

# MHF<sup>®</sup> 4L Connector

Plug Part No. 20565-001R-13

Receptacle Part No. 20449-001E-\*\*

## Product Specification

Qualification Test Report No. TR-14142

3	S21020	January 19, 2021	K. Ikeshita		M. Takemoto
2	S21018	January 18, 2021	K. Ikeshita		M. Takemoto
1	S19017	January 8, 2019	K. Ikeshita	K. Shinozaki	T. Matsumoto
0	S14540	December 24, 2014	S. Suzuki	K. Yotsutani	T. Takano
Rev.	ECN	Date	Prepared by	Checked by	Approved by

## 1. Scope

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

## 2. Product Name and Parts No.

### 2.1 Product Name

MHF 4L Connector

### 2.2 Parts No.

Plug: 20565-001R-13

Receptacle: 20449-001E-\*\*

## 3. Rating

### 3.1 Applicable cable

#### (1) Description

Inner conductor : AWG#33(7/0.071), Silver plating annealed copper wire

Dielectric core : Fluoro-plastics , diameter 0.63( $\pm$ 0.02)mm , nominal thickness 0.21mm

Outer conductor : 16/6/0.04 , nominal diameter 0.85mm, Copper-Polyester tape + Sn plating annealed copper wire

Jacket : Fluoro-plastics , diameter 0.95( $\pm$ 0.04)mm

#### (2) Requirements

Characteristic impedance :  $50 \pm 5 \Omega$  by TDR method

Nominal capacitance(Reference value): 97 pF/m

Conductor resistance of inner conductor at 293K (20°C)(Reference value) : 752 $\Omega$ /km

Insulation resistance : 1,000 M $\Omega$ ·km MIN.

Dielectric withstand voltage : no breakdown at AC 500V for 1 minutes.

### 3.2 Conditions

Voltage: 60 Vr.m.s AC

Operating Temperature: 233~363K(-40°C~+90°C)

(Containing temperature rise by current)

Nominal characteristic impedance: 50 $\Omega$

Frequency: DC~12 GHz

VSWR: [Plug] 1.3 MAX at 0.1~3 GHz

1.45 MAX at 3~6 GHz

1.6MAX at 6~9 GHz

1.9MAX at 9~12 GHz

[Receptacle] 1.3 MAX at 0.1~3 GHz

1.4 MAX at 3~6 GHz

1.5 MAX at 6~9 GHz

## 4. Test and Performance

### Test Condition

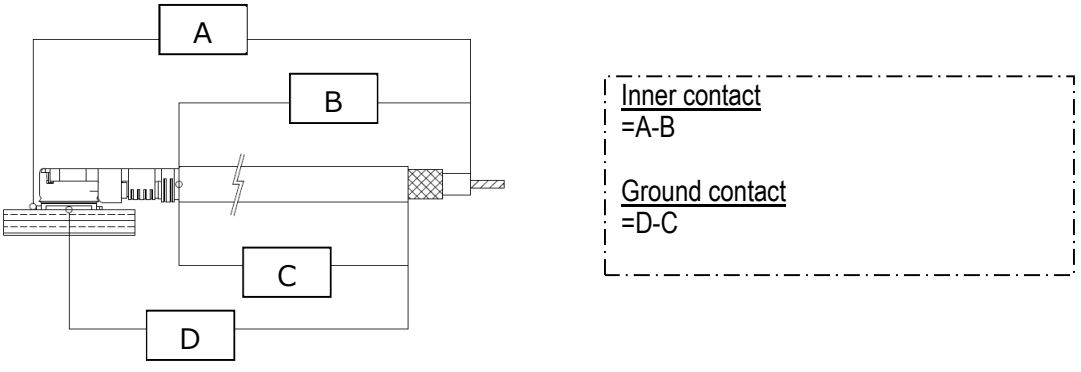
This initial test is equal to it's at shipping condition and unless otherwise specified, all tests and measurements shall be performed under the following conditions in accordance with MIL-STD-202.

Temperature... 288K~308K (15°C~35°C)

Pressure... 866hPa~1066hPa (650mmHg~800mmHg)

Relative humidity... 45~75%R.H.

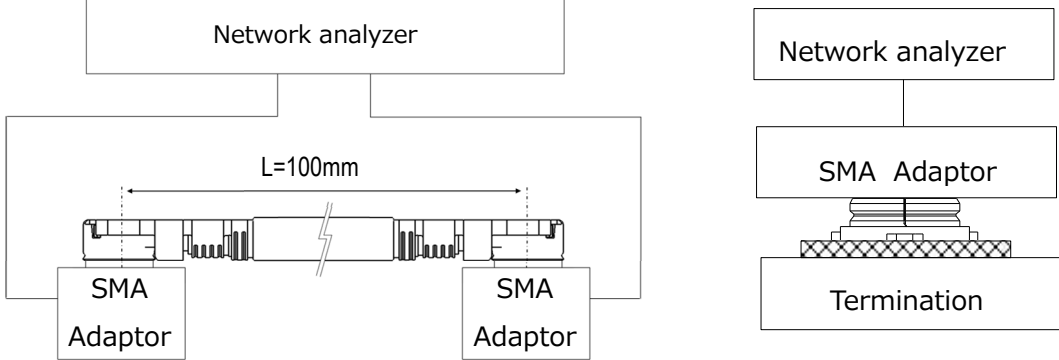
## 4.1. Electrical Performance

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 methods. Apply the low level condition of 20mV MAX. DC for the open circuit voltage and 10mA MAX. DC for the closed circuit current.
	
Fig. 1 Contact resistance	
Pass criteria:	Contact Initial: 20 mΩ MAX. After testing: $\triangleleft$ R20 mΩ MAX. Ground contact Initial: 20 mΩ MAX. After testing: $\triangleleft$ R20 mΩ MAX.

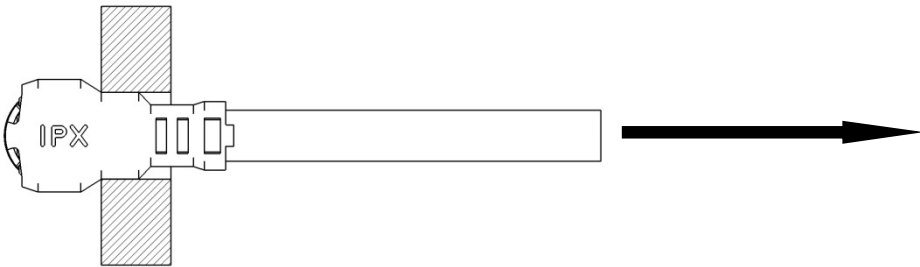
2. Insulation resistance	
Reference standard:	MIL-STD-202-302
Test conditions:	Mate the plug and receptacle connector together, and then apply DC 100 V between the inner contact and the ground contact.
Pass criteria:	Initial: 500 MΩ MIN. After testing: 100 MΩ MIN.

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

## 4.1. Electrical Performance

4.VSWR	
Reference standard:	-
Test conditions:	Measure the VSWR as shown in Fig. 2 by the network analyzer. Frequency : 100MHz ~ 12GHz
	
Fig. 2 VSWR	
Pass criteria:	PLUG: 1.3 MAX. at 0.1~3GHz, 1.45 MAX. at 3~6GHz 1.6 MAX. at 6~9GHz, 1.9 MAX. at 9~12GHz RECEPTACLE: 1.3 MAX. at 0.1~3GHz, 1.4 MAX. at 3~6GHz, 1.5MAX. at 6~9GHz

## 4.2. Mechanical Performance

1. Mating force and Un-mating force	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then place the board and plug on push-on/pull-off machine, measure of initial and mating/unmating 30 cycles at a speed 25±3mm/min. along the mating axis.
Pass criteria:	Mating force Initial: 30 N MAX. 30cycles: 30 N MAX. Unmating force Initial: 20 N MAX., 5 N MIN. 30cycles: 20 N MAX., 3 N MIN..
2. Crimp strength	
Reference standard:	-
Test conditions:	Pull the cable as shown in Fig-3 at speed of 25±3mm/minutes by the tensile strength machine and measure the retention force.
	
Fig. 3 Crimp strength	
Pass criteria:	8N MIN.



**4.3. Environmental Performance**

<b>3. Humidity(Steady state)</b>	
Reference standard:	MIL-STD-202-103, Condition A.
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: $313\pm 2\text{K}$ ( $40\pm 2^\circ\text{C}$ ) Humidity: 90~95%RH Duration: 96 hours
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

<b>4. Saltwater spray</b>	
Reference standard:	MIL-STD-202-101, Condition B
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. 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:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur.

<b>5. H<sub>2</sub>S gas</b>	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: $313\pm 2\text{K}$ ( $40\pm 2^\circ\text{C}$ ) Relative humidity: $80\pm 5\%$ RH Gas: H <sub>2</sub> S $3\pm 1$ ppm Duration: 48 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur.

4.4.Others

1. Solder ability	
Reference standard:	MIL-STD-202-208
Test conditions:	Dip the solder tine of the contact in the solder bath at $518 \pm 5K$ ( $245 \pm 5^{\circ}C$ ) for $5 \pm 0.5$ seconds after immersing the tine in the flux of RMA or R type for 5 to 10 seconds.
Pass criteria:	The surface of the dipped contact must become 95% wet and the non-wetted pinholes must not accumulate in one area but be distributed and must be less than 5% of the contact area to be soldered.

2. Soldering heat resistance	
Reference standard:	-
Test conditions:	Reflow temperature profile as shown in Fig. 4. The number of times of reflow is within 2.
<p>The graph shows a reflow temperature profile. The y-axis represents temperature with markers at 533, 528, and 423~473 K (150~200°C). The x-axis represents time. The profile consists of: a ramp up to 423~473 K; a horizontal hold at 423~473 K for 60~120sec; a second ramp up to 533; a horizontal hold at 533 for 30sec; and a final ramp down. A dashed horizontal line is drawn at 528.</p>	
Fig. 4 Reflow Temperature Profile	
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
Contact resistance					1,3	1,3	1,3	1,5	1,3	1,5	1,3	1,3		
Insulation resistance								2,6		2,6				
Dielectric withstanding voltage	1							3,7		3,7				
VSWR		1												
Mating force Unmating force			1											
Crimp strength				1										
Durability					2									
Vibration						2								
Shock							2							
Thermal shock								4						
High temperature life									2					
Humidity (Steady State)										4				
Saltwater spray											2			
H <sub>2</sub> S gas												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.

※Numbers indicate sequence in which tests are performed.

## 5. Recommended Metal Mask

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