

25Gb/s 10km Transmission performance Using 1.3- μm DML

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- ◆ Eye safety problem (TP2 max pwr $>12\text{dBm}$) was pointed out in Portland interim meeting when CWDM DML link budget was discussed.
- ◆ New link budget estimation based on experimental results, such as DML temperature dependence, is proposed here.
- ◆ Considering future cost and power dissipation savings potential, uncooled DML is a promising solution and to be examined as the candidate.

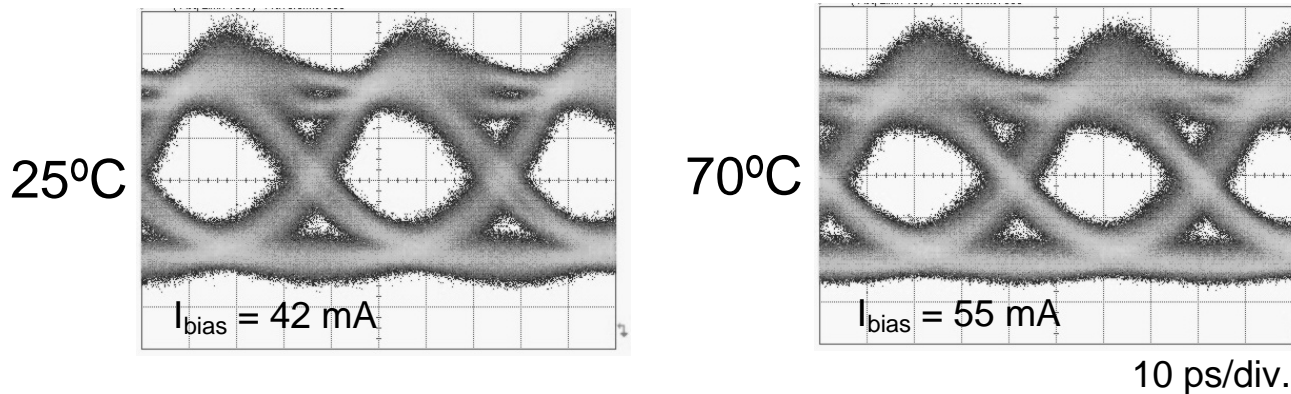
Power Budget Estimation in Portland

Technology		LAN WDM cooled DML	CWDM uncooled DML
Lambda	nm	1318	1331
Maximum Chromatic Dispersion	ps/nm	16.40	33.43
Extinction Ratio	dB	4.5	3.5
Tx min(OMA)	dBm	2.44	4.44
Tx min(Av)	dBm	3.09	5.60
Optical Mux loss	dB	2.50	2.50
TP2 Tx min(in OMA)	dBm	-0.06	1.94
TP2 Tx min(Av)	dBm	0.59	3.10
Power Budget	dB	8.80	10.80
a) Fiber loss(G.652 A&B)	dB	4.20	4.30
b) Connector&Other losses	dB	3.00	3.00
c) CD Penalty	dB	1.60	3.50
TP3 Rx min(in OMA)	dBm	-8.86	-8.86
TP3 Rx min (Av @given ER)	dBm	-8.21	-7.70
Optical DeMux loss	dB	2.50	2.50
Rx min sensitivity (in OMA)	dBm	-11.36	-11.36
Rx min sensitivity (Av @given ER)	dBm	-10.71	-10.20
ER Penalty (versus ER=10dB)	dB	2.79	3.30
Rx min sensitivity (Av @ER=10dB)	dBm	-13.50	-13.50
TP2 Tx max *1	dBm	9.59	12.10

*1: Tx min(Av)+3dB+6dB

◆ AlGaInAs Buried-Hetero structure DFB LD with multiple quantum well active layers

- NRZ signal, PRBS = $2^{31}-1$
- $I_{\text{mod}} = 40 \text{ mA}_{\text{p-p}}$



$I_{\text{th}} = 9.4 \text{ mA}@25^\circ\text{C}$
 $16.2 \text{ mA}@70^\circ\text{C}$
 $22.8 \text{ mA}@85^\circ\text{C}$

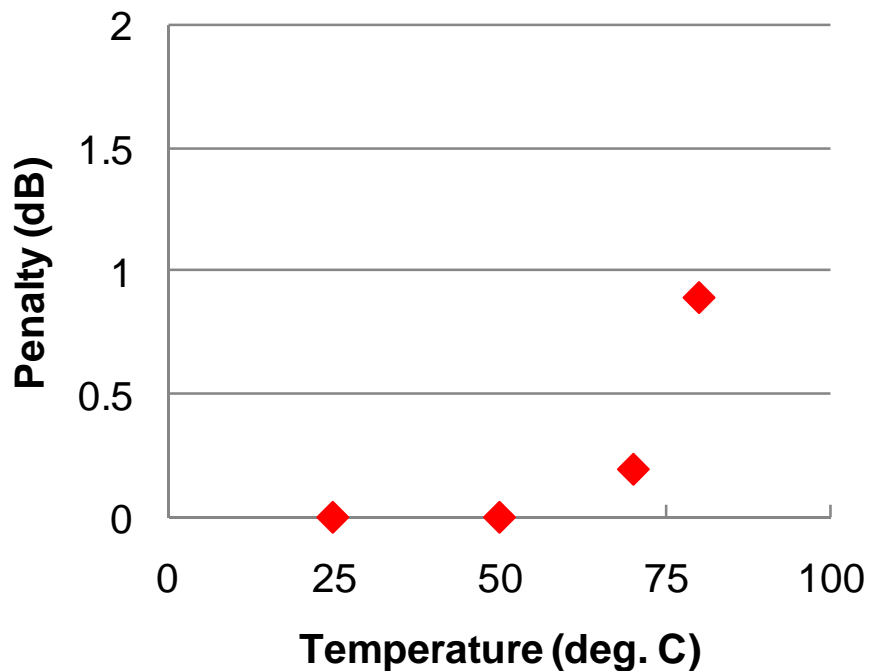
Dynamic extinction ratio : 5.0 dB

Transmission Characteristics

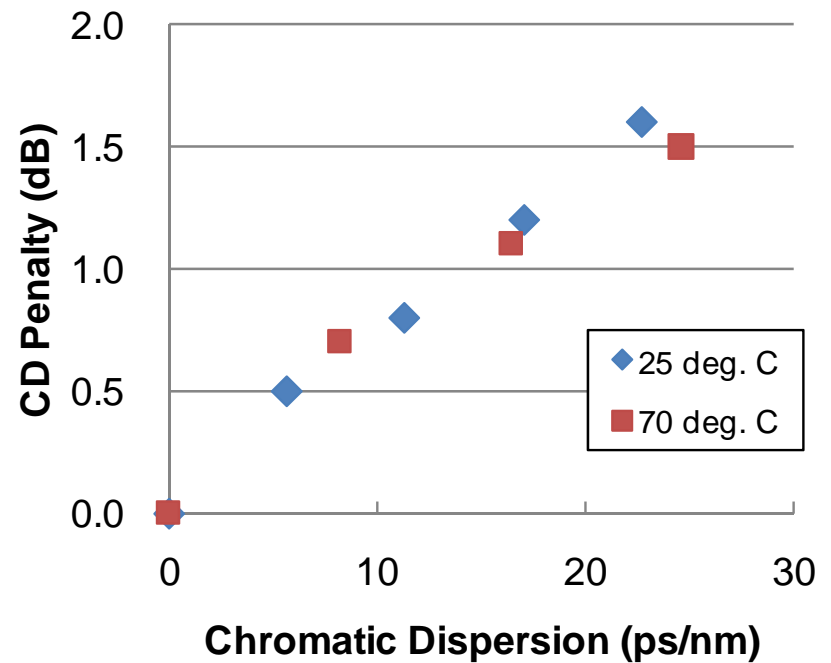
Measurement condition

NRZ signal, PRBS = $2^{31}-1$

Dynamic Extinction Ratio **5.5** dB

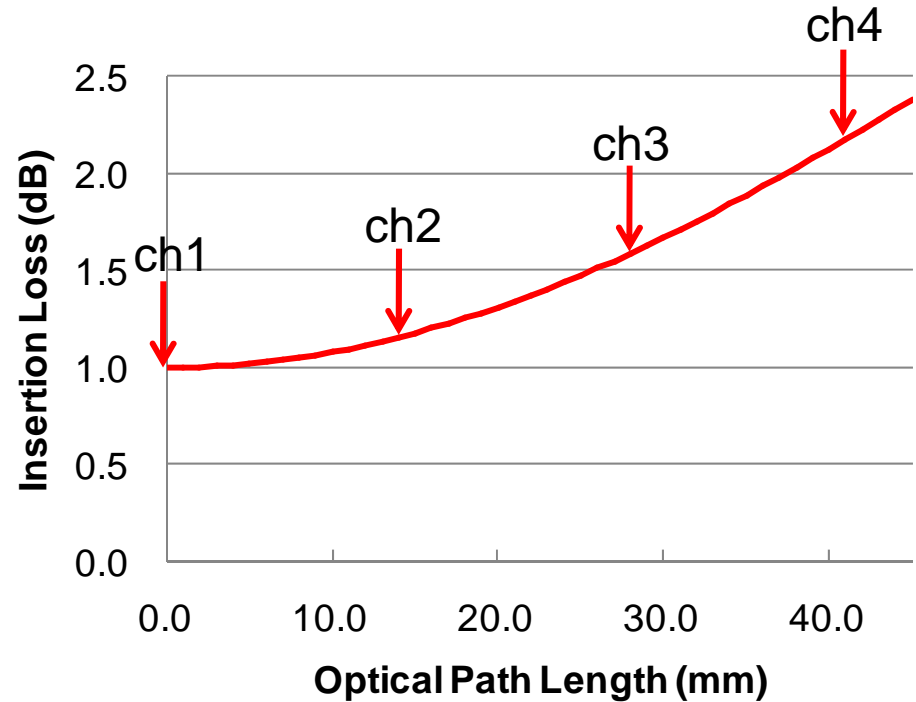
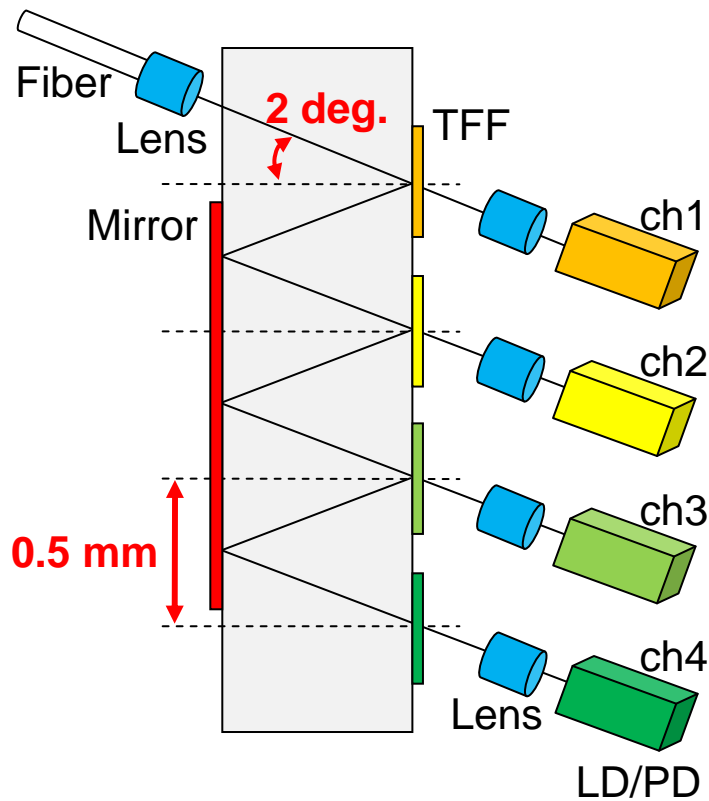


Temperature dependence on
B to B penalty from 25 deg.C




Temperature dependence on
CD penalty

◆ Thin-Film Filter Base Configuration



“Step insertion loss spec” for channels is available.

Low Loss channel  Large CD penalty channel

New Estimation using DML Experimental Results

Technology		CWDM uncooled DML			
Lambda	nm	1331	1311	1291	1271
Maximum Chromatic Dispersion	ps/nm	33.44	15.95	-2.33	-21.48
Extinction Ratio	dB	5.00	5.00	5.00	5.00
Tx min(OMA)	dBm	1.39	0.56	0.21	1.56
Tx min(Av)	dBm	1.22	0.09	-0.36	1.09
Optical Mux loss	dB	1.00	1.20	1.60	2.20
TP2 Tx min(in OMA)	dBm	0.39	-0.64	-1.39	-0.64
TP2 Tx min(Av)	dBm	0.22	-1.11	-1.96	-1.11
Power Budget	dB	10.75	9.22	7.97	8.22
a) Fiber loss(G.652 A&B)	dB	4.25	4.22	4.47	4.72
b) Connector&Other losses	dB	3.00	3.00	3.00	3.00
c) CD Penalty *1	dB	3.50	2.00	0.50	0.50
TP3 Rx min(in OMA)	dBm	-10.36	-9.86	-9.36	-8.86
TP3 Rx min (Av @given ER)	dBm	-10.53	-10.33	-9.93	-9.33
Optical DeMux loss	dB	1.00	1.20	1.60	2.20
Rx min sensitivity (in OMA)	dBm	-11.36	-11.36	-11.36	-11.36
Rx min sensitivity (Av @given ER)	dBm	-11.53	-11.53	-11.53	-11.53
ER Penalty (versus ER=10dB)	dB	1.97	1.97	1.97	1.97
Rx min sensitivity (Av @ER=10dB)	dBm	-13.50	-13.50	-13.50	-13.50
TP2 Tx max *2	dBm	8.10			

*1: Experimental Result(Isono_01_1107) +0.5dB margin, *2: Sum of 4 wavelength power +3dB

- ◆ CWDM DML will be applicable for 25Gx4 SMF 10km transmission in near future, considering the recent DML performance improvement.
- ◆ It is necessary to discuss the link penalties estimation including “Chirp” performance.