

SFP⁺-EDFA

Plug and Play EDFA Series



FOA

(SFP⁺-Optical Amplifier)

SFP⁺ Compatible EDFA

The world first plug and play SFP⁺-EDFA, FOA is a full-functioning EDFA module with control circuitry packaged inside. It is totally compatible with conventional SFP⁺ optical transceiver in respect of size and pin-map. Due to the small size and easy installation, the FOA is designed for amplification of optical signals at C-band in fiber optic communications system in 5G network, high speed datacenter, core networks, SDN and CATV networks. The FOA provides very stable output power up to +19 dBm and noise figure of 6 dB in C-band over wide operating temperature range. FOA size (14 x 72 x 8.5 mm) is 15mm longer than conventional SFP⁺ size (14 x 57 x 8.5 mm), combined with extremely low power consumption, allows the FOA to be highly suitable for applications of power equalization or pre-emphasis in densely packaged telecom systems, especially for densely integrated high speed transmitter or receiver card.

Features

- Conventional SFP⁺ compatible size and pin map
- Cost efficiency with pluggable type
- Space efficiency using remaining slot (No extra equipment required)
- EDFA module including micro process control circuit
- Uncooled 980 nm pump laser module
- Extremely lower the heat generation
- High saturation output power up to 19dBm
- Selectable output power
- Wide input dynamic range
- Significantly low power consumption
- Control & monitoring by I2C
- LVTTTL alarm
- Single + 3.3 V power supply

Applications

- 5G network & ROADM system
- Power boosting and pre-emphasis optical amplifier for DWDM metro system
- High speed data center network
- 100G or higher speed channel optical amplifier
- Reach extension for L2/L3 ethernet switch
- RF over Fiber Network
- Signal loss compensation in switch matrix
- SONET/SDH system
- OADM access networks
- CATV System



Optical Fiber Amplifier

FOA (SFP+ Optical Amplifier)

Optical Characteristics : Single Channel

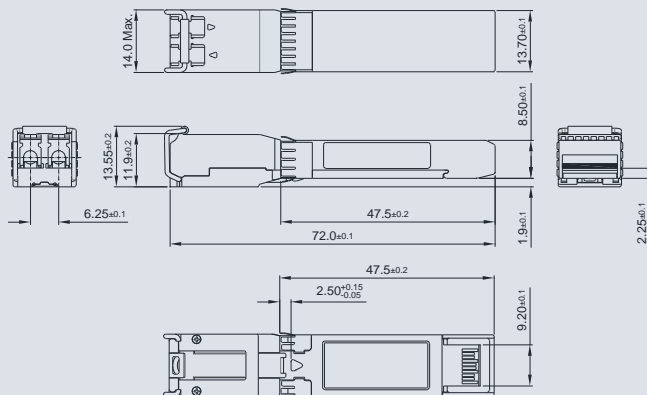
Parameter	Symbol	Booster Specification			Pre-Amp. Specification			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Signal wavelength range	λ	1527.99	-	1568.36	1527.99	-	1568.36	nm
Input power	P_{IN}	-20	-	5	-25	-	-5	dBm
Saturation output power	P_{OUT}	-	19 ⁽¹⁾	-	-	10 ⁽²⁾	-	dBm
Noise figure	NF	-	6	7	-	6.5	7.5	dB
Optical isolation	ISO	20	-	-	20	-	-	dB
Return loss	RL	40	-	-	40	-	-	dB
Polarization mode dispersion	PMD	-	-	0.5	-	-	0.5	ps
Polarization dependent gain	PDG	-	-	0.5	-	-	0.5	dB
Control scheme	-	APC			APC			-

(1) Input power = 0 dBm, set gain = 19dB, full wavelength range

(2) Input power = -10 dBm, set gain = 20dB, full wavelength range

Mechanical Dimension

(WxLxH = 14 X 72 X 8.5 [mm])



Electric & Environmental Characteristics

Parameter	Specification
Power supply voltage	+3.3 V
Interface	I2C
Alarm	LVTTTL
Operating case temperature	-5 ~ 75 °C
Storage temperature	-40 ~ 85 °C
Storage humidity	5 ~ 85 % R.H
Power consumption*	2.4 W

* in max. input power and full temperature range

* The cage with heatsink is recommended for normal operation.

Control and Monitoring Functions

Parameter	Specification
Control scheme	APC with FLS
Monitor	IPM / OPM / LD-Bias / Case-Temp
Alarm	LOS / LOP / LD-Bias / Gain

* FLS: Forced Laser Shutdown

Ordering Information (Ex. : OFA-TCF-19AP, TDM C-band SFP+ type 19dBm output power EDFA with APC)

O	F	A	-	T	C	X	-	19AP	-	F15 *
	F : EDFA			T : TDM	C : C-band	F : SFP+ -EDFA		19AP : 19dBm Pout		G : without GFF
				C : CATV	L : L-band	Q : QSFP-EDFA		14AP : 14dBm Pout		F : with GFF
				W : DWDM		X : XFP-EDFA		10AG : 10dBm Pout		
								05AG : 5dBm Pout		15 : Gain 15dB
								AP : Automatic Power Control		
								AG : Automatic Gain Control		* Only available for AGC
								SG : Settable Gain Control		

※ Single Channel Standard Product : BST_OFA-TCF-17AP, PRE_OFA-TCF-10AP

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Optical Fiber Amplifier

FOA (SFP+ Optical Amplifier)

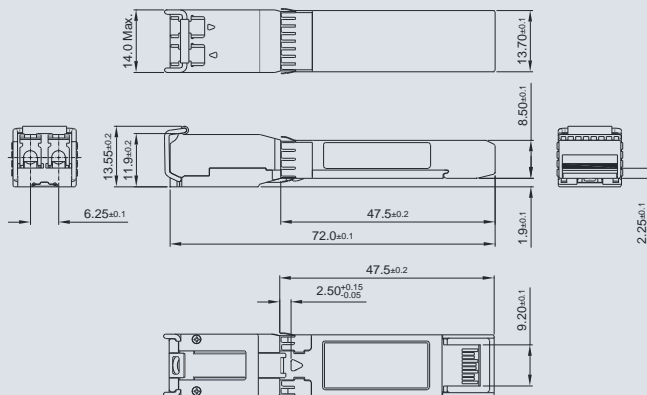
Optical Characteristics : Multi Channel **without GFF**

Parameter	Symbol	Booster Specification			Pre-Amp. Specification			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Signal wavelength range	λ	1527.99	-	1568.36	1527.99	-	1568.36	nm
Input power	P_{IN}	-20	-	5	-25	-	-5	dBm
Saturation output power	P_{OUT}	-	19 ⁽¹⁾	-	-	10 ⁽²⁾	-	dBm
Gain	G	-	15 ⁽¹⁾	-	-	20 ⁽²⁾	-	dB
Gain setting range ⁽³⁾	-	10	15	20	15	20	23	dB
Gain flatness	G_{FLAT}	-	5.5	6.5	-	5.5	6.5	dB
Noise figure	NF	-	6	7	-	6.5	7.5	dB
Transient Performance ⁽⁴⁾	TR	-	-	-	-	-	-	-
① Excursion Tr/Tf = 100us, 12dB Add/Drop	-	-3	-	4	-3	-	4	dB
② Gain offset	-	-3.3	-	3.3	-3.3	-	3.3	dB
③ Settling time	-	-	-	500	-	-	500	ms
Optical isolation	ISO	20	-	-	20	-	-	dB
Return loss	RL	40	-	-	40	-	-	dB
Polarization mode dispersion	PMD	-	-	0.5	-	-	0.5	ps
Polarization dependent gain	PDG	-	-	0.5	-	-	0.5	dB
Control scheme	-	AGC			AGC			=

- (1) Input power = +4 dBm, set gain = 15dB, full wavelength range
 (2) Input power = -10 dBm, set gain = 20dB, full wavelength range
 (3) The gain setting is a function the only works for SGC models.
 (4) at Typical gain. Excursion corresponds to Net Gain overshoot / undershoot.

Mechanical Dimension

(WxLxH = 14 X 72 X 8.5 [mm])



Electric & Environmental Characteristics

Parameter	Specification
Power supply voltage	+3.3 V
Interface	I2C
Alarm	LVTTL
Operating case temperature	-5 ~ 75 °C
Storage temperature	-40 ~ 85 °C
Storage humidity	5 ~ 85 % R.H
Power consumption*	2.4 W

- * in max. input power and full temperature range
 * The cage with heatsink is recommended for normal operation.

Control and Monitoring Functions

Parameter	Specification
Control scheme	AGC with FLS
Monitor	IPM / OPM / LD-Bias / Case-Temp
Alarm	LOS / LOP / LD-Bias / Gain

* FLS: Forced Laser Shutdown

Ordering Information (Ex.: OFA-WCF-19AG-G15, WDM C-band SFP+-type 19dBm output power & 15dB gain EDFA without GFF)

O	F	A	-	T	C	X	-	19AP	-	F15 *
	F : EDFA			T : TDM	C : C-band	F : SFP+ -EDFA		19AP : 19dBm Pout		G : without GFF
				C : CATV	L : L-band	Q : QSFP-EDFA		14AP : 14dBm Pout		F : with GFF
				W : DWDM		X : XFP-EDFA		10AG : 10dBm Pout		
								05AG : 5dBm Pout		15 : Gain 15dB
								AP : Automatic Power Control		
								AG : Automatic Gain Control		* Only available for AGC
								SG : Settable Gain Control		

※ Multi Channel Standard Product without GFF : BST_OFA-WCF-17AG-G15, PRE_OFA-WCF-10AG-G20

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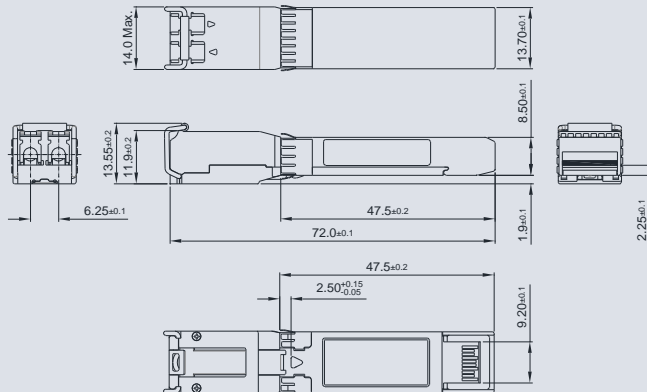
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Input power	P_{IN}	-20	-	5	-25	-	-5	dBm
Saturation output power	P_{OUT}	-	16 ⁽¹⁾	-	-	10 ⁽²⁾	-	dBm
Gain	G	-	15 ⁽¹⁾	-	-	20 ⁽²⁾	-	dB
Gain setting range ⁽³⁾	-	10	15	20	15	20	23	dB
Gain flatness	G_{FLAT}	-	1	2	-	1	2	dB
Noise figure	NF	-	6	7	-	6.5	7.5	dB
Transient Performance ⁽⁴⁾	TR							
① Excursion Tr/Tf = 100us, 12dB Add/Drop	-	-3	-	4	-3	-	4	dB
② Gain offset	-	-1	-	1	-1	-	1	dB
③ Settling time	-	-	-	500	-	-	500	ms
Optical isolation	ISO	20	-	-	20	-	-	dB
Return loss	RL	40	-	-	40	-	-	dB
Polarization mode dispersion	PMD	-	-	0.5	-	-	0.5	Ps
Polarization dependent gain	PDG	-	-	0.5	-	-	0.5	dB
Control scheme	-	AGC			AGC			-

- (1) Input power = +1 dBm, set gain = 15dB, full wavelength range
 (2) Input power = -10 dBm, set gain = 20dB, full wavelength range
 (3) The gain setting is a function the only works for SGC models.
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Control scheme	AGC with FLS
Monitor	IPM / OPM / LD-Bias / Case-Temp
Alarm	LOS / LOP / LD-Bias / Gain

* FLS: Forced Laser Shutdown

Ordering Information (Ex.: OFA-WCF-16AG-F15, WDM C-band SFP+-type 16dBm output power & 15dB gain EDFA with GFF)

O	F	A	-	T	C	X	-	19AP	-	F15 *
	F : EDFA			T : TDM	C : C-band	F : SFP+ -EDFA		19AP : 19dBm Pout		G : without GFF
				C : CATV	L : L-band	Q : QSFP-EDFA		14AP : 14dBm Pout		F : with GFF
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								AP : Automatic Power Control		
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								SG : Settable Gain Control		

※ Multi Channel Standard Product with GFF : BST_OFA-WCF-14AG-F15, PRE_OFA-WCF-10AG-F20

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