

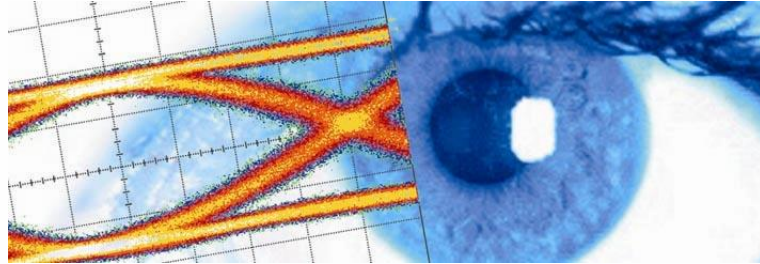


## SHF Communication Technologies AG

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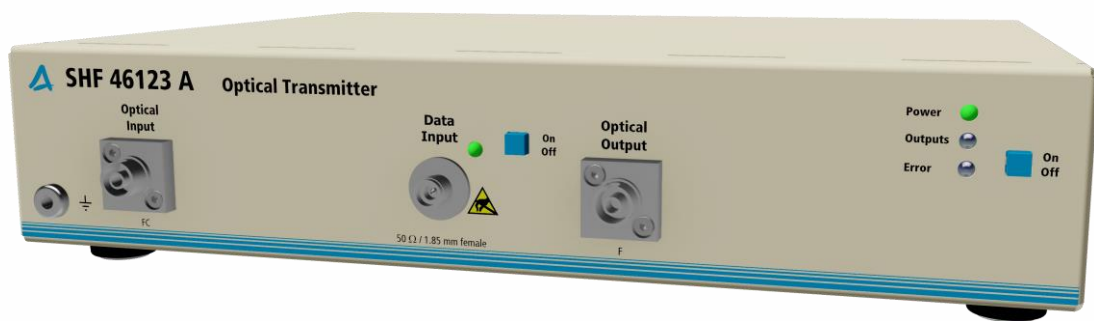


# Datasheet

## SHF 46123 A

### Optical Transmitter

1310 nm + 1550 nm





## Description

The SHF 46123 A is a stand-alone optical transmitter unit.

The transmitter works in C+L band and O band.

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

PAM signal generation is possible up to ~ 56 GBaud when driving the data input with an electrical PAM signal.

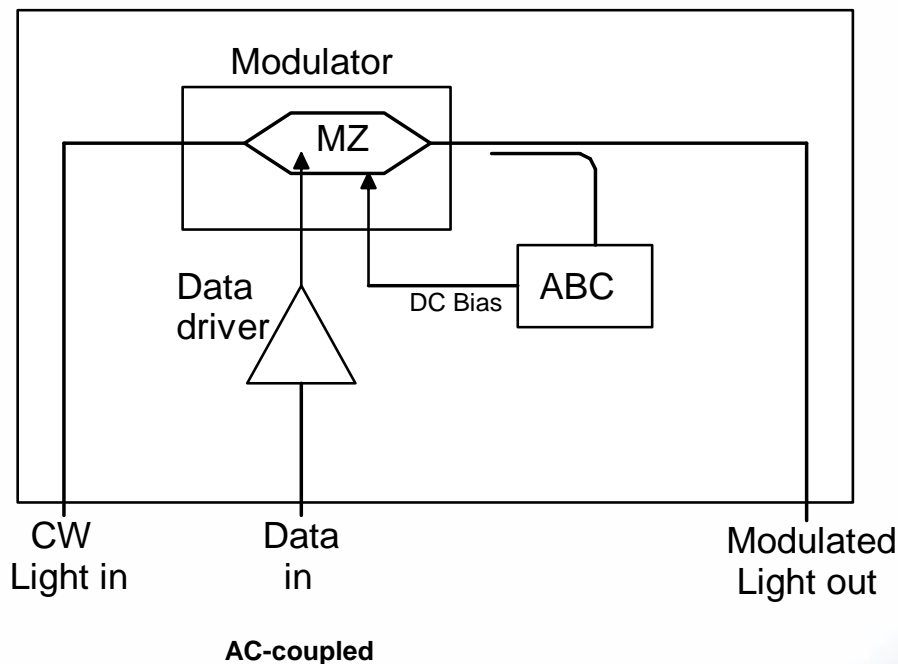
The main element of the SHF 46123 A is a thermally stable Lithium Niobate Mach-Zehnder modulator which is driven by an individually optimized amplifier.

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

## Features

- Dual-band 1310 nm and 1550 nm operation
- $\geq 56$  Gbps NRZ optical data stream generation
- Fast rise and fall time of < 10 ps compressed digital optical signals
- Capable of PAM 4 up to 56 GBaud
- Modulators' DC bias condition controlled automatically
- SONET/SDH compatible
- Stressed eye generation for optical compliance testing
- Selectable slope (positive slope / negative slope)
- Option 'Low power' available for optical input power 0...10 dBm

## Functional block diagram





# Specifications – SHF 46123 A

Parameter	Unit	Min.	Typ.	Max.	Conditions
<b>Absolute Maximum Ratings</b>					
Optical Input Power	dBm			17	
Data Input Level	V <sub>pp</sub>			2	
DC Input Voltage	V			±9	
<b>Optical Parameters</b>					
Wavelength Range	nm	1260 - 1360, 1530 - 1625 O band, C+L-band			
Insertion Loss	dB		10.5 8	12 9	1310 nm band 1550 nm band, *Note
DC Extinction Ratio	dB		20		
Return Loss	dB		tbd		
<b>Electrical and electro-optical parameters (measured at 1550 nm)</b>					
EO Bandwidth of Modulator	GHz	35			-3dB electrical
EO Bandwidth of Transmitter	GHz	35			-3dB electrical
Optical input power	dBm	6 0		15 10	Standard ABC operating range Option low power
Min. Bit Rate	Gbps			2	
Max. Bit Rate	Gbps	50	56		Criteria: Ext.Ratio & S/N @ PRBS 2 <sup>7</sup> -1 ... 2 <sup>31</sup> -1
Electrical Return Loss of Data Input	dB		10	7	1 MHz – 20 GHz
Data Input Level	V <sub>pp</sub>		0.1 0.3 0.6		ExtRatio = 2 dB ExtRatio = 6 dB ExtRatio = 12 dB
Dynamic Extinction Ratio range	dB	0		13	ABC operating range
Dynamic Extinction Ratio	dB	10 9	11		Data input level : 0.4 V ... 0.7 V, ≤ 50 Gbps ... ≤ 56 Gbps, PRBS
Dynamic Signal to Noise Ratio		16 10	18		Data input level : 0.4 V ... 0.7 V, ≤ 50 Gbps ... ≤ 56 Gbps, PRBS
Output Rise and Fall Times	ps			tbd	ExtRatio > 10 dB ExtRatio < 7 dB **Note
Output Timing Jitter <RMS>	ps		1.0	1.2	***Note

\* Note connector to connector, modulator at quadrature point

\*\* Note: rise time 20%...80% as displayed on 70 GHz oscilloscope using a 50 GHz detector

\*\*\* Note: Measured with SHF Pattern Generator, prec. timebase DCA. De-embedded from 32 Gbps NRZ electrical data source.



### Electrical and electro-optical parameters

Crossing NRZ	%	45	50	55	* Note
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### Auto-bias control (ABC)

Dither Signal Frequency	kHz		1		
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\* Note: Input crossing = 50 %, signal measured @ ExtRatio 0...13 dB

## General specifications

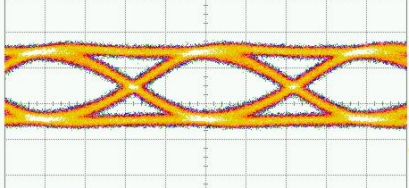
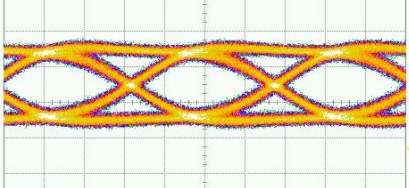
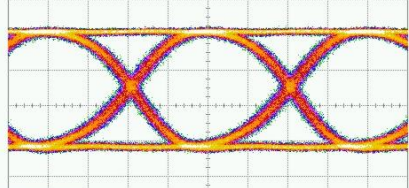
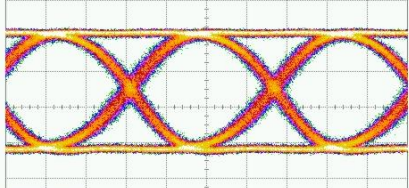
Parameter	Unit	Min.	Typ.	Max.	Conditions
Weight	kg		0.82		
Dimensions (W x H x D)	mm		221 x 51 x 177		w/o Frontpanel - Connectors
Power Consumption	W		10		
Operating Temperature	°C	10		35	
Electrical Data Input Connector					V (1.85 mm) female
Optical Connectors			FC/PC * Note		PMF in, key aligned to slow axis, SMF out

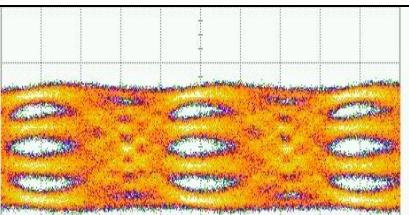
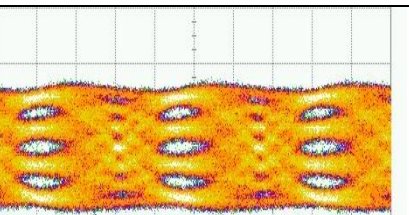
\* Note: Other connectors available on request



# Typical transmitter output signals

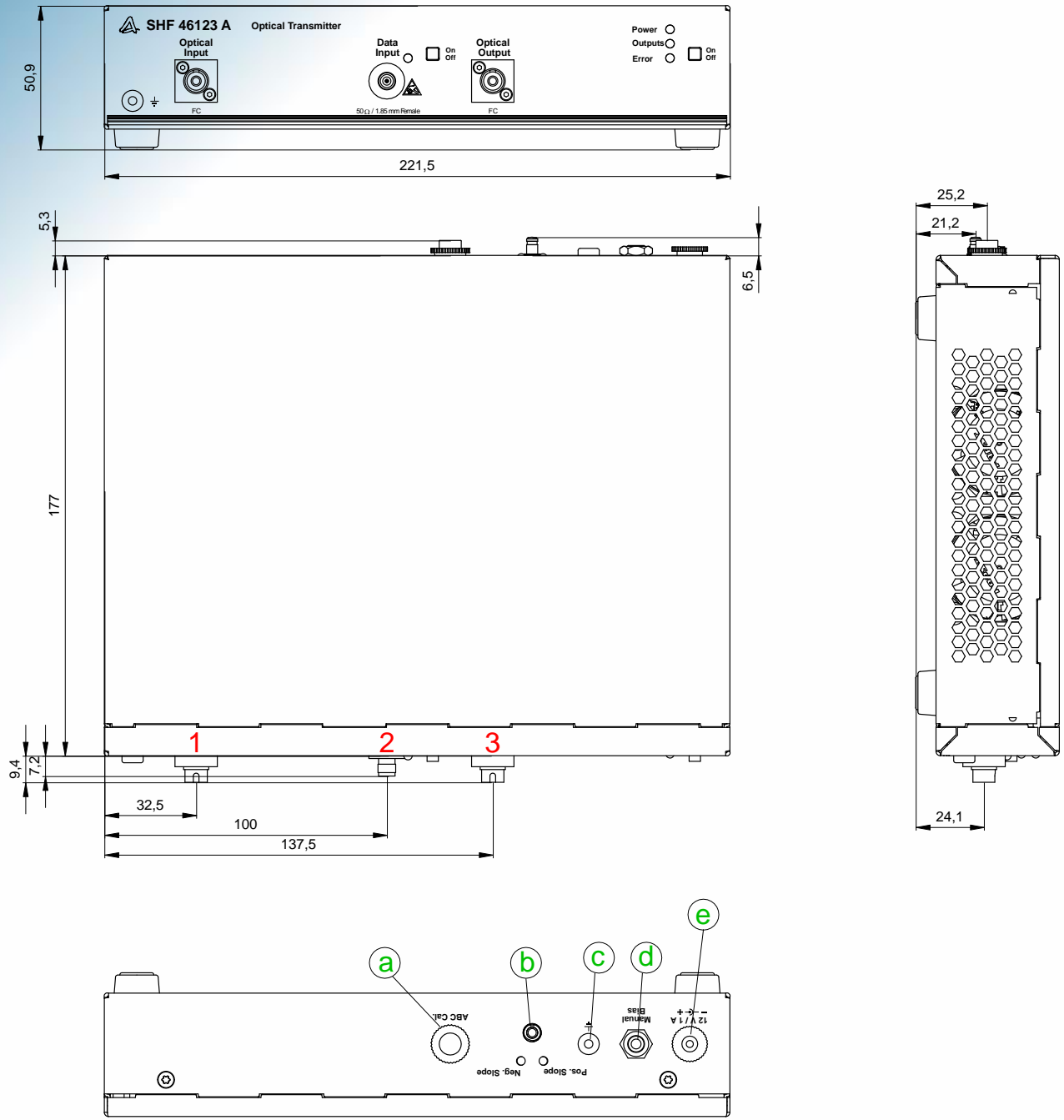
Data source: SHF 12104 BPG + SHF 613 DAC, using a 50 GHz bandwidth PIN detector.

Binary (NRZ)	50 GBit/s	56 GBit/s																																																		
Linear operation 220 mV <sub>pp</sub> data drive amplitude	 <table border="1"> <thead> <tr> <th>Measure</th> <th>current</th> <th>minimum</th> <th>maximum</th> <th>total meas</th> </tr> </thead> <tbody> <tr> <td>Eye S/N</td> <td>9.30</td> <td>9.24</td> <td>9.42</td> <td>52</td> </tr> <tr> <td>Jitter RMS</td> <td>666 fs</td> <td>585 fs</td> <td>666 fs</td> <td>52</td> </tr> <tr> <td>Crossing %</td> <td>47.4 %</td> <td>47.4 %</td> <td>48.7 %</td> <td>52</td> </tr> <tr> <td>Ext_ratio</td> <td>4.84 dB</td> <td>4.80 dB</td> <td>4.84 dB</td> <td>52</td> </tr> </tbody> </table> S/N: 9.3 Jitter: 666 fs Crossing: 47 % ExtRatio: 4.9 dB	Measure	current	minimum	maximum	total meas	Eye S/N	9.30	9.24	9.42	52	Jitter RMS	666 fs	585 fs	666 fs	52	Crossing %	47.4 %	47.4 %	48.7 %	52	Ext_ratio	4.84 dB	4.80 dB	4.84 dB	52	 <table border="1"> <thead> <tr> <th>Measure</th> <th>current</th> <th>minimum</th> <th>maximum</th> <th>total meas</th> </tr> </thead> <tbody> <tr> <td>Eye S/N</td> <td>8.14</td> <td>8.04</td> <td>8.34</td> <td>59</td> </tr> <tr> <td>Jitter RMS</td> <td>647 fs</td> <td>616 fs</td> <td>666 fs</td> <td>59</td> </tr> <tr> <td>Crossing %</td> <td>48.8 %</td> <td>48.5 %</td> <td>49.0 %</td> <td>59</td> </tr> <tr> <td>Ext_ratio</td> <td>4.76 dB</td> <td>4.60 dB</td> <td>4.76 dB</td> <td>59</td> </tr> </tbody> </table> S/N: 8.1 Jitter: 647 fs Crossing: 49 % ExtRatio: 4.8 dB	Measure	current	minimum	maximum	total meas	Eye S/N	8.14	8.04	8.34	59	Jitter RMS	647 fs	616 fs	666 fs	59	Crossing %	48.8 %	48.5 %	49.0 %	59	Ext_ratio	4.76 dB	4.60 dB	4.76 dB	59
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	50 GBaud	56 GBaud
PAM4 220 mV <sub>pp</sub> data drive amplitude		



# Outline Drawing



Pos.	Designation	Connector
1	Optical Input	FC
2	Data Input	1.85 mm (V) Female
3	Optical Output	FC

Pos.	Designation
a	ABC Calibration
b	Positive Negative Slope switch
c	GND
d	Manual Bias
e	Power Supply

All dimensions are specified in millimeters (mm).