HL9405 Broadband Balun (50 GHz)

The HL9405 Broadband Balun offers industry-leading amplitude and phase match to 50 GHz.

Features and Technical Specifications

Bandwidth (-3 dB)	5 MHz to 50 GHz
Amplitude Balance (typical)	± 0.1 dB to 20 GHz ± 0.3 dB at 20-50 GHz see *Fig. 3* below
Phase Balance (typical)	± 2 degrees at 10 GHz ± 4 degrees at 18 GHz see note below
Rise time	10.5 ps
Insertion Delay	278 ps
Insertion Loss	-6 dB, see *Figs. 3-4* below
Return Loss	See *Figs. 5-6* below
Max Input Power	+30 dBm
Impedance	50 Ω In, 2 x 50 Ω Out
Isolation	RF Out +/- not isolated
Connectors	2.4 mm, 1 x Jack In, 2 x Jack Out
Dimensions	59.69 x 38.1 x 14 mm 2.35″ x 1.50″ x 0.55″
Weight	45.3 g 1.6 oz
Temperature Limits	0° to +40° C, operating -40° to +85° C, storage
RoHS Compliance	RoHS compliant; made with lead-free solder
Warranty	1 year, see our website for details

An S-parameters (.s3p) file for a typical HL9405 unit is available on our website.

The frequency domain charts shown on the following page are available in higher-resolution on our website: http://www.hyperlabsinc.com/HL9405.aspx

Figure 1: HL9405 Broadband Balun

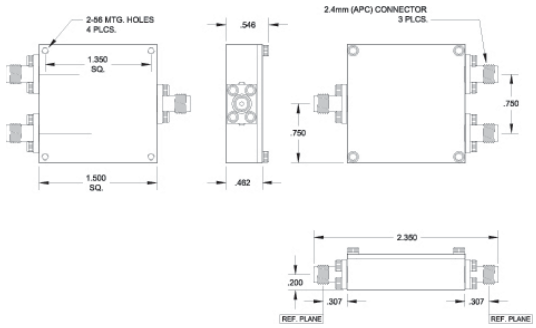

Figure 2: HL9405 Dimensional Drawing

Deployment Notes

If the DC voltage of the input or output is not zero, DC block capacitors are required.

Applications

- 50 Gbps communications systems
- Modulator drivers
- High-speed analog-to-digital converters
- Single-ended to differential data conversion
- Signal combiner

HL9405 Amplitude Match

In *Figures 3-4* below, typical HL9405 insertion loss is shown from 5 MHz to 50 GHz. The vertical axis in both charts is dB (-5 to -10).

The amplitude balance can be seen by comparing the blue trace, Non-inverting (+) Output, with the red trace, Inverting (-) Output.

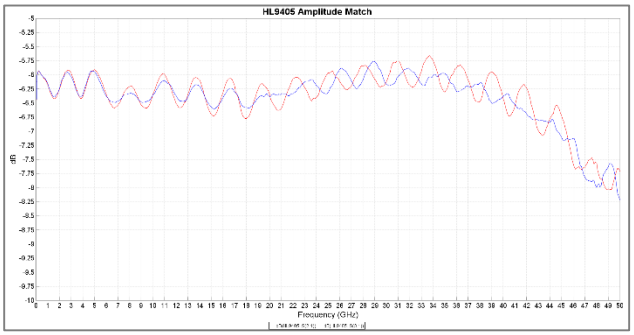

Figure 3: Typical insertion loss (S21/S31) measurements of the HL9405 RF Outputs

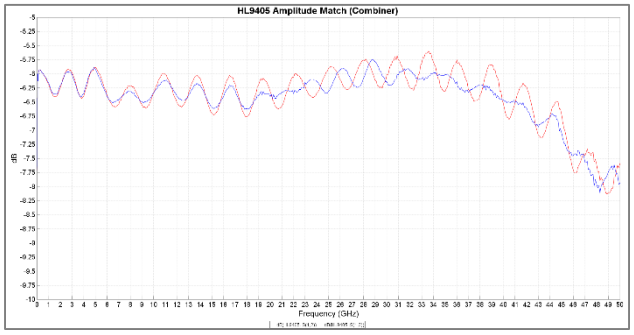

Figure 4: Typical insertion loss (S12/S13) of the HL9405 when used as a signal combiner

HL9405 Phase Match

The test system HYPERLABS uses to certify each unit has a maximum phase uncertainty of ± 2%.

Match is dependent on the delay of each RF Output. Phase match of 2 degrees at 10 GHz requires the RF Output delays be within ≈ 0.5 ps of each other.

For more details on phase match, please see the published S-parameters and Phase Uncertainty plot found on our website.

HL9405 Return Loss Measurements

In *Figure 5*, return loss on the HL9405 RF Input is shown from 5 MHz to 50 GHz. The vertical axis is dB (0 to -60).

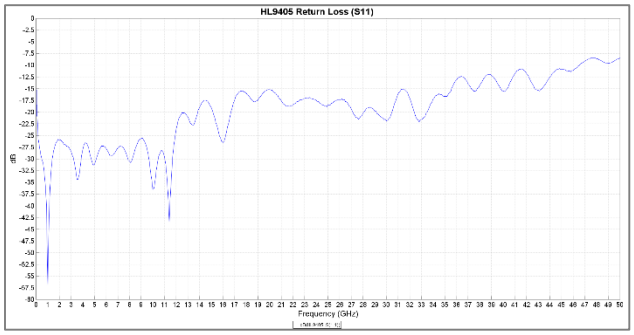

Figure 5: Typical return loss (S11) on the HL9405 RF Input

In *Figure 6*, the HL9405 used as a signal combiner. Return loss (S22 and S33) on the RF Outputs is shown from 5 MHz to 50 GHz. The vertical axis is dB (0 to -20).

The blue trace is the Non-inverting (+) RF Output. The red trace shows the Inverting (-) RF Output.

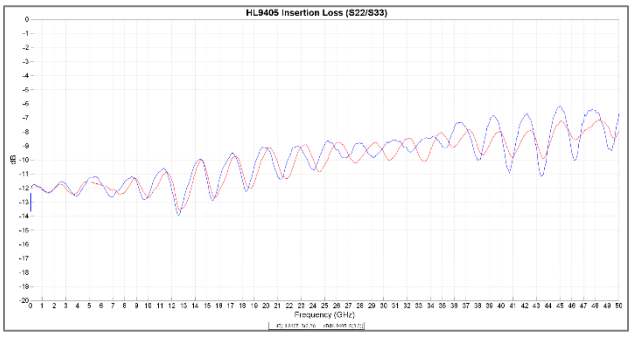

Figure 6: Typical return loss (S22/S33) on the HL9405 RF Outputs