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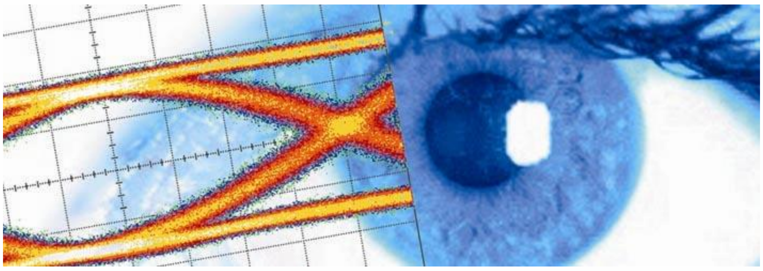
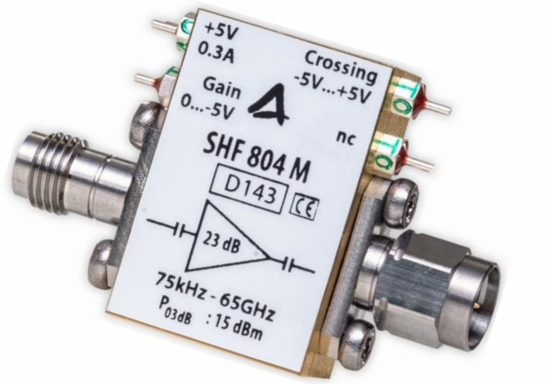


Datasheet

SHF 804 M

Ultra-Broadband Amplifier



Description

The SHF 804 M is an ultra-broadband RF amplifier with small footprint and more than 65 GHz bandwidth.

A traveling wave amplifier design is employed using our special monolithic microwave integrated circuits (MMICs) inside special carriers to achieve the ultra-wide bandwidth and a good noise performance.

This extreme bandwidth offers the capability to amplify binary signals of more than 80 Gbps

Applications

- Optical Communications
- High-Speed Pulse Experiments
- Satellite Communications
- Research and Development
- Antenna Measurements
- Data Transmission

Available Options

MP: Matches gain and phase characteristics of two amplifiers

Specifications

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				±2	AC coupled input
DC Voltage at RF Output	V				±7	AC coupled output
Positive Supply Voltage	V	V_{DD}	4.5	5	5.5	reverse voltage protected
Positive Supply Current	A	I_{DD}		0.25	0.3	
Gain Control Voltage	V	U_{GC}	-5		0	Reduction by approx. 3dB I_{GC} <= 10 mA pin open: max gain is achieved.
Crossing Control Voltage	V	U_{CC}	-5		+5	I_{CC} <= 20 mA pin open: approx. 50% is achieved.
Case Temperature	T_{case}	°C	10	35	45	

Parameter	Unit	Symbol	Min	Typ	Max	Conditions
Electrical Characteristics (At 35°C case temperature, unless otherwise specified)						
High Frequency 3 dB Point	GHz	f_{HIGH}	65			
Low Frequency 3 dB Point	kHz	f_{LOW}			75	
Gain	dB	S_{21}	22	23		non-inverting measured at P_{in}=-27 dBm @ 40 MHz
Gain Ripple	dB	ΔS_{21}		±0,5	±1	40 MHz…40 GHz
Output Power at 1 dB Compression	dBm V	P_{01dB}	11 2.2	12 2.5		10 MHz…30 GHz peak to peak voltage
Output Power at 2 dB Compression	dBm V	P_{02dB}	13.5 3	14.5 3.3		10 MHz…30 GHz peak to peak voltage
Output Power at 3 dB Compression	dBm V	P_{03dB}	15 3.5	15.5 3.7		10 MHz…30 GHz peak to peak voltage
Input Return Loss	dB	S_{11}		-10 -5	-9 -3	< 30 GHz < 65 GHz
Output Return Loss	dB	S_{22}		-10 -7	-9 -5	< 50 GHz < 65 GHz
Rise Time/Fall Time	ps	t_r/t_f			 6 10	20%...80%, 3 V ≤ Vout ≤ 4 V Deconvoluted [1, 2] Full Setup [1]
Jitter	fs	J_{RMS}		 350 450	 500 600	3 V ≤ Vout ≤ 4 V @ 80 Gbps Deconvoluted [1, 2] Full Setup [1]
Group Delay Ripple	ps				±50	40 MHz…40 GHz, 100 MHz aperture
Power Consumption	W			1.25		V_{DD} = 5 V / I_{DD} = 0.25A
Mechanical Characteristics						
Input Connector						1.85mm (V) female[3]
Output Connector						1.85mm (V) male[3]

[1] Measured with the following setup: SHF 603A -> DUT (SHF 804M) -> Agilent 86100A with 70 GHz sampling head and precision time base.

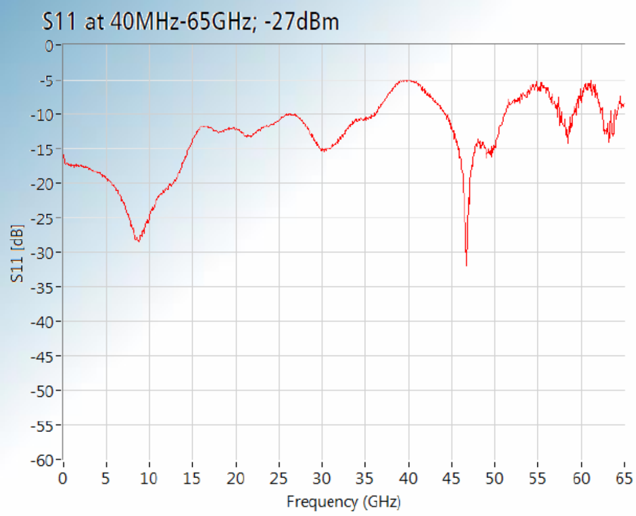
[2] Calculation based on typical results of setup without DUT :

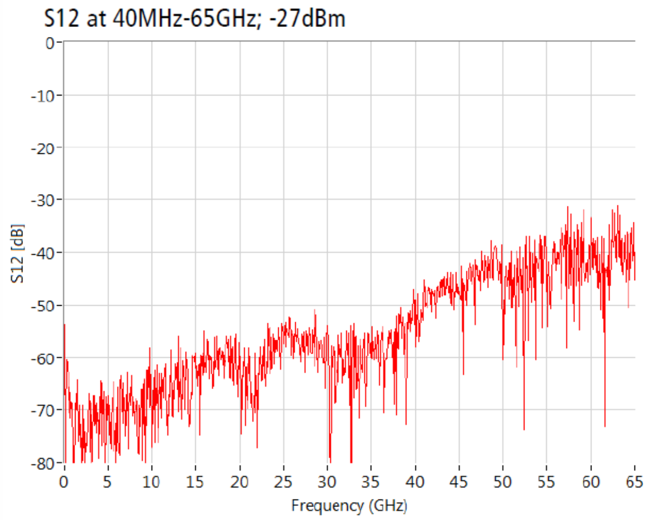
$$t_r/t_{f\ deconvoluted} = \sqrt{(t_r/t_{f\ full\ setup})^2 - (t_r/t_{f\ setup\ w/o\ DUT})^2} = \sqrt{(t_r/t_{f\ full\ setup})^2 - 8\ ps^2}$$

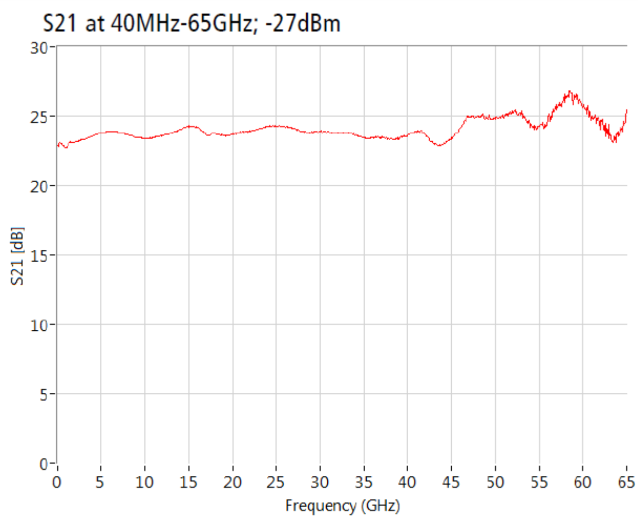
$$J_{RMS\ deconvoluted} = \sqrt{(J_{RMS\ full\ setup})^2 - \left(J_{RMS\ setup\ w/o\ DUT}\right)^2} = \sqrt{(J_{RMS\ full\ setup})^2 - 300\ fs^2}$$

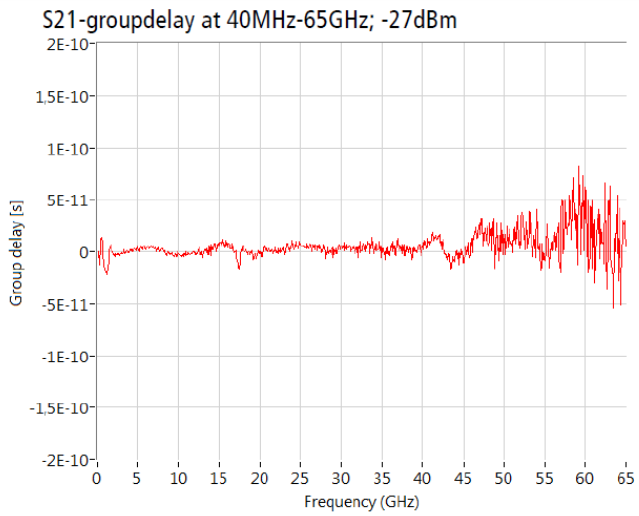
[3] Other gender configurations are available on request.

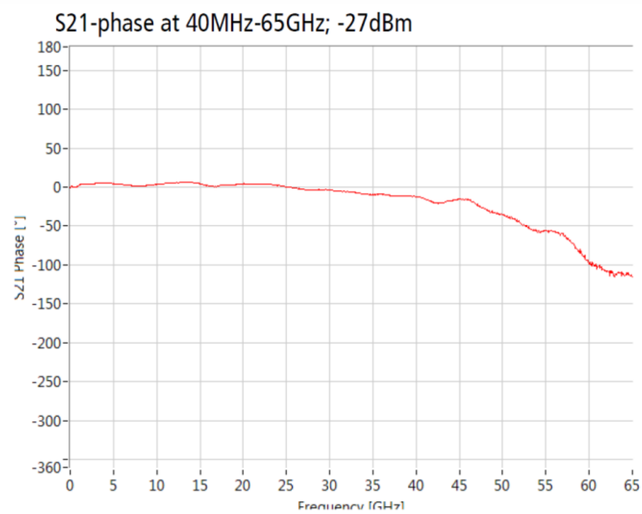
Typical S-Parameters, Group Delay and Phase Response

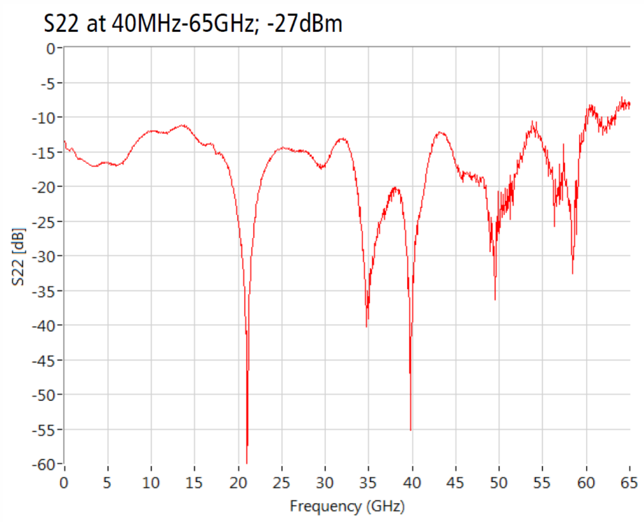








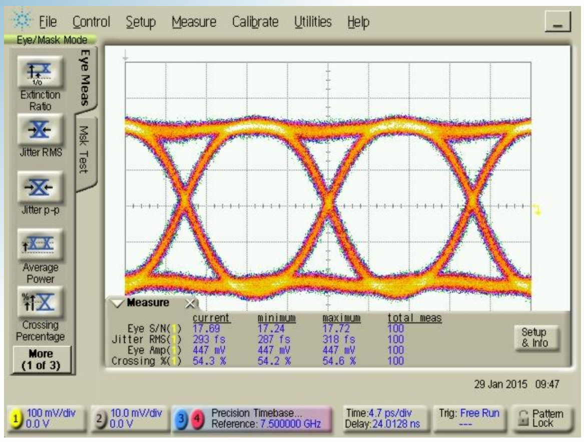




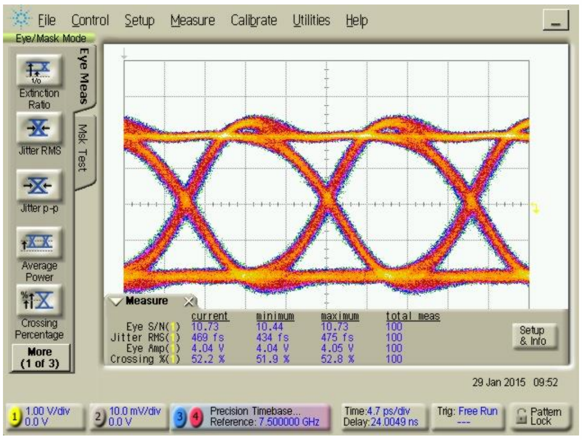
Aperture of group delay measurement: 100 MHz

Typical Binary Eye diagram

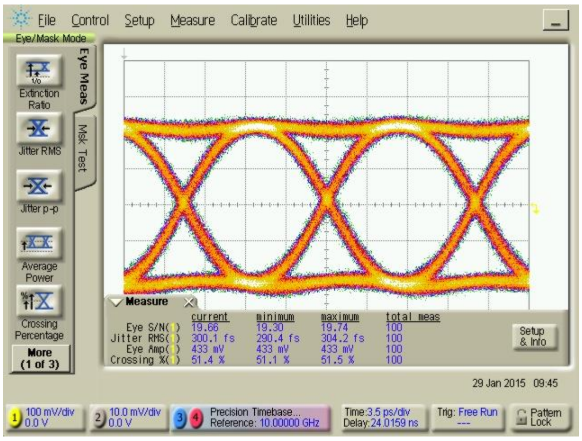
The measurements below had been performed using a SHF 603A MUX and an Agilent 86100D DCA with Precision Time Base Module (86107A) and 70 GHz Sampling Head (86118A).



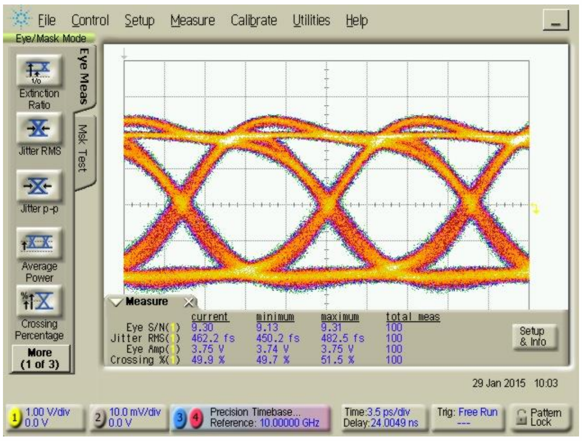
Input Signal @ 60 Gbps, Eye amplitude: 447 mV



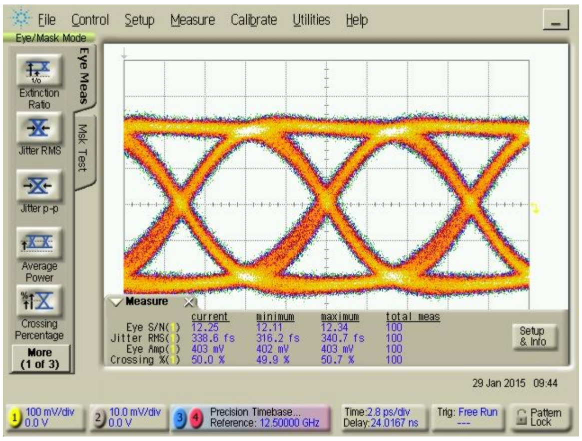
Output Signal @ 60 Gbps, Eye amplitude: 4.04 V



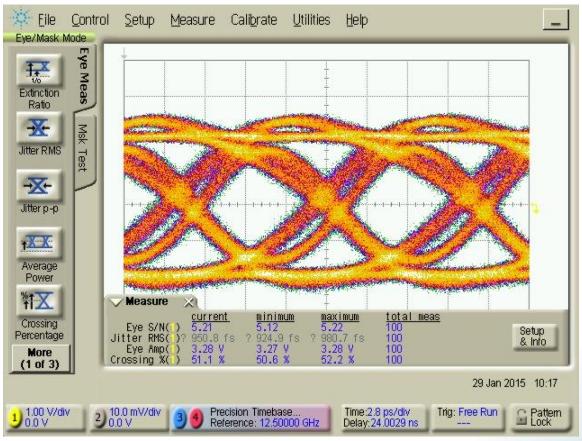
Input Signal @ 80 Gbps, Eye amplitude: 433 mV



Output Signal @ 80 Gbps, Eye amplitude: 3.75 V

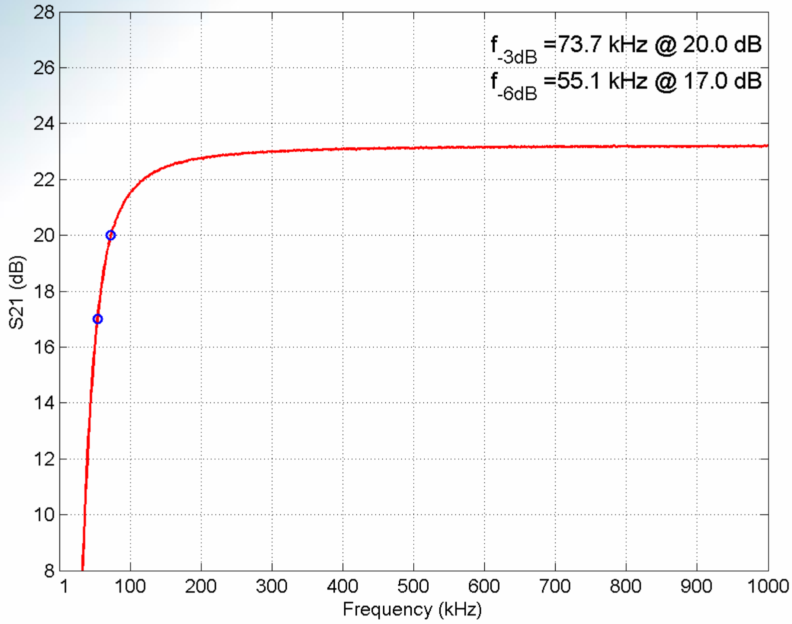


Input Signal @ 100 Gbps, Eye amplitude: 403 mV

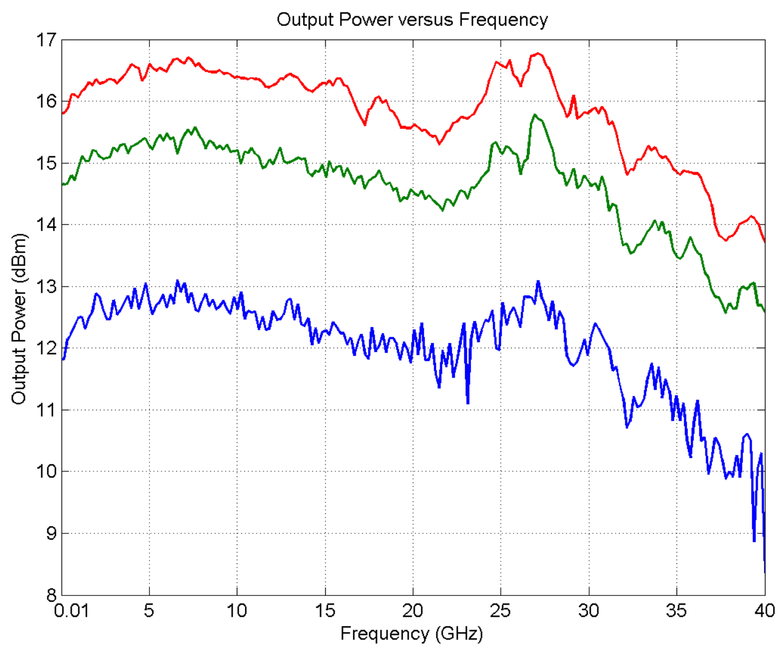


Output Signal @ 100 Gbps, Eye amplitude: 3.28 V

Typical Low Frequency Response (<1 MHz)



Typical Saturation power



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

Handling Instructions

To operate the amplifier a positive supply voltage of approximately +5 V must be applied.

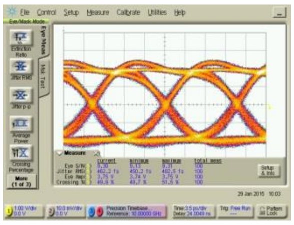
Please do never exceed the maximum values given in the above table. This will severely damage the amplifier.

Gain

The gain can be reduced by applying a negative voltage to the Gain control pin "Gain". If it is left open the amplifier will operate with its maximum gain.

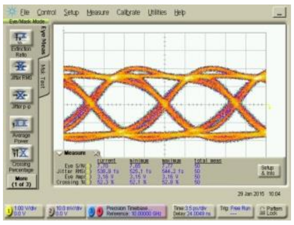
Note: If the amplifier is driven in saturation the effect of the gain control is reduced.

Examples:



Gain control = open

Amplitude = 3.75 V



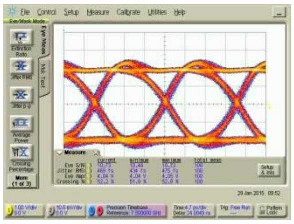
Gain control = -5 V

Amplitude = 3.16 V

Crossing

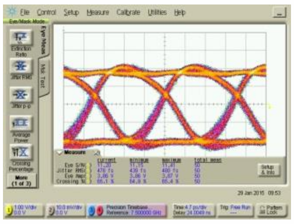
The crossing can be adjusted by applying a voltage to the cross point control pin "Crossing". If it is left open the output signal will have approximately 50% crossing. In case this is considered to be accurate enough for the application the cross point control pin "Crossing" can be left open.

Examples:



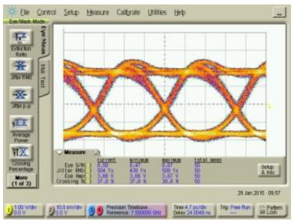
Crossing control = open

Crossing = 52 %



Crossing control = -5 V

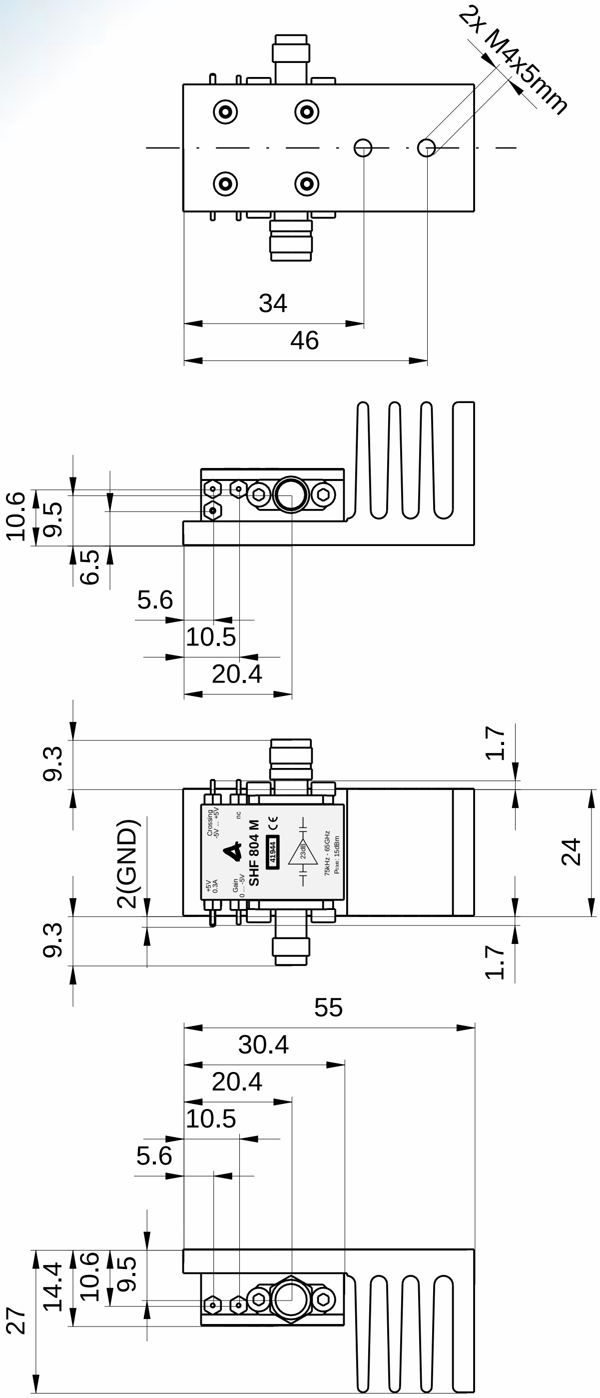
Crossing = 65 %



Crossing control = +5 V

Crossing = 38 %

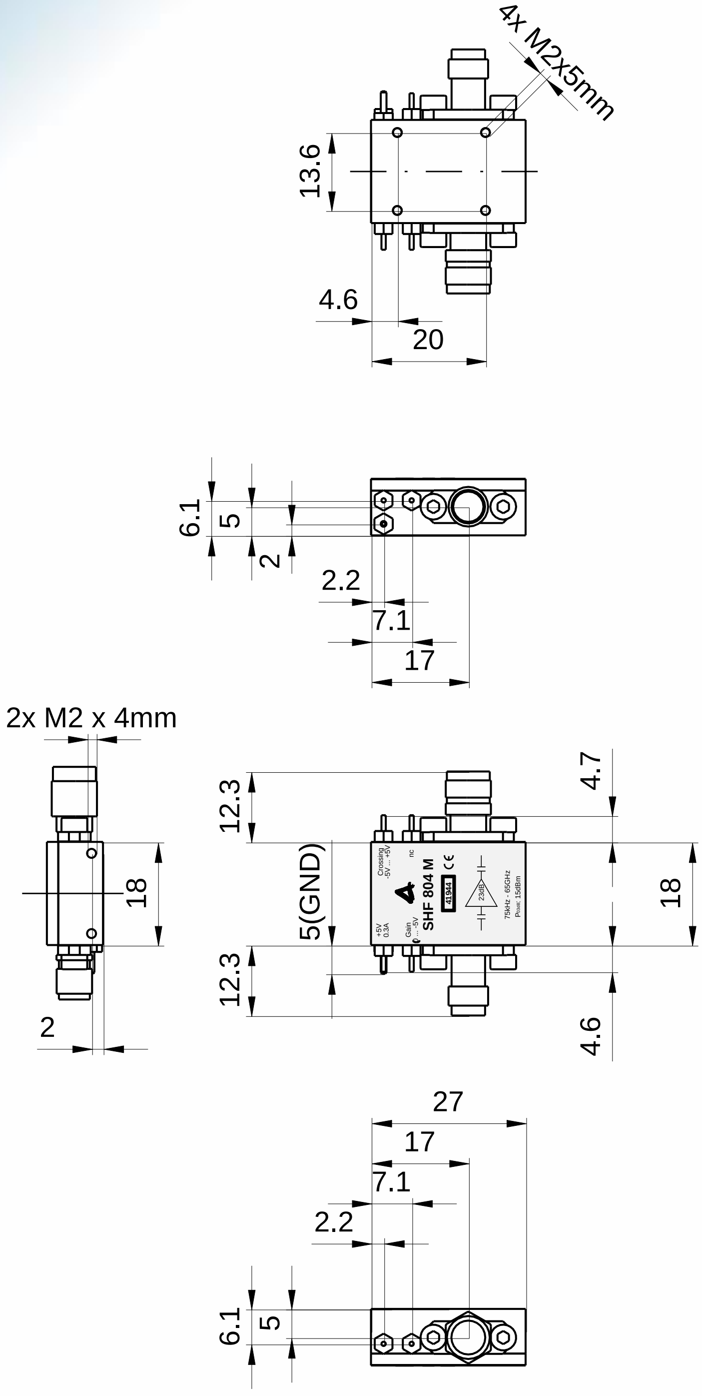
Mechanical Drawing with Heat Sink



All dimensions in mm

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.

Mechanical Drawing without Heat Sink



All dimensions in mm

Please ensure that adequate cooling of the amplifier is guaranteed.

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 a well regulated 4.5…5.5 V, 0.3 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 0.5 V_{pp} will produce saturated output swing of about 3.5 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.