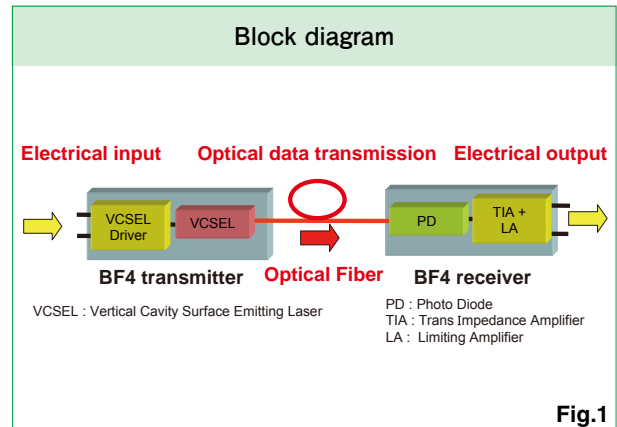


# Active Optical Connector

## 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.

### 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.

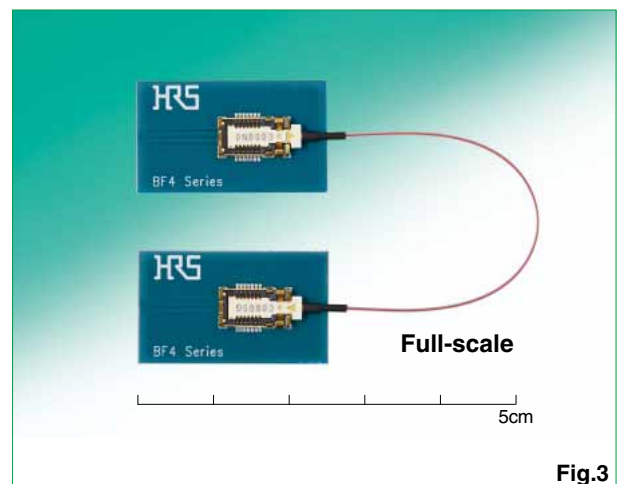
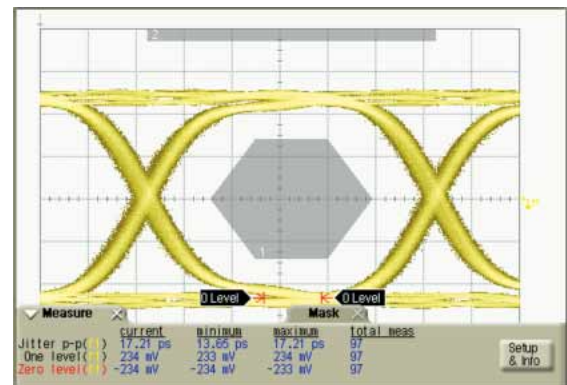
#### 4. Long-distance, high-speed and high quality signal transmissions

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.

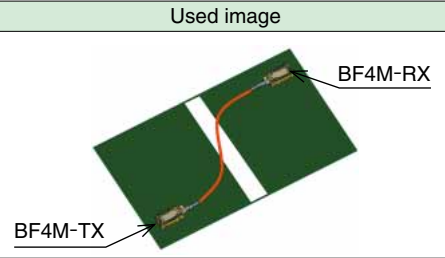
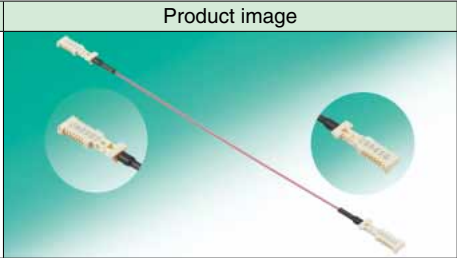
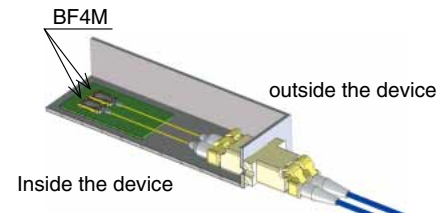

### Eye Diagram (Typical) : Transmission speed 6.25 Gbps, Length 5 meters



#### 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<br>(Connection for board to board)  |  |  |
| One end BF4M, the other conventional optical connector<br>(Connection for box interface) |  |  |

**Electrical characteristics**

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

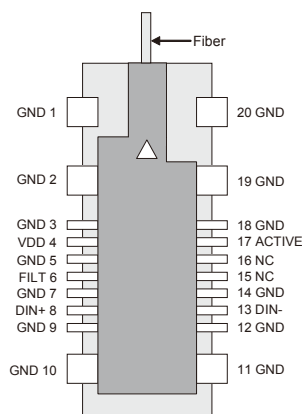
|                             | Min  | Nominal | Max         | Unit |
|-----------------------------|------|---------|-------------|------|
| Transmission speed (8B/10B) | 0.05 | —       | 6.25        | Gbps |
| VDD voltage                 | 2.25 | 2.5/3.3 | 3.6         | V    |
| ACTIVATE = H voltage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

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

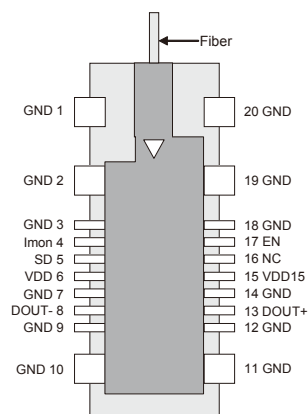
|                             | Min  | Nominal | Max  | Unit | Remarks                              |
|-----------------------------|------|---------|------|------|--------------------------------------|
| Transmission speed (8B/10B) | 0.05 | —       | 6.25 | Gbps | —                                    |
| 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<br>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<br>L voltage:Undetected   |
| DOUT+            | Data Output +                       | Output | Differential Data Output   |
| DOUT-            | Data Output -                       | Output | Differential Data Output   |
| EN               | Regulator Enable                    | Input  | [Dual supply mode]<br>Not connected<br>[Single supply mode]<br>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)<br>and<br>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

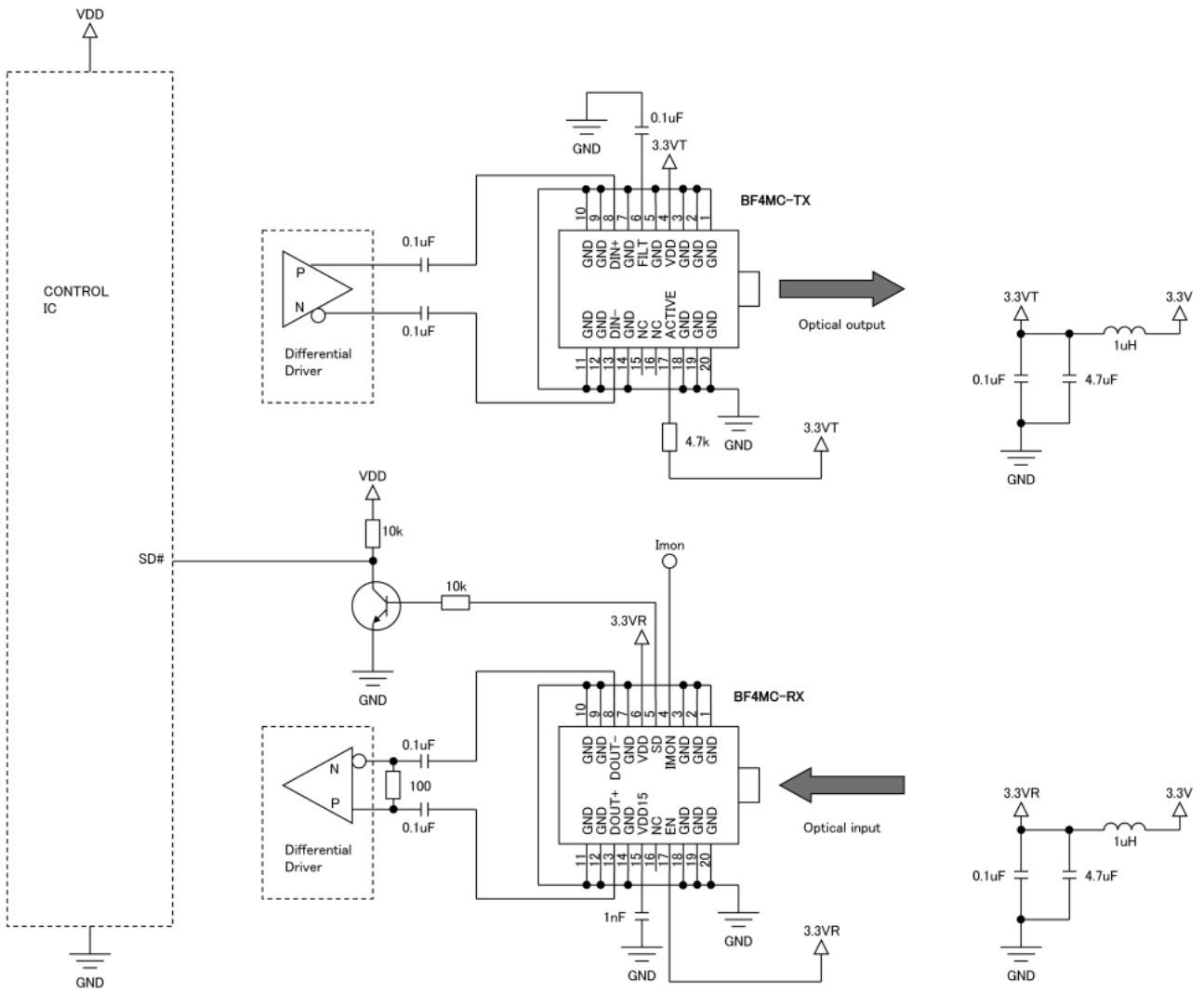
|   |
|---|
| ① Series  |
| ② Identification of Bit rate<br>C-6G : 0.05 to 6.25 Gbps  |
| ③ ④ Type of plug that attaches to both ends of the harness<br>TX : BF4 Transmitter plugx SC : SC connector<br>RX : BF4 Receiver plug LC : LC connector  |
| ⑤ Type of fiber cable<br>B1 : diameter φ0.5, Red<br>B2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

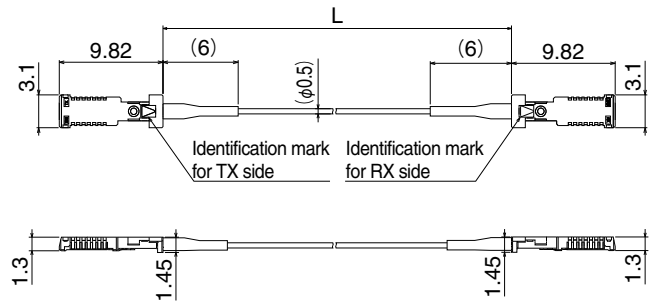
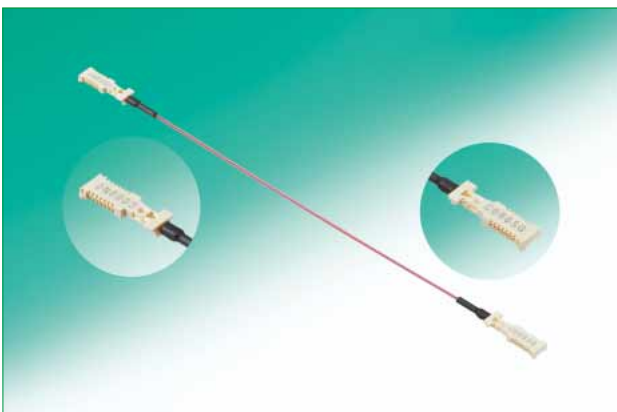
|  |
|--|
| ① Series   |
| ② Identification of the Transmitter and Receiver<br>TX : Transmitter<br>RX : Receiver  |
| ③ Number of Electrical terminal pin<br>14 pin  |
| ④ Identification of Socket shape<br>Socket(S) of Double line assignment pins(D)  |
| ⑤ Identification of the electric terminal pitch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



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

■ Product Appearance and HRS No.

● Plug harness

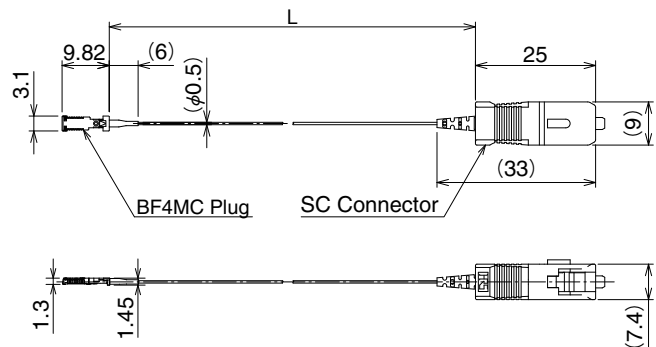


●BF4MC harness

| 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.

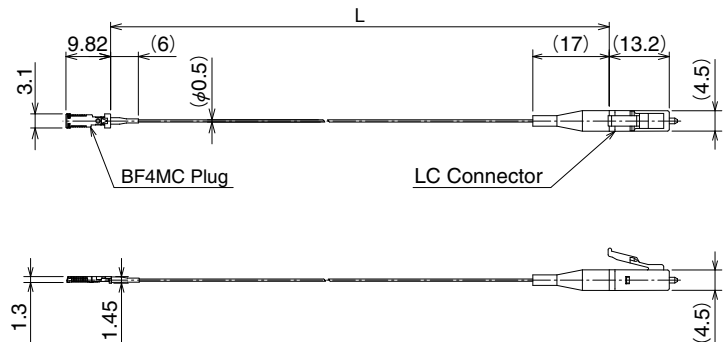
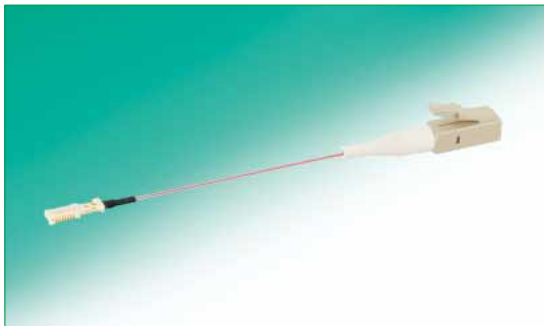


●BF4MC - SC Connector harness

| Part No.              | HRS No.    | Fiber    | Length | TX or RX |
|-----------------------|------------|----------|--------|----------|
| BF4MC-6GTXSC-B1-100MM | 831-1111-0 | φ0.5 Red | 100mm  | TX       |
| BF4MC-6GRXSC-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.



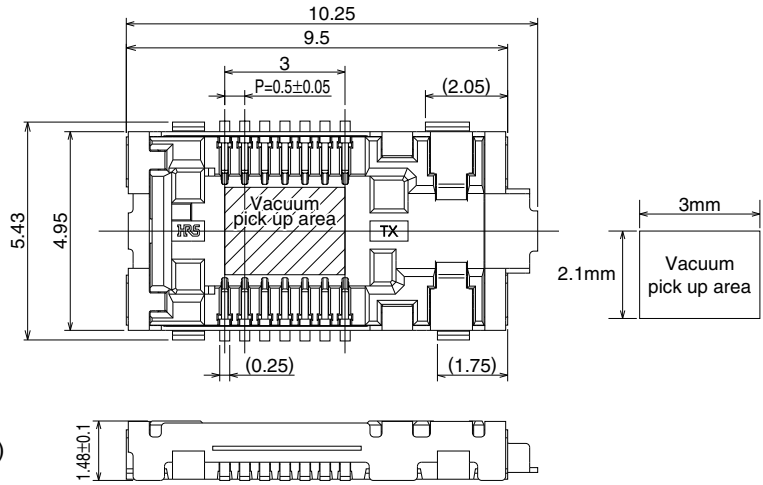
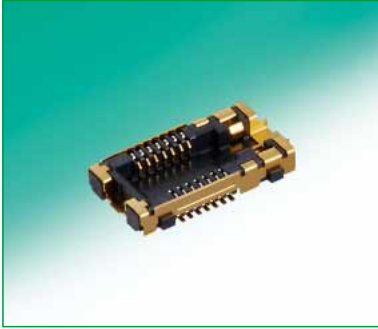
●BF4MC - LC Connector harness

| Part No.              | HRS No.    | Fiber    | Length | TX or RX |
|-----------------------|------------|----------|--------|----------|
| BF4MC-6GTXLC-B1-100MM | 831-1114-0 | φ0.5 Red | 100mm  | TX       |
| BF4MC-6GRXLC-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.

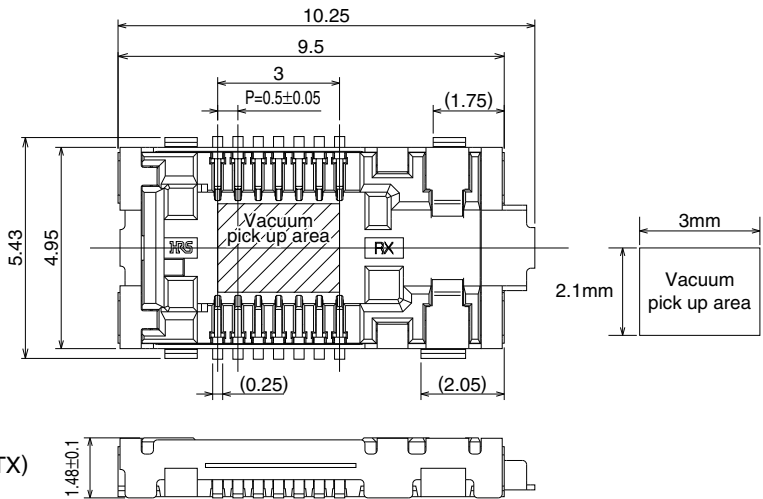
● Receptacle: Transmitter (TX)



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)

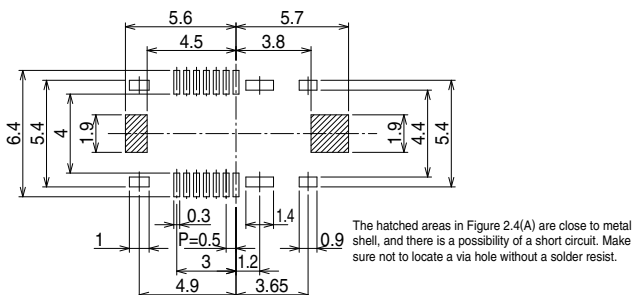


The structure is designed so that the transmitter (TX) plug does not mate.

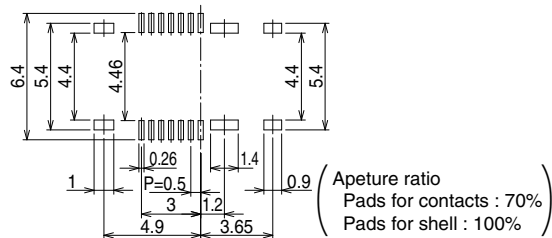
| Part No.             | HRS No.       | Package specifications |
|----------------------|---------------|------------------------|
| BF4-RX-14DS-0.5V     | 831-0009-9    | 500 pcs/reel           |
| BF4-RX-14DS-0.5V(01) | 831-0009-9 01 | 1000 pcs/reel          |
| BF4-RX-14DS-0.5V(02) | 831-0009-9 02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

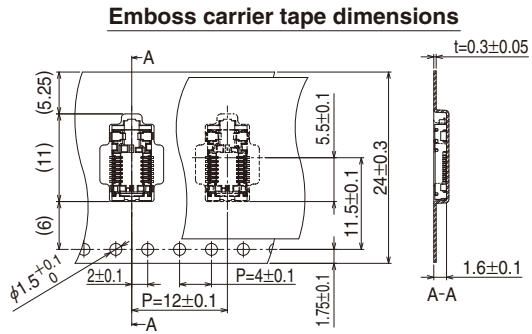
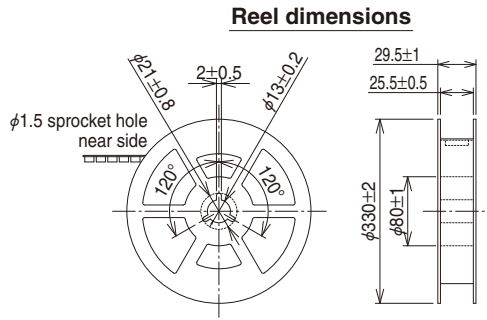


Recommended stencil dimensions (Stencil thickness 120 μm)



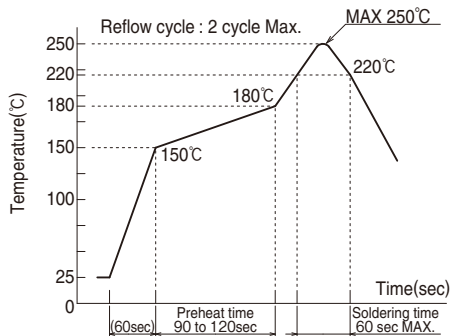


● Packaging Specifications for the receptacles

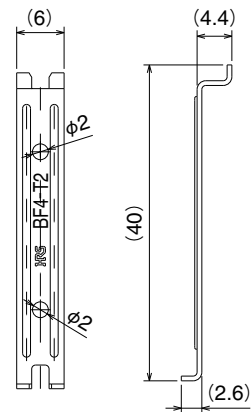


◆ Recommended reflow temperature profile (lead-free solder)

Recommended reflow temperature profile (lead-free solder)

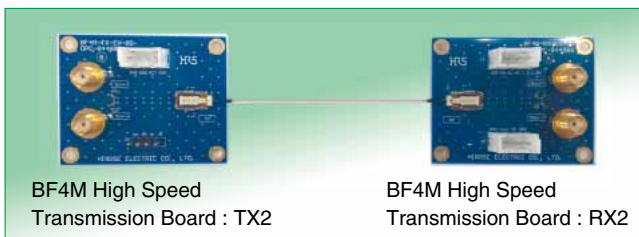


◆ Extraction tool



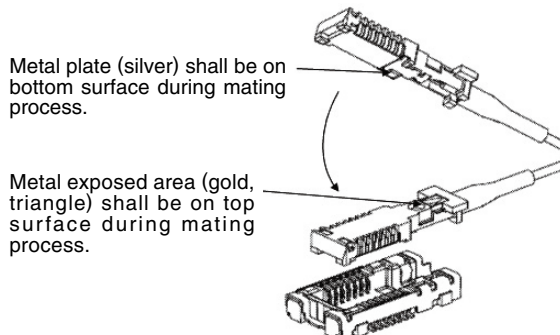
| Part No. | HRS No.    | Packing specifications |
|----------|------------|------------------------|
| BF4-T2   | 831-0006-0 | 1 piece                |

◆ Test board



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

◆ Connector Mating Method

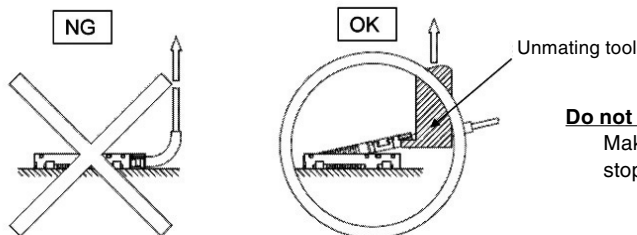


**Do not mate the connector while power is being supplied**

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)

No part of this document may be copied or reproduced without prior written consent of Hirose Electric Co., Ltd. (hereafter, Hirose). Even if written consent of Hirose is obtained, it is prohibited to amend any part of this document and copy or reproduce it. Hirose shall assume no obligation or liability in connection with such amended information or reproduction.

### (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>

<http://www.hirose-connectors.com>