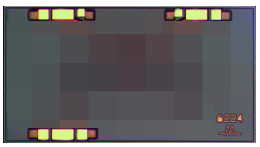
MMIC 14-40GHz Isolation Balun **MBAL-1440**

1 Device Overview



Bare Die

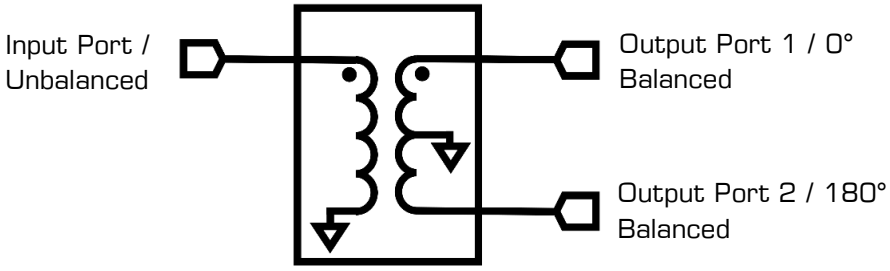
1.1 General Description

The MBAL-1440 is a MMIC isolation balun. 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 balun technologies. The MBAL-1440 is available as a wire bondable chip. Low unit to unit variation allow for accurate simulations using the provided S3P file taken from measured production units. Applications include high-speed track-and-hold amplifiers, digital-to-analog converters, balanced amplifiers, and signal integrity.

1.2 Features

- 14GHz to 40GHz Balun (Balanced to Unbalanced Transformer)
- High Isolation
- High CMRR
- Low Excess Insertion Loss
- S3P data MBAL-1440.zip

1.3 Functional Block Diagram



1.4 Part Ordering Options[1]

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MBAL-1440CH	Wire bondable die	CH	RoHS	Active	EAR99

[1] Refer to our website for a list of definitions for terminology presented in this table.

Table of Contents

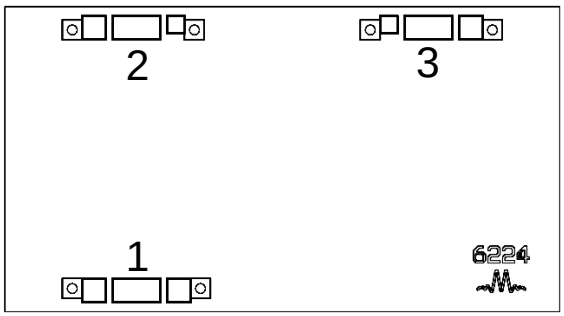
Revision History

Revision Code	Revision Date	Comment
-	May 2018	Datasheet Initial Release
A	July 2020	Specs table update

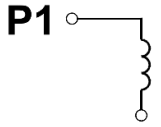
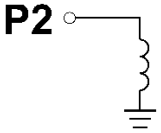
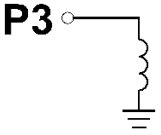
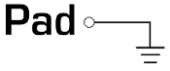
2 Port Configurations and Functions

2.1 Port Diagram

A top-down view of the MQH-1440CH package outline drawing is shown below. The MMIC baluns are passive reciprocal devices allowing either single ended to differential or differential to single ended conversion.



2.2 Port Functions

Port	Function	Description	Equivalent Circuit
Port 1	Common Port / In (Unbalanced)	The common port is DC open to ground.	
Port 2	Out 1 / 0° Port (Balanced)	The 0° port is DC short to ground.	
Port 3	Out 2 / 180° Port (Balanced)	The 180° port is DC short to ground.	
Pad	Ground	CH package ground path is provided through the substrate and ground bond pads.	

3 Specifications

3.1 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	Units
Common Port DC Current	N/A (open)	mA
Differential Port 1 DC Current	TBD	mA
Differential Port 2 DC Current	TBD	mA
Power Handling, at any Port	TBD	dBm
Operating Temperature	-55 to +100	°C
Storage Temperature	-65 to +125	°C

3.2 Package Information

Parameter	Details	Rating
ESD	Human Body Model (HBM), per MIL-STD-750, Method 1020	N/A

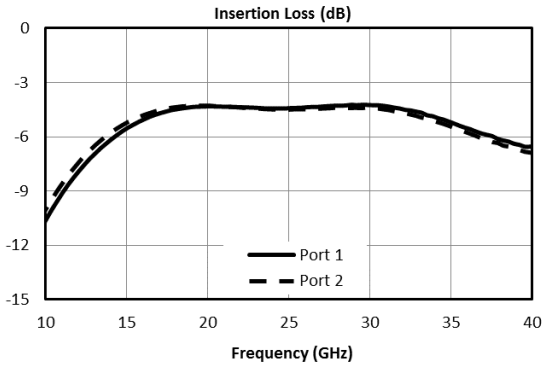
3.3 Electrical Specifications

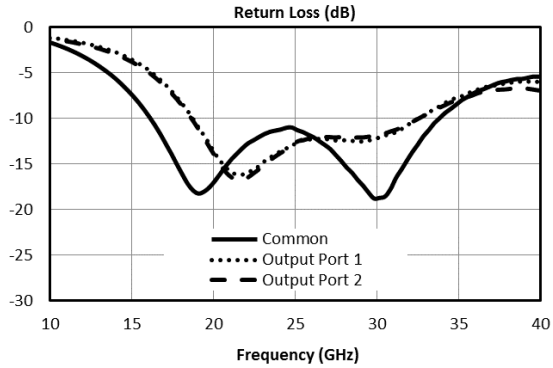
The electrical specifications apply at T_A=+25°C in a 50Ω system.

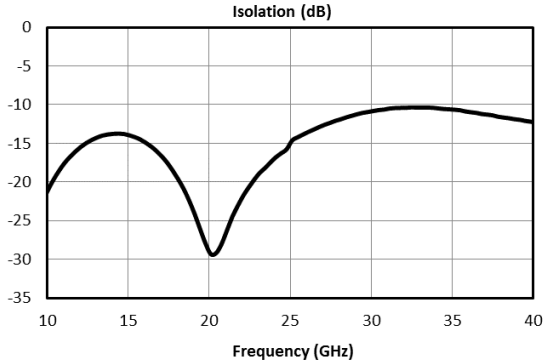
Min and Max limits are guaranteed at T_A=+25°C. All bare die are 100% DC tested and visually inspected.

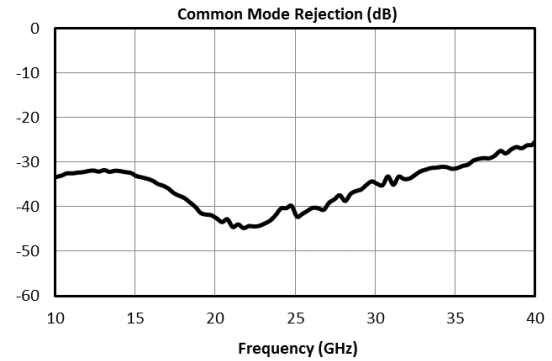
Parameter	Frequency (GHz)	Min	Typ.	Max	Units
Insertion Loss as a mode converter	14-40		3	5.65	dB
Nominal Phase Shift			180		Degrees
Amplitude Balance			0.2	0.8	dB
Phase Balance			1.1	8.5	Degrees
Excess Insertion Loss			1.5	5.0	dB
Common Mode Rejection		19	35		dB
Isolation		7.5	13		dB
VSWR			1.8		
Impedance			**50**		Ω

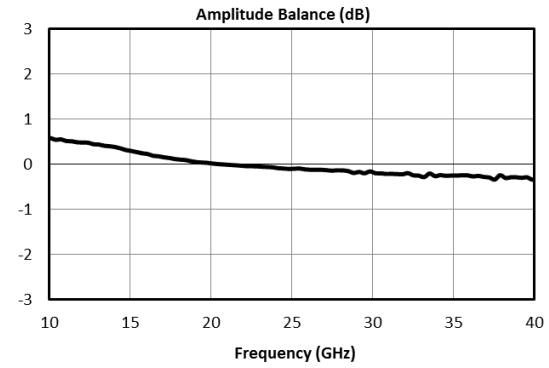
3.4 Typical Performance Plots

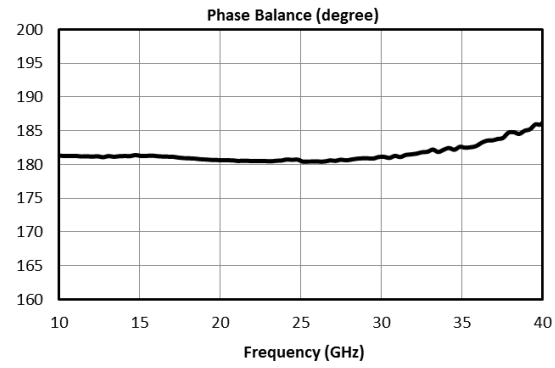


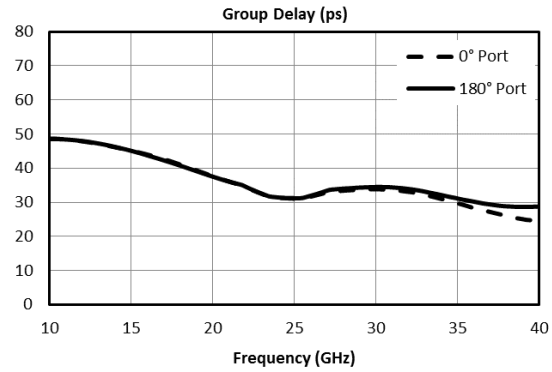


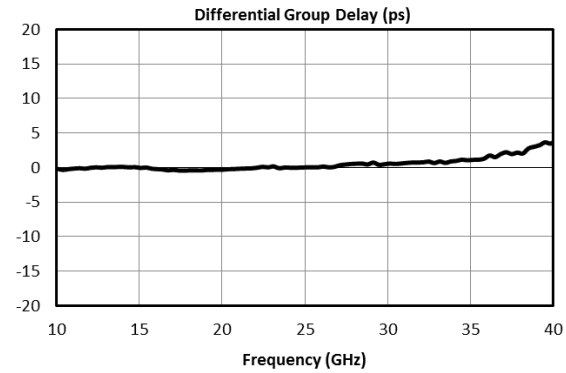












4 Die Mounting Recommendations

4.1 Mounting and Bonding Recommendations

Marki MMICs should be attached directly to a ground plane with conductive epoxy. The ground plane electrical impedance should be as low as practically possible. This will prevent resonances and permit the best possible electrical performance. Datasheet performance is only guaranteed in an environment with a low electrical impedance ground.

Mounting - To epoxy the chip, apply a minimum amount of conductive epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip. Cure epoxy according to manufacturer instructions.

Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31 mm (12 mils).

Circuit Considerations – 50 Ω transmission lines should be used for all high frequency connections in and out of the chip. Wirebonds should be kept as short as possible, with multiple wirebonds recommended for higher frequency connections to reduce parasitic inductance. In circumstances where the chip more than .001" thinner than the substrate, a heat spreading spacer tab is optional to further reduce bondwire length and parasitic inductance.

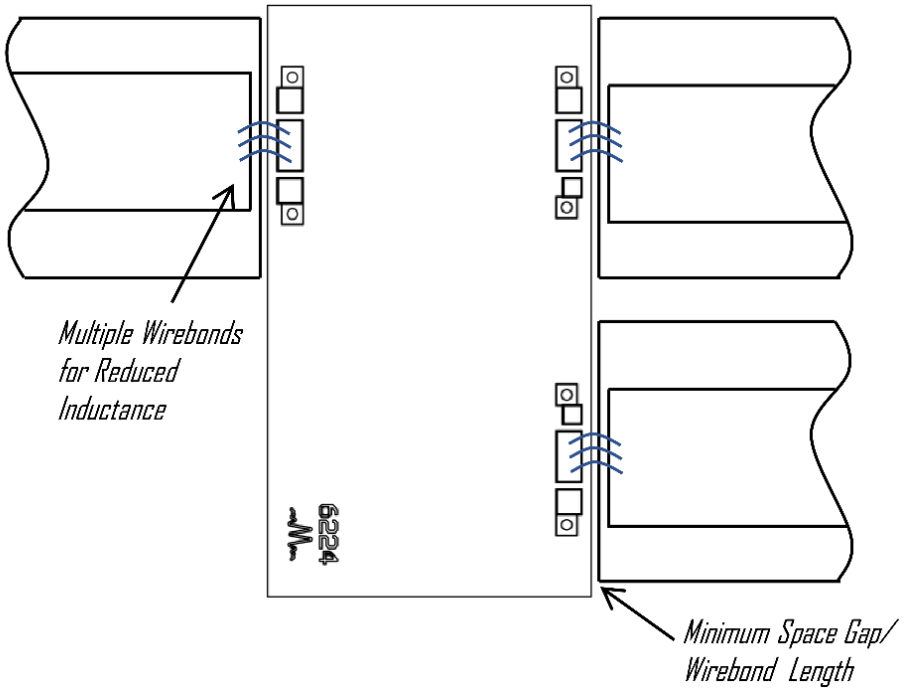
4.2 Handling Precautions

General Handling

Chips should be handled with care using tweezers or a vacuum collet. Users should take precautions to protect chips from direct human contact that can deposit contaminants, like perspiration and skin oils on any of the chip's surfaces.

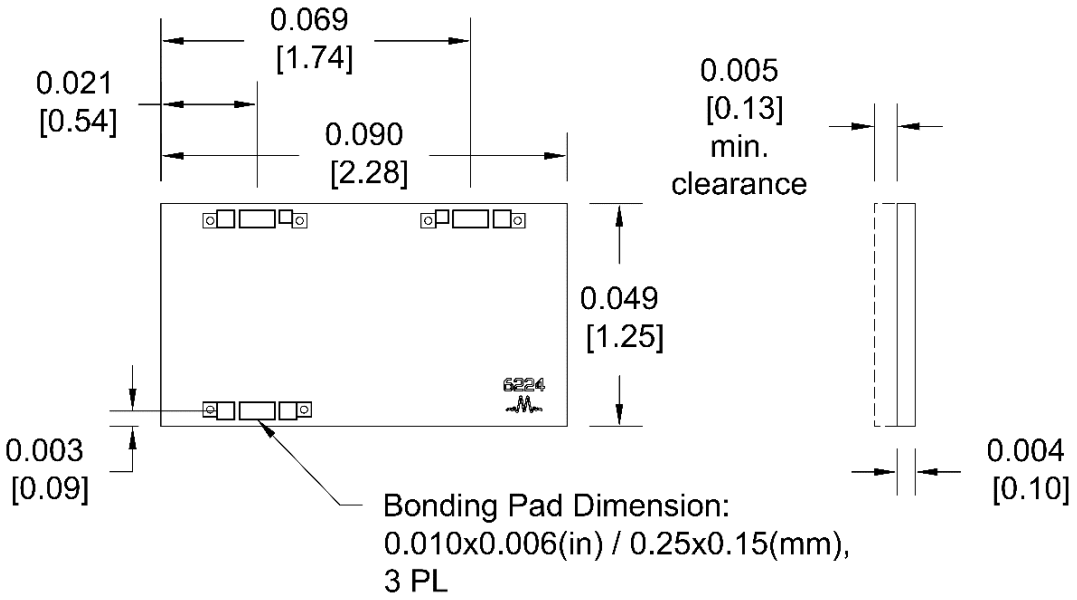
Cleaning and Storage: Do not attempt to clean the chip with a liquid cleaning system or expose the bare chips to liquid. Once the ESD sensitive bags the chips are stored in are opened, chips should be stored in a dry nitrogen atmosphere.

4.3 Bonding Diagram



5 Mechanical Data

5.1 CH Package Outline Drawing



1. CH Substrate material is 0.004 in thick GaAs.
2. I/O trace finish is 5 microns Au. Ground plane finish is 4 microns Au.