

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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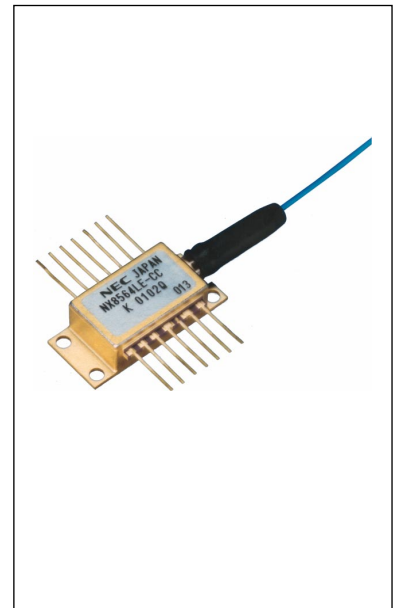
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LASER DIODE
NX8564/8565/8566LE Series

**EA MODULATOR INTEGRATED
 1 550 nm MQW-DFB LASER DIODE MODULE FOR
 2.5 Gb/s DWDM ULTRALONG-REACH 360 km, 600 km, 240 km APPLICATIONS**

DESCRIPTION

The NX8564/8565/8566LE Series 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 360 km, 600 km, 240 km ultralong-reach and available for Dense Wavelength Division Multiplexing (DWDM) wavelengths based on ITU-T recommendations, enabling a wide range of applications.

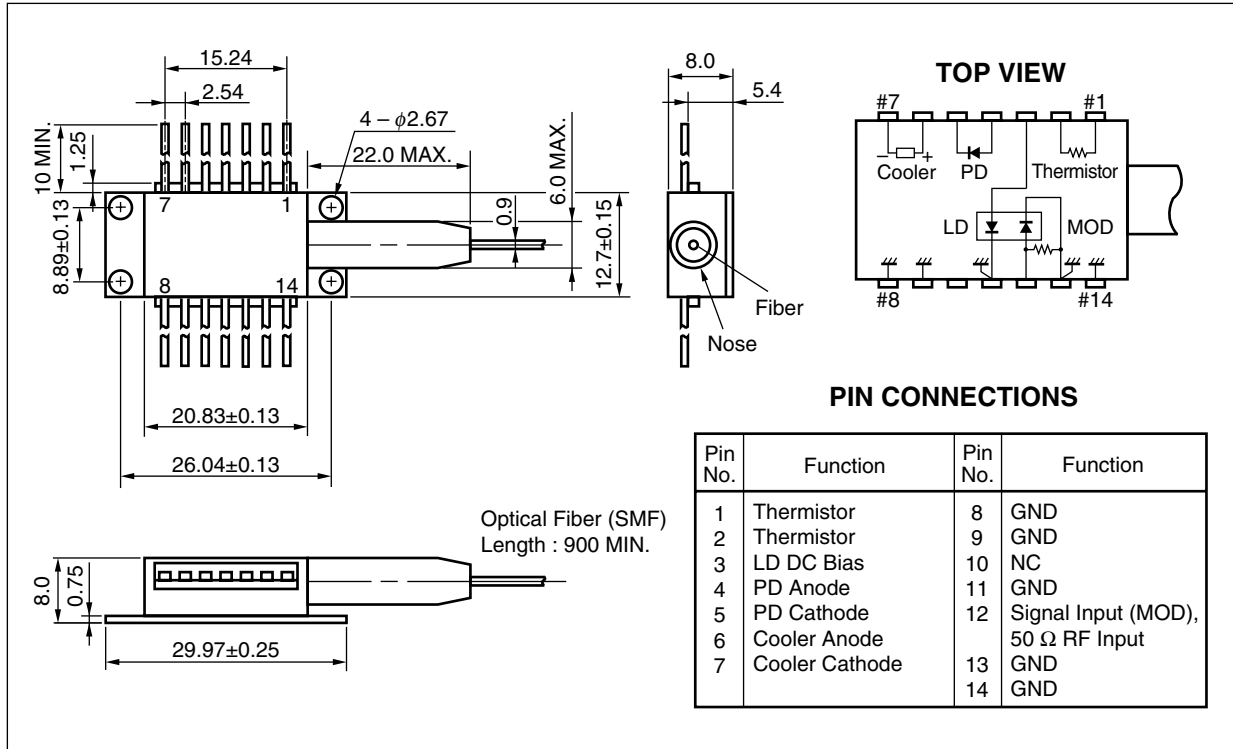


FEATURES

- Integrated electroabsorption modulator
- Very low dispersion penalty (over 360 km (6480 ps/nm), NX8564LE-BC/CC)
 (over 600 km (10800 ps/nm), NX8565LE-BC/CC)
 (over 240 km (4320 ps/nm), NX8566LE-BC/CC)
- Low modulation voltage
- Available for DWDM wavelengths based on ITU-T recommendations (100 GHz grid, refer to **ORDERING INFORMATION**)

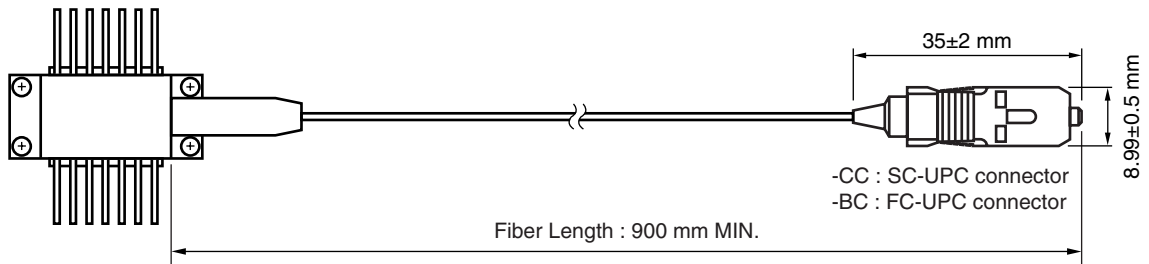
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★ PACKAGE DIMENSIONS (UNIT: mm, unless otherwise specified ±0.2 mm)



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

NX856□LE□□□-□□

- CC : SC-UPC connector
- BC : FC-UPC connector (option)
- Without wavelength code : Wavelength is a certain point between 1528 to 1565 nm, 1579 to 1609 nm
- With wavelength code : Refer to **Table A**
- 4 : 360 km (6480 ps/nm)
- 5 : 600 km (10800 ps/nm)
- 6 : 240 km (4320 ps/nm)

Table A: DWDM wavelengths based on ITU-T recommendations (@T_{LD} = T_{set}) (1/2)

Wavelength Code	ITU-T Wavelength ^{*1} (nm)	Frequency (THz)	Wavelength Code	ITU-T Wavelength ^{*1} (nm)	Frequency (THz)
287	1528.77	196.10	485	1548.51	193.60
295	1529.55	196.00	493	1549.31	193.50
303	1530.33	195.90	501	1550.11	193.40
311	1531.11	195.80	509	1550.91	193.30
318	1531.89	195.70	517	1551.72	193.20
326	1532.68	195.60	525	1552.52	193.10
334	1533.46	195.50	533	1553.32	193.00
342	1534.25	195.40	541	1554.13	192.90
350	1535.03	195.30	549	1554.94	192.80
358	1535.82	195.20	557	1555.74	192.70
366	1536.60	195.10	565	1556.55	192.60
373	1537.39	195.00	573	1557.36	192.50
381	1538.18	194.90	581	1558.17	192.40
389	1538.97	194.80	589	1558.98	192.30
397	1539.76	194.70	597	1559.79	192.20
405	1540.55	194.60	606	1560.60	192.10
413	1541.34	194.50	614	1561.41	192.00
421	1542.14	194.40	622	1562.23	191.90
429	1542.93	194.30	630	1563.04	191.80
437	1543.73	194.20	745	1574.54	190.40
445	1544.52	194.10	753	1575.36	190.30
453	1545.32	194.00	761	1576.19	190.20
461	1546.11	193.90	770	1577.02	190.10
469	1546.91	193.80	778	1577.85	190.00
477	1547.71	193.70	786	1578.68	189.90

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

Table A: DWDM wavelengths based on ITU-T recommendations (@T_{LD} = T_{set}) (2/2)

Wavelength Code	ITU-T Wavelength ^{*1} (nm)	Frequency (THz)	Wavelength Code	ITU-T Wavelength ^{*1} (nm)	Frequency (THz)
795	1579.51	189.80	946	1594.64	188.00
803	1580.35	189.70	954	1595.48	187.90
811	1581.18	189.60	963	1596.33	187.80
820	1582.01	189.50	971	1597.18	187.70
828	1582.85	189.40	980	1598.04	187.60
836	1583.69	189.30	988	1598.89	187.50
845	1584.52	189.20	997	1599.74	187.40
853	1585.36	189.10	6006	1600.60	187.30
862	1586.20	189.00	6014	1601.45	187.20
870	1587.04	188.90	6023	1602.31	187.10
878	1587.88	188.80	6031	1603.16	187.00
887	1588.72	188.70	6040	1604.02	186.90
895	1589.56	188.60	6048	1604.88	186.80
904	1590.41	188.50	6057	1605.74	186.70
912	1591.25	188.40	6066	1606.60	186.60
921	1592.10	188.30	6074	1607.46	186.50
929	1592.94	188.20	6083	1608.32	186.40
937	1593.79	188.10			

*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_{FEA}	1	V
Reverse Voltage of Modulator	V_{REA}	5	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} = T_{set}, T_c = -20 to +70°C, unless otherwise specified)

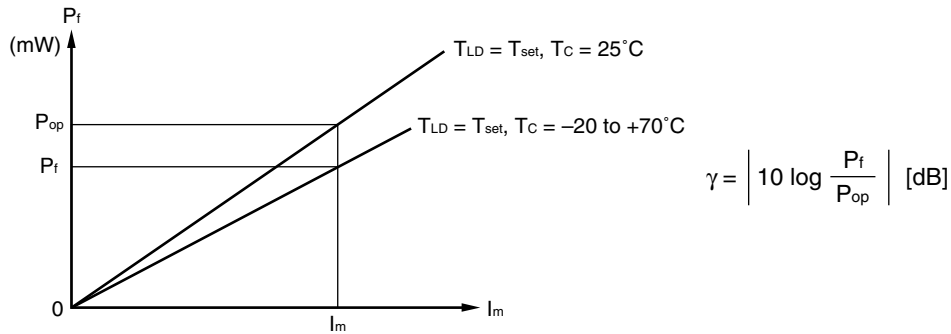
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Laser Set Temperature	T _{set}	*1	20		35	°C
Operating Current	I _{op}		50	60	80	mA
Modulation Center Voltage	V _{center}	Under modulation ²	-1.5	-1.2	-0.5	V
Modulation Voltage	V _{mod}	Under modulation ²		2	3	V
Forward Voltage of LD	V _{FLD}	I _{FLD} = I _{op}		1.6	2.0	V
Threshold Current	I _{th}			7	20	mA
Optical Output Power from Fiber	P _f	I _{FLD} = I _{op} , Under modulation ² (NX8564/65LE Series)	-5	-2		dBm
		I _{FLD} = I _{op} , Under modulation ² (NX8566LE Series)	0	1		
Peak Emission Wavelength	λ _p	I _{FLD} = I _{op} , V _{EA} = 0 V	1 528	ITU-T ³	1 565	nm
			1 574		1 609	
Side Mode Suppression Ratio	SMSR	I _{FLD} = I _{op} , V _{EA} = 0 V	30	> 37		dB
Extinction Ratio	ER	I _{FLD} = I _{op} , Under modulation ²	10	> 11		dB
Rise Time	t _r	I _{FLD} = I _{op} , 20-80%, Under modulation ²		70	125	ps
Fall Time	t _f	I _{FLD} = I _{op} , 80-20%, Under modulation ²		70	125	ps
Dispersion Penalty	DP	I _{FLD} = I _{op} , Under modulation ^{2,4}		< 1.5	2.0	dB
Isolation	I _s		23			dB
Relative Intensity Noise	RIN	10 MHz to 10 GHz, V _{EA} = 0 V, I _{FLD} = I _{op}		< -135	-130	dB/Hz
Input Return Loss	S ₁₁	I _{FLD} = I _{op} , V _{EA} = -1 V, 50 Ω, f = 130 MHz to 2 GHz			-8	dB
		I _{FLD} = I _{op} , V _{EA} = -1 V, 50 Ω, f = 2 to 2.5 GHz			-5	

- *1 NX8564/65/66LE Series : T_{set} is a certain point between 20 and 35°C
 NX8564/65/66LE××× Series : T_{set} is set at a certain point between 20 and 35°C for ITU-T grid wavelength
- *2 NX8564LE : C-band 360 km, L-band 288 km (6480 ps/nm) SMF under modulation
 NX8565LE : C-band 600 km, L-band 480 km (10800 ps/nm) SMF under modulation
 NX8566LE : C-band 240 km, L-band 192 km (4320 ps/nm) SMF under modulation
 2.48832 Gb/s, PRBS 2²³-1, V_{EA} = V_{center} ± 1/2V_{mod}, I_{FLD} = I_{op}, T_{LD} = T_{set}, NEC Test System
 V_{center} : a certain point between -1.5 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 (100 GHz grid).
 Please refer to **ORDERING INFORMATION**.
- *4 BER = 10⁻¹⁰

ELECTRO-OPTICAL CHARACTERISTICS (Applicable to Monitor PD: $T_{LD} = T_{set}$, $T_c = -20$ to $+70^\circ\text{C}$)

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

*1 Tracking Error: γ

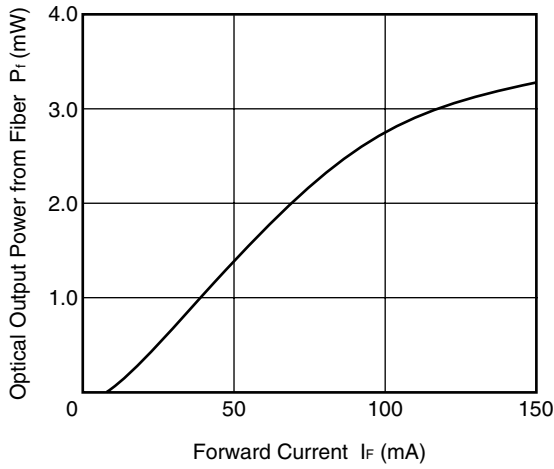


★ **ELECTRO-OPTICAL CHARACTERISTICS (Applicable to Thermistor and TEC: $T_c = -20$ to $+70^\circ\text{C}$)**

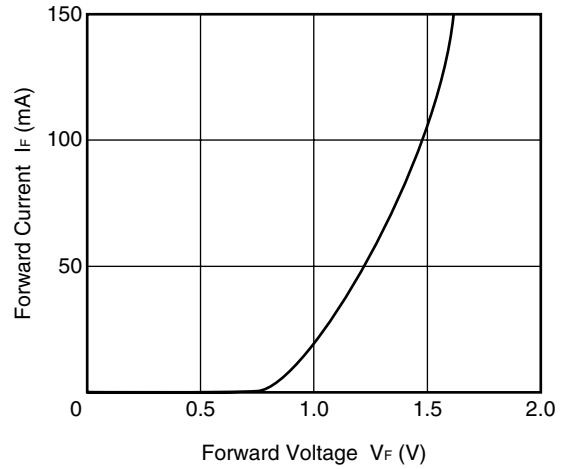
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Thermistor Resistance	R	$T_{LD} = 25^\circ\text{C}$	9.5	10.0	10.5	$\text{k}\Omega$
B Constant	B		3 350	3 450	3 550	K
TEC Current	I_c	$T_{LD} = T_{set}$			1.2	A
TEC Voltage	V_c	$T_{LD} = T_{set}$			2.4	V

TYPICAL CHARACTERISTICS ($T_{LD} = T_{set}$, $T_c = 25^\circ\text{C}$, unless otherwise specified)

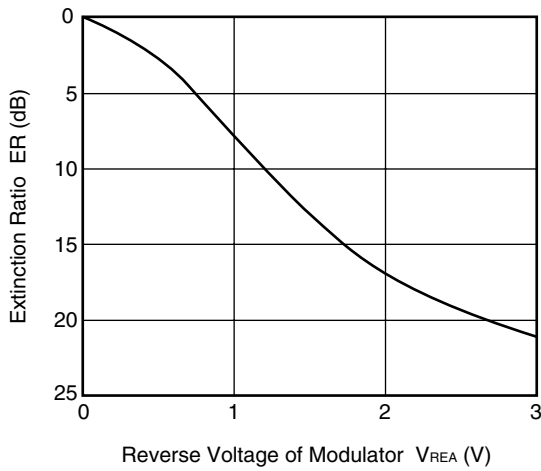
OPTICAL OUTPUT POWER FROM FIBER (CW) vs. FORWARD CURRENT



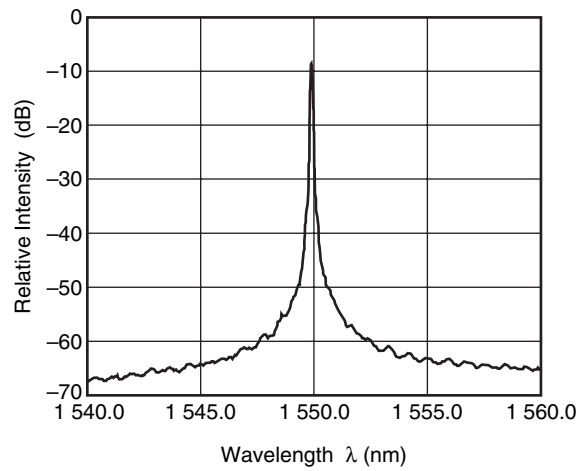
FORWARD CURRENT vs. FORWARD VOLTAGE



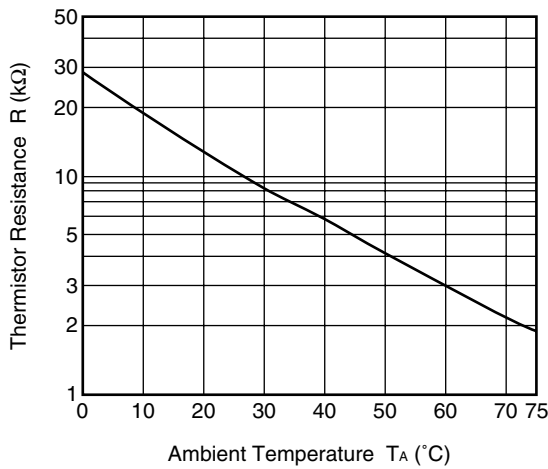
EXTINCTION RATIO vs. MODULATOR VOLTAGE



SPECTRUM



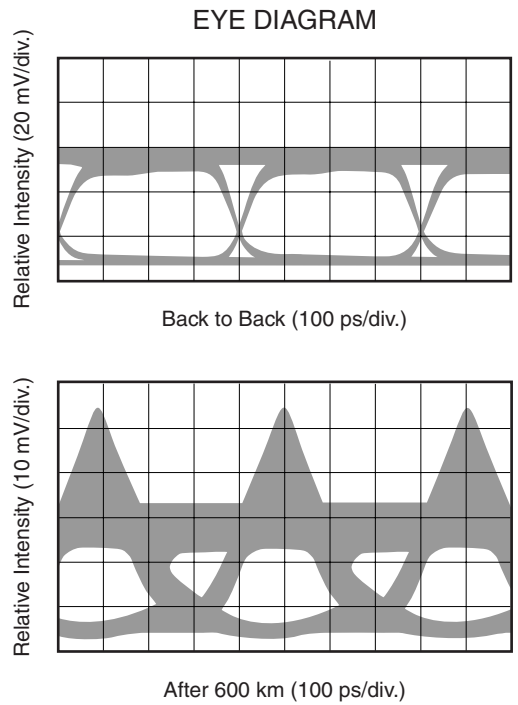
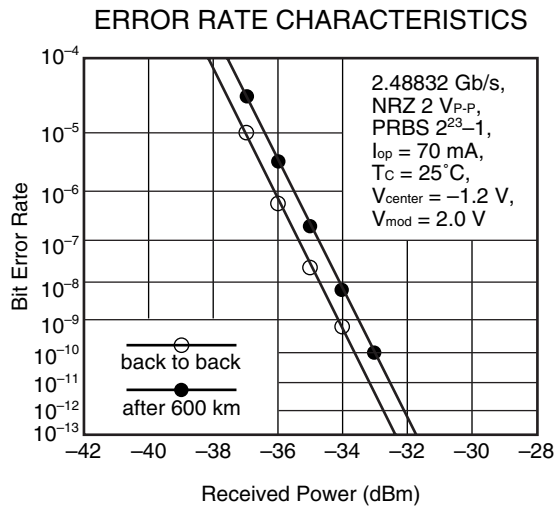
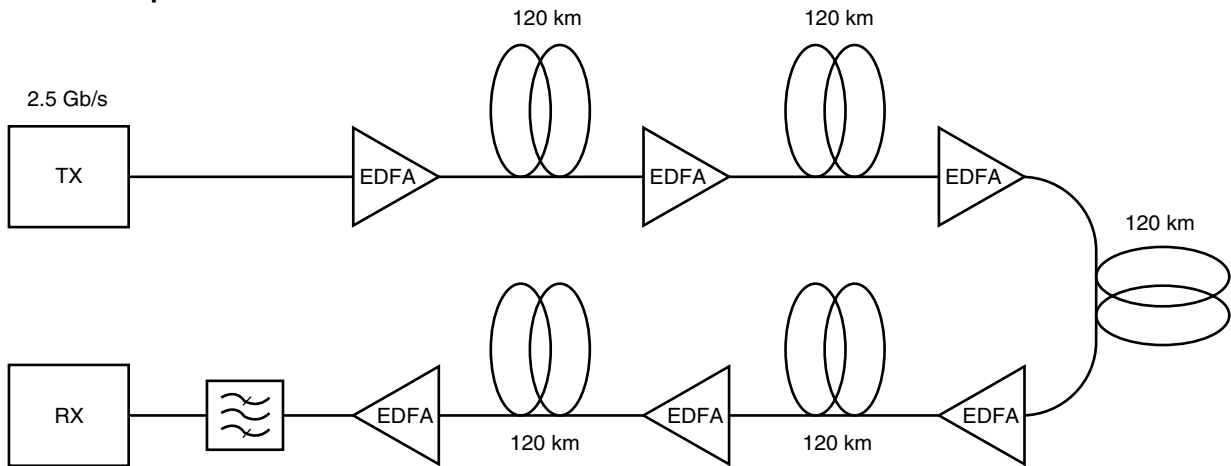
THERMISTOR RESISTANCE vs. AMBIENT TEMPERATURE



Remark The graphs indicate nominal characteristics.

600 km STANDARD FIBER TRANSMISSION EXAMPLE (NX8565LE Series)

Test Setup



Remark The graphs indicate nominal characteristics.

EA MODULATOR INTEGRATED DFB-LD FAMILY

Part Number	Absolute Maximum Ratings		Electro-Optical Characteristics		Application	Package
	T _c (°C)	T _{stg} (°C)	P _{r1} [*] (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	PL10161E
Opto-Electronics Devices Pamphlet	PX10160E

- **PATENT**
 USP 4,826,295
 CA 1,286,848
 EP 143 000

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 "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

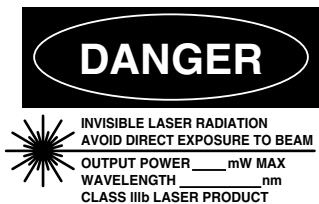
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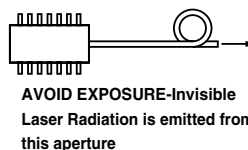
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M8E 00.4-0110

SAFETY INFORMATION ON THIS PRODUCT



SEMICONDUCTOR LASER



<p>Warning Laser Beam</p>	<p>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.</p> <ul style="list-style-type: none"> • Do not look directly into the laser beam. • Avoid exposure to the laser beam, any reflected or collimated beam.
<p>Caution GaAs Products</p>	<p>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.</p> <ul style="list-style-type: none"> • 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. <ol style="list-style-type: none"> 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.
<p>Caution Optical Fiber</p>	<p>A glass-fiber is attached on the product. Handle with care.</p> <ul style="list-style-type: none"> • When the fiber is broken or damaged, handle carefully to avoid injury from the damaged part or fragments.

► For further information, please contact

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