HL956x Broadband Pick-off Tee (50 GHz)

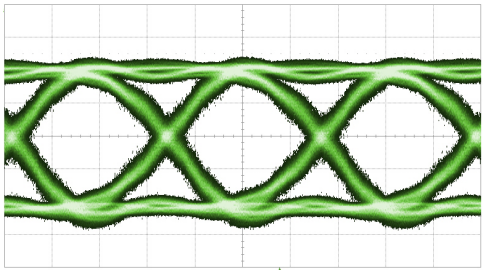
Key Features and Technical Specifications[1] (HL9565 opt.-14 shown)

Bandwidth	DC to 50 GHz, thru and pick-off lines
Insertion Loss (opt. -14)	0.9 (+0.1,-1.25) dB, thru 14.5 ± 2 dB, pick-off See *Fig. 1*
Return Loss (opt.-14)	< 13 dB, thru line < 3.5 dB, pick-off line See *Fig. 3*
Amplitude Match (opt. -M only)	± 0.1 dB See *Fig. 2*
Phase Match (opt. -M only)	± 2°, f = 10 GHz
Group Delay	≈ 130 ps, thru line (all opts.) ≈ 137 ps, pick-off line (all opts.) *See Fig. 5*
Connectors	2.40 mm jack, all ports (opt. -JJJ) 2.40 mm jack, Thru 1 and Pick-off; 2.40 mm plug, Thru 2 (opt. -JPJ)
Unit Dimensions	32.69 x 24.23 x 13.59 mm 1.29” x 0.95” x 0.54”
RoHS Compliant	Yes
REACH Compliant	Yes

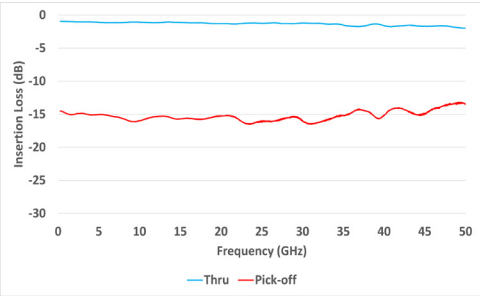
NOTE 1 - The specifications in this table are typical using the standard connector configuration (-JPJ, jack/plug/jack).. Full specifications are available on page 2 of this datasheet.



HL9565, opt. -M-JPJ shown



56 Gbps NRZ pattern on the Thru Out port of HL9565-20-JPJ; see also Figs. 11-13



Typical Insertion Loss on thru and pick-off lines of HL9565 (opt.-14-JPJ); see also Fig. 1

PRODUCT SUMMARY

The HL956x series is a pick-off tee with a flat frequency response from DC up to 50 GHz on the thru and pick-off lines.

It is suitable as a trigger source with minimum perturbation of the thru signal path.

Digital oscilloscope applications include pre-scaler triggering, synchronization, and clock/data recovery.

DEPLOYMENT NOTES

Some of the specifications in this datasheet are only applicable to matched pairs of devices and are labeled accordingly.

S-PARAMETERS

S-parameters are available on our website.

MODELS & OPTIONS

The following models are available:

- ***HL9562***, 26.5 GHz
- ***HL9564***, 40 GHz
- ***HL9565***, 50 GHz

The following options and configurations are available for this product:

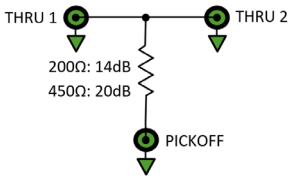
- ***-M***, matched pair
- ***-U***, unmatched part(s)

- ***-14***, 14 dB nominal insertion loss on pick-off
- ***-20***, 20 dB nominal insertion loss on pick-off

- ***-JJJ***, jack (female), all ports
- ***-JPJ***, jack (female) thru in and pick-off; plug (male) thru out

DEVICE PORT ASSIGNMENTS

For the purposes of this datasheet, the below port assignments are used.



HL956x Full Specifications

Parameter	HL9562	HL9564	HL9565	Comments
Bandwidth	DC to 26.5 GHz, thru and pick-off	DC to 40 GHz, thru and pick-off	DC to 50 GHz, thru and pick-off	3 dB roll-off point, relative to nominal insertion loss
Insertion Loss See *Fig. 1*	1.1 (+0.1,-0.5) dB, thru 14.5 ± 2 dB, pick-off	0.9 (+0.1,-1.0) dB, thru 14.5 ± 2 dB, pick-off	0.9 (+0.1,-1.25) dB, thru 14.5 ± 2 dB, pick-off	Opt. -14
Insertion Loss See *Fig. 6*	0.4 (+0.1,-1.0) dB, thru 20.5 ± 2 dB, pick-off	0.45 (+0.1,-1.4) dB, thru 20.25 ± 2 dB, pick-off	0.45 (+0.1,-1.25) dB, thru 20.5 ± 3 dB, pick-off	Opt. -20
Return Loss, Thru See *Figs. 3, 8*	< 18 dB, thru (opt. -14) < 20 dB, thru (opt. -20)	< 12 dB, thru (opt. -14) < 13 dB, thru (opt. -20)	< 13 dB, thru (opt. -14) < 12 dB, thru (opt. -20)	
Return Loss, Pick-off See *Figs. 3, 8*	< 4.5 dB, pick-off (opt. -14) < 2.5 dB, pick-off (opt. -20)	< 4.0 dB, pick-off (opt. -14) < 1.8 dB, pick-off (opt. -20)	< 3.5 dB, pick-off (opt. -14) < 1.75 dB, pick-off (opt. -20)	
Amplitude Match See *Figs.2, 7*	± 0.1 dB	± 0.1 dB	± 0.1 dB	Matched pair (opt. -M) only
Phase Match	± 2.°, f = 10 GHz			Matched pair (opt. -M) only
Rise Time	17.5 ps	9.0 ps	7 ps	
Group Delay *See Figs. 5, 10*	127 ps, thru 137 ps, pick-off	110 ps, thru 120 ps, pick-off	130 ps, thru 137 ps, pick-off	All options
Max Input Power	+36 dBm (4 W)	+33 dBm (2 W) (opt.-14) +36 dBm (4 W) (opt.-20)	+33 dBm (2 W) (opt.-14) +36 dBm (4 W) (opt.-20)	
Pick-off Resistor	200 Ω ± 2% (opt.-14) 450 Ω ± 2% (opt.-20)			
Impedance	41.7 Ω (opt.-14) 45.5 Ω (opt.-20)			
Connectors	SMA, 3x jack SMA, jack/plug/jack	2.92 mm, 3x jack 2.92 mm, jack/plug/jack	2.4 mm, 3x jack 2.4 mm, jack/plug/jack	opt. -JJJ opt. -JPJ
Dimensions (W x D x H)	1.23” x 0.90” x 0.54” 31.24 x 22.86 x 13.59 mm	1.10” x 0.90” x 0.54” 26.41 x 22.86 x 13.59 mm	1.29” x 0.95” x 0.54” 32.69 x 24.23 x 13.59 mm	Package including connectors
Weight	15 g (0.53 oz.)	15 g (0.53 oz.)	15 g (0.53 oz.)	
Operating Temperature	-40° to +40° C			Case temperature
RoHS Compliant	Yes, assembled with lead-free solder			
REACH Compliant	Yes			
Warranty	1 year, repair or replacement; see website for details			

Note: All specifications are based on test results using the standard connector configuration (-JPJ). Specifications may vary slightly for other configurations.

HL9565-14 Plot Diagrams

Figures 1-5 show the typical insertion loss, return loss, VSWR, amplitude matching, and group delay plots for an HL9565 opt. -14. The plots for the HL9562 and HL9564 will be similar through their respective frequency bandwidths.

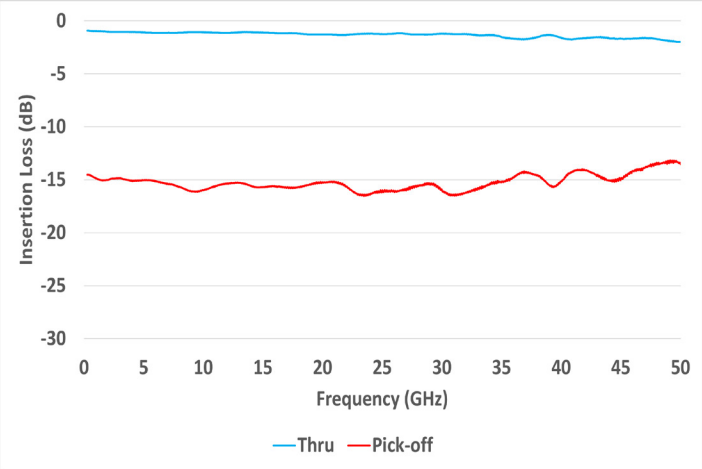


Figure 1: HL9565 Insertion Loss (-JPJ)

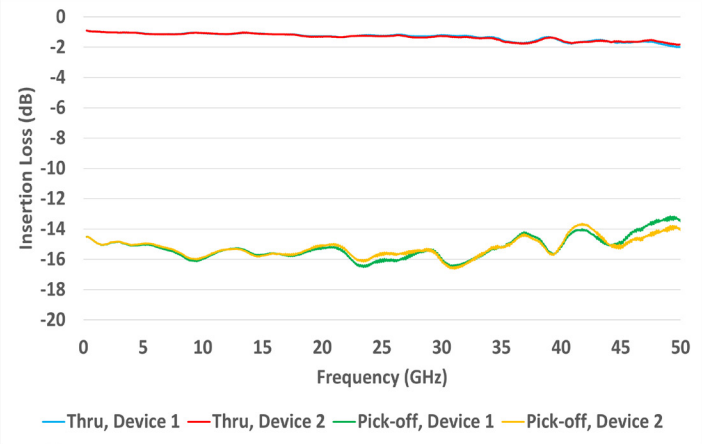


Figure 2: HL9565 Amplitude Match (-JPJ)

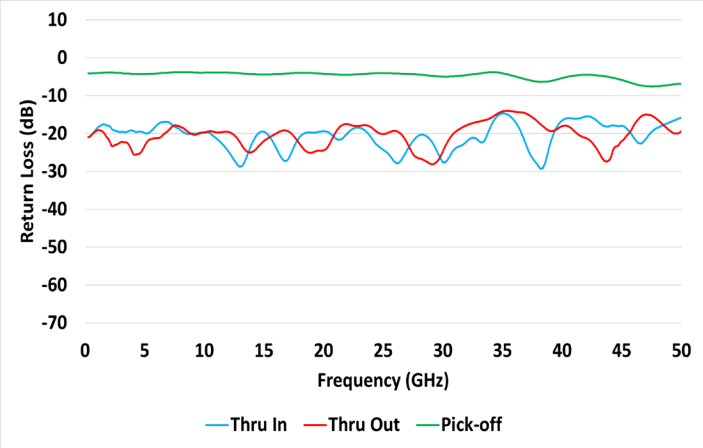


Figure 3: HL9565 Return Loss (-JPJ)

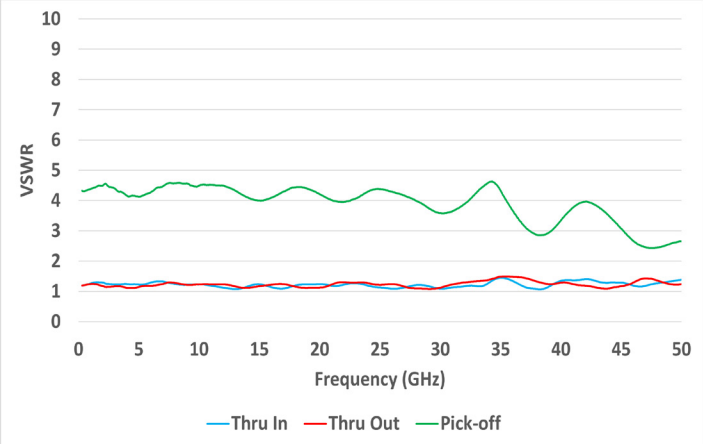


Figure 4: HL9565 VSWR (-JPJ)

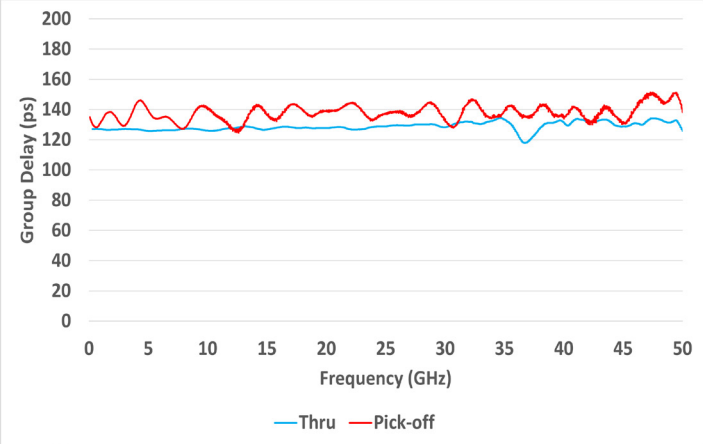


Figure 5: HL9565 Group Delay (-JPJ)

HL9565-20 Plot Diagrams

Figures 5-10 show the typical insertion loss, return loss, VSWR, amplitude matching, and group delay plots for an HL9465 opt. -20. The plots for the HL9562 and HL9564 will be similar through their respective frequency bandwidths.

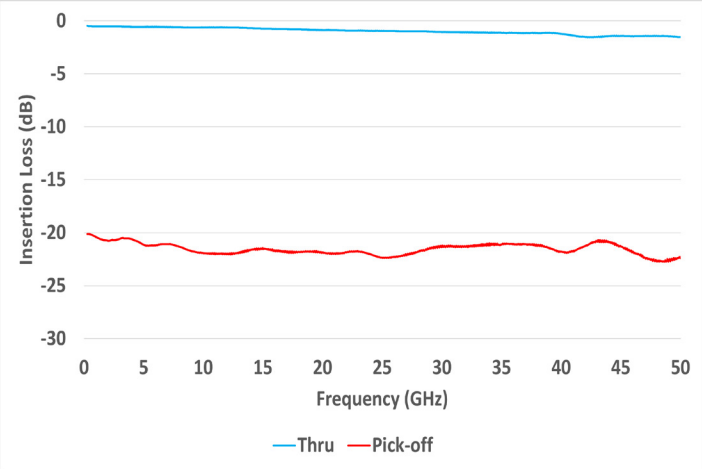


Figure 6: HL9565 Insertion Loss (-JPJ)

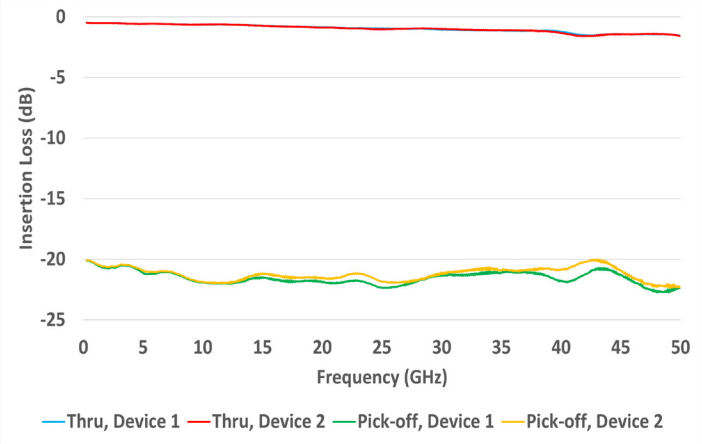


Figure 7: HL9565 Amplitude Match (-JPJ)

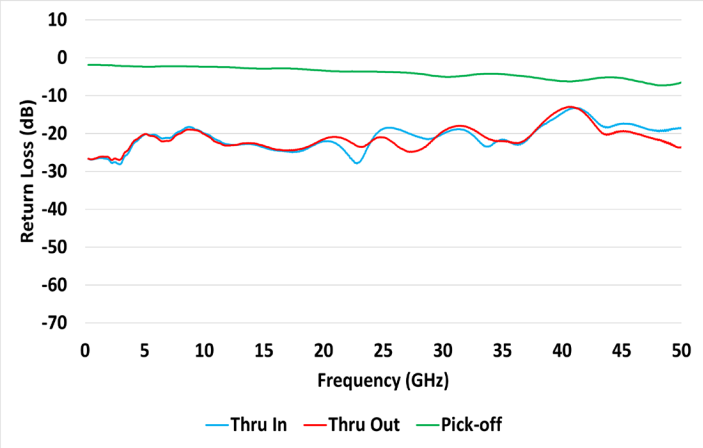


Figure 8: HL9565 Return Loss (-JPJ)

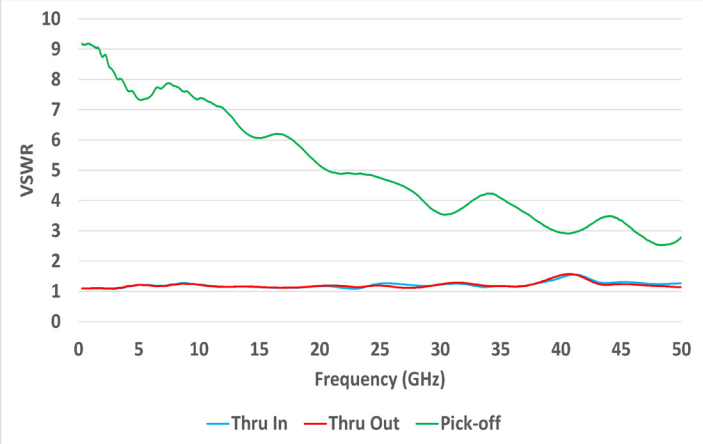


Figure 9: HL9565 VSWR (-JPJ)

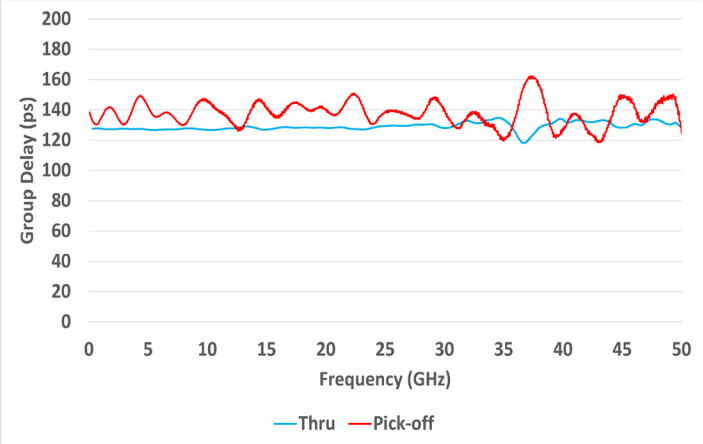


Figure 10: HL9565 Group Delay (-JPJ)

HL9565-20 Eye Diagrams

The eye diagrams in *Figures 11-13* show an NRZ pattern at 56 Gpbs. The input signal has an amplitude of 809 mV. The thru output is 809 mV at a scale of 150 mV/div and the pick-off output is 196 mV at a scale of 106 mV/div.

The eye diagrams in *Figures 14-16* show a PAM4 pattern at 56 Gpbs. The input signal has an amplitude of 860 mV. The thru and output is 859 mV at a scale of 166 mV/div and the pick-off output is 209 mV at a 54 mV/div scale.

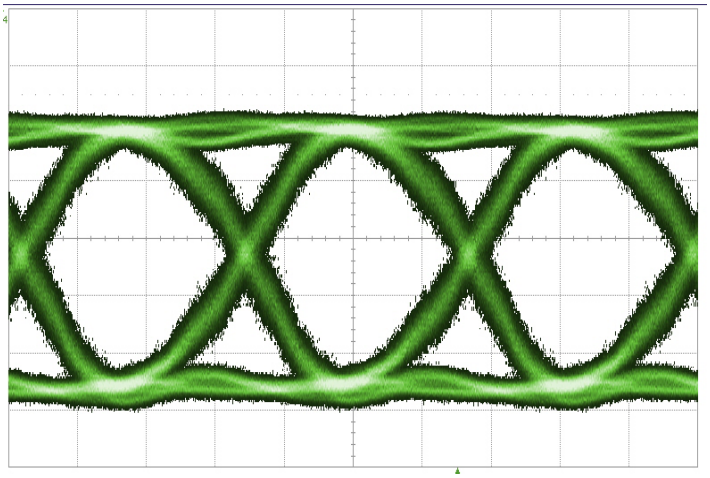


Figure 11: 56 Gbps NRZ pattern on RF In

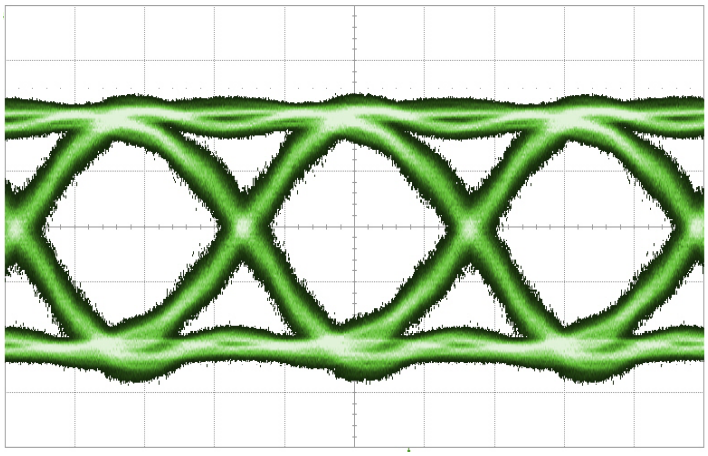


Figure 12: 56 Gbps NRZ pattern on Thru Out

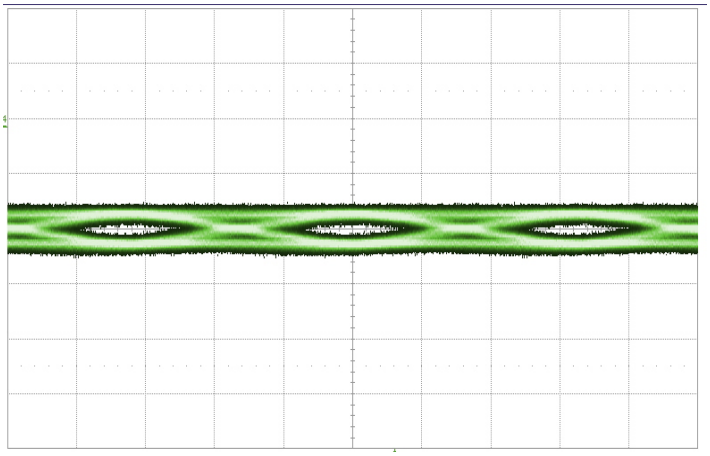


Figure 13: 56 Gbps NRZ pattern on Pick-off Out

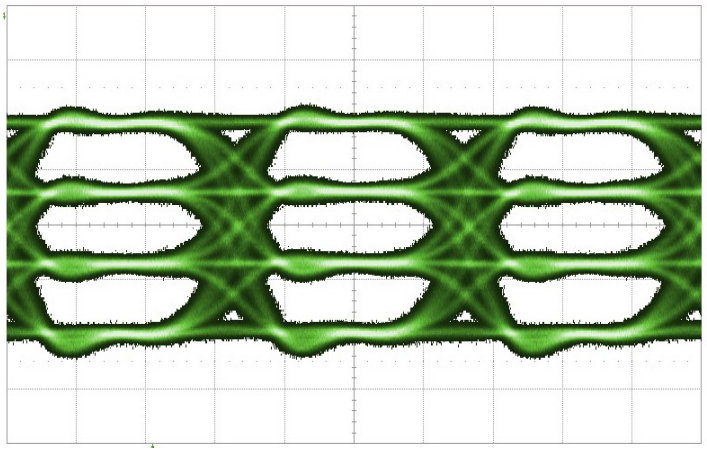


Figure 14: 56 Gbps PAM4 pattern on RF In

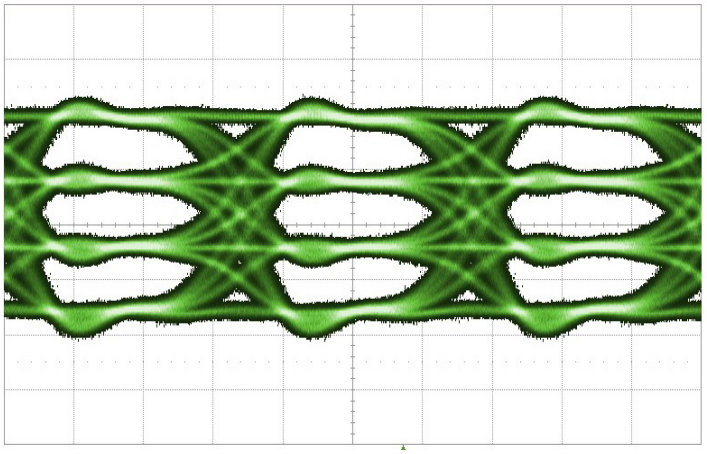


Figure 15: 56 Gbps PAM4 pattern on Thru Out

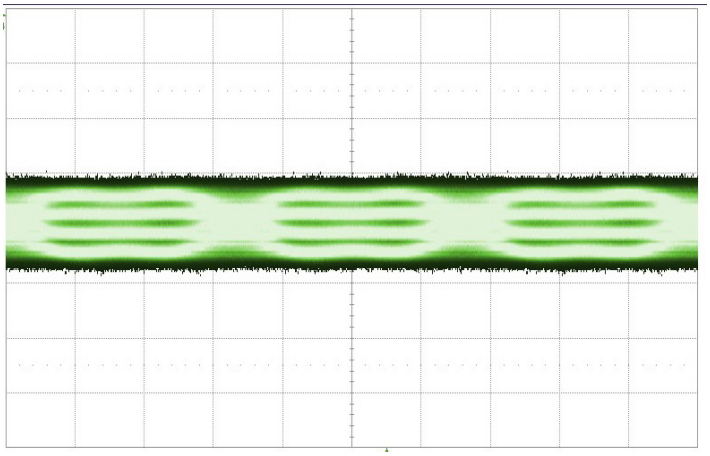


Figure 16: 56 Gbps PAM4 pattern on Pick-off Out

HL9565 Dimensional Drawing

Figure 17 shows a mechanical drawing of an HL9565, option -JPJ. Unless otherwise noted, all units are in inches.

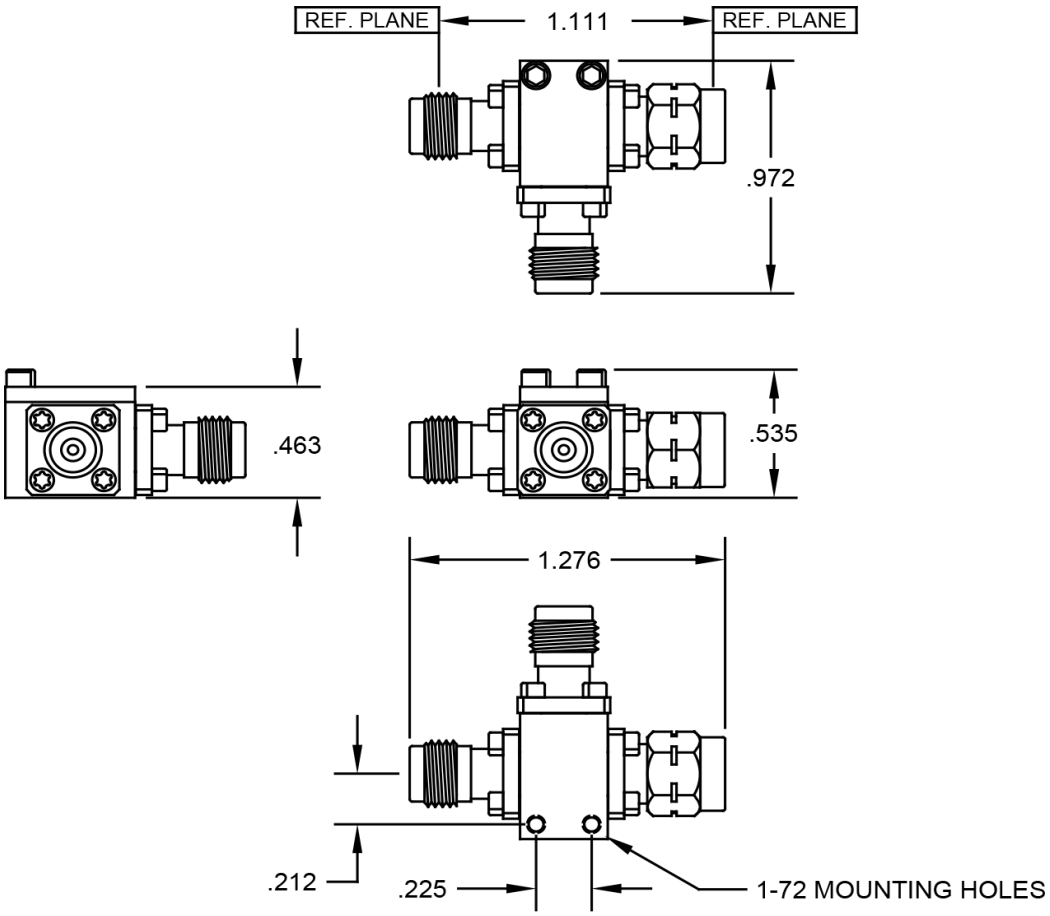


Figure 17: HL9565 mechnical drawing (opt. -JPJ)