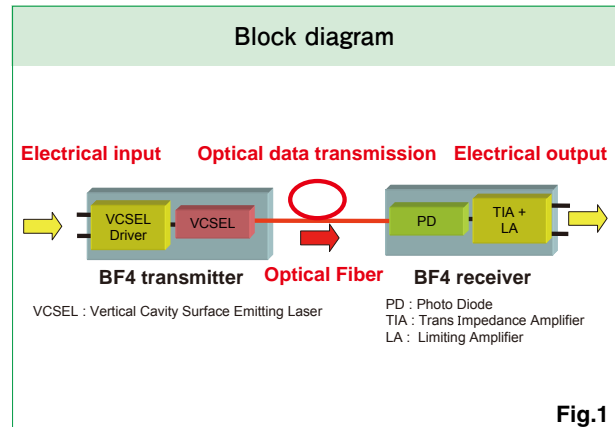


# Active Optical Connector

## BF4M Series

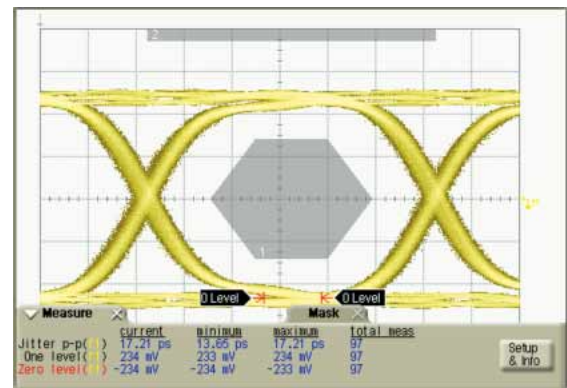


### Overview

Hirose developed the micro "BF4MC connector" that enables optical transmission of data between boards that are incorporated in devices.

It converts an electrical signal that is received from a board by using the semiconductor component built-in the connector, and transfers the data via optical fiber. BF4MC connector is a revolutionary design that enables easy use of electromagnetic noise-free, insulated, long-distance, high-speed transmission. These are the merits of the optical transmission, mounted inside devices achieving dramatic downsizing and lower power consumption when compared to existing optical products. It can be used in a wide range of applications, medical appliances Measurement equipments, FA system etc.

### Eye Diagram (Typical) : Transmission speed 6.25 Gbps, Length 5 meters



### Features

#### 1. Optical transmissions achieved by simplified electrical connections

An easy transmission is accomplished with electronic connectors and has eliminated the need for cleaning the mating faces of traditional fiber optic connectors.

#### 2. High-speed, signal transmissions with no EMI noise.

Optical signal transmissions rated up to 6.25 Gbps are possible. Since there is no EMI noise on the signal lines, system design time will be saved.

#### 3. Highly flexible optical fiber

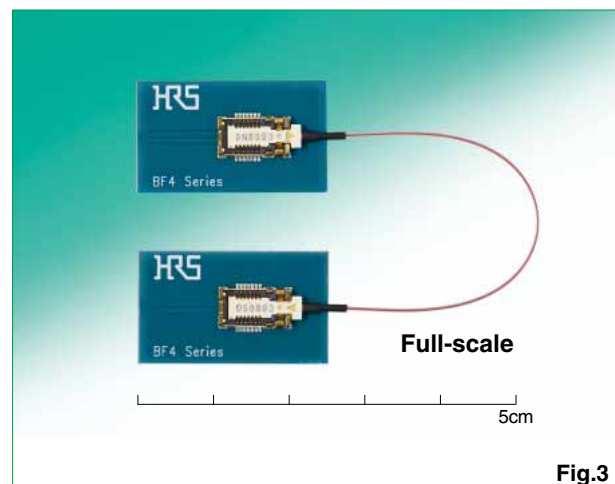
A highly flexible optical fiber is useful for narrow space wiring in the box.

#### 4. Long-distance, high-speed and high quality signal transmissions

The BF4M design is capable of high speed and high quality signal transmissions even over long transmission distances.

#### 5. Low power consumption

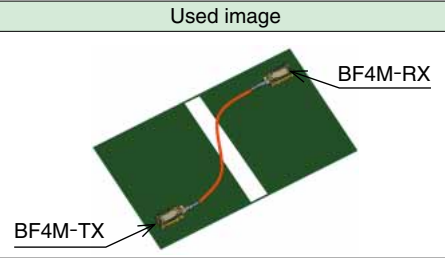
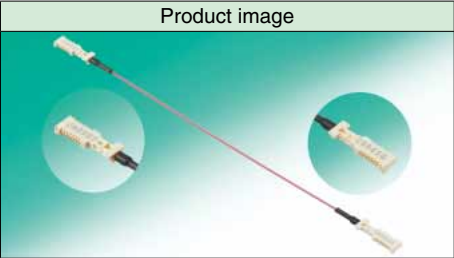
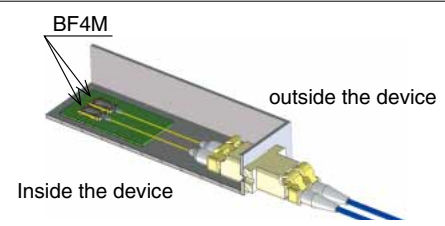
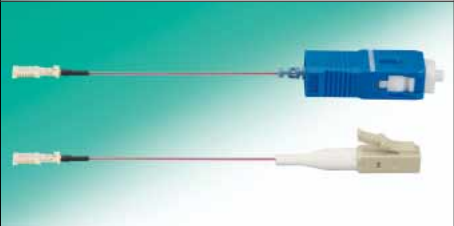
Power consumption is significantly reduced compared to conventional optical transceiver.



#### 6. Space-saving and low profile design with 1.5mm height

By using the BF4M, optical transmissions can be achieved with small form factor electronic connectors that save on overall size and valuable PCB space.

**BF4 variations**

TYPE	Used image	Product image
Both ends BF4M (Connection for board to board)		
One end BF4M, the other conventional optical connector (Connection for box interface)		

**Electrical characteristics**

● **Electrical characteristics of BF4MC-TX (transmitter side)**

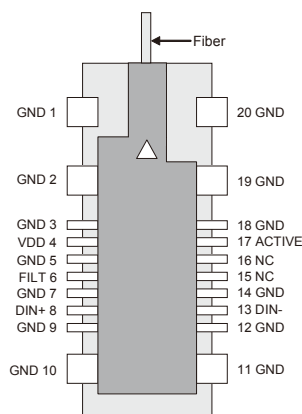
	Min	Nominal	Max	Unit
Transmission speed (8B/10B)	0.05	—	6.25	Gbps
VDD voltage	2.25	2.5/3.3	3.6	V
ACTIVATE = H voltage	1.0	—	VDD voltage	V
DIN common voltage	150	—	340	mVp
DIN differential voltage	200	—	1400	mVp

● **Electrical characteristics of BF4MC-RX (receiver side)**

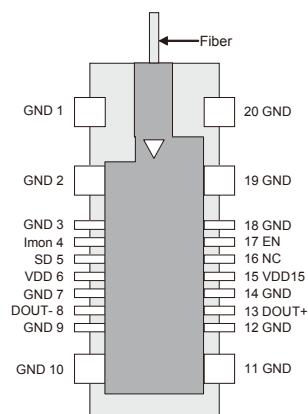
	Min	Nominal	Max	Unit	Remarks
Transmission speed (8B/10B)	0.05	—	6.25	Gbps	—
VDD voltage	2.25	2.5/3.3	3.6	V	—
VDD 15 voltage	1.45	1.5	1.55	V	When driving with dual power sources
DOUT common voltage	160	—	330	mVp	—
DOUT differential voltage	160	—	330	mVp	—
SD = H voltage	1.0	1.5	1.6	V	—
I <sub>mon</sub>	20.0	—	—	uA	For internal inspection

**<Pin Assignment>**

**BF4MC-TX Plug**



**BF4MC-RX Plug**



Top View

**<Pin Functions>**

**Descriptions of BF4MC-TX pins**

Symbol	Name	Type	Details
VDD	V <sub>supply</sub>	Power	Power Supply DC+2.5 or +3.3V
GND	Ground	Ground	—
ACTIVE	Activate	Input	H voltage : Active mode L voltage : Sleep mode
FILT	Filter	—	Decoupling capacitor connection contact
DIN+	Data input +	Input	Differential Data Input
DIN-	Data input -	Input	Differential Data Input
NC	Not Connect	—	Not connected in normal operation

**Descriptions of BF4MC-RX pins**

Symbol	Name	Type	Details
VDD	V <sub>supply</sub>	Power	Power for PD(*)
VDD15	V <sub>dd1.5V</sub>	Power	Power for Core(*)
GND	Ground	Ground	—
SD	Signal Detect	Output	H voltage:Detected L voltage:Undetected
DOUT+	Data Output +	Output	Differential Data Output
DOUT-	Data Output -	Output	Differential Data Output
EN	Regulator Enable	Input	[Dual supply mode] Not connected [Single supply mode] EN pin must be connect to VDD
I <sub>mon</sub>	Mirrored photodiode current monitor	Output	Not connected(Inspection pin)
NC	Not Connect	—	Not connected in normal operation

(\*): For details, see Hirose's technical specification ETAD-K0671.

## ■ Product Materials

### ● Plug harnesses

Component		Materials
Transmitter plug (TX)	Housing	LCP (White)
	Contact	Phosphor bronze (Au plating)
	Plate	Phosphor bronze (Ni plating)
	VCSEL	GaAs
	VCSEL driver	Si (CMOS)
	Bonding wire	Au
	Sealing resin	Epoxy resin
	Heat shrink tubing	Polyolefin (Black)
	ESD cap	Elastomer (Black)
Receiver plug (RX)	Housing	LCP (White)
	Contact	Phosphor bronze (Au plating)
	Plate	Phosphor bronze (Ni plating)
	PD	GaAs
	TIA / LA	Si (CMOS)
	Bonding wire	Au
	Sealing resin	Epoxy resin
	Heat shrink tubing	Polyolefin (Black)
	ESD cap	Elastomer (Black)
Optical fiber	Fiber	Silica glass (GI-50/80)
	Coating	UV curable resin / Thermoplastic resin (φ0.5)
SC connector	Housing	PBT (Blue)
	Boot	Elastomer (Blue)
	Spring	Stainless steel
	Ferrule	ZrO2
	Ferrule flange	Stainless steel
	Cap	Elastomer (Black)
LC connector	Housing	PEI (Beige)
	Boot	Elastomer (White)
	Spring	Stainless steel
	Ferrule	ZrO2
	Ferrule flange	Brass
	Cap	PP (Black)

### ● Receptacles

Component		Materials
Transmitter Receptacle(TX) and Receiver Receptacle(RX)	Housing	LCP(Black)
	Contact	Phosphor bronze (Au plating)
	Shell	Phosphor bronze (Au plating)

## ■ Product Number Structure

Refer to the chart below when determining the product specifications from the product number.  
Please select from the product numbers listed in this catalog when placing orders.

### ● Plug harness

**BF4M C-6G TX RX - B1 - 75MM**

① ② ③ ④ ⑤ ⑥

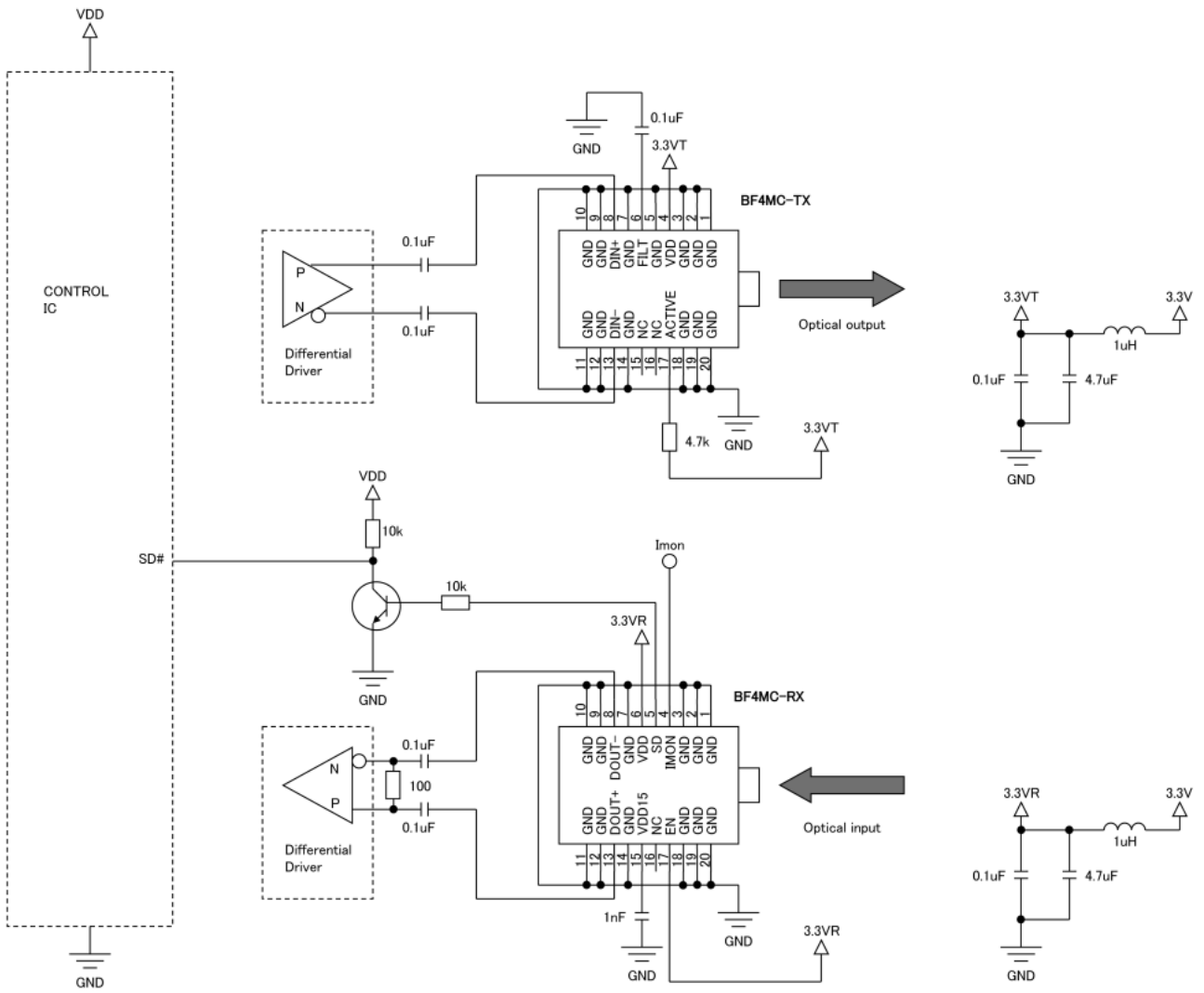
① Series
② Identification of Bit rate C-6G : 0.05 to 6.25 Gbps
③ ④ Type of plug that attaches to both ends of the harness TX : BF4 Transmitter plugx SC : SC connector RX : BF4 Receiver plug LC : LC connector
⑤ Type of fiber cable B1 : diameter φ0.5, Red B2 : diameter φ0.5, Blue
⑥ Identification of the length of the fiber cable *Cable length less than 1m ⇒ The end of the product name:**MM(Millimeter) *Cable length 1m or more ⇒ The end of the product name:**M(Meter)

### ● Receptacle

**BF4 - TX - 14 DS - 0.5 V (01)**

① ② ③ ④ ⑤ ⑥ ⑦

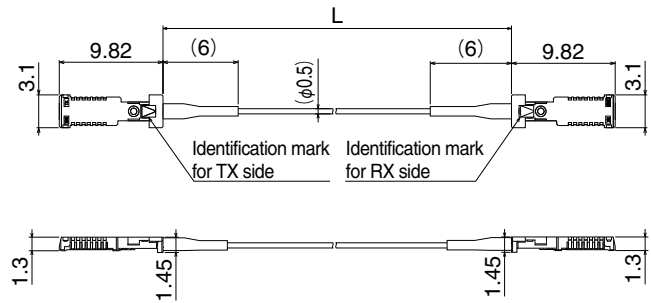
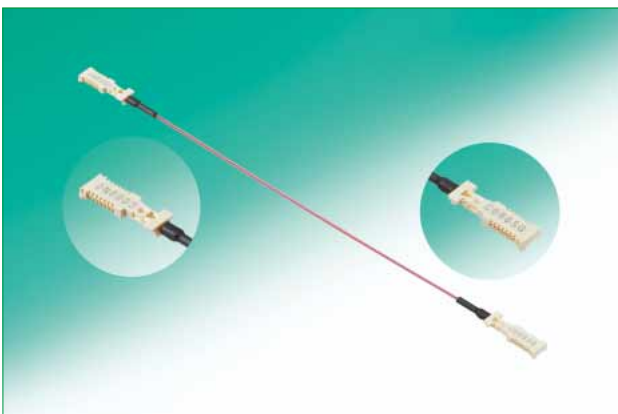
① Series
② Identification of the Transmitter and Receiver TX : Transmitter RX : Receiver
③ Number of Electrical terminal pin 14 pin
④ Identification of Socket shape Socket(S) of Double line assignment pins(D)
⑤ Identification of the electric terminal pitch 0.5mm
⑥ Identification of the mating method V : Vertical mated to the mounting surface
⑦ Packing specifications None : 500 pcs/reel (01) : 1000 pcs/reel (02) : 2000 pcs/reel (10) : 10 pcs/pack (11) : 100 pcs/reel



Connection example of +3.3 V (single power supply mode)

■ Product Appearance and HRS No.

● Plug harness

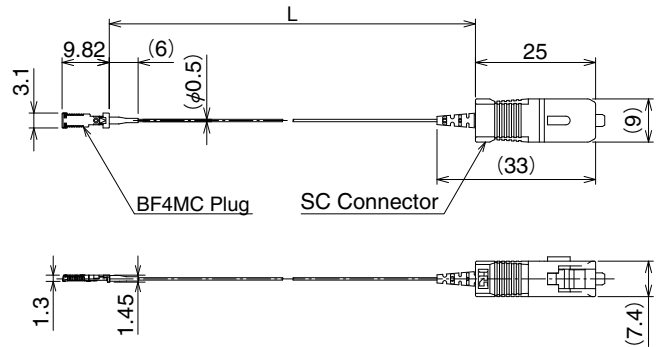
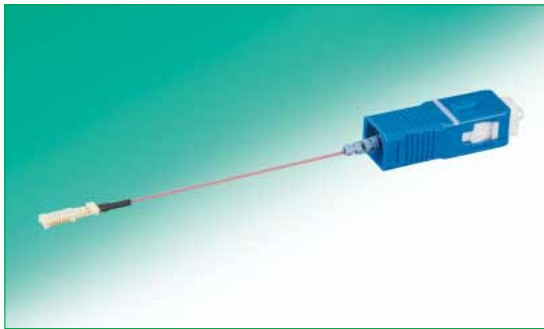


●BF4MC harness

Part No.	HRS No.	Fiber	Cable length L
BF4MC-6GTXRX-B1-45MM	831-1102-0 04	φ0.5 Red	45mm
BF4MC-6GTXRX-B1-50MM	831-1102-0 05		50mm
BF4MC-6GTXRX-B1-55MM	831-1102-0 06		55mm
BF4MC-6GTXRX-B1-60MM	831-1102-0 07		60mm
BF4MC-6GTXRX-B1-65MM	831-1102-0 08		65mm
BF4MC-6GTXRX-B1-70MM	831-1102-0 09		70mm
BF4MC-6GTXRX-B1-75MM	831-1102-0		75mm
BF4MC-6GTXRX-B1-80MM	831-1102-0 11		80mm
BF4MC-6GTXRX-B1-85MM	831-1102-0 12		85mm
BF4MC-6GTXRX-B1-90MM	831-1102-0 13		90mm
BF4MC-6GTXRX-B1-95MM	831-1102-0 14		95mm
BF4MC-6GTXRX-B1-100MM	831-1102-0 15		100mm
BF4MC-6GTXRX-B1-1M	831-1109-9		1m
BF4MC-6GTXRX-B1-2M	831-1109-9 01		2m
BF4MC-6GTXRX-B1-3M	831-1109-9 02		3m
BF4MC-6GTXRX-B1-4M	831-1109-9 03		4m
BF4MC-6GTXRX-B1-5M	831-1109-9 04		5m

Length (L) of the harness

- The shortest harness length is 45mm, and the harness up to 100mm in length is available in 5mm increments. (45mm, 50mm, 55mm ..., 100mm)
- Harness longer than those listed above is also available upon request. Please inform us of your desired harness length.
- Blue Fiber color is also available. Contact Hirose sales representative for details.

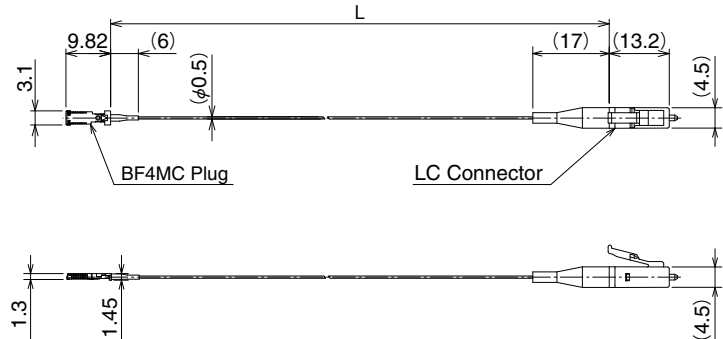


●BF4MC - SC Connector harness

Part No.	HRS No.	Fiber	Length	TX or RX
BF4MC-6GTXS-C-B1-100MM	831-1111-0	φ0.5 Red	100mm	TX
BF4MC-6GRXS-C-B1-100MM	831-1112-0		100mm	RX

The shortest harness length is 100mm.

- Please use the transmit and receive BF4MC connectors together.
- Harness longer than those listed above is also available upon request. Please inform us of your desired harness length.
- Blue fiber color is also available.



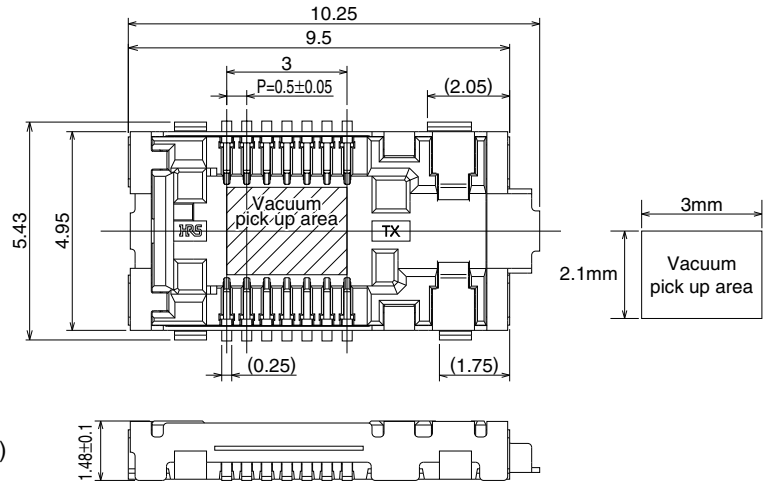
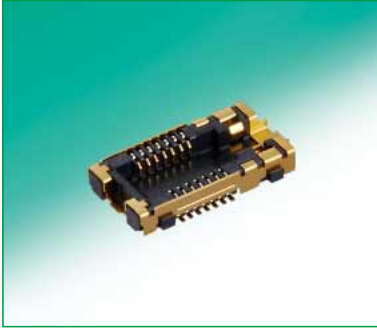
●BF4MC - LC Connector harness

Part No.	HRS No.	Fiber	Length	TX or RX
BF4MC-6GTXL-C-B1-100MM	831-1114-0	φ0.5 Red	100mm	TX
BF4MC-6GRXL-C-B1-100MM	831-1135-0		100mm	RX

The shortest harness length is 100 mm.

- Please use the transmit and receive BF4MC connectors together.
- Harness longer than those listed above is also available upon request. Please inform us of your desired harness length.
- Blue fiber color is also available.

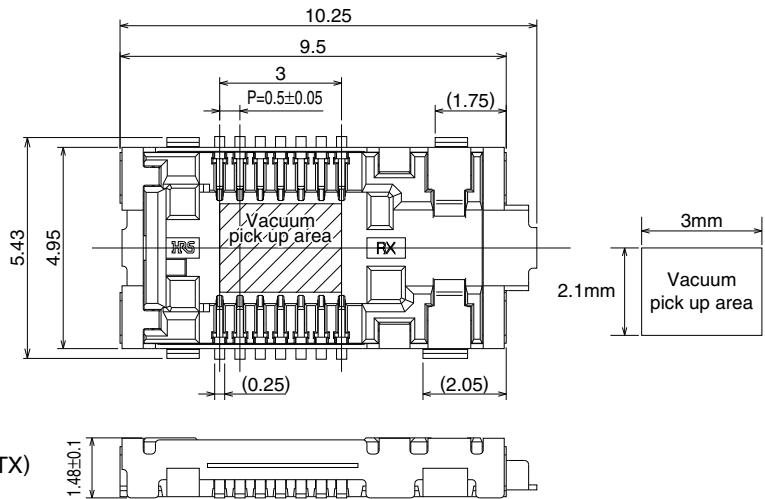
● Receptacle: Transmitter (TX)



The structure is designed so that the receiver (RX) plug does not mate.

Part No.	HRS No.	Package specifications
BF4-TX-14DS-0.5V	831-0008-6	500 pcs/reel
BF4-TX-14DS-0.5V(01)	831-0008-6 01	1000 pcs/reel
BF4-TX-14DS-0.5V(02)	831-0008-6 02	2000 pcs/reel
BF4-TX-14DS-0.5V(10)	831-0008-6 10	10 pcs/pack
BF4-TX-14DS-0.5V(11)	831-0008-6 11	100 pcs/reel

● Receptacle: Receiver (RX)

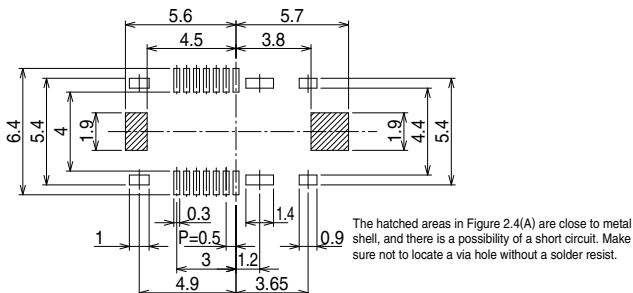


The structure is designed so that the transmitter (TX) plug does not mate.

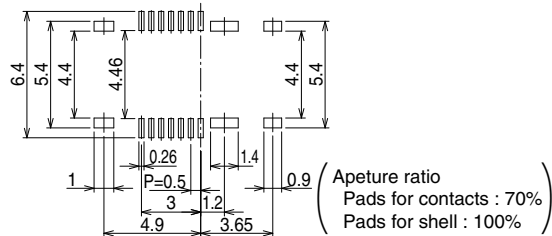
Part No.	HRS No.	Package specifications
BF4-RX-14DS-0.5V	831-0009-9	500 pcs/reel
BF4-RX-14DS-0.5V(01)	831-0009-9 01	1000 pcs/reel
BF4-RX-14DS-0.5V(02)	831-0009-9 02	2000 pcs/reel
BF4-RX-14DS-0.5V(10)	831-0009-9 10	10 pcs/pack
BF4-RX-14DS-0.5V(11)	831-0009-9 11	100 pcs/reel

● Receptacle: Pattern Layout

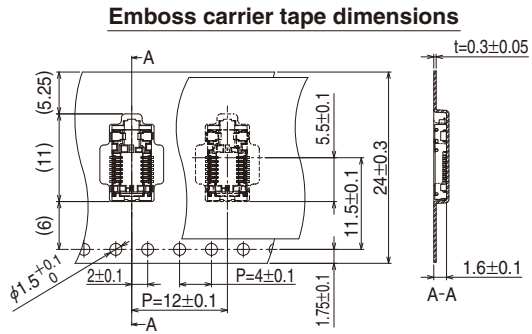
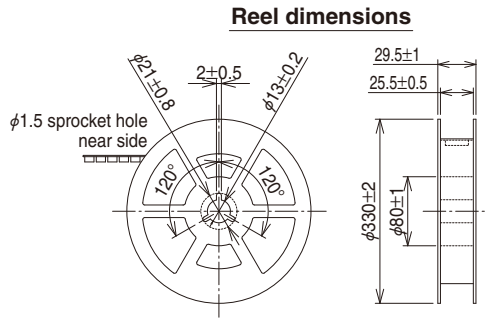
Recommended PCB land pattern dimensions



Recommended stencil dimensions (Stencil thickness 120 μm)

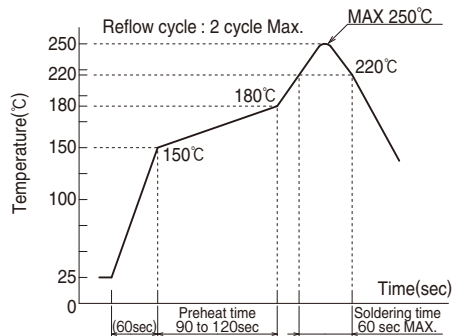


● Packaging Specifications for the receptacles

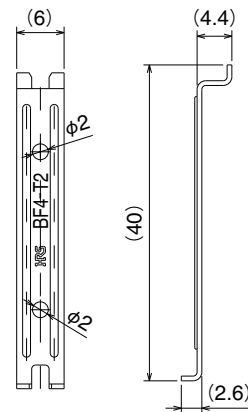


◆ Recommended reflow temperature profile (lead-free solder)

Recommended reflow temperature profile (lead-free solder)

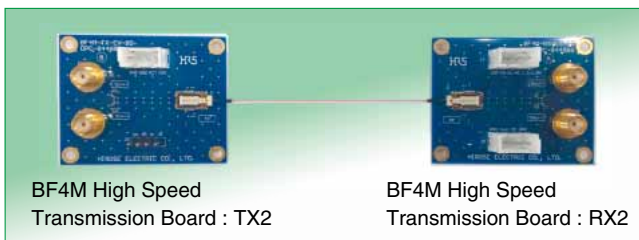


◆ Extraction tool



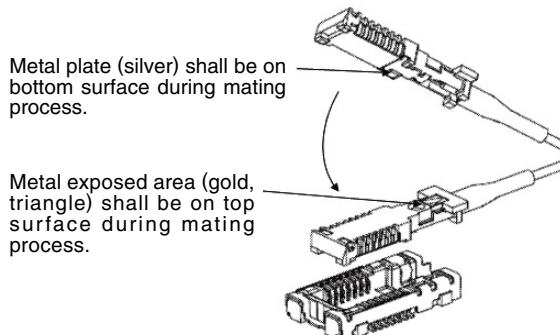
Part No.	HRS No.	Packing specifications
BF4-T2	831-0006-0	1 piece

◆ Test board



PCBs for testing and evaluation are available. Please contact us for more information.

◆ Connector Mating Method

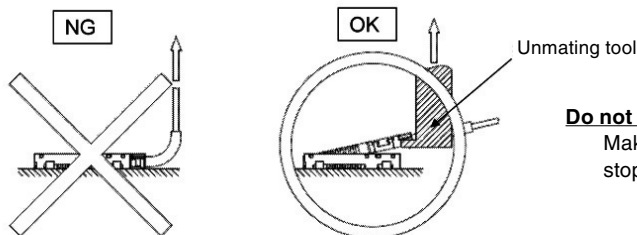


**Do not mate the connector while power is being supplied**

Make sure to insert or remove the plug after the power supply is turned off. Hot plugging/unplugging may cause damage.

## ◆ Cautions

Do not pull the fiber when removing the connector. When removing the connector, make sure to hook the plug with an extraction tool so that the stress is not applied to the cable. Pulling the cable to remove it may cause a breakage in the cable



### **Do not remove the plug while power is being supplied.**

Make sure to remove the plug after the power supply is stopped. Hot plugging / unplugging may cause damage.

## ◆ Notes on handling of the product

### (Notes on change of information)

The content of this document including the information regarding the connector (hereafter, the Product) is subject to change without prior notice.

### (Prohibition of reproduction)

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### (Responsibilities for design safety)

Hirose shall assume no responsibilities for the support for the application of the Product or the product design of the customer. The customer shall be responsible for the product and application of the customer in which the Product is used. The customer shall take appropriate design and operational safety measures in order to minimize the potential risks predicted for the product and application of the customer in which the Product is used.

### (Responsibilities for determination of the suitability)

When using the Product, the customer shall ensure safe design at his/her own responsibility so that malfunction or failure of the Product would never cause an infringement on the life, body or property. For design or use of the Product, make sure to refer to the materials (including the catalog, specifications, and design note) and follow the same. When using information including the product data provided in the document, technical data or circuit examples shown in the figures and tables, the customer shall evaluate the information on the customer's product and determine the suitability at the customer's own responsibility.

### (Responsibilities for specific applications)

Make sure to consult with our sales representative in advance when considering of use for specific applications that require extremely high quality and reliability (e.g. nuclear equipment, aerospace systems, transportation equipment and various safety related equipment).

### (Prohibition of replication)

Do not disassemble reverse-engineer, modify, analyze or replicate the Product.

### (Prohibition of application to prohibited products)

The Product must not be used for any product that manufacture, use and sale of which is prohibited by the domestic or international laws, regulations and ordinances.

### (Notes on the guarantee and license)

The technical data provided in the materials of the Product is intended to describe the representative behaviors and application of the Product. It is not to guarantee the intellectual property rights or any other rights of Hirose nor a third party and not to grant the license.

### (Notes on the warranties for the contract)

Unless otherwise provided in a written contract or other documents (specifications) agreed between the customer and Hirose, Hirose makes no warranties of any kind (including, but not limited to, warranties of the function and operation, warranties of merchantability, warranties of suitability for a specific application or purpose and warranties of correctness of the information).

### (Prohibition of weapons of mass destruction and military purposes)

It is prohibited to use the Product or the technical information contained in this document for any military purposes, including but not limited to, development of weapons of mass destruction.

### (Notes on export)

To export the Product to other countries, the exporter shall conduct the applicability determination based on Foreign Exchange and Foreign Trade Act of Japan. If you wish to have the applicability determination sheet issued by Hirose, contact our sales representative. Note that in the export arrangement, the customer shall be an exporter and responsible for compliance with all the applicable laws and regulations and terms and conditions of the agreement with Hirose.

## ◆ Notes on use of the product

### (Notes on the specification range)

Using the Product under conditions beyond the specification range (for voltage, current and temperature) provided in this document may result in an accident (including ignition, heat generation, and smoking). Confirm the document thoroughly and make sure to use the Product within the specification range.

### (Notes on the laser)

The laser beam is emitted from the end-face of the optical fiber in operation. It may cause eye injury or loss of sight if it enters the eyes. Do not stare directly into the end-face of the optical fiber. The laser beam is emitted from the VCSEL in operation. It may not be visible depending on its wavelength, but nonetheless it may cause eye injury or loss of sight if the laser beam or its reflected beam enters the eyes. Do not stare (look into) the laser beam directly.

### (Notes on fracture of the optical fiber)

In case of fracture of the optical fiber used in the Product, turn off the power immediately. In addition, Use care when handling it to avoid injury from fractured parts or fragments.

### (Notes on use of GaAs)

The Product is equipped with a semiconductor within the connector and contains gallium arsenide (GaAs).

### (Notes on the environment including gases)

Avoid the use of the Product in gas environments with chlorides or sulfides. The Product may deteriorate and features may be affected.

### (Notes on storage)

Store the Product out of corrosive substances, corrosive gases, high temperature and humidity or direct sunlight. Do not apply excessive pressure or vibration to the Product. It may cause deterioration, deformation, damage or failure of the Product.

### (Notes on resin molded part)

The resin molded part of the Product may contain black spots or its color may be slightly different, but that has no effect on the product performance.



# HIROSE ELECTRIC CO.,LTD.

2-6-3,Nakagawa Chuoh,Tsuzuki-Ku,Yokohama-Shi 224-8540,JAPAN

TEL: +81-45-620-3526 Fax: +81-45-591-3726

<http://www.hirose.com>

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