



Narrow Linewidth Full Band Tunable DFB Laser Module

Component Specifications

FRL15TCWA-D66-19610-D (C-band, Pf=10dBm, $\Delta v < 500\text{kHz}$)
FRL15TCWB-D66-19610-D (C-band, Pf=13dBm, $\Delta v < 500\text{kHz}$)
FRL15TCWC-D66-19610-D (C-band, Pf=15dBm, $\Delta v < 500\text{kHz}$)
FRL15TCWD-D66-19610-D (C-band, Pf=16dBm, $\Delta v < 500\text{kHz}$)
FRL15TCWA-D66-19090-D (L-band, Pf=10dBm, $\Delta v < 500\text{kHz}$)
FRL15TCWB-D66-19090-D (L-band, Pf=13dBm, $\Delta v < 500\text{kHz}$)
FRL15TCWC-D66-19090-D (L-band, Pf=15dBm, $\Delta v < 500\text{kHz}$)



Date:	April 13, 2012
Version:	A
Doc Number:	OD-YAHC0002

Narrow Linewidth Full Band Tunable DFB Laser Module

FRL15TCWA-D66-19610-D (C-band, Pf=10dBm, $\Delta\nu$ <500kHz)

FRL15TCWB-D66-19610-D (C-band, Pf=13dBm, $\Delta\nu$ <500kHz)

FRL15TCWC-D66-19610-D (C-band, Pf=15dBm, $\Delta\nu$ <500kHz)

FRL15TCWD-D66-19610-D (C-band, Pf=16dBm, $\Delta\nu$ <500kHz)

FRL15TCWA-D66-19090-D (L-band, Pf=10dBm, $\Delta\nu$ <500kHz)

FRL15TCWB-D66-19090-D (L-band, Pf=13dBm, $\Delta\nu$ <500kHz)

FRL15TCWC-D66-19090-D (L-band, Pf=15dBm, $\Delta\nu$ <500kHz)

1. Absolute Maximum Ratings

Basic Parameters	Sym.	Min.	Max.	Unit	Conditions
Storage Temperature	T _{stg}	-40	85	°C	
Operating Case Temperature	T _c	-5	75	°C	
LD Operating Temperature	T _{LD}	8	57	°C	
Filter Operating Temperature	T _f	30	55	°C	
LD Forward Current	I _{fLD}	-	300	mA	
LD Reverse Voltage	V _{rLD}	-	2	V	
SOA Forward Current	I _{fSOA}	-	1050	mA	
SOA Reverse Voltage	V _{rSOA}	-	2	V	
PD Forward Current	I _{fPD}	-	10	mA	
PD Reverse Voltage	V _{rPD}	-	20	V	
TEC1 Current (LD)	I _{tec1}	-0.2	2.3	A	+: cooling, -: heating
TEC1 Voltage (LD)	V _{tec1}	-	4.9	V	
TEC2 Current (Filter)	I _{tec2}	-0.4	3.4	A	+: cooling, -: heating
TEC2 Voltage (Filter)	V _{tec2}	-	5.5	V	
Relative Humidity	RH	0	85	%	
Fiber Bend Radius	-	20	-	mm	
Fiber Axial Pull Force	-	-	10	N	
Lead Soldering Temperature	-	-	350	°C	
Lead Soldering Duration	-	-	10	sec	
Torque Force	-	-	0.1	Nm	Flatness : <20 μ m
Electrostatic Discharge (ESD)	-	-	500	V	HBM, C=100pF, R=1.5k Ω

2. Performance Specifications

(Tc=25°C, BOL, unless otherwise specified)

Parameters	Sym.	Min.	Typ.	Max.	Unit	Conditions
Maximum Optical Output Power	Pf	-----			dBm	CW
FRL15TCWA-D66-19xxx-D		10				
FRL15TCWB-D66-19xxx-D		13				
FRL15TCWC-D66-19xxx-D		15				
FRL15TCWD-D66-19610-D	16					
LD Operating Temperature	T _{LD}	15	-	55	°C	Rated power
LD Forward Current	I _{fLD}	-	-	300	mA	
LD Forward Voltage	V _{fLD}	-	-	2.7	V	
SOA Forward Current (BOL)	I _{fSOA} (BOL)	-	-	600	mA	Rated power, BOL
SOA Forward Current (EOL)	I _{fSOA} (EOL)	-	-	840	mA	Rated power, EOL, I _{fSOA} (EOL)=1.4 x I _{fSOA} (BOL)
SOA Forward Voltage	V _{fSOA}	-	-	3.0	V	Rated power, EOL
Wavelength	λ _p	-----			nm	Rated power, 50GHz spacing
FRL15TCWx-D66-19610-D		1528.773	-	1563.455		
FRL15TCWx-D66-19090-D		1570.416	-	1607.035		
Spectral Linewidth	Δv	-	-	500	kHz	Rated power
Side Mode Suppression Ratio	SMSR	40	-	-	dB	Rated power
Optical Isolation	Iso	25	-	-	dB	
Relative Intensity Noise	RIN	-	-	-135	dB/Hz	Rated power, OpRL<25dB, 10MHz<f<10GHz
Frequency variation over Tc change	Δfs	-1.25	-	1.25	GHz	Rated power, I _m =const., I _m λ=const., Tc=-5°C/35°C/75°C, BOL
Frequency Stability to ITU Grid	Δfs	-2.5	-	2.5	GHz	Rated power, I _m =const., I _m λ=const., EOL
Filter Operating Temperature	T _f	35	-	55	°C	
Filter Temperature Coefficient	ΔT _f	-	15	-	pm/°C	
Free Spectral Range	FSR	-	50	-	GHz	See Note 1
Capture Range (negative side)	-CR	14.0	-	22.5	GHz	See Note 1
Capture Range (positive side)	+CR	27.5	-	36.0	GHz	See Note 1
Power Monitor Current	I _m	-----			μA	V _{rPD} =5V, Rated power
FRL15TCWA-D66-19xxx-D		10				
FRL15TCWB-D66-19xxx-D		20				
FRL15TCWC-D66-19xxx-D		30				
FRL15TCWD-D66-19610-D	40					
Power Monitor Dark Current	I _d	-	-	100	nA	V _{rPD} =5V
Wavelength Monitor Current	I _m λ	-----			μA	V _{rPD} =5V, Rated power
FRL15TCWA-D66-19xxx-D		4				
FRL15TCWB-D66-19xxx-D		8				
FRL15TCWC-D66-19xxx-D		12				
FRL15TCWD-D66-19610-D	16					
Wavelength Monitor Dark Current	I _d λ	-	-	100	nA	V _{rPD} =5V
Wavelength Monitor Current Slope	Slope	1	-	120	μA/GHz	V _{rPD} =5V, See Note 1
Tracking Error	TE	-0.5	-	0.5	dB	I _m =const., Tc=-5°C/35°C/75°C
TEC1 Current (LD)	I _{tec1}	-	-	0.9	A	Tc=75°C, Rated power, EOL
TEC1 Voltage (LD)	V _{tec1}	-	-	1.7	V	Tc=75°C, Rated power, EOL
TEC2 Current (Filter)	I _{tec2}	-	-	1.7	A	Tc=75°C, Rated power, EOL
TEC2 Voltage (Filter)	V _{tec2}	-	-	2.5	V	Tc=75°C, Rated power, EOL
Total Power Consumption (P _{LD} +P _{SOA} +P _{TEC1} +P _{TEC2})	P _{total}	-	-	5.5	W	Tc=75°C, Rated power, EOL
Thermistor B Constant	B _{th}	-	3900	-	K	
Thermistor Resistance	R _{th}	9.5	10	10.5	kΩ	T _{LD} =25°C, T _f =25°C
Polarization Extinction Ratio	E _r	20	-	-	dB	

BOL: Beginning of Life, EOL: End of Life, OpRL: Optical Return Loss

3. Wavelength

C-band

Part Number	Channel	λ (nm)	ITU Frequency (THz)
FRL15TCWA-D66-19610-D	1	1528.773	196.10
FRL15TCWB-D66-19610-D	2	1529.163	196.05
FRL15TCWC-D66-19610-D	~	~	~
FRL15TCWD-D66-19610-D	87	1563.047	191.80
	88	1563.455	191.75

L-band

Part Number	Channel	λ (nm)	ITU Frequency (THz)
FRL15TCWA-D66-19090-D	1	1570.416	190.90
FRL15TCWB-D66-19090-D	2	1570.828	190.85
FRL15TCWC-D66-19090-D	~	~	~
	87	1606.605	186.60
	88	1607.035	186.55

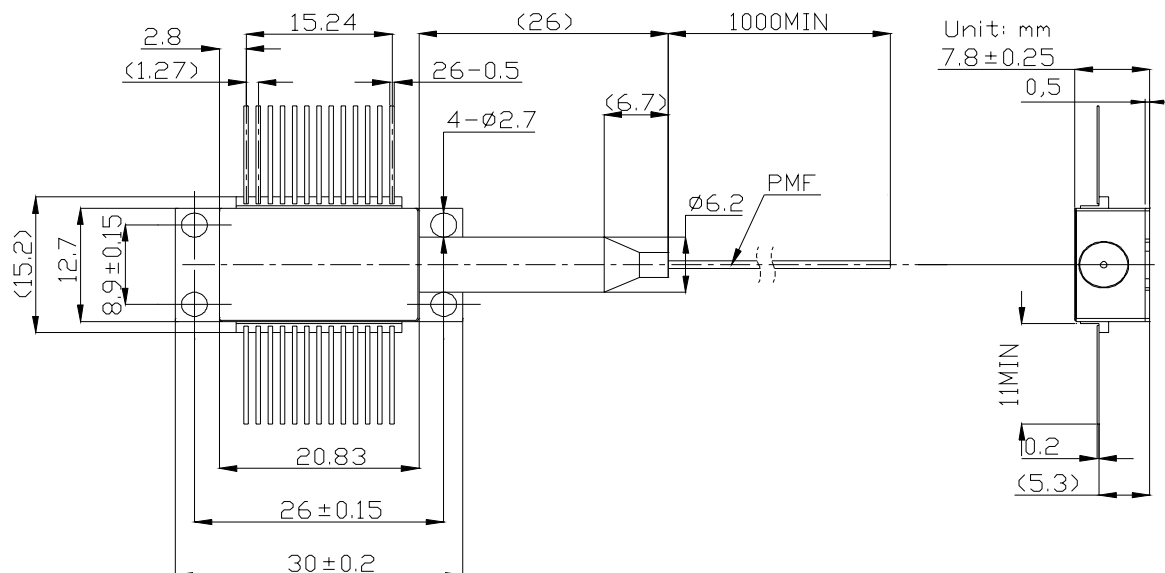
Wavelength values are referenced to vacuum.

Wavelength (λ) and ITU frequency (f) have a relationship of λ [nm] = 299792458 / f [THz] / 1000.

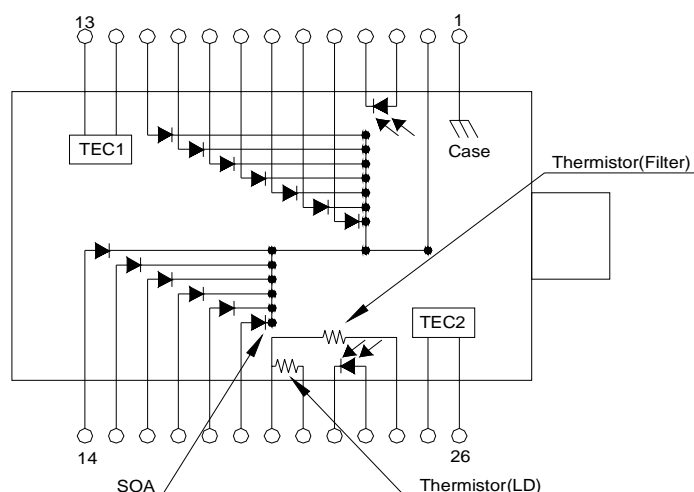
FITEL wavelength code is expressed as a 5-digit integer rounded from 100 x f [THz].

4. Dimensions and Pin Assignment

4.1 Dimensions



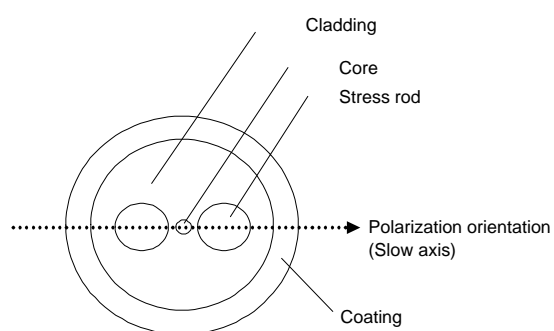
4.2 Pin Assignment



Pin No.	Function	Pin No.	Function
1	Case Ground	14	LD6 Anode(+)
2	LD, SOA Cathode Common(-)	15	LD5 Anode(+)
3	Power Monitor PD Anode(-)	16	LD4 Anode(+)
4	Power Monitor PD Cathode(+)	17	LD3 Anode(+)
5	LD1 Anode(+)	18	LD2 Anode(+)
6	LD12 Anode(+)	19	SOA Anode(+)
7	LD11 Anode(+)	20	Thermistor Common
8	LD10 Anode(+)	21	Thermistor(LD)
9	LD9 Anode(+)	22	Wavelength Monitor PD Cathode(+)
10	LD8 Anode(+)	23	Wavelength Monitor PD Anode(-)
11	LD7 Anode(+)	24	Thermistor(Filter)
12	TEC1(LD)(+)	25	TEC2(Filter)(+)
13	TEC1(LD)(-)	26	TEC2(Filter)(-)

5. Fiber Pigtail Specifications

Parameters	Min.	Typ.	Max.	Unit	Conditions
Fiber	Polarization Maintaining (PANDA) Fiber				
Cutoff Wavelength	-	1400	-	nm	
Mode Field Diameter	-	10	-	μm	$\lambda=1.55\mu\text{m}$
Cladding Diameter	122	125	128	μm	
Fiber Diameter	-	0.4	-	mm	UV coating
Pigtail Length	1	-	-	m	Housing edge to connect end
Fiber Connector	No connector				
Polarization Axis	Slow Axis				



6. Accompanying Data

Parameters	Conditions
Model Number	
Serial Number	
Channel Number	
Pin Number	
Wavelength	Tc=25°C, Pf=Rated power
LD Operating Temperature	Tc=25°C, Pf=Rated power
Filter Operating Temperature	Tc=25°C, Pf=Rated power
LD Forward Current	Tc=25°C, Pf=Rated power
SOA Forward Current	Tc=25°C, Pf=Rated power
Power Monitor Current	Tc=25°C, Pf=Rated power
Wavelength Monitor Current	Tc=25°C, Pf=Rated power
Wavelength Monitor Current Slope	Tc=25°C, Pf=Rated power
Capture Range (negative side)	Tc=25°C, Pf=Rated power

7. RoHS compliance

This product is comply with RoHS requirements (Directive 2002/95/EC, see highlights in the following table). Please note that current design meets RoHS directive by the using some exemption for Lead content, so please ask technical contact for details.

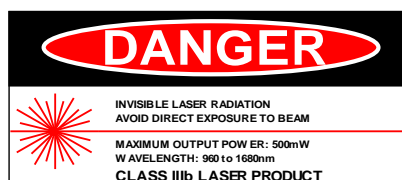
Material	Concentration
Cadmium (Cd)	<100ppm
Hexavalent Chromium (Cr VI)	<1000ppm
Mercury (Hg)	<1000ppm
Polybrominated biphenyls (PBB)	<1000ppm
Polybrominated diphenyl ethers (PBDE)	<1000ppm
Lead (Pb)	<1000ppm

8. Warning

- (1) The laser light emitted from the optical fiber end is invisible and will be hazardous to the human eye. Avoid looking directly into the optical fiber, when the device is in operation.
- (2) The device should be damaged by static electricity and surge current. Static electricity protection and surge protection are needed before handling.

9. Safety Information

The product complies with 21 CFR1040.10 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.



10. Limited Warranty

Furukawa Electric warrants the LD modules against defects in parts and workmanship for one full year from B/L date. This warranty shall be invalid by any abuse, misuse, misapplication or improper installation of the product.

<Note 1>

