HYPERLABS™
Innovation at Hyperspeed since 1992

HL941x Series Pulse Inverters (150 kHz to 100 GHz)

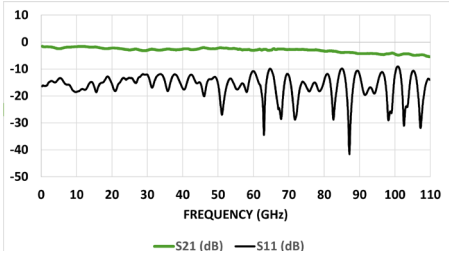
Features and Technical Specifications[1] (HL9419 shown)

Bandwidth	150 kHz to 100 GHz
Insertion Loss	2 dB, 150 kHz < f ≤ 100 GHz See *Fig. 1*
Return Loss	10 dB, 150 kHz < f ≤ 100 GHz See *Fig. 2*
Input Power	1 W (30 dBm)
Group Delay	255 ps See *Fig. 3*
Rise Time (10-90%)	3 ps
Connectors (PORT 1 / PORT 2)	1.0 mm, jack/jack (opt. -JJ) 1.0 mm, jack/plug (opt. -JP), standard 1.0 mm, plug/plug (opt. -PP)
Temperature Limits	-40° to +50° C, case
RoHS Compliant	Yes, assembled with lead-free solder
REACH Compliant	Yes
Warranty	1 year, see website

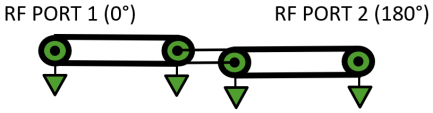
Note 1 - Unless otherwise noted, the specifications in this table are typical for Model Number HL9419 using the standard configuration (-JP). See page 2 for full specifications for each model.



HL9419, Option -JP shown



Typical HL9419 Insertion and Return Loss



HL9419 Schematic and Port Assignments

PRODUCT SUMMARY

The HL9417 and HL9419 are ultra-broadband Pulse Inverters with a typical fixed insertion loss of 2 dB with a very flat frequency response over the specified bandwidth.

These devices are used to invert a signal in the time domain, corresponding to a 180° shift in the frequency domain. The inverters are bi-directional with regards to the applied signal.

The cross-connection of the coaxial center conductor and outer ground along with ferrites and microwave absorber are used to accomplish the inversion.

Typical Applications:

- Test & Measurement
- High-speed data systems
- Pulse experiments
- RADAR

MODELS & OPTIONS

The following models are available:

HL9417, 67 GHz
HL9419, 100 GHz

The following options are available:

-JJ, jack RF 1 and RF 2
-JP, jack RF 1, plug RF 2
-PP, plug RF 1 and RF 2

Other connector series are available upon request (e.g., 2.92mm).

HL9417 and HL9419 Full Specifications

Parameter	HL9417	HL9419	Comments
Upper Frequency Limit	> 67 GHz	> 100 GHz	
Lower Frequency Limit	150 kHz		
Input Power	1 W (30 dBm)		
Insertion Loss See *Fig. 1*	2 dB; 150 kHz < f ≤ 70 GHz	2 dB; 150 kHz < f ≤ 100 GHz	Typical
Return Loss See *Fig. 2*	10 dB, 150 kHz < f ≤ 70 GHz	10 dB, 150 kHz < f ≤ 100 GHz	Typical
Rise Time	5 ps	3 ps	Typical
Group Delay See *Fig. 3*	265 ps	255 ps	
Connectors	1.85 mm	1.0 mm	Other connector series are available upon request (eg. 2.92mm).
Impedance	50 Ω		Input and Output
Dimensions (W x D x H)	2.39" x 0.8" x 0.4" 60.7 x 20.3 x 10.2 mm		Package including connectors (1.0 mm option)
Weight	25 g (0.88 oz.)		
Operating Temperature	-40° to +50° 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 (jack/plug). Specifications may vary slightly for other configurations.

HL9419 Plots

Figures 1 and 2 show the Insertion Loss and Return Loss of the HL9419 to 110 GHz.

Figure 3 shows the Group Delay of the HL9419 to 110 GHz.

Figures 4 and 5 show the Time Domain waveforms of a 12 ps pulse with corresponding inverted output pulse.

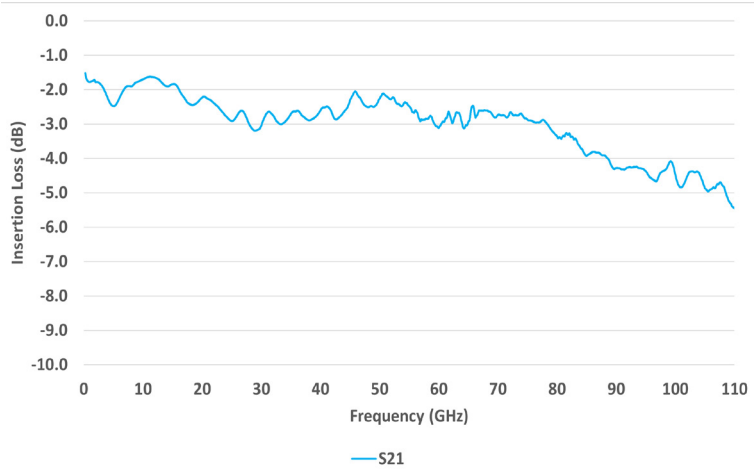


Figure 1: Typical HL9419 Insertion Loss

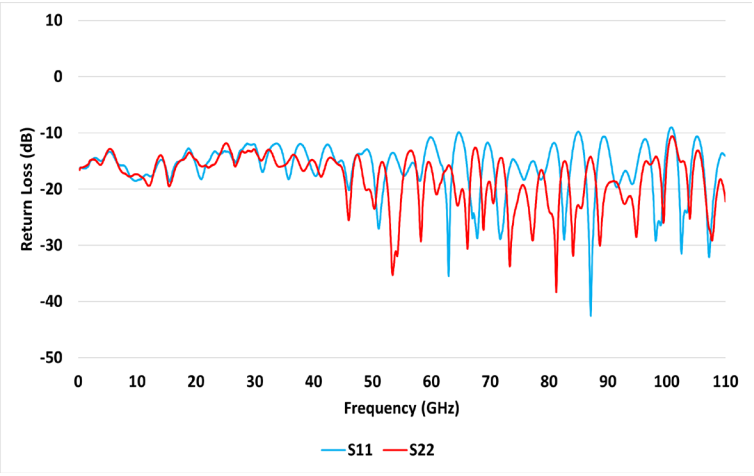


Figure 2: Typical HL9419 Return Loss

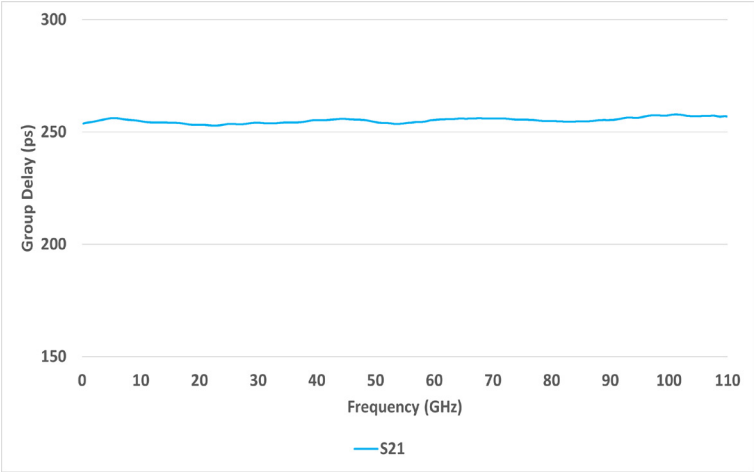


Figure 3: Typical HL9419 Group Delay

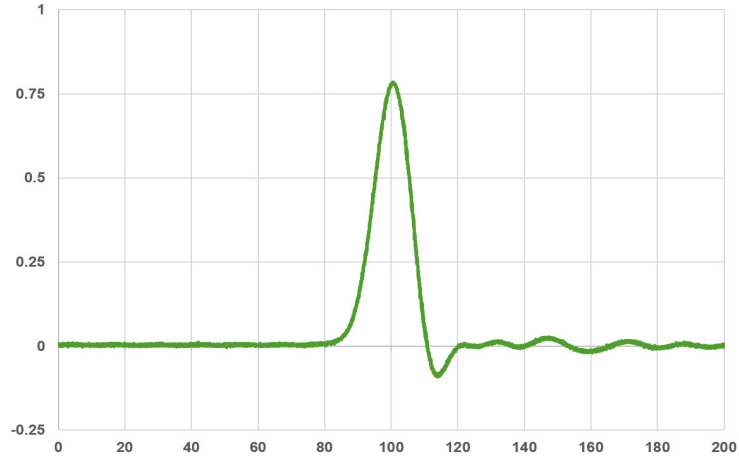


Figure 4: HL9417 12.4 ps Input Pulse

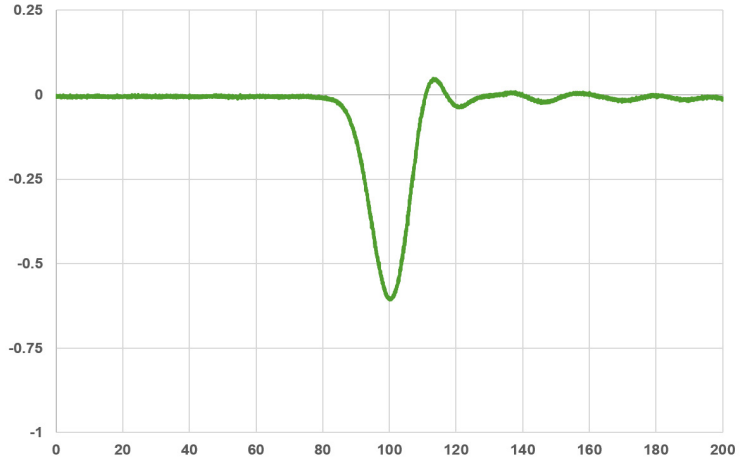


Figure 5 HL9417 12.8 ps Inverted Output Pulse

HL9419 Dimensional Drawing

Figure 6 shows a mechanical drawing of an HL9419-JP. Unless otherwise noted, all units are in inches. See page 2 for full dimensions.

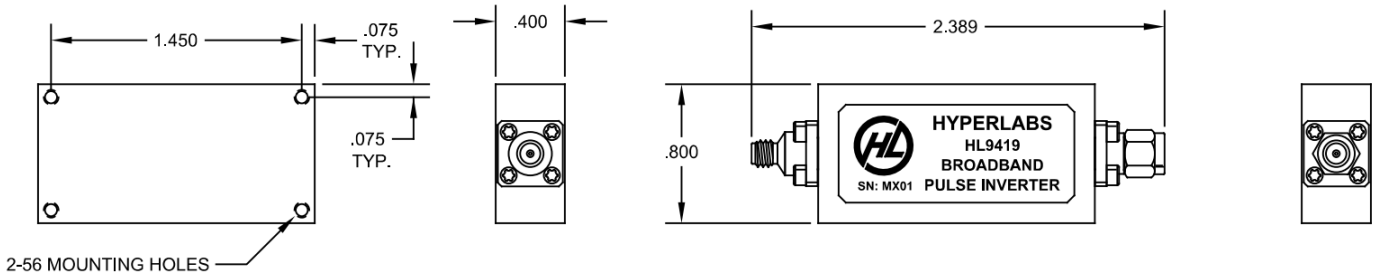


Fig 6: HL9419 Mechanical Drawing