

Multiwavelength Gain Module EDFA

Bookham Technology's MultiWavelength Gain Modules are supplied with the EDFA optical, optoelectronic and electronic functions built in, requiring only a +5 V power supply for operation. They allow sophisticated optical amplifier card level solutions to be implemented very easily.

The MultiWavelength Gain Module optical amplifiers have been specially designed for use in wide bandwidth DWDM optical transmission systems. The series, consisting of a number of standard configurations, has been designed to allow rapid customisation to meet the widely varying requirements of customer specific system design.

Through selection of certain component values within the gain block, the designs can be rapidly customised to meet specific amplifier requirements for output power and gain. All of the amplifiers also have an integrated optical output monitor port.

A combination of a pre-amplifier and a line amplifier gives the option of Mid-Stage Access (MSA) to allow insertion of network components such as add-drop multiplexers, dispersion compensators or optical attenuators.



Features

- High reliability
- Semi-custom design flexibility
- Fast gain and transient control modes
- Single +5 V supply operation
- Low power consumption
- Low noise figure
- Low gain ripple over temperature
- Optical output monitor

Applications

- DWDM Pre-Amplifier
- DWDM Line Amplifier

General Information Gain and Transient Control

The amplifier modules incorporate a powerful, processor-controlled gain and transient control system for optimum performance. Input and output powers are continually monitored to dynamically maintain the desired operating gain under changing input conditions. This scheme permits wavelengths to be added or dropped whilst maintaining performance of the remaining channels. A simple serial interface to the processor allows amplifier configuration and monitoring functions to be carried out.

Optical

The amplifiers have been optimized for full-band gain-bandwidth DWDM operation by careful selection of both passive and active components. All amplifiers are pumped with high reliability 980 nm and 1480 nm pumps and are provided with optical monitor outputs to allow customer spectral analysis or monitoring of the amplified signal.

Electrical

Electrical connection is through a male DB25 connector.

Package

The units are housed within a metal package, allowing an attachment of a heatsink to the base. Optical connections are made through single mode fibre pigtailed with SC/PC connectors as standard.

Standard Configurations

Both full band (1530 -1563 nm) and extended band (1570 - 1603 nm) amplifiers are available in two basic configurations: Pre-amplifier and Line amplifier. Full band amplifier variants are pre-fixed with F and extended band with E.

Electrical Power Supplies

The electrical power required by the unit is supplied from a single rail power supply. Maximum power dissipation values include a 5 W contribution from the erbium heater available with products containing METEOR electronics. Maximum values could be reached at a combination of switch on, end of life and low ambient temperature.

Parameter	Min	Typ	Max
Positive supply voltage	+4.75 V	+5.0 V	+5.25 V
Power dissipation (Start of Life)			
Preamp	-	2.5 W	-
Dual pump line	-	5 W	-
Triple pump line	-	7 W	-
Power dissipation (End of Life)			
Preamp	-	-	12.5 W
Dual pump line	-	-	23.5 W
Triple pump line	-	-	35 W
Ripple noise	-	-	2%PP
Transient pulse	+4.6 V for 75 ms.		+6.0 V for 75 ms.
Radiated emissions	EN5022 class B		
Conducted emissions	EN5022 class B		
Radiation immunity	IEC801-3		
ESD	IEC801-2		
Temperature range (Case)	0°C	65°C	

Pre-amplifiers

FP-1 Provides a total output power in the region of 14 dBm and has both input and output isolators.

FP-2 Provides similar performance to P-1, but has no input isolator, thereby providing a lower noise figure.

EP-2 Provides a total output power in the region of 14 dBm and has both input and output isolators.

Line amplifiers

FL-1 Typically provides output power in the region of 17 dBm. (Dual pump)

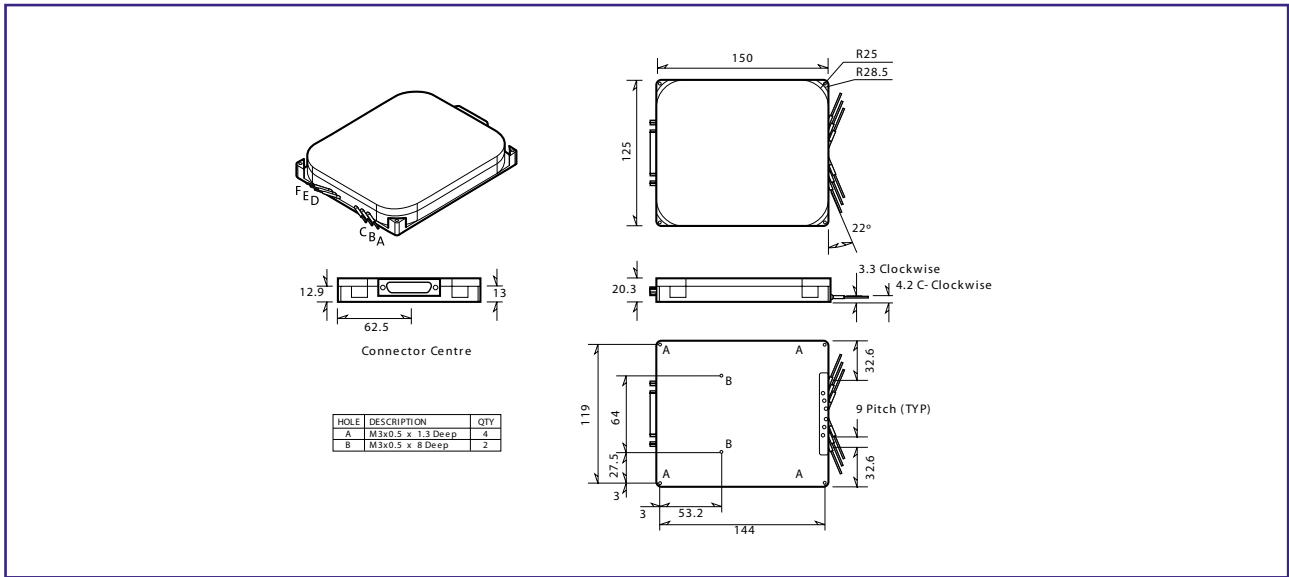
FL-2 Typically provides output power in the region of 21 dBm. (Triple pump)

EL-1 Typically provides output power in the region of 21 dBm. (Triple pump)

Parameters specified in the individual datasheets are valid over temperature, wavelength and life unless otherwise stated.

Outline Drawing

Dimensions in mm



Connector Pin -Out

The pinout for the male DB25 connector

PIN #	Function	PIN #	Function
1	+5.0 V	14	GND
2	+5.0 V	15	GND
3	+5.0 V	16	GND
4	+5.0 V	17	GND
5	Output power monitor	18	RS-232 OUT (TTL Levels)
6	Input power monitor	19	Loss of input power alarm
7	EDFA temperature alarm	20	Output power mute input
8	Loss of output power alarm	21	Amplifier disable input
9	Pumps bias alarm	22	RS-232 IN (TTL Levels)
10	Pumps temperature alarm	23	N/C
11	N/C	24	+5.0 V
12	+5.0 V	25	GND
13	GND	-	-

Instructions for Use - MGM

Pin 1, 2, 3, 4, 12, 24 +5.0 V Supply

DC voltage between 4.75 and 5.25 V should be made to all pins. Current requirement is dependent on amplifier type - see the power supply section for details.

Pin 5 Output Power Monitor

A DC voltage that is proportional to the amplifier output power. For a preamp, this voltage is approximately 30 mV/mW. For a line amplifier, the factor is 12.9 mV/mW.

Pin 6 Input Power Monitor

A DC voltage that is proportional to the amplifier input power. For a preamp or line amp, this voltage is approximately 1.6 V/mW.

Pin 7 EDFA Temperature Alarm

This is a TTL logic level alarm which is normally at logic "0". When the EDFA internal temperature exceeds 65°C, the alarm is activated (logic "1"). The temperature sensor is located on the pcb.

Pin 8 Loss of Output Power Alarm

This is a TTL logic level alarm, normally at logic "0". The alarm is raised to logic level "1" if the amplifier output power is more than 2 dB different from the set value. This function is active in Output power, Drive or Gain modes. In Drive mode, the alarm threshold is taken as the last value stored for either Output or Gain mode.

Pin 9 Pump Bias Alarm

This is a TTL logic level alarm, normally at logic "0". The alarm is raised to logic "1" if any of the pump drive currents exceed 95% of the pre-set end-of-life value.

Pin 10 Pump Temperature Alarm

This is a TTL logic level alarm, normally at logic "0". The alarm is raised to logic "1" if any of the pump submount temperatures are more than 5 degrees away from the set point (factory default setting). The threshold levels can be modified by using the ST command.

Pin 11, 23 N/C

No connection.

Pin 13, 14, 15, 16, 17, 25 Ground

Ground Connection should be made to all pins.

Pin 18 RS-232 OUT

Serial data output at TTL levels.

Pin 19 Loss of Input Power Alarm

This is a TTL logic level alarm, normally at logic "0". The alarm is raised to logic level "1" if the amplifier input power falls below a user-specified value. The alarm threshold is set via the LO command.

Pin 20 Output Power Mute

A TTL input signal (normally at logic "0") which is used to limit the optical output to +7 dBm.

Pin 21 Amplifier Disable

A TTL input signal (normally at logic "0") which is used to turn off the pump lasers. The temperature control electronics and all other functions are unaffected. NOTE THAT UNDER HIGH INPUT POWER CONDITIONS, CONSIDERABLE OUTPUT POWER CAN STILL EXIST EVEN WHEN THE AMPLIFIER IS DISABLED. THIS INPUT MUST NOT BE REGARDED AS AN INTERLOCK AND THE AMPLIFIER MUST STILL BE CONSIDERED AS CLASS 3B, IEC.

Pin 22 RS-232 IN

Serial data input at TTL levels.

MGMFL-1AEC28 - Full Band Line Amplifier

Parameter	Min	Typ	Max	Unit	Notes
Operating wavelength	1530	1540	1563	nm	Calibrated to a of 1540 nm
Optical input power			-6	dBm	
Optical output power	17			dBm	-6 dBm input power, 1540 nm
Gain		23		dB	1540 nm, 40°C
Noise figure maximum			5.5	dB	Over wavelength range, -6 dBm I/P
Backward ASE			-25	dBm	
Remnant 980 to output			-30	dBm	
Remnant 1480 to input			-30	dBm	
Remnant 1480 to output			-30	dBm	
Gain flatness		1.0	1.5	dBpk-pk	23 dB gain 1540 nm, 17 dBm O/P, 40°C
PDG			0.5	dB	
PMD			1.0	ps	
Optical power monitor	1.0	2.5	5.0	%	
Optical input return loss			40	dB	Amplifier off
Optical output return loss			40	dB	Amplifier off
Gain control ripple			0.5	dB	15 dB Δ in input power
Power consumption		5	23.5	W	

Input port F
Output port E
Monitor port C

MGMFL-1ALC28 - Full Band Line Amplifier

Parameter	Min	Typ	Max	Unit	Notes
Operating wavelength	1530	1540	1563	nm	Calibrated to a λ of 1540 nm
Optical input power			-9	dBm	
Optical output power	17.5			dBm	-9 dBm input power, 1540 nm
Gain		26.5		dB	1540 nm, 40°C
Noise figure maximum			5.5	dB	Over wavelength range, -9 dBm I/P
Backward ASE			-25	dBm	
Remnant 980 to output			-30	dBm	
Remnant 1480 to input			-30	dBm	
Remnant 1480 to output			-30	dBm	
Gain flatness		0.9	1.5	dBpk-pk	26.5 dB gain 1540 nm, 17.5 dBm O/P, 40°C
PDG			0.5	dB	
PMD			1.0	ps	
Optical power monitor	1.0	2.5	5.0	%	
Optical input return loss			40	dB	Amplifier off
Optical output return loss			40	dB	Amplifier off
Gain control ripple		0.5		dB	15 dB Δ in input power
Power consumption		5	23.5	W	

Input port F
Output port E
Monitor port C

MGMFP - 1AOC28 - Full Band Line Amplifier

Parameter	Min	Typ	Max	Unit	Notes
Operating wavelength	1530	1540	1563	nm	Calibrated to a λ of 1540 nm
Optical input power			-10	dBm	
Optical output power	13			dBm	-10 dBm input power, 1540 nm
Gain		23		dB	1540 nm, 40°C
Noise figure maximum			5.0	dB	Over wavelength range, -10 dBm I/P
Backward ASE			-30	dBm	
Remnant 980 to output			-30	dBm	
Gain flatness		1.0	2.0	dBpk-pk	23 dB gain 1540 nm, 13 dBm O/P, 40°C
PDG			0.5	dB	
PMD			1.0	ps	
Optical power monitor	1.0	2.5	5.0	%	
Optical input return loss			40	dB	Amplifier off
Optical output return loss			40	dB	Amplifier off
Gain control ripple			0.5	dB	15 dB in input power
Power consumption		2.5	12.5	W	

Input port F
Output port E
Monitor port C

MGMFL-1AWC28 - Full Band Line Amplifier

Parameter	Min	Typ	Max	Unit	Notes
Operating wavelength	1530	1540	1563	nm	Calibrated to a λ of 1540 nm
Optical input power			-0.5	dBm	
Optical output power	17.5			dBm	-0.5 dBm input power, 1540 nm
Gain		18		dB	1540 nm, 40°C
Noise figure maximum		5.5	6.0	dB	Over wavelength range, -0.5 dBm I/P
Backward ASE			-25	dBm	
Remnant 980 to output			-30	dBm	
Remnant 1480 to input			-30	dBm	
Remnant 1480 to output			-30	dBm	
Gain flatness		1.0	1.5	dBpk-pk	18 dB gain 1540 nm, 17.5 dBm O/P, 40°C
PDG			0.5	dB	
PMD			1.0	ps	
Optical power monitor	1.0	2.5	5.0	%	
Optical input return loss			40	dB	Amplifier off
Optical output return loss			40	dB	Amplifier off
Gain control ripple			0.5	dB	15 dB Δ in input power
Power consumption		5	23.5	W	

Input port F
Output port E
Monitor port C

MGMFL - 2ATC28 - Full Band Line Amplifier

Parameter	Min	Typ	Max	Unit	Notes
Operating wavelength	1530	1540	1563	nm	Calibrated to a λ of 1540 nm
Optical input power			-2	dBm	
Optical output power	21			dBm	-2 dBm input power, 1540 nm
Gain		23		dB	1540 nm, 40°C
Noise figure maximum			6.0	dB	Over wavelength range, -2 dBm I/P
Backward ASE			-25	dBm	
Remnant 980 to output			-30	dBm	
Remnant 1480 to input			-20	dBm	
Remnant 1480 to output			-30	dBm	
Gain flatness		1.0	1.5	dBpk-pk	23 dB gain 1540 nm, 21 dBm O/P, 40°C
PDG			0.5	dB	
PMD			1.0	ps	
Optical power monitor	1.0	2.5	5.0	%	
Optical input return loss			40	dB	Amplifier off
Optical output return loss			40	dB	Amplifier off
Gain control ripple			0.5	dB	15 dB in input power
Power consumption		7	35	W	

Input port F
Output port E
Monitor port C

MGMGL - 2AUC28 - Full Band Line Amplifier

Parameter	Min	Typ	Max	Unit	Notes
Operating wavelength	1530	1540	1563	nm	Calibrated to a λ of 1540 nm
Optical input power			-7	dBm	
Optical output power	21			dBm	-7 dBm input power, 1540 nm
Gain		28		dB	1540 nm, 40°C
Noise figure maximum			6.0	dB	Over wavelength range, -7 dBm I/P
Backward ASE			-25	dBm	
Remnant 980 to output			-30	dBm	
Remnant 1480 to input			-20	dBm	
Remnant 1480 to output			-30	dBm	
Gain flatness		1.0	1.5	dBpk-pk	28 dB gain 1540 nm, 21 dBm O/P, 40°C
PDG			0.5	dB	
PMD			1.0	ps	
Optical power monitor	1.0	2.5	5.0	%	
Optical input return loss			40	dB	Amplifier off
Optical output return loss			40	dB	Amplifier off
Gain control ripple			0.5	dB	15 dB in input power
Power consumption		7	35	W	

Input port F
Output port E
Monitor port C

Ordering Information

The above specifications is a guide to the operating parameters that can be achieved with the Multiwavelength Gain Module EDFA series of amplifiers. Please contact your Bookham Technology representative to discuss any issues regarding customisation of these units to meet specific system needs.

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This product complies with 21CFR 1040.10



Certificate No. FM 15040



Certificate No. EMS 35100