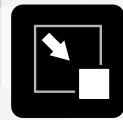


# MMCX Series

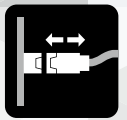
## Ultra-small Push-on Coaxial Connector



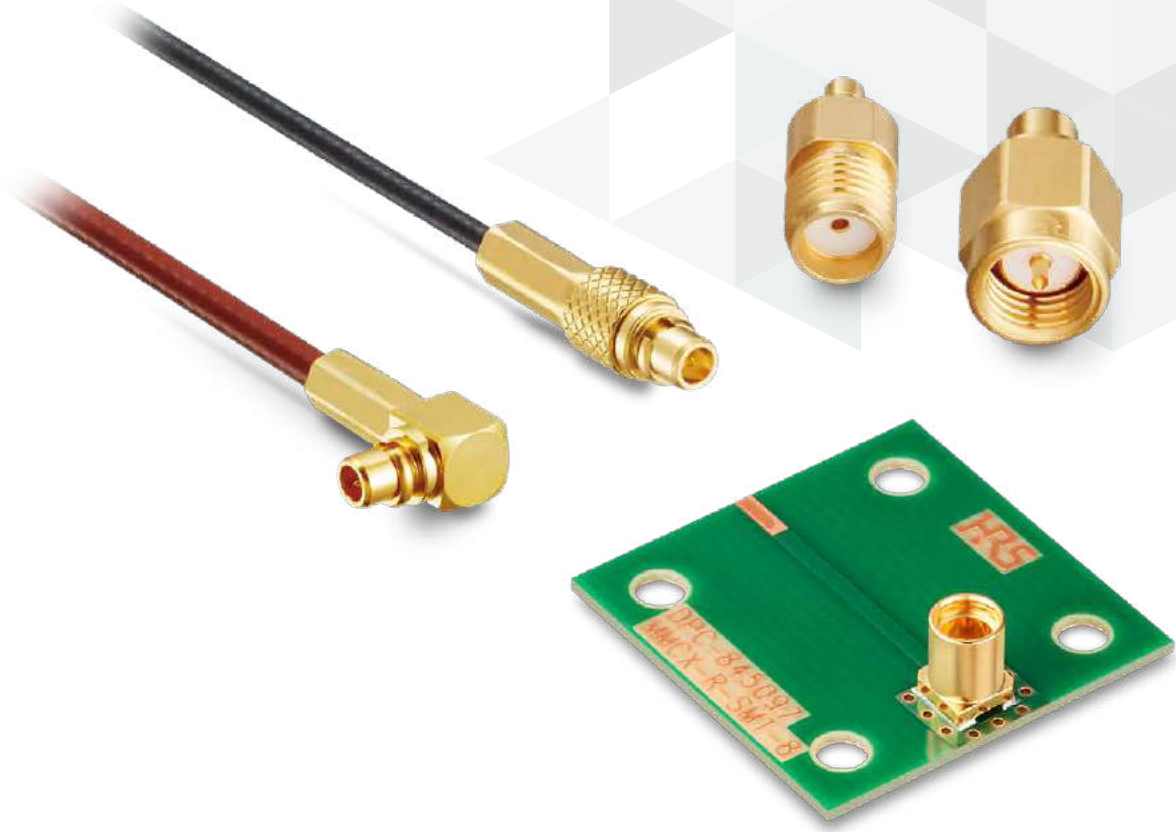
MMCX



Compact



Push On



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## Features

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### 1. Push-on System for Easy Attachment and Removal

### 2. Applicable Cable

RG Type High Frequency Coaxial Cable

- RG-178B/U ( $\phi$  1.8)
- RG-316/U ( $\phi$  2.59 Max.)

Extra-fine Fluororesin Cable

- Single Shielded Cable ( $\phi$  1.13,  $\phi$  1.37,  $\phi$  1.48)
- Double Shielded Cable ( $\phi$  1.32)

Semi-flexible Cable

- External conductor diameter equivalent to 0.085 inches  
(With jacket finishing diameter is  $\phi$  2.5)
- External conductor diameter equivalent to 0.047 inches  
(With jacket finishing diameter is  $\phi$  1.44)

### 3. Double-ended Cable Assembly with Other Hirose Series

Double-ended cable assembly available with H.FL, U.FL, SMA, and SMA(R).

### 4. High Frequency Characteristics

Guaranteed frequency : DC to 8GHz  
(The guaranteed frequency of some parts is DC to 6GHz.)

### 5. Two Types of Plugs Available

In addition to the standard plug, a mating compatible outer conductor contact reinforced type is also available.

### 6. RoHS2 Compliant

## Application Examples

Wireless LAN, GPS, POS, Measurement Instrument, Wiring Inside Transmission Equipment

## Product Specifications

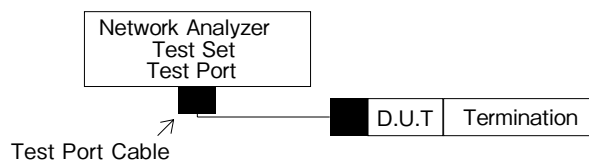
|                          |             |                          |              |
|--------------------------|-------------|--------------------------|--------------|
| Characteristic Impedance | 50 $\Omega$ | Operating Temperature    | -55 to +85°C |
| Rated Frequency          | DC to 8GHz  | Operating Humidity Range | 90% Max.     |

| Item                                      | Specification   | Condition   |
|---|---|---|
| Insulation Resistance                     | 500 M $\Omega$ Min.   | Measured with 500V DC   |
| Withstanding Voltage                      | No flashover or insulation breakdown  | 500V AC for 1 min.  |
| Contact Resistance                        | Center : 10m $\Omega$ Max.<br>Outer : 5m $\Omega$ Max.  | Measured at a maximum of 100mA (DC or 1000Hz)   |
| Retention Force of Female Contact         | 0.2 to 2N   | Measured with $\phi$ 0.37 pin gauge.  |
| Total Insertion / Extraction Force (Plug) | Insertion Force : 15N Max.,<br>Extraction Force : 6 to 15N  | Standard Type   |
|   | Extraction Force : 6N Min.  | Outer Conductor Contact Reinforced Type [MMCX(AR)]  |
| V.S.W.R.* (Note)                          | 1.2 Max.  | DC to 6GHz  |
|   | 1.4 Max.  | 6 to 8GHz   |
| Vibration Resistance                      | No electrical discontinuity for 1 $\mu$ s or more.<br>No damaged, cracks or loose parts.  | Frequency of 10 to 500Hz, single amplitude of 0.75mm, acceleration of 98m/s <sup>2</sup> for 12 cycles in each of the 3 axes direction.         |
| Thermal Shock                             | No electrical discontinuity for 1 $\mu$ s or more.<br>No damaged, cracks or loose parts.  | Acceleration of 735m/s <sup>2</sup> , for a duration of 6ms, sine half-wave waveform, 3 cycles in each of the 3 axes direction.                 |
| Humidity Resistance                       | No damaged, cracked or loose parts<br>Insulation Resistance : 10M $\Omega$ Min. (High Humidity)<br>Insulation Resistance : 500M $\Omega$ Min. (Dry) | 96 hours at temperature of 40°C and humidity of 95%.  |
| Temperature Cycle                         | No damaged, cracked or loose parts.   | Temperature : -55°C → +20 to +35°C → +85°C → +20 to +35°C<br>Time : 30 min. → 5 min. → 30 min. → 5 min.<br>5 cycles                             |
| Mating Durability                         | Contact Resistance<br>Center : 20m $\Omega$ Max.<br>Outer : 10m $\Omega$ Max.   | Mating/unmating : 500 mating cycles : Standard Type<br>Mating/unmating : 100 mating cycles : Outer Conductor Contact Reinforced Type [MMCX(AR)] |
| Salt Spray                                | Satisfies the V.S.M.R.  | 5% salt water solution for 48 consecutive hours   |

Note : Refer to section on V.S.W.R. for details.

### \* V.S.W.R. Measurement System

The above V.S.W.R. standard values were measured using the measurement system shown below.



Note 1 : The cable connector is measured attached to a double-ended cable assembly with an applicable 15cm cable.

Note 2 : The board connector is measured while mounted to a 50  $\Omega$  board and attached to a dedicated adapter.

### ● V.S.W.R.

V.S.W.R is 1.2 Max. (DC to 6GHz) or 1.4 Max. (6 to 8GHz) excluding the products listed below.

| Item   | Part No.              | V.S.W.R.                                      |
|--|-----------------------|---|
| Receptacle                                   | MMCX-R-SMT-8          | 1.2 Max. (DC to 8GHz)                         |
|  | MMCX-LR-SMT(40)       | 1.2 Max. (DC to 4GHz)                         |
|  |                       | 1.3 Max. (4 to 6GHz)<br>1.4 Max. (6 to 8GHz)  |
|  | MMCX-R-PC(40)         | 1.2 Max. (DC to 6GHz)                         |
| MMCX-LR-PC-1(40)                             | 1.3 Max. (DC to 3GHz) |   |
|  | 1.5 Max. (3 to 6GHz)  |   |
| Plug / Jack                                  | MMCX(AR)-P-SF047      | 1.3 Max. (DC to 3GHz)<br>1.4 Max. (3 to 8GHz) |
|  | MMCX(AR)-P-SF085      |   |
|  | MMCX(AR)-LP-SF047     |   |
|  | MMCX-PJ-SF085         |   |
|  | MMCX(AR)-LP-SF085     | 1.3 Max. (DC to 3GHz)                         |
| 1.4 Max. (3 to 4GHz)                         |                       |   |
| 1.5 Max. (4 to 5GHz)<br>1.6 Max. (5 to 6GHz) |                       |   |

## Materials / Finish

| Component                     | Material                                      | Finish       |
|-------------------------------|---|--------------|
| Shell                         | Brass<br>Stainless steel (Conversion Adapter) | Gold Plating |
| Male Center Contact           | Phosphor Bronze                               | Gold Plating |
| Female Center Contact         | Beryllium Copper                              | Gold Plating |
| In-line Contact (Male/Female) | Beryllium Copper (Conversion Adapter)         | Gold Plating |
| Insulator                     | PTFE Resin                                    | —            |
| Securing Ring                 | Beryllium Copper (Plug)                       | Gold Plating |
| Crimp Sleeve                  | Bronze  | Gold Plating |
| Cap                           | Brass (Plug)                                  | Gold 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.

### ■ Standard Type

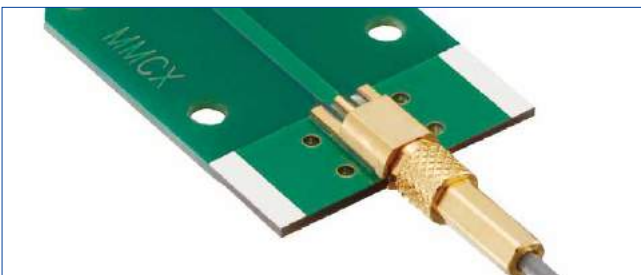
## MMCX - LP - 066 (40)

- ①      ②      ③      ④

|                         |  |   |   |
|-------------------------|--|---|---|
| <p>① Series Name</p>    | <p>MMCX</p>  | <p>③ Applicable Cable /PCB Mounting Style</p> | <p>178B/U : RG-178B/U ( φ 1.8)<br/>                     316/U : RG-316/U ( φ 2.59 Max.)<br/>                     FHSB : φ 1.48 (Single Shielded Cable)<br/>                     Coaxial Fluororesin Cable<br/>                     088 : φ 1.37 (Single Shielded Cable)<br/>                     Coaxial Fluororesin Cable<br/>                     066 : φ 1.32 (Double Shielded Cable)<br/>                     Coaxial Fluororesin Cable<br/>                     : φ 1.13 (Single Shielded Cable)<br/>                     Coaxial Fluororesin Cable<br/>                     SF085 :External Conductor Diameter<br/>                     Equivalent to 0.085 Inches<br/>                     (With Jacket Finishing Diameter<br/>                     is φ 2.5)<br/>                     PC : PCB Through Hole Type<br/>                     SMT : PCB SMT Mounting Type</p> |
| <p>② Connector Type</p> | <p>P : Straight Plug<br/>                     LP : Right Angle Plug<br/>                     PJ, BPJ : Pannel Jack<br/>                     J : Straight Jack<br/>                     LR : Right Angle Receptacle<br/>                     R : Receptacle</p> | <p>④ Specifications</p>                       | <p>RoHS2 Compliant</p>  |

## Examples of Mated Condition

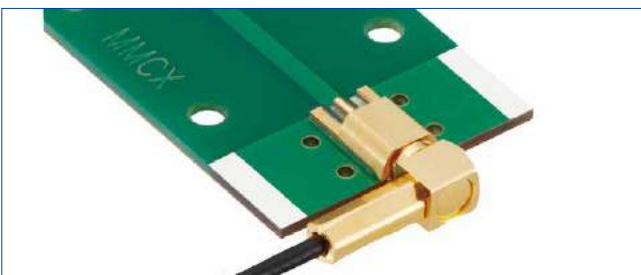
Right Angle Receptacle + Straight Plug



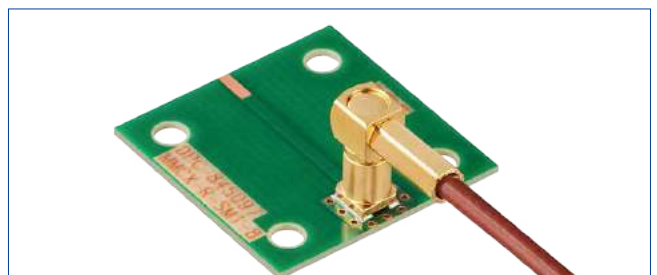
Straight Receptacle + Straight Plug



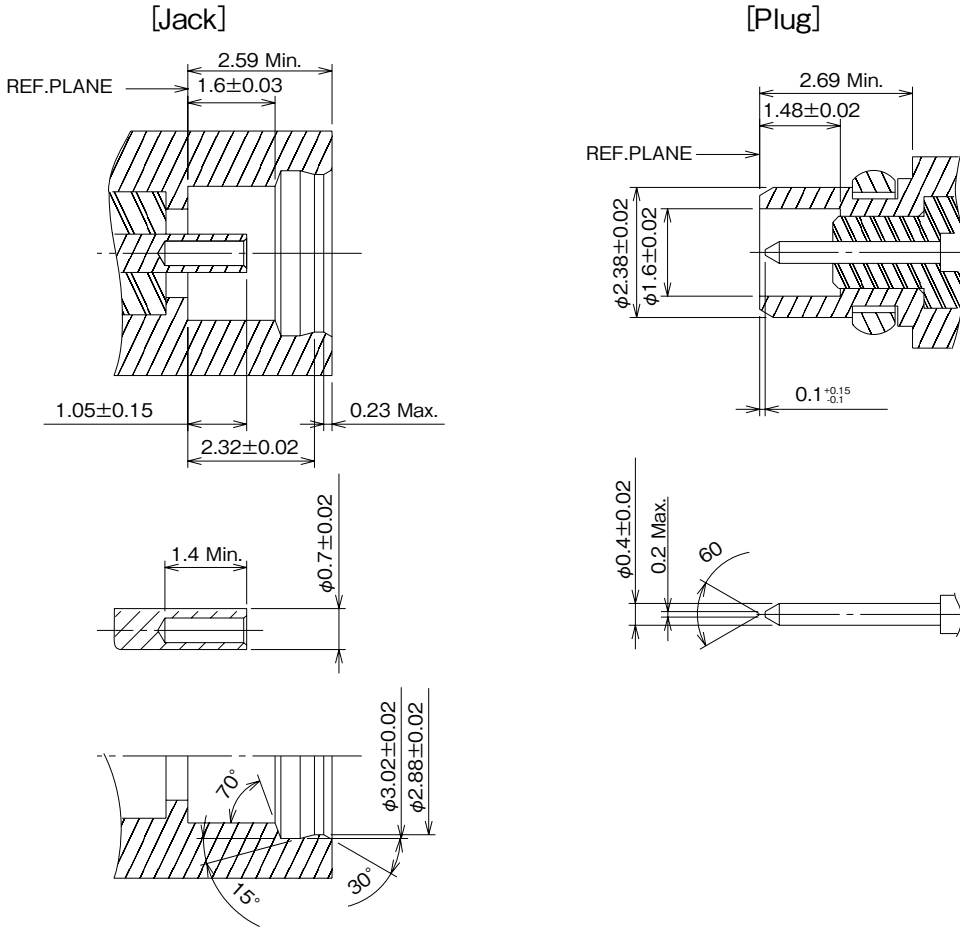
Right Angle Receptacle + Right Angle Plug



Straight Receptacle + Right Angle Plug

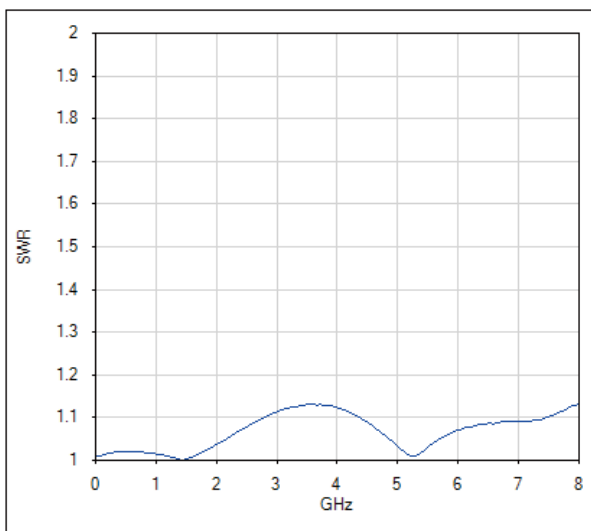


### Interface Dimensions

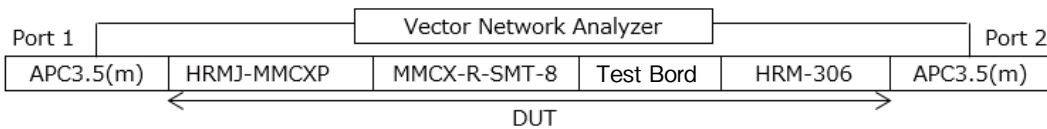
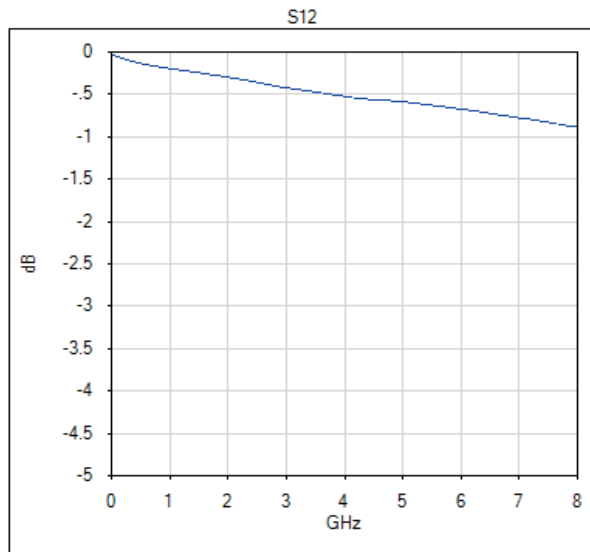


### [Reference] MMCX-R-SMT-8 High Frequency Characteristics

#### ■ Insertion Loss



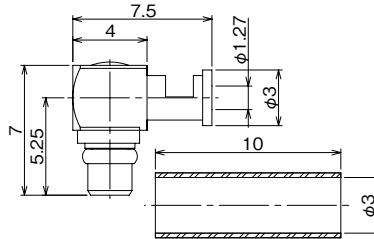
#### ■ V.S.W.R.



## Right Angle Plug

- For  $\phi 1.32$  Double Shielded Cable  
For  $\phi 1.13$  Single Shielded Cable

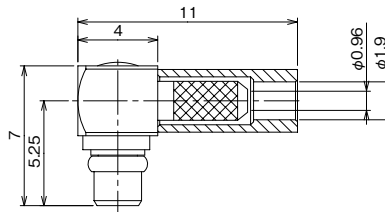
Connects with U.FL-LP-066HF(06).



| Part No.        | HRS No.          | Purchase Unit |
|-----------------|------------------|---------------|
| MMCX-LP-066(40) | CL0339-0019-2-40 | 20pcs per bag |

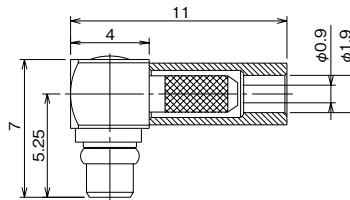
- For  $\phi 1.37$  Single Shielded Cable

Connects with U.FL-LP-088HF(06).



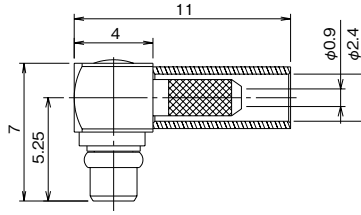
| Part No.        | HRS No.          | Purchase Unit |
|-----------------|------------------|---------------|
| MMCX-LP-088(40) | CL0339-0020-1-40 | 20pcs per bag |

- For  $\phi 1.48$  Single Shielded Cable



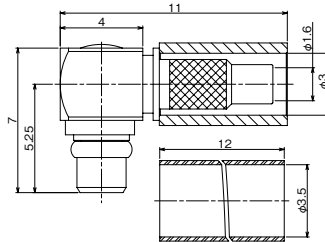
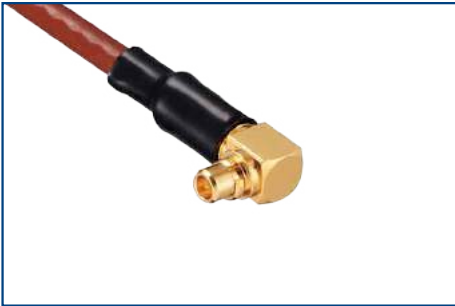
| Part No.         | HRS No.          | Purchase Unit  |
|------------------|------------------|----------------|
| MMCX-LP-FHSB(40) | CL0339-0007-3-40 | 100pcs per bag |

● For RG-178B/U Cable



| Part No.           | HRS No.          | Purchase Unit |
|--------------------|------------------|---------------|
| MMCX-LP-178B/U(40) | CL0339-0001-7-40 | 20pcs per bag |

● For RG-316/U Cable



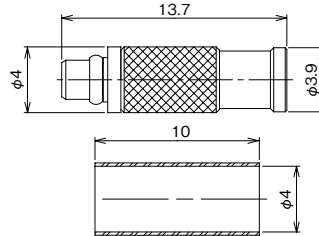
| Part No.          | HRS No.          | Remarks  |
|-------------------|------------------|--|
| MMCX-LP-316/U(40) | CL0339-0006-0-40 | We accept cable assembly specifications. Please contact a Hirose sales representative. |



## Straight Plug

- For  $\phi 1.32$  Double Shielded Cable  
For  $\phi 1.13$  Single Shielded Cable

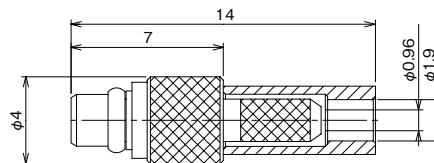
Connects with U.FL-LP-066HF(06).



| Part No.       | HRS No.          | Purchase Unit  |
|----------------|------------------|----------------|
| MMCX-P-066(40) | CL0339-0023-0-40 | 100pcs per bag |

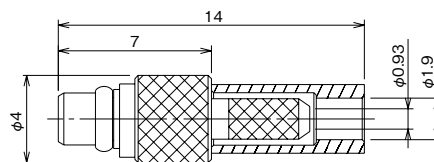
- For  $\phi 1.37$  Single Shielded Cable

Connects with U.FL-LP-088HF(06).



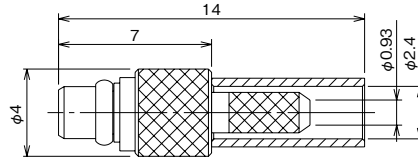
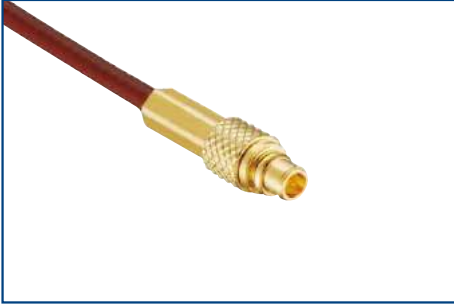
| Part No.       | HRS No.          | Purchase Unit |
|----------------|------------------|---------------|
| MMCX-P-088(40) | CL0339-0021-4-40 | 20pcs per bag |

- For  $\phi 1.48$  Single Shielded Cable



| Part No.        | HRS No.          | Purchase Unit  |
|-----------------|------------------|----------------|
| MMCX-P-FHSB(40) | CL0339-0008-6-40 | 100pcs per bag |

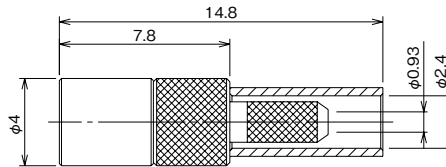
● For RG-178B/U Cable



| Part No.          | HRS No.          | Purchase Unit |
|-------------------|------------------|---------------|
| MMCX-P-178B/U(40) | CL0339-0010-8-40 | 20pcs per bag |

**Straight Jack**

● For RG-178B/U Cable

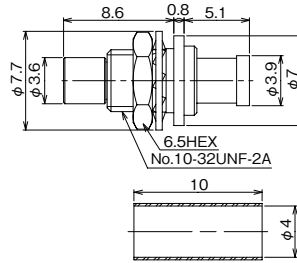


| Part No.          | HRS No.          | Purchase Unit  |
|-------------------|------------------|----------------|
| MMCX-J-178B/U(40) | CL0339-0011-0-40 | 100pcs per bag |

## Panel Jack

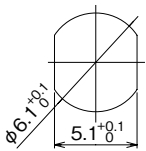
- For  $\phi 1.32$  Double Shielded Cable  
For  $\phi 1.13$  Single Shielded Cable

Connects with U.FL-LP-066HF(06).



| Part No.         | HRS No.          | Remarks  |
|------------------|------------------|--|
| MMCX-BPJ-066(40) | CL0339-0016-4-40 | We accept cable assembly specifications. Please contact a Hirose sales representative. |

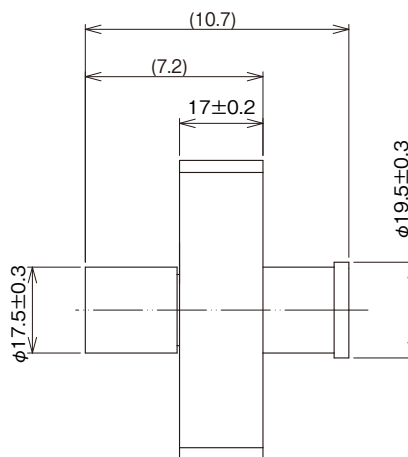
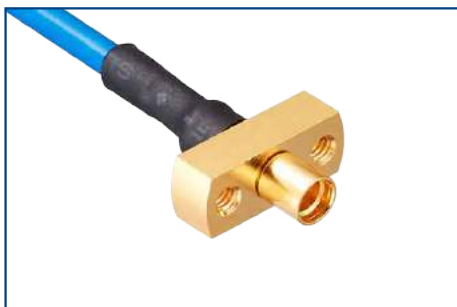
### Panel Cut-Out Dimensions



Recommended Panel Thickness : 1.3 to 2.5mm

- For Semi-flexible Cable (Low Loss Type)

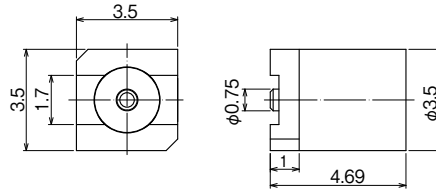
External conductor diameter equivalent to 0.085 Inches. (With jacket finishing diameter is  $\phi 2.5$ .)



| Part No.      | HRS No.          | Remarks  |
|---------------|------------------|--|
| MMCX-PJ-SF085 | CL0339-0045-0-00 | We accept cable assembly specifications. Please contact a Hirose sales representative. |

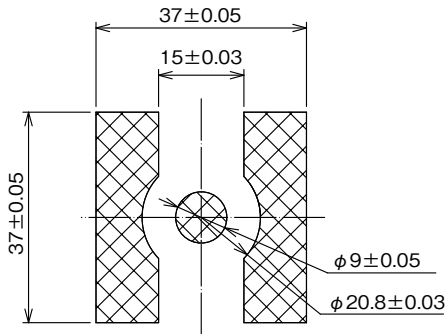
## Receptacle

### ● For Straight SMT

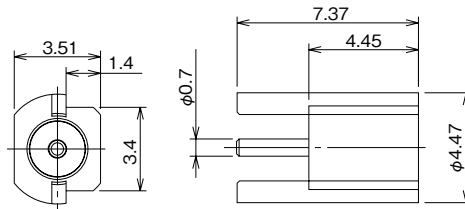


| Part No.     | HRS No.          | Purchase Unit   |
|--------------|------------------|-----------------|
| MMCX-R-SMT-8 | CL0339-0046-0-00 | 500pcs per reel |

### ■ Recommended PCB Layout

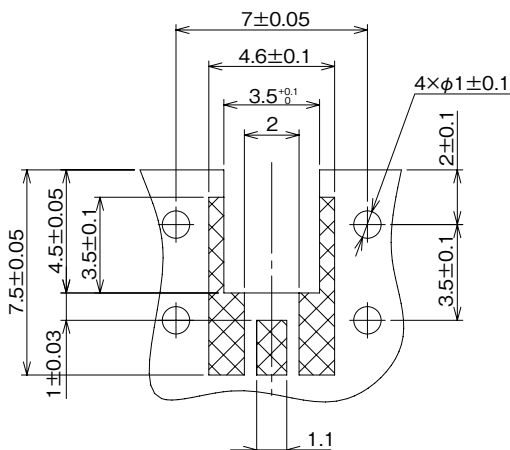


### ● For Right Angle SMT

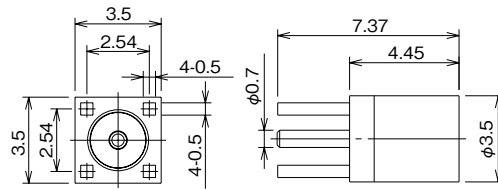


| Part No.        | HRS No.          | Purchase Unit  |
|-----------------|------------------|----------------|
| MMCX-LR-SMT(40) | CL0339-0003-2-40 | 50pcs per tray |

### ■ Recommended PCB Layout

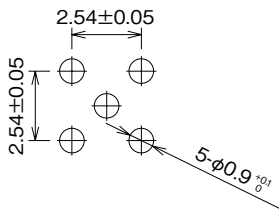


● For Straight Through-Hole

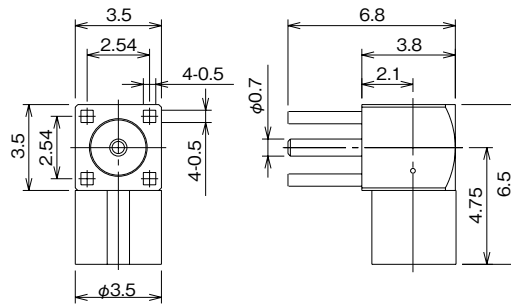


| Part No.      | HRS No.          | Purchase Unit  |
|---------------|------------------|----------------|
| MMCX-R-PC(40) | CL0339-0005-8-40 | 100pcs per bag |

■ Recommended PCB Dimensions

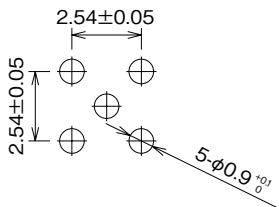


● For Right Angle Through-Hole



| Part No.         | HRS No.          | Purchase Unit |
|------------------|------------------|---------------|
| MMCX-LR-PC-1(40) | CL0339-0013-6-40 | 10pcs per bag |

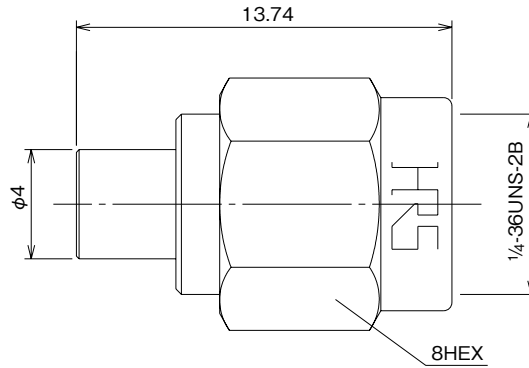
■ Recommended PCB Dimensions



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## Conversion Adapter

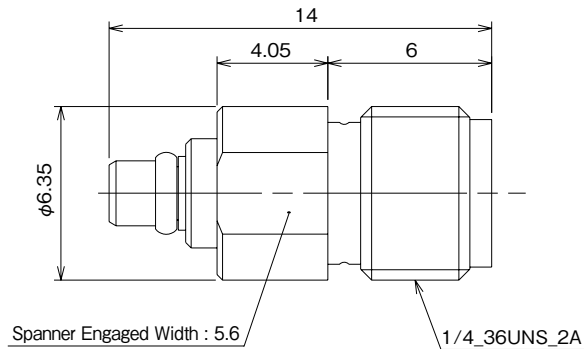
### ● SMA Conversion Adapter (Mated Portion : SMA Plug - MMCX Jack)



| Part No.   | HRS No.          | Purchase Unit |
|------------|------------------|---------------|
| HRMP-MMCXJ | CL0311-0312-1-00 | 20pcs per bag |

Note : Can be used with standard type and outer conductor contact reinforced type (MMCX[AR]) MMCX plugs.

### ● SMA Conversion Adapter (Mated Portion : SMA Jack - MMCX Plug)



| Part No.   | HRS No.          | Purchase Unit |
|------------|------------------|---------------|
| HRMJ-MMCXP | CL0311-0313-4-00 | 20pcs per bag |

## Plug/Jack Termination Tools

| Item             | Part No.           | Tool              | HRS No.           | Usage                      |
|------------------|--------------------|-------------------|-------------------|----------------------------|
| Right Angle Plug | MMCX-LP-066(40)    | MMCX-LP/PR-MP     | CL0902-3064-6-00  | Cap Press Fitting          |
|                  | MMCX-LP-088(40)    | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
|                  |                    | MMCX-LP/PR-MP     | CL0902-3064-6-00  | Cap Press Fitting          |
|                  | MMCX-LP-FHSB(40)   | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
|                  |                    | MMCX-LP/PR-MP     | CL0902-3064-6-00  | Cap Press Fitting          |
|                  | MMCX-LP-178B/U(40) | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
| MMCX-LP/PR-MP    |                    | CL0902-3064-6-00  | Cap Press Fitting |                            |
| Straight Plug    | MMCX-P-066(40)     | MMCX-P-066/CV-MD  | CL0902-3272-0-00  | Clamp Press Fitting        |
|                  | MMCX-P-088(40)     | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
|                  | MMCX-P-FHSB(40)    | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
|                  | MMCX-P-178B/U(40)  | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
| Straight Jack    | MMCX-J-178B/U(40)  | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |

# Outer Conductor Contact Reinforced Plug Connector [MMCX(AR)]

## 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.

### MMCX (AR) - LP - 066

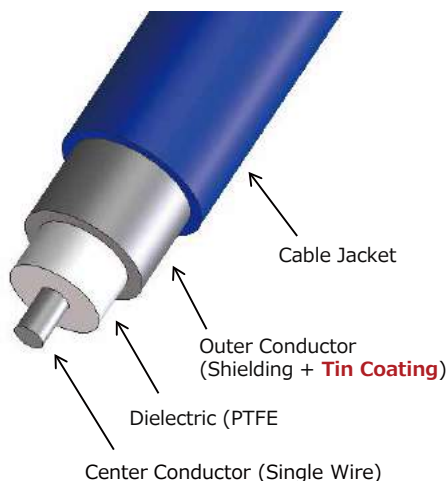
①      ②      ③      ④

|   |  |  |   |
|---|--|--|---|
| ① Series Name                             | MMCX   | ④ Applicable Cable or Board Mounting Style | 178B/U : RG-178B/U ( $\phi$ 1.8)  |
| ② Outer Conductor Contact Reinforced Type | (AR)   |  | FHSB : $\phi$ 1.48 (Single Shielded Cable)<br>Coaxial Fluororesin Cable   |
| ③ Connector Type                          | P : Straight Plug<br>LP : Right Angle Plug<br>TMP : Termination Plug |  | 088 : $\phi$ 1.37 (Single Shielded Cable)<br>Coaxial Fluororesin Cable  |
|   |  |  | 066 : $\phi$ 1.32 (Double Shielded Cable)<br>Coaxial Fluororesin Cable  |
|   |  |  | : $\phi$ 1.13 (Single Shielded Cable)<br>Coaxial Fluororesin Cable  |
|   |  |  | SF085 : External Conductor Diameter<br>Equivalent to 0.085 Inches<br>(With Jacket Finishing Diameter<br>is $\phi$ 2.5)  |
|   |  |  | SF047 : External Conductor Diameter<br>Equivalent to 0.047 Inches<br>(With Jacket Finishing Diameter<br>is $\phi$ 1.44) |

## [Reference] Semi-flexible Cable Configuration and Cable Loss Comparison

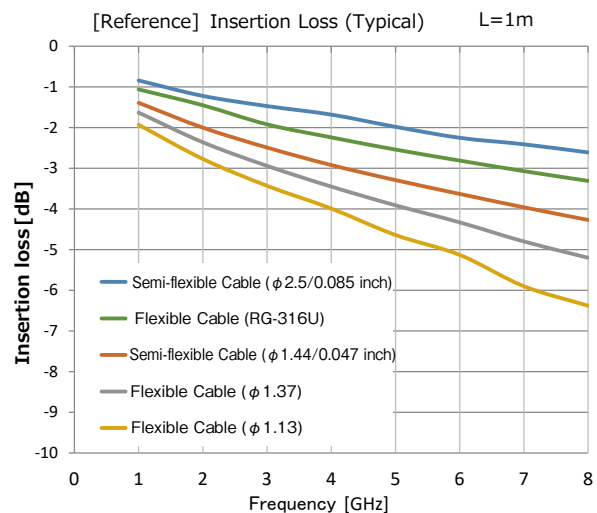
### Semi-flexible Cable Configuration

**Excellent Electrical Performance Due to  
Tin-Coated Braided Shielding**



### Insertion Loss Comparison

(Semi-flexible Cable & Flexible Cable)

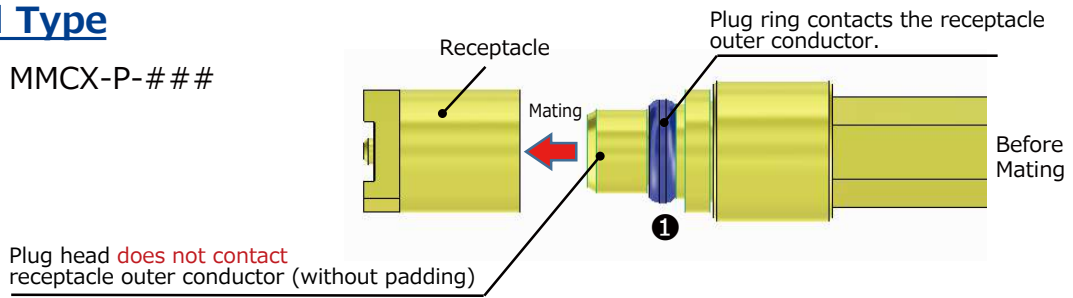




## Standard Type and Outer Conductor Contact Reinforced Type [MMCX(AR)]

### Standard Type

Product : MMCX-P-# # #

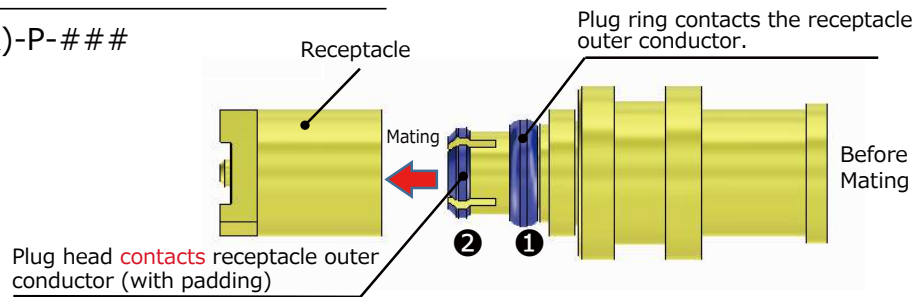


Only a single point makes contact with the outer conductor.

### Outer Conductor Contact Reinforced Type [MMCX(AR)]

Since the contact is strengthened compared to the standard type, mating feels tighter.

Product : MMCX(AR)-P-# # #



Contact with the receptacle outer conductor at two points enhances prying force and ensures high contact reliability even in difficult wiring conditions.

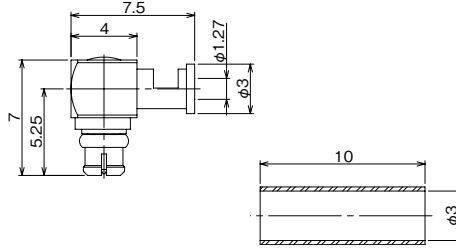
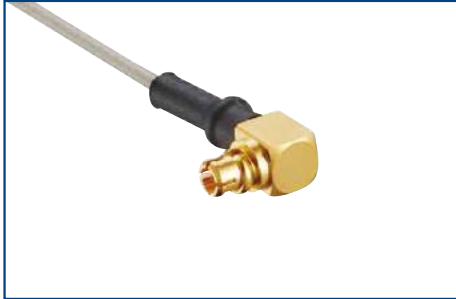
### Mating and Extraction Forces Comparison (Reference Value)

| (Reference Value)                                  | Mating Force | Extraction Force |
|--|--------------|------------------|
| Standard Type                                      | 15N          | 15N              |
| Outer Conductor Contact Reinforced Type [MMCX(AR)] | 35N          | 25N              |

## Right Angle Plug

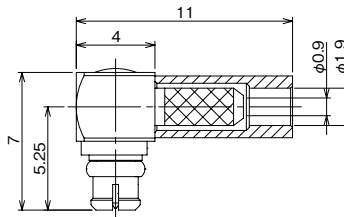
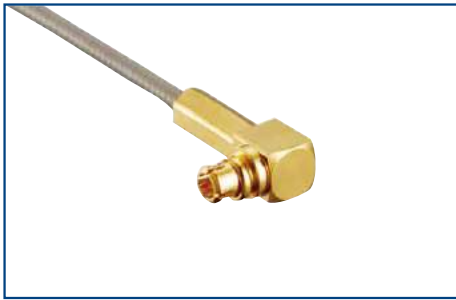
- For  $\phi 1.32$  Double Shielded Cable  
For  $\phi 1.13$  Single Shielded Cable

Connects with U.FL-LP-066HF(06).



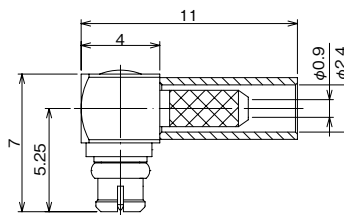
| Part No.        | HRS No.          | Purchase Unit |
|-----------------|------------------|---------------|
| MMCX(AR)-LP-066 | CL0339-0031-8-00 | 20pcs per bag |

- For  $\phi 1.48$  Single Shielded Cable



| Part No.         | HRS No.          | Purchase Unit  |
|------------------|------------------|----------------|
| MMCX(AR)-LP-FHSB | CL0339-0035-9-00 | 100pcs per bag |

- For RG-178B/U Cable

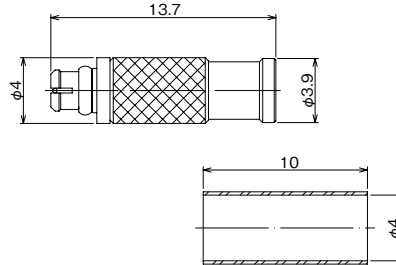


| Part No.           | HRS No.          | Purchase Unit  |
|--------------------|------------------|----------------|
| MMCX(AR)-LP-178B/U | CL0339-0033-3-00 | 100pcs per bag |

## Straight Plug

- For  $\phi 1.32$  Double Shielded Cable  
For  $\phi 1.13$  Single Shielded Cable

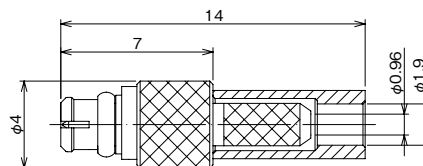
Connects with U.FL-LP-066HF(06).



| Part No.       | HRS No.          | Purchase Unit  |
|----------------|------------------|----------------|
| MMCX(AR)-P-066 | CL0339-0030-5-00 | 100pcs per bag |

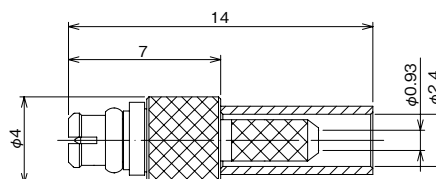
- For  $\phi 1.37$  Single Shielded Cable

Connects with U.FL-LP-088HF(06).



| Part No.       | HRS No.          | Purchase Unit |
|----------------|------------------|---------------|
| MMCX(AR)-P-088 | CL0339-0037-4-00 | 20pcs per bag |

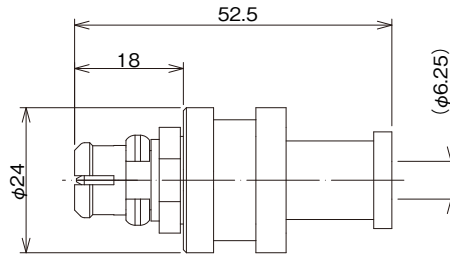
- For RG-178B/U Cable



| Part No.          | HRS No.          | Purchase Unit  |
|-------------------|------------------|----------------|
| MMCX(AR)-P-178B/U | CL0339-0038-7-00 | 100pcs per bag |

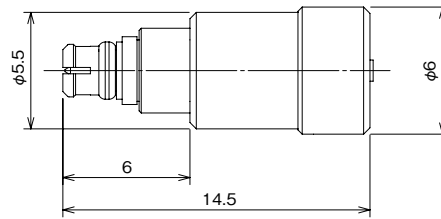
● For Semi-flexible Cable (Low Loss Type)

External conductor diameter equivalent to 0.047 Inches. (With jacket finishing diameter is  $\phi 1.44$ .)



| Part No.         | HRS No.          | Remarks  |
|------------------|------------------|--|
| MMCX(AR)-P-SF047 | CL0339-0032-0-00 | We accept cable assembly specifications. Please contact a Hirose sales representative. |

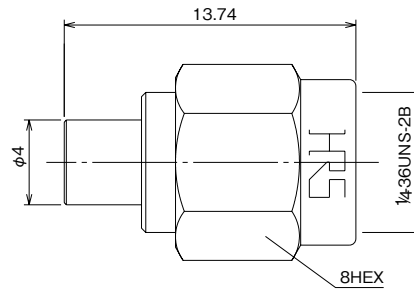
## Non-reflective Terminator



| Part No.     | HRS No.          | Electric Power (W) | Purchase Unit |
|--------------|------------------|--------------------|---------------|
| MMCX(AR)-TMP | CL0353-0010-0-00 | 1/4                | 20pcs per bag |

## Conversion Adapter

### ● SMA Conversion Adapter (Mated Portion : SMA Plug - MMCX Jack)



| Part No.   | HRS No.          | Purchase Unit |
|------------|------------------|---------------|
| HRMP-MMCXJ | CL0311-0312-1-00 | 20pcs per bag |

Note : Can be used with standard type and outer conductor contact reinforced type (MMCX[AR]) MMCX plugs.

## Plug Termination Tools

| Item             | Part No.           | Tool              | HRS No.           | Usage                      |
|------------------|--------------------|-------------------|-------------------|----------------------------|
| Right Angle Plug | MMCX(AR)-LP-066    | MMCX-LP/PR-MP     | CL0902-3064-6-00  | Cap Press Fitting          |
|                  | MMCX(AR)-LP-FHSB   | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
|                  |                    | MMCX-LP/PR-MP     | CL0902-3064-6-00  | Cap Press Fitting          |
|                  | MMCX(AR)-LP-178B/U | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
| MMCX-LP/PR-MP    |                    | CL0902-3064-6-00  | Cap Press Fitting |                            |
| Straight Plug    | MMCX(AR)-P-066     | MMCX-P-066/CV-MD  | CL0902-3272-0-00  | Clamp Press Fitting        |
|                  | MMCX(AR)-P-088     | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |
|                  | MMCX(AR)-P-178B/U  | HT103/MRF01-J-178 | CL0350-0128-5-00  | Outer Conductor Tightening |

## While Taking into Consideration

Specifications mentioned in this catalog are reference values.

When considering to order or use this product, please confirm the Drawing and Product Specifications sheets.

Use an appropriate cable when using the connector in combination with cables.

If considering usage of a non-specified cable, please contact your sales representative.

If assembly process is done by jigs & tools which are not identified by Hirose, assurance will not be given.

If considering usage for below mentioned applications, please contact your sales representative.

In cases where the application will demand a high level of reliability, such as automotive, medical instruments, public infrastructure, aerospace/ defense etc. Hirose must review before assurance of reliability can be given.

