

## HL9491 Surface Mount Balun (1 MHz to 20 GHz)

### Features and Technical Specifications

Bandwidth	3 dB, 1 MHz to 20 GHz
Amplitude Match	$\pm 0.4$ dB, poly fit <sup>1</sup> , $f \leq 20$ GHz $\pm 1.0$ dB, max, $f \leq 15$ GHz
Phase Match	$\pm 5^\circ$ , $f \leq 10$ GHz, poly fit <sup>1</sup>
Insertion Loss	7 dB, $f = 70$ MHz, nominal
Return Loss (Single-ended)	> 10 dB, unbalanced port, $f \leq 10$ GHz > 8 dB, unbalanced port, $f \leq 15$ GHz > 5 dB, balanced ports, $f \leq 15$ GHz
Rise Time	< 20 ps
Insertion Delay	$\approx 140$ ps, balun only $\approx 330$ ps, balun mounted to eval board
Max Input Power	1 W (+30 dBm)
Impedance	50 $\Omega$ Unbal., 2 x 50 $\Omega$ Bal.
Interface	Solderable pads, Gold ENIG
Reflow Profile	Designed to be compatible with a SAC305 thermal reflow profile: - max reflow time above 217 C is 90 seconds - peak reflow temperature is 245 C, not to be exceeded
Evaluation Board	Pre-mounted (opt. -EVAL)
Dimensions	1.1" x 0.2" x 0.13" 27.94 x 5.08 x 3.30 mm
Weight	0.8 g (0.03 oz.)
Temperature Limits	-40° to +85° C, operating
RoHS Compliant	Yes, < 0.1% lead content
REACH Compliant	Yes
Warranty	1 year, see website
NOTE 1 - Curve fit using 6th order polynomial	

#### PRODUCT SUMMARY

The HL9491 is a surface mountable (SMD) signal splitter and combiner that offers excellent amplitude and phase match over an industry-best bandwidth of 1 MHz to 20 GHz (3 dB).

It is suitable for use in high-speed communications systems, high-speed analog-to-digital conversion, and many other applications.

#### DEPLOYMENT NOTES

For ideal performance, the HL9491 should be installed on a PCB designed using the material and footprint recommended by HYPERLABS.

Contact HYPERLABS for more information on design best practices.

This device is bidirectional and can be used as a signal splitter or combiner.

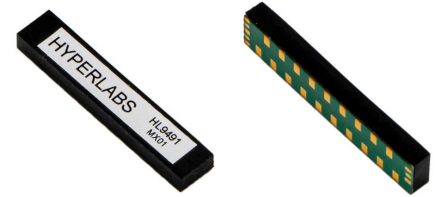
If the DC voltage of the balanced or unbalanced ports is non-zero, DC blocks are required. The balanced ports (2 and 3) are DC shorted.

All measurements taken using an HL9491 balun installed on an HL9490 Evaluation Board.

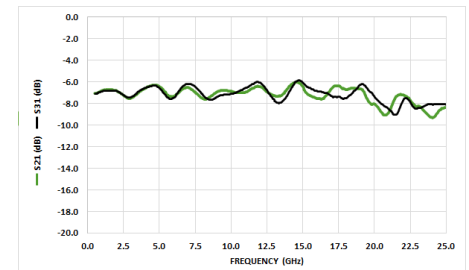
#### EVALUATION BOARD

To order the part mounted to an evaluation board, please specify the following option:

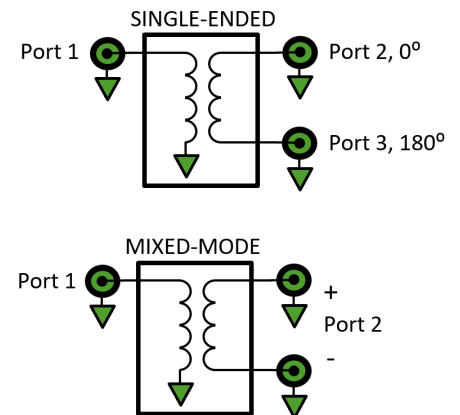
**HL9491-EVAL**



HL9491 Surface Mount Balun



Typical HL9491 Single-ended Insertion Loss



HL9491 Schematic and Port Assignments

## HL9491 Single-ended Insertion Loss and Return Loss

Bandwidth is defined as the range of frequencies where insertion loss is within 3 dB of the 70 MHz value (nominally 7 dB single-ended, 4dB differential).

Figure 1 shows the insertion loss and amplitude match of an HL9491 in single-ended mode.

Figure 2 shows the return loss of all ports in single-ended mode.

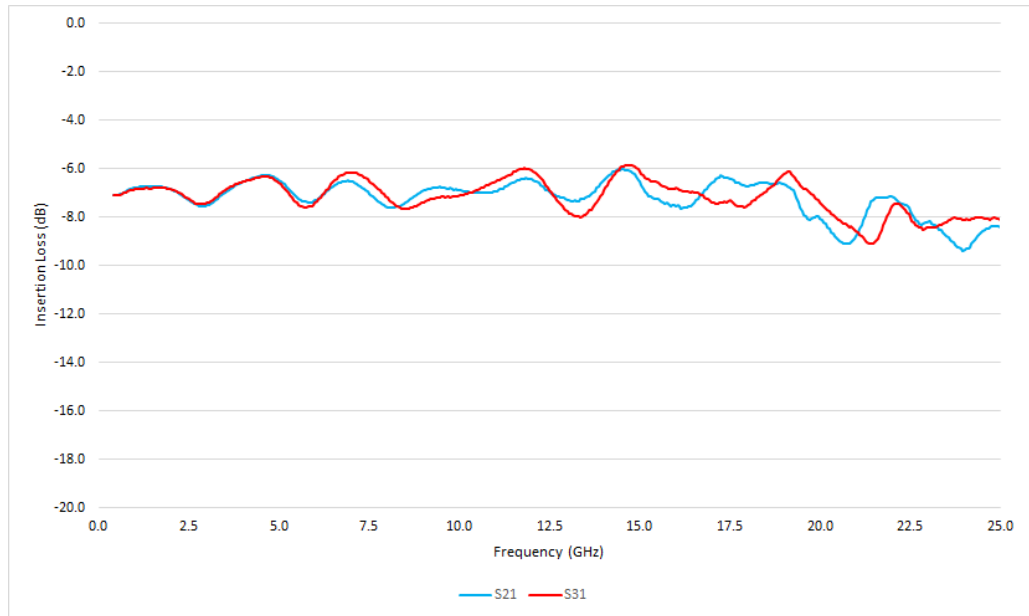


Figure 1: HL9491 Single-ended Insertion Loss

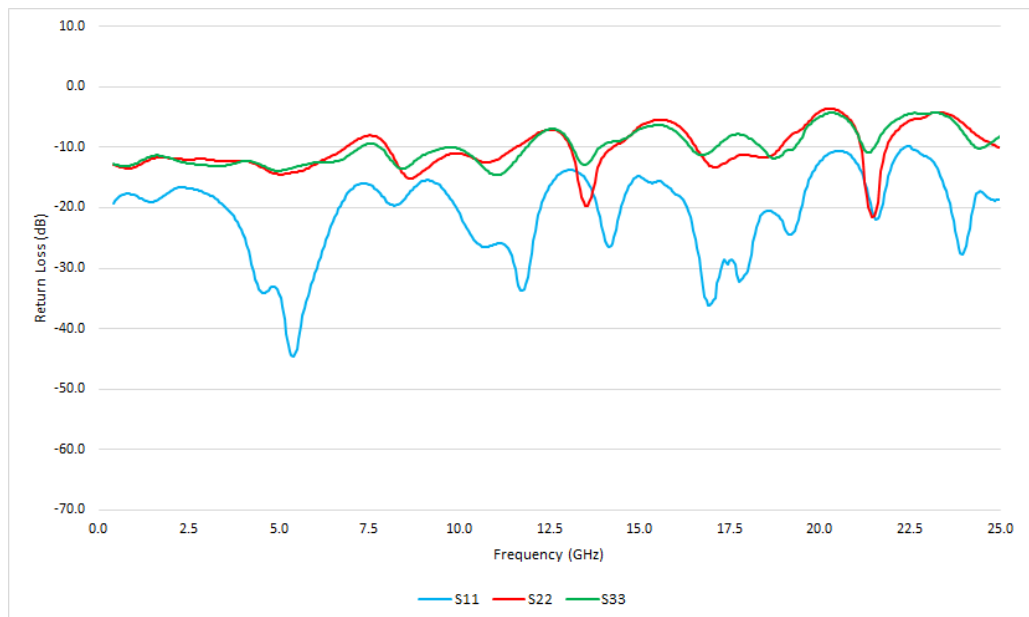


Figure 2: HL9491 Single-ended Return Loss

## HL9491 Mixed-mode Insertion Loss

Mixed-mode S-parameters are useful for characterizing the performance of differential circuits such as broadband baluns.

Figures 3-4 show the insertion loss of an HL9491 balun in mixed mode to 25 GHz.

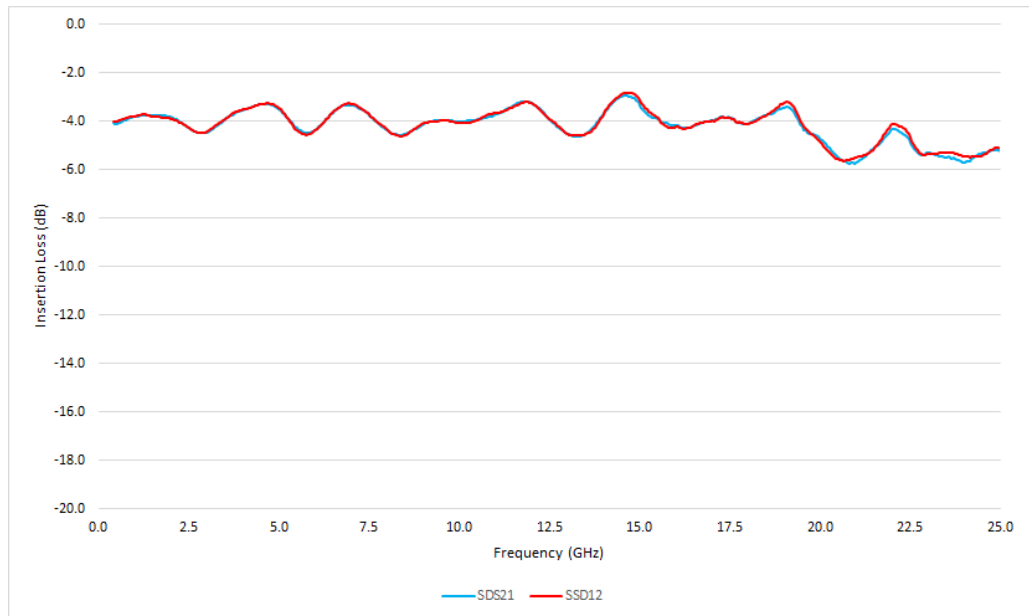


Figure 3: HL9491 Differential Mode Insertion Loss

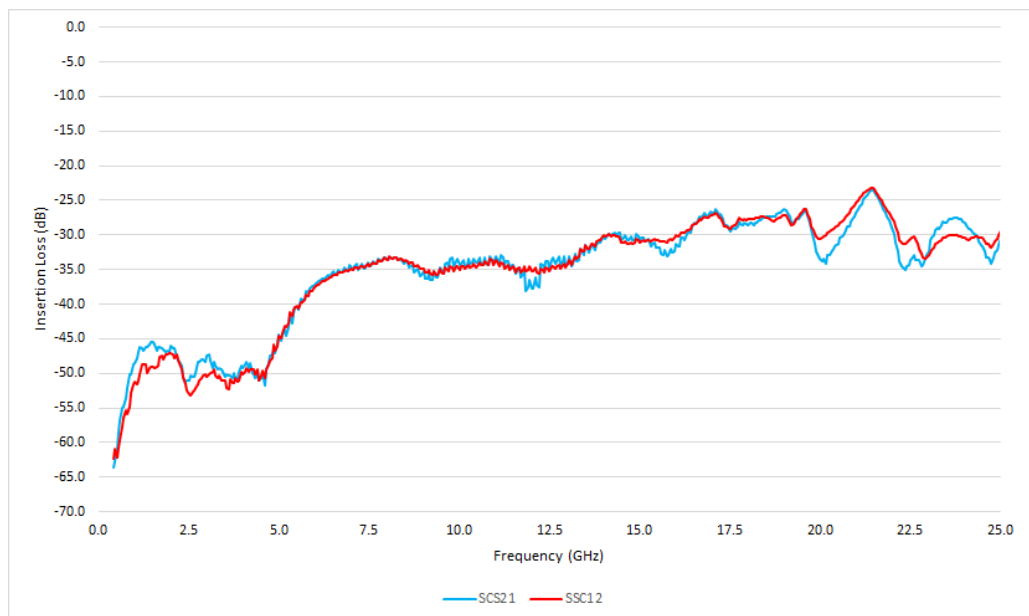


Figure 4: HL9491 Common Mode Insertion Loss

## HL9491 Mixed-mode Return Loss

Figure 5 shows the typical mixed-mode return loss of the unbalanced and balanced ports of an HL9491 to 25 GHz.

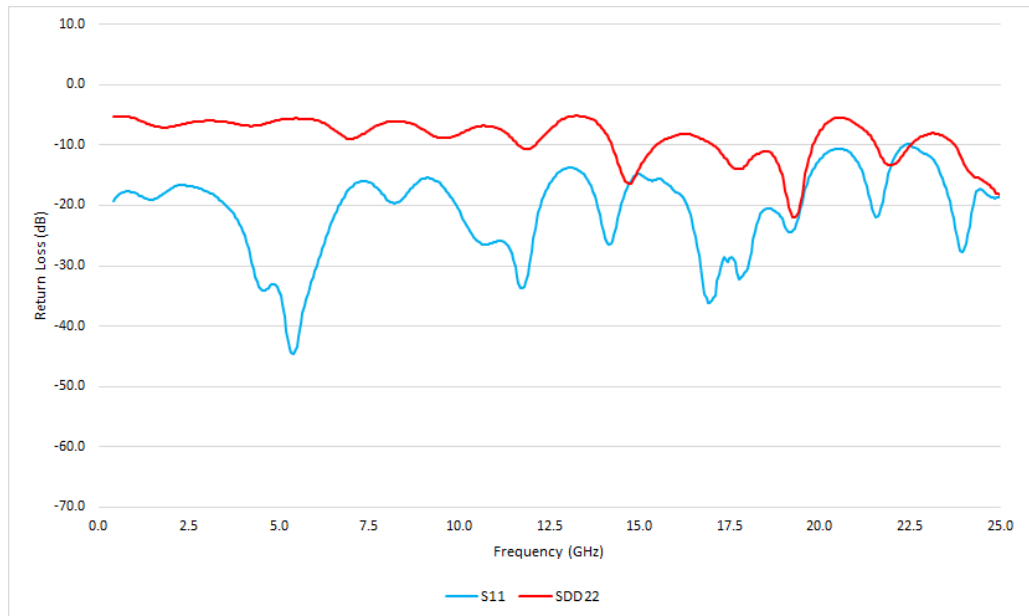


Figure 5: HL9491 Mixed-mode Return Loss

## HL9491 Eye Diagrams

The eye diagrams in Figures 6-7 show a 56 Gbps PRBS11 pattern passed through an HL9491. All plots are shown at 100 mV/div.

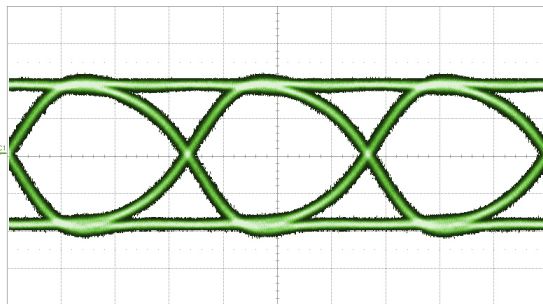


Figure 6: HL9491 56 Gbps PRBS 11, RF Input

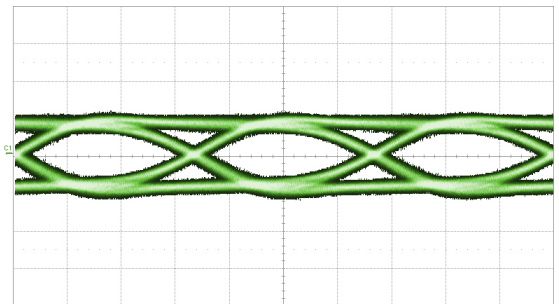


Figure 7: HL9491 56 Gbps PRBS 11, RF Output

## HL9491 Group Delay and Phase Match

Figure 8 shows the typical group delay of an HL9491 used as a signal splitter. The average slope of the phase mismatch, shown in Figure 9, is equal to the group delay mismatch.

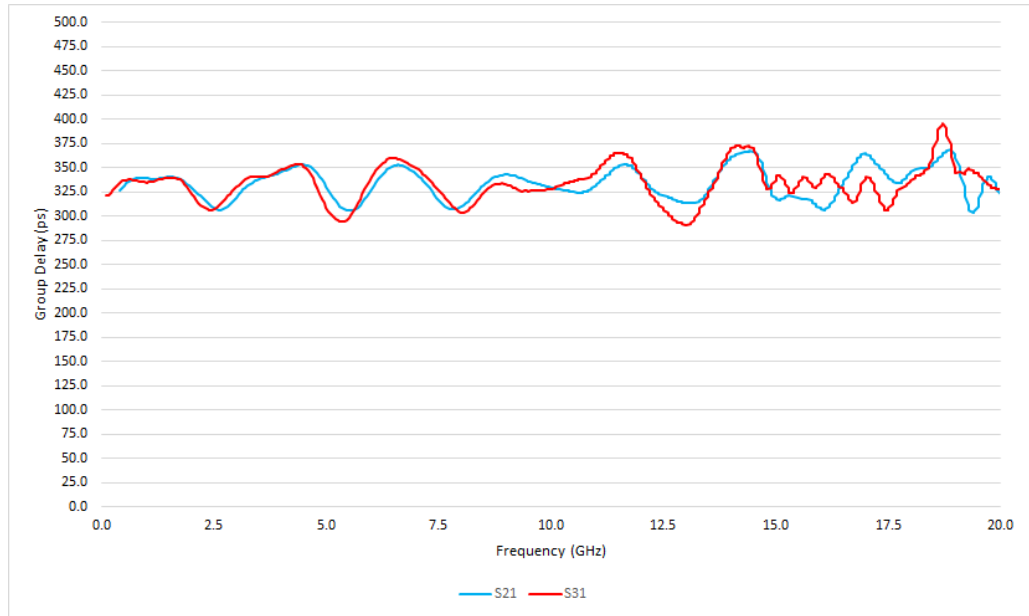


Figure 8: HL9491 Single-ended Group Delay

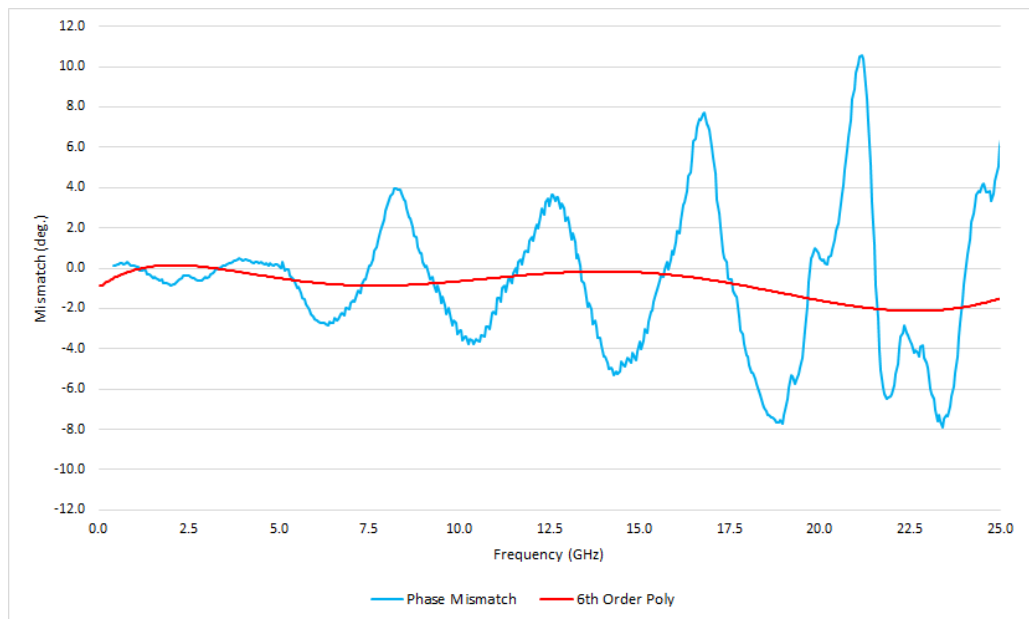


Figure 9: HL9491 Phase Mismatch

## HL9491 Footprint

Figure 10 shows the recommended footprint of an HL9491. Unless otherwise noted, all units are in inches. Other models vary in width based on connectors.

Figure 11 shows a drawing of the HL9490 Evaluation Board, available mounted with the HL9491 as Opt. -EVAL.

The HL9491 is designed to be compatible with the SAC305 thermal reflow profile. See the specs on Page 1 for specific temperatures.

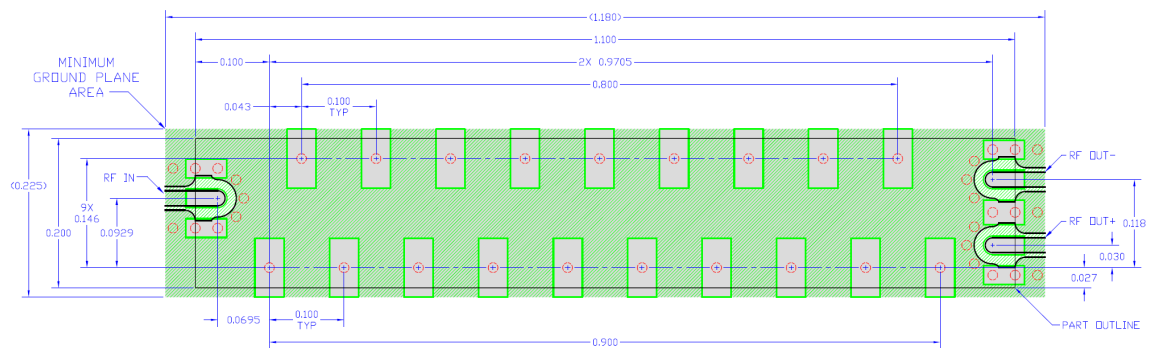


Fig. 10: HL9491 Recommended Footprint

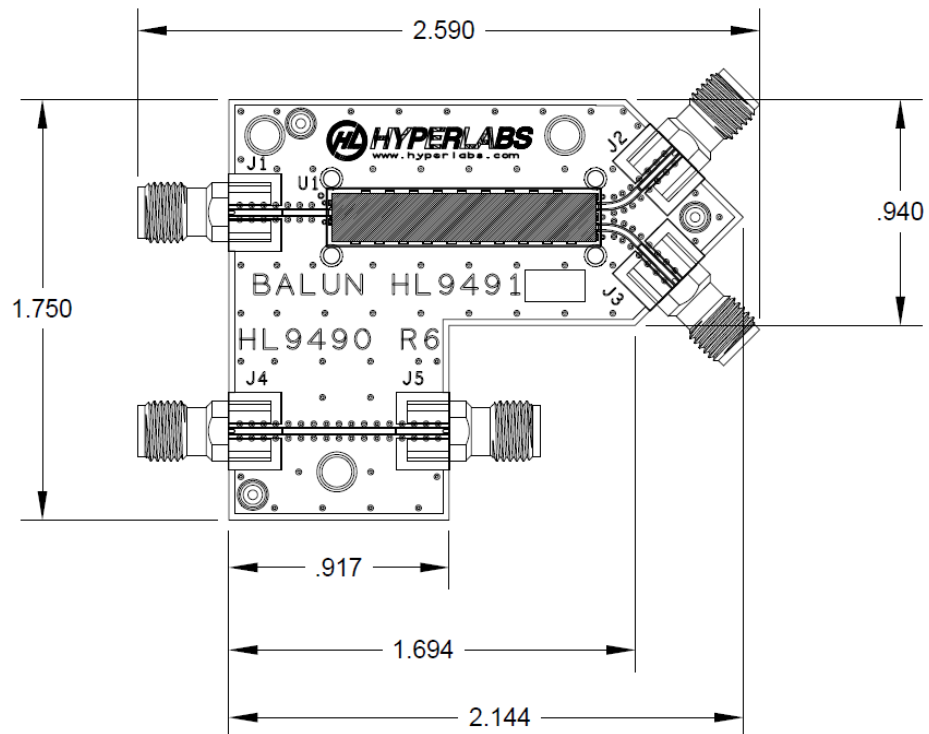


Fig. 11: HL9491-EVAL Evaluation Board