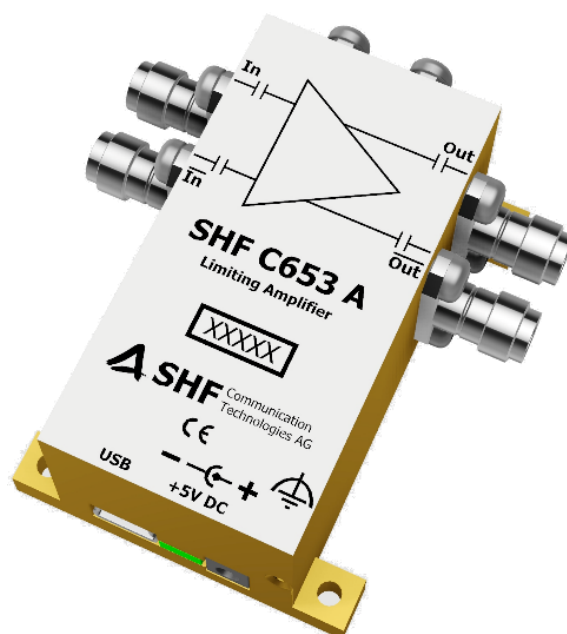


Data Sheet SHF C653 A



120 Gbps Limiting Amplifier



Description

The SHF C653 A is a RoHS compliant limiting amplifier which operates at data rates up to 120 Gbps and with clock signal up to 70 GHz for use in broadband test setups and telecom transmission systems. The AC-coupled differential inputs can be driven single-ended by terminating the unused input. For input signals >150 mV the output voltage will be clipped to 600 mV.

Features

- Supports data rates up to 120 GBit/s
- Supports clock frequencies up to 70 GHz
- Output amplitude control
- Output crossing control
- Output signal speed (trim) control
- Single ended or differential operation (either In or In! or both can be used)
- 600 mV single ended output swing

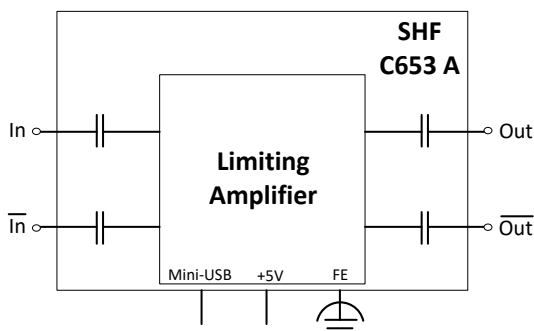
Applications

- 100GbE, 200GbE, 400GbE and 1TbE system evaluation & development
- Telecom transmission
- Broadband test and measurement equipment

Accessories

- +5 V Power Supply Desktop Adapter
- Functional Earth Cable → Connection to test setup ground has to be set up first before any other connection to prevent instrument damage!
- Mini-USB cable

Block Diagram



Specifications

Absolute Maximum Ratings

Parameter	Unit	Symbol	Min	Typ	Max	Comment
RF Input Voltage	mV	V_{in}			900	Peak-to-Peak Single-ended
External DC Voltage on RF Input Ports	V	V_{DCin}	-6		+6	AC coupled input
External DC Voltage on RF Output Ports	V	V_{DCout}	-6		+6	AC coupled output
DC Supply Voltage	V	V_{cc}	0		+6	

Input Parameters

Parameter	Unit	Symbol	Min	Typ	Max	Comment
Minimum Data Rate	Gbps	$R_{in,min}$			1	
Maximum Data Rate	Gbps	$R_{in,max}$	120			
Input Voltage	mV _{pp}	$V_{clk\ in}$	150		850	Peak-to-Peak Single ended

Output Parameters

Parameter	Unit	Symbol	Min	Typ	Max	Comment
Output Voltage	mV	V_{out}	450 530	500 600	700 700	> 64 Gbps ≤ 64 Gbps Eye Amplitude, Single-ended, Adjustable up to -10 dB
Output Jitter, RMS value	fs	J_{rms}		500	800	
Small Signal Gain	dB	G_p	23	25		$T_{ambient}=25^{\circ}C$



Power Requirements

Parameter	Unit	Symbol	Min	Typ	Max	Comment
Supply Voltage	V	V_{CC}	+4.8		+5.2	2.5 x 0.7 mm DC Power Jack
Supply Current	mA	I_{EE}		280	300	
Power Dissipation	W	P_d		1.4		@ $V_{CC} = +5V$

Mechanical Characteristics

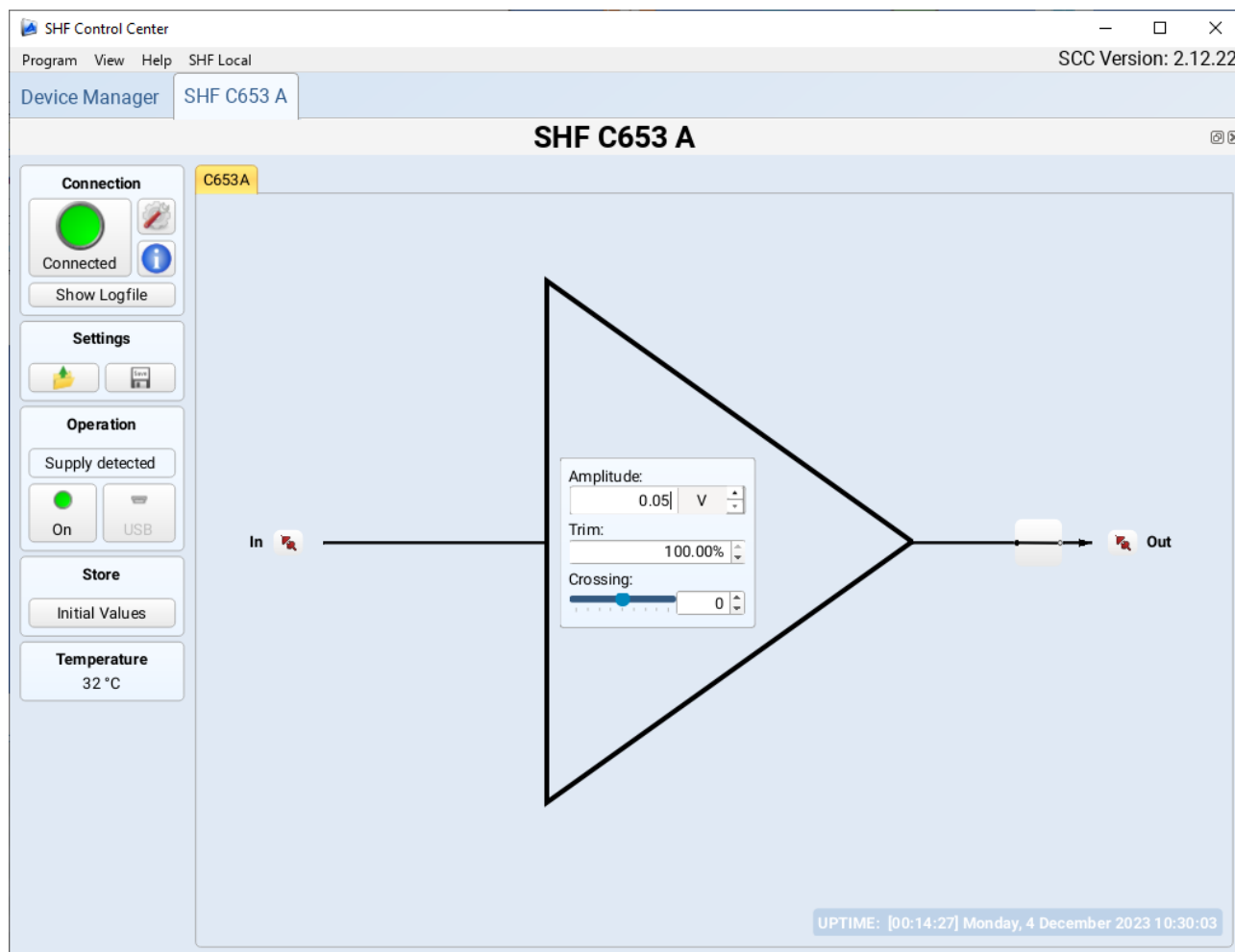
Parameter	Unit	Symbol	Min	Typ	Max	Comment
Input Connectors	Ω			50		1.85 mm (V) female
Output Connectors	Ω			50		1.85 mm (V) female
Dimensions	mm					See page 12
Weight	g			90		

Conditions

Parameter	Unit	Symbol	Min	Typ	Max	Comment
Operating Temperature	$^{\circ}C$	$T_{Ambient}$	15		35	

Remote Interface & Software

The Limiting Amplifier is controlled by the easy-to-use software package SHF Control Center (SCC). The amplitude, crossing, output signal speed (trim) and the RF output state (on/off) can be set and are displayed in the graphical user interface (GUI).



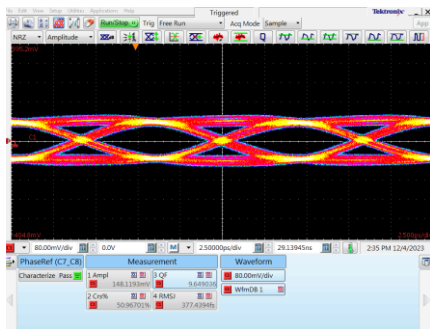
GUI – SHF Control Center SCC



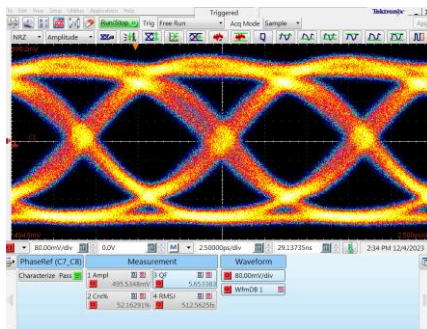
Typical Output Eye Diagrams

Output Signal Measurement

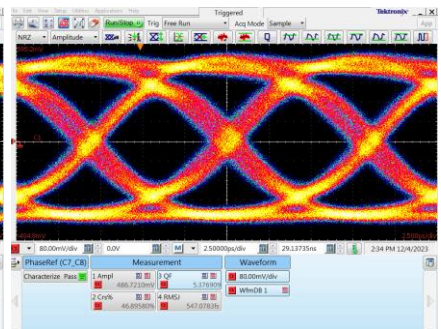
The measurements below had been performed using a SHF C603 B Mux (PRBS $2^{31}-1$) and a Tektronix DSA 8300 Digital Serial Analyzer with Phase Reference (82A04B-60G) and 70 GHz Sampling Module (80E11). The input of the module is driven single ended. The outputs of the module had been connected directly to the DSA input.



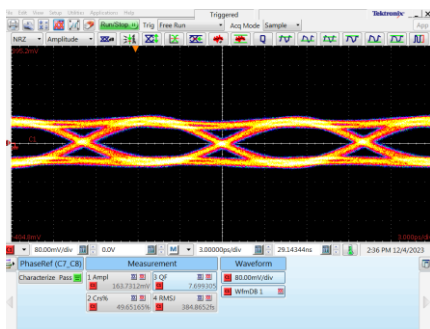
Input @ 120 Gbps



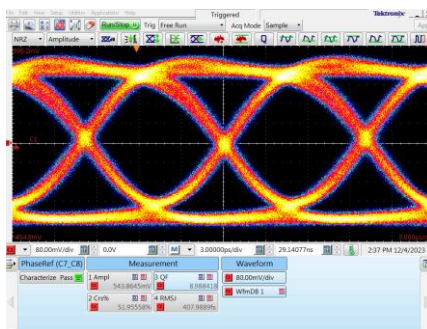
Output @ 120 Gbps



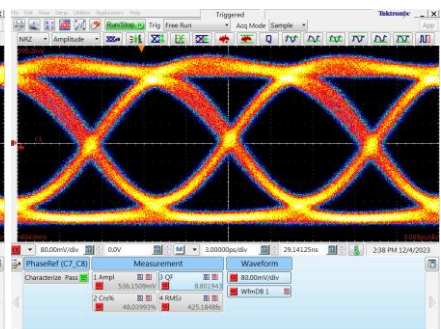
Output inv. @ 120 Gbps



Input @ 100 Gbps



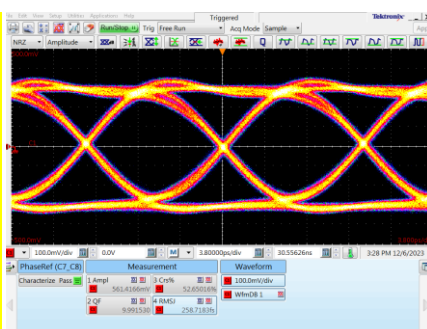
Output @ 100 Gbps



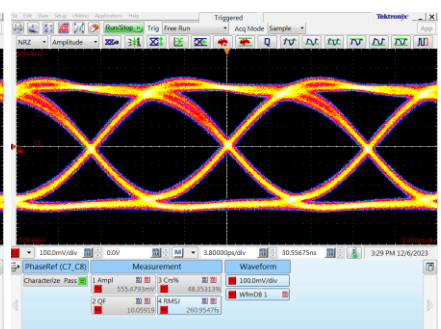
Output inv. @ 100 Gbps



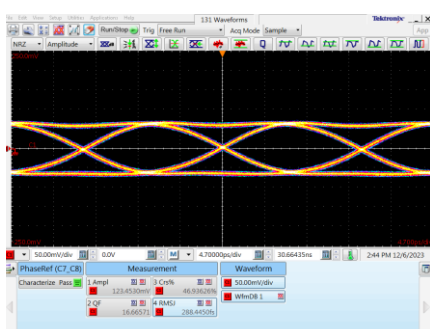
Input @ 80 Gbps



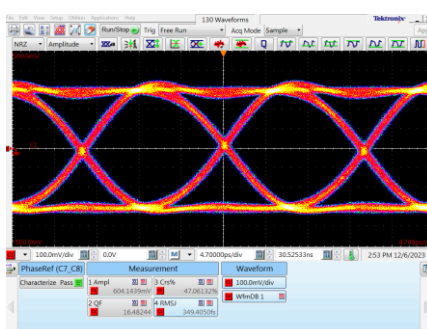
Output @ 80 Gbps



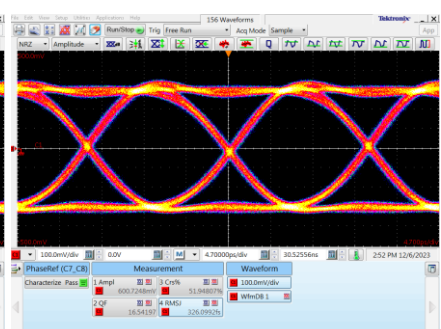
Output inv. @ 80 Gbps



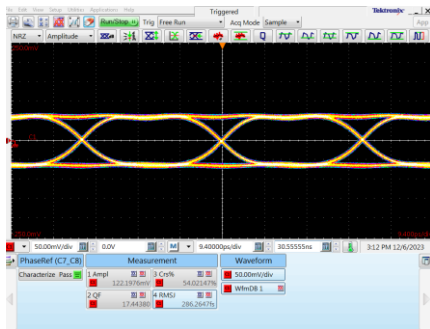
Input @ 64 Gbps



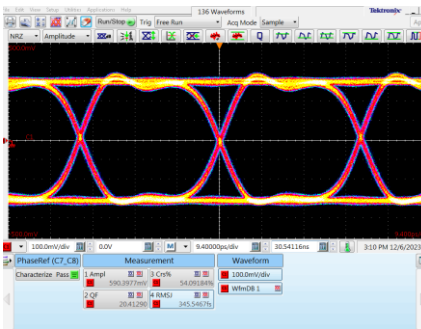
Output @ 64 Gbps



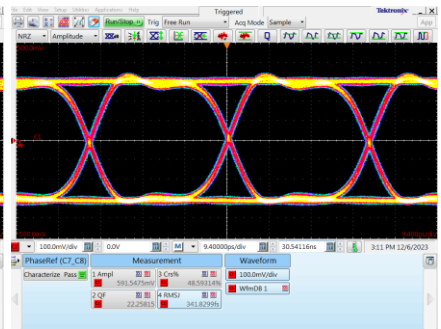
Output inv. @ 64 Gbps



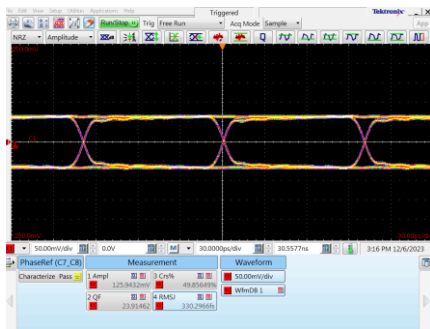
Input @ 32 Gbps



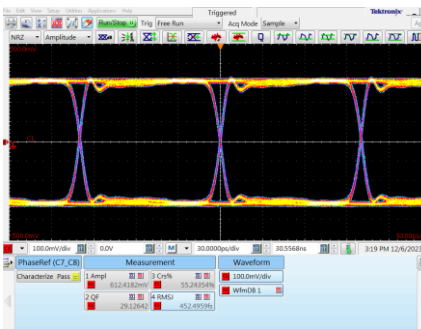
Output @ 32 Gbps



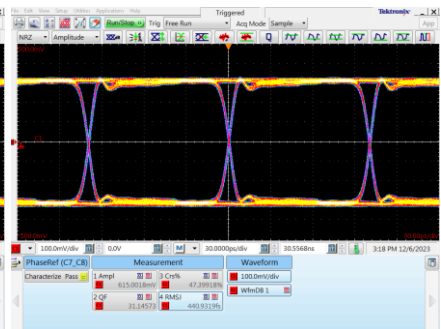
Output inv. @ 32 Gbps



Input @ 10 Gbps



Output @ 10 Gbps

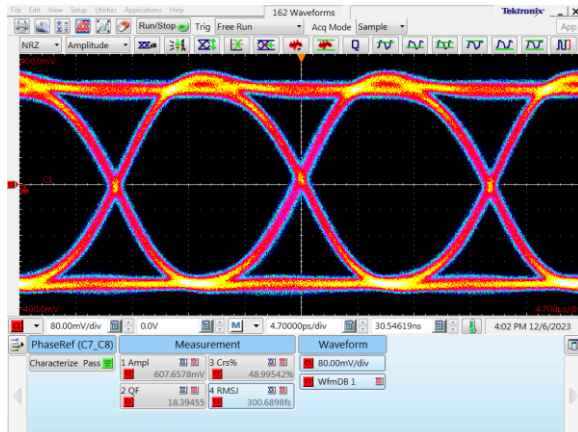


Output inv. @ 10 Gbps

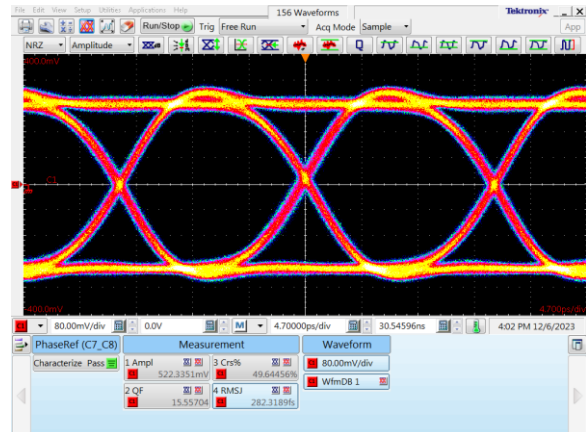


Output Amplitude Adjustment

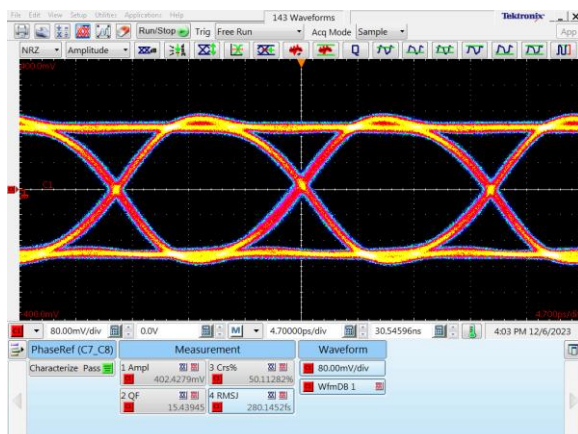
The measurements below had been performed using a SHF C603 B Mux (PRBS $2^{31}-1$) and a Tektronix DSA 8300 Digital Serial Analyzer with Phase Reference (82A04B-60G) and 70 GHz Sampling Module (80E11). The input of the module is driven single ended. The output of the module had been connected directly to the DSA input with a 6 dB attenuator.



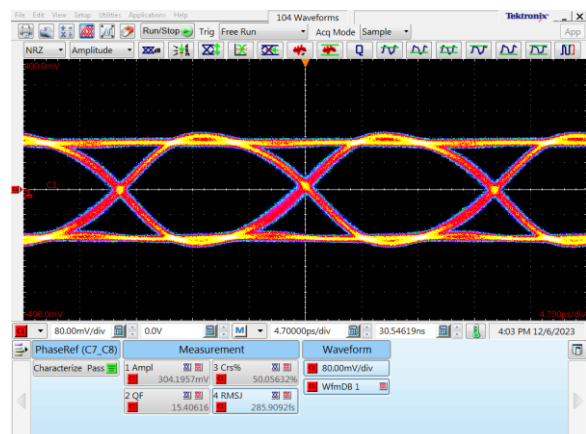
64 Gbps @ 600 mV



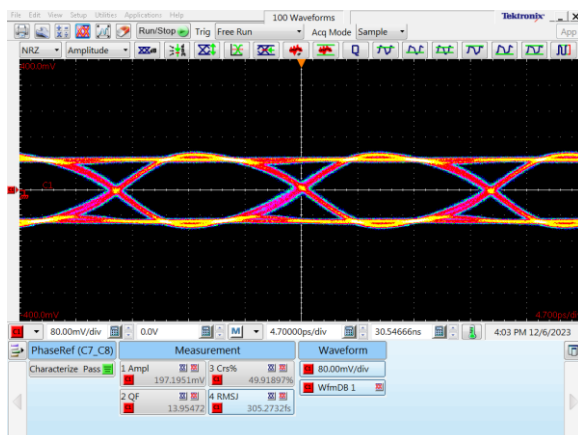
64 Gbps @ 500 mV



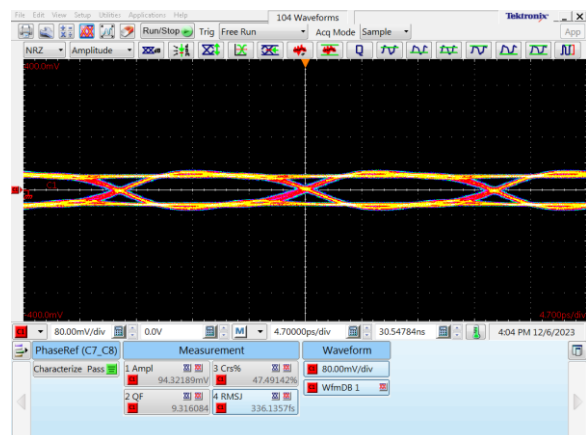
64 Gbps @ 400 mV



64 Gbps @ 300 mV



64 Gbps @ 200 mV

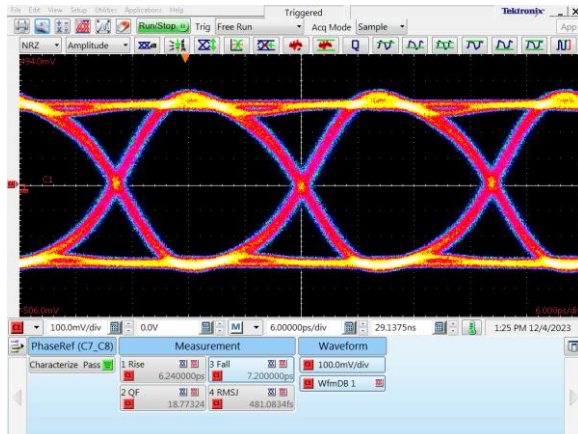


64 Gbps @ 100 mV

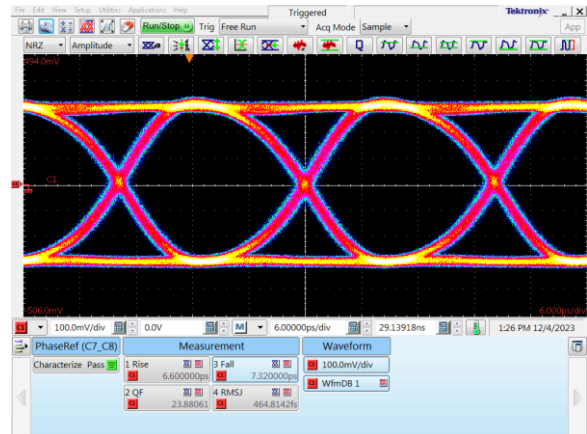


Output Signal Speed (Trim) – Adjustment

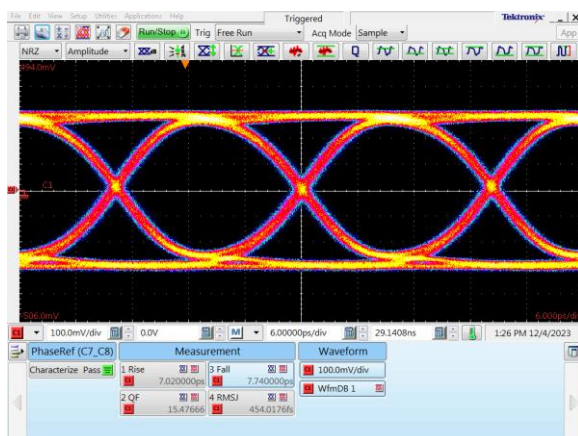
The measurements below had been performed using a SHF 12105 A BPG (PRBS $2^{31}-1$) and a Tektronix DSA 8300 Digital Serial Analyzer with Phase Reference (82A04B-60G) and 70 GHz Sampling Module (80E11). The input of the module is driven single ended. The output of the module had been connected directly to the DSA input with a 6 dB attenuator.



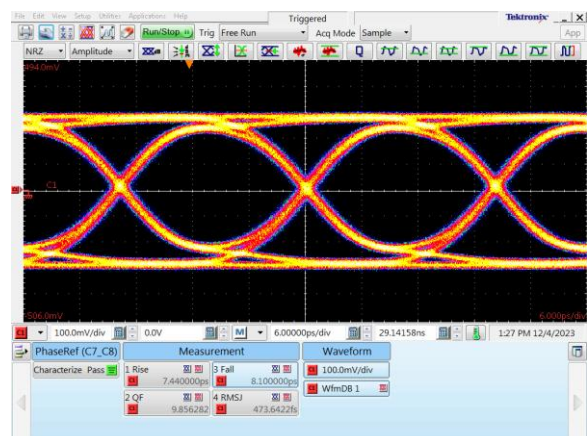
50 Gbps @ TRIM = 100 %



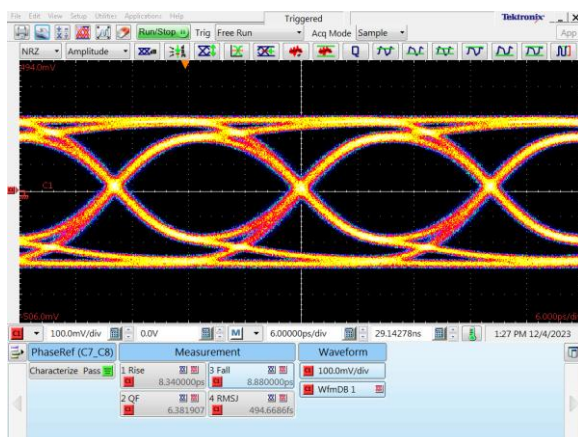
50 Gbps @ TRIM = 80 %



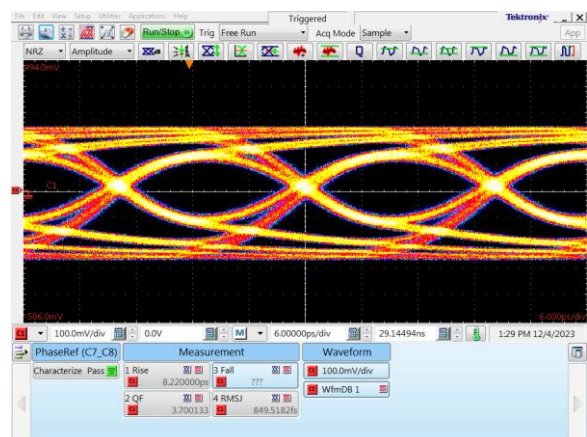
50 Gbps @ TRIM = 60 %



50 Gbps @ TRIM = 40 %



50 Gbps @ TRIM = 20 %

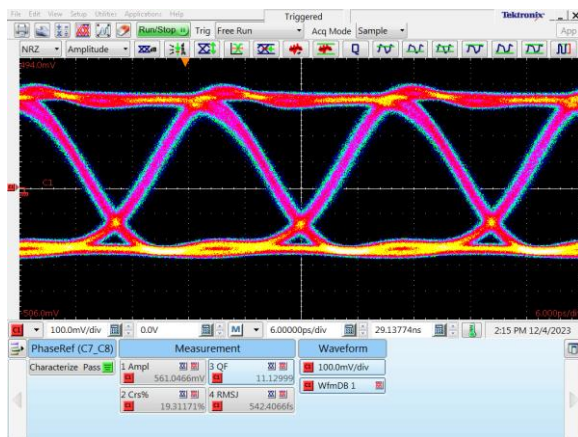


50 Gbps @ TRIM = 0 %

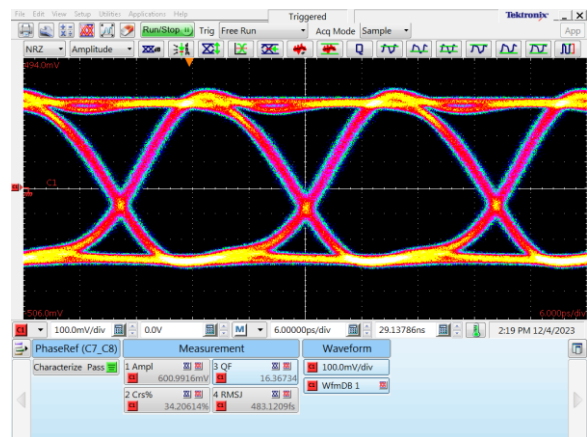


Output Signal Crossing – Adjustment

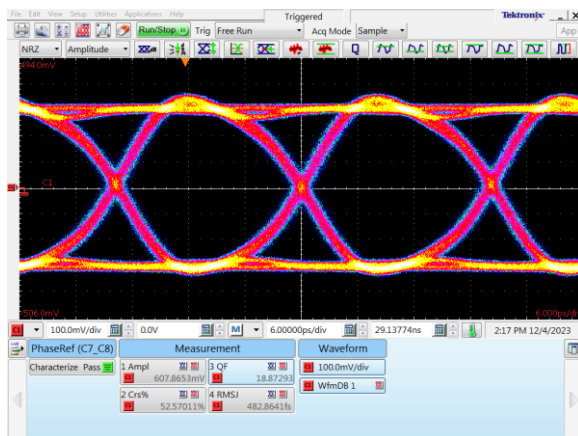
The measurements below had been performed using a SHF 12105 A BPG (PRBS $2^{31}-1$) and a Tektronix DSA 8300 Digital Serial Analyzer with Phase Reference (82A04B-60G) and 70 GHz Sampling Module (80E11). The input of the module is driven single ended. The output of the module had been connected directly to the DSA input with a 6 dB attenuator. A maximum Crossing adjustment range can be achieved at a max. input amplitude of 150 mV. With increasing the input amplitude the range of the crossing adjustment will be reduced.



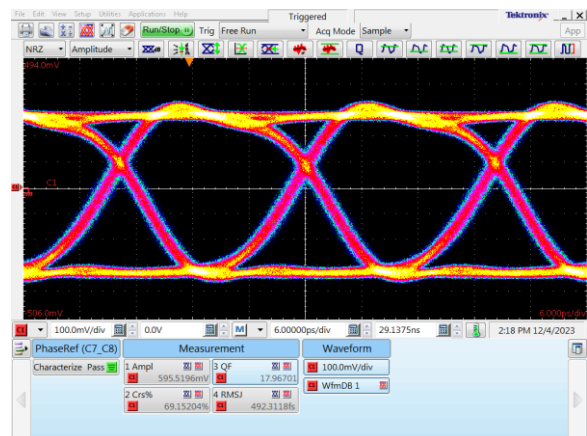
50 Gbps @ CROSSING = -100



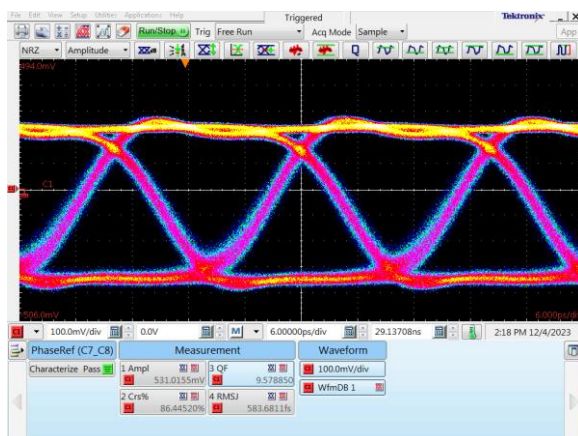
50 Gbps @ CROSSING = -50



50 Gbps @ CROSSING = 0



50 Gbps @ CROSSING = 50



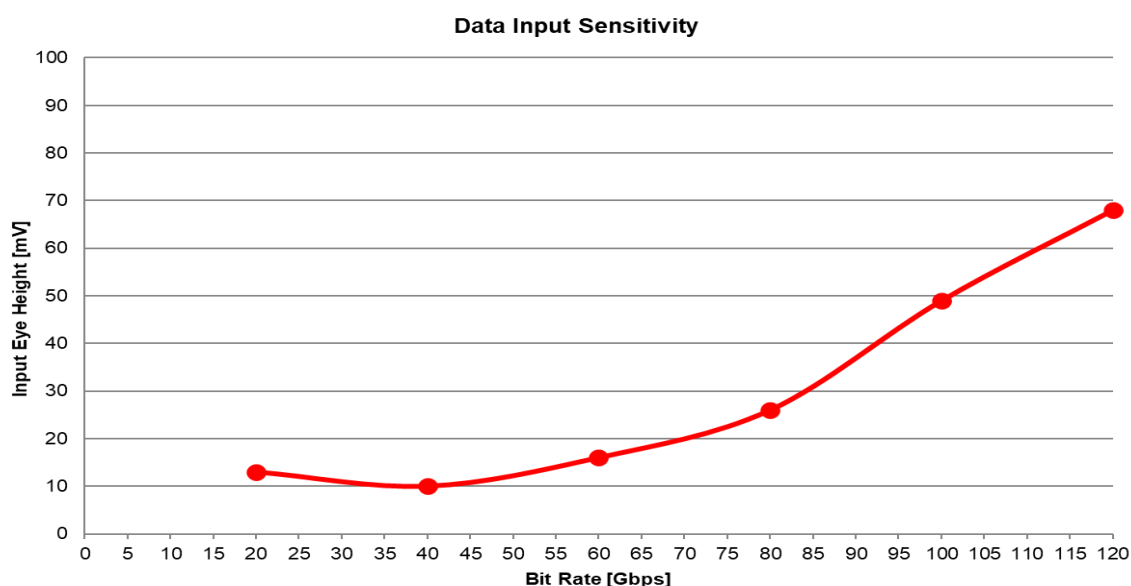
50 Gbps @ CROSSING = 100



Typical Measurement Results

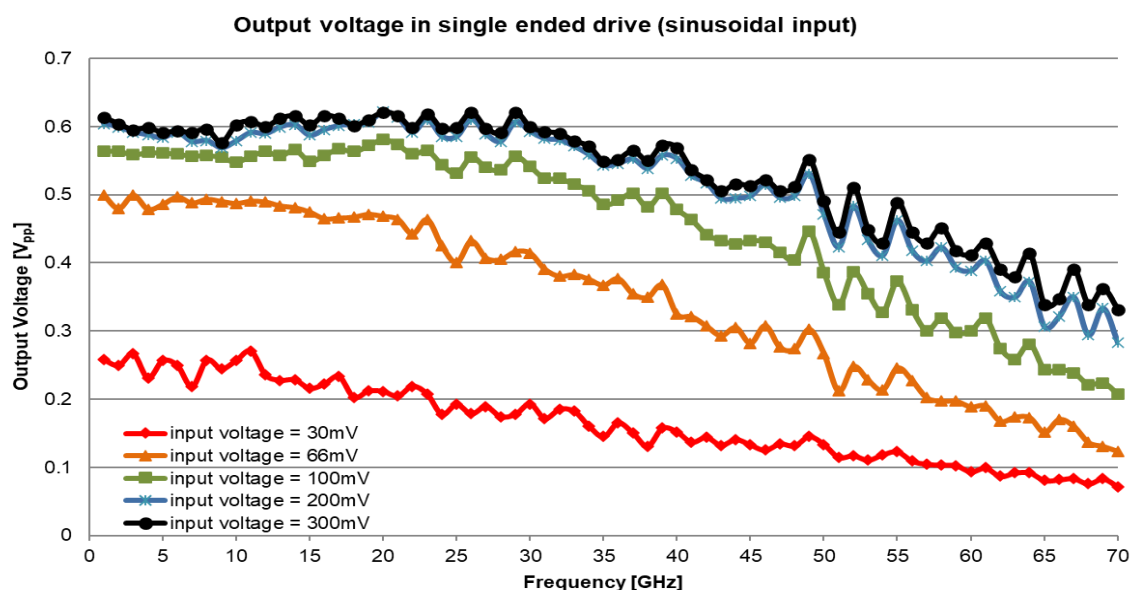
Data Input Sensitivity

The measurements shown below had been performed using a SHF C603 B Mux (PRBS $2^{31}-1$), a SHF 11104 A Error Analyzer, a Tektronix DSA 8300 Digital Serial Analyzer with Phase Reference (82A04B-60G) and 70 GHz Sampling Module (80E11) to determine the data input eye height. The input of the module is driven single ended. The input signal had been reduced until a BER limit of $<10^{-9}$ had been achieved.



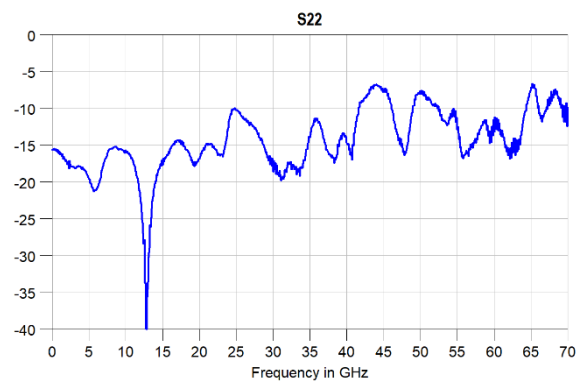
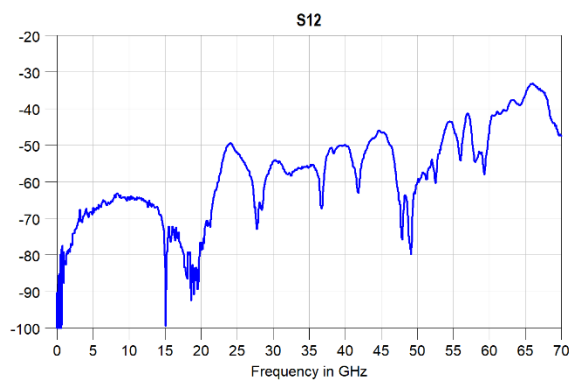
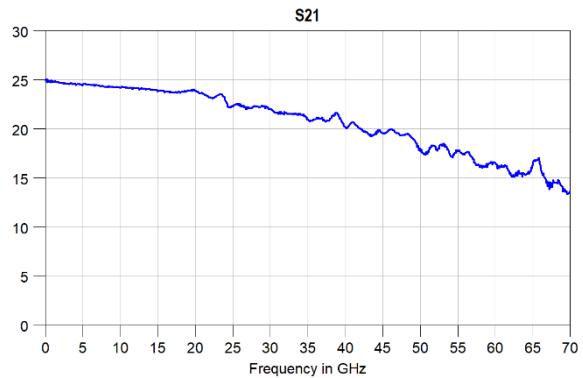
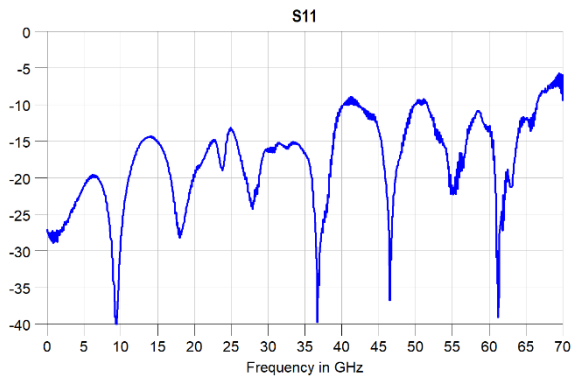
Output Voltage

The measurements shown below had been performed using a SHF 78122 B Signal Generator, an Agilent 86100B DCA with Precision Time Base Module (86107A) and a 70 GHz Sampling Head (86118A) to determine the output amplitude. The input of the module is driven single ended. The output of the module had been connected directly to the DSA input with a 6 dB attenuator.





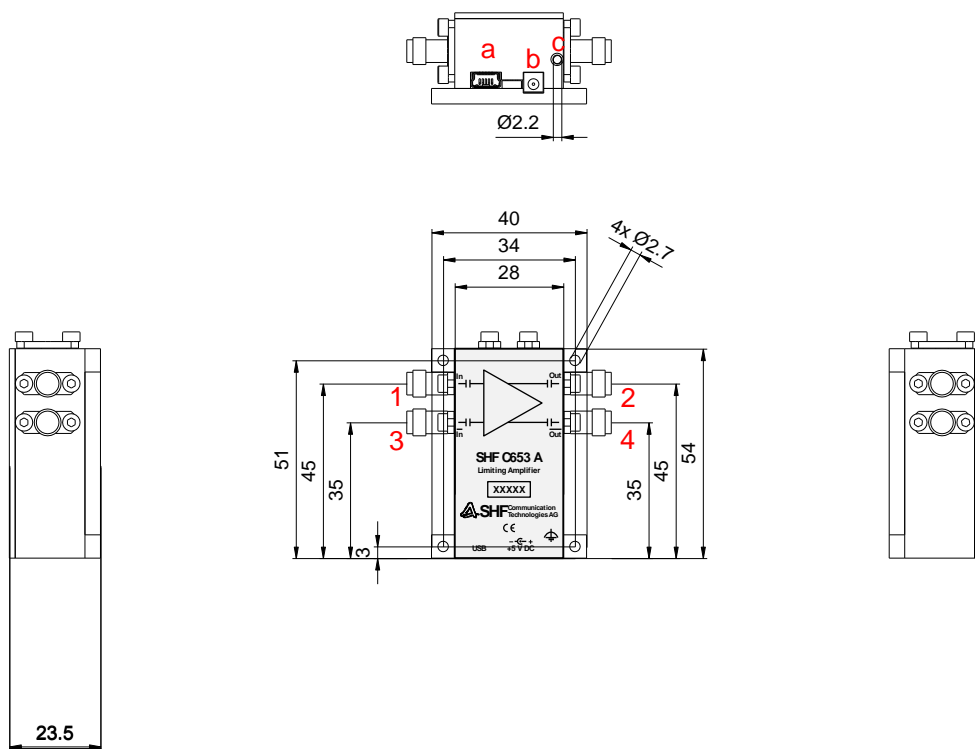
Typical S-Parameters



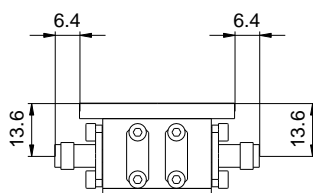
S-Parameter measurements @ Pin = -30 dBm



Mechanical Drawing



Pos	Port	Connector
1	In	1.85 mm (V) female
2	Out	1.85 mm (V) female
3	In	1.85 mm (V) female
4	Out	1.85 mm (V) female



All dimensions are in mm

Port	Connector	Designation
a	Mini-USB	Control Interface
b	Power Jack 2.5 x 0.7 mm	+5 V
c	2 mm Banana Jack	Functional Earth



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