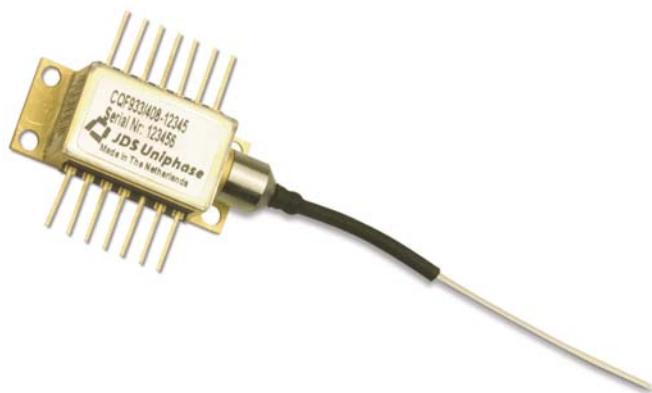


Product Bulletin



10 mW 1550 nm DWDM DFB Laser for Direct Analog Modulation CQF933/408 Series

The JDS Uniphase CQF933/408 series laser is a direct analog modulated source laser with 10 mW output for use in dense wavelength division multiplexing (DWDM) systems. Available wavelengths comply with ITU recommended channels that range from 1530.33 to 1560.61 nm and adhere to the 100 GHz grid.

The laser is housed in a standard 14-pin butterfly package and equipped with a single-mode fiber. The package itself features a high performance thermoelectric cooler for application in uncontrolled ambient temperatures. A cooled isolator minimizes optical isolation dependence on case temperature and results in superb thermal stability. The internal bias-T network and built-in monitor diode enable simple direct current bias conditioning and output stabilization of the laser diode.

The CQF933/408 shows excellent side mode suppression ratios (typically 45 dB), relative intensity noise (-157 dB/Hz maximum), and small linewidths (3 MHz maximum). The distributed feedback (DFB) laser's intrinsically low chirp, narrow linewidth, and analog characteristics offer excellent system performance with respect to carrier-to-noise ratio (CNR), composite second order (CSO), and composite triple beat (CTB). JDS Uniphase wavelength drift tests warrant long term wavelength stability.

Key Features

- 1550 nm DWDM DFB laser diode
- 10 mW output power
- Built-in thermoelectric cooler for operation up to 80 °C
- Cooled built-in optical isolator
- 1530.33 - 1560.61 nm wavelength range
- 0.8 nm (100 GHz) spacing
- Excellent relative intensity noise (-157 dB maximum)
- Very low second and third order distortion
- SC/APC connector optional

Applications

- Hybrid fiber coax (HFC) and cable television (CATV) networks. Especially suitable in environments with uncontrolled ambient temperature.
- Designed for quadrature amplitude modulated (QAM) signal transmission.

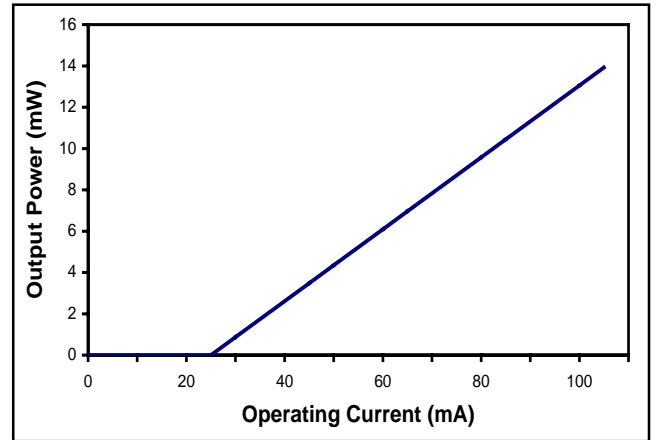
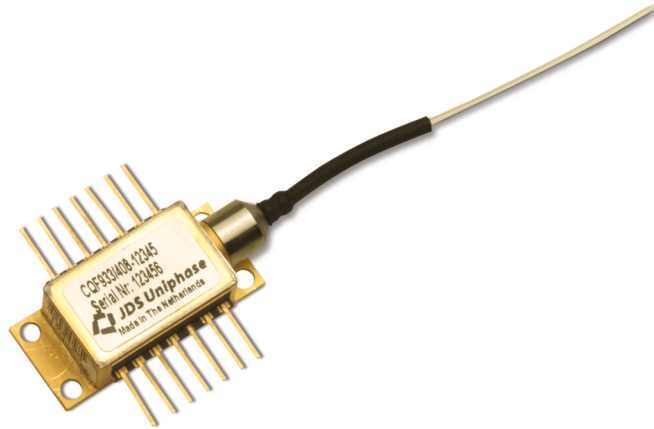
Specifications

Limiting Values						
Parameter	Symbol	Conditions	Min		Max	Unit
Laser Diode						
Radiant output power from pigtail	P_{peak}	-	-		15	mW
Reverse voltage	V_R	-	-		2.0	V
Forward current	I_F	-	-		300	mA
Monitor Diode						
Reverse voltage	V_R	-	-		20	V
Forward current	I_F	-	-		10	mA
Module						
Storage temperature range	T_{sg}	See note ¹	-40		85	°C
Case operating temperature range	T_{op}	Cooler active	-5		80	°C
Fiber Pigtail						
Bending radius	R	-	35		-	mm
Tensile strength fiber to case	F	See note ¹	-		5	N
Characteristics ($T_{chip} = T_\lambda$, T_{amb} at 25 °C, $P_O = 10$ mW unless otherwise specified)						
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Radiant output power from pigtail	P_O	15 °C < T_λ < 35 °C	10	-	-	mW
Operating current	I_{op}	-	-	-	140	mA
Laser Diode						
Threshold current	I_{th}	-	-	25	40	mA
Slope efficiency	η	-	0.14	0.20	-	W/A
Central wavelength (ITU grid)	λ_c	-	1530	-	1561	nm
Laser set temperature for λ_c	T_λ	-	15	-	35	°C
Forward voltage	V_F	-	-	-	3.0	V
Side mode suppression ratio	SMSR	-	30	45	-	dB
Optical isolation	ISO	-	30	-	-	dB
Optical return loss	ORL	-	40	-	-	dB
Relative intensity noise	RIN	50 kHz - 2.5 GHz	-	-	-157	dB/Hz
Spectral linewidth	$\Delta\lambda$	FWHM	-	1.0	3.0	MHz
Bandwidth	s_{21}	5 - 870 MHz	-1	-	1	dB
Laser chirp	FM	-	-	50	150	MHz/mA
Second order distortion	IM2	$I_F = I_{op}$, 35% OMI, 60 km fiber at $f_2 - f_1$, $f_1 = 595.25$ MHz, $f_2 = 553.25$ MHz	-	-	-43	dBc
Third order distortion	IM3	$I_F = I_{op}$, 35% OMI, 60 km fiber at $2f_1 - f_2$, $f_1 = 595.25$ MHz, $f_2 = 553.25$ MHz	-	-	-52	dBc
Monitor Diode ($V_R = 10$ V)						
Monitor diode current	R	-	30	-	3000	μ A
Dark current	I_{md}	-	-	-	0.2	μ A
Temperature tracking error	TE	-5 °C < T_{case} < 80 °C	-	-	15	%
Thermistor						
Resistance	R_{th}	$T_{th} = 25$ °C	9.5	10	10.5	k Ω
Thermistor constant	B	-	3800	-	4100	K
Thermoelectric Cooler ($\Delta T = 65$ °C)						
Cooler current	I_{cool}	-	-	-	1.5	A
Cooler voltage	V_{cool}	-	-	-	3.2	V
Single Mode Fiber Pigtail (SMF 28 equivalent)						
Mode field diameter	\varnothing_{mf}	-	9.5	-	11.5	μ m
Cladding diameter	\varnothing_{cl}	-	122	-	128	μ m
Outer diameter of secondary coating	\varnothing_{sc}	-	0.8	0.9	1.0	mm
Length of pigtail	-	-	-	1	-	m
Reliability						
Long term wavelength drift, see note ¹	ML_λ	EOL: $\Delta\lambda = 0.2$ nm	-	300	-	years

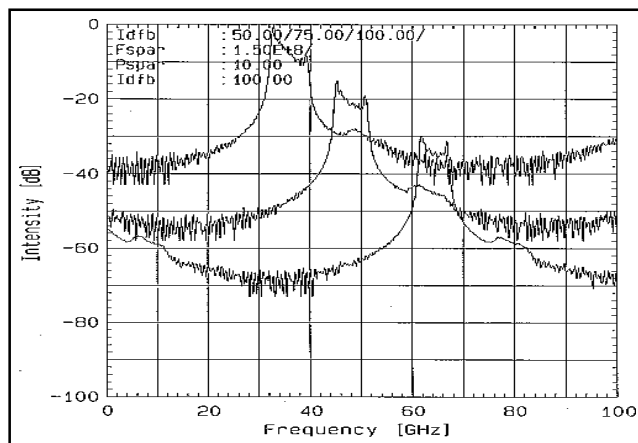
1. Mechanical integrity/environmental endurance tested according to Telcordia GR-468-CORE and MIL-STD-883.

ML = Median Life, EOL = End Of Life.

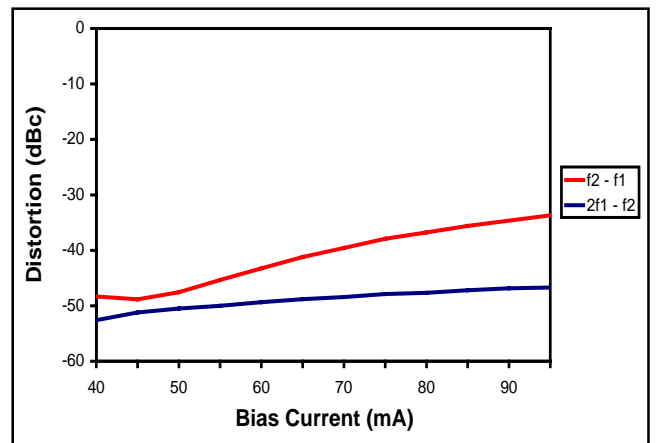
Typical Performance Characteristics



Typical efficiency of 0.15 mW/mA results in operating currents below 140 mA for an output power of 10 mW.

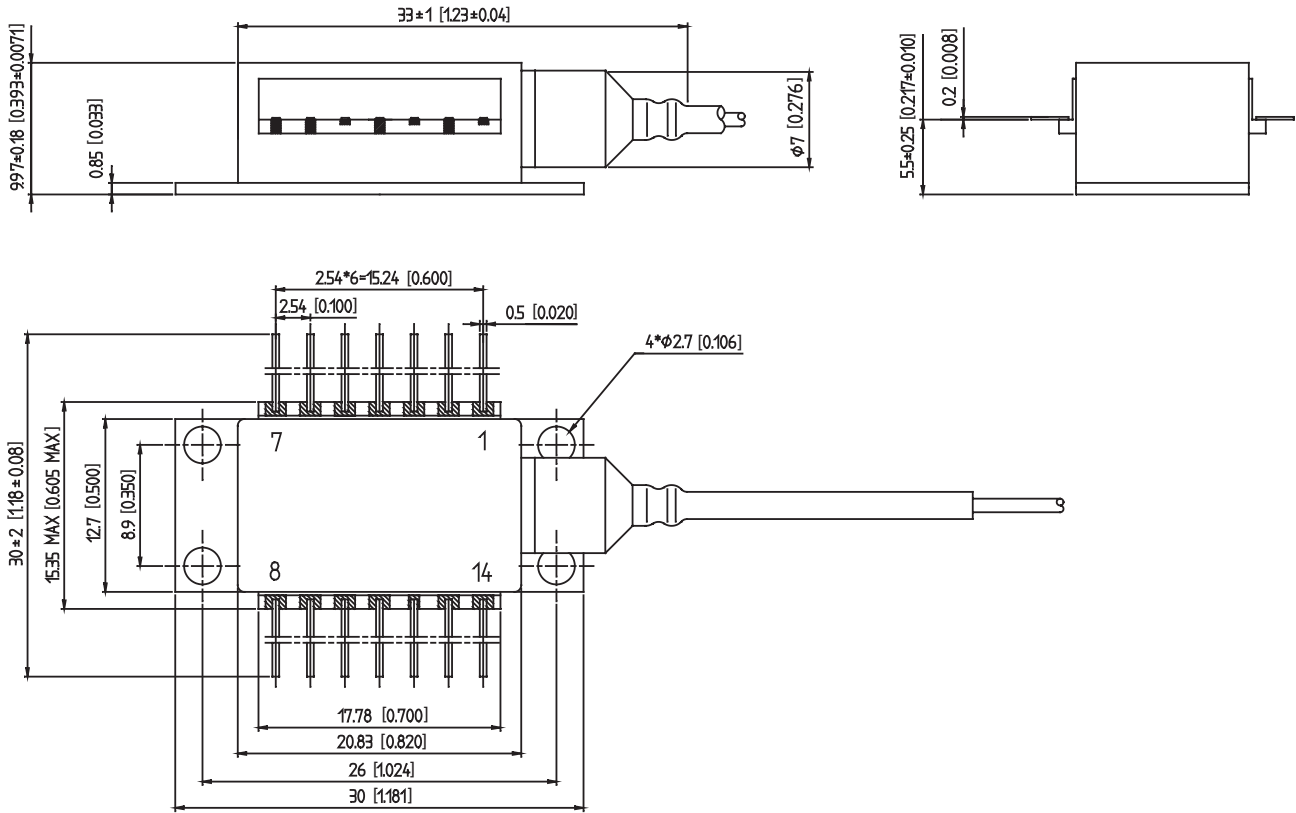


Typical chirp is better than 125 MHz/mA.



Typical second order and third order measurement of the laser versus the bias current ($f_2 - f_1 = IM_2$, $2f_1 - f_2 = IM_3$, $f_1 = 595.25$ kHz, $f_2 = 553.25$ kHz).

Dimensions Diagram (Specifications in mm [inches] unless otherwise noted; tolerance = ± 0.15 [± 0.006])



Pinout	
1	Thermistor
2	Thermistor
3	LD cathode DC input via inductance
4	PD anode
5	PD cathode
6	Cooler anode
7	Cooler cathode
8	Case GND
9	Case GND
10	Not connected
11	LD anode, case
12	LD cathode, AC input
13	LD anode, case
14	Not connected

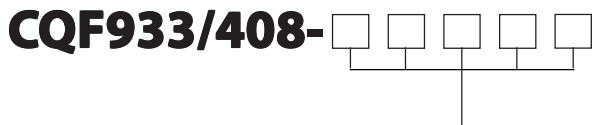
Fiber termination: Default 1.25 mm ferrule, SC/APC connector optional

Ordering Information

For more information on this or other products and their availability, please contact your local JDS Uniphase account manager or JDS Uniphase directly at 1-800-498-JDSU (5378) in North America and +800-5378-JDSU worldwide or via e-mail at jdsu.sales@jdsu.com.

Sample: CQF933/408-19270 for wavelength 1555.75 nm.

Attention: Order confirmations on this part number are preceded by FG' (e.g., FG'CQF933/408-19270).



Channel Code	Optical Frequency f_c (THz)	Wavelength (Vacuum) λ_c (nm)	Channel Code	Optical Frequency f_c (THz)	Wavelength (Vacuum) λ_c (nm)	Channel Code	Optical Frequency f_c (THz)	Wavelength (Vacuum) λ_c (nm)
19590	195.90	1530.33	19460	194.60	1540.56	19330	193.30	1550.92
19580	195.80	1531.12	19450	194.50	1541.35	19320	193.20	1551.72
19570	195.70	1531.90	19440	194.40	1542.14	19310	193.10	1552.52
19560	195.60	1532.68	19430	194.30	1542.94	19300	193.00	1553.33
19550	195.50	1533.47	19420	194.20	1543.73	19290	192.90	1554.13
19540	195.40	1534.25	19410	194.10	1544.53	19280	192.80	1554.94
19530	195.30	1535.04	19400	194.00	1545.32	19270	192.70	1555.75
19520	195.20	1535.82	19390	193.90	1546.12	19260	192.60	1556.56
19510	195.10	1536.61	19380	193.80	1546.92	19250	192.50	1557.36
19500	195.00	1537.40	19370	193.70	1547.72	19240	192.40	1558.17
19490	194.90	1538.19	19360	193.60	1548.51	19230	192.30	1558.98
19480	194.80	1538.98	19350	193.50	1549.32	19220	192.20	1559.79
19470	194.70	1539.77	19340	193.40	1550.12	19210	192.10	1560.61

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