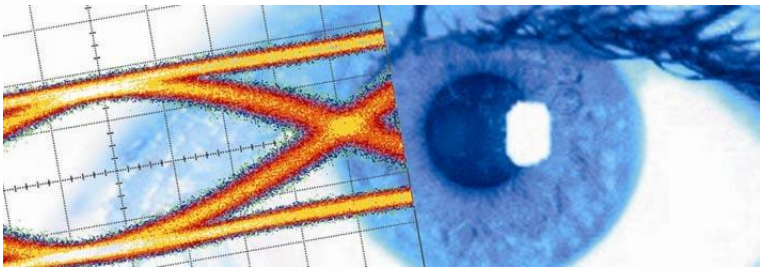
SHF Communication Technologies AG

Wilhelm-von-Siemens-Str. 23D • 12277 Berlin • Germany

Phone ++49 30 772 051-0 • Fax ++49 30 753 10 78

E-Mail: sales@shf.de • Web: http://www.shf.de



Datasheet

SHF 46121 A

Optical Transmitter

Description

The SHF 46121 A is a stand-alone optical transmitter unit.

This optical transmitter converts electrical signals into optical signals at a data rate of at least 56 Gbps in ASK (amplitude shift keying) format.

PAM signal generation is possible up to ~ 40 GBaud when driving the data input with an electrical PAM signal.

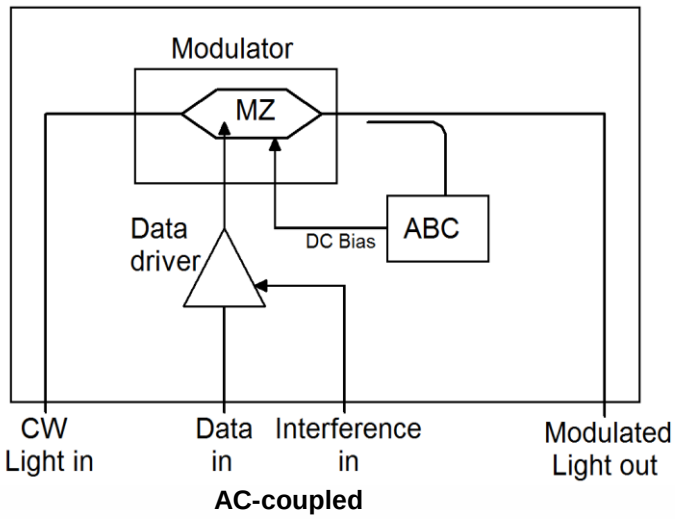
The main element of the SHF 46121 A is a thermally stable Chirp-free Lithium Niobate Mach-Zehnder modulator which is driven by an individually optimized amplifier.

The temperature stable modulator and an automatic bias circuit ensure high stability of the output signal.

Features

- ≥ 56 Gbps optical data streams
- < 9 ps rise and fall time digital optical signals
- PAM 4 up to 40 GBaud
- Modulators' bias condition controlled automatically
- SONET/SDH compatible
- Stressed eye generation for optical compliance testing
- Interference input to set the Vertical Eye Closure Penalty (VECP)

Functional Block Diagram



AC-coupled

Specifications – SHF 46121 A

Parameter	Unit	Min.	Typ.	Max.	Conditions
Absolute Maximum Ratings					
Optical Input Power	dBm	6		13	
Data Input Level	V_{pp} (dBm)			2 10	NRZ data
Interference Input Level	V_{pp} (dBm)			2 10	
DC Input Voltage (Data & Interference Input)	V			±9	
Optical Parameters					
Wavelength Range	nm	1550 +/- 50			
Insertion Loss	dB		7	8	connector to connector, maximum transmission without modulation
DC Extinction Ratio	dB		>20		
Return Loss	dB		>20		
Electrical and electro-optical parameters					
Electro-Optical Bandwidth of Modulator	GHz	20			-3dB electrical
Min. Bit Rate	Gbps			2	
Max. Bit Rate		56	60		ASK
Electrical Return Loss of Data Input	dB		-12	-10	1 MHz – 30 GHz
Data Input Level @ 32 Gbps	V_{pp} (dBm)		0.1 (-16) 0.2 (-10) 0.25 (-8)		ExtRatio = 6 dB ExtRatio = 10 dB ExtRatio = 12 dB
Data Input Level @ 56 Gbps	V_{pp} (dBm)		0.18 (-11) 0.25 (-8) 0.35 (-5)		ExtRatio = 6 dB ExtRatio = 10 dB ExtRatio = 12 dB
Dynamic Extinction Ratio	dB	11	12		Data input level : 0.25 V … 0.35 V, ≤ 50 Gbps, ASK
	dB	9			Data input level : 0.3 V … 0.5 V, ≤ 56 Gbps, ASK
Dynamic Signal to Noise Ratio		14	16		≤ 50 Gbps, ASK
		10			≤ 56 Gbps, ASK
Output Rise and Fall Times	ps		8	9	* Note

* Note: rise time 20%…80% as displayed on 70 GHz oscilloscope, measured with drive level set to max. S/N

Electrical and electro-optical parameters					
Output Timing Jitter <RMS>	ps		1.0	1.2	Measured with SHF Pattern Generator, precision timebase DCA. De-embedded from 32 Gbps NRZ electrical data source
Crossing NRZ	%	45	50	55	* Note
Interference Input					
Low frequency limit	KHz		50	100	
High frequency limit	MHz	700	1000		
Input Voltage Interference Input	V_{pp}			1	
Auto-bias control (ABC)					
Dither Signal Frequency	kHz		10		

* Note: Input crossing = 50 %, signal measured with drive level set to max. S/N

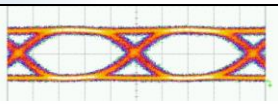
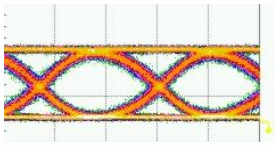
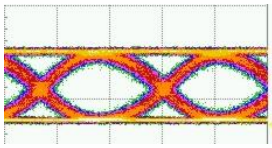
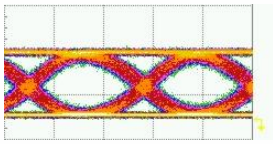
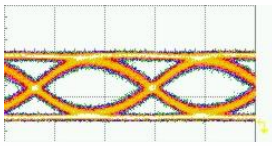
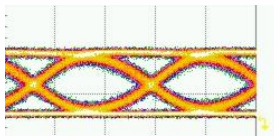
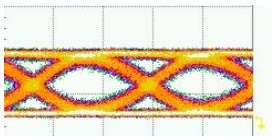
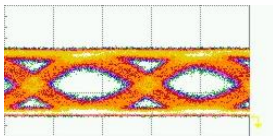
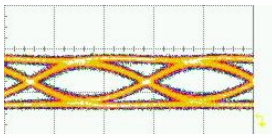
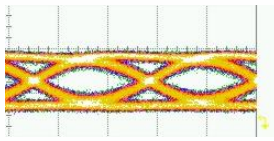
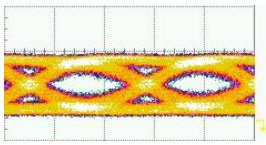
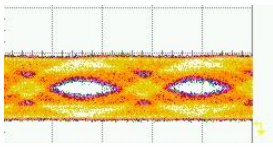
General Specifications

Parameter	Unit	Min.	Typ.	Max.	Conditions
Weight	kg		0.82		
Dimensions (W x H x D)	mm		115 x 64 x 174		w/o Frontpanel -Connectors
Power Consumption	W		10		+12V switching power supply is included
Operating Temperature	°C	10		35	
Electrical Data Input Connector					K (2.9mm) female
Interference Input Connector					K (2.9mm) female
Optical Connectors			FC/PC		PMF in, key aligned to slow axis, SMF out

Stressed Eye Generation

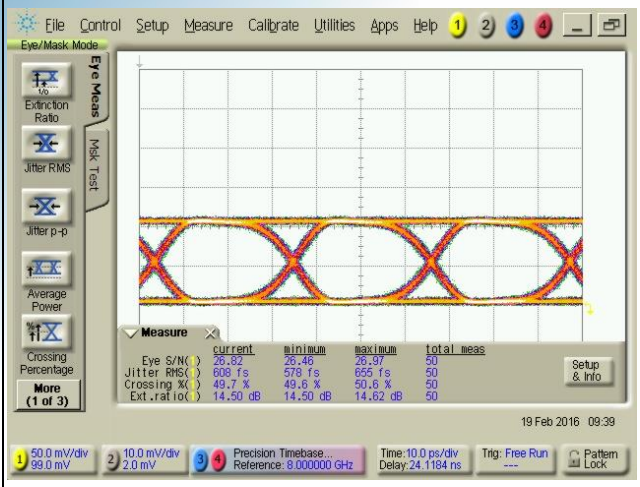
When driving the transmitter with an input signal below the compression level of ~ 450 mV_{pp}, a stable but impaired eye diagram is generated.

Additional stress can be superposed by adding an external interference signal via a dedicated interference input.

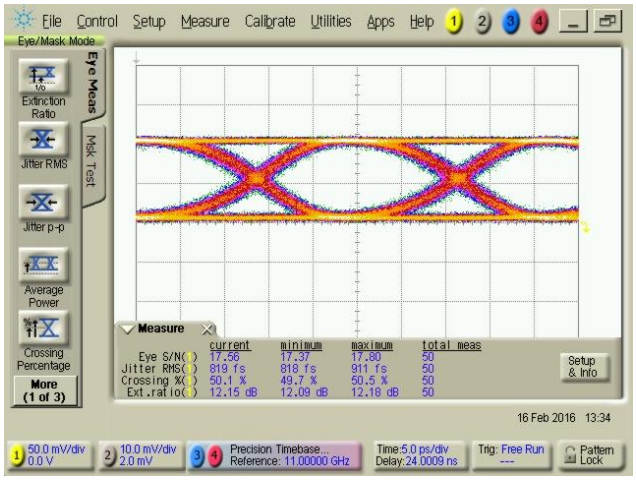
44 GBit/s	No interferer	200 mV_{pp} interference	400 mV_{pp} interference	600 mV_{pp} interference
Best signal quality 300 mV drive amplitude	 S/N: 16.9 ExtRatio:11.8 dB	Interference has no significant influence on signal		
250 mV drive amplitude	 S/N: 13 ExtRatio: 11.1 dB	Interference has no significant influence on signal	 S/N: 11.8 ExtRatio: 10.9 dB	 S/N: 11.3 ExtRatio: 10.6 dB
200 mV drive amplitude	 S/N: 8.6 ExtRatio: 9.3 dB	 S/N: 8.3 ExtRatio: 9.2 dB	 S/N: 7.4 ExtRatio: 9.2 dB	 S/N: 6.4 ExtRatio: 9.1 dB
150 mV drive amplitude	 S/N: 7 ExtRatio: 6.0 dB	 S/N: 6.1 ExtRatio: 6.0 dB	 S/N: 5 ExtRatio: 6.2 dB	 S/N: ~3.5 ExtRatio: ~6 dB

Typical ASK Results

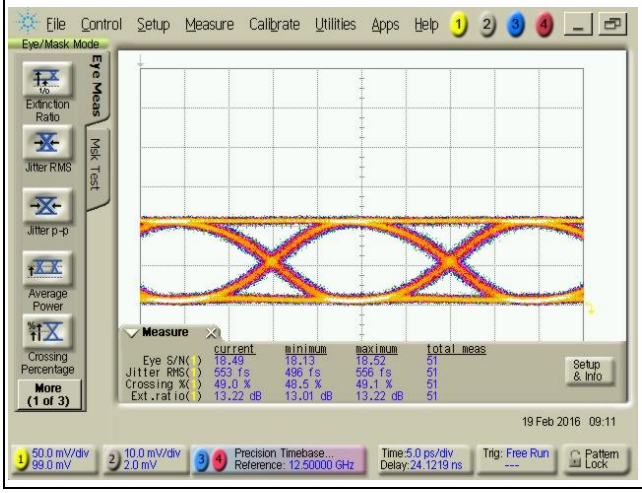
32 GBps



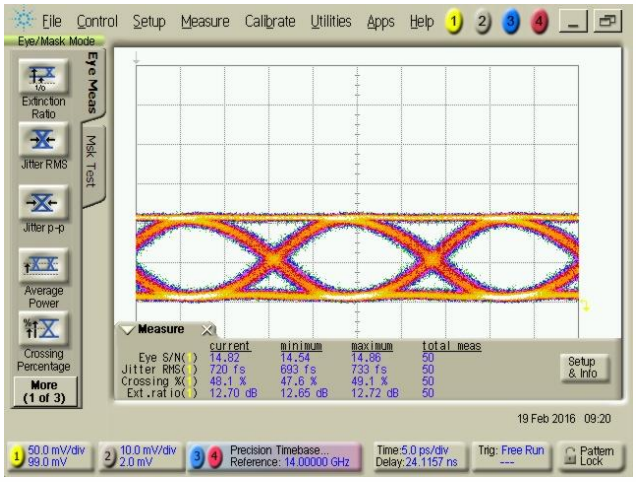
44 GBps



50 GBps

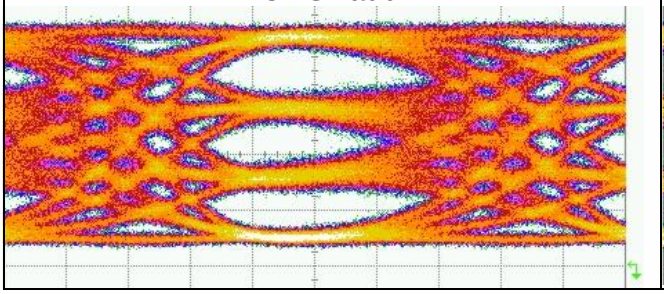


56 GBps

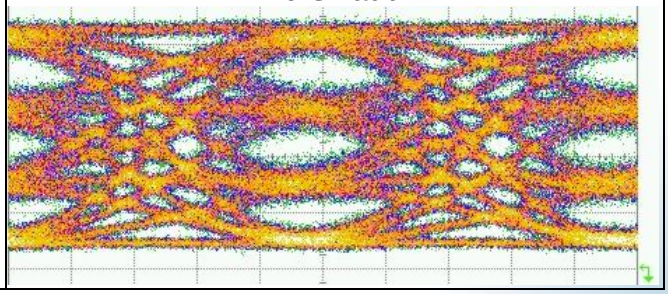


Typical PAM4 Results

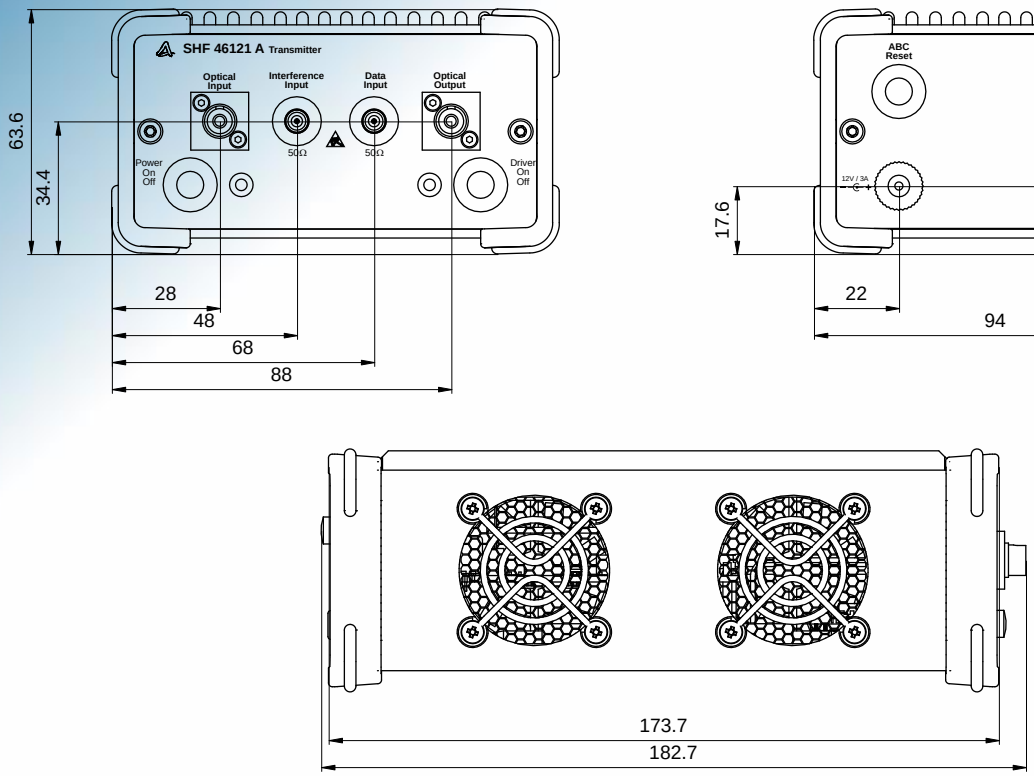
32 GBaud



40 GBaud



Outline Drawing



All dimensions are specified in millimeters (mm).