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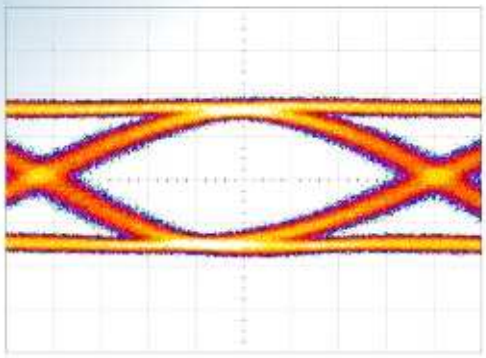
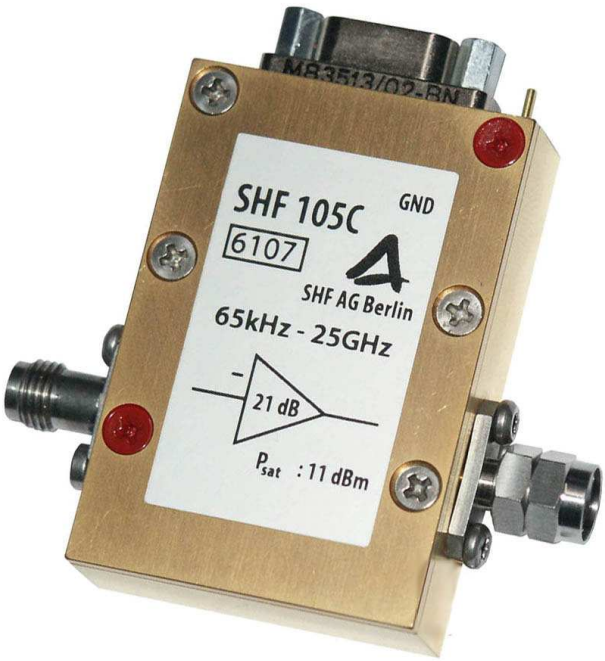


Preliminary Datasheet

SHF 105C

Amplifier for Cryogenic Environment



Preliminary specifications – SHF 105C

Absolute maximum ratings (20K < T_{case} < 348K)						
Parameter	**Symbol**	**Unit**	**Min**	**Typ**	**Max**	**Conditions**
Drain Voltage Stage 1	V_{D1}	V	0		5.5	
Drain Voltage Stage 2	V_{D2}	V	0		5.5	
Drain Voltage Stage 3	V_{D3}	V	0		5.5	
Drain Current Stage 1	I_{D1}	mA			170	
Drain Current Stage 2	I_{D2}	mA			170	
Drain Current Stage 3	I_{D3}	mA			170	
First Gate Voltage Stage 1	V_{G1_1}	V	-3		0	
First Gate Voltage Stage 2	V_{G1_2}	V	-3		0	
First Gate Voltage Stage 3	V_{G1_3}	V	-3		0	
Second Gate Voltage Stage 1	V_{G2_1}	V	-3		+3	
Gain Control Voltage	V_{CNT}	V	0		5	
Input Signal Level	V_{in}	V_{pp}			1	
Case Temperature	T_{case}	K	20		348	
Power dissipation	P_D	W			2.8	

Recommended operating conditions for ***Maximum Gain Performance*** All Data at $T_{ambient}$ = 22℃ unless otherwise specified						
Parameter	**Symbol**	**Unit**	**Min**	**Typ**	**Max**	**Conditions**
Drain Voltage Stage 1	V_{D1}	V		4.7		
Drain Voltage Stage 2	V_{D2}	V		4.7		
Drain Voltage Stage 3	V_{D3}	V		4.7		
Drain Current Stage 1	I_{D1}	mA		60		Depends on V_{G1_1}
Drain Current Stage 2	I_{D2}	mA		60		Depends on V_{G1_2}
Drain Current Stage 3	I_{D3}	mA		80		Depends on V_{G1_3}
First Gate Voltage Stage 1	V_{G1_1}	V		-1		
First Gate Voltage Stage 2	V_{G1_2}	V		-1		
First Gate Voltage Stage 3	V_{G1_3}	V		-1		
Second Gate Voltage Stage 1	V_{G2_1}	V		1.7		Self-biasing from V_{D1} (V_{G2_1} = V_{D1} x 0.38), Note 1
Gain Control Voltage	V_{CNT}	V		0		Max Gain, Note 2
Power dissipation	P_D	W		1		

Recommended operating conditions for minimum ***Noise Figure Performance*** All Data at $T_{ambient}$ = 22℃ unless otherwise specified						
Parameter	**Symbol**	**Unit**	**Min**	**Typ**	**Max**	**Conditions**
Drain Voltage Stage 1	V_{D1}	V		2.5		
Drain Voltage Stage 2	V_{D2}	V		2.5		
Drain Voltage Stage 3	V_{D3}	V		4.7		
Drain Current Stage 1	I_{D1}	mA		30		Depends on V_{G1_1}
Drain Current Stage 2	I_{D2}	mA		30		Depends on V_{G1_2}
Drain Current Stage 3	I_{D3}	mA		60		Depends on V_{G1_3}
First Gate Voltage Stage 1	V_{G1_1}	V		-1.7		
First Gate Voltage Stage 2	V_{G1_2}	V		-1.7		
First Gate Voltage Stage 3	V_{G1_3}	V		-1		
Second Gate Voltage Stage 1	V_{G2_1}	V		0.9		Self-biasing from V_{D1} (V_{G2_1} = V_{D1} x 0.38), Note 1
Gain Control Voltage	V_{CNT}	V		0		Max Gain, Note 2
Power dissipation	P_D	W		0.5		

Electrical characteristics – SHF 105C

All Data at $T_{ambient}$ = 22℃ and Recommended operating conditions for ***Maximum Gain Performance*** unless otherwise specified

Parameter	Symbol	Unit	Min	Typ	Max	Conditions
High frequency 3dB point	f_{High}	GHz	25	30		0dB@40MHz; -27dBm input power
Low frequency 3dB point	f_{Low}	kHz			65	0dB@40MHz; -27dBm input power
Small Signal Gain	G_p	dB	21			-27dBm@40MHz
Temperature coefficient (G_p)	T_c	dB/℃		-0.035		
Gain ripple		dB		±1.5		
Gain control Voltage -Current	V_{CNT} I_{CNT}	V mA	0 0		+5 3	reduces Small Signal Gain, Note 2
Group delay		ps		±50		> 40MHz < 25GHz, 100MHz aperture
Output jitter, RMS value		ps		0.7		Output voltage ~1V_{pp}
Rise time/fall time	t_r/t_f	ps		20		20…80%
Noise figure	N_F	dB		6		at 5 GHz
Output power at 1 dB compression	P_{01dB}	dBm (V_{pp})	9 (1.8)			<30 GHz
Output power at saturation	P_{sat}	dBm (V_{pp})	11 (2.2)			<30 GHz
Input return loss	S_{11}	dB		-15 -10 -5		< 10 GHz < 32 GHz < 45 GHz
Output return loss	S_{22}	dB		-12 -10 -5		< 20 GHz < 32 GHz < 45 GHz
Power dissipation	P_D	W		0.85		
Input and output connector	-			-		Input V-female, Output V-male; Other config. on request
Power supply connector	-			-		Micro-D 15 Socket Connector *(Glenair)* see Note 3

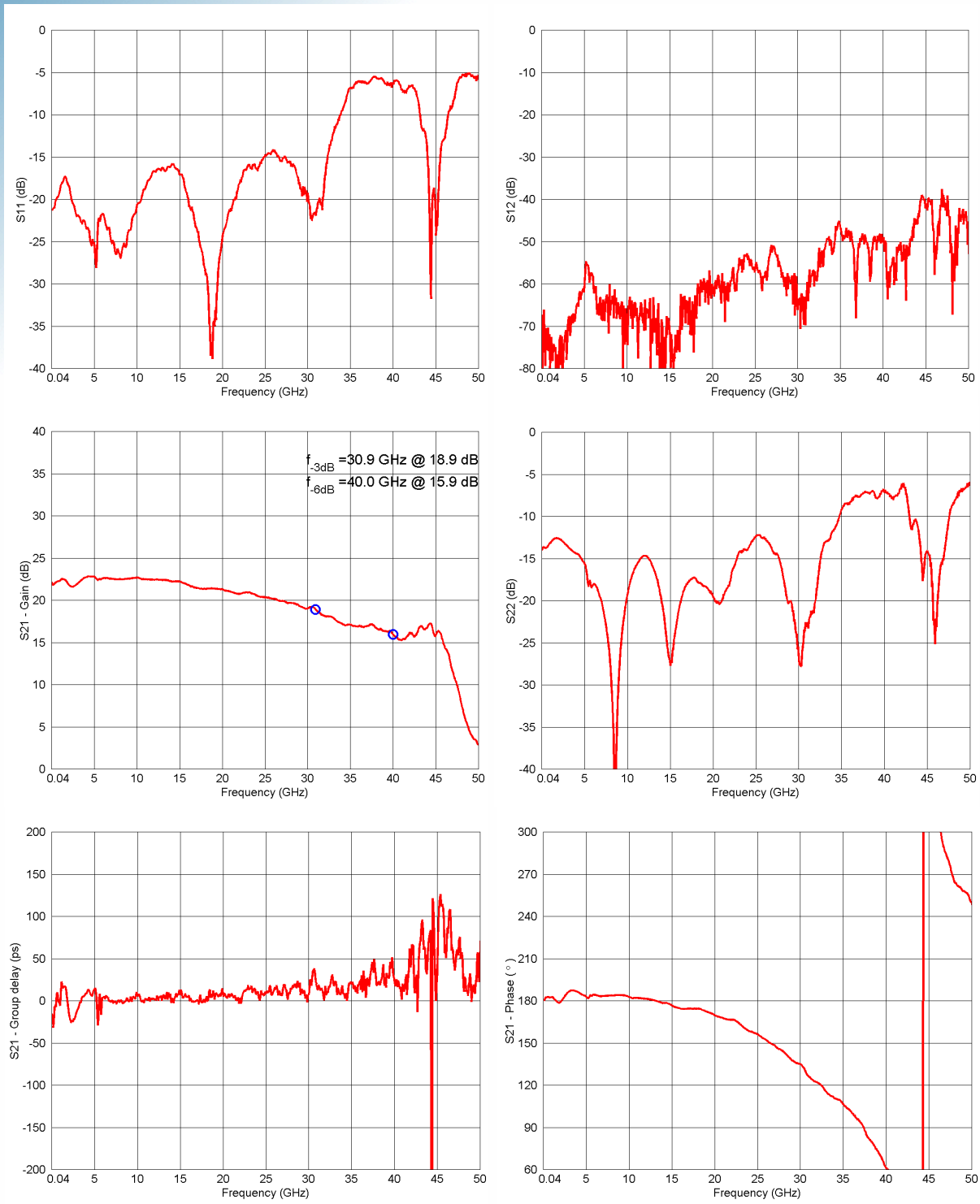
Note 1: For standard operation it is not required to apply a voltage to V_{G2_1}. V_{G2_1} is self-biased by a voltage derived from V_{D1} (V_{G2_1} = V_{D1} x 0.38).

Note 2: The gain reduction functionality will be provided by precision potentiometers when using the SHF bias control box, which is capable to supply ten SHF 105C at the same time.
Without using the bias control box, it is required to operate the first amplifier stage in constant current mode by applying an external regulation which controls V_{G1_1}. In this case an applied voltage at V_{CNT} will cause a linear reduction of the drain current of approximately 10mA/V.
Alternatively V_{G2_1} can be used to control the small signal gain. In this case V_{CNT} is not being used.

Note 3: For connecting the Micro D-15 socket a connector with cable pigtail can be provided by Glenair (Part No: DCDM15P-6E5-18.0MC240) or by SHF as an option.

S-Parameters – SHF 105C

Measured at $T_{ambient}$ = 22℃ and Recommended operating conditions for ***Maximum Gain Performance***

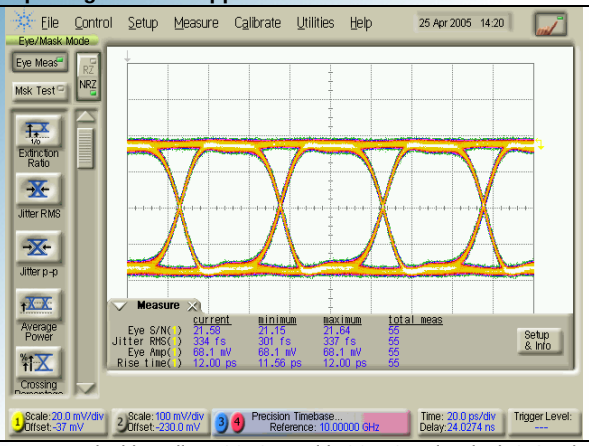
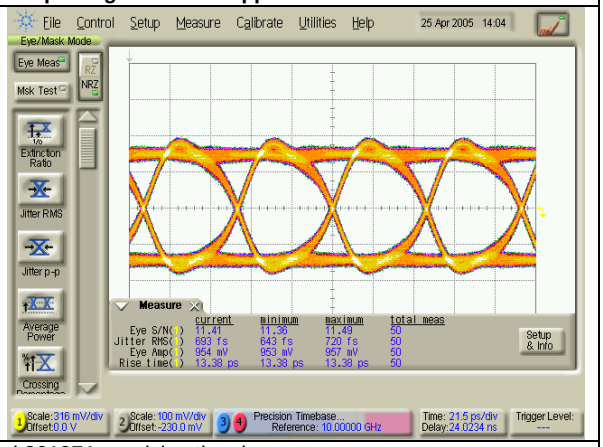


Aperture of Group Delay measurement: 100MHz

SHF Communication Technologies AG
the bandwidth company

Eye diagrams at 20 Gbps – SHF 105C

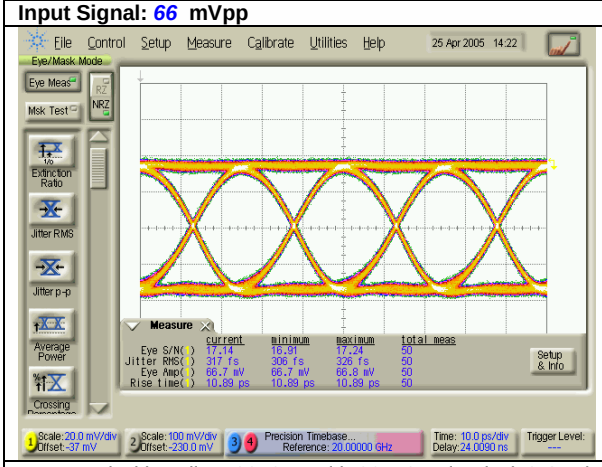
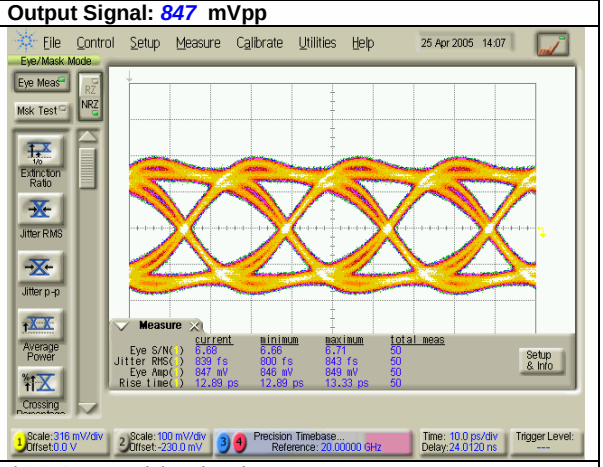
Measured at $T_{ambient}$ = 22℃ and Recommended operating conditions for ***Maximum Gain Performance***

Input Signal: *68* mVpp	**Output Signal: *950* mVpp**
	

Measured with Agilent 83484A with 86118A plug-in (70 GHz) and 86107A precision time base.
Signal source: SHF BPG 44 E. Pattern length: 2^{31}-1.

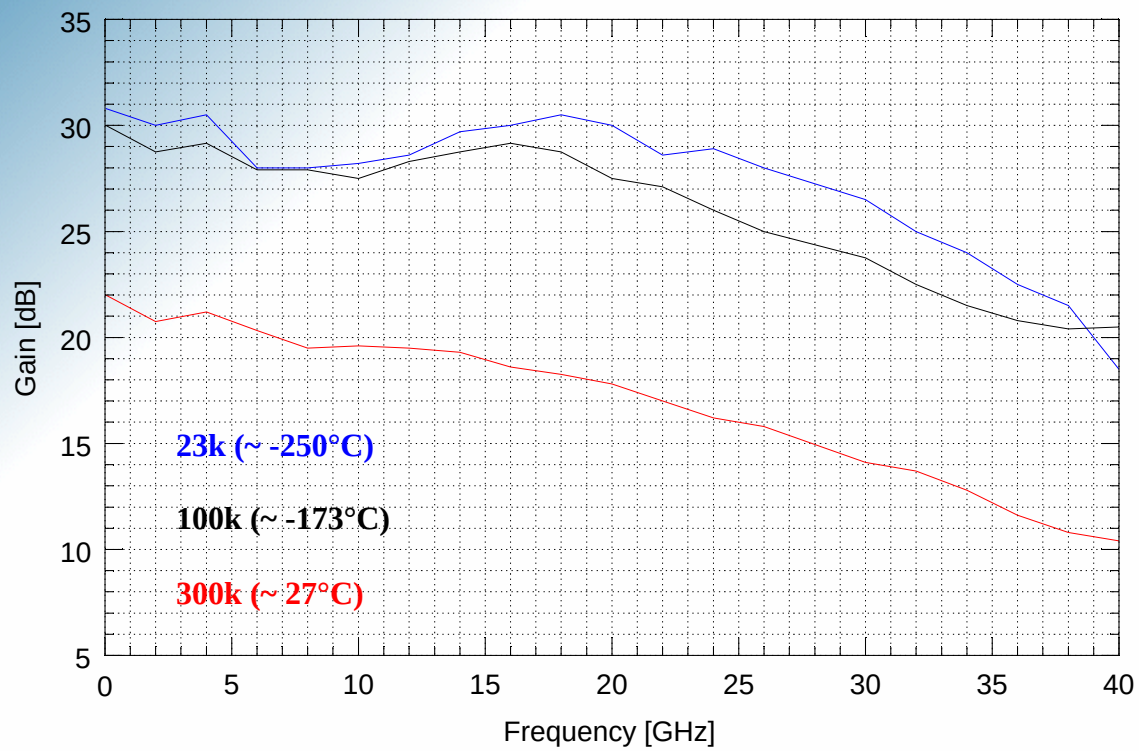
Eye diagrams at 40 Gbps – SHF 105C

Measured at $T_{ambient}$ = 22℃ and Recommended operating conditions for ***Maximum Gain Performance***

Input Signal: *66* mVpp	**Output Signal: *847* mVpp**
	

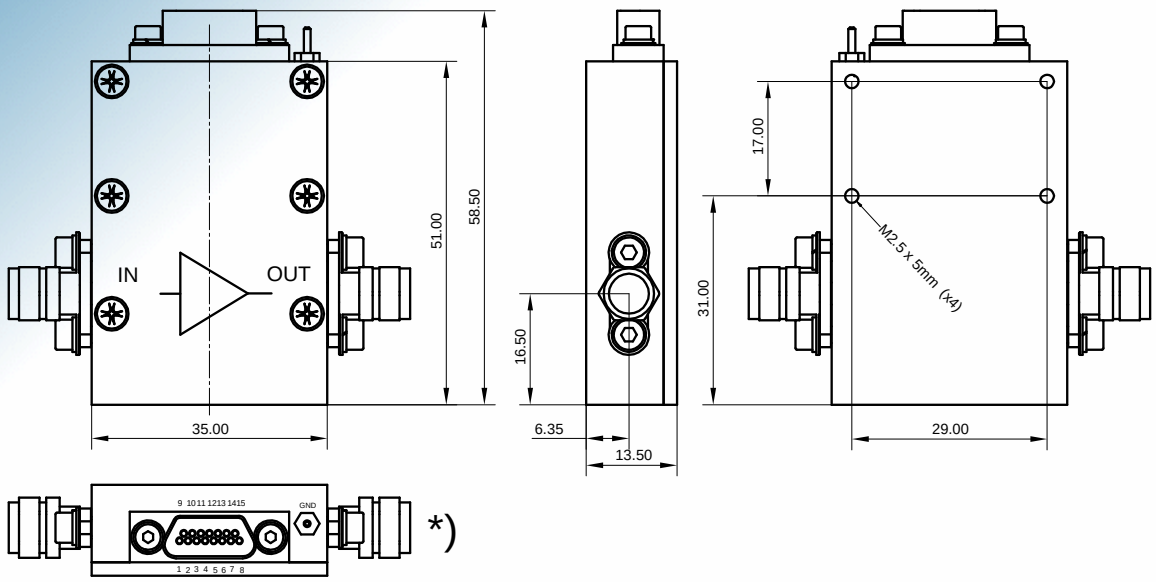
Measured with Agilent 83484A with 86118A plug-in (70 GHz) and 86107A precision time base.
Signal source: SHF BPG 44 E. Pattern length: 2^{31}-1.

Gain characteristic at cryogenic temperatures – SHF 105C



Based on measurement results provided by courtesy of International Superconductivity Technology Center (ISTEC), Japan

Mechanical drawings – SHF 105C



Pin No.	Function
1	Gaincontrol (Cnt)
2	Drainvoltage first stage (D1)
3	Gatevoltage first stage (G1)
4	Drainvoltage second stage (D2)
5	Gatevoltage second stage (G2)
6	Drainvoltage third stage (D3)
7	Gatevoltage third stage (G3)
8	Common Ground (GND)
9	Second gate first stage (G2_1)
10..15	Not connected

Pin numbering according to view *)