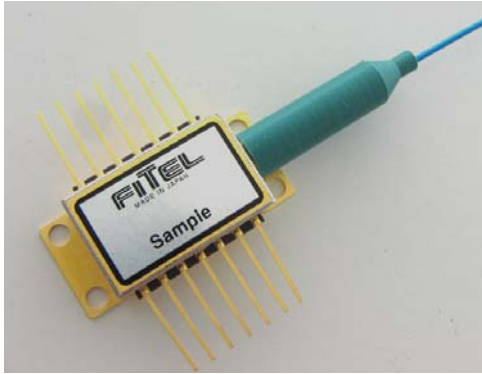


# Directly Modulated DFB Laser Module

## for Wireless Communications



### Applications

- Wideband wireless communications
- High frequency analog transmission
- DWDM transmission
- CWDM transmission

## Product Type: FRL1xDDRx series

### Descriptions

- FRL1xDDRx series of DFB laser module is designed for high frequency analog transmission in wideband wireless communications.
- The modules provide high output power while maintaining high linearity. The modules are housed in an industry standard hermetically sealed 14-pin butterfly package, which contains optical isolator, thermoelectric cooler, and power monitor photodiode.

### Features

- Industry standard OC-48 pin compatibility
- High fiber-coupled power, 8mW for DWDM and CWDM, and up to 16mW for 1310nm
- Optimized for wireless communications with 2GHz modulation
- ITU standard wavelengths for DWDM and CWDM transmission
- RoHS compliant package

### Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Storage Temperature	T <sub>stg</sub>	-40	85	°C
Operating Case Temperature	T <sub>c</sub>	-20	70	°C
LD Reverse Voltage	V <sub>rLD</sub>	-	2	V
LD Forward Current	I <sub>fLD</sub>	-	150	mA
PD Reverse Voltage	V <sub>rPD</sub>	-	20	V
PD Forward Current	I <sub>fPD</sub>	-	5	mA
TEC Current	I <sub>tec</sub>	-	1.6	A
TEC Voltage	V <sub>tec</sub>	-	2.6	V

**Specifications** (TLD=Tset, Tc=25°C, unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Optical Output Power	Pf				mW	CW
FRL15DDR8-A31		8	-	-		
FRL13DDRx-A31		8	-	16		
LD Forward Current	If				mA	Rated power, CW, BOL* <sup>1</sup>
FRL15DDR8-A31		-	-	80		
FRL13DDRx-A31		-	-	100		
LD Forward Voltage	Vf	-	-	2.0	V	Rated power, CW
Threshold Current	I <sub>th</sub>	-	10	20	mA	BOL* <sup>1</sup>
Submount Temperature	Tset				°C	Rated power, CW
FRL15DDR8-A31-xxxxx		20	-	35		
FRL15DDR8-A31-Wxxxx		-	25	-		
FRL13DDRx-A31		-	25	-		
Slope Efficiency	η				W/A	Rated power, CW
FRL15DDR8-A31		0.14	0.20	0.35		
FRL13DDRx-A31		0.16	0.32	-		
Input Impedance	Zin	-	25	-	Ω	
Wavelength	λ				nm	Rated power, CW, See Table 1
FRL15DDR8-A31-xxxxx		λ <sub>ITU</sub> -0.1	λ <sub>ITU</sub>	λ <sub>ITU</sub> +0.1		
FRL15DDR8-A31-Wxxxx		λ-3	λ	λ+3		
FRL13DDRx-A31		1290	1310	1330		Rated power, CW, See ordering information
Optical Isolation	ISO	30	-	-	dB	
Side Mode Suppression Ratio	SMSR	35	45	-	dB	Rated power, CW
Cut-off Frequency	fc(-1.5dB)	2	3	-	GHz	Rated power
	fc(-3dB)	3	4	-	GHz	Rated power
Frequency Response	S <sub>21</sub>			±0.5	dB	f=1900 to 2200MHz
3rd Order Distortion	IMD3	-	-	-65	dBc	2 tone test, f1=1997MHz, f2=2003MHz, OMI=21%/tone, Rated power
Relative Intensity Noise	RIN	-	-	-155	dB/Hz	Rated power, CW, f=2000MHz
Monitor Current	I <sub>m</sub>	0.05	-	2	mA	Rated power, CW, V <sub>rPD</sub> =5V
Monitor Dark Current	I <sub>d</sub>	-	-	100	nA	V <sub>rPD</sub> =5V
Tracking Error	TE	-0.5	-	0.5	dB	I <sub>m</sub> =constant, T <sub>c</sub> = -20~70°C
TEC Current	I <sub>tec</sub>	-	-	1.2	A	T <sub>c</sub> =70°C, Rated power, CW
TEC Voltage	V <sub>tec</sub>	-	-	2.4	V	T <sub>c</sub> =70°C, Rated power, CW
Thermistor B constant	B	-	3900	-	K	
Thermistor Resistance	R	9.5	-	10.5	kΩ	Tset=25°C

\*1 BOL : Beginning of Life

# Data Sheet

## FRL1xDDRx series

Apr. 2016



Table 1 Wavelength code for ITU wavelength

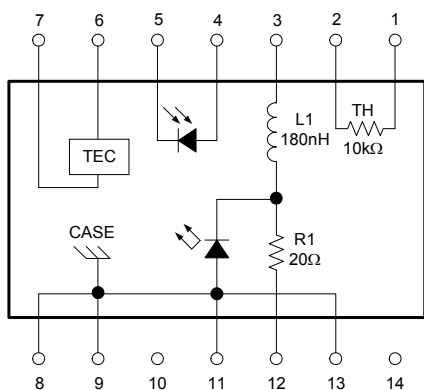
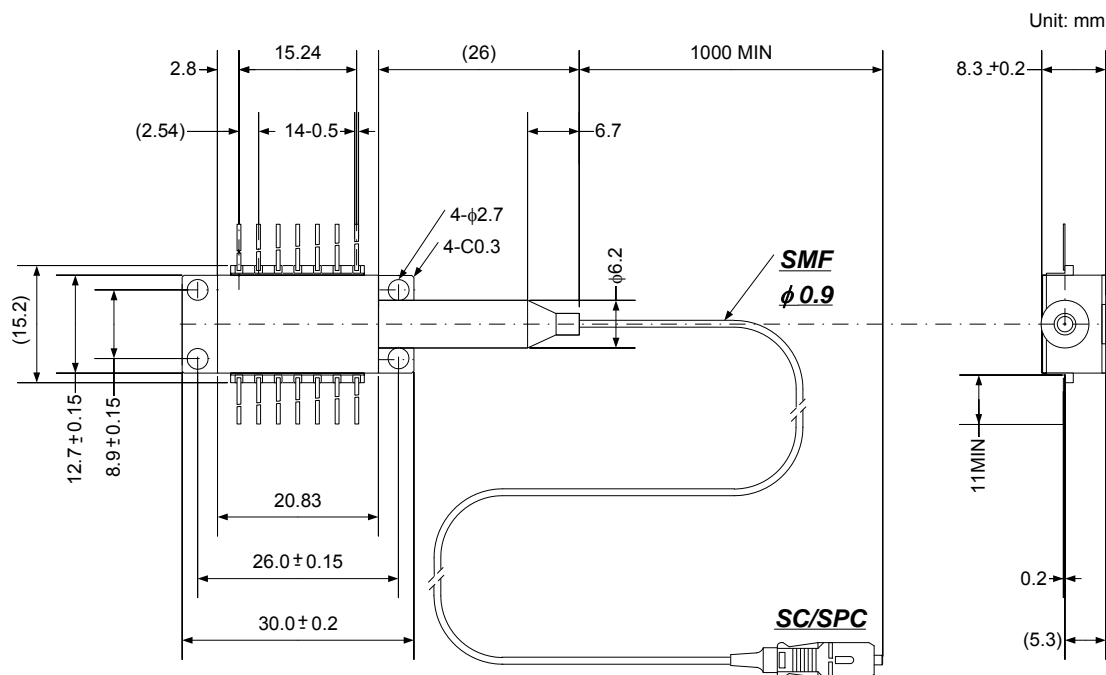
$\lambda_{ITU}$ [nm]	ITU Freq. [THz]	Wavelength code	$\lambda_{ITU}$ [nm]	ITU Freq. [THz]	Wavelength code	$\lambda_{ITU}$ [nm]	ITU Freq. [THz]	Wavelength code
1527.22	196.30	19630	1554.13	192.90	19290	1582.02	189.50	18950
1527.60	196.25	19625	1554.54	192.85	19285	1582.44	189.45	18945
1527.99	196.20	19620	1554.94	192.80	19280	1582.85	189.40	18940
1528.38	196.15	19615	1555.34	192.75	19275	1583.27	189.35	18935
1528.77	196.10	19610	1555.75	192.70	19270	1583.69	189.30	18930
1529.16	196.05	19605	1556.15	192.65	19265	1584.11	189.25	18925
1529.55	196.00	19600	1556.55	192.60	19260	1584.53	189.20	18920
1529.94	195.95	19595	1556.96	192.55	19255	1584.95	189.15	18915
1530.33	195.90	19590	1557.36	192.50	19250	1585.36	189.10	18910
1530.72	195.85	19585	1557.77	192.45	19245	1585.78	189.05	18905
1531.12	195.80	19580	1558.17	192.40	19240	1586.20	189.00	18900
1531.51	195.75	19575	1558.58	192.35	19235	1586.62	188.95	18895
1531.90	195.70	19570	1558.98	192.30	19230	1587.04	188.90	18890
1532.29	195.65	19565	1559.39	192.25	19225	1587.46	188.85	18885
1532.68	195.60	19560	1559.79	192.20	19220	1587.88	188.80	18880
1533.07	195.55	19555	1560.20	192.15	19215	1588.30	188.75	18875
1533.47	195.50	19550	1560.61	192.10	19210	1588.73	188.70	18870
1533.86	195.45	19545	1561.01	192.05	19205	1589.15	188.65	18865
1534.25	195.40	19540	1561.42	192.00	19200	1589.57	188.60	18860
1534.64	195.35	19535	1561.83	191.95	19195	1589.99	188.55	18855
1535.04	195.30	19530	1562.23	191.90	19190	1590.41	188.50	18850
1535.43	195.25	19525	1562.64	191.85	19185	1590.83	188.45	18845
1535.82	195.20	19520	1563.05	191.80	19180	1591.26	188.40	18840
1536.22	195.15	19515	1563.45	191.75	19175	1591.68	188.35	18835
1536.61	195.10	19510	1563.86	191.70	19170	1592.10	188.30	18830
1537.00	195.05	19505	1564.27	191.65	19165	1592.52	188.25	18825
1537.40	195.00	19500	1564.68	191.60	19160	1592.95	188.20	18820
1537.79	194.95	19495	1565.09	191.55	19155	1593.37	188.15	18815
1538.19	194.90	19490	1565.50	191.50	19150	1593.79	188.10	18810
1538.58	194.85	19485	1565.90	191.45	19145	1594.22	188.05	18805
1538.98	194.80	19480	1566.31	191.40	19140	1594.64	188.00	18800
1539.37	194.75	19475	1566.72	191.35	19135	1595.06	187.95	18795
1539.77	194.70	19470	1567.13	191.30	19130	1595.49	187.90	18790
1540.16	194.65	19465	1567.54	191.25	19125	1595.91	187.85	18785
1540.56	194.60	19460	1567.95	191.20	19120	1596.34	187.80	18780
1540.95	194.55	19455	1568.36	191.15	19115	1596.76	187.75	18775
1541.35	194.50	19450	1568.77	191.10	19110	1597.19	187.70	18770
1541.75	194.45	19445	1569.18	191.05	19105	1597.62	187.65	18765
1542.14	194.40	19440	1569.59	191.00	19100	1598.04	187.60	18760
1542.54	194.35	19435	1570.01	190.95	19095	1598.47	187.55	18755
1542.94	194.30	19430	1570.42	190.90	19090	1598.89	187.50	18750
1543.33	194.25	19425	1570.83	190.85	19085	1599.32	187.45	18745
1543.73	194.20	19420	1571.24	190.80	19080	1599.75	187.40	18740
1544.13	194.15	19415	1571.65	190.75	19075	1600.17	187.35	18735
1544.53	194.10	19410	1572.06	190.70	19070	1600.60	187.30	18730
1544.92	194.05	19405	1572.48	190.65	19065	1601.03	187.25	18725
1545.32	194.00	19400	1572.89	190.60	19060	1601.46	187.20	18720
1545.72	193.95	19395	1573.30	190.55	19055	1601.88	187.15	18715
1546.12	193.90	19390	1573.71	190.50	19050	1602.31	187.10	18710
1546.52	193.85	19385	1574.13	190.45	19045	1602.74	187.05	18705
1546.92	193.80	19380	1574.54	190.40	19040	1603.17	187.00	18700
1547.32	193.75	19375	1574.95	190.35	19035	1603.60	186.95	18695
1547.72	193.70	19370	1575.37	190.30	19030	1604.03	186.90	18690
1548.11	193.65	19365	1575.78	190.25	19025	1604.46	186.85	18685
1548.51	193.60	19360	1576.20	190.20	19020	1604.88	186.80	18680
1548.91	193.55	19355	1576.61	190.15	19015	1605.31	186.75	18675
1549.32	193.50	19350	1577.03	190.10	19010	1605.74	186.70	18670
1549.72	193.45	19345	1577.44	190.05	19005	1606.17	186.65	18665
1550.12	193.40	19340	1577.86	190.00	19000	1606.60	186.60	18660
1550.52	193.35	19335	1578.27	189.95	18995	1607.04	186.55	18655
1550.92	193.30	19330	1578.69	189.90	18990	1607.47	186.50	18650
1551.32	193.25	19325	1579.10	189.85	18985	1607.90	186.45	18645
1551.72	193.20	19320	1579.52	189.80	18980	1608.33	186.40	18640
1552.12	193.15	19315	1579.93	189.75	18975	1608.76	186.35	18635
1552.52	193.10	19310	1580.35	189.70	18970	1609.19	186.30	18630
1552.93	193.05	19305	1580.77	189.65	18965	1609.62	186.25	18625
1553.33	193.00	19300	1581.18	189.60	18960	1610.06	186.20	18620
1553.73	192.95	19295	1581.60	189.55	18955			

Wavelength values are referenced to vacuum.

## Optical Fiber Pigtail Specifications

Parameter	Specification	Unit
Fiber Type	Corning SMF-28 or equivalent Flame Retardant Hytel Coating 0.9mmΦ	-
Nominal Fiber Length	Min. 1,000 (Boot edge (fiber side) to connector edge)	mm
Connector Type	SC/SPC Connector	-

## Dimensions and Pin Assignments



PIN No.	Object	PIN No.	Function
1	Thermistor	8	Case Ground
2	Thermistor	9	Case Ground
3	LD Cathode(-)	10	No Connect
4	Monitor Anode(-)	11	Laser Anode(+), Case Ground
5	Monitor Cathode(+)	12	Laser RF
6	TEC(+)	13	Laser Anode(+), Case Ground
7	TEC(-)	14	No Connect

**Ordering Information**

FRL15DDR8 – A31 – □□□□□

Wavelength code	
xxxx:	See Table 1 for ITU wavelength
W1470:	1470nm
W1490:	1490nm
W1510:	1510nm
W1530:	1530nm
W1550:	1550nm
W1570:	1570nm
W1590:	1590nm
W1610:	1610nm

FRL13DDR□ – A31

Optical Output Power	
8:	8mW
A:	12mW
B:	16mW

**Safety Information**

This product complies with 21 CFR 1040.10 and 1040.11, Class 3b laser product. Invisible laser radiation is emitted from the end of the fiber or connector. Avoid direct exposure to the beam.



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