

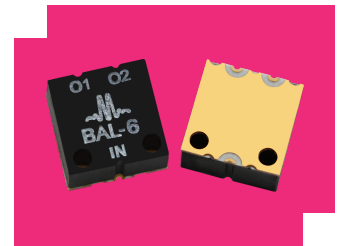
# BAL-0006SMG

## SURFACE-MOUNT BROADBAND BALUN

### DEVICE OVERVIEW

#### General Description

The BAL-0006SMG is a broadband surface mount balun, hand-tuned for optimal phase and amplitude balance over a 500 kHz to 6 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](#)

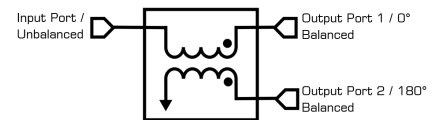
#### Features

- 500 kHz to 6 GHz 1:2 Balun (Balanced to Unbalanced Transformer)
- Transforms 50  $\Omega$  Input to 100  $\Omega$  Differential (50 Ohm Single) Output
- Tuned for Optimal Phase/Amplitude Balance

#### Applications

- Balanced Receivers
- Analog to Digital Converters
- Baseband Digital Modulation
- Signal Integrity

#### Functional Block Diagram



#### Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
BAL-0006SMG	SURFACE-MOUNT BROADBAND BALUN	SMG	REACH RoHS	Released	EAR99
<u>EVAL-BAL-0006</u>	Evaluation Board, High Power 0.0005 - 6 GHz Broadband Balun	EVAL	Non-RoHS	Released	EAR99

## Table Of Contents

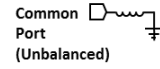
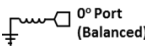
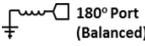
- **Device Overview**
  - General Description
  - Features
  - Applications
  - Functional Block Diagram
- **Port Configuration and Functions**
  - Port Functions
- **Revision History**
- **Specifications**
  - Package Information
  - Electrical Specifications
  - Time Domain Performance Plots
  - Mixed Mode Scattering Parameters
- **Mechanical Data**
  - Outline Drawing
- **Footprint Image**

## 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	Update Specs table & low frequency Ssd21 plot added
E	2020-10-01	Update Specs table
F	2022-05-01	Max DC current update, Ground Plane Finish Update
G	2022-11-01	Banded Electrical Specifications Added
H	2023-12-21	Updated Specs table to add sub-banding on certain specifications.

## Port Configuration and Functions

### Port Functions

Port	Function	Description	Equivalent Circuit for Package
Common Port / In (Unbalanced)	RF Input	The common port is DC short to ground.	 <p>Common Port (Unbalanced)</p>
Out 1 / 0° Port (Balanced)	0° Port	The 0° port is DC short to ground.	 <p>0° Port (Balanced)</p>
Out 2 / 180° Port (Balanced)	180° Port	The 180° port is DC short to ground.	 <p>180° Port (Balanced)</p>

## Specifications

### Package Information

Parameter	Details	Rating
Dimensions	-	8.13 x 8.13 mm

## Electrical Specifications

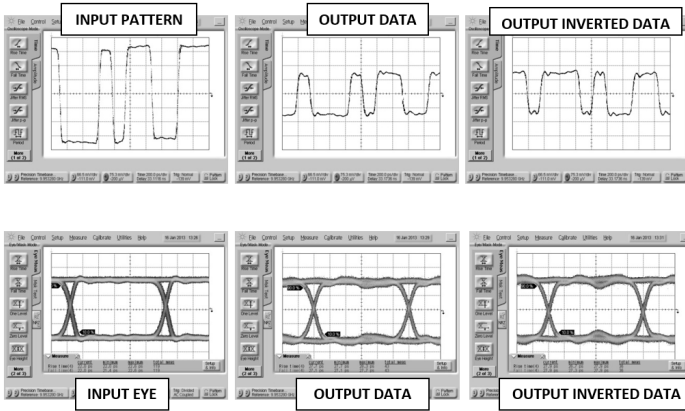
Specifications guaranteed from -55 to +100°C, measured in a 50Ω system.

Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Insertion Loss as a Mode Converter	-	0.0005	0.002	-	3.9	-	dB
Insertion Loss as a Mode Converter	-	0.002	0.006	-	3.8	6.5	dB
Insertion Loss as a Mode Converter	-	0.006	6	-	4	5.5	dB
Nominal Phase Shift	-	0.0005	6	-	180	-	°
Amplitude Balance	-	0.0005	0.002	-	0.1	-	dB
Amplitude Balance	-	0.002	0.006	-	0.1	3	dB
Amplitude Balance	-	0.006	6	-	0.4	1.2	dB
Phase Balance	-	0.0005	0.002	-	0.9	-	°
Phase Balance	-	0.002	0.006	-	0.4	12	°
Phase Balance	-	0.006	6	-	3	10	°
Common Mode Rejection	-	0.0005	0.002	-	39	-	dB
Common Mode Rejection	-	0.002	0.006	16	45	-	dB
Common Mode Rejection	-	0.006	6	20	30	-	dB
Isolation	-	0.0005	6	-	8	-	dB
VSWR	-	0.0005	6	-	1.5	-	-
Risetime/Falltime <sup>1</sup>	-	0.0005	6	-	17	-	ps
Total Input Power	-	0.0005	6	-	-	1	W

<sup>[1]</sup> Specified as 90%/10%. Calculated from  $\tau_{\text{balun2}} = (\tau_{\text{out2}} - \tau_{\text{in2}})$

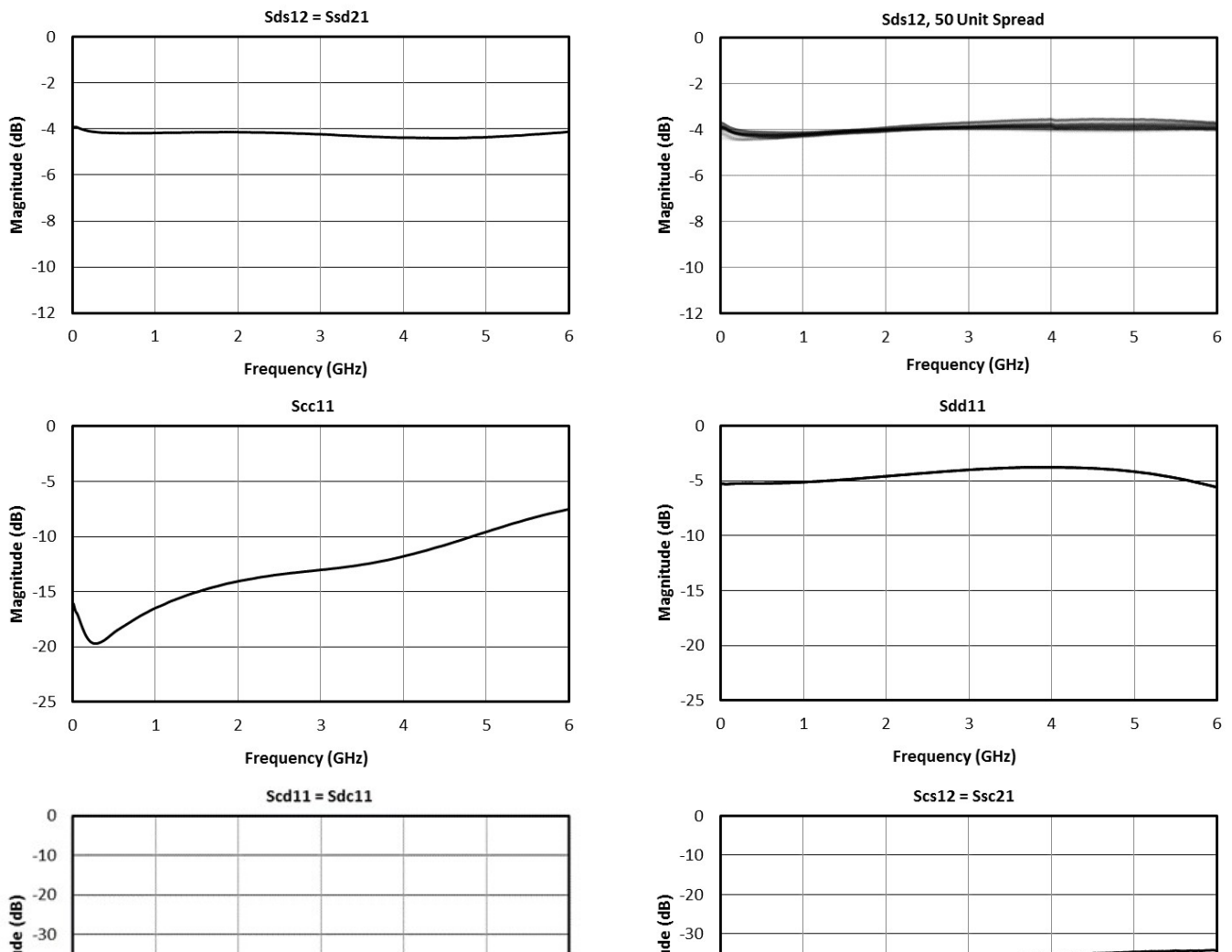
### Time Domain Performance Plots

Oscilloscope measurements of the BAL-0006SMG with a 6 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).



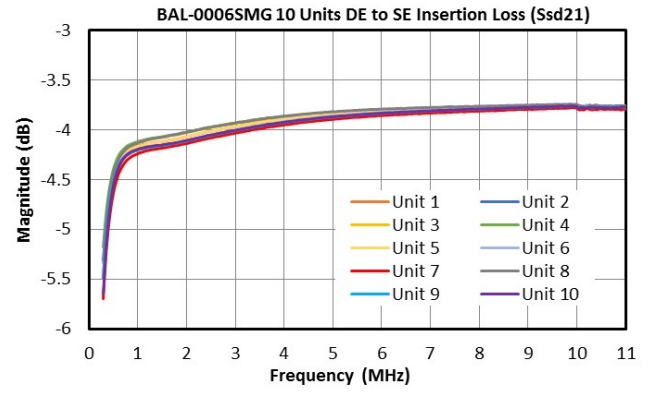
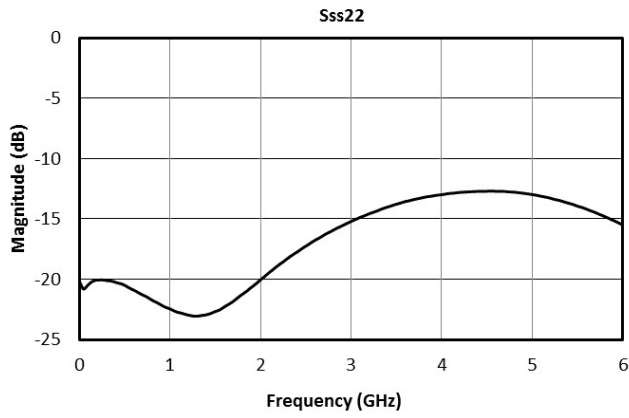
### Mixed Mode Scattering Parameters

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.



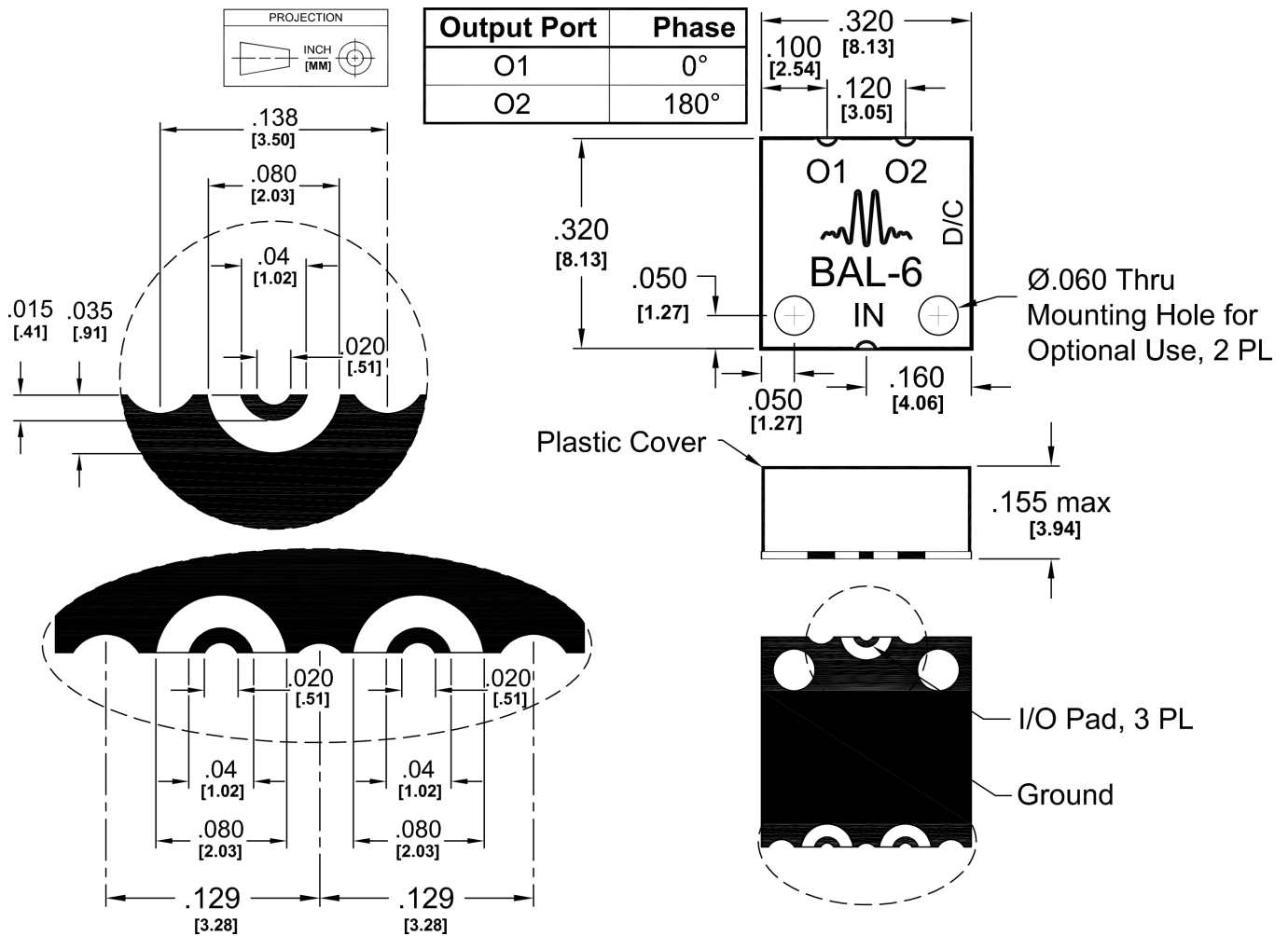
# BAL-0006SMG

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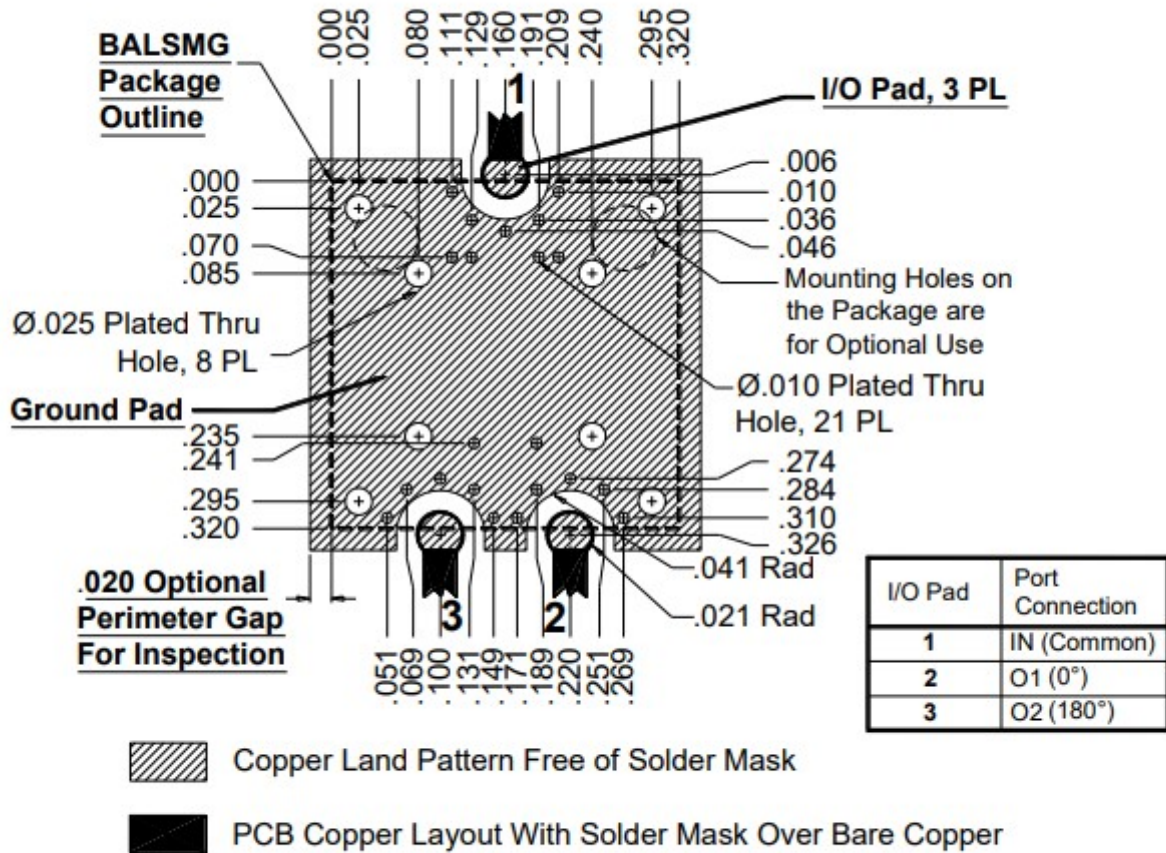
**Mechanical Data**

**Outline Drawing**



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.

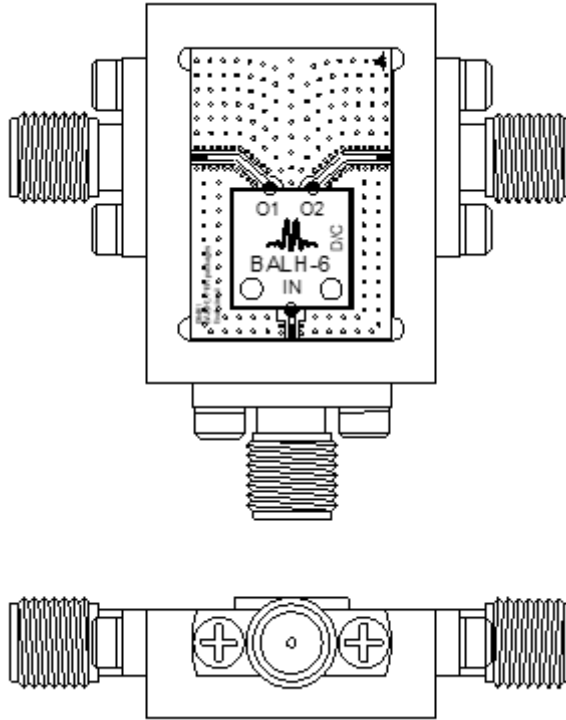
Footprint Image



**Note:** Trace widths shown are for Rogers RO5880/Taconic TLY-5, .010" thick, 1/2 Oz copper. Widths may need to be modified for other materials.

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### SURFACE-MOUNT BROADBAND BALUN



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