DATA SHEET

NEC

LASER DIODE
NX8565LE-CC

EA MODULATOR INTEGRATED
1 550 nm MQW-DFB LASER DIODE MODULE
FOR 2.5 Gb/s DWDM ULTRALONG-REACH 600 km APPLICATIONS

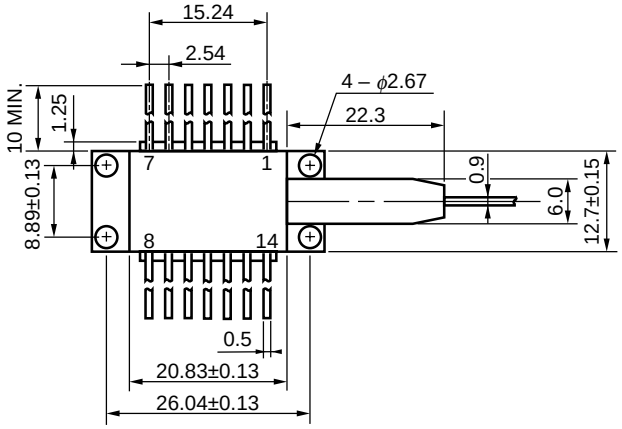
DESCRIPTION

The NX8565LE-CC is an Electro-Absorption (EA) modulator integrated, 1 550 nm Multiple Quantum Well (MQW) structured Distributed Feed-Back (DFB) laser diode. The module is capable of 2.5 Gb/s applications of over 600 km ultralong-reach and available for Dense Wavelength Division Multiplexing (DWDM) wavelengths based on ITU-T recommendations, enabling a wide range of applications.

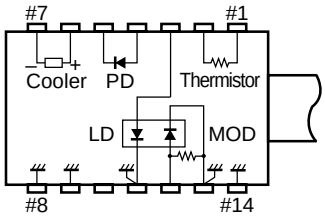
FEATURES

- Integrated electroabsorption modulator
- Very low dispersion penalty over 600 km
- Low modulation voltage
- Available for DWDM wavelength based on ITU-T recommendation (100 GHz grid, refer to ORDERING INFORMATION)
- 14-pin butterfly package with SC-UPC connector

★ PACKAGE DIMENSIONS (UNIT: mm)



TOP VIEW



PIN CONNECTIONS

Pin No.	Function	Pin No.	Function
1	Thermistor	8	GND
2	Thermistor	9	GND
3	LD DC Bias	10	NC
4	PD Anode	11	GND
5	PD Cathode	12	Signal Input (MOD), 50 Ω RF Input
6	Cooler Anode		
7	Cooler Cathode	13	GND
		14	GND

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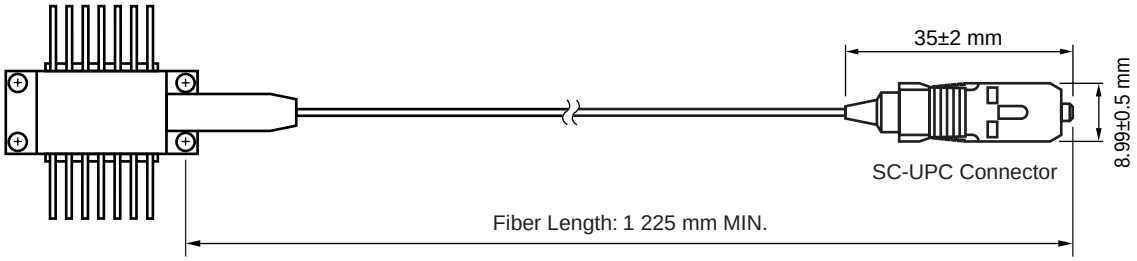
Printed in Japan

The mark ★ shows major revised points.

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	1 225 MIN.	mm
Flammability	UL1581 VW-1	



★ ORDERING INFORMATION

Part Number With SC-UPC Connector	ITU-T Wavelength[*1] (nm)	Frequency (THz)
NX8565LE311-CC	1531.11	195.80
NX8565LE318-CC	1531.89	195.70
NX8565LE326-CC	1532.68	195.60
NX8565LE334-CC	1533.46	195.50
NX8565LE342-CC	1534.25	195.40
NX8565LE350-CC	1535.03	195.30
NX8565LE358-CC	1535.82	195.20
NX8565LE366-CC	1536.60	195.10
NX8565LE373-CC	1537.39	195.00
NX8565LE381-CC	1538.18	194.90
NX8565LE389-CC	1538.97	194.80
NX8565LE397-CC	1539.76	194.70
NX8565LE405-CC	1540.55	194.60
NX8565LE413-CC	1541.34	194.50
NX8565LE421-CC	1542.14	194.40
NX8565LE429-CC	1542.93	194.30
NX8565LE437-CC	1543.73	194.20
NX8565LE445-CC	1544.52	194.10
NX8565LE453-CC	1545.32	194.00
NX8565LE461-CC	1546.11	193.90
NX8565LE469-CC	1546.91	193.80
NX8565LE477-CC	1547.71	193.70
NX8565LE485-CC	1548.51	193.60
NX8565LE493-CC	1549.31	193.50
NX8565LE501-CC	1550.11	193.40
NX8565LE509-CC	1550.91	193.30
NX8565LE517-CC	1551.72	193.20
NX8565LE525-CC	1552.52	193.10
NX8565LE533-CC	1553.32	193.00
NX8565LE541-CC	1554.13	192.90
NX8565LE549-CC	1554.94	192.80
NX8565LE557-CC	1555.74	192.70
NX8565LE565-CC	1556.55	192.60
NX8565LE573-CC	1557.36	192.50
NX8565LE581-CC	1558.17	192.40

***1** The value which omitted and computed the 3rd place below the decimal point

Part Number With SC-UPC Connector	ITU-T Wavelength*1 (nm)	Frequency (THz)
NX8565LE589-CC	1558.98	192.30
NX8565LE597-CC	1559.79	192.20
NX8565LE606-CC	1560.60	192.10
NX8565LE614-CC	1561.41	192.00
NX8565LE622-CC	1562.23	191.90
NX8565LE745-CC	1574.54	190.40
NX8565LE753-CC	1575.36	190.30
NX8565LE761-CC	1576.19	190.20
NX8565LE770-CC	1577.02	190.10
NX8565LE778-CC	1577.85	190.00
NX8565LE786-CC	1578.68	189.90
NX8565LE795-CC	1579.51	189.80
NX8565LE803-CC	1580.35	189.70
NX8565LE811-CC	1581.18	189.60
NX8565LE820-CC	1582.01	189.50
NX8565LE828-CC	1582.85	189.40
NX8565LE836-CC	1583.69	189.30
NX8565LE845-CC	1584.52	189.20
NX8565LE853-CC	1585.36	189.10
NX8565LE862-CC	1586.20	189.00
NX8565LE870-CC	1587.04	188.90
NX8565LE878-CC	1587.88	188.80
NX8565LE887-CC	1588.72	188.70
NX8565LE895-CC	1589.56	188.60
NX8565LE904-CC	1590.41	188.50
NX8565LE912-CC	1591.25	188.40
NX8565LE921-CC	1592.10	188.30
NX8565LE929-CC	1592.94	188.20
NX8565LE937-CC	1593.79	188.10
NX8565LE946-CC	1594.64	188.00
NX8565LE954-CC	1595.48	187.90
NX8565LE963-CC	1596.33	187.80
NX8565LE971-CC	1597.18	187.70
NX8565LE980-CC	1598.04	187.60
NX8565LE988-CC	1598.89	187.50
NX8565LE997-CC	1599.74	187.40

***1** The value which omitted and computed the 3rd place below the decimal point

Part Number With SC-UPC Connector	ITU-T Wavelength*1 (nm)	Frequency (THz)
NX8565LE6006-CC	1600.60	187.30
NX8565LE6014-CC	1601.45	187.20
NX8565LE6023-CC	1602.31	187.10
NX8565LE6031-CC	1603.16	187.00
NX8565LE6040-CC	1604.02	186.90
NX8565LE6048-CC	1604.88	186.80
NX8565LE6057-CC	1605.74	186.70
NX8565LE6066-CC	1606.60	186.60
NX8565LE6074-CC	1607.46	186.50
NX8565LE6083-CC	1608.32	186.40

***1** The value which omitted and computed the 3rd place below the decimal point

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_{Fm}	1	V
Reverse Voltage of Modulator	V_{Rm}	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	–20 to +70	°C
Storage Temperature	T_{stg}	–40 to +85	°C
Lead Soldering Temperature	T_{sld}	260 (10 sec.)	°C

★ ELECTRO-OPTICAL CHARACTERISTICS

(T_{LD} = 25 ºC, T_C = –20 to +70 ºC, unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Laser Set Temperature	T_{set}	$I_{FLD} = I_{op}$, V_{Rm} = 0 V	20		35	°C
Operating Current	I_{op}	$T_{LD} = T_{set}$	50	60	100	mA
Modulation Center Voltage	V_{Rmc}	Under modulation[*1]	–1.5	–1.2	–0.5	V
Modulation Voltage	V_{Rmpp}	Under modulation[*1]	2		3	V
Forward Voltage of LD	V_{FLD}	$I_{FLD} = I_{op}$		1.6	2.0	V
Threshold Current	I_{th}	$T_{LD} = T_{set}$		7	20	mA
Optical Output Power from Fiber	P_f	$I_{FLD} = I_{op}$, $T_{LD} = T_{set}$, Under modulation[*1]	0.3	0.6		mW
Peak Emission Wavelength	λ_p	$I_{FLD} = I_{op}$, V_{Rm} = 0 V, $T_{LD} = T_{set}$	1 530	ITU-T[*2]	1 563	nm
			1 574		1 609	
Side Mode Suppression Ratio	SMSR	$I_{FLD} = I_{op}$, V_{Rm} = 0 V	30	37		dB
Extinction Ratio	ER	$I_{FLD} = I_{op}$, Under modulation[*1]	10	11		dB
Rise Time	t_r	$I_{FLD} = I_{op}$, 20-80%, Under modulation[*1]		70	125	ps
Fall Time	t_f	$I_{FLD} = I_{op}$, 80-20%, Under modulation[*1]		70	125	ps
Dispersion Penalty	DP	$I_{FLD} = I_{op}$, 600 km SMF under modulation[*1]		1.5	2.0	dB
Isolation	I_s		23			dB
Relative Intensity Noise	RIN	10 MHz to 10 GHz, V_{Rm} = 0 V, $T_{LD} = T_{set}$, $I_{FLD} = I_{op}$		–135	–130	dB
Input Return Loss	S_{11}	$I_{FLD} = I_{op}$, $V_{Rm} = 1/2V_{Rmpp}$, 50 Ω, f = 130 MHz to 2 GHz			–10	dB
		$I_{FLD} = I_{op}$, $V_{Rm} = 1/2V_{Rmpp}$, 50 Ω, f = 2 GHz to 2.5 GHz			–5	
		$I_{FLD} = I_{op}$, $V_{Rm} = 1/2V_{Rmpp}$, 50 Ω, f = 2.5 GHz to 3.5 GHz			–3	

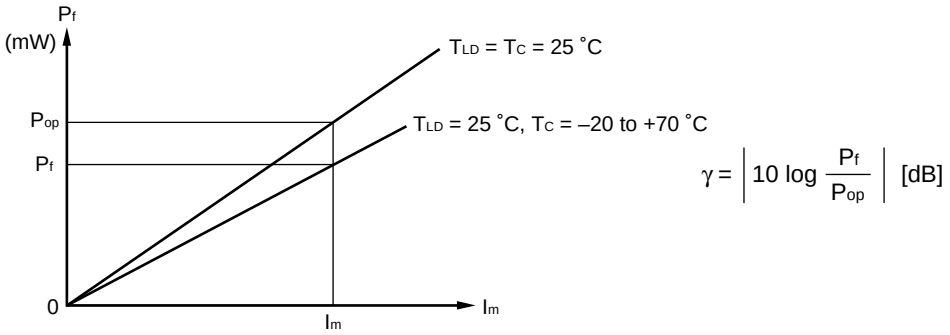
***1** 600 km (@ C-band) SMF under modulation, 2.48832 Gb/s, PRBS 2^{23}–1, $V_{Rm} = V_{Rmc} \pm 1/2V_{Rmpp}$, BER = 10^{-9}, NEC Test System
480 km (@ L-band) SMF under modulation, 2.48832 Gb/s, PRBS 2^{23}–1, $V_{Rm} = V_{Rmc} \pm 1/2V_{Rmpp}$, BER = 10^{-9}, NEC Test System

***2** Available for DWDM wavelength based on ITU-T recommendation (100 GHz grid).
Please refer to ORDERING INFORMATION.

ELECTRO-OPTICAL CHARACTERISTICS
(Applicable to Monitor PD: T_{LD} = 25 °C, T_C = –20 to +70 °C)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
	Monitor Current	I_m	I_{FLD} = I_{op}, V_{Rm} = 0 V	20	100	1 000	μA
★	Dark Current	I_D	V_{RPD} = 5 V			10	nA
	Terminal Capacitance	C_t	V_{RPD} = 5 V, f = 1 MHz			15	pF
	Tracking Error	γ^{*1}	I_m = const.			0.5	dB

***1** Tracking Error: γ

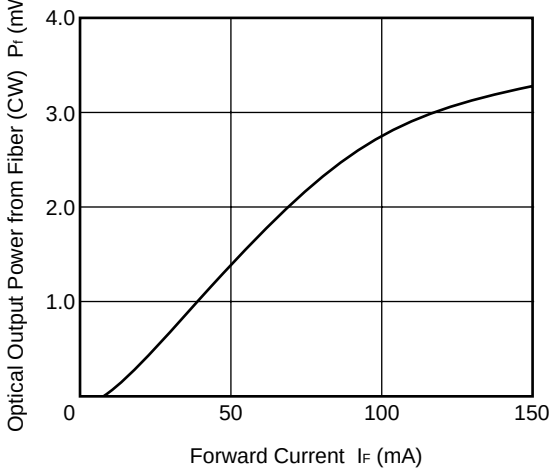


ELECTRO-OPTICAL CHARACTERISTICS
(Applicable to Thermistor and TEC: T_{LD} = 25 °C, T_C = –20 to +70 °C)

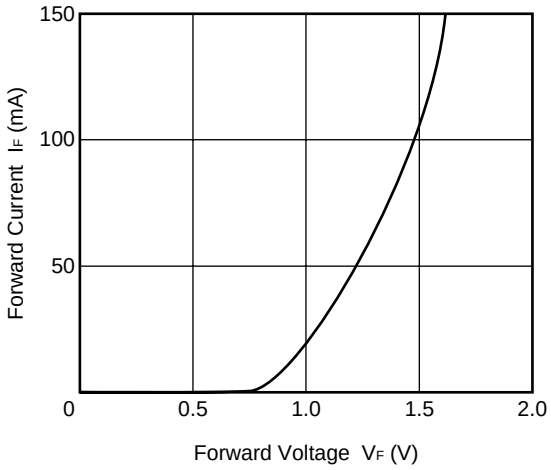
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Thermistor Resistance	R	T_{LD} = 25 °C	9.5	10.0	10.5	kΩ
B Constant	B		3 350	3 450	3 550	K
Cooler Current	I_C	ΔT = 50 °C, I_{op} = 150 mA			1.2	A
Cooler Voltage	V_C	ΔT = 50 °C, I_{op} = 150 mA			2.4	V

★ **TYPICAL CHARACTERISTICS (T_{LD} = 25 °C, unless otherwise specified)**

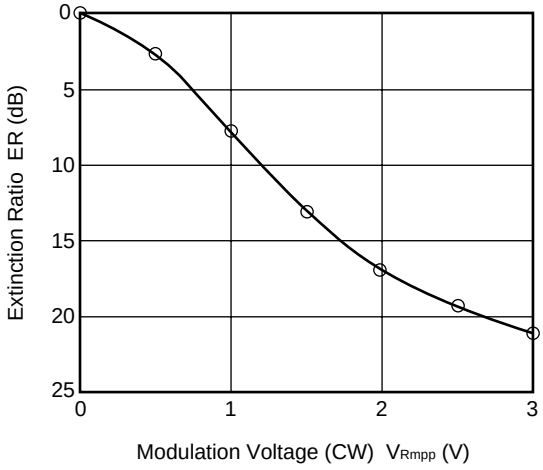
OPTICAL OUTPUT POWER FROM FIBER (CW) vs. FORWARD CURRENT



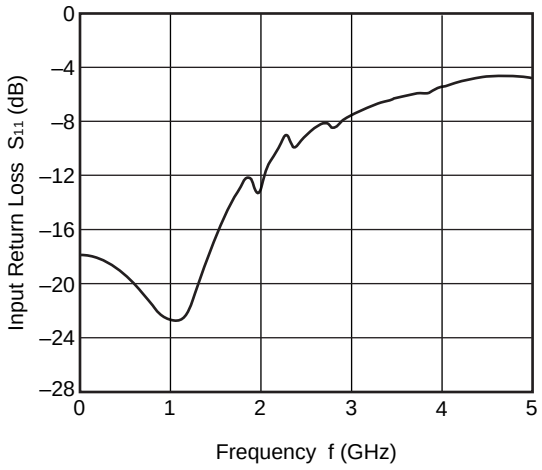
FORWARD CURRENT vs. FORWARD VOLTAGE



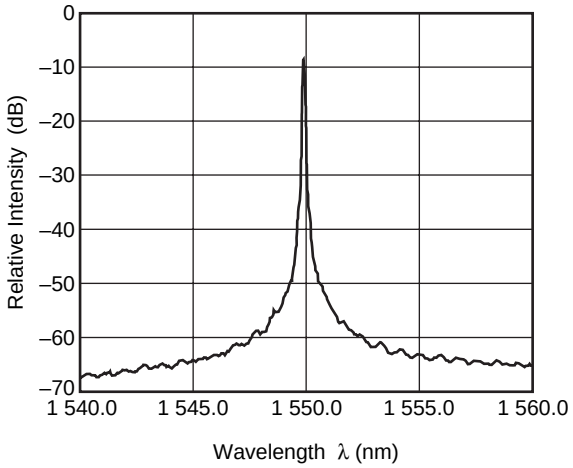
EXTINCTION RATIO vs. MODULATION VOLTAGE (CW)



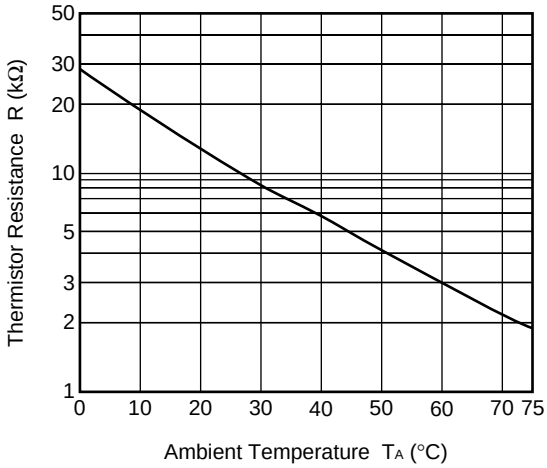
INPUT RETURN LOSS CHARACTERISTICS (S_{11})



SPECTRUM



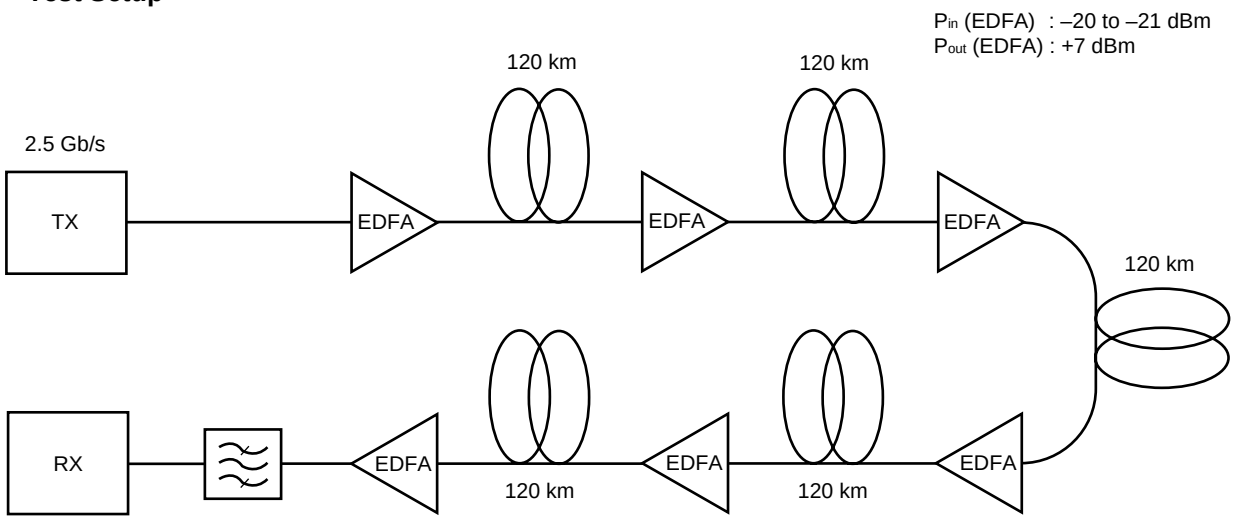
THERMISTOR RESISTANCE vs. AMBIENT TEMPERATURE



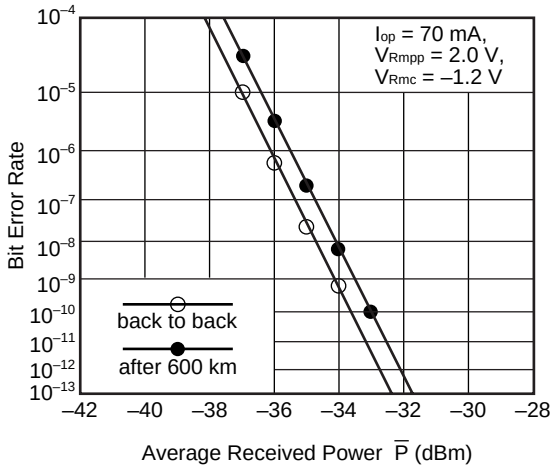
Remark The graphs indicate nominal characteristics.

★ 600 km STANDARD FIBER TRANSMISSION EXAMPLE

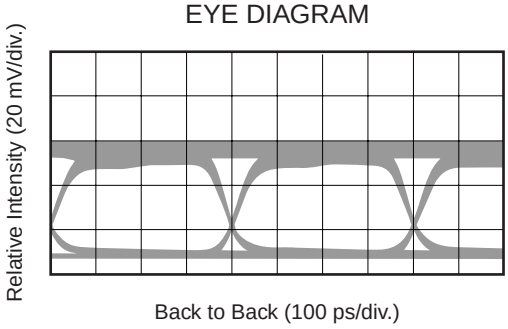
Test Setup



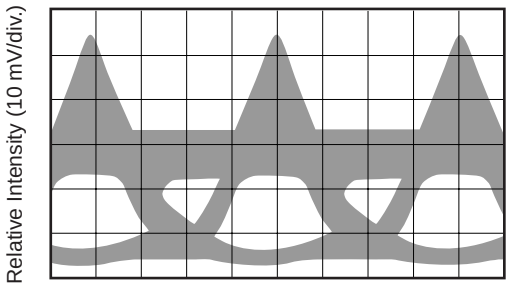
ERROR RATE CHARACTERISTICS



EYE DIAGRAM



Back to Back (100 ps/div.)



After 600 km (100 ps/div.)

Remark The graphs indicate nominal characteristics.

★ DFB-LD FAMILY

Part Number	Absolute Maximum Ratings		Electro-Optical Characteristics (T_C = 25 °C)			Application	Package
	T_C (°C)	T_{stg} (°C)	I_{th} (mA)	P_f (mW)	λ_p (nm)		
			TYP.	MIN.	TYP.		
NX8300BE-CC NX8300CE-CC	0 to +75	−40 to +85	15	2[*1]	1 310	2.5 Gb/s: STM-16 (S-16.1, L-16.1)	Coaxial
NX8303BG-CC NX8303CG-CC	−10 to +85	−40 to +85	15	2[*1]	1 310	622 Mb/s: STM-4 (L-4.1)	Coaxial
NX8503BG-CC NX8503CG-CC	−10 to +85	−40 to +85	15	2[*1]	1 550	156 Mb/s: STM-1 (L-1.2, L-1.3)	Coaxial
						622 Mb/s: STM-4 (L-4.2, L-4.3)	
NX8504BE-CC NX8504CE-CC	−10 to +85	−40 to +85	15	2[*1]	1 550	622 Mb/s: STM-4 (L-4.2, L-4.3)	Coaxial
NX8560LJ-CC	−20 to +70	−40 to +85	6	−2 dBm	1 550	≤ 10 Gb/s: STM-64	BFY with GPO™
NX8562LB	−20 to +65	−40 to +85	20	20	1 550[*2]	CW Light Source for external modulator	BFY
NX8563LB	−20 to +65	−40 to +85	20	10	1 550[*2]	CW Light Source for external modulator	BFY
NX8564LE-CC	−20 to +70	−40 to +85	7	0.6[*1]	1 550[*2]	2.5 Gb/s: STM-16 EA modulator integrated	BFY
NX8565LE-CC	−20 to +70	−40 to +85	7	0.6[*1]	1 550[*2]	2.5 Gb/s: STM-16 EA modulator integrated	BFY
NX8570SA	−20 to +70	−40 to +85	20	20	1 550[*2]	CW Light Source with λ monitoring PD	BFY
NX8571SA	−20 to +70	−40 to +85	20	10	1 550[*2]	CW Light Source with λ monitoring PD	BFY

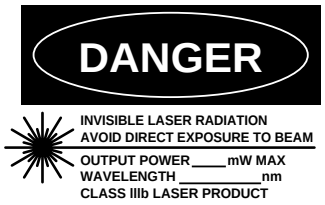
***1** TYP.

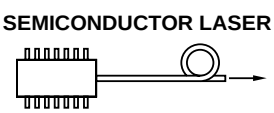
***2** Available for DWDM Wavelength based on ITU-T recommendation

REFERENCE

Document Name	Document No.
Optical semiconducrtor devices for fiberoptic communications Selection Guide	P12480E
Opto-Electronics Devices Pamphlet	P13623E
Opto-Electronics Devices (CD-ROM)	P12944X
NEC semiconductor device reliability/quality control system	C11159E
Quality grades on NEC semiconductor devices	C11531E
SEMICONDUCTOR SELECTION GUIDE –Products and Packages–	X13769E

SAFETY INFORMATION ON THIS PRODUCT





NEC Corporation
NEC Building, 7-1, Shiba 5-chome,
Minato-ku, Tokyo 108-01, Japan

Type number: _____
Manufactured: _____
Serial Number: _____
This product conforms to FDA regulations as applicable to standards 21 CFR Chapter 1. Subchapter J.

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	The product contains gallium arsenide, GaAs. GaAs vapor and powder are hazardous to human health if inhaled or ingested. • Do not destroy or burn the product. • Do not cut or cleave off any part of the product. • Do not crush or chemically dissolve the product. • Do not put the product in the mouth. Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.
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