

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

DESCRIPTION

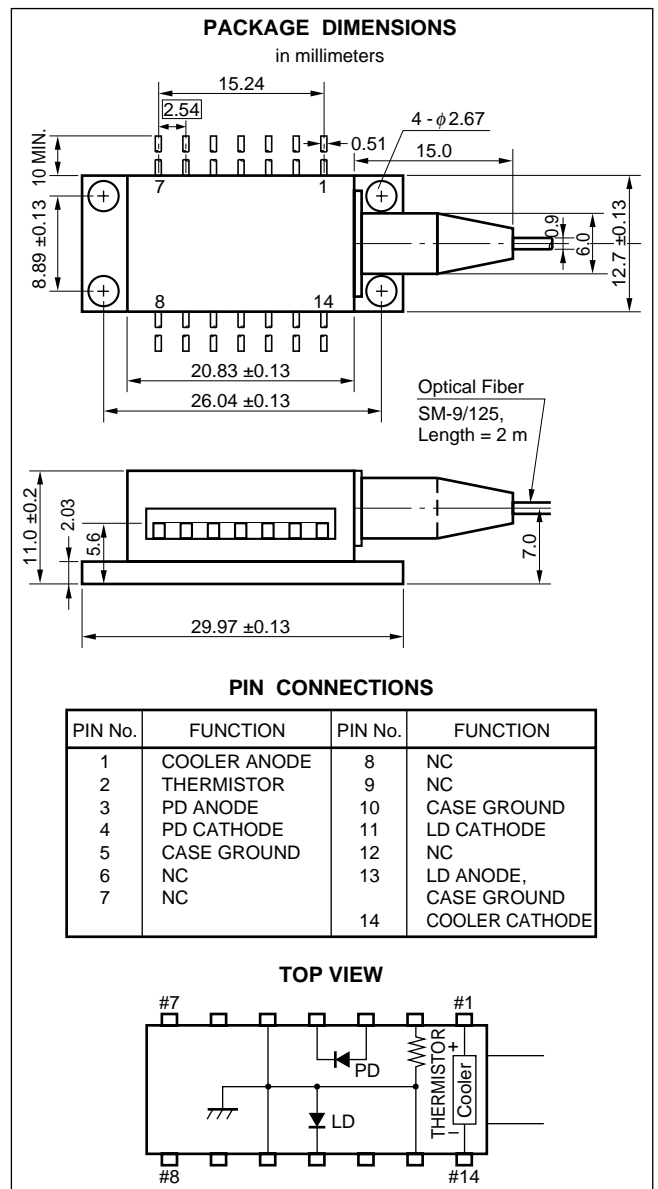
NDL7650P is a 1 310 nm DFB (Distributed Feed-Back) laser diode, that has a newly developed Multiple Quantum Well (MQW) structure, butterfly package module with optical isolator. It is especially designed for a 4 mW light source of CATV analog applications.

FEATURES

- Low noise RIN = -155 dB/Hz
- Low distortion CSO = -60 dBc
CTB = -65 dBc
- High output power $P_r = 4.0$ 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
NDL7650P	Without Connector
NDL7650PC	With FC-UPC Connector
NDL7650PD	With SC-UPC Connector



ABSOLUTE MAXIMUM RATINGS (T_c = 25 °C)

Parameter	Symbol	Ratings	Unit
Operating Case Temperature	T _c	-20 to +65	°C
Storage Temperature	T _{stg}	-40 to +70	°C
Lead Soldering Temperature (10 s)	T _{slid}	260	°C
Optical Output Power	P _f	15	mW
Forward Current of LD	I _F	150	mA
Reverse Voltage of LD	V _R	2.0	V
Forward Current of PD	I _F	10	mA
Reverse Voltage of PD	V _R	20	V
Cooler Current	I _c	1.0	A
Cooler Voltage	V _c	2.0	V

ELECTRO-OPTICAL CHARACTERISTICS (T_{LD} = 25 °C, T_c = -20 °C to +65 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Threshold Current	I _{th}			20	35	mA
Forward Voltage	V _F	I _F = 30 mA	0.9	1.2	1.4	V
Optical Output Power from Fiber (Recommended Operating Point)	P _{op} ^{*1}		4.0			mW
Spontaneous Emission Power from Fiber	P _s	I _b = I _{th}			50	μW
Differential Efficiency from Fiber	η _d	P _f ≤ P _{op}	0.16	0.22		W/A
Peak Emission Wavelength	λ _p	P _f = P _{op}	1 290	1 310	1 330	nm
Sub-mode Suppression Ratio	SMSR	P _f = P _{op}	30	35		dB
1 dB Bandwidth	f	P _f = P _{op}	900			MHz
Relative Intensity Noise	RIN ^{*2}	P _f = P _{op}			-150	dB/Hz
Composite Second Order Distortion	CSO ^{*3}	P _f = P _{op}		-60	-55	dBc
Composite Triple Beat Distortion	CTB ^{*3}	P _f = P _{op}		-65	-60	dBc
Carrier to Noise Ratio	CNR ^{*3}	P _f = P _{op}	50			dBc
Isolation	I _s		35	40		dB

*1. Recommended P_{op} value is supplied with each device.

*2. Conditions : P_f = P_{op}, CW

Measuring Bandwidth: 50 MHz to 600 MHz

Optical Reflection -40 dB

*3. Conditions : P_f = P_{op}, 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

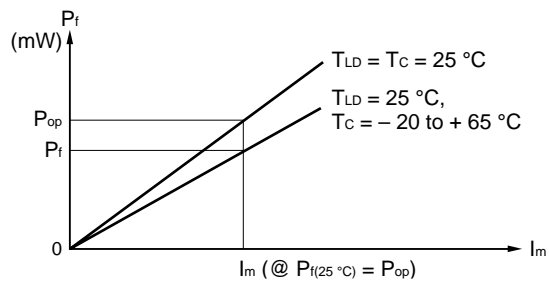
ELECTRO-OPTICAL CHARACTERISTICS

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

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

*4. Tracking Error : γ

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



ELECTRO-OPTICAL CHARACTERISTICS

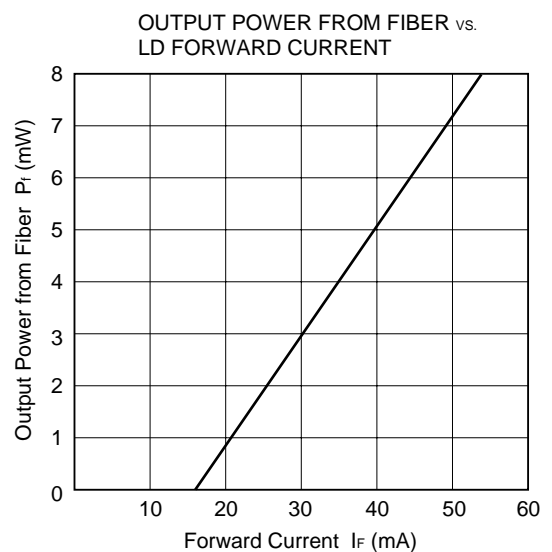
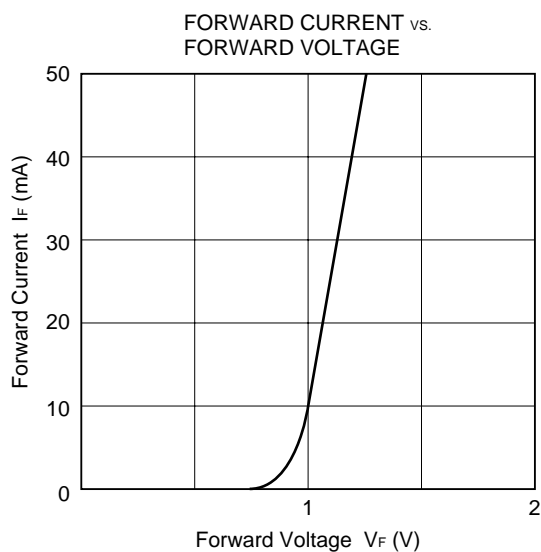
(Applicable to Thermistor and TE Cooler: $T_{LD} = 25\text{ }^{\circ}\text{C}$, $T_C = -20\text{ }^{\circ}\text{C}$ to $+65\text{ }^{\circ}\text{C}$)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Thermistor Resistance	R^*5	$T_{LD} = 25\text{ }^{\circ}\text{C}$	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	ΔT^*6	$I_c = 0.8\text{ A}$, $P_f = P_{op}$	40			K

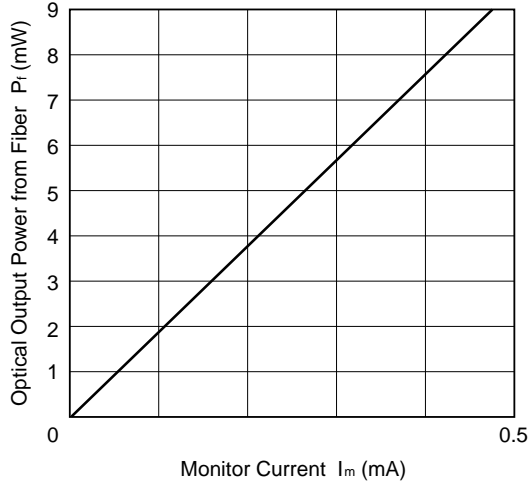
*5. B Constant = $3\ 400 \pm 100\text{ K}$

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

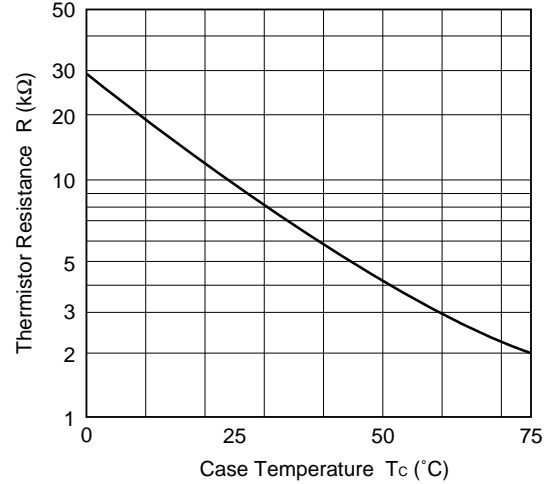
TYPICAL CHARACTERISTICS ($T_C = 25\text{ }^{\circ}\text{C}$)



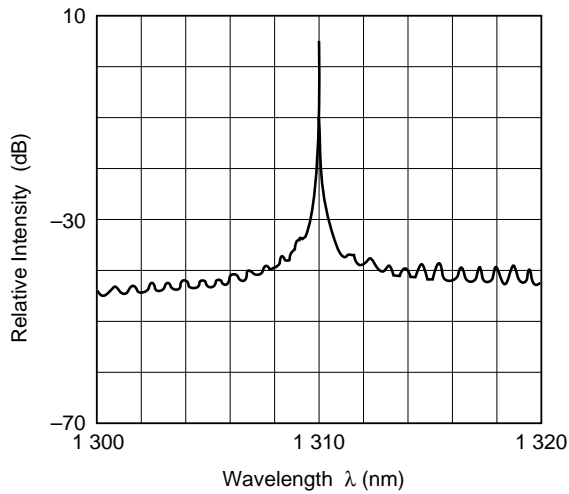
OUTPUT POWER FROM FIBER vs. LD MONITOR CURRENT



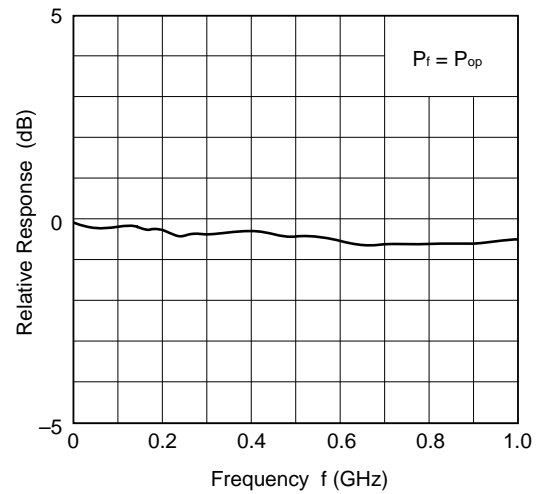
TYPICAL THERMISTOR RESISTANCE vs. CASE TEMPERATURE



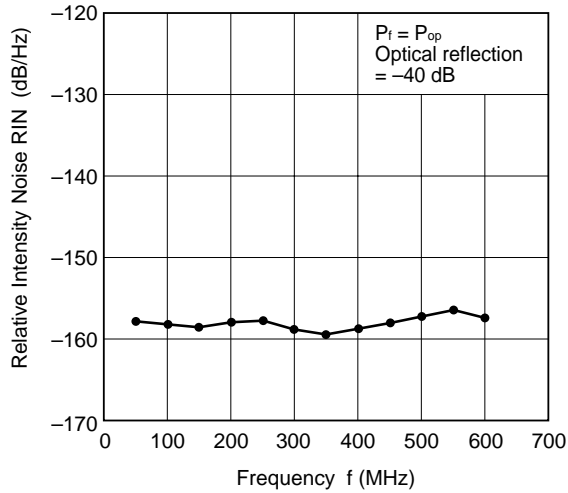
LONGITUDINAL MODE



FREQUENCY RESPONSE



RIN vs. FREQUENCY



DFB LASER DIODE FAMILY FOR CATV/ANALOG APPLICATIONS

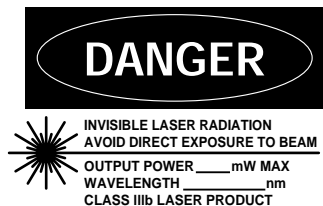
Features Packages	P _{op} : Operating point power (min. value)						Remarks
	3 mW min.	4 mW min.	6 mW min.	8 mW min.	12 mW min.	15 mW min.	
14 pin BFY module with SMF	NDL7680P	NDL7650P	NDL7660P	NDL7670P	NDL7672P	NDL7673P	BFY module with monitor PD, TEC, thermistor, isolator

REFERENCE

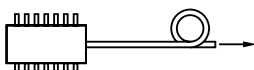
Document Name	Document No.
NEC semiconductor device reliability/quality control system	LEI-1201
Quality grade on NEC semiconductor devices	IEI-1209
Semiconductor device mounting technology manual	C10535E
Guide to quality assurance for semiconductor devices	MEI-1202
Semiconductor selection guide	X10679E

CAUTION

Within this device 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.

The export of this product from Japan is prohibited without governmental license. To export or re-export this product from a country other than Japan may also be prohibited without a license from that country. Please call an NEC sales representative.

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customer must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.