

# MHF<sup>®</sup> 4 Connector

Part No. Plug: 20611-001R Receptacle: 20449-001E-\*\*

## Product Specification

Qualification Test Report No. TR-18086

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Rev.	ECN	Date	Prepared by	Checked by	Approved by

## 1. Scope

This Product Specification defines the test conditions and the performances of the MHF 4 Connector.

## 2. Product Name and Parts No.

### 2.1 Product Name

MHF 4 PLUG (Ni Top)  
MHF 4 RECEPTACLE (Pd-Ni)

### 2.2 Parts No.

Plug : 20611-001R  
Receptacle : 20449-001E-\*\*

## 3. Rating

### 3.1 Applicable Cable

#### (1) Description

Inner conductor: AWG#36(7/0.05), silver plating annealed copper wire  
Dielectric core: Fluoro-plastics, diameter 0.4(+0.04, -0.02) mm, nominal thickness 0.125 mm  
Outer conductor: Nominal diameter 0.65mm, silver plating annealed copper wire or tin plating annealed copper wire  
Jacket: Fluoro-plastics, diameter 0.81(+0.04, -0.02) mm, nominal thickness 0.08 mm

#### (2) Requirements

Characteristic impedance: 50(+3,-3) ohm by TDR method  
Nominal capacitance (Reference value): 96pF/m  
Conductor resistance of inner conductor at 293K (20°C): 1400 ohm/km MAX.  
Insulation resistance: 1000 mega-ohm·km MIN.  
Dielectric withstand voltage: No breakdown at AC1000V for 1 minute.

### 3.2 Operating Conditions

Voltage: 60V AC (per a contact)  
Operating temperature: 233K~363K(-40°C~+90°C)  
(Containing temperature rise by current)  
Nominal characteristic impedance : 50Ω  
Frequency: DC~6.0GHz  
VSWR: PLUG: 1.3 MAX at DC~3.0GHz. 1.5 MAX at 3.0~6.0GHz.  
RECEPTACLE: 1.3 MAX at DC ~ 3.0 GHz. 1.4 MAX at 3.0 ~ 6.0 GHz.

### 3.3 Storage Conditions

Storage temperature: 248 to 333K(-25°C to 60°C)  
Storage humidity: 85% max. (Non-condensing)

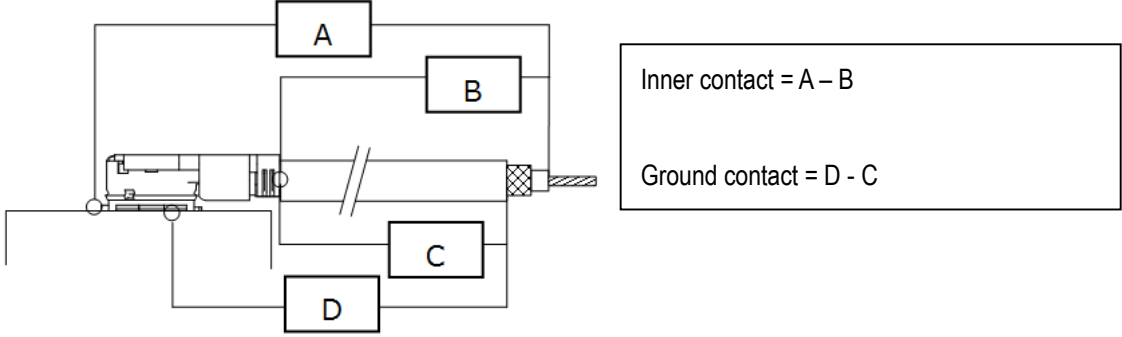
## 4. Test and Performance

### Test Condition

Unless otherwise specified, all tests and measurements shall be performed under the following conditions in accordance with MIL-STD-202.

Temperature: 288K to 308K(15°C to 35°C)  
Pressure: 866hPa to 1066hPa(650mmHg to 800mmHg)  
Relative humidity: 45 to 75% R.H.

## 4.1. Electrical Performance

1. Contact resistance	
Reference standard :	MIL-STD-202-307
Test conditions :	Solder the receptacle connector to the test board and mate the plug connector together, then, measure the contact resistance as shown in Fig. 1 by the four terminal method. Apply the low level condition. Open circuit voltage : 20mV MAX. Circuit current : 10mA MAX.
	
Fig. 1	
Pass criteria :	Inner contact Initial : 20mΩ MAX.      After testing : $\Delta R$ 20mΩ MAX. Ground contact Initial : 20mΩ MAX.      After testing : $\Delta R$ 100mΩ MAX.

2. Insulation resistance	
Reference standard :	MIL-STD-202-302
Test conditions :	Mate the plug and receptacle connector together, and then apply DC 100 V between the inner contact and the ground contact.
Pass criteria :	Initial : 500 MΩ MIN.      After testing : 100 MΩ MIN.

3. Dielectric withstanding voltage	
Reference standard :	MIL-STD-202-301
Test conditions :	Mate the plug and receptacle connector together, then, apply AC 200 V rms between the inner contact and the ground contact for a minute.
Pass criteria :	No creeping discharge, no flashover, and no insulator breakdown.

## 4.1. Electrical Performance

### 4. VSWR

Reference standard : -

Test conditions : Measure the VSWR as shown in Fig. 2 by the network analyzer.  
Frequency : 0.1 ~ 6GHz

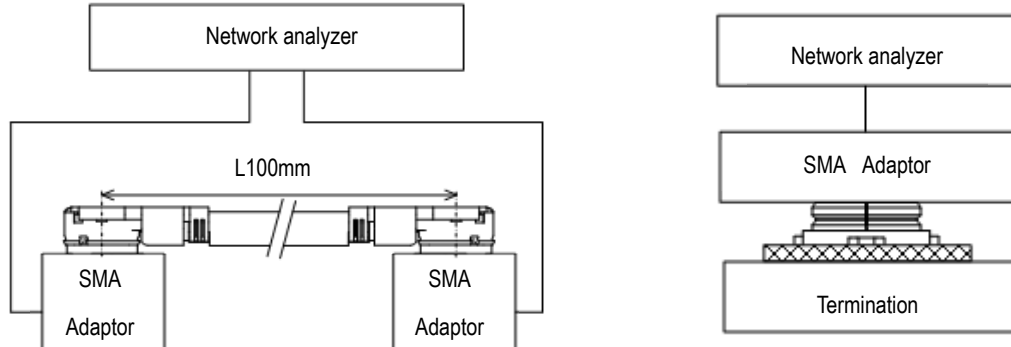


Fig. 2

Pass criteria : Plug: 1.3MAX.at 0.1~3GHz, 1.5MAX.at 3~6GHz  
Receptacle: 1.3MAX.at 0.1~3GHz, 1.4MAX.at 3~6GHz

## 4.2. Mechanical Performance

### 1. Unmating force

Reference standard : -

Test conditions : Solder the receptacle connector to the test board and mate the plug connector together then, measure the unmating force at speed of  $25 \pm 3$ mm/minutes in parallel with the mating axis by the push-pull machine.

Pass criteria : Unmating force  
Initial : 4 N MIN. After 30 cycles : 2 N MIN.

### 2. Crimp strength

Reference standard : -

Test conditions : Pull the cable as shown in Fig. 3 at speed of  $25 \pm 3$ mm/minutes by the tensile strength machine and measure the retention force.

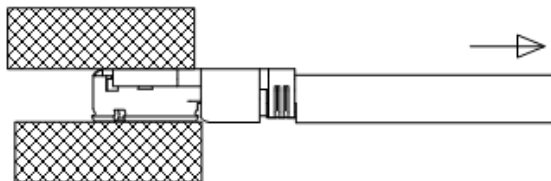
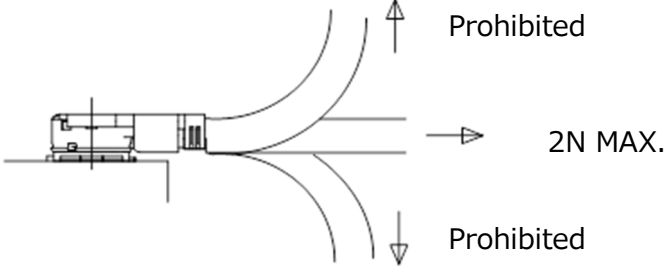


Fig. 3

Pass criteria : 5N MIN.

## 4.2. Mechanical Performance

3. Durability	
Reference standard :	-
Test conditions :	Mate and unmate the receptacle connector(soldered to the test board) and plug connector 30cycles at speed of $25\pm 3\text{mm/minutes}$ in parallel with the mating axis by the push-pull machine.
Pass criteria :	Appearance : No abnormality adversely affecting the performance shall occur. Contact resistance : Shall meet 4.1.1.

4. Cable retention force	
Reference standard :	-
Test conditions :	Apply force to cable as shown in Fig. 4. During the testing, run 100mA DC to check electrical discontinuity.
 <p style="text-align: center;">Fig. 4</p>	
Pass criteria :	Appearance : No abnormality adversely affecting the performance shall occur. Electrical discontinuity : No electrical discontinuity greater than $1\mu\text{s}$ shall occur.

5. Vibration	
Reference standard :	MIL-STD-202-201
Test conditions :	Apply the following vibration to the mating connector. During the testing, run 100mA DC to check electrical discontinuity. Frequency : $10\text{Hz} \rightarrow 100\text{Hz} \rightarrow 10\text{Hz}$ / approx. 20minutes. Half amplitude, Peak value of acceleration : $1.5\text{mm}$ or $59\text{m/s}^2$ (6G) Directions , cycle : 3 mutually perpendicular direction, 3 cycles for each direction.
Pass criteria :	Appearance : No abnormality adversely affecting the performance shall occur. Contact resistance : Shall meet 4.1.1. Electrical discontinuity : No electrical discontinuity greater than $1\mu\text{s}$ shall occur.

6. Shock	
Reference standard :	MIL-STD-202-213
Test conditions :	Apply the following shock to the mating connector. During the testing, run 100mA DC to check electrical discontinuity. Peak value of acceleration : $735\text{m/s}^2$ (75G) Duration : 11msec. Wave Form : Half sinusoidal Directions, cycle : 6 mutually perpendicular direction, 3 cycles for each direction
Pass criteria :	Appearance : No abnormality adversely affecting the performance shall occur. Contact resistance : Shall meet 4.1.1. Electrical discontinuity : No electrical discontinuity greater than $1\mu\text{s}$ shall occur.

## 4.3. Environmental Performance

1. Humidity(Steady state)	
Reference standard :	MIL-STD-202-103, Condition B
Test conditions :	Apply the following environment to the mating connector. Temperature : 313±2K (40±2°C) Humidity : 90~95%RH Duration : 96 hours
Pass criteria :	Appearance : No abnormality adversely affecting the performance shall occur. Contact resistance : Shall meet 4.1.1. Insulation resistance : Shall meet 4.1.2. Dielectric withstanding voltage : Shall meet 4.1.3.

2. Thermal shock	
Reference standard :	MIL-STD-202-107 Condition A
Test conditions :	Apply the following environment to the mating connector. Temperature : 218K(-55°C) : 30min. ↔ 358K(85) : 30min. Transition time : 5min. MAX. No. of cycles : 5 cycles
Pass criteria :	Contact resistance : Shall meet 4.1.1. Insulation resistance : Shall meet 4.1.2. Dielectric withstanding voltage : Shall meet 4.1.3. Appearance : No abnormality adversely affecting the performance shall occur.

3. High temperature life	
Reference standard :	-
Test conditions :	Apply the following environment to the mating connector. Temperature: 363±2K (90±2°C) Duration: 96 hours
Pass criteria :	Appearance : No abnormality adversely affecting the performance shall occur. Contact resistance : Shall meet 4.1.1.

4. H <sub>2</sub> S gas	
Reference standard :	-
Test conditions :	Apply the following environment to the mating connector. Temperature : 313±2K (40±2°C) Relative humidity : 80±5%RH Gas : H <sub>2</sub> S 3±1ppm Duration : 96 hours
Pass criteria :	Contact resistance : Shall meet 4.1.1. Appearance : No abnormality adversely affecting the performance shall occur.

## 4.3. Environmental Performance

5. Saltwater spray	
Reference standard :	MIL-STD-202-101, Condition B
Test conditions :	Apply the following environment to the mating connector. Temperature : $308 \pm 2\text{K}$ ( $35 \pm 2^\circ\text{C}$ ) Salt water density : $5 \pm 1\%$ [by weight] Duration : 48 hours
Pass criteria :	Appearance : No abnormality adversely affecting the performance shall occur. Contact resistance : Shall meet 4.1.1.

## 4.4. Others

1. Solder ability	
Reference standard :	MIL-STD-202-208
Test conditions :	Dip the soldering point of the contacts in the solder bath at $518 \pm 5\text{K}$ ( $245 \pm 5^\circ\text{C}$ ) for $5 \pm 0.5$ seconds after immersing the tine in the flux of RMA type for 5 to 10 seconds.
Pass criteria :	More than 95% of the dipped surface shall be evenly wet.

2. Soldering heat resistance	
Reference standard :	-
Test conditions :	Reflow temperature profile. : Fig. 5 The number of reflow is 2 times.
<p>Fig. 5</p> <p>The graph shows a temperature profile with two reflow cycles. The first cycle starts with a ramp up to a plateau at 403-443 K (130-170°C), which lasts for 60-120 seconds. This is followed by a second ramp up to a higher peak at 553 K (260°C), which lasts for 10±5 seconds. The temperature then ramps down after each peak.</p>	
Pass criteria :	No abnormality adversely affecting the performance shall not occur.

## 4.5. Test Sequence and Specimen Quantity

**Table 1 Test Sequence and Sample Quantity**

Test Item	Group														
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
Contact Resistance					1,3		1,3	1,3	1,5	1,5	1,3	1,3	1,3		
Insulation resistance									2,6	2,6					
Dielectric withstanding voltage	1								3,7	3,7					
VSWR		1													
Unmating force			1												
Crimp strength				1											
Durability					2										
Cable retention force						1									
Vibration							2								
Shock								2							
Humidity steady state									4						
Thermal shock										4					
High temperature life											2				
H <sub>2</sub> S gas												2			
Saltwater spray													2		
Solder ability														1	
Soldering heat resistance															1
Specimen quantity.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.	10 pcs.

※Numbers indicate sequence in which tests are performed.

## 5. Recommended Metal Mask

Refer to drawing for the recommended metal mask thickness and opening dimension.