Passive MMIC 2-20 GHz Surface Mount Balun

MBAL-0220SM

The MBAL-0220SM is a GaAs passive MMIC balun in a 4mm QFN surface mount package. Its frequency ranges from 2 to 20 GHz and offers a 1:2 impedance ratio. The 4mm QFN package is a lead free, RoHS compliant package compatible with standard leaded and lead-free solder reflows. Connectorized evaluation packages are available. The MBAL-0220SM is an excellent choice for balanced amplifiers, clock distribution, and higher order Nyquist sampling in analog to digital converters.

QFN

Features

- 2 GHz to 20 GHz 1:2 Balun (Balanced to Unbalanced Transformer)
- Tuned for Optimal Phase/Amplitude Balance
- Applications: Analog to Digital Converters, Balanced Receivers, Baseband Digital Modulation, Signal Integrity, push-pull amplifiers.
- RoHS Compliant
- MBAL-0220SM.S3P

Electrical Specifications[1] - Specifications guaranteed for +25°C, measured in a 50Ω system.

Parameter	Frequency Range	Min	Typ	Max
Insertion Loss as a mode converter (dB)[2]	2 GHz to 20 GHz		6	8.5
Nominal Phase Shift (Degrees)			180	
Amplitude Balance (dB) [3]			0.25	1
Phase Balance (Degrees)[3]			3	10
Common Mode Rejection (dB)		22	30	
Isolation (dB)			10	
Output VSWR			2	
Common Port VSWR			1.4	

[1] Measured data was taken on an Eval Board with output traces having an offset. Refer to page 3 of this document on Layout guidelines
[2] Includes fixture losses.
[3] Guaranteed only for eval board.

Part Number Options

Model Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MBAL-0220SM[1]	2 GHz to 20 GHz MMIC Balun, Surface Mount	SM	RoHS	Active	EAR99
EVAL-MBAL-0220[2]	Connectorized Evaluation Module	Eval		Active	EAR99

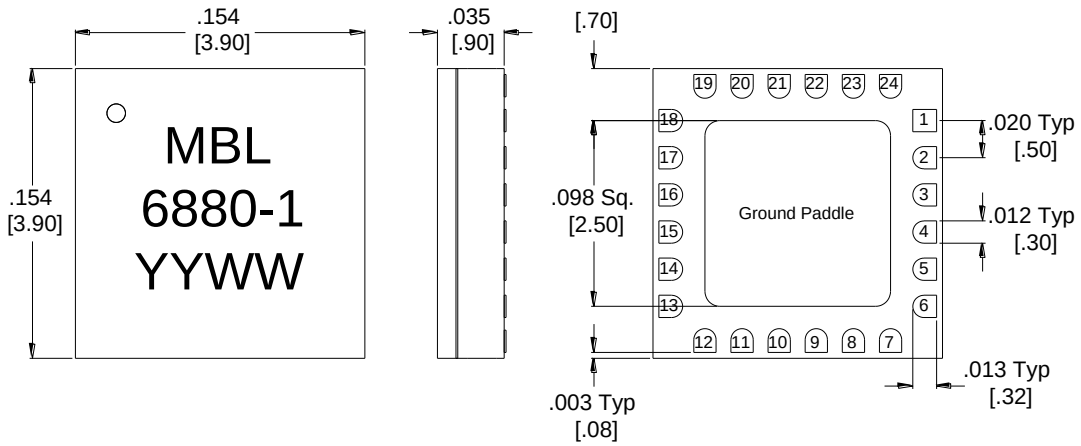
[1] Note: For port locations and I/O designations, refer to the drawings on page 2 of this document.
[2] Note: Eval board is built with an offset on output traces

Revision History

Revision code	Revision Date	Comment
D	07/2020	Specs table update

Passive MMIC 2-20 GHz Surface Mount Balun MBAL-0220SM

Outline Drawing



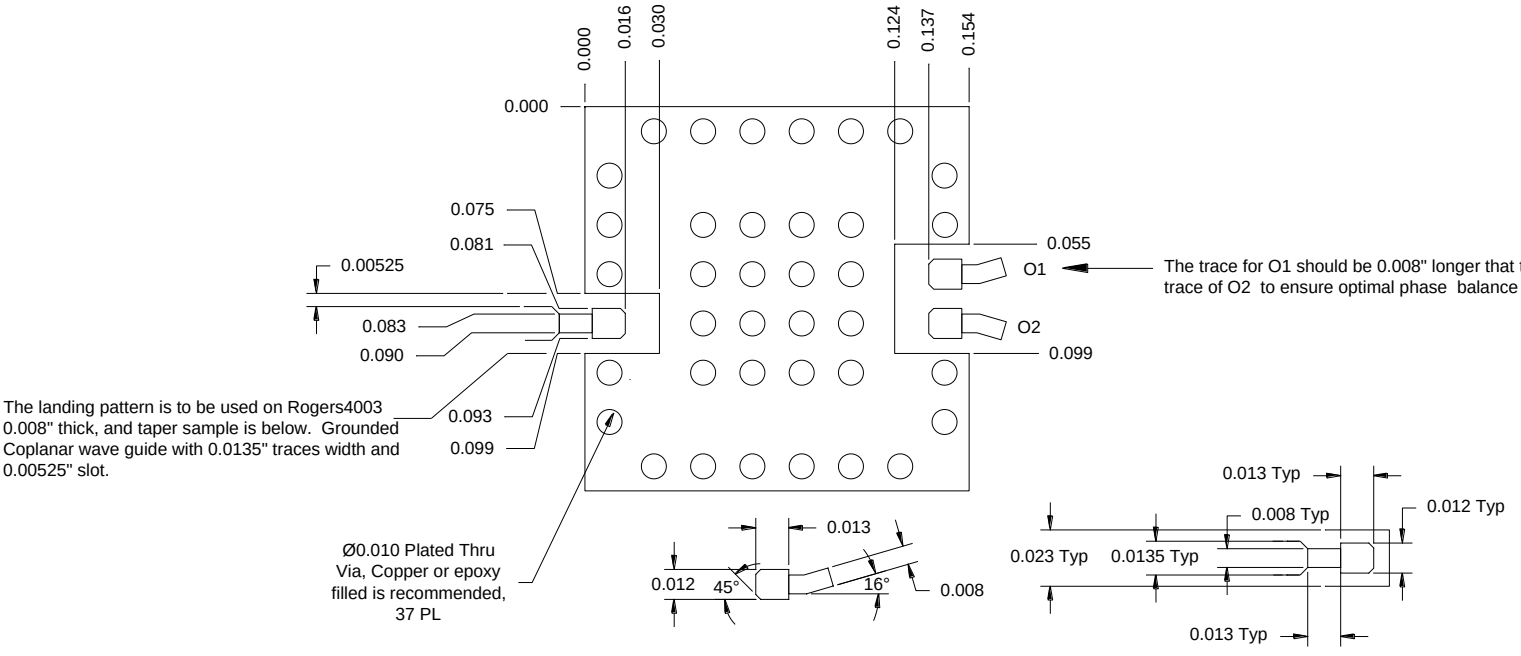
Pad #	Function
1	N/C
2	N/C
3	N/C
4	Common
5	N/C
6	N/C
7	N/C
8	N/C
9	N/C
10	N/C
11	N/C
12	N/C
13	N/C
14	N/C
15	Output 2
16	Output 1
17	N/C
18	N/C
19	N/C
20	N/C
21	N/C
22	N/C
23	N/C
24	N/C

1. Substrate material
2. I/O Leads and Ground Paddle plating is (from base to finish):

Ni:	8.89um	MAX	1.27um MIN
Pd:	0.17um	MAX	0.07um MIN
Au:	0.254um	MAX	0.03um MIN

All unconnected pads should be connected to PCB RF ground.

PCB Footprint Drawing



QFN-Package Surface-Mount Landing Pattern

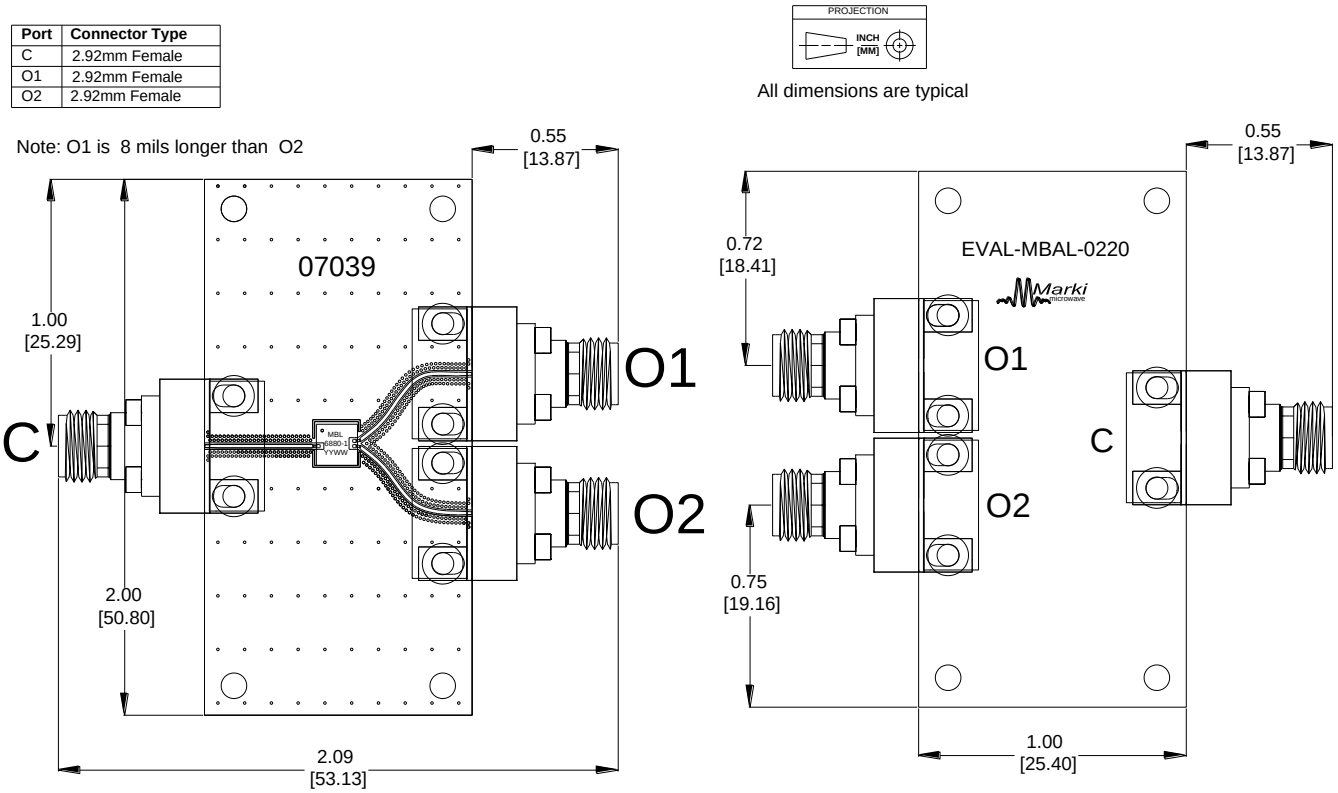
Click here for a DXF of the above layout.

Click here for leaded solder reflow. Click here for lead-free solder reflow.

Layout/Routing Guidelines and EVAL Package Outline Drawing

In order to ensure an optimal phase balance an 0.008” offset is required between output traces of the Eval board. The overall length of the trace O1 should be 0.008” longer than the trace of O2 on a dielectric of 3.38.

Port	Connector Type
C	2.92mm Female
O1	2.92mm Female
O2	2.92mm Female



Mixed Mode Scattering Parameters[5]

Mixed mode scattering parameters are used to characterize differential circuits. For baluns, this means that the 0° and 180° ports become a single 100Ω differential port and the common port remains the same 50Ω common port. The two-port s-parameters of the balun are then characterized based on differential (d), common mode (c), or single-ended (s) signals. For example: Scs12 is the Common output response given a single ended input.

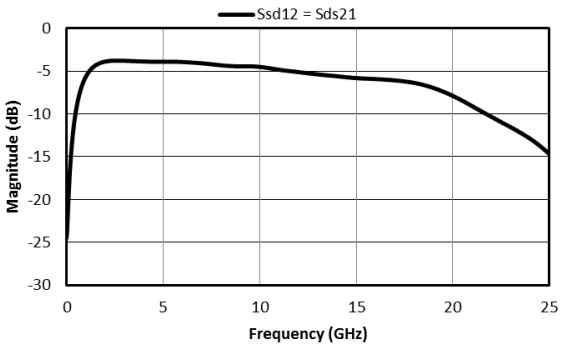


Fig. 1. Insertion loss as a mode converter

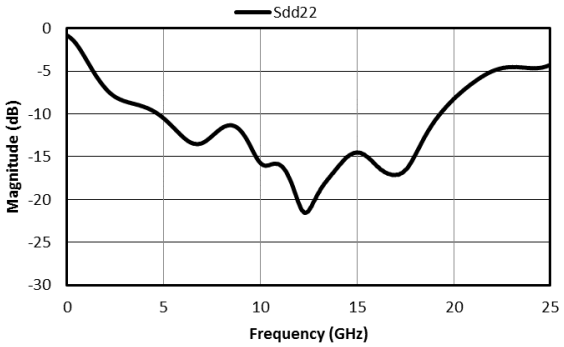


Fig. 2. Differential port return loss

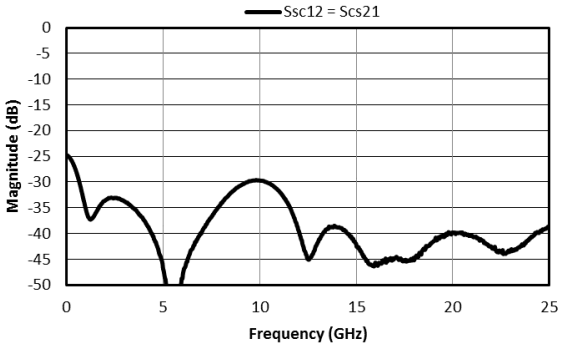


Fig. 3. Insertion loss of a common mode signal

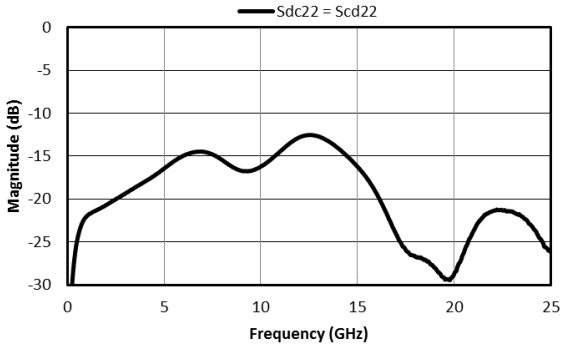


Fig. 4. Reflection converted between differential and common modes

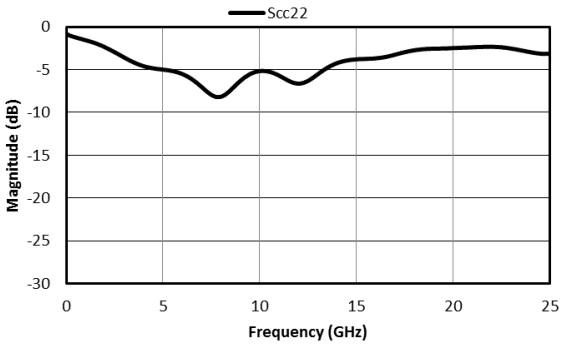


Fig. 5. Return loss of a common mode signal

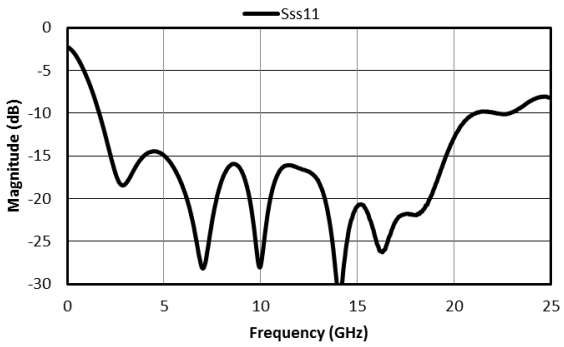


Fig. 6. Unbalanced port return loss

Typical Performance Scattering Parameters[5]

Three port scattering parameters measured as three single-ended 50Ω ports showing relationship between any two ports.

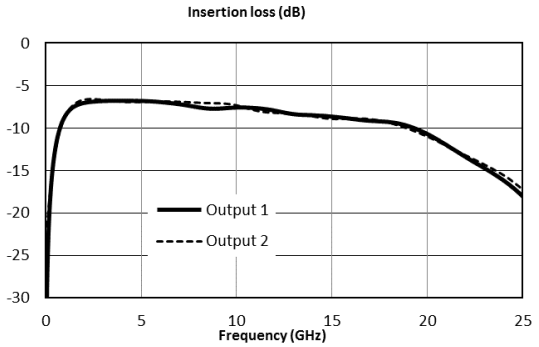


Fig. 7. Common to output port insertion loss

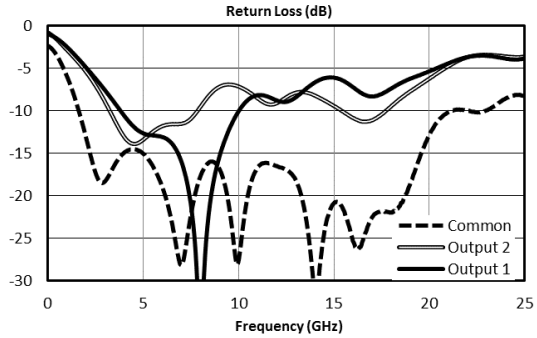


Fig. 8. Return loss for common port and output ports.

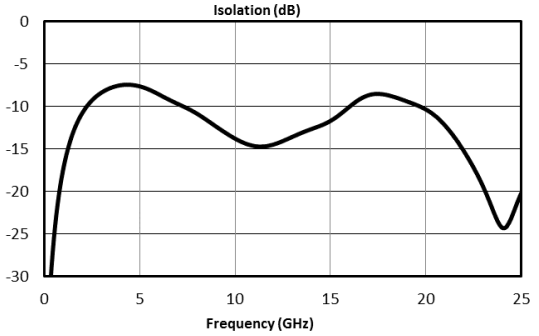


Fig. 9. Phase balance between output ports.

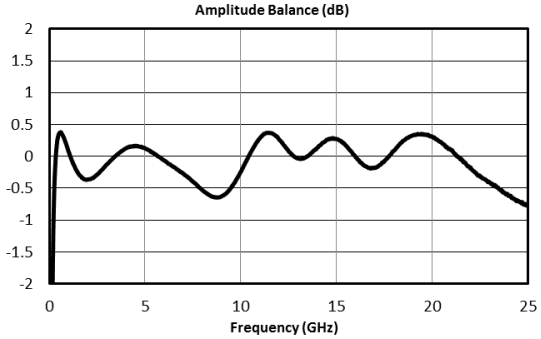


Fig. 10. Amplitude balance between output ports.

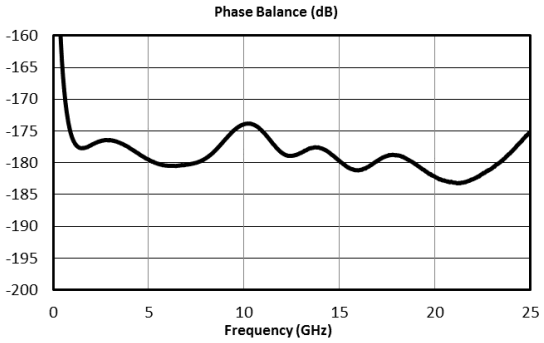


Fig. 11. Isolation between output ports

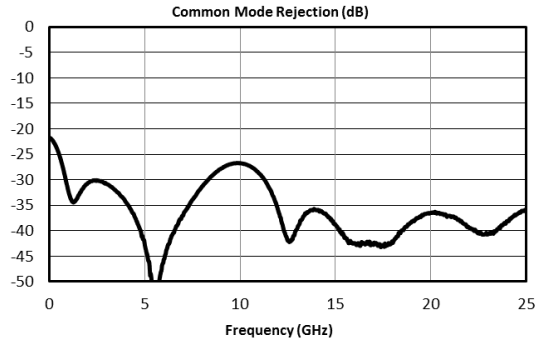
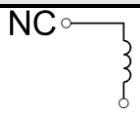
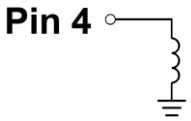
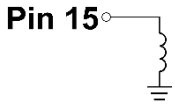
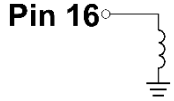
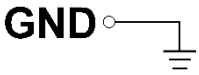


Fig. 12. Common mode rejection.

Pin Number	Function	Description	DC Interface Schematic
1-3, 5-14, 17-24	Non-connect (NC)	These pins are not connected internally. Datasheet performance is tested with NC pins grounded.	
4	Common	Pin 4 is DC short. Blocking capacitor is optional.	
15	Out 2	Pin 15 is DC short. Blocking capacitor is optional.	
16	Out 1	Pin 16 is DC short. Blocking capacitor is optional.	
Paddle	Ground (GND)	Ground pad should be connected to RF/DC ground with low electrical and thermal resistance.	

Absolute Maximum Ratings	
Parameter	**Maximum Rating**
Output Port 1 DC Current	TBD
Output Port 2 DC Current	TBD
Common Port DC Current	TBD
RF Power Handling	+30 dBm
Operating Temperature	-65ºC to +125ºC
Storage Temperature	-65ºC to +125ºC

DATA SHEET NOTES:
1. Balun measured as a splitter. Combiner measurement is equivalent to splitter measurement.
2. Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.
3. Catalog circuits are continually improved. Configuration control requires custom model numbers and specifications
4. Sdd22: differential return loss of the differential port driven with a differential signal
   Sdc22: differential return loss of the differential port driven with a common signal
   Sds21: insertion loss from a single ended input to a differential output
   Scc22: common mode return loss of the differential port driven with a common signal
   Scd22: common mode return loss of the differential port driven with a differential signal
   Scs21: insertion loss from a single ended input to a common output
   Sss11: single ended return loss
   Ssd12: insertion loss from a differential signal to single ended output
   Ssc12: insertion loss from a common signal to single ended output
5. Measured data was taken on an Eval Board with output traces having an offset of 0.008” on a dielectric of 3.38.

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

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