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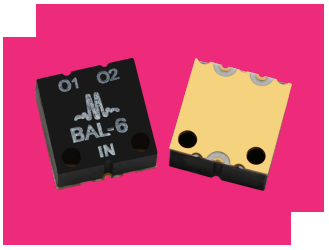
BAL-0006SMG

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

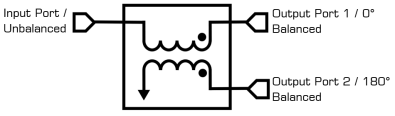
Features

- 2:1 Impedance Ratio
- 500 kHz to 6 GHz Balun (Balanced to Unbalanced Transformer)
- Transforms 50 Ω Input to 100 Ω 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	Packing Size	Green Status	Product Lifecycle	Export Classification
BAL-0006SMG	SURFACE-MOUNT BROADBAND BALUN	SMG	-	REACH RoHS	Released	EAR99
EVAL-BAL-0006	Evaluation Board, High Power 0.0005 - 6 GHz Broadband Balun	EVAL	-	Non-RoHS	Released	EAR99
BAL-0006SMG-TR	Tape and Reel, SURFACE-MOUNT BROADBAND BALUN	SMG	13"	REACH RoHS	Released	EAR99

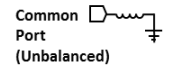
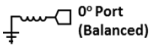
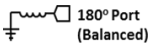
Table Of Contents

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	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	DC Equivalent Circuit
Common Port / In (Unbalanced)	RF Input	The common port is DC short to ground.	
Out 1 / 0° Port (Balanced)	0° Port	The 0° port is DC short to ground.	
Out 2 / 180° Port (Balanced)	180° Port	The 180° port is DC short to ground.	

Specifications

Absolute Maximum Ratings

Parameter	Maximum Rating	Unit
Maximum Operating Temperature	100	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-55	°C
Minimum Storage Temperature	-65	°C
RF Power Handling	1	W

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

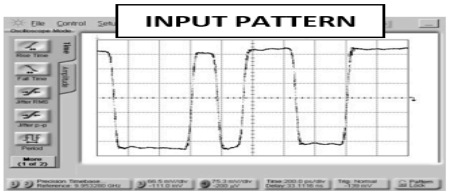
The electrical specifications apply at TA=+25°C in a 50Ω system. Min and Max limits are guaranteed at TA=+25°C.

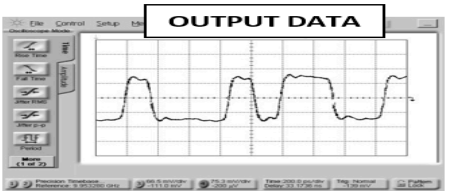
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
VSWR	-	0.0005	6	-	1.5	-	
Isolation	-	0.0005	6	-	8	-	dB
Impedance Ratio	-	-	-	-	2:1	-	
Risetime/Falltime [1]	-	0.0005	6	-	17	-	ps
Nominal Phase Shift	-	0.0005	6	-	180	-	°
Amplitude Balance	-	0.0005	0.002	-	0.1	-	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
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

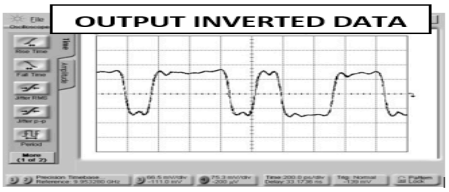
[1] Specified as 90%/10%. Calculated from Tau_balun2 = (Tau_out2 – Tau_in2)

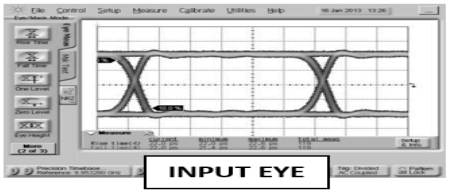
Time Domain Performance Plots

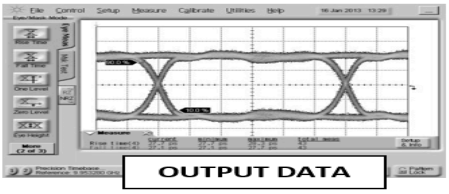
Oscilloscope measurements of the BAL-0006SMG with a 6 Gb/s PRBS pattern. Bit pattern is measured with a 27-1 PRBS input demonstrating extremely good pulse fidelity for both inverted and non-inverted output. Eye diagrams are taken with a 231-1 PRBS input demonstrating minimal eye distortion/closure afforded by the extremely low frequency operation of the balun (<500 kHz).

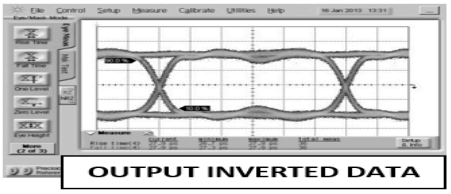






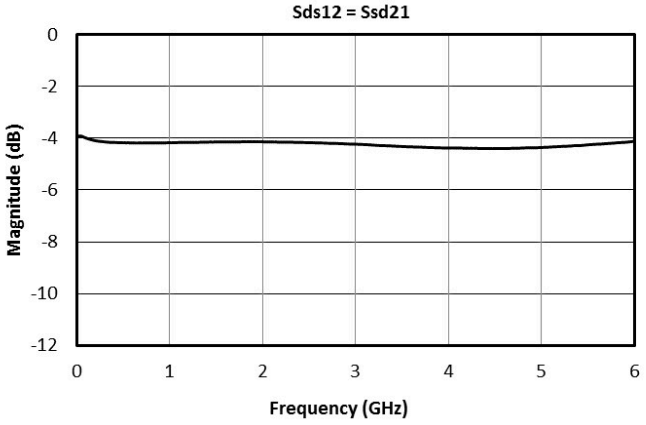


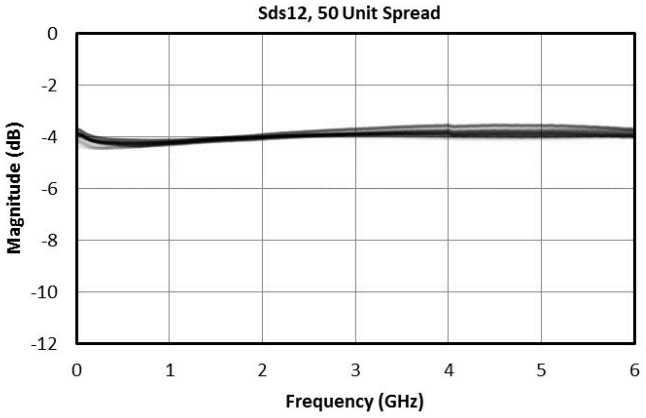


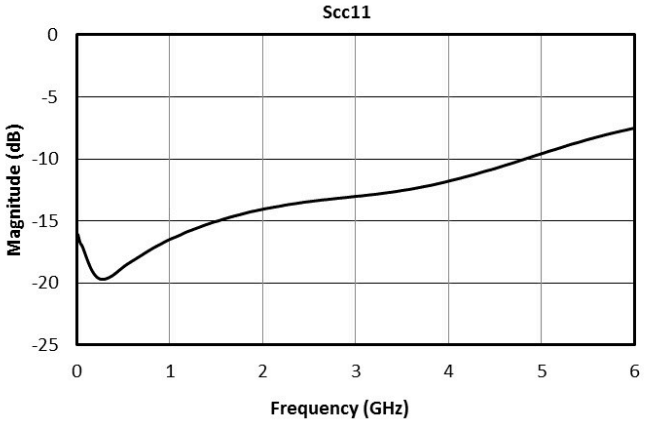


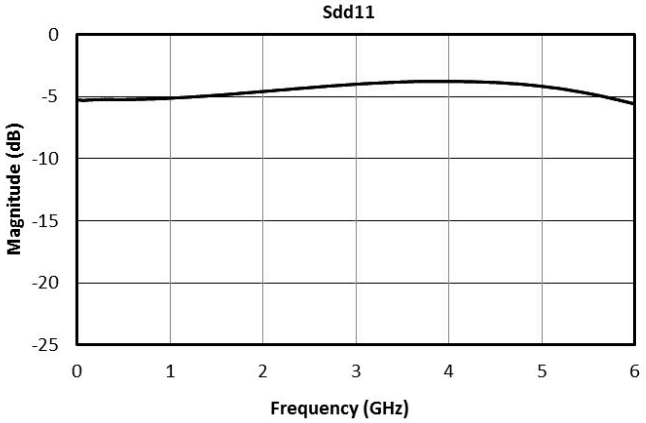
Mixed Mode Scattering Parameters

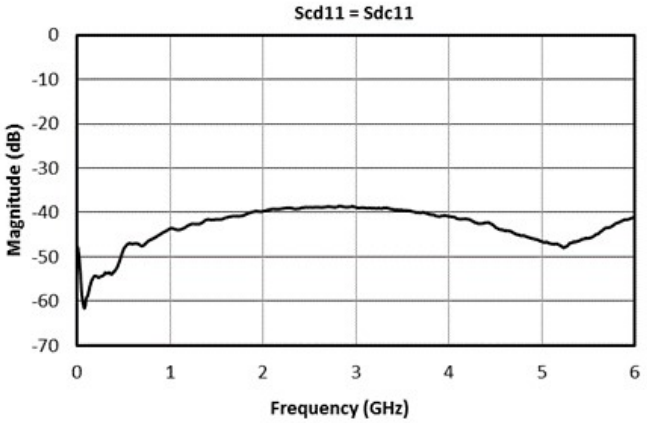
Mixed mode scattering parameters are used to characterize differential circuits. For baluns, this means that the 0° and 180° ports become a single 100Ω differential port and the common port remains the same 50Ω common port. The two-port s-parameters of the balun are then characterized based on differential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

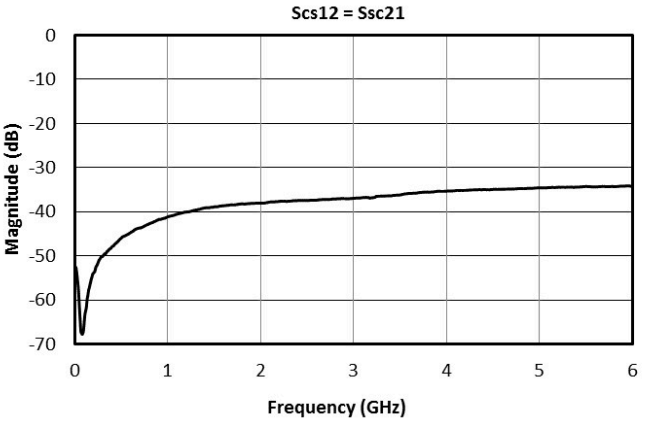


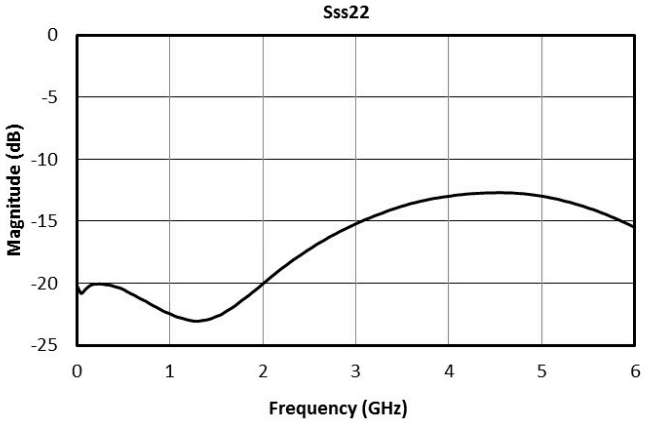


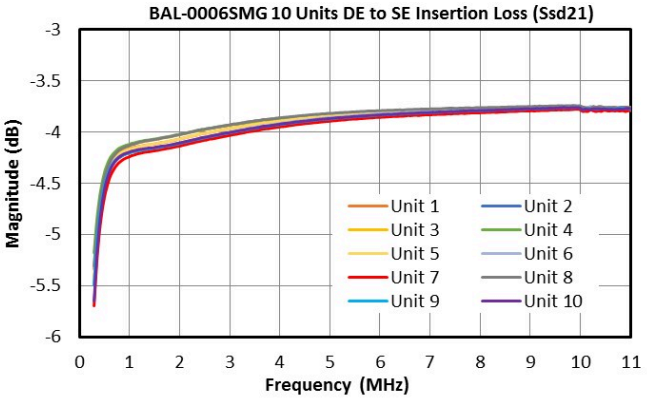




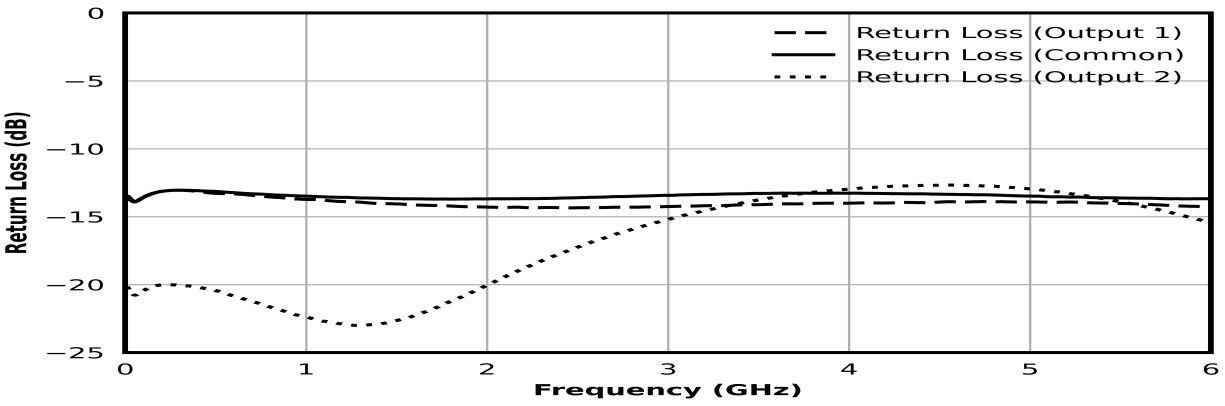








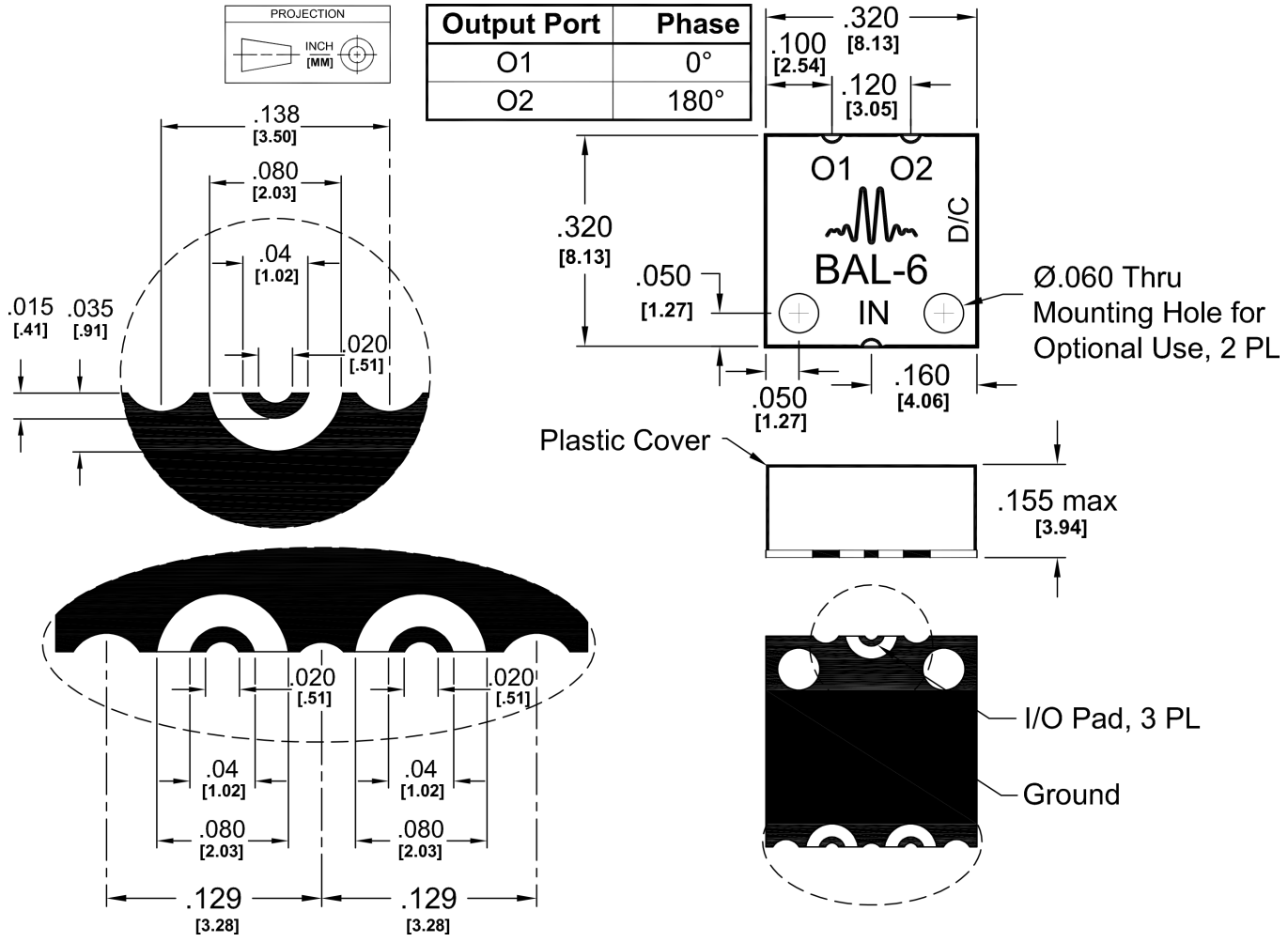
Typical Performance Scattering Parameters



Mechanical Data

Outline Drawing

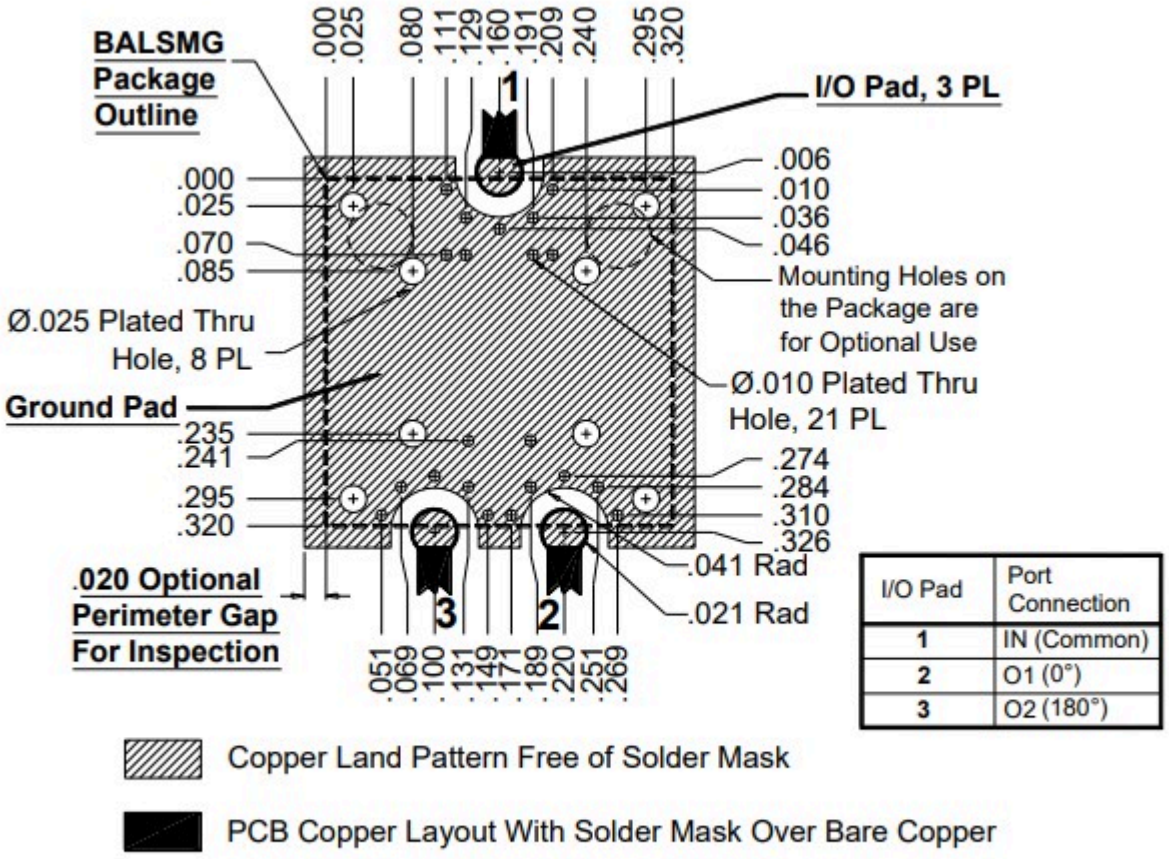
Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP



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



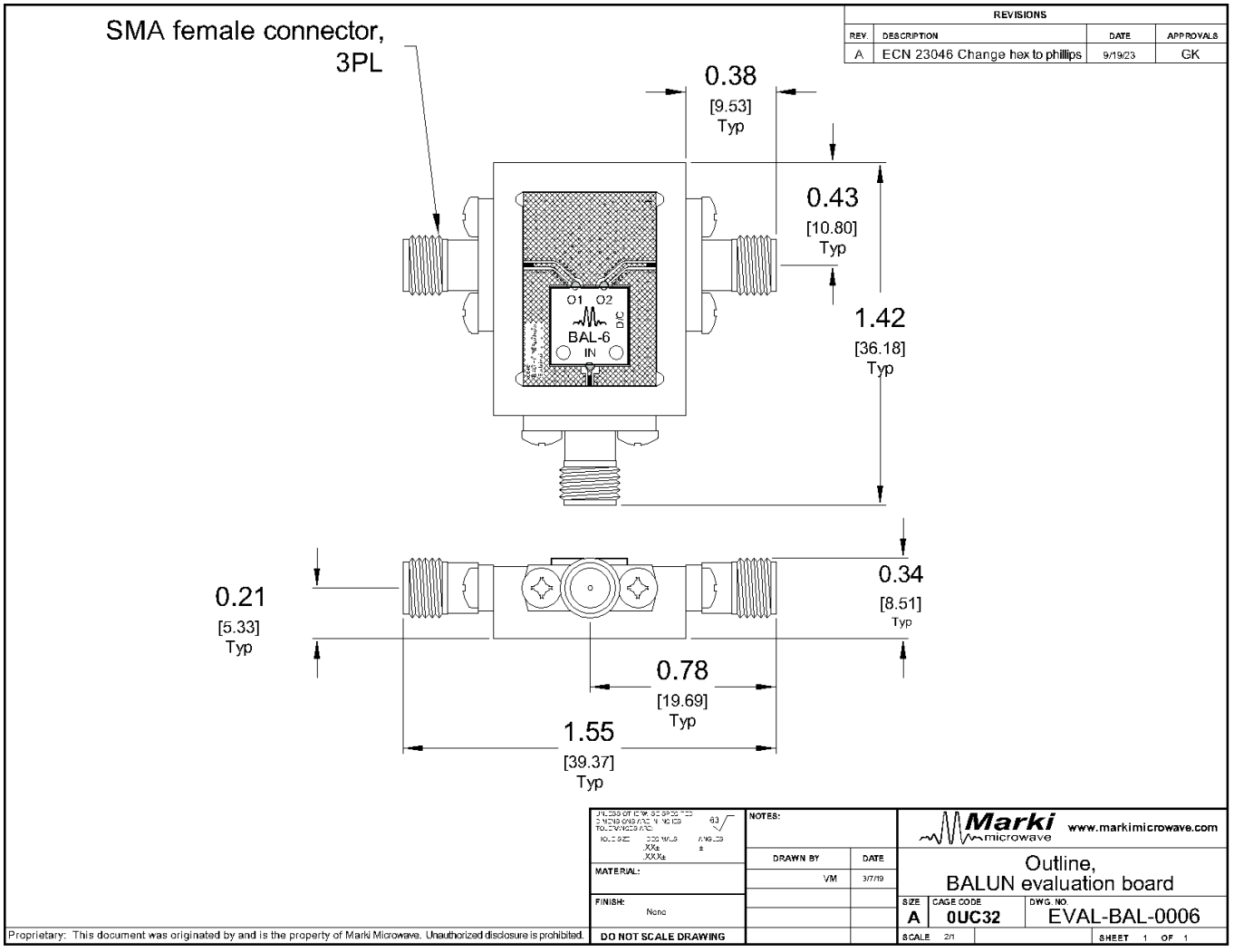
I/O Pad	Port Connection
1	IN (Common)
2	O1 (0°)
3	O2 (180°)

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	-	-	-	2	-	

Evaluation Board - Outline Drawing



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