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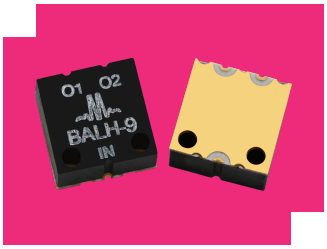
BALH-0009SMG

HIGH POWER SURFACE-MOUNT BALUN

DEVICE OVERVIEW

General Description

The BALH-0009SMG is a broadband surface mount balun, hand-tuned for optimal phase and amplitude balance over a 500 kHz to 9 GHz bandwidth. It serves as an excellent choice for analog to digital converters, balanced receivers, baseband digital modulations, and signal integrity enhancement.



Download s-parameters here

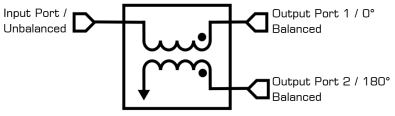
Features

- 1:1 Impedance Ratio
- 500 kHz to 9 GHz Balun (Balanced to Unbalanced Transformer)
- High 37 dBm 1-dB compression enables high power applications
- Tuned for Optimal Phase/Amplitude Balance

Applications

- Balanced Amplifiers
- Baseband Digital Modulation
- Signal Integrity

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
BALH-0009SMG	HIGH POWER SURFACE-MOUNT BALUN	SMG	REACH RoHS	Released	EAR99
EVAL-BALH-0009	Evaluation Board, High Power Surface-Mount Balun	EVAL	Consult Factory	Released	EAR99

Table Of Contents

Revision History

Revision Code	Revision Date	Comment
-	2013-02-01	Datasheet Initial Release
A	2019-03-01	Evaluation Board Outline Added
B	2019-10-01	Mixed Mode Scattering Parameters added
C	2020-04-01	Unit Spread Graphs Added
D	2020-07-01	Specs Table Update
E	2020-10-01	Specs Table Update
F	2022-05-01	Max DC current update, Ground Plane Finish Update
G	2022-08-01	Over Temperature Performance Plots Added
H	2022-11-01	Banded Electrical Specifications Added
I	2024-03-06	Updated specs table to add frequency resolution to insertion loss, balance and rejection specs.

Specifications

Absolute Maximum Ratings

Parameter	Maximum Rating	Unit
Minimum Operating Temperature	-55	°C
RF Power Handling	33	dBm
Maximum Operating Temperature	100	°C

Package Information

Parameter	Details	Rating
Weight	Package name: SMG	0.24g
Dimensions	-	8.13 x 8.13 mm
Moisture Sensitivity Level	-	MSL 1

Electrical Specifications

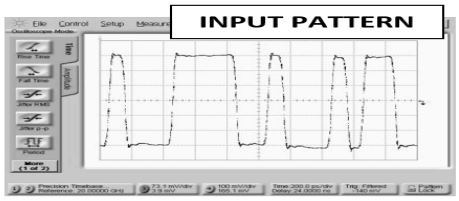
The electrical specifications apply at TA=+25°C in a 50Ω system. Min and Max limits are guaranteed at TA=+25°C.

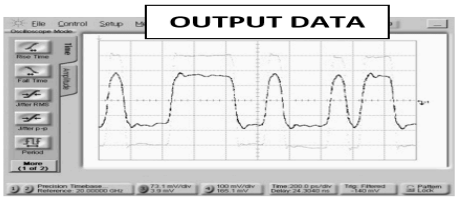
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
VSWR (Input)	-	0.0005	3	-	1.6	-	
VSWR (Input)	-	3	9	-	2.1	-	
VSWR (Output)	-	0.0005	3	-	1.1	-	
VSWR (Output)	-	3	6	-	1.2	-	
VSWR (Output)	-	6	9	-	1.3	-	
Isolation	-	0.0005	3	-	7	-	dB
Isolation	-	3	9	-	6	-	dB
Input P1dB	-	0.0005	9	-	37	-	dBm
Impedance Ratio	-	-	-	-	1:1	-	
Risetime/Falltime [1]	-	0.0005	6	-	22	-	ps
Risetime/Falltime [2]	-	6	9	-	25	-	ps
Nominal Phase Shift	-	0.0005	9	-	180	-	°
Amplitude Balance	-	0.0005	0.002	-	0.5	-	dB
Amplitude Balance	-	0.002	0.01	-	0.2	3.5	dB
Amplitude Balance	-	0.01	9	-	0.8	1.6	dB
Phase Balance	-	0.0005	0.002	-	2.5	-	°
Phase Balance	-	0.002	0.01	-	2	14	°
Phase Balance	-	0.01	9	-	5	12	°
Common Mode Rejection	-	0.0005	0.002	-	30	-	dB
Common Mode Rejection	-	0.002	0.01	13	32	-	dB
Common Mode Rejection	-	0.01	9	17	25	-	dB
Insertion Loss as a Mode Converter	-	0.0005	0.002	-	2	-	dB
Insertion Loss as a Mode Converter	-	0.01	9	-	2	4	dB
Insertion Loss as a Mode Converter	-	0.002	0.01	-	1.9	4	dB

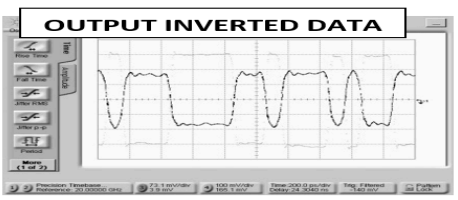
[1] Specified as 90%/10%. Calculated from $Tau\_balun^2 = (Tau\_out^2 - Tau\_in^2)$.
[2] Specified as 90%/10%. Calculated from Tau_balun2 = (Tau_out2 – Tau_in2).

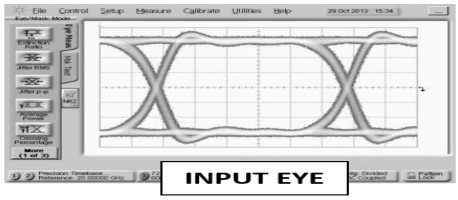
Time Domain Performance Plots

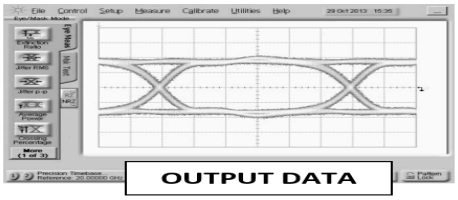
Oscilloscope measurements of the BALH-0009SMG with a 10 Gb/s PRBS pattern. Bit pattern is measured with a 27-1 PRBS input demonstrating extremely good pulse fidelity for both inverted and non-inverted output. Eye diagrams are taken with a 231-1 PRBS input demonstrating minimal eye distortion/closure afforded by the extremely low frequency operation of the balun (<500 kHz).

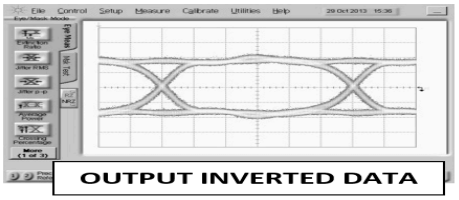






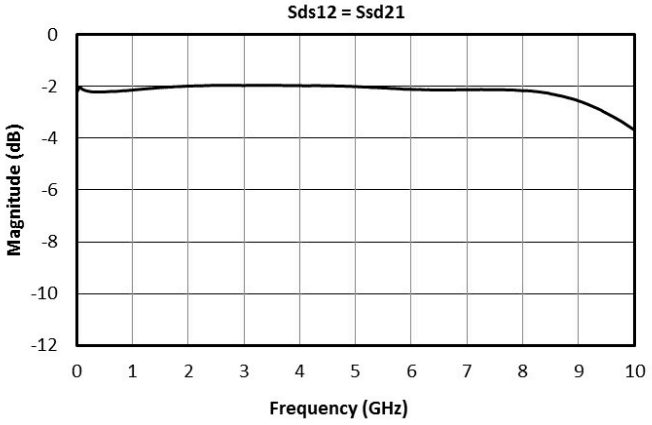


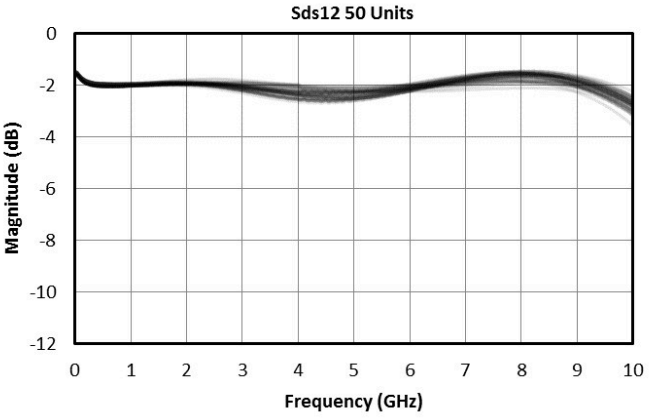


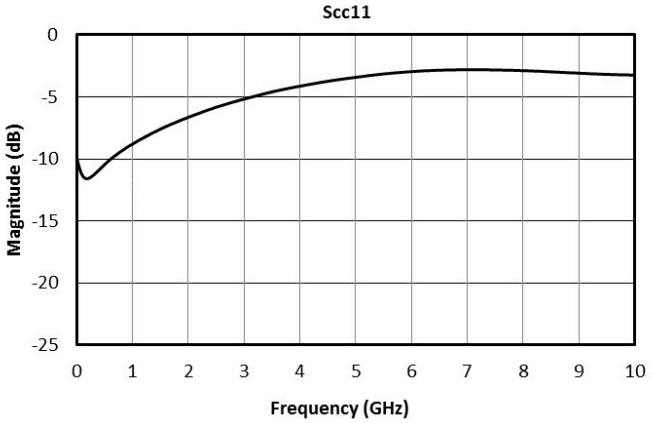


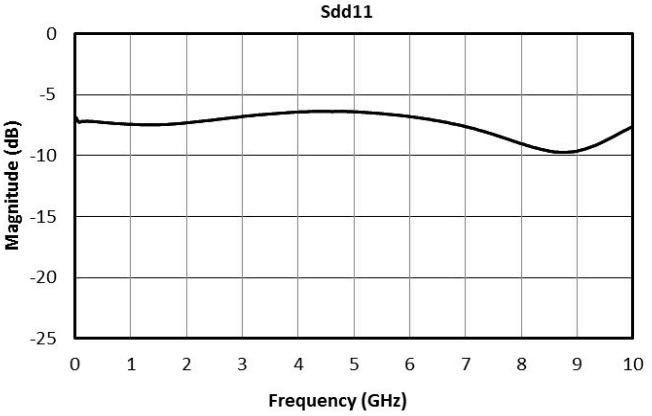
Mixed Mode Scattering Parameters

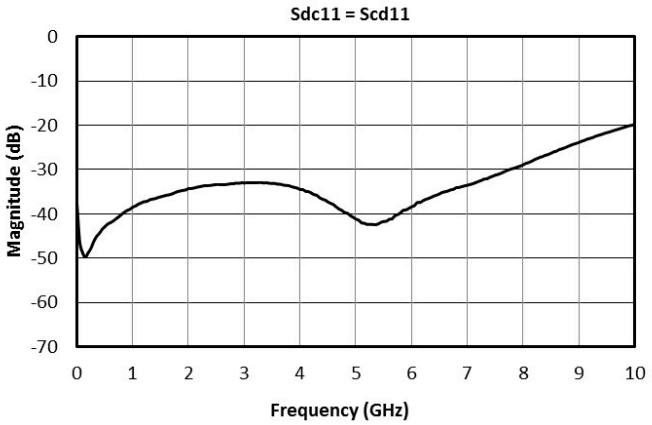
Mixed mode scattering parameters are used to characterize differential circuits. For baluns, this means that the 0° and 180° ports become a single 100Ω differential port and the common port remains the same 50Ω common port. The two-port s-parameters of the balun are then characterized based on differential (d), common mode (c), or single-ended (s) signals. For example: Sds12 is the differential output response given a single ended input.

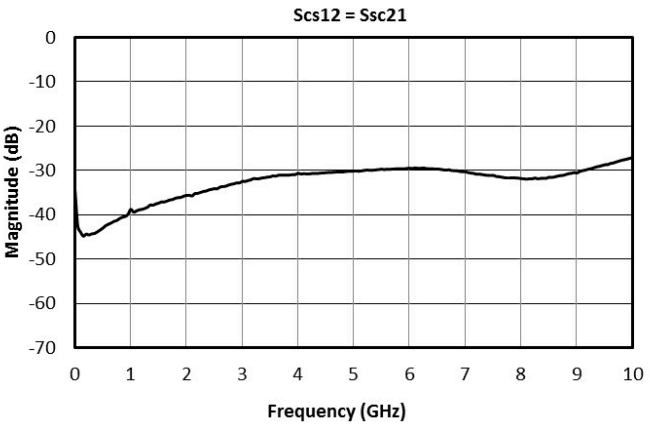


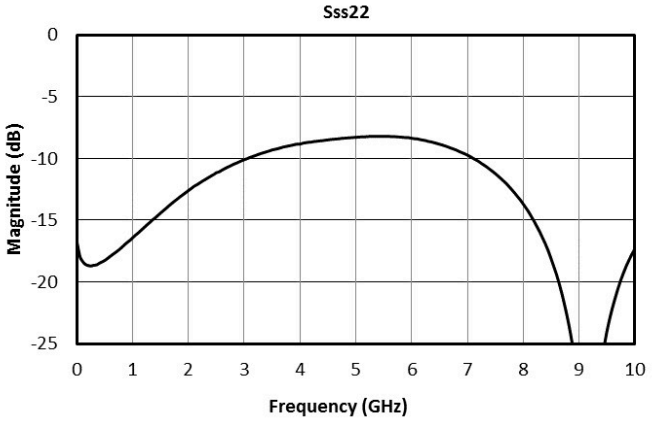


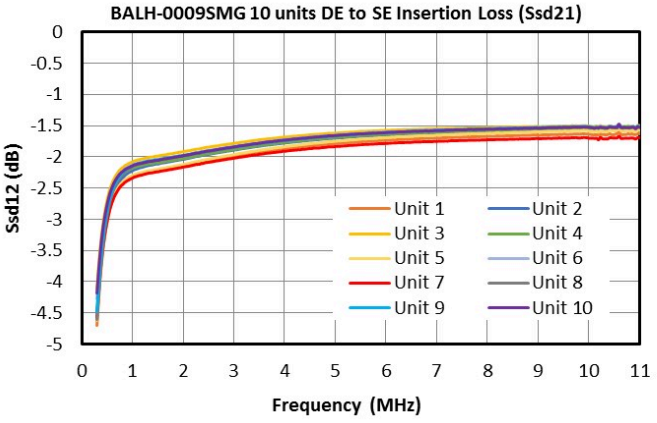


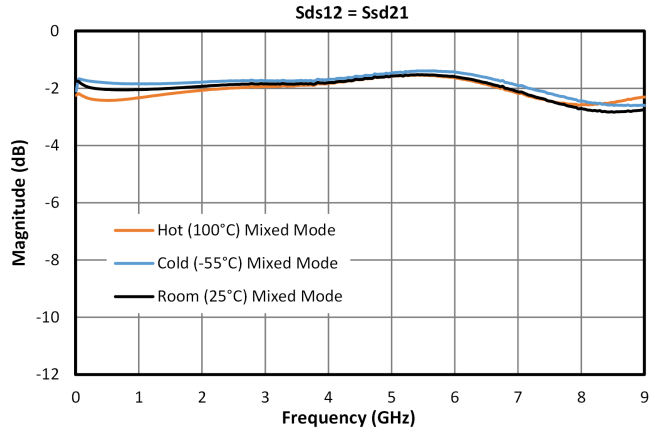








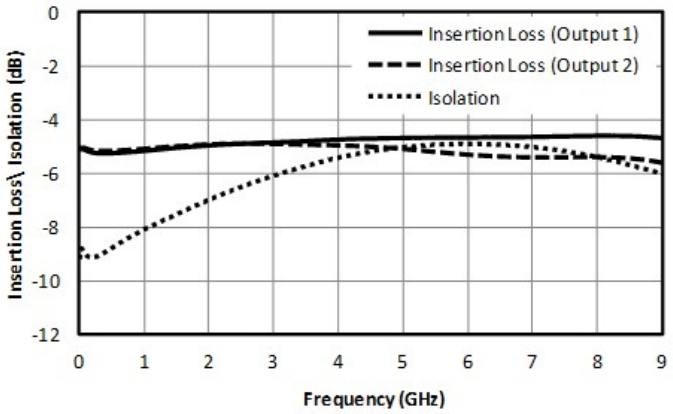


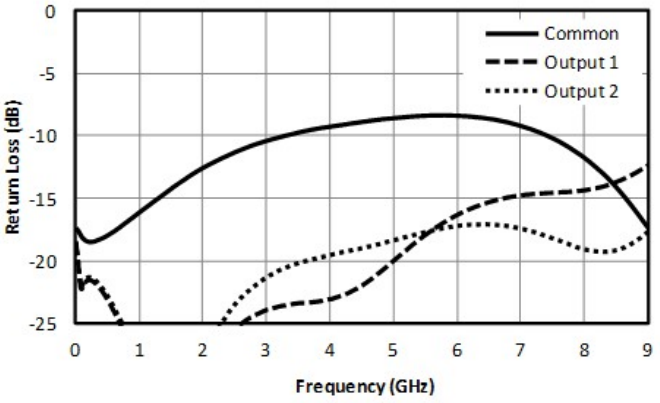


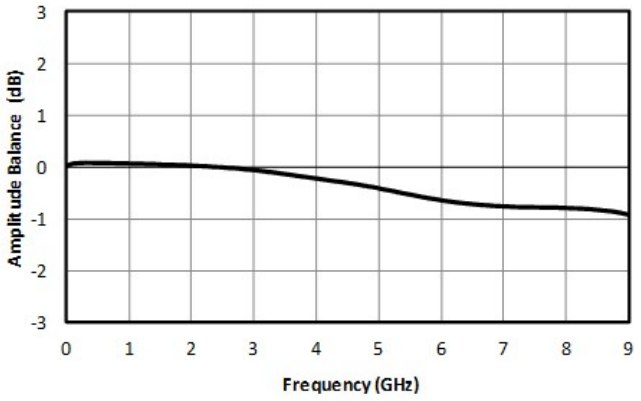
Typical Performance Scattering Parameters

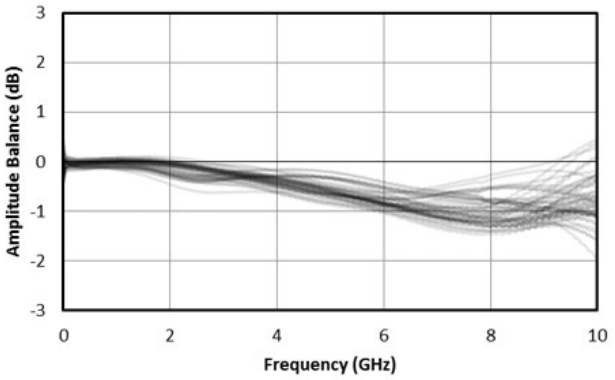
Three port scattering parameters measured as three single-ended 50Ω ports showing relationship between any two ports. For example: S21 and S31, often referred to as insertion loss of a balun, is the output response on ports 2 and 3 with an input stimulus on port 1.

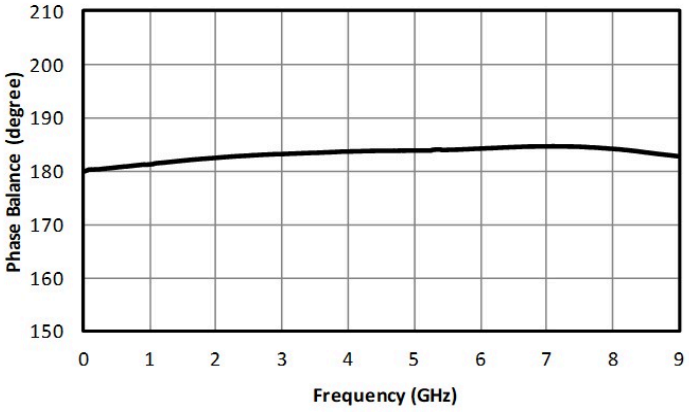
Measured as phase deviation from 180° between output 1 and output 2.

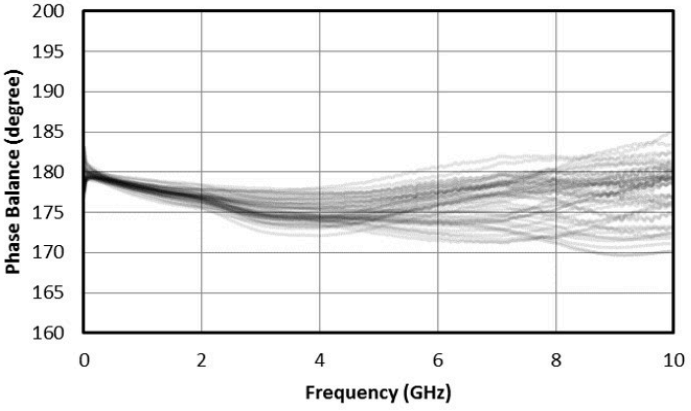


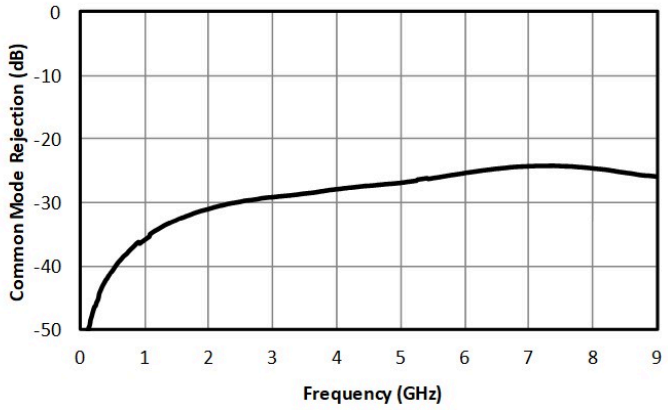


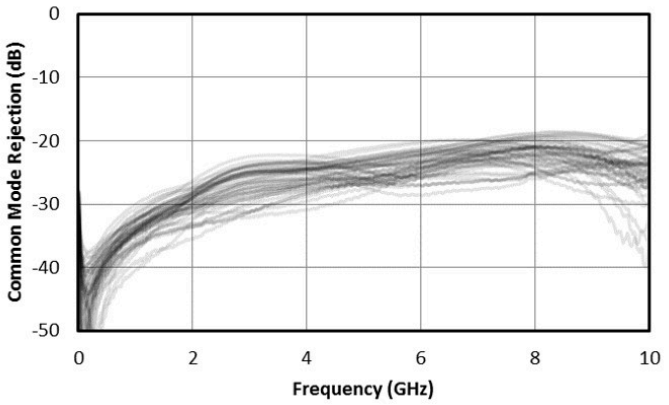


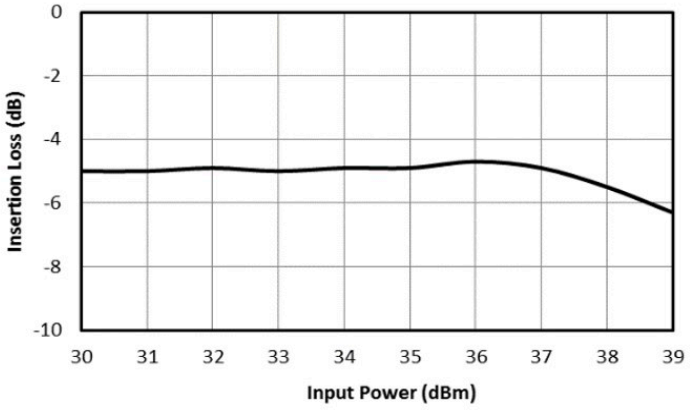


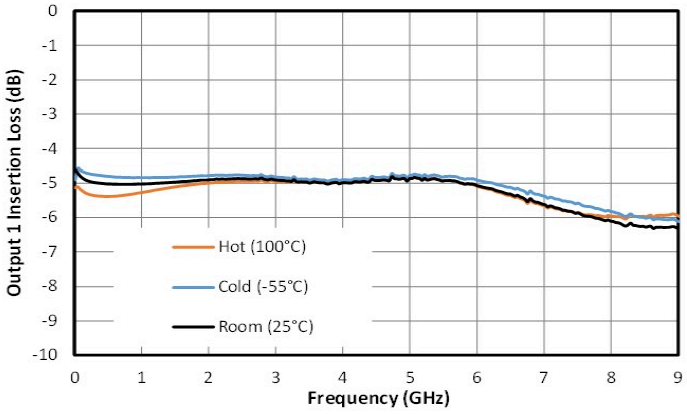


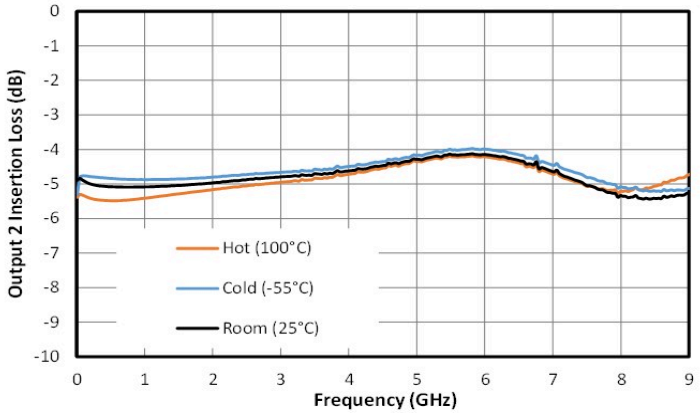


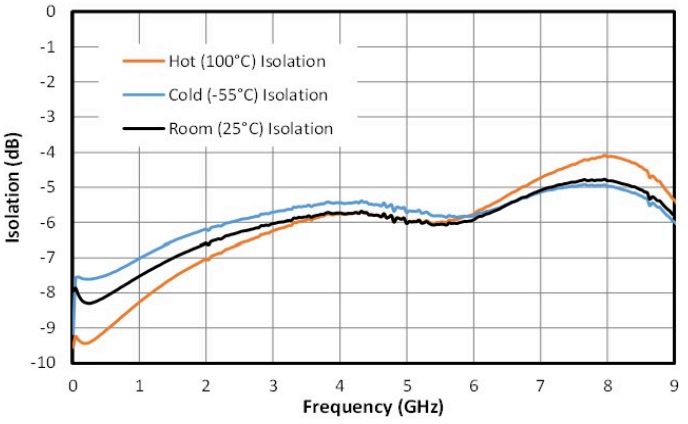


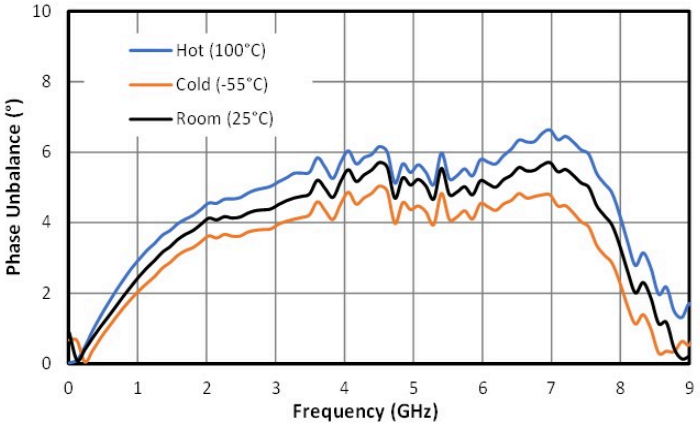








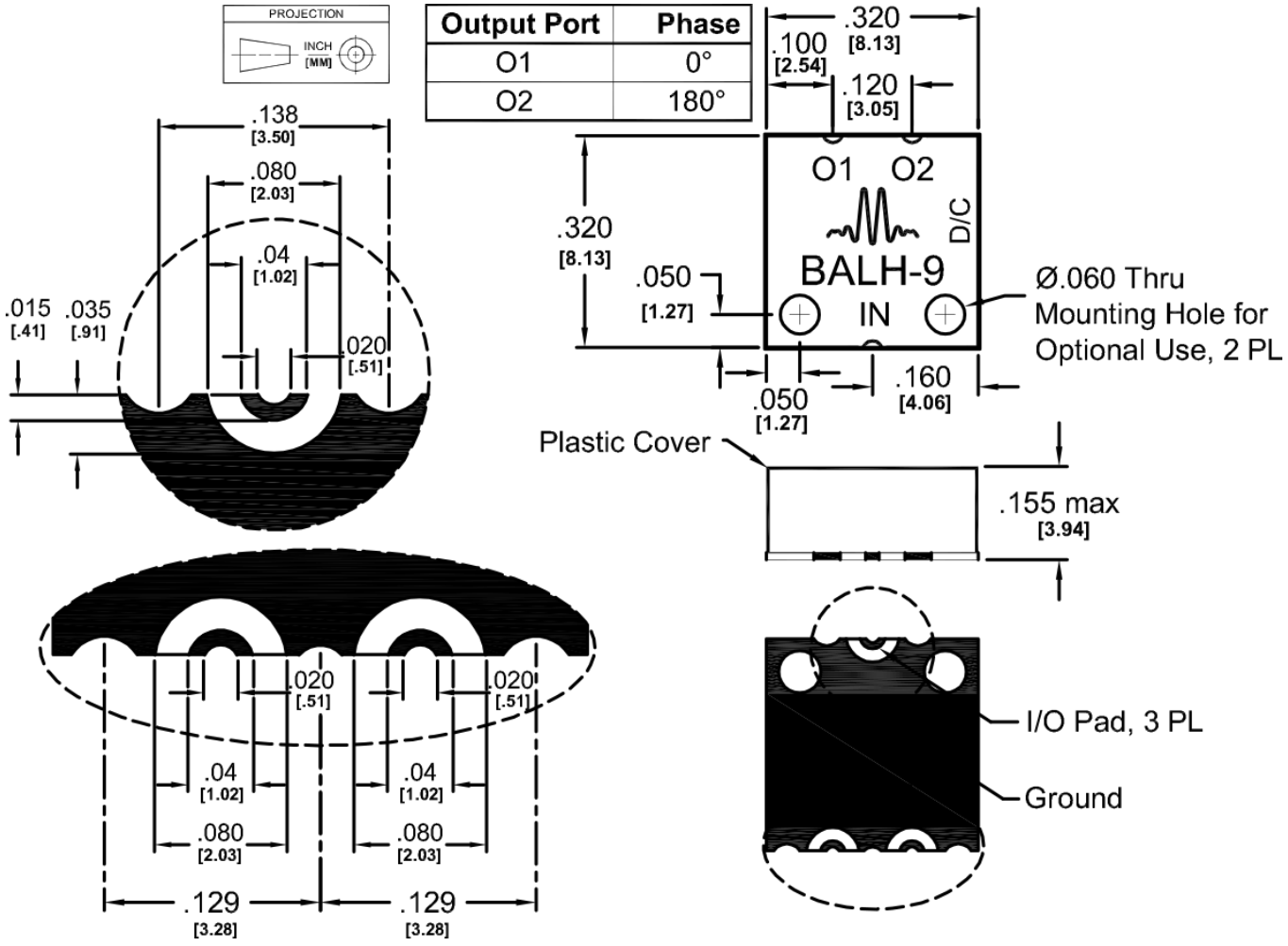




Mechanical Data

Outline Drawing

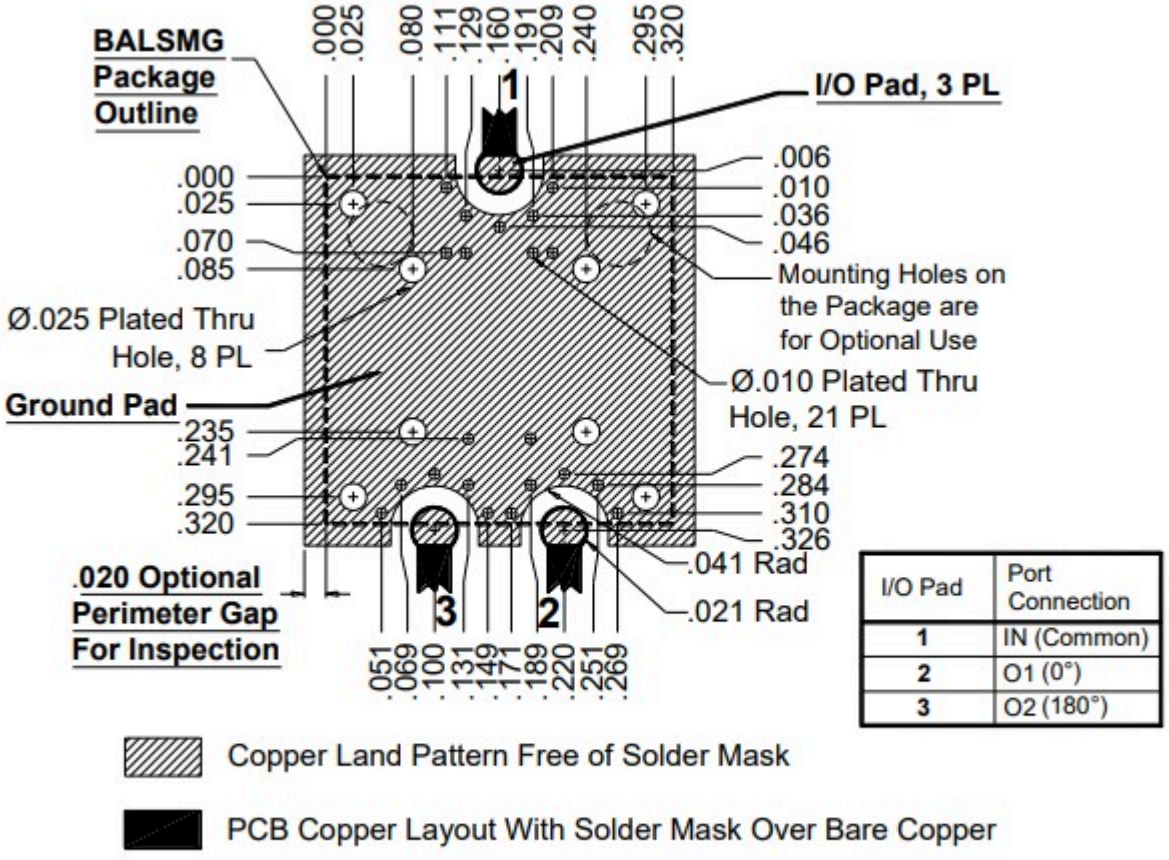
Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP



Substrate material is 8-mil thick Rogers 4003, 1 Oz Electrodeposited Cu. I/O Pads & Ground Plane Finish is Gold Flash, 5 to 10 µinches, over Electroplated Nickel, 100-200 µ-inches, over Cu.

Footprint Image

Download : Footprint Drawing



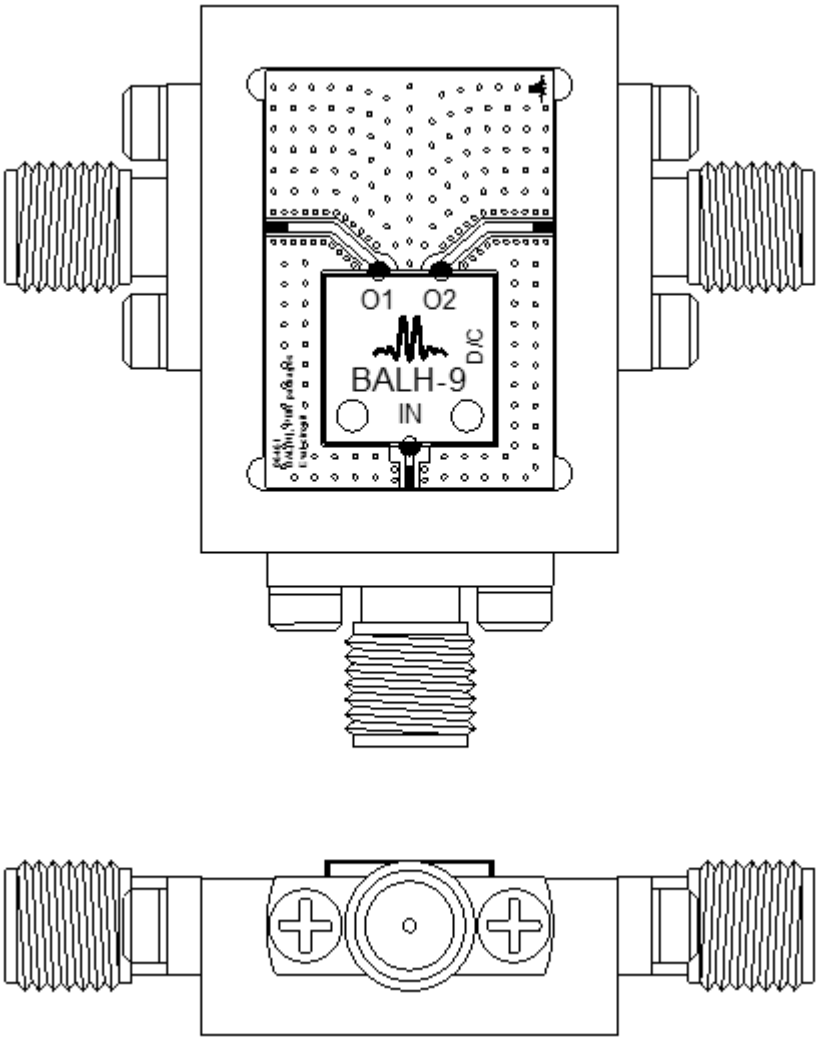
I/O Pad	Port Connection
1	IN (Common)
2	O1 (0°)
3	O2 (180°)

Note: Trace widths shown are for Rogers RO5880/Taconic TLY-5, .010" thick, ½ Oz copper. Widths may need to be modified for other materials.

Evaluation Board - Performance Data

Parameter	Test Conditions	Frequency Range (GHz)	Min	Typ	Max	Unit
Impedance Ratio	-	-	-	1	-	

Evaluation Board - Outline Drawing



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