



### Features

- Standard OC-48 pin compatibility
- Negative bias
- Direct modulation
- Meets GR 468 reliability specifications

### Applications

- Digital CATV transmission
- 1550-nm broadcast and point-to-point applications

### Description

The DFB-xx-BF-10-A8-xx DFB laser modules are designed for forward-path CATV applications, especially digital transmission using Quadrature Amplitude Modulation (QAM). The modules are designed to incorporate high output power while maintaining high linearity. The devices feature standard pin assignments (compatible with OC-48).

These devices offer excellent performance in directly-modulation QAM transmission, offering considerable cost savings over externally-modulated solutions. The combination of high performance and very reasonable price make these modules the most cost-effective CATV transmitter solutions in the industry.





**DFB-xx-BF-xx-A8-XX Laser Module**

**Absolute Maximum Ratings**

Parameter	Symbol	Condition	Min	Max	Unit
Operating Case Temperature	Tc	I=Iop	-20	65	°C
Storage Temperature	Tstg	--	-40	85	°C
Laser Forward Current	If	--	--	120	mA
Laser Reverse Bias	Vr	--	--	2	V
Photodiode Reverse Bias	Vrpd	--	--	10	V
TEC Current	Itec	-20 °C < Tc < +65 °C, Top=25 °C If=100 mA	--	1.5	A
Soldering Temperature for Lead	Ts	<10 sec	--	260	°C

**Electrical and Optical Characteristics**

Parameters are over operating temperature range unless otherwise noted.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Center Wavelength*	$\lambda_c$	P <sub>o</sub> = 10 mW, CW, Tset = 20C - 35C	1530	--	1560	nm
Optical Output Power	P <sub>o</sub>	CW, T <sub>i</sub> = Tset	6.0	--	10.0	mW
Optical Isolation	I <sub>s</sub>	T=25 °C	30	--	--	dB
Side-mode Suppression Ratio	SMSR	P <sub>o</sub> = 10 mW	30	--	--	dB
Linewidth	FWHM	P <sub>o</sub> = 10 mW, CW	--	6	10	MHz
Chirp	$\Delta\lambda/\Delta f$	P <sub>o</sub> = 10 mW, 500 MHz	40	--	120	MHz/mA
Threshold Current	I <sub>th</sub>	T <sub>i</sub> =25 °C	--	25	40	mA
Operating Current	I <sub>op</sub>	--	--	60	90	mA
Slope Efficiency	SE**	P <sub>o</sub> = 10 mW	0.15	0.22	--	mW/mA
Forward Voltage	V <sub>F</sub>	P <sub>o</sub> = 10 mW	--	1.2	1.9	V
Monitor Current	I <sub>mon</sub>	V <sub>pd</sub> =5 V	9	--	150	µA/mW
Monitor Dark Current	I <sub>D</sub>	V <sub>pd</sub> =5 V	--	--	200	nA
Operating Case Temperature	T	--	-20	--	65	°C
Tracking Error	$\gamma$	I <sub>mon</sub> =const, $\gamma=10 \log (P_o/10 \text{ mW})$ [dB]	-0.5	--	0.5	dB
Thermistor Resistance	R <sub>t</sub>	T=25 °C	9.5	--	10.5	K $\Omega$
Thermistor B Constant	B	T=25 °C	--	3900	--	K
TEC Current	I <sub>c</sub>	$\Delta T=40^\circ\text{C}$	--	--	1.5	A
TEC Voltage	V <sub>c</sub>	$\Delta T=40^\circ\text{C}$	--	--	2.0	V

\*See available wavelengths from Ordering Options. DWDM wavelength set by laser sub-mount temperature.

\*\* The SE will be lower since decoupling for lower output Power levels.

Pop	SE_min (mW/mA)	SE_typ (mW/mA)
10 mW	0.15	0.22
8 mW	0.12	0.176
6 mW	0.09	0.132

**RF Characteristics**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input impedance	Z <sub>IN</sub>	nominal	--	25	--	$\Omega$
Frequency Range	F	--	45	--	3000	MHz
Frequency Response	S <sub>21</sub>	If=Iop 45 MHz-870 MHz T=25 °C	--	± 0.5	--	dB
		If=Iop 45 MHz-3000 MHz T=25 °C	--	± 1.0	--	
RF return loss	S <sub>11</sub>	50 – 870 MHz, P=P <sub>Fr</sub> @ 50 $\Omega$ ,	6	7	--	dB
Relative Intensity Noise	RIN	CW, P <sub>o</sub> = 10 mW, Note 1	--	--	-155	dB/Hz
2 <sup>nd</sup> Order Intermodulation	IMD2	Note 2, 42 MHz, @ f <sub>2</sub> -f <sub>1</sub>	--	--	-44	dBc
3 <sup>rd</sup> Order Intermodulation	IMD3	Note 2, 511.25 MHz, @ 2f <sub>1</sub> -f <sub>2</sub>	--	--	-53	dBc

Note 1: Test condition: P<sub>o</sub>=10 mW, f = 500 MHz, Optical reflection<-40 dB, 0 km fiber.

Note 2: Test condition: P<sub>o</sub> ≥ 5 mW, 2 unmodulated carriers (f<sub>1</sub>=553.25, f<sub>2</sub>=595.25), 35% OMI/ carrier, 50 km zero dispersion single mode fiber, optical reflection <-40 dB.



Electrical Schematics

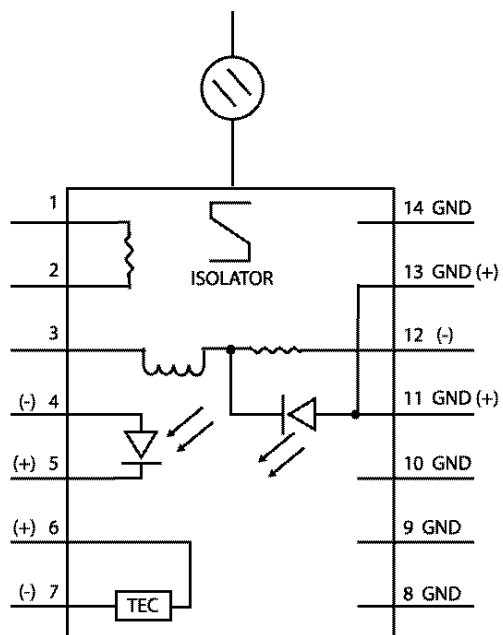


Figure 1. Laser Schematic

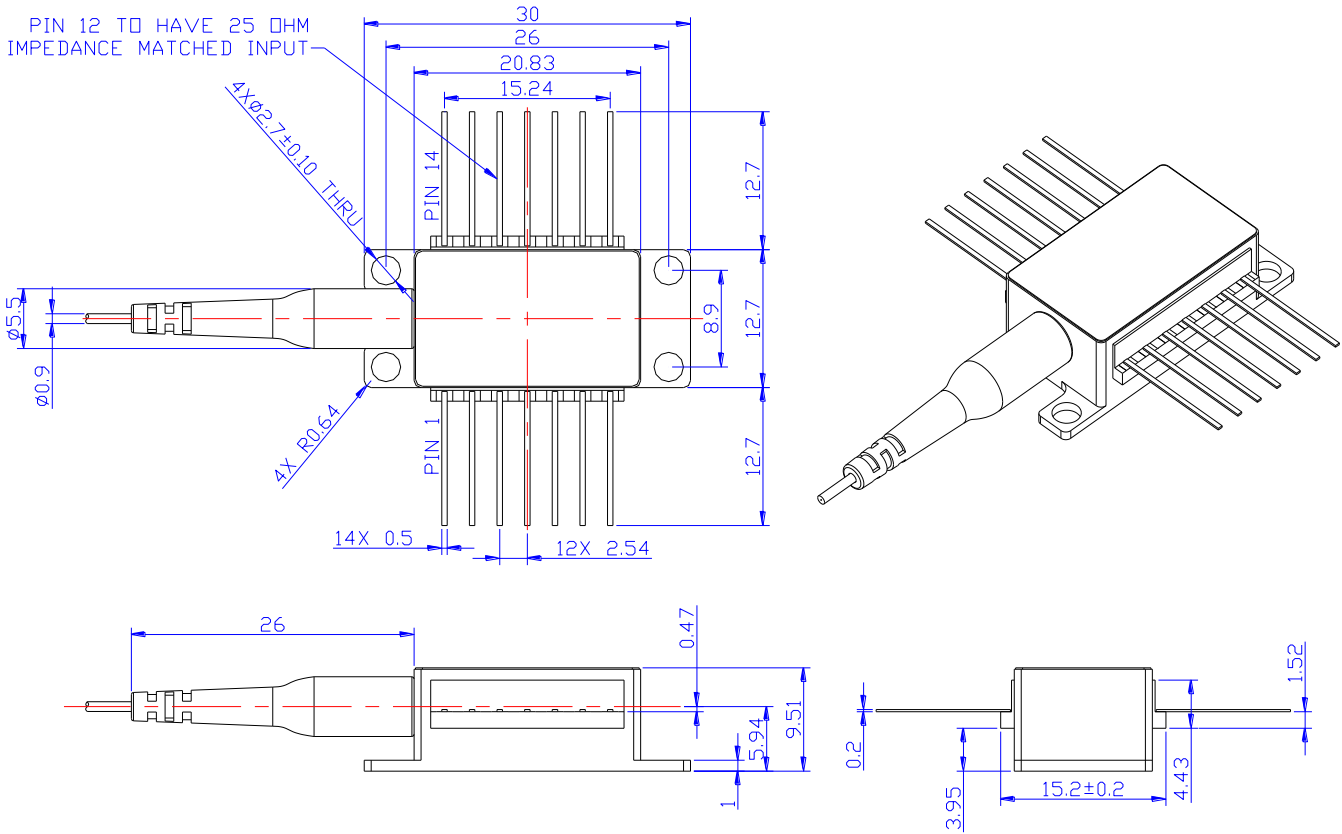
Pin Information

Pin No.	Description
1	Thermistor
2	Thermistor
3	DC Laser Bias (-)
4	MPD Anode (-)
5	MPD Cathode (+)
6	Thermoelectric Cooler (+)
7	Thermoelectric Cooler (-)
8	Case Ground
9	Case Ground
10	Case Ground
11	Laser Common (+), Case Ground
12	Laser Modulation (-)
13	Laser Common (+), Case Ground
14	Case Ground



**Outline Diagram**

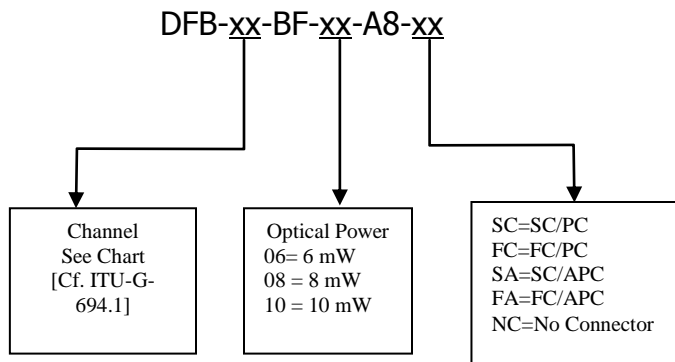
Dimensions are in millimeters





**DFB-xx-BF-xx-A8-XX Laser Module**

**Ordering Options**



**Available Channels**

Ordering Option*	ITU Frequency	Center Wavelength	Ordering Option*	ITU Frequency	Center Wavelength
15	191.5	1565.5	40	194	1545.32
16	191.6	1564.68	41	194.1	1544.53
17	191.7	1563.86	42	194.2	1543.73
18	191.8	1563.05	43	194.3	1542.94
19	191.9	1562.23	44	194.4	1542.14
20	192.0	1561.42	45	194.5	1541.35
21	192.1	1560.61	46	194.6	1540.56
22	192.2	1559.79	47	194.7	1539.77
23	192.3	1558.98	48	194.8	1538.98
24	192.4	1558.17	49	194.9	1538.19
25	192.5	1557.36	50	195.0	1537.4
26	192.6	1556.56	51	195.1	1536.61
27	192.7	1555.75	52	195.2	1535.82
28	192.8	1554.94	53	195.3	1535.04
29	192.9	1554.13	54	195.4	1534.25
30	193.0	1553.33	55	195.5	1533.47
31	193.1	1552.52	56	195.6	1532.68
32	193.2	1551.72	57	195.7	1531.9
33	193.3	1550.92	58	195.8	1531.12
34	193.4	1550.12	59	195.9	1530.33
35	193.5	1549.32	60	196.0	1529.55
36	193.6	1548.51	61	196.1	1528.77
37	193.7	1547.72	62	196.2	1527.99
38	193.8	1546.92	63	196.3	1527.22
39	193.9	1546.12			

\* Please consult factory for wavelength availability before ordering

## DFB-xx-BF-xx-A8-XX Laser Module

### Safety Information

All versions of this laser are Class 1M laser products per IEC<sup>1</sup>/EN<sup>2</sup> 60825-1:2001-08. Users should observe safety precautions such as those recommended by ANSI<sup>3</sup> Z136.1-2000, ANSI Z36.2-1997 and IEC 60825-1:2001-08.

#### Notes about Laser Safety Class:

The Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) in the USA has decided to harmonize their requirements with 21 CFR 1040.10 and 1040.11 with the IEC/EN 60825-1 and IEC/EN 60601-2-22 standards. This process has not yet happened and in the interim, the CDRH agency has released '[Laser Notice No.50](#)' to reduce the regulatory burden. This notice allows IEC/EN classification and labeling of lasers within the USA.

#### IEC<sup>1</sup>/EN<sup>2</sup> 60825-1 Laser Class

**Class 1M:** laser is safe for all conditions of use except when passed through magnifying optics such as microscopes and telescopes. Class 1M lasers produce large-diameter beams, or beams that are divergent. The MPE for a Class 1M laser cannot normally be exceeded unless focusing or imaging optics are used to narrow the beam. If the beam is refocused, the hazard of Class 1M lasers may be increased and the product class may be changed. A laser can be classified as Class 1M if the total output power is below (IEC/EN) class 3B but the power that can pass through the pupil of the eye is within Class 1.

#### FDA Laser Class

**Class IIIB:** moderate power lasers (cw: 5-500 mW, pulsed: 10 J/cm<sup>2</sup> or the diffuse reflection limit, whichever is lower). In general Class IIIB lasers will not be a fire hazard, nor are they generally capable of producing a hazardous diffuse reflection. Specific controls are recommended.

This product does not conform to 21 CFR 1040.10 and 1040.11. Consequently, this laser module is only intended for use as a component by manufacturers of electronic products and equipment.

Wavelength = 1270 – 1610 nm  
 Maximum Power = 75mW  
 Single-mode fiber pigtail  
 Fiber Numerical Aperture = 0.14

Labeling is not affixed to the laser module due to size constraints; rather, labeling is placed on the outside of the shipping box.

This product is not shipped with a power supply.

**Caution: use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.**



classified in accordance with IEC 60825-1: 2001-08

(1) IEC is a registered trademark of the International Electrotechnical Commission

(2) Within Europe the IEC standard has been adopted as a European Normative standard known as EN 60825, and each European country will have its own version of this standard, for example, the British Standards version known as BS EN 60825. There can be small differences between the different countries versions of EN 60825, and these are in part caused by the process of translating the standard into the native language of that country.

(3) ANSI is a registered trademark of the American National Standards Institute.