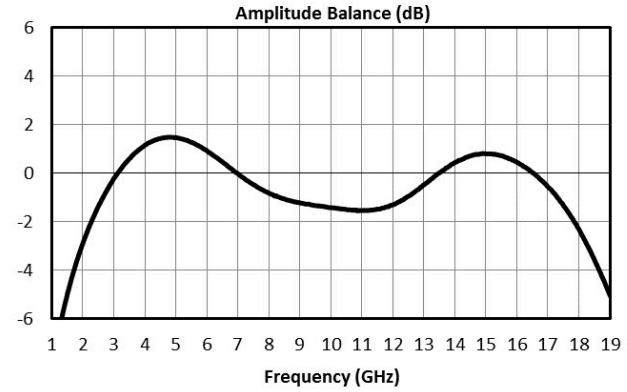


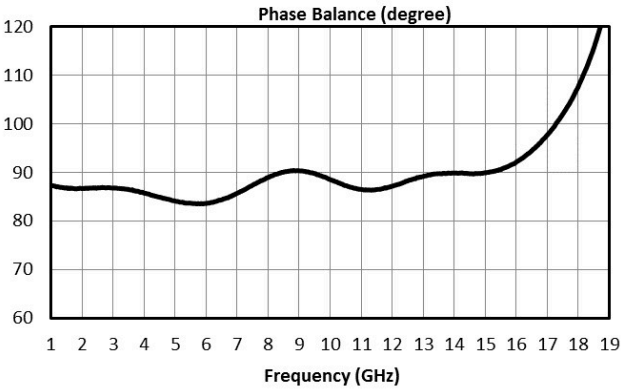
Evaluation Board Typical Performance Plots

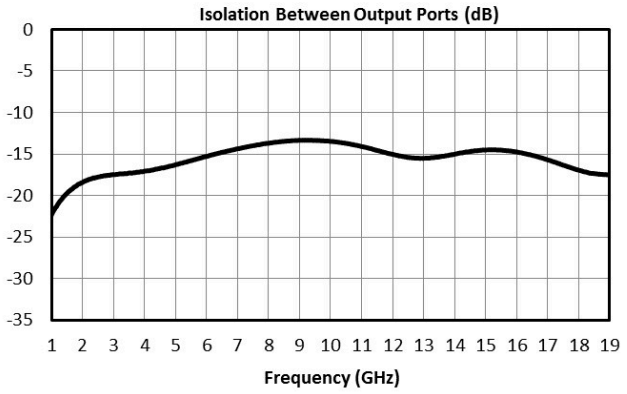
All measured data is taken from the eval board without de-embedding of the connectors and traces.All measurements taken in a 50Ω environment. On-chip load was used when taking measurements.











Application Information

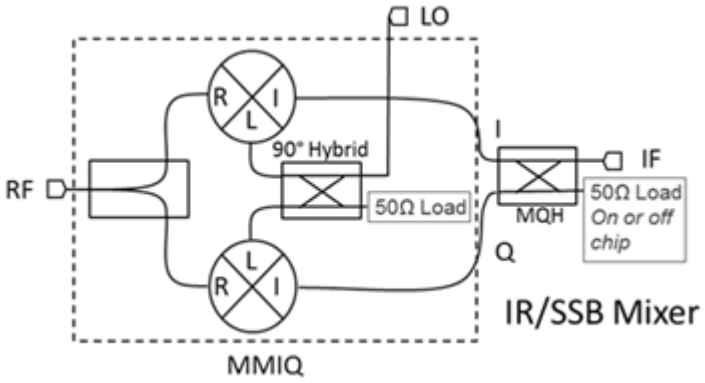
Quadrature signal generation is useful for many applications in analog signal processing. Marki MQH (MMIC quadrature hybrids) and MQS (MMIC 90˚ Splitter/Combiners) offer this functionality in a small form factor with high repeatability. Below are applications and how they can be realized with the MQH and MQS product lines.

Quadrature Hybrids vs 90˚ Splitter/Combiners

Some products are 'true' quadrature hybrids, while others are 90˚ Splitter/Combiners. A quadrature hybrid is symmetric about all four ports, meaning that in a splitting application any port can be used as an input, with the isolated and output ports following from this selection. Likewise, for a combining application, any port can be used as an output.

A 90˚ Splitter/Combiner is not symmetric. When splitting, only ports 1 and 2 can be used as an input. If ports 3 or 4 were used, there would be significant phase walk-off between the output ports. As a combiner, only ports 1 and 2 are suitable as output ports. The phase walk-off introduced when using ports 3 or 4 as an output means that reflected signals recombine and cancel poorly inside a 90° Splitter/Combiner.

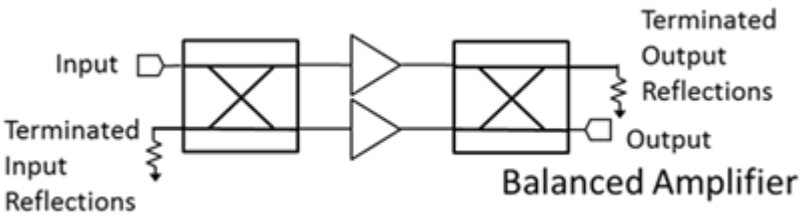
Single Sideband and Image Reject Mixers



The primary application for the MQH and MQS series is as IF or LO quadrature signal splitter/combiners. They can be used in combination with the MMIQ series of IQ mixers to create broadband single sideband and image reject mixers. Either 90˚ Splitter/Combiners or quadrature hybrids can be used as the IF hybrid, but if a 90˚ Splitter/Combiner is used only one sideband (or image) is accessible, whereas if a quadrature hybrid is used than both sidebands are accessible.

Ifa 90˚ Splitter/Combiner is used for a single sideband upconverter or image reject mixer, port 1 should be used as the IF input/output and ports 2 and 3 should be connected to the I and Q ports.

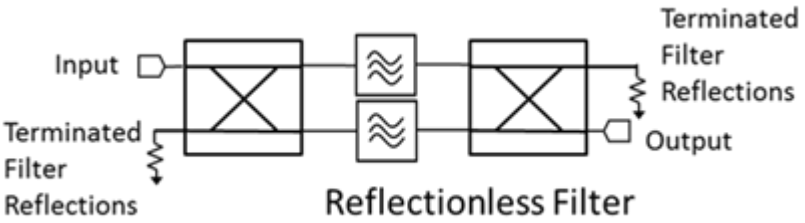
Balanced Amplifiers



In a balanced amplifier, the poor return loss of an amplifier is compensated for with a quadrature hybrid. In this application, the reflections from the input or output are collected at the isolated port of the quadrature hybrid and terminated.

Since a 90˚ Splitter/Combiner is not completely symmetric, reflected signals will not terminate as well as with a quadrature hybrid. An MQH option is recommended for this application. If a 90˚ Splitter/Combiner is used for a single sideband upconverter or image reject mixer, port 1 should be used as the IF input/output and ports 2 and 3 should be connected to the I and Q ports. Testing/simulation is recommended when considering if a 90° Splitter/Combiner is suitable.

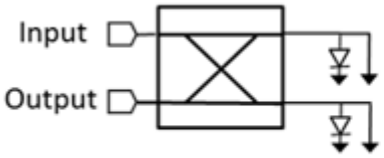
Reflectionless Filter



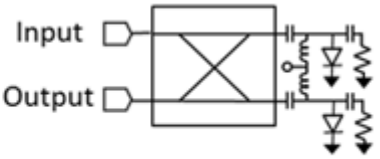
Similar to a balanced amplifier, a reflectionless filter will terminate reflections that are out of band for a filter (but in band for the quadrature hybrid) at the isolated port.

Since a 90˚ Splitter/Combiner is not completely symmetric, reflected signals will not terminate as well as with a quadrature hybrid. An MQH option is recommended for this application. If a 90˚ Splitter/Combiner is used for a single sideband upconverter or image reject mixer, port 1 should be used as the IF input/output and ports 2 and 3 should be connected to the I and Q ports. Testing/simulation is recommended when considering if a 90° Splitter/Combiner is suitable

Reflective Applications



Reflective Phase Shifter



Reflective Attenuator

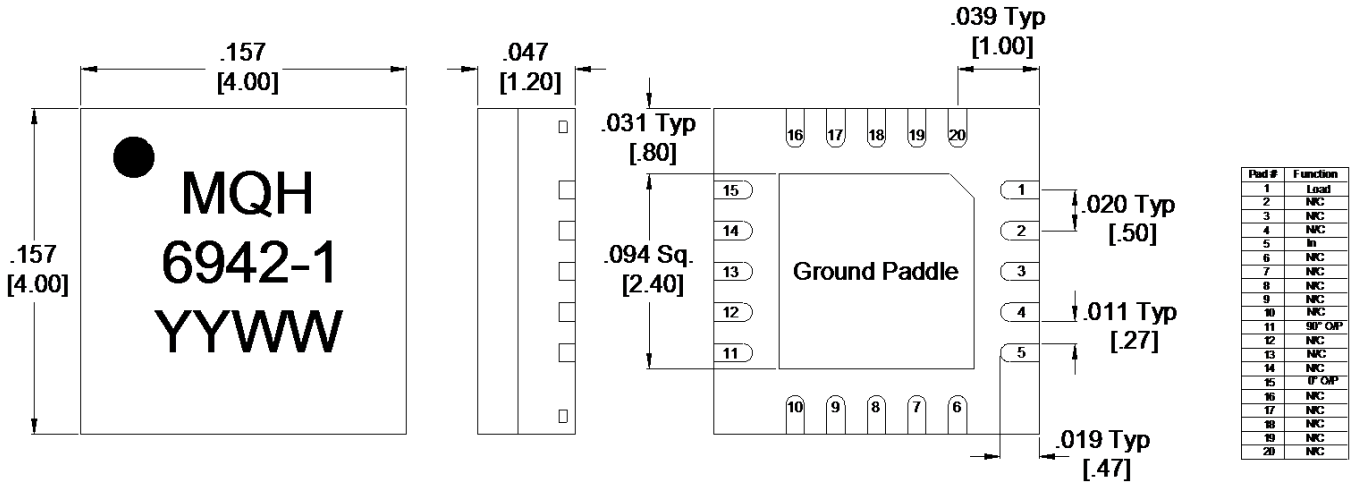
Unlike in the previous applications, reflective applications only work well with a quadrature hybrid (not a 90˚ Splitter/Combiner). In these applications a signal is reflected off of two identical structures (typically a PIN diode) and the output signal is collected at the isolated port. In this case the desired signal is deliberately reflected.

Since a 90˚ Splitter/Combiner is not completely symmetric, you will have poor results if you use these for reflective applications.

Mechanical Data

Outline Drawing

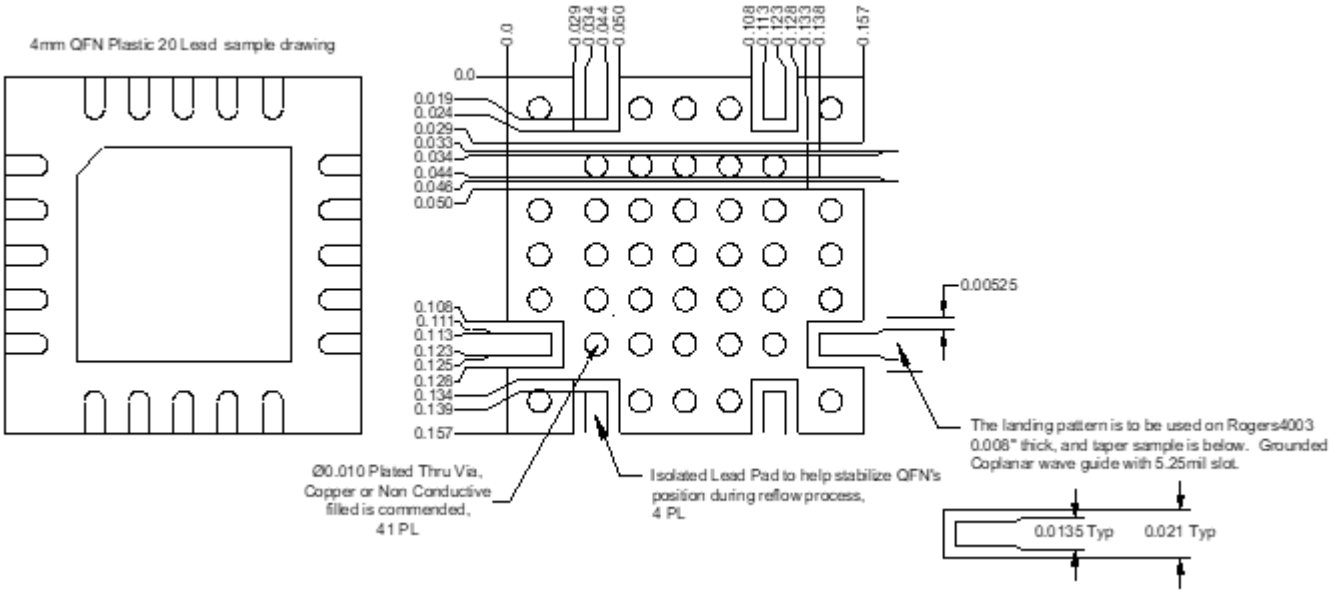
Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP



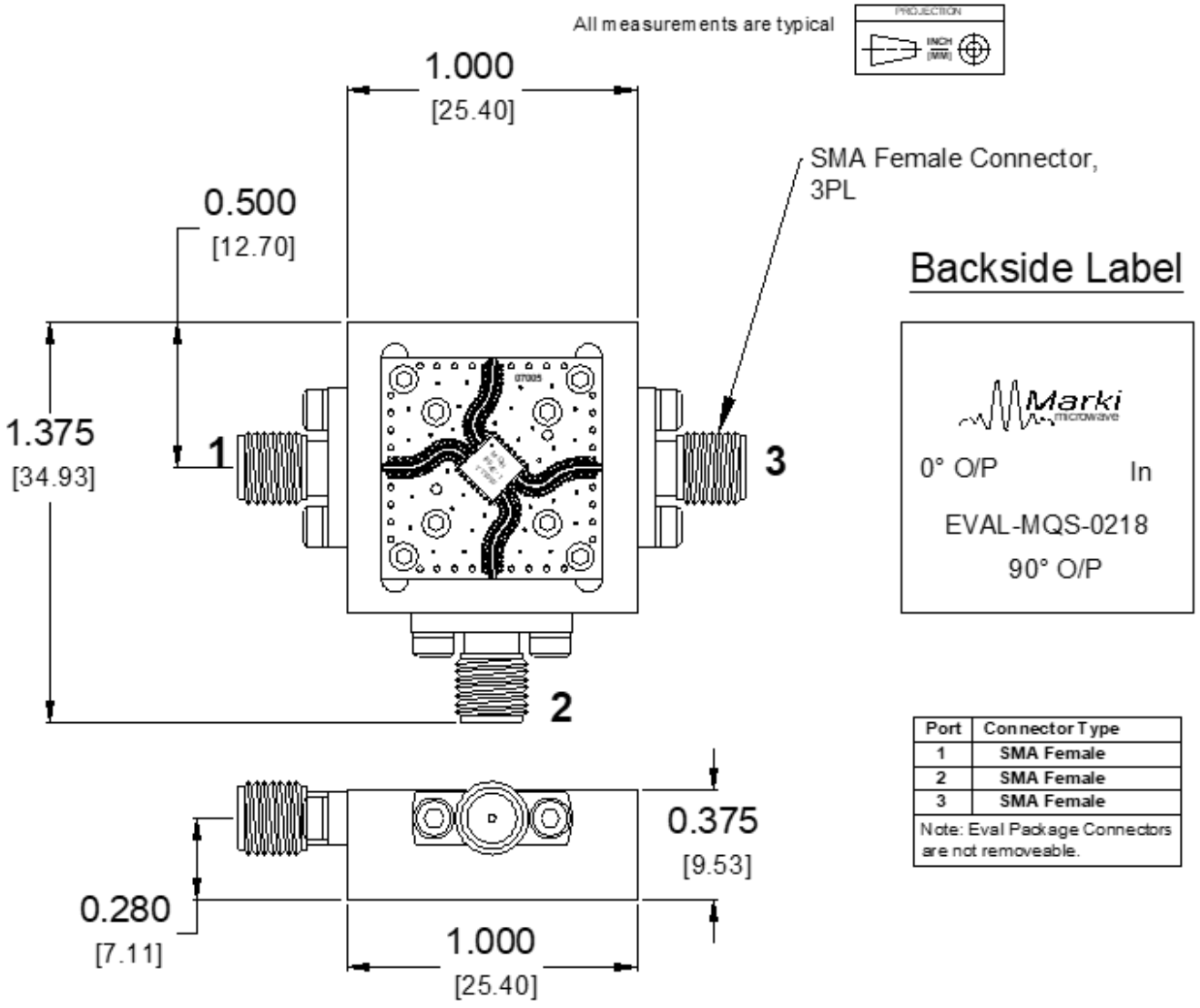
Pad #	Function
1	Load
2	NIC
3	NIC
4	NIC
5	In
6	NIC
7	NIC
8	NIC
9	NIC
10	NIC
11	90° O/P
12	NIC
13	NIC
14	NIC
15	0° O/P
16	NIC
17	NIC
18	NIC
19	NIC
20	NIC

Footprint Image

Download : Footprint Drawing



Evaluation Board - Outline Drawing



Backside Label

Port	Connector Type
1	SMA Female
2	SMA Female
3	SMA Female
Note: Eval Package Connectors are not removeable.	

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