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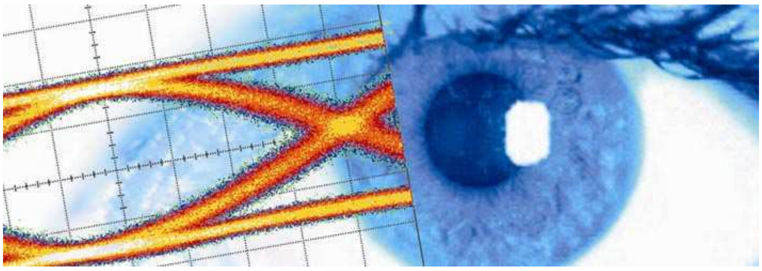
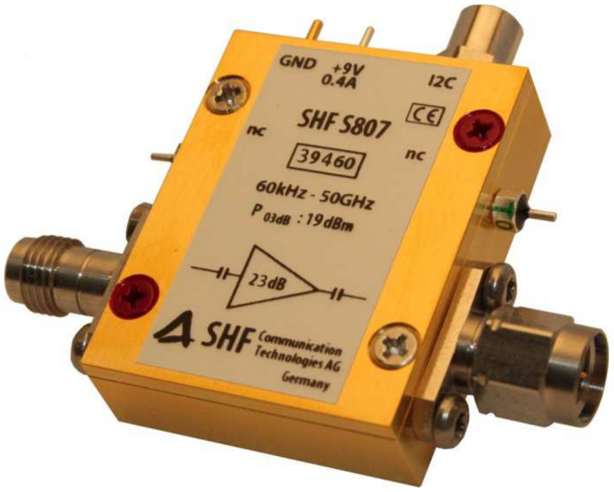


Datasheet

SHF S807

Linear Broadband Amplifier



Description

The SHF S807 is a much improved successor to the popular SHF 807 linear driver amplifier. It offers more bandwidth than the 807, smaller foot-print and less power dissipation. This bandwidth improvement offers the capability of higher baud rate operation of up to 43 Gbaud.

The important features of ultra-fast rise and fall time, high linear output power (P1dB) and high third order intercept point (IP3), render the amplifier well suited for PAM4, optical 16QAM, and OFDM signal generation applications.

The S807 is a two-stage amplifier design, using proprietary monolithic microwave integrated circuits (MMICs) inside special carriers to achieve ultra wide bandwidth and low noise performance. An internal voltage regulation PCB design protects the amplifier against accidental reverse voltage connection and insensitive to line voltage ripple variations.

A new feature has been built-in to enable the amplifier gain and crossing to be control externally via software.

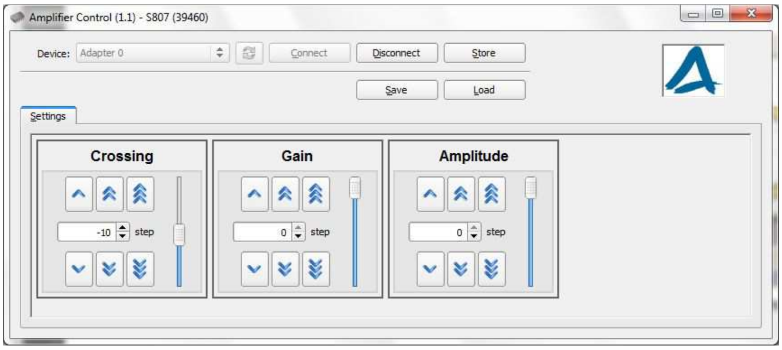
Ease of Use

Upon delivery, the amplifier is already pre-set to deliver maximum gain, maximum output amplitude and nominally 50% crossing.

These settings can be modified in an easy to use graphical software interface, as shown below. For connecting the amplifier to the computer, the USB to I2C converter cable, as well as the required software are included with each amplifier with no extra charge.

Once new settings are stored on the device the amplifier will remember the settings until further changes are made. There is no need to connect a computer to the device unless gain, maximum amplitude or crossing adjustments are to be made.

The software is available for download at www.shf.de .



GUI of the SHF amplifier control software

Available Options

01: DC return on input (max. ±1.75 V, max. 35 mA)[1]

02: Built-in bias tee on input (max. ±9 V, max. 220 mA)[1]

03: DC return on output (max. ±1.75 V, max. 35 mA) [1]

04: Built-in bias tee on output (max. ±7 V, max. 220 mA) [1]

MP: Matches the phase of two amplifiers

[1] The options 01 & 02 or 03 & 04 cannot be combined.
If an option is chosen, the maximum gain might be reduced by up to 1 dB and the low frequency 3 dB Point might be increased up to 75 kHz.

Specifications – SHF S807

Parameter	Unit	Symbol	Min	Typ	Max	Conditions
Absolute Maximum Ratings						
Maximum RF Input Power in Operation	dBm V	$P_{in\ max}$			4 1	 peak to peak voltage
Maximum RF Input Power without Power Supply	dBm V	$P_{in\ max}$			10 2	 peak to peak voltage
DC Voltage at RF Input	V				±9	AC coupled input
DC Voltage at RF Input	V				±7	AC coupled output
Supply Voltage	V		8		12	0.4 A, reverse voltage protected
Case Temperature[2]	T_{case}	°C	10	40	50	
Electrical Characteristics (At 40°C case temperature, unless otherwise specified)						
High Frequency 3 dB Point	GHz	f_{HIGH}	50			
Low Frequency 3 dB Point	kHz	f_{LOW}			60	
Gain	dB	S_{21}	22	23		non-inverting measured at P_{in}=-27 dBm
Gain Ripple	dB	ΔS_{21}		±0,5	±1	40 MHz…40 GHz
Max. Gain Reduction	dB		-2,5	-3	-4	Control via software interface
Output Power at 1 dB Compression	dBm V	P_{01dB}	15 3,5	16 4		10 MHz…25 GHz peak to peak voltage
Output Power at 2 dB Compression	dBm V	P_{02dB}	17 4,5	18 5		10 MHz…25GHz peak to peak voltage
Output Power at 3 dB Compression	dBm V	P_{03dB}	19 5,6	19,5 6		10 MHz…25 GHz peak to peak voltage
3rd Order Intercept Point	dBm	IP_3	28			
Max. RF Input for Linear Operation	dBm V	$P_{in\ lin}$			-8 0,25	I.e. Pout ≤ P01dB peak to peak voltage
Max. Output Power Reduction	dB		2			P_{in} ≥ - 2 dBm Crossing might need to be readjusted by using the crossing control feature. Control via software interface
Crossing Control Range	%		-4		4	Control via software interface
Input Return Loss	dB	S_{11}		-12 -7	-10 -5	< 30 GHz < 50 GHz
Output Return Loss	dB	S_{22}		-12	-10	< 40 GHz

[2] If operated with heat sink (part of the delivery) at room temperature there is no need for additional cooling.

Parameter	Unit	Symbol	Min	Typ	Max	Conditions
Rise Time/Fall Time	ps	t_r/t_f			8 13.5	20%...80%, 3 V ≤ Vout ≤ 4 V Deconvoluted [3, 4] Full Setup [3]
Jitter	fs	J_{RMS}		440 530	580 650	3 V ≤ Vout ≤ 4 V Deconvoluted [3, 4] Full Setup [3]
Group Delay Ripple	ps				±50	40 MHz…40 GHz, 100 MHz aperture
Power Consumption	W			3		9 V supply voltage
Mechanical Characteristics						
Input Connector						1.85mm (V) female[5]
Output Connector						1.85mm (V) male[5]

[3] Measured with the following setup: SHF 611 C DAC -> DUT (SHF S807) -> Agilent 86100A with 70 GHz sampling head and precision time base.

[4] Calculation based on typical results of setup without DUT :

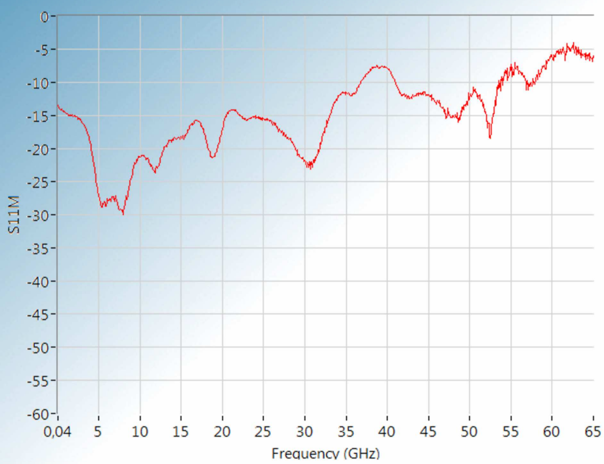
$$t_r/t_{f\ deconvoluted} = \sqrt{(t_r/t_{f\ full\ setup})^2 - (t_r/t_{f\ setup\ w/o\ DUT})^2} = \sqrt{(t_r/t_{f\ full\ setup})^2 - 11\ ps^2}$$

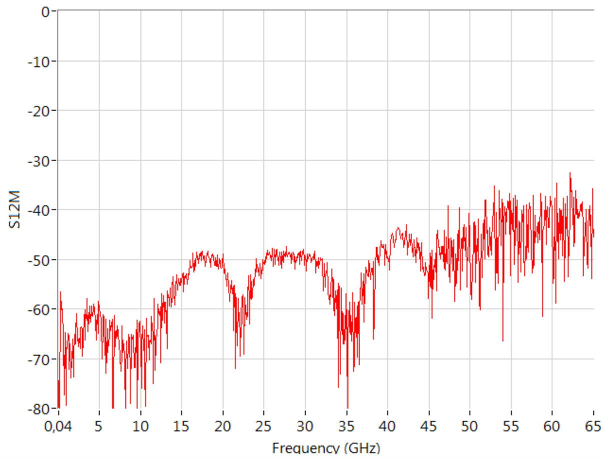
$$J_{RMS\ deconvoluted} = \sqrt{(J_{RMS\ full\ setup})^2 - (J_{RMS\ setup\ w/o\ DUT})^2} = \sqrt{(J_{RMS\ full\ setup})^2 - 300\ fs^2}$$

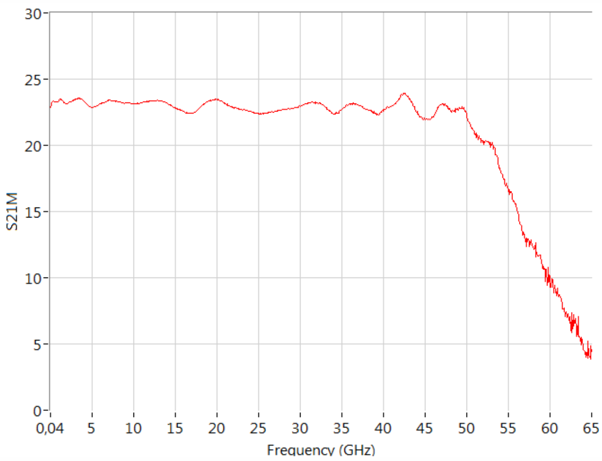
[5] Other gender configurations are available on request.

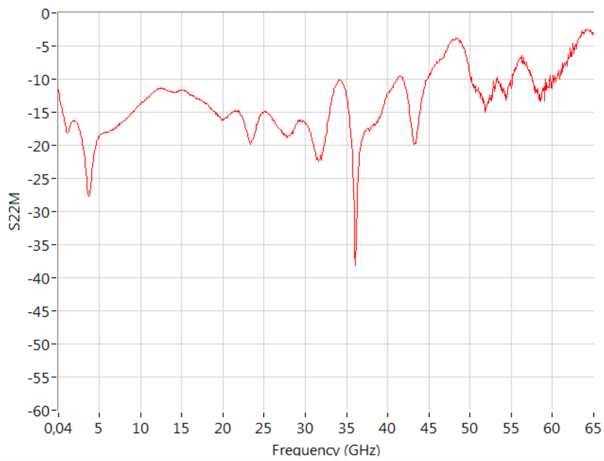
Other connector types, e.g. 2.92mm (K) or Mini-SMP (GPPO®) connectors, are also available but may impact the bandwidth and reflection characteristic.

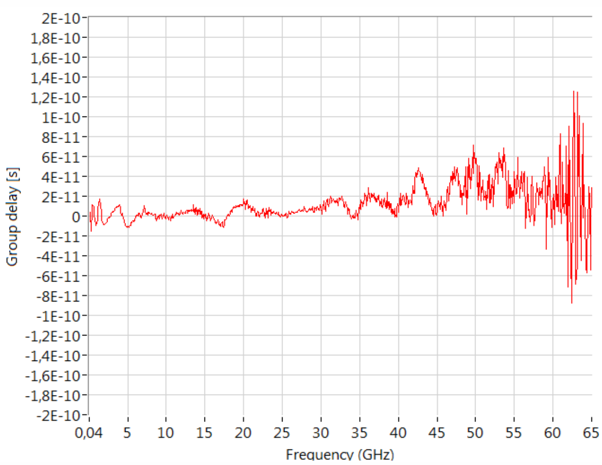
Typical S-Parameters, Group Delay and Phase Response

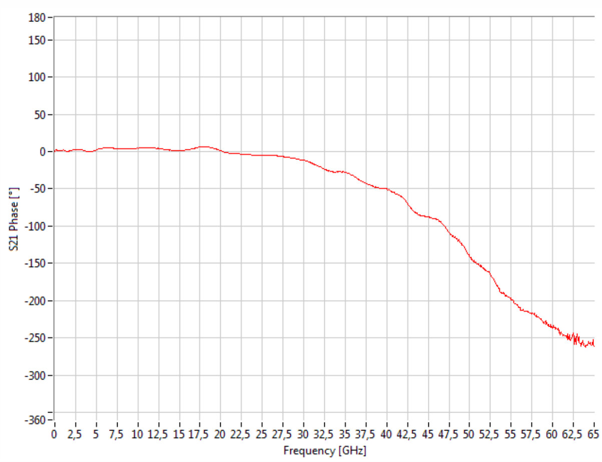








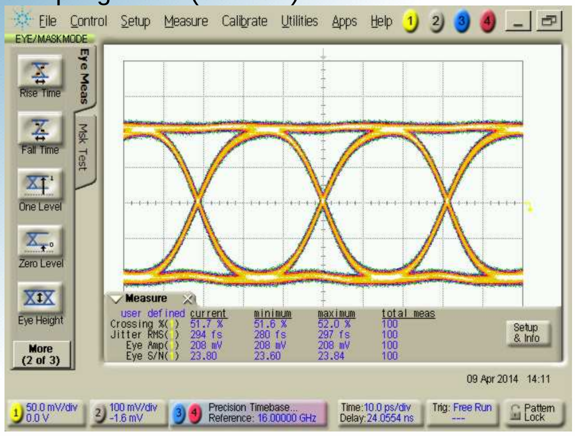




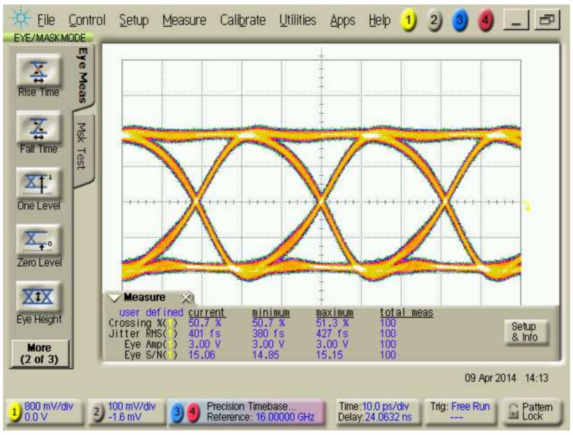
Aperture of group delay measurement: 100 MHz

Typical Binary Eye diagrams

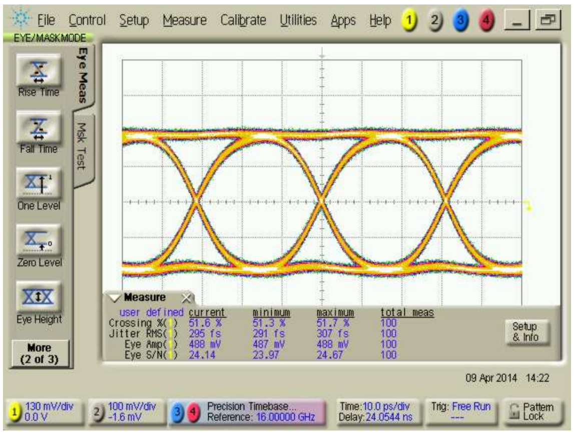
The measurements below had been performed using a SHF 611 C DAC or a SHF 12103 A (for 43 Gbps), respectively and an Agilent 86100D DCA with Precision Time Base Module (86107A) and 70 GHz Sampling Head (86118A).



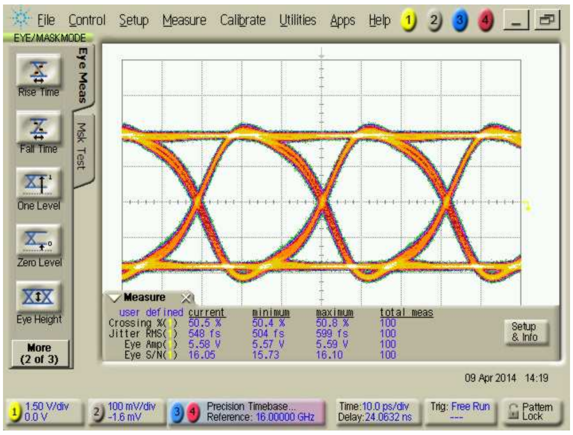
Input Signal @ 32 Gbps, Eye amplitude: 208 mV



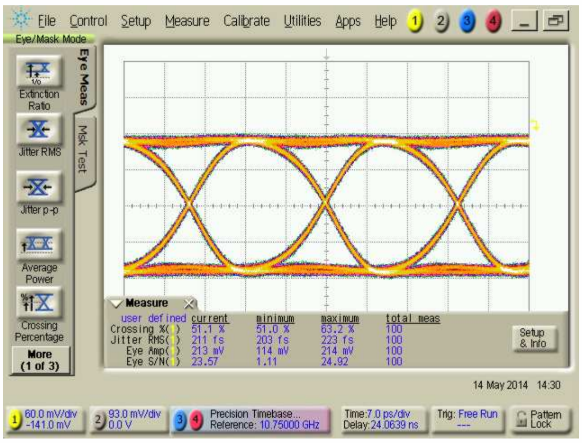
Output Signal @ 32 Gbps, Eye amplitude: 3.0 V



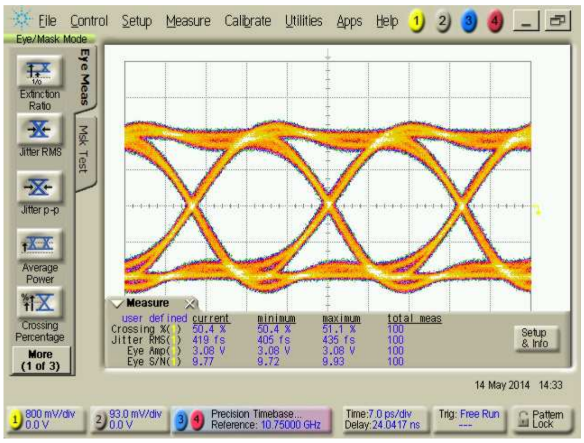
Input Signal @ 32 Gbps, Eye amplitude: 488 mV



Output Signal @ 32 Gbps, Eye amplitude: 5.58 V



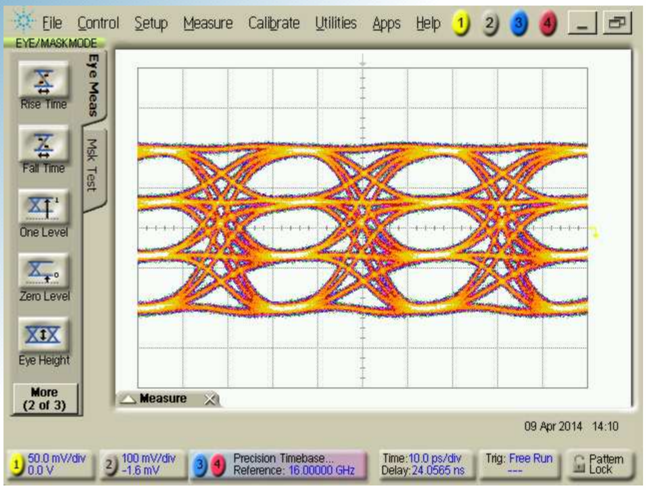
Input Signal @ 43 Gbps, Eye amplitude: 213 mV



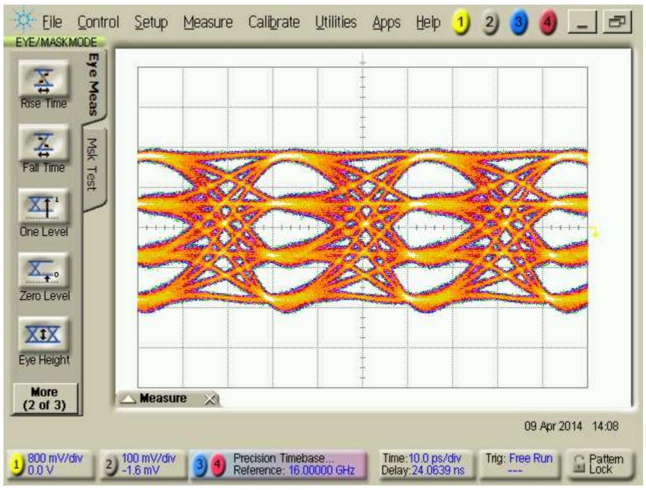
Output Signal @ 43 Gbps, Eye amplitude: 3.08 V

Typical 4-Level Eye diagrams

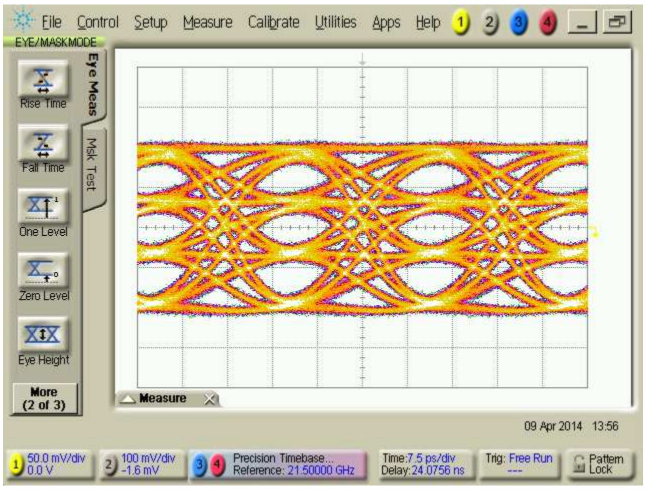
The measurements below had been performed using a SHF 611C DAC and an Agilent 86100D DCA with Precision Time Base Module (86107A) and 70 GHz Sampling Head (86118A).



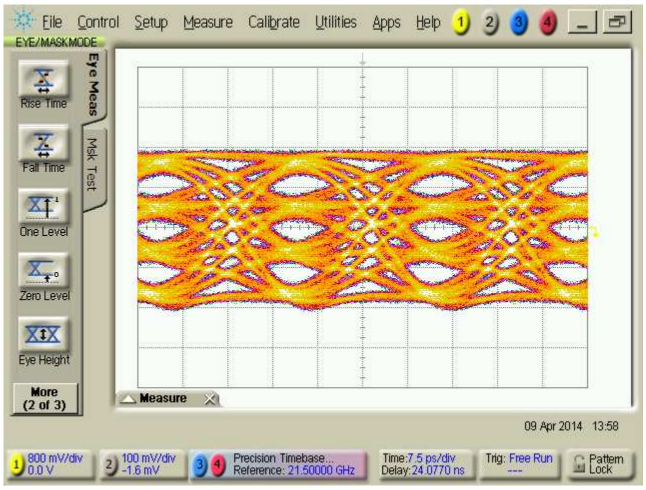
Input Signal @ 32 GBaud, ~200 mVpp



Output Signal @ 32 GBaud, ~3 Vpp

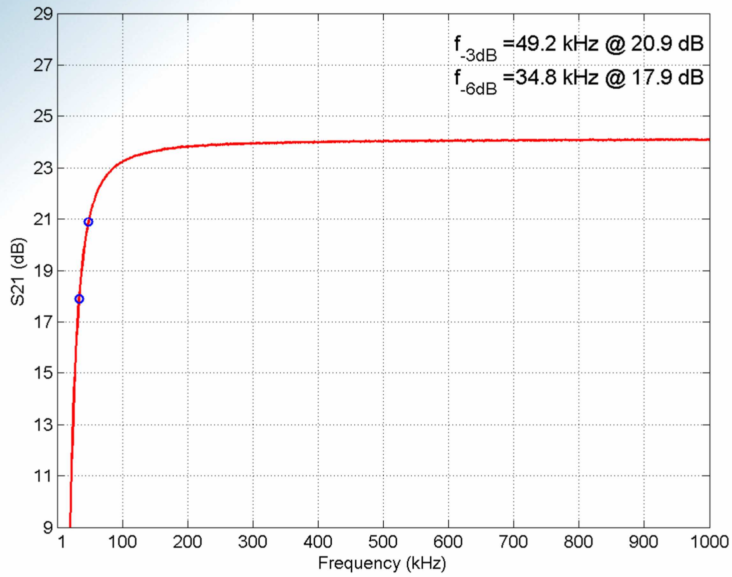


Input Signal @ 43 GBaud, ~200 mVpp

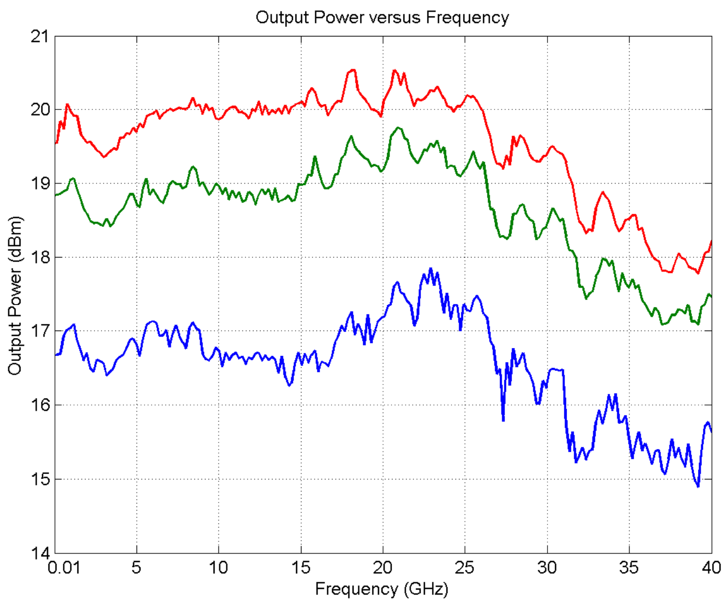


Output Signal @ 43 GBaud, ~3 Vpp

Typical Low Frequency Response (<1 MHz)

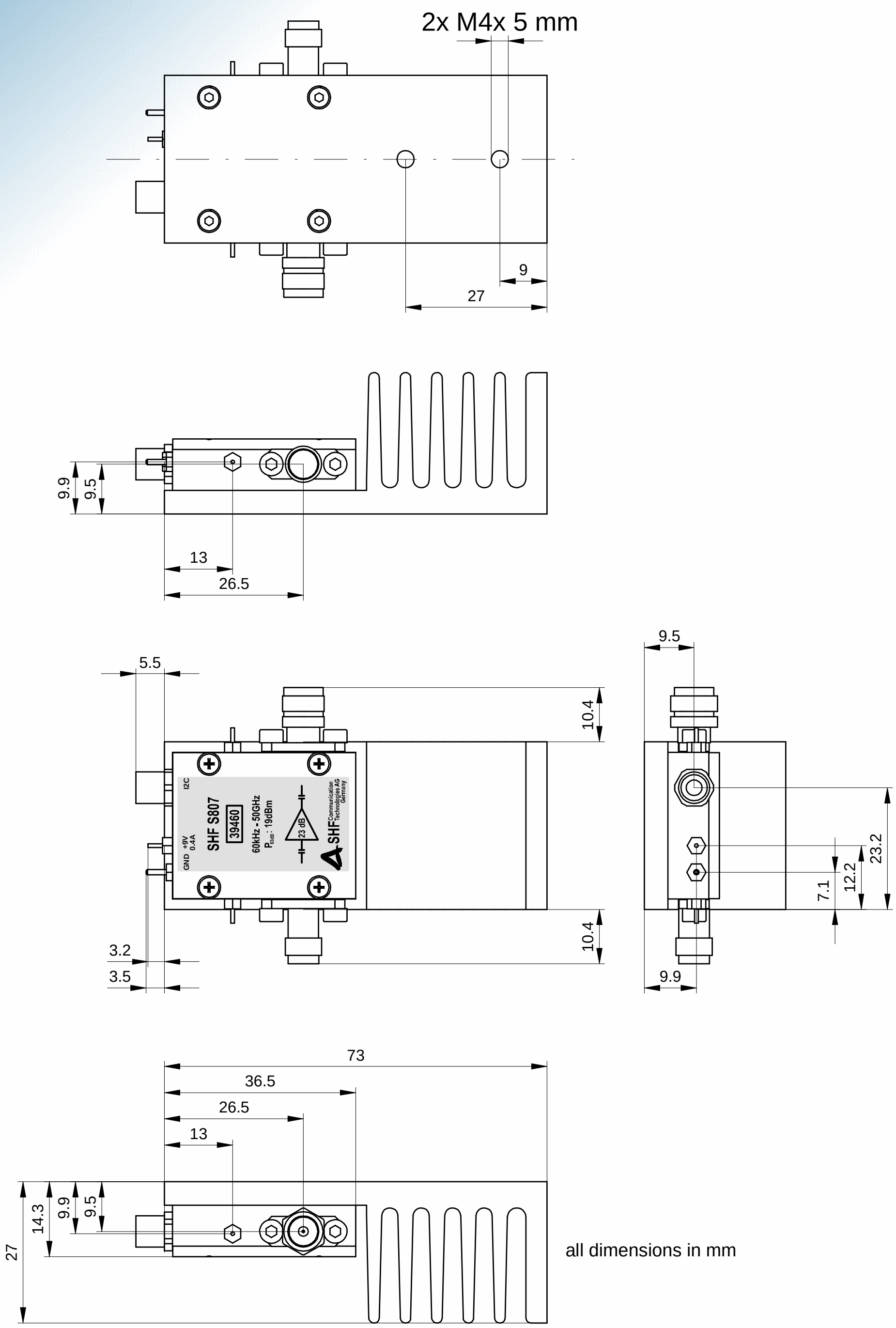


Typical Saturation power



Top (red): 3 dB compression;
Middle (green): 2 dB compression;
Bottom (blue): 1 dB compression

Mechanical Drawing with Heat Sink

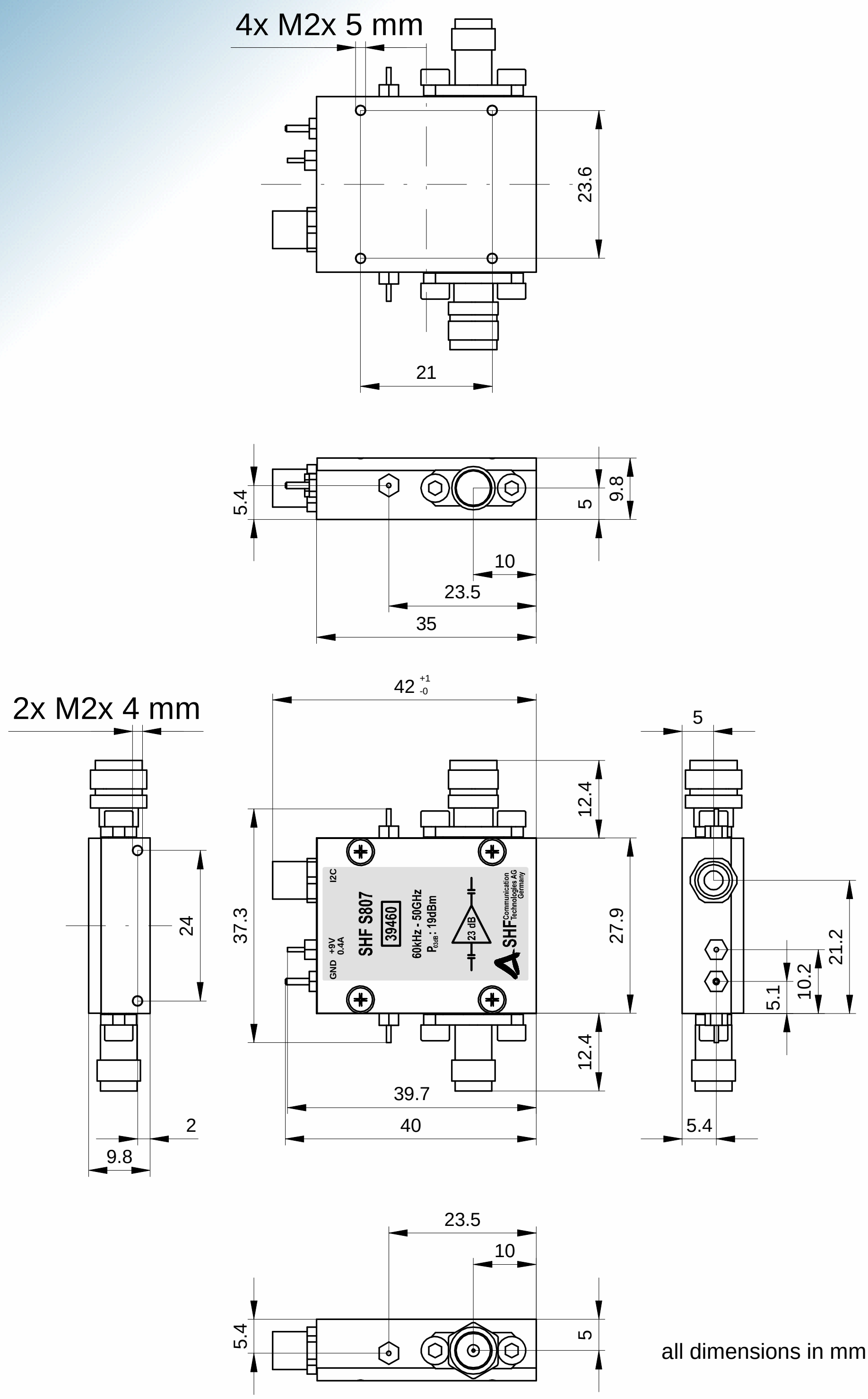


Pin assignment might change if a bias tee option is chosen.

Thermal resistance of heat sink approx. 6 K/W

For permanent mounting remove the heat sink from the amplifier. In that case please ensure that adequate cooling of the amplifier is guaranteed. It is recommended to use thermal paste or a thermal gap pad for the mounting. In order to separate the heat sink from the amplifier, remove the four screws on the heat sink. Please note, thermal paste is used between the heat sink and the amplifier housing.

Mechanical Drawing without Heat Sink



all dimensions in mm

Pin assignment might change if a bias tee option is chosen.

Please ensure that adequate cooling of the amplifier is guaranteed.

User Instructions

ATTENTION!

Electrostatic sensitive GaAs FET amplifier

1. To prevent damage through static charge build up, cables should be always discharged before connecting them to the amplifier!
2. Attach a 50 Ohm output load **before** supplying DC power to the amplifier!
3. The supply voltage can be taken from any regular 8…12 V, 0.4 A DC power supply and can be connected to the supply feed-through filter via an ON / OFF switch.
4. Using a 3 dB or 6 dB input attenuator will result in a 6 dB or 12 dB increase of the input return loss. For minimal degradation of amplifier rise time, these attenuators should have a bandwidth specification of greater 50 GHz (V/ 1.85mm attenuators)!
5. An input signal of about 0.6 V_{pp} will produce saturated output swing of about 5.6 V_{pp}.
6. Higher input voltages will drive the amplifier's output stage into saturation, leading to waveform peak clipping.
8. Saturated output voltages can only be used without damage while the amplifier is connected to a 50 Ohm precision load with a VSWR of less than 1.2 or better than 20 dB return loss up to 40 GHz.
9. While using a reflective load the output voltage has to be reduced to a safe operating level according to the magnitudes of the reflections.

   ATTENTION: At radio frequencies a capacitive load can be transformed to an inductive one through transmission lines! With an output stage driven into saturation this may lead to the immediate destruction of the amplifier (within a few ps)!
10. The input voltage should never be greater than 1 V_{pp} equivalent to 4 dBm input power.

    The input voltage without DC power supplied to the amplifier should never be greater than 2 V_{pp} equivalent to 10 dBm input power.