

1 310 nm OPTICAL CATV/ANALOG APPLICATIONS  
InGaAsP MQW-DFB LASER DIODE MODULE

DESCRIPTION

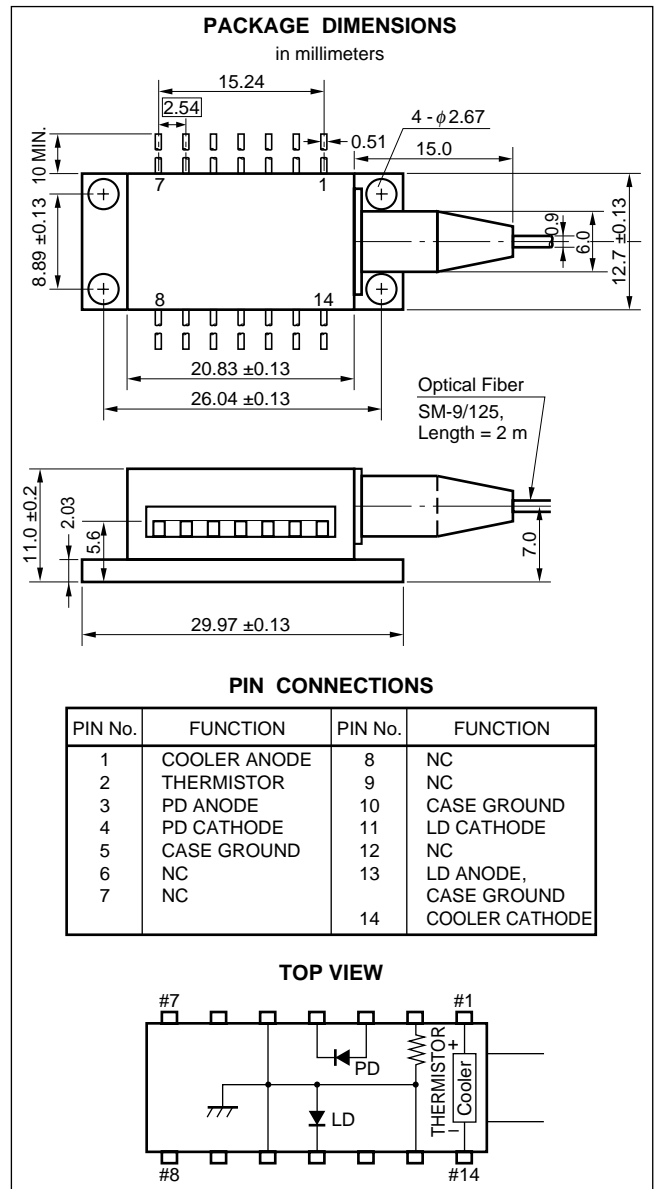
NDL7660P is a 1 310 nm DFB (Distributed Feed-Back) laser diode, that has a newly developed Multiple Quantum Well (MQW) structure, butterfly package module with optical isolator. It is especially designed for a 6 mW light source of CATV analog applications.

FEATURES

- Low noise RIN = -155 dB/Hz
- Low distortion CSO = -60 dBc  
CTB = -65 dBc
- High output power  $P_r = 6.0$  mW MIN.
- Long wavelength  $\lambda_p = 1\ 310$  nm
- High isolation 40 dB
- Internal InGaAs monitor PD
- Internal thermoelectric cooler
- Hermetically sealed 14 pin butterfly package
- Singlemode fiber pigtail
- Wide operating temperature range
- High reliability

ORDERING INFORMATION

Part Number	Available Connector
NDL7660P	Without Connector
NDL7660PC	With FC-UPC Connector
NDL7660PD	With SC-UPC Connector



**ABSOLUTE MAXIMUM RATINGS (T<sub>c</sub> = 25 °C)**

Parameter	Symbol	Ratings	Unit
Operating Case Temperature	T <sub>c</sub>	-20 to +65	°C
Storage Temperature	T <sub>stg</sub>	-40 to +70	°C
Lead Soldering Temperature (10 s)	T <sub>slid</sub>	260	°C
Optical Output Power	P <sub>f</sub>	15	mW
Forward Current of LD	I <sub>F</sub>	150	mA
Reverse Voltage of LD	V <sub>R</sub>	2.0	V
Forward Current of PD	I <sub>F</sub>	10	mA
Reverse Voltage of PD	V <sub>R</sub>	20	V
Cooler Current	I <sub>c</sub>	1.0	A
Cooler Voltage	V <sub>c</sub>	2.0	V

**ELECTRO-OPTICAL CHARACTERISTICS (T<sub>LD</sub> = 25 °C, T<sub>c</sub> = -20 °C to +65 °C)**

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Threshold Current	I <sub>th</sub>			20	35	mA
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 30 mA	0.9	1.2	1.4	V
Optical Output Power from Fiber (Recommended Operating Point)	P <sub>op</sub> <sup>*1</sup>		6.0			mW
Spontaneous Emission Power from Fiber	P <sub>s</sub>	I <sub>b</sub> = I <sub>th</sub>			50	μW
Differential Efficiency from Fiber	η <sub>d</sub>	P <sub>f</sub> ≤ P <sub>op</sub>	0.16	0.22		W/A
Peak Emission Wavelength	λ <sub>p</sub>	P <sub>f</sub> = P <sub>op</sub>	1 290	1 310	1 330	nm
Sub-mode Suppression Ratio	SMSR	P <sub>f</sub> = P <sub>op</sub>	30	35		dB
1 dB Bandwidth	f	P <sub>f</sub> = P <sub>op</sub>	900			MHz
Relative Intensity Noise	RIN <sup>*2</sup>	P <sub>f</sub> = P <sub>op</sub>		-155	-150	dB/Hz
Composite Second Order Distortion	CSO <sup>*3</sup>	P <sub>f</sub> = P <sub>op</sub>		-60	-55	dBc
Composite Triple Beat Distortion	CTB <sup>*3</sup>	P <sub>f</sub> = P <sub>op</sub>		-65	-60	dBc
Carrier to Noise Ratio	CNR <sup>*3</sup>	P <sub>f</sub> = P <sub>op</sub>	50			dBc
Isolation	I <sub>s</sub>		35	40		dB

\*1. Recommended P<sub>op</sub> value is supplied to each device.

\*2. Conditions : P<sub>f</sub> = P<sub>op</sub>, CW

Measuring Bandwidth: 50 MHz to 600 MHz

Optical Reflection -40 dB

\*3. Conditions : P<sub>f</sub> = P<sub>op</sub>, Optical Modulation Index = 3.5 %/channel

79 channel unmodulated carriers (55.25 MHz to 547.25 MHz)

Optical Reflection -40 dB, Optical Loss = 5.5 dB

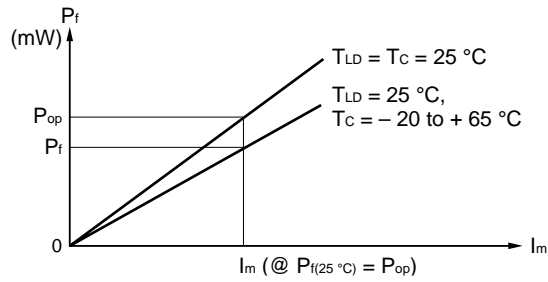
**ELECTRO-OPTICAL CHARACTERISTICS**

(Applicable to Monitor PD:  $T_{LD} = 25\text{ °C}$ ,  $T_c = -20\text{ °C}$  to  $+65\text{ °C}$ )

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Monitor Current	$I_m$	$V_R = 5\text{ V}$ , $P_f = P_{op}$	50	200		$\mu\text{A}$
Dark Current	$I_D$	$V_R = 5\text{ V}$		2	10	nA
Tracking Error	$\gamma^{*4}$	$I_m = \text{const.}$			0.5	dB

\*4. Tracking Error :  $\gamma$

$$\gamma = \left| 10 \log \frac{P_f}{P_{op}} \right|$$



**ELECTRO-OPTICAL CHARACTERISTICS**

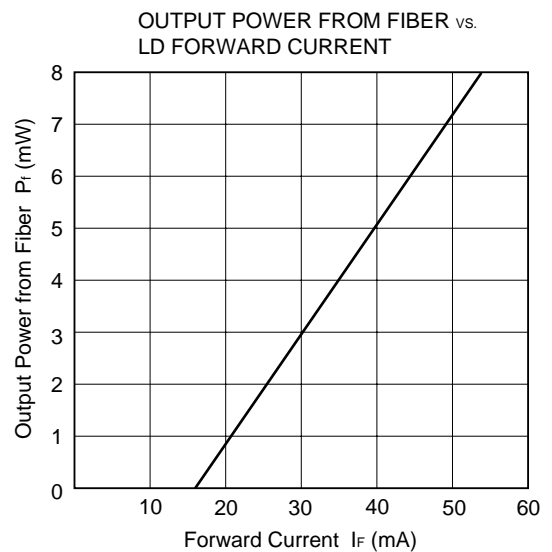
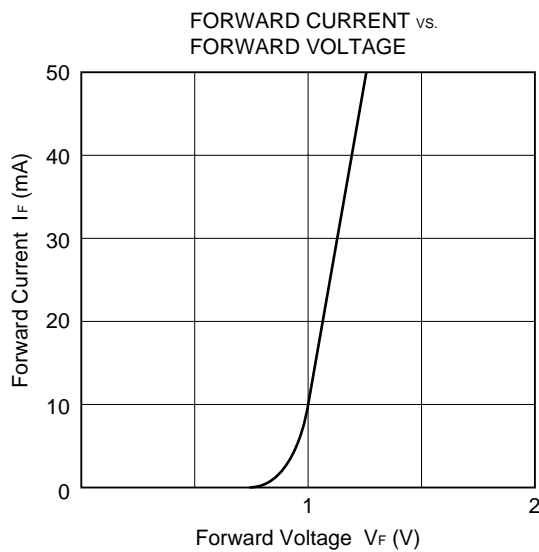
(Applicable to Thermistor and TE Cooler:  $T_{LD} = 25\text{ °C}$ ,  $T_c = -20\text{ °C}$  to  $+65\text{ °C}$ )

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Thermistor Resistance	$R^{*5}$	$T_{LD} = 25\text{ °C}$	9.5	10	10.5	$\text{k}\Omega$
Cooler Current	$I_c$	$\Delta T = 40\text{ K}$		0.6	0.8	A
Cooler Voltage	$V_c$	$\Delta T = 40\text{ K}$		1.1	1.5	V
Cooling Capacity	$\Delta T^{*6}$	$I_c = 0.8\text{ A}$ , $P_f = P_{op}$	40			K

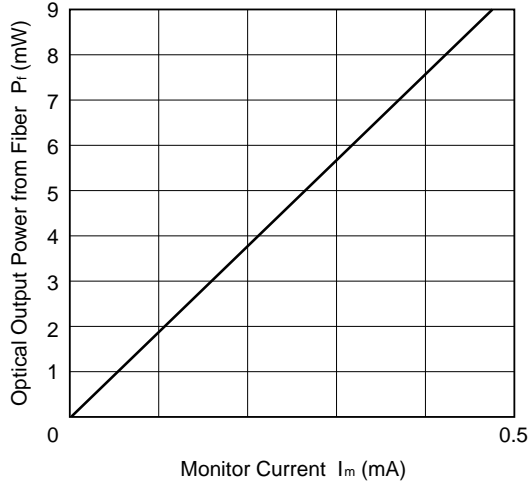
\*5. B Constant =  $3\,400 \pm 100\text{ K}$

\*6.  $\Delta T = |T_c - T_{LD}|$

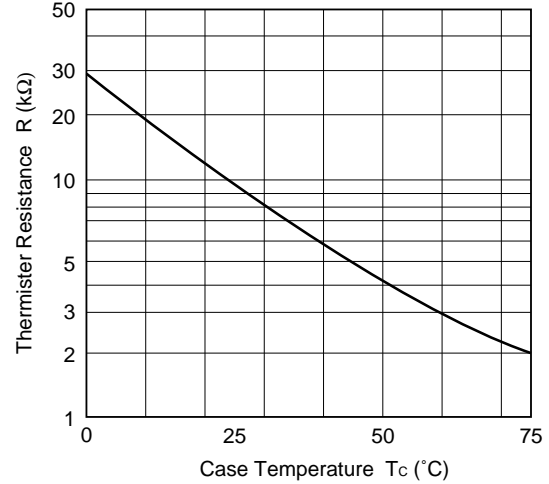
**TYPICAL CHARACTERISTICS ( $T_c = 25\text{ °C}$ )**



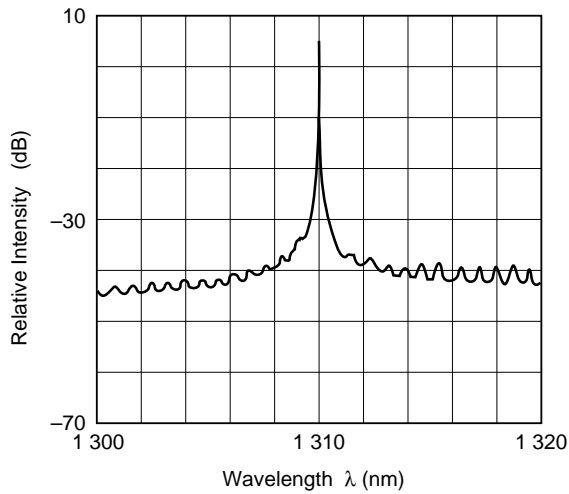
OUTPUT POWER FROM FIBER vs. LD MONITOR CURRENT



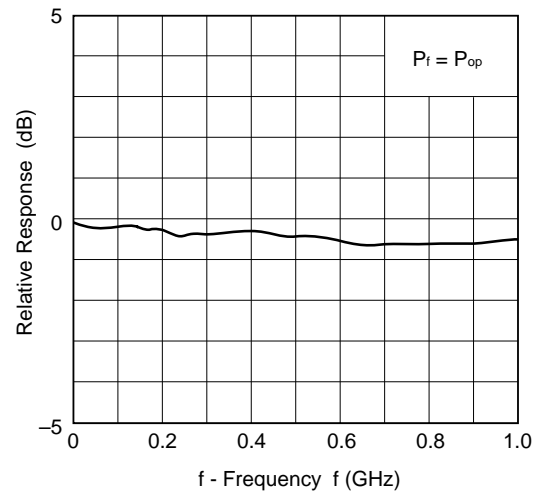
TYPICAL THERMISTOR RESISTANCE vs. CASE TEMPERATURE



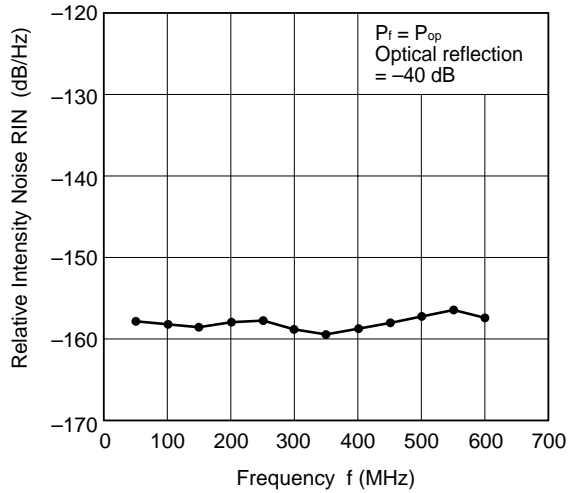
LONGITUDINAL MODE



FREQUENCY RESPONSE



RIN vs. FREQUENCY



**DFB LASER DIODE FAMILY FOR CATV/ANALOG APPLICATIONS**

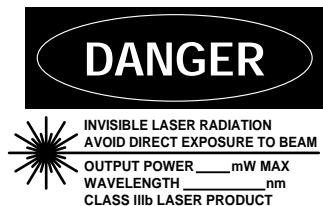
Features Packages	P <sub>op</sub> : Operating point power (min. value)						Remarks
	3 mW min.	4 mW min.	6 mW min.	8 mW min.	12 mW min.	15 mW min.	
14 pin BFY module with SMF	NDL7680P	NDL7650P	NDL7660P	NDL7670P	NDL7672P	NDL7673P	BFY module with monitor PD, TEC, thermistor, isolator

**REFERENCE**

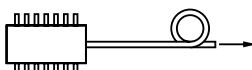
Document Name	Document No.
NEC semiconductor device reliability/quality control system	LEI-1201
Quality grade on NEC semiconductor devices	IEI-1209
Semiconductor device mounting technology manual	C10535E
Guide to quality assurance for semiconductor devices	MEI-1202
Semiconductor selection guide	X10679E

**CAUTION**

**Within this module there exists GaAs (Gallium Arsenide) material which is a harmful substance if ingested. Please do not under any circumstances break the hermetic seal.**



**SEMICONDUCTOR LASER**



**AVOID EXPOSURE-Invisible**  
Laser Radiation is emitted from this aperture

**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.

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Anti-radioactive design is not implemented in this product.