PRELIMINARY DATA SHEET

NEC

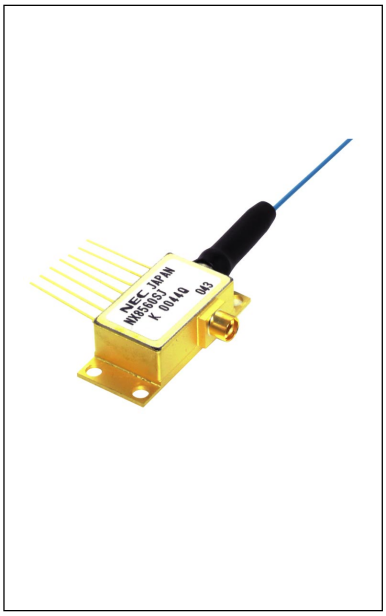
LASER DIODE

NX8560SJ Series

EA MODULATOR AND WAVELENGTH MONITOR INTEGRATED 1 550 nm MQW-DFB LASER DIODE MODULE FOR 10 Gb/s APPLICATIONS

DESCRIPTION

The NX8560SJ Series is an Electro-Absorption (EA) modulator and wavelength monitor integrated, 1 550 nm Multiple Quantum Well (MQW) structured Distributed Feed-Back (DFB) laser diode module. It is capable of transmitting up to 40 km standard single mode fiber (dispersion: 800 ps/nm) for 10 Gb/s applications with built in wavelength monitor.



FEATURES

- Integrated electroabsorption modulator
- Wavelength monitor function (Etalon filter, Wavelength monitor PD)
- 10 Gb/s transmission up to 40 km SSMF (dispersion: 800 ps/nm)
- 7-pin butterfly package with GPO™ connector
- Available for DWDM wavelengths based on ITU-T recommendations (50 GHz grid, refer to **ORDERING INFORMATION**)

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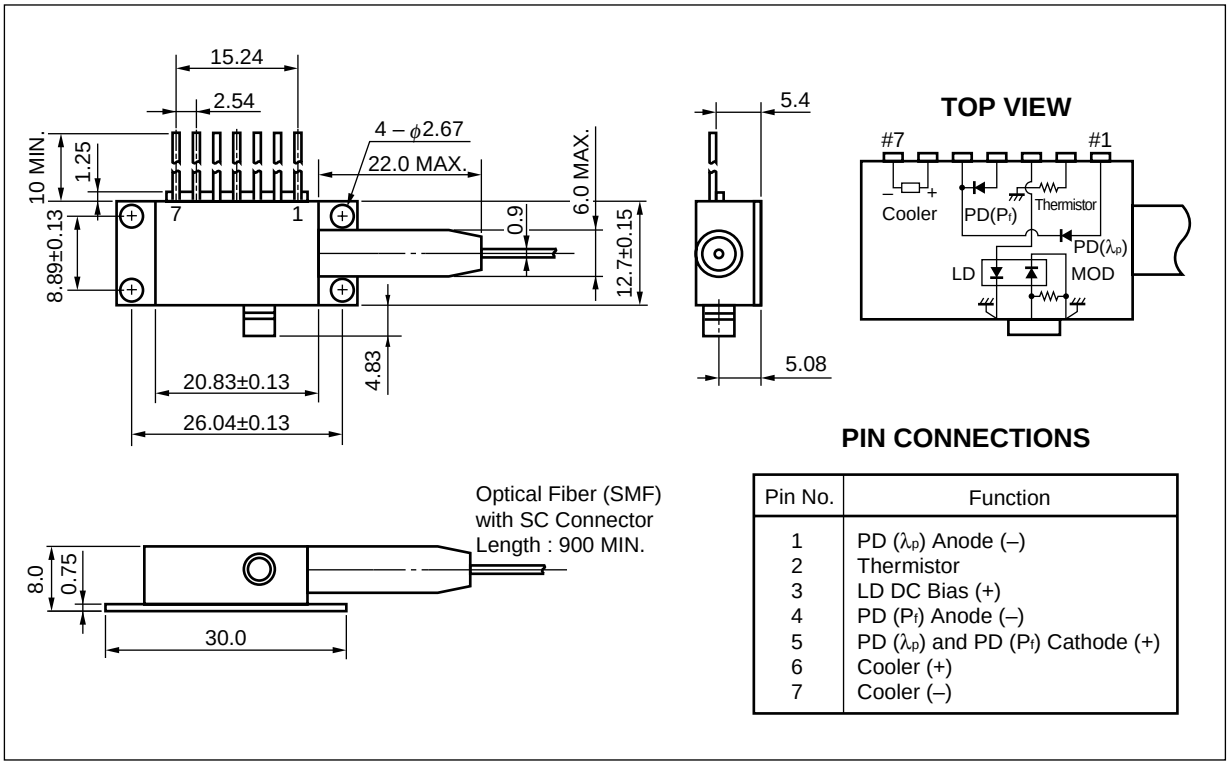
PACKAGE DIMENSIONS (UNIT: mm, unless otherwise specified ±0.2 mm)

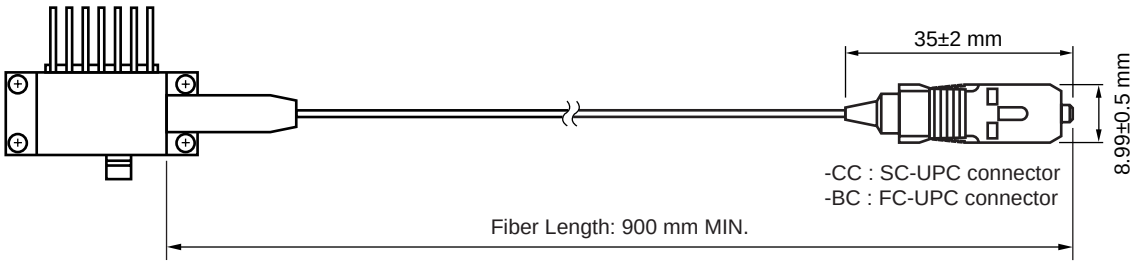


PIN CONNECTIONS

Pin No.	Function
1	PD (λ_p) Anode (–)
2	Thermistor
3	LD DC Bias (+)
4	PD (P_f) Anode (–)
5	PD (λ_p) and PD (P_f) Cathode (+)
6	Cooler (+)
7	Cooler (–)

OPTICAL FIBER CHARACTERISTICS

Parameter	Specification	Unit
Mode Field Diameter	9.3±0.5	μm
Cladding Diameter	125±1	μm
Tight Buffer Diameter	900±100	μm
Cut-off Wavelength	< 1 270	nm
Attenuation 1 525 to 1 575 nm	< 0.3	dB/km
Minimum Fiber Bending Radius	30	mm
Fiber Length	900 MIN.	mm
Flammability	UL1581 VW-1	



ORDERING INFORMATION

NX8560SJ□□□-□□

- CC : SC-UPC connector
  BC : FC-UPC connector (option)
- Wavelength code : Refer to **Table A**

Table A: DWDM wavelengths based on ITU-T recommendations (@ $T_{LD} = T_{set}$)

Wavelength Code	ITU-T Wavelength (nm)	Frequency (THz)	Wavelength Code	ITU-T Wavelength (nm)	Frequency (THz)
287	1528.773	196.10	397	1539.766	194.70
291	1529.163	196.05	401	1540.162	194.65
295	1529.553	196.00	405	1540.557	194.60
299	1529.944	195.95	409	1540.953	194.55
303	1530.334	195.90	413	1541.349	194.50
307	1530.725	195.85	417	1541.746	194.45
311	1531.116	195.80	421	1542.142	194.40
315	1531.507	195.75	425	1542.539	194.35
318	1531.898	195.70	429	1542.936	194.30
322	1532.290	195.65	433	1543.333	194.25
326	1532.681	195.60	437	1543.730	194.20
330	1533.073	195.55	441	1544.128	194.15
334	1533.465	195.50	445	1544.526	194.10
338	1533.858	195.45	449	1544.924	194.05
342	1534.250	195.40	453	1545.322	194.00
346	1534.643	195.35	457	1545.720	193.95
350	1535.036	195.30	461	1546.119	193.90
354	1535.429	195.25	465	1546.518	193.85
358	1535.822	195.20	469	1546.917	193.80
362	1536.216	195.15	473	1547.316	193.75
366	1536.609	195.10	477	1547.715	193.70
370	1537.003	195.05	481	1548.115	193.65
373	1537.397	195.00	485	1548.515	193.60
377	1537.792	194.95	489	1548.915	193.55
381	1538.186	194.90	493	1549.315	193.50
385	1538.581	194.85	497	1549.715	193.45
389	1538.976	194.80	501	1550.116	193.40
393	1539.371	194.75	505	1550.517	193.35

Remark λ monitor slope: Channel frequency for 191.80 THz + 2n × 0.05 THz is assigned on negative slope.
Channel frequency for 191.80 THz + (2n + 1) × 0.05 THz is assigned on positive slope.
n is a positive integer including zero.

Wavelength Code	ITU-T Wavelength (nm)	Frequency (THz)
509	1550.918	193.30
513	1551.319	193.25
517	1551.721	193.20
521	1552.122	193.15
525	1552.524	193.10
529	1552.926	193.05
533	1553.329	193.00
537	1553.731	192.95
541	1554.134	192.90
545	1554.537	192.85
549	1554.940	192.80
553	1555.343	192.75
557	1555.747	192.70
561	1556.151	192.65
565	1556.555	192.60
569	1556.959	192.55
573	1557.363	192.50
577	1557.768	192.45
581	1558.173	192.40
585	1558.578	192.35
589	1558.983	192.30
593	1559.389	192.25
597	1559.794	192.20
602	1560.200	192.15
606	1560.606	192.10
610	1561.013	192.05
614	1561.419	192.00
618	1561.826	191.95
622	1562.233	191.90
626	1562.640	191.85
630	1563.047	191.80

Remark λ monitor slope: Channel frequency for 191.80 THz + 2n × 0.05 THz is assigned on negative slope.
Channel frequency for 191.80 THz + (2n + 1) × 0.05 THz is assigned on positive slope.
n is a positive integer including zero.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit
Optical Output Power from Fiber	P_f	10	mW
Forward Current of LD	I_{FLD}	150	mA
Reverse Voltage of LD	V_{RLD}	2.0	V
Forward Voltage of Modulator	V_{FEA}	1	V
Reverse Voltage of Modulator	V_{REA}	4	V
Forward Current of PD	I_{FPD}	1	mA
Reverse Voltage of PD	V_{RPD}	10	V
Cooler Current	I_C	1.5	A
Cooler Voltage	V_C	2.5	V
Operating Case Temperature	T_C	–5 to +70	°C
Storage Temperature	T_{stg}	–40 to +85	°C
Lead Soldering Temperature	T_{sld}	350 (3 sec.)	°C

ELECTRO-OPTICAL CHARACTERISTICS

(T_{LD} = T_{set}, T_C = –5 to +70°C, BOL, unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Laser Set Temperature	T_{set}	***1**	20		35	°C
Operating Current	I_{op}		50	60	80	mA
Modulation Center Voltage	V_{center}		–2.0		–0.5	V
Modulation Voltage	V_{mod}			2	3	V
Forward Voltage of LD	V_{FLD}	I_{FLD} = I_{op}			2.0	V
Threshold Current	I_{th}			7	20	mA
Optical Output Power from Fiber	P_f	Under modulation[*2]	–3	–2		dBm
Peak Emission Wavelength	λ_p	I_{FLD} = I_{op}, V_{EA} = 0 V, T_{LD} = T_{set}	1 528	ITU-T[*3]	1 564	nm
Side Mode Suppression Ratio	SMSR	I_{FLD} = I_{op}, V_{EA} = 0 V	30	> 37		dB
Extinction Ratio	ER	Under modulation[*2]	10	11		dB
Rise Time	t_r	20-80%, Under modulation[*2]			40	ps
Fall Time	t_f	80-20%, Under modulation[*2]			40	ps
Dispersion Penalty	DP	800 ps/nm under modulation[*2, 4]			2.0	dB
Optical Isolation	I_s		23			dB
Input Return Loss	S_{11}	I_{FLD} = I_{op}, V_{EA} = –1 V, f = 130 MHz to 5 GHz		–10	–8	dB
		I_{FLD} = I_{op}, V_{EA} = –1 V, f = 5 to 10 GHz		–8	–5	

***1** T_{set} is set at a certain point between 20 and 35°C for ITU-T grid wavelength

***2** 40 km SMF under modulation, 9.95328 Gb/s, PRBS 2^{23}–1, V_{EA} = V_{center} ± 1/2V_{mod}, I_{FLD} = I_{op}, NEC Test System

V_{center} : a certain point between –2.0 and –0.5 V

V_{mod} : a certain point 3 V or below

I_{op} : a certain point between 50 and 80 mA

***3** Available for DWDM wavelengths based on ITU-T recommendations (50 GHz grid).
Please refer to **ORDERING INFORMATION**.

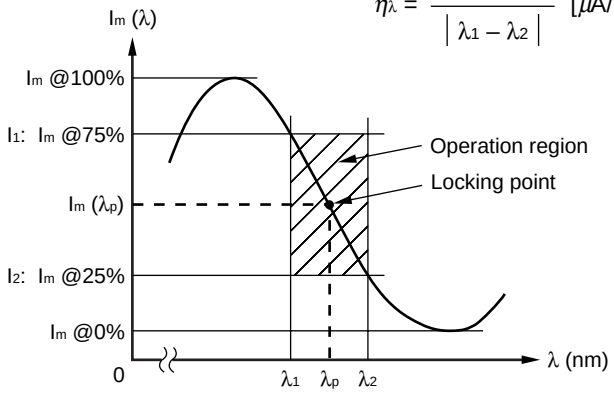
***4** BER = 10^{-10}

ELECTRO-OPTICAL CHARACTERISTICS (Applicable to Monitor PD: $T_{LD} = T_{set}$, T_C = –5 to +70°C, BOL)

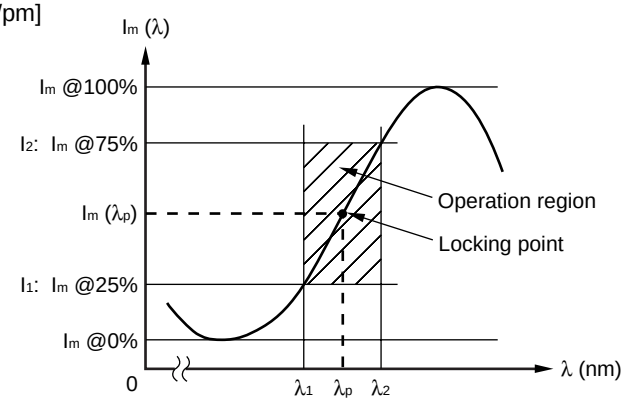
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Monitor Current (P_f Monitor)	I_m (P_f)	V_{RPD} = 5 V, $I_{FLD} = I_{op}$	10		200	μA
Monitor Current (λ_p Monitor)	I_m (λ_p)	V_{RPD} = 5 V, $I_{FLD} = I_{op}$, Locking point	5		100	μA
Operation Region *1	I_m (λ)		25		75	%
	$\lvert\lambda_1-\lambda_2\rvert$		90			pm
Discrimination Slope *1	$\eta\lambda$	V_{RPD} = 5 V, $I_{FLD} = I_{op}$, Locking point	0.24			μA/pm
Dark Current	I_D	V_{RPD} = 5 V, V_{EA} = 0 V			10	nA
Terminal Capacitance	C_t	V_{RPD} = 5 V, f = 1 MHz			15	pF
Tracking Error	γ *2	I_m (P_f) = const.			0.5	dB

***1** Operation region, Discrimination slope, Slope assignment

$$\eta\lambda = \frac{\lvert I_1 - I_2 \rvert}{\lvert \lambda_1 - \lambda_2 \rvert} \text{ [μA/pm]}$$

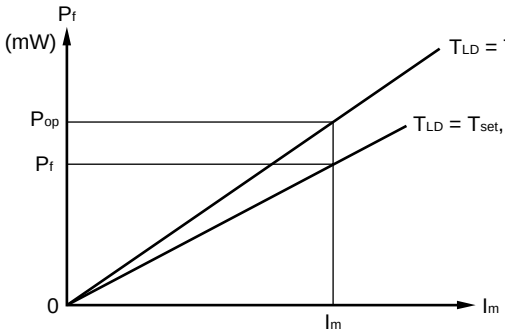


Negative Slope



Positive Slope

***2** Tracking Error: γ



$$\gamma = \left| 10 \log \frac{P_f}{P_{op}} \right| \text{ [dB]}$$

ELECTRO-OPTICAL CHARACTERISTICS (Applicable to Thermistor and TEC: T_C = –5 to +70°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Thermistor Resistance	R	T_{LD} = 25°C	9.5	10.0	10.5	kΩ
B Constant	B		3 350	3 450	3 550	K
Cooler Current	I_C	$T_{LD} = T_{set}$			1.2	A
Cooler Voltage	V_C	$T_{LD} = T_{set}$			2.4	V

EA MODULATOR INTEGRATED DFB-LD FAMILY

Part Number	Absolute Maximum Ratings		Electro-Optical Characteristics		Application	Package
	T_C (°C)	T_{stg} (°C)	P_f [*1] (mW)	λ_p (nm)		
			MIN.	TYP.		
NX8560LJ Series	–20 to +70	–40 to +85	–3 dBm	1 550 [*2]	10 Gb/s: STM-64	BFY with GPO
			–1 dBm	1 550		
NX8560MC Series	0 to +75	–40 to +85	–1 dBm	1 550	10 Gb/s: STM-64	19-pin mini BFY
NX8560MCS Series	0 to +75	–40 to +85	–5 dBm	1 550	10 Gb/s: STM-64	19-pin mini BFY
NX8560SJ Series	–5 to +70	–40 to +85	–3 dBm	1 550 [*2]	10 Gb/s: STM-64 with λ monitoring PD	BFY with GPO
NX8564LE Series	–20 to +70	–40 to +85	–5 dBm	1 550 [*2]	2.5 Gb/s: STM-16, 360 km	BFY
NX8565LE Series	–20 to +70	–40 to +85	–5 dBm	1 550 [*2]	2.5 Gb/s: STM-16, 600 km	BFY
NX8566LE Series	–20 to +70	–40 to +85	0 dBm	1 550 [*2]	2.5 Gb/s: STM-16, 240 km	BFY
NX8567SA Series	–5 to +70	–40 to +85	–5 dBm	1 550 [*2]	2.5 Gb/s: STM-16, 600 km with λ monitoring PD	BFY
NX8567SAM Series	–5 to +70	–40 to +85	–5 dBm	1 550 [*2]	2.5 Gb/s: STM-16, 360 km with λ monitoring PD	BFY
NX8567SAS Series	–5 to +70	–40 to +85	0 dBm	1 550 [*2]	2.5 Gb/s: STM-16, 240 km with λ monitoring PD	BFY

***1** Under modulation

***2** Available for DWDM Wavelengths based on ITU-T recommendations

REFERENCE

Document Name	Document No.
OPTICAL SEMICONDUCTOR DEVICES FOR FIBEROPTIC COMMUNICATIONS SELECTION GUIDE	PX10161E
Opto-Electronics Devices Pamphlet	PX10160E

- **PATENT**

  USP 4,826,295

  CA 1,286,848

  EP 143 000

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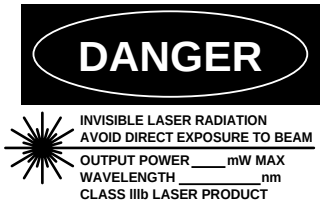
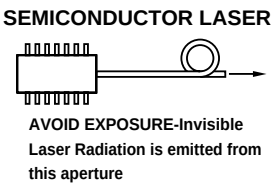
M8E 00.4-0110

SAFETY INFORMATION ON THIS PRODUCT





Warning Laser Beam	A laser beam is emitted from this diode during operation. The laser beam, visible or invisible, directly or indirectly, may cause injury to the eye or loss of eyesight. • Do not look directly into the laser beam. • Avoid exposure to the laser beam, any reflected or collimated beam.
Caution GaAs Products	This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points. • Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below. 1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials. 2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal. • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or in any way allow it to enter the mouth.
Caution Optical Fiber	A glass-fiber is attached on the product. Handle with care. • When the fiber is broken or damaged, handle carefully to avoid injury from the damaged part or fragments.

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