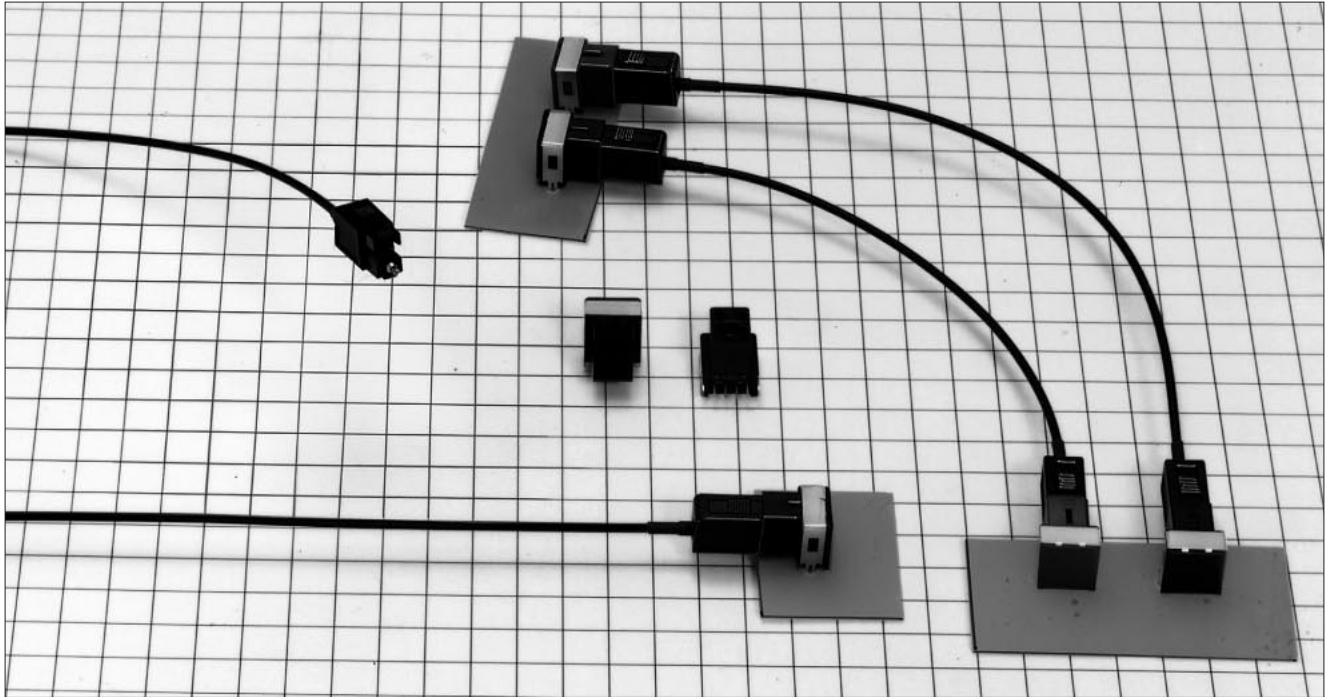


# Plastic Fiber Optical Data Link

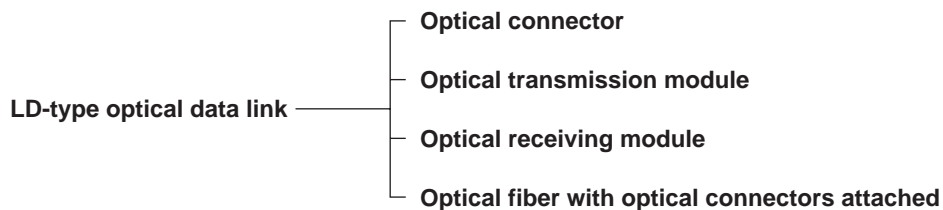
## LD Series



### ■Features

1. Low pulse width distortion.
2. This is a TTL and CMOS compatible interface.  
(Direct coupling permitted to 74LS and 74HC)
3. Full-lock connectors in which the optical connectors use a lock lever in the fastening mechanism.
4. POF (all-plastic fiber) is used.
5. The fiber wiring method is crimping by means of a special tool (LD-T1) which does not use adhesive. (The special tool is available separately.)
6. Ferrules are of a simple structure and are low cost.

### 7. Types



### ■Applications

Between equipment such as audio/video, factory automation, and office equipment, and short data links such as transfer systems within equipment.

## ■Product Standards

### ●Modules for Optical Transfer(Transmission)

Rating	Operating temperature range	-20°C~85°C	Storage temperature range	-40°C~100°C
	Power supply voltage	-0.5~7V	Input voltage	-0.5~5.5V
	Soldering temperature	260°C(Time:within 10 s)	Suitable cable	OFC2.2-PSI-980/1000

Item		Test Method (JIS C 5961)	Standard
Electrical Performance	High level input voltage	Power supply voltage 5 V, resistance 8.2k $\Omega$ , high level-17 dBm Test standard:JIS C 6111	2.0 V or greater
	Low level input voltage	Power supply voltage 5 V, resistance 8.2k $\Omega$ , high level-60 dBm Test standard:JIS C 6111	0.8 V or less
	High level input current	Power supply voltage 5 V, high level input voltage 2.7 V Test standard:JIS C 6111	100 $\mu$ or less
	Low level input current	Power supply voltage 5 V, low level input voltage 0.4 V Test standard:JIS C 6111	400 $\mu$ or less
Optical Performance	Peak emission wavelength	Power supply voltage 5 V, measured with input signal OPEN Test standard:JIS C 6111	660 $\pm$ 30nm
	Emission output	Power supply voltage 5 V, measured with input signal OPEN, resistance 8.2 $\Omega$ ,POF=1 m Test standard:JIS C 6111	-17 dBm or greater -13.5 dBm or less
Mechanical Performance	Repetitive operation	500 cycles of coupling/decoupling	1)Emission output fluctuation : 0.5 dB or less 2) No damage, cracks, or part looseness
	Vibration resistance	Vibration range of 10 to 55 Hz,in 3 directions,3 hours each	1)Emission output fluctuation after test: 0.3 dB or less 2) No damage, cracks, or part looseness
	Shock resistance	Acceleration of 981 m/s <sup>2</sup> ,in both directions along 3 axes, 3 times each (Total of 18 times)	
Environmental performance	Humidity resistance	Resistance 0 $\Omega$ ,input signal OPEN, leave for 1,000 hours at temperature 40°C and humidity 90%	1)Emission output fluctuation: 1 dB or less 2) No damage, cracks, or part looseness
	Continuous operation	Resistance 0 $\Omega$ ,input signal OPEN, leave for 1,000 hours at temperature 85°C	1)Emission output fluctuation: 1 dB or less 2) No damage, cracks, or part looseness

### ●Modules for Optical Transfer(Receiving)

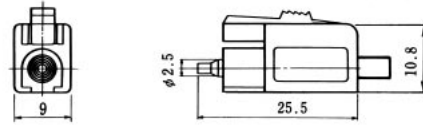
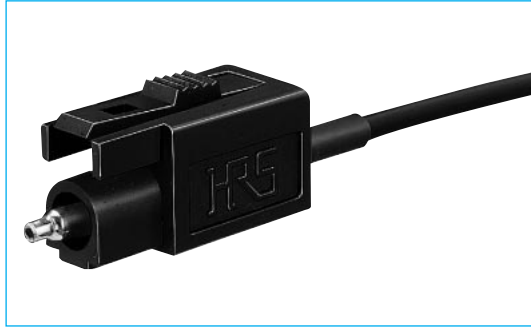
Rating	Operating temperature range	-20°C~85°C	Storage temperature range	-40°C~100°C
	Power supply voltage	-0.7~7V	Low level output current	20mA
	Soldering temperature	260°C(Time:within 10 s)	High level output current	-1mA
			Suitable cable	OFC2.2-PSI-980/1000

Item		Test Method (JIS C 5961)	Standard
Electrical Performance	High level output voltage	Power supply voltage 4.75 V, measured with level -20 dBm,signal OPEN, output current 60 $\mu$ A Test standard:JIS C 6111	4.4 V or greater
	Low level output voltage	Power supply voltage 4.75 V, measured with level -60 dBm,signal OPEN, output current 2mA Test standard:JIS C 6111	0.5 V or less
	Rise time Fall time	Power supply voltage 4.75 V, level -20 dBm Measured at transfer speed 2 Mbps(NRZ) Test standard:JIS C 6111	Rise time 100 ns or less Fall time 70 ns or less
Optical Performance	Receiving power	Power supply voltage 4.75 V, transfer speed 6 Mbps(NRZ) Test standard:JIS C 6111	Receiving electric power(max):-12dB or more Receiving electric power(min):-28dB or less

## Materials

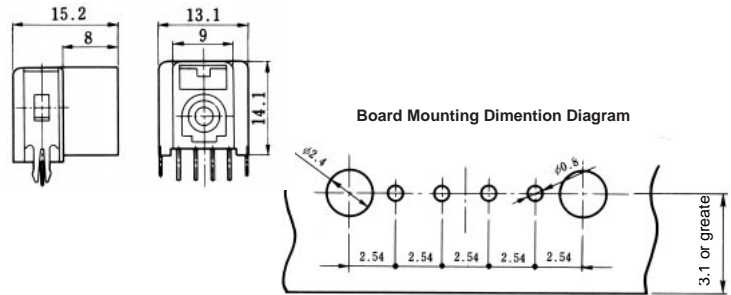
Part Name	Material
Plug housing	Polybutylene terephthalate
Coil spring	Stainless steel
Ferrule	Copper alloy
Module housing	Polybutylene terephthalate
Lock pin	Copper alloy

## Optical Connectors



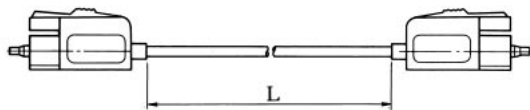
HRS No.	Product Number	Notes
CL822-0022-6	LD-AP1-P1	Suitable cable diameter: $\varnothing 2.2$ mm, Suitable fiber diameter: $\varnothing 1$ mm, Casing color: Black
CL822-0022-6-01	LD-AP1-P1(01)	Suitable cable diameter: $\varnothing 2.2$ mm, Suitable fiber diameter: $\varnothing 1$ mm, Casing color: Blue

## Modules for Optical Transfer



HRS No.	Product Number	Notes
CL822-5001-3	LD-AP1-R1	Transmission, Casing color: Blue
CL822-6001-9	LD-AP1-R2	Receiving, Casing color: Black

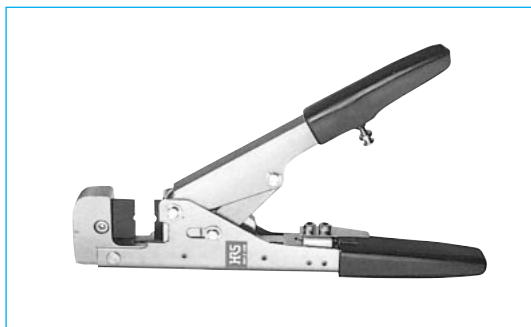
## Fiber Cable with Optical Connectors Attached



HRS No.	Product Number	Suitable Fiber	Ferrule Heat Surface Processing	Notes
CL822-2002-0	LD-P22-F2X-L	SL-980/1000	Heat Processing	OCF2.2-PSI-980/1000

The "L" within the Product Number indicates the length of the cable. Please contact us for information about cable length. Please specify values of "L" in meter units.

## Crimping Tool



HRS No.	Product Number	Suitable Products
—	LD-T1	LD-AP1-P1

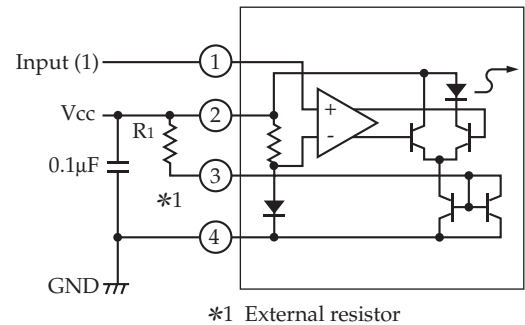
■Structure

Name	Product Name	HRS No.	Notes
Optical transmission module	LD-AP1-R1	CL702-0008-2	JIS C 5975
Optical receiving module	LD-AP1-R2	CL702-0009-5	JIS C 5975
Optical connector	LD-AP1-P1	CL702-0007-9	JIS C 5975
Optical fiber with optical connector attached	LD-P22-F2X-L	CL702-1001-9	Connector: LD-AP1-P1 Fiber: OFC2.2-PSI-980/1000
Crimping tool	LD-T1	—	LD-AP1-P1 Assembly jig

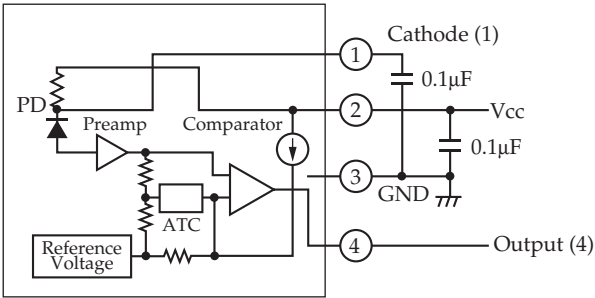
●Correspondence List with Old Product Names

Name	Product Name	Old Product Name
Optical transmission module	LD-AP1-R1	LD1-AP-R1
Optical receiving module	LD-AP1-R2	LD1-AP-R2
Optical connector	LD-AP1-P1	LD2-AP-P1
Optical fiber with optical connector attached	LD-P22-F2X-L	LD-AP1-P2-L
Crimping tool	LD-T1	LD-AP1-T

■Block Diagrams

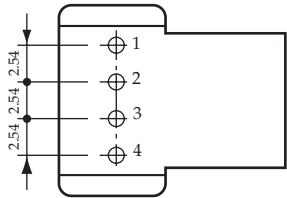


Optical Transmission Module  
LD-AP1-R1



Optical Receiving Module  
LD-AP1-R2

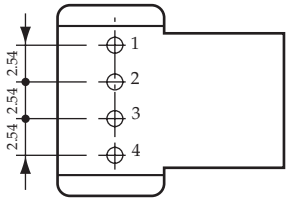
■Pin Arrangement



(Diagram of Bottom Surface)

Optical Transmission Module  
LD-AP1-R1

Pin No.	Name
1	Transmission signal input
2	Transmission power supply (+5 V)
3	LED current limiting resistor
4	Transmission ground



(Diagram of Bottom Surface)

Optical Receiving Module  
LD-AP1-R2

Pin No.	Name
1	Receiving ground
2	Receiving power supply (+5 V)
3	Receiving ground
4	Receiving signal output

## ■Absolute Maximum Rating

### ●Transmission Module

Part Name	Item	Abbreviation	Rating	Unit
LD-AP1-R1	Supply voltage	V <sub>cc</sub>	-0.5~+7	V
	Input voltage	V <sub>in</sub>	-0.5~+5.5	V
	Operating temperature	T <sub>opt</sub>	-20~+85	°C
	Storage temperature	T <sub>stg</sub>	-40~+100	°C
	Soldering temperature*	T <sub>sol</sub>	260 (Time: within 10 s)	°C

\* Lead portion only

### ●Receiving Module

Part Name	Item	Abbreviation	Rating	Unit
LD-AP1-R2	Supply voltage	V <sub>cc</sub>	-0.7~+7	V
	Low level output current	I <sub>OL</sub>	20	mA
	High level output current	I <sub>OH</sub>	-1	mA
	Operating temperature	T <sub>opt</sub>	-20~+85	°C
	Storage temperature	T <sub>stg</sub>	-40~+100	°C
	Soldering temperature*	T <sub>sol</sub>	260 (Time: within 10 s)	°C

\* Lead portion only

### ●Optical Fiber with Optical Connector Attached

Part Name	Item	Abbreviation	Rating	Unit
LD-P22-F2X-L	Fiber tensile strength	T <sub>CF</sub>	29.4	N
	Fiber bending radius	R	25	mm
	Operating temperature	T <sub>opt</sub>	-40~+85	°C
	Storage temperature	T <sub>stg</sub>	-40~+85	°C

## ■Electrical and Optical Characteristics

### ●Optical Data Link Characteristics

Item	Abbreviation	Condition	MIN.	TYP.	MAX.	Unit
Transfer speed		NRZ code	DC		6	Mbps
Transfer distance		When POF used			10	m
Propagation delay time (L → H)	t <sub>PLH</sub>	Fiber length 1 m			150	ns
Propagation delay time (H → L)	t <sub>PLH</sub>	Fiber length 1 m			150	ns
Pulse width distortion	Δtw	Pulse width 165 ns Duty 50%			±20	ns

### ●Optical Transmission Module Characteristics (LD-AP1-R1)

Item	Abbreviation	Condition	MIN.	TYP.	MAX.	Unit
Current drawn	I <sub>cc</sub>	R <sub>L</sub> =8.2kΩ* <sup>1</sup>		15	25	mA
High level input current	I <sub>IH</sub>	V <sub>CC</sub> =5.25V, V <sub>IH</sub> =2.7V			100	μA
Low level input current	I <sub>IL</sub>	V <sub>CC</sub> =5.25V, V <sub>IH</sub> =0.4V			400	μA
High level input voltage	V <sub>IH</sub>		2.0			V
Low level input voltage	V <sub>IL</sub>				0.8	V
Emission output power *2	P <sub>i</sub>	POF=1m* <sup>3</sup> , R <sub>L</sub> =8.2kΩ	-21		-11	dBm
Peak emission wavelength	λ <sub>p</sub>	R <sub>L</sub> =8.2kΩ		660		nm

\*1 Insertion portion for external resistor

\*2 Emission output power (P<sub>f</sub>) can be changed depending on the external resistance value. (See the standard characteristic curves.)

\*3 POF: Plastic Optical Fiber

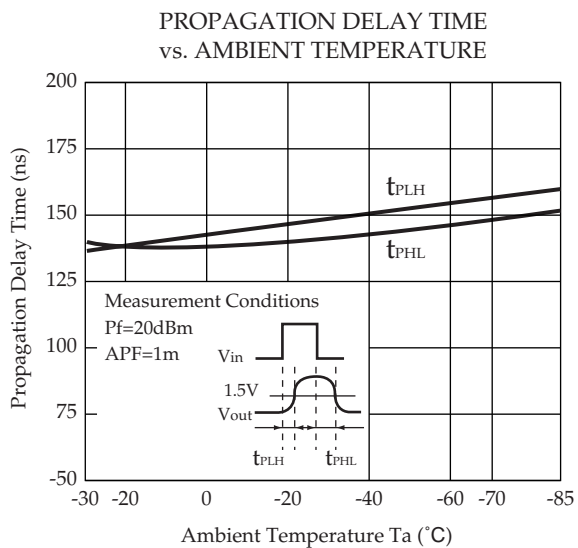
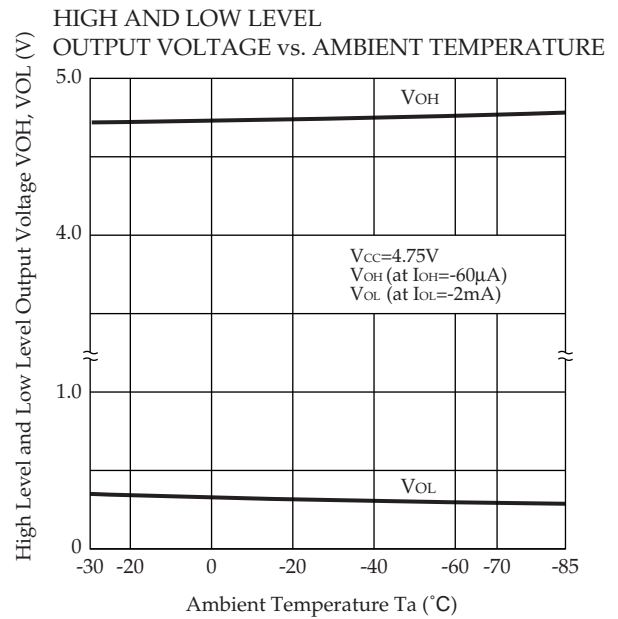
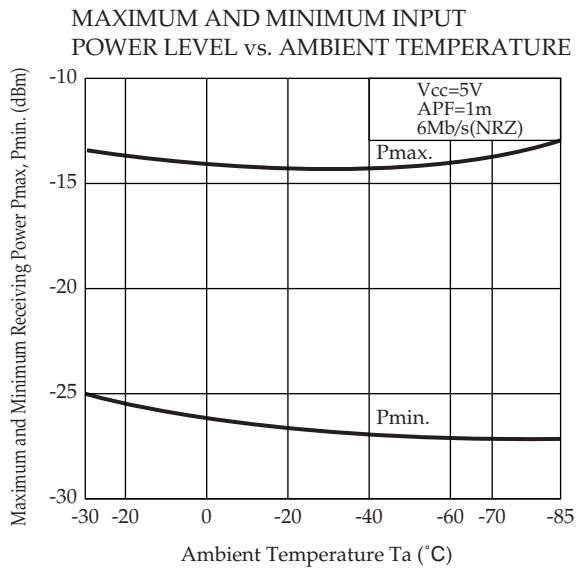
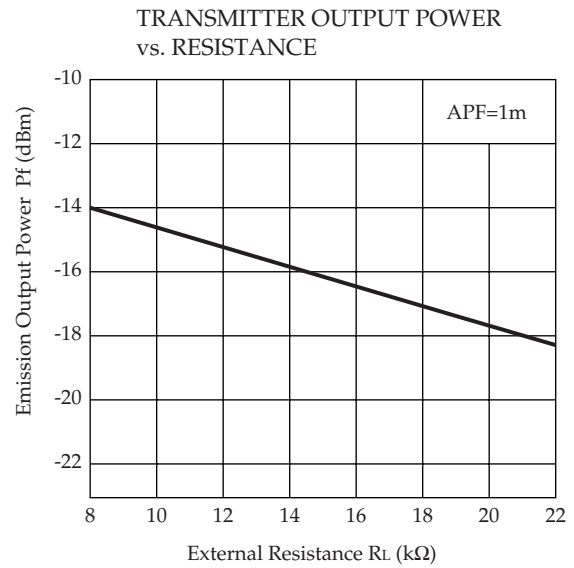
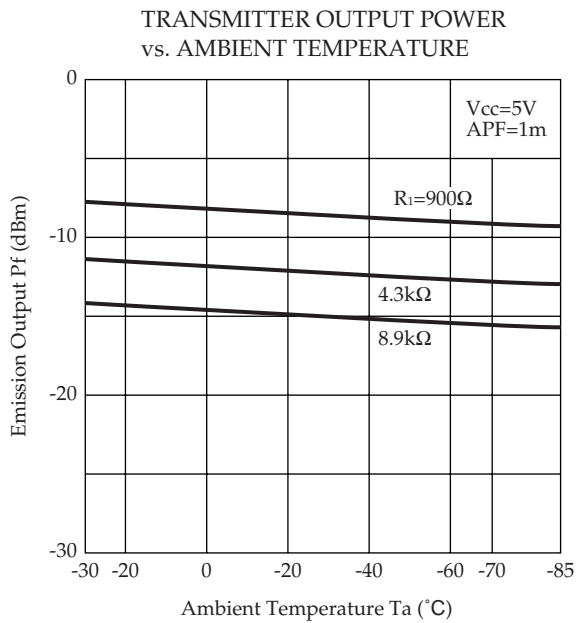
### ●Optical Receiving Module Characteristics (LD-AP1-R2)

Item	Abbreviation	Condition	MIN.	TYP.	MAX.	Unit
Current drawn	I <sub>cc</sub>	R <sub>L</sub> =8.2kΩ* <sup>1</sup>		15	25	mA
High level output voltage	V <sub>OH</sub>	V <sub>CC</sub> =4.75V, I <sub>OH</sub> =60μA	4.4			V
Low level output voltage	V <sub>OL</sub>	V <sub>CC</sub> =4.75V, I <sub>OL</sub> =2mA			0.5	V
Maximum receiving power	P <sub>max</sub>	6Mb/s(NRZ)	-14.5			dBm
Minimum receiving power	P <sub>min</sub>	6Mb/s(NRZ)			-24	dBm
Rise time	t <sub>r</sub>	P <sub>i</sub> =-20dBm		50	100	ns
Fall time	t <sub>f</sub>	P <sub>i</sub> =-20dBm		20	70	ns

### ●Optical Fiber with Optical Connector Attached (LD-P22-F2X-L)

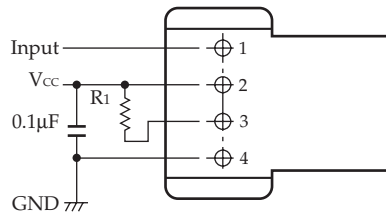
Item	Abbreviation	Condition	MIN.	TYP.	MAX.	Unit
Transfer loss		λ <sub>p</sub> =660nm, LED		0.2	0.3	dBm
Coupling/decoupling emitted power fluctuation		500 times of coupling/decoupling			0.5	dB

## ■ Standard Product Characteristic Curves (Ta = 25 °C)



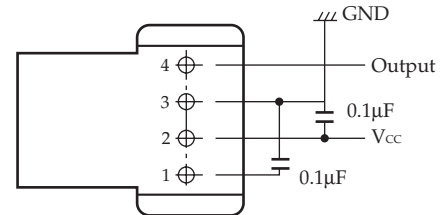
## ■Method of Use

### ●Electrode Connections



(Diagram of Bottom Surface)

Optical Transmission Module Characteristics  
LD-AP1-R1



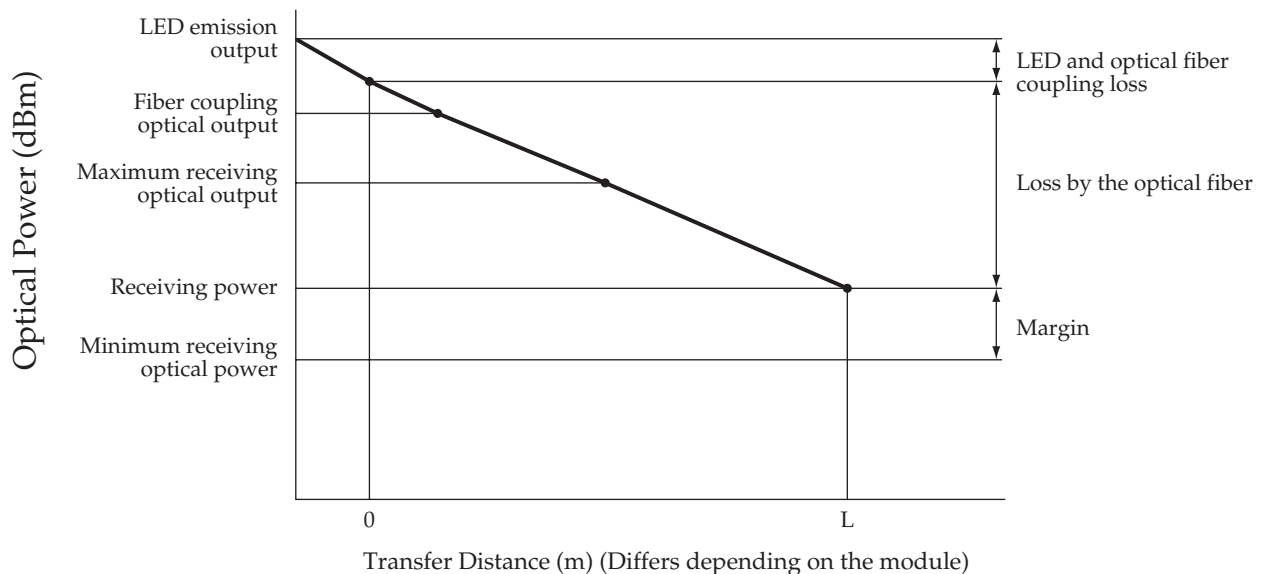
(Diagram of Bottom Surface)

Optical Receiving Module Characteristics  
LD-AP1-R2

Please select the resistance value by referring to the standard characteristic curve corresponding to the transmitter output power.

### ●Optical Data Link Transfer Distance

The transfer distance of the optical data link can be found from the following level diagram and the following formula.



Level Diagram

$$\text{Maximum transfer distance} = \frac{(\text{Optical fiber coupling optical output}) - (\text{Minimum receiving optical output}) - (\text{Margin})}{(\text{Transfer loss})}$$

Margin = 1 dB

Note that the transfer distance will vary depending on the usage conditions (e.g., transfer speed, signal duty ratio, and pulse width distortion). Please verify the transfer distance with the actual usage conditions.

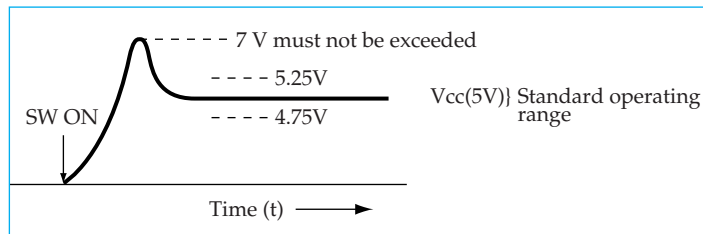
## ■ Usage Precautions

### (1) Fixation of the Optical Transmission Module and the Optical Receiving Module

The lock pins of each of these modules must be fixed to the printed circuit board by soldering.

### (2) Power Supply Conditions

Please follow the conditions described in the diagram below.



### (3) LD Module Soldering (Hand Soldering) Work and Precautions

The resin molded semiconductors of this product require a degree of transparency and so additives are few and in comparison to other molded semiconductors a thermally and mechanically weak resin is used. In view of this, please refer to the following procedure and solder accordingly.

#### ① Soldering of the Lock Pins

Before soldering the lead pins, be sure to fix the lock pins to the printed circuit board by soldering.

#### ② Soldering of the Lead Pins

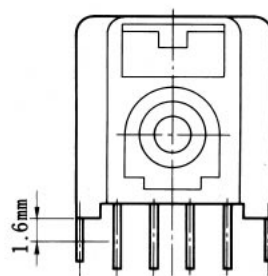
Observe the temperature, time, and iron capacity of Table 1 for the soldering of the lead pins and solder at a point which will allow the leads to maintain at least a length of 1.6 mm from the bottom surface of the module. (See Figure 1.)

Soldering should be done from the back side with respect to the coupling face of the module as illustrated in Figure 2.

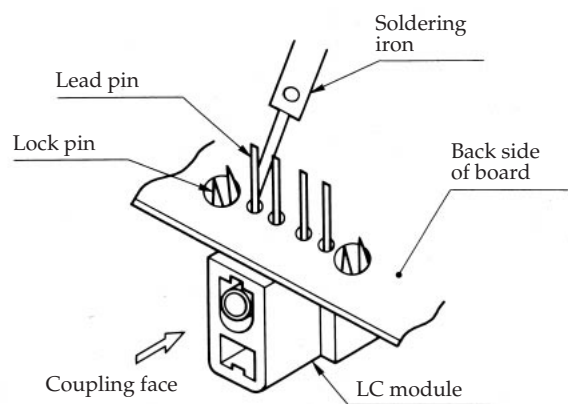
**Table 1**

Recommended temperature	240°C to 260°C
Recommended time	4 s or less
Recommended iron capacity	30 W to 40 W

**Figure 1**



**Figure 2**



#### ③ After Soldering

Please note that soon after soldering, any mounting corrections of the module or corrections of board warping that are performed will place stress on the resin mold and may destroy the resin molded semiconductor.

#### ④ Cutting of Leads

The cutting of leads in a high temperature condition may cause lead breakage accidents. Please cut leads at room temperature after soldering.

Be especially careful of the high temperature immediately after soldering.



#### **(4) Washing Conditions**

- ① Depending on the solvent used in washing, the resin of the package may be penetrated. Please observe the conditions described below when washing. One of the following alcohol-based solvents should be used at a solvent temperature of 45°C or less with an immersion time within 3 minutes:
  - Ethyl alcohol
  - Methyl alcohol
  - Isopropyl alcohol
- ② The adhering of dirt or dust at the time of washing could lead to a malfunction. Extra care is warranted to keep the module free of dirt and dust.
- ③ Chloro- and Freon type solvents should not be used.
- ④ Do not use ultrasonic cleaning.

#### **(5) Short-circuiting of the Output**

Do not short-circuit the output of the optical receiving module to the power supply side or the ground side.

#### **(6) Washing the Ends of the Optical Connectors**

Please take care not to allow the ferrule end of the optical connector to become soiled.

To clean dirt from the ferrule end, moisten an industrial-type rag with alcohol and wipe away the dirt that adheres to the ferrule.