AFBR-1310Z / AFBR-1310xZ

Fiber Optic Transmitter for Multi GHz Analog Links

Data Sheet

Description

The AFBR-1310xZ is a compact, high performance, cost effective transmitter for multi GHz analog communication over single mode optical fiber.

The transmitter incorporates a linear wide bandwidth InGaAsAl/InP Fabry-Perot laser packaged inside a TO-header, coupled to a single mode fiber pigtail terminated with a standard FC/PC connector (or an SC/APC connector, or an LC/PC connector), a monitor photodiode for closed loop operation, a 50 ohm input impedance linear RF amplifier and a bias network that allows to separately control the laser average output power.

The transmitter operates at a nominal wavelength of 1310 nm.

Access to RF input, electrical control signals I/Os and amplifier supply is through a flexible printed circuit board. The RF input is self biased and AC coupled, and thus does not require an external DC block.

A suitable bracket is used to mount the transmitter onto a PCB or metal substrate.

The high output power and conversion gain allow for a high splitting ratio in branched Passive Optical Networks.

Features

- Compact package
- Uncooled operation in a wide temperature range
- High performance 1310 nm Fabry-Perot laser
- Built-in high performance RF amplifier
- Floating Monitor Photodiode for flexibility in control loop design
- Single mode fiber pigtailed output with standard FC/PC connector (AFBR-1310Z)
- SC/APC pigtail option available (AFBR-1310AZ)
- LC/PC pigtail option available (AFBR-1310BZ)
- Low power consumption
- Flex interconnect to customer PCB
- Minimal external circuitry required
- RoHS6 compliant
- Pairs to AFBR-2310Z Receiver for multi GHz analog links

Specifications

- Nominal 50 ohm RF input impedance
- 5 mW typical output power at 50 mA laser current (room temperature)
- 5 V RF amplifier supply voltage
- 200 MHz to 5.5 GHz frequency range
- 20 mW/V typical slope efficiency/conversion gain

Applications

- Analog optical links for satellite signal distribution
- In-building antenna remote systems

Table 1. Absolute Maximum Ratings [1]

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Storage Temperature (non-operating)	Ts	-40		85	C	
Operating Temperature	Ta	-40		85	C	
Relative Humidity (non condensing)	RH			85	%	
RF amplifier supply voltage		0		5.5	V	
RF amplifier input power	Pin			20	dBm	
RF amplifier input DC voltage	Vin			6	V	
Laser bias current (direct)	I_{bias}			100	mA	
Laser bias reverse voltage				2	V	
Monitor photodiode reverse voltage	V_R			15	V	
Monitor photodiode direct current				5	mA	
Flex soldering temperature				300	C	For manual soldering, no longer than 2 sec/pad. It is advisable to pre-heat the customer PCB.
ESD capability (HBM)	V_{ESDHBM}			250	V	

Notes:
1. Absolute maximum ratings are those values beyond which functional performance is not intended, device reliability is not implied, and damage to the device may occur.

Table 2. Recommended operating conditions [2]

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Operating Temperature	Ta	-40		85	C	
Relative Humidity (non condensing)	RH			80	%	
RF amplifier supply voltage	V_{CC}	4.75	5	5.25	V	
Monitor photodiode reverse voltage	V_R	2	5	10	V	

Notes:
2. Typical operating conditions are those values for which functional performance and device reliability is implied.

Table 3. Electro-Optical specifications

Parameter	Symbol	Conditions	Min.	Nom.	Max.	Unit	Notes
Output Power	P_o	25° C, I_f = 60 mA	5			mW	
Laser threshold current	I_{th}	T = 25° C T = 85° C			15 30	mA	
Laser operating current	I_{op}	P_o = 5 mW, T = 25° C T = 85° C			 60 95	mA	
Laser wavelength	λ	P_o = 5 mw, CW, T = 25° C	1290	1310	1330	nm	
Laser spectral width	$\Delta\lambda$	P_o = 5 mw, CW, Over temperature			3	nm	rms
Temperature coefficient of wavelength	$\Delta\lambda/\Delta T$				0.6	nm/°C	
Laser slope efficiency	η	Over temperature, CW	0.08	0.12	0.2	W/A	
Relative intensity noise	RIN	CW, 0.2 to 5.5 GHz, 5 mW LOP			-120	dB/Hz	
Monitor photo current	I_{mon}	P_o = 5 mW Over temperature CW	0.4		2.5	mA	
Dark current	I_{dark}	At Vr = 5 V			0.1	µA	
Monitor photodiode capacitance	C_{mon}			5	50	pF	
Monitor tracking accuracy [3]	TA	P_o = 5 mW Over temperature CW	-1.0		+1.0	dB	
RF Input impedance	Z_{in}			50		Ω	
Conversion gain	G	T = 25° C		20		mW/V	
Bandwidth at -3dB	BW	In electrical domain		5.5		GHz	
Gain ripple (peak to peak)		0.2 to 5.5 GHz		+/- 3		dB	
Gain temperature dependence		-40 to +85° C		+/- 2		dB	
Low frequency cut-off				50		MHz	
Third order Input Intercept point	IIP3	F = 5.4 GHz		+8		dBm	
Second order Input Intercept point	IIP2	F_o = 2.7 GHz, dual tone technique		+15		dBm	
RF amplifier supply current	Icc	Vcc = 5 V		65	88	mA	

Notes:
3. Monitor Tracking Accuracy is defined as: max | 10Log(Po/Po@25° C) |

Table 4. Pigtail parameters

Parameter	AFBR-1310Z	AFBR-1310AZ	AFBR-1310BZ
Optical connector	FC/PC	SC/APC, 8° angle	LC/PC
Fibre type	Single Mode	Single Mode	Single Mode
Fibre length	0.5 ± 0.05 m	0.5 ± 0.05 m	0.5 ± 0.05 m
Secondary coating diameter	0.9 mm	0.9 mm	0.9 mm
Return loss of optical connector	35 dB minimum	45 dB minimum	35 dB minimum

Schematic Diagram

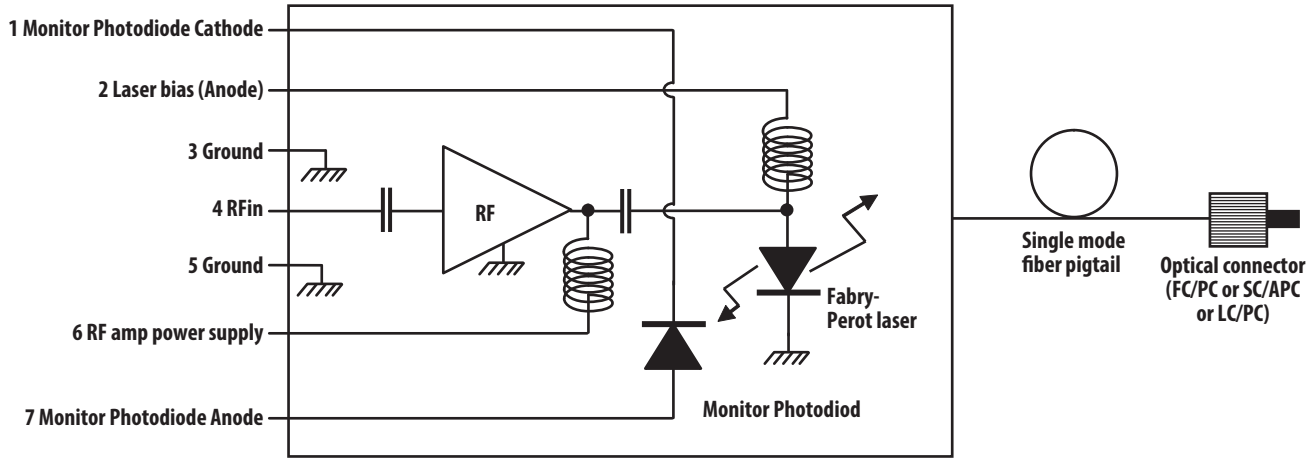

Figure 1. Schematic Diagram

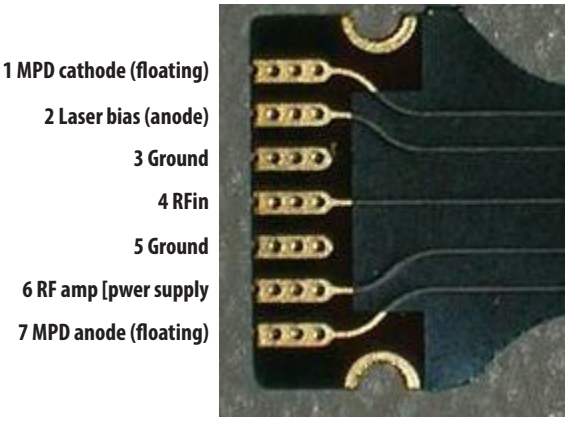

Figure 2. Electrical pinout (top view after 90° bending of the flexible PCB)

Table 5. Pinout

PAD	FUNCTION
1	Monitor Photodiode Cathode (floating)
2	Laser bias (anode)
3	Ground
4	RF in
5	Ground
6	RF amplifier supply
7	Monitor Photodiode Anode (floating)

Package Information

The AFBR-1310xZ Transmitter is housed in a robust TO header. The amplifier portion is hosted on a flex/rigid printed circuit. The fiber pigtail jacket is made of Hytrel.

The flex circuit can be soldered to the customer PCB by hand soldering or with automatic equipment (like hot bar).

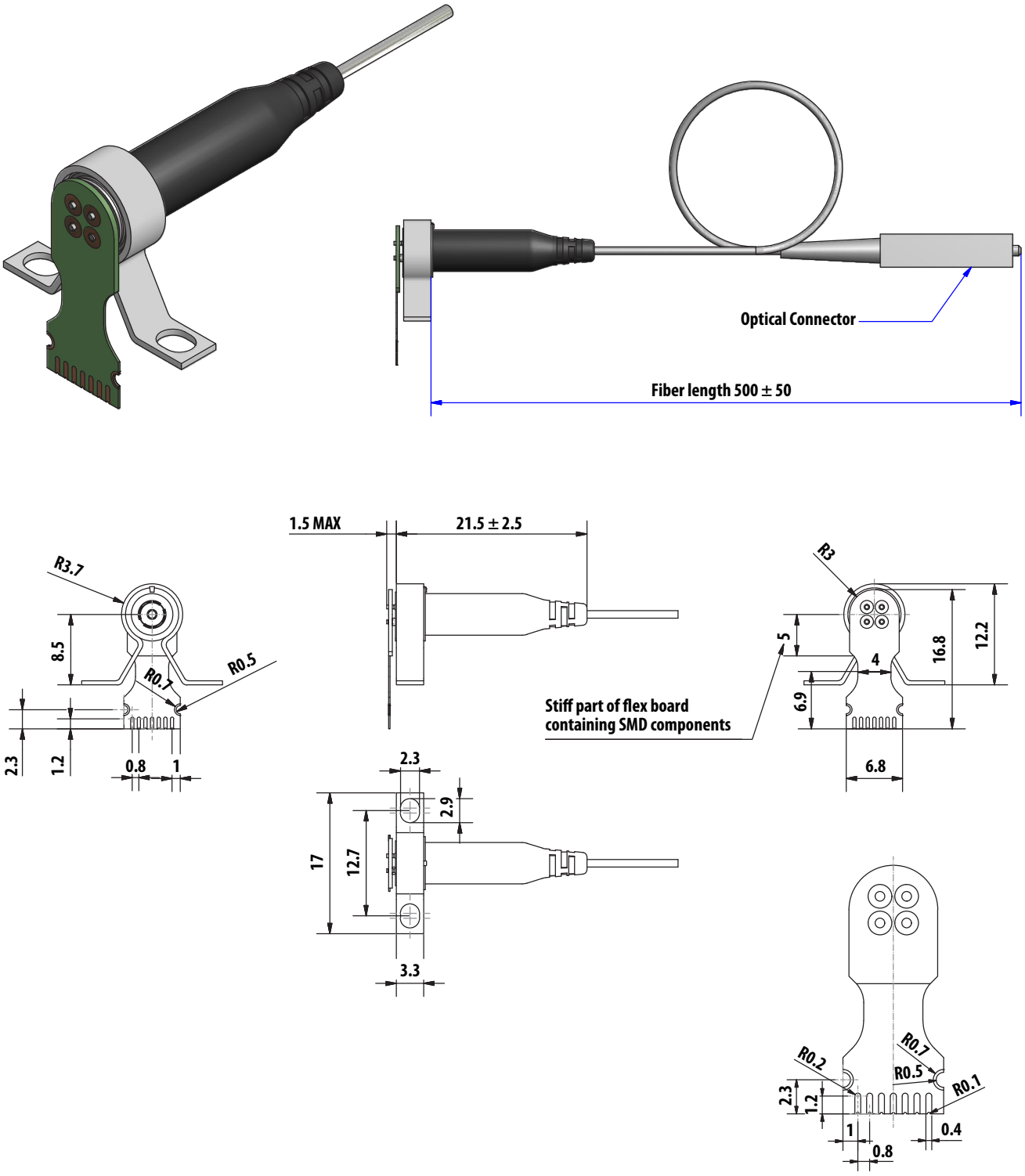

Figure 3. Mechanical layout of Analog Transmitter. The flex is shown before 90° bending. All dimensions are in [mm]

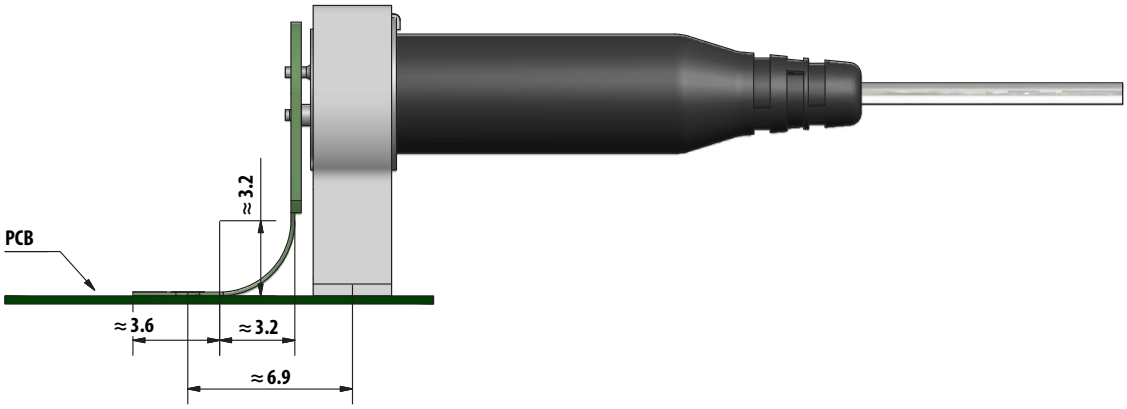

Figure 4. Example of flex bending when soldered onto a PCB. All dimensions are in [mm]

Handling information

When soldering the flex to the customer PCB, it is advisable to avoid heating or touching with the hot iron the fiber pigtail, the header to flex interconnections and the region of the flex where the amplifier and passive components are present.

This device is sensitive to ESD discharge. To protect the device, it's important to use normal ESD handling precautions. These include use of grounded wrist straps, work-benches and floor wherever the device is handled.

Mounting hardware

An omega shaped bracket is pre-assembled to the TO header, for easy mounting of the transmitter to the customer PCB or better to a metal case.

Laser safety

The AFBR-1310xZ is a class 1M product, according to the CEI IEC International Standard 60825-1, Second edition 2007-03. Invisible radiation is emitted from the fiber connector, do not view directly with optical instruments.

Recommended application circuit

Figure 5 shows the recommended application circuit.

Proper 50 ohm controlled impedance traces are required on the Laser bias, RF input and RF amplifier power supply connections. 50 ohm terminations, in parallel to bias inductors, are required on the Laser bias and RF amplifier power supply connections. Additionally, filtering caps are required on the bias lines.

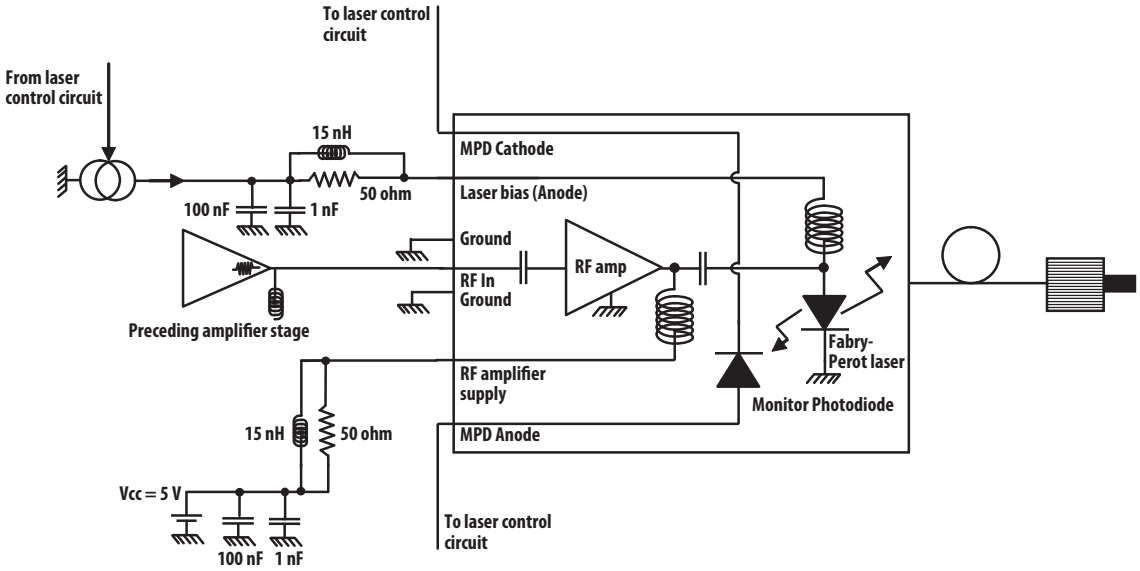

Figure 5. Recommended Application Circuit

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