

# MHF<sup>®</sup> 7S Connector

Part No. Plug: 20980-001R-13 Receptacle: 20981-001E-02

## Product Specification

Qualification Test Report No. TR-20043

0	S20540	October 12, 2020	Y. Imaji	H. Nakamura	Hiro Takahashi
Rev.	ECN	Date	Prepared by	Checked by	Approved by

## 1. Scope

This product specification defines the test conditions and the performances of the MHF 7S Connector

## 2. Product Name and Parts No.

### 2.1 Product Name

MHF 7S Connector

### 2.2 Parts No.

Plug: 20980-001R-13

Receptacle: 20981-001E-02

## 3. Rating

### 3.1 Applicable Cable

#### (1) Description

Inner conductor: AWG#32(7/0.08)

Silver plating annealed copper wire

Dielectric core: Fluoro-plastics, diameter 0.70(+/-0.03)mm, nominal thickness 0.23mm

Outer conductor: 16/5/0.04, diameter 0.90(+/-0.09)mm, tin-copper alloy

Jacket: Fluoro-plastics, diameter 1.13(+0.08,-0.05)mm, nominal thickness 0.12mm

#### (2) Requirements

Characteristic impedance:  $50 \pm 2\Omega$  by TDR method

Nominal capacitance(Reference value): 97 pF/m

Conductor resistance of inner conductor at 293K (20°C)(Reference value): 520 $\Omega$ /km

Insulation resistance: 1,500M $\Omega$ ·km MIN.

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

### 3.2 Operating Conditions

Voltage: 60 Vrms AC

Operating temperature: 233 to 363K(-40°C to +90°C) (Containing temperature rise by current)

Nominal characteristic impedance: 50 $\Omega$

Frequency: DC~15 GHz

VSWR: [Mating condition] 1.30 MAX at 0.1~3 GHz

1.35 MAX at 3~6 GHz

1.40 MAX at 6~9 GHz

1.45 MAX at 9~12 GHz

1.50 MAX at 12~15 GHz

Operating humidity: 90% max

### 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

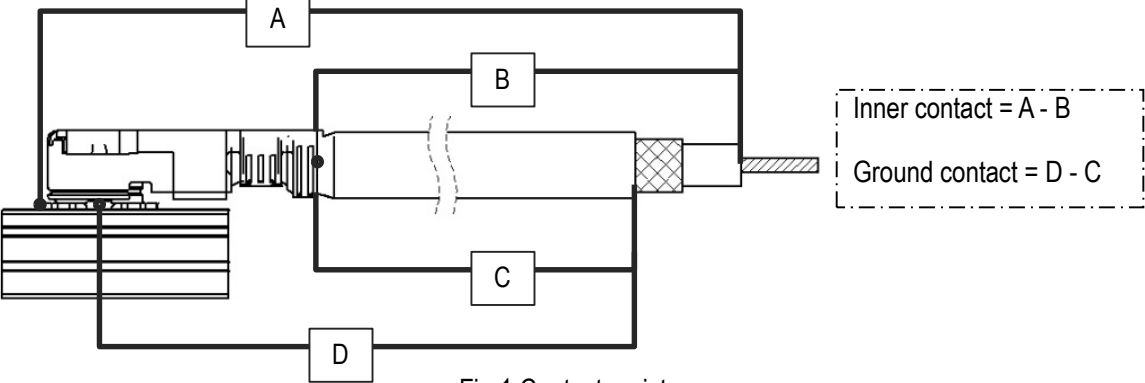
This initial test is equal to it's at shipping condition and unless otherwise specified, all tests and measurements shall be performed under the following conditions in accordance with MIL-STD-202 G.

Temperature: 288K to 308K(15°C to 35°C)

Pressure: 866hPa to 1066hPa (650 mmHg to 800 mmHg)

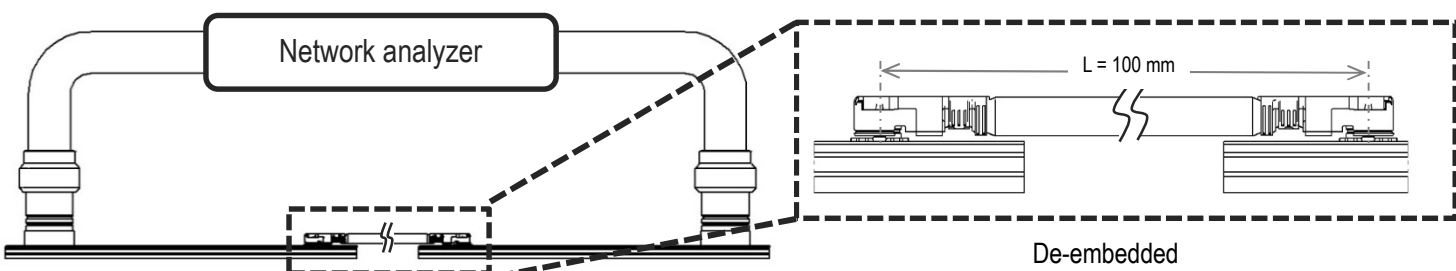
Relative humidity: 45 to 75% R.H.

4.1. Electrical Performance

1. Contact resistance	
Reference standard:	MIL-STD-202G, Method 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.
 <p>Fig.1 Contact resistance</p>	
Pass criteria:	Contact Initial: 20 mΩ MAX. After testing: $\Delta R$ 20 mΩ MAX. Ground contact Initial: 20 mΩ MAX. After testing: $\Delta R$ 20 mΩ MAX.

2. Insulation resistance	
Reference standard:	MIL-STD-202G, Method 302, Condition A
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: 500 MΩ MIN.

3. Dielectric withstanding voltage	
Reference standard:	MIL-STD-202G, Method 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. VSWR	
Reference standard:	-
Test conditions:	Mate the plug and receptacle connector together and then apply rating current per contact.
 <p>Fig. 2 VSWR</p>	
Pass criteria:	MATING CONDITION: 1.30 MAX at 0.1~3 GHz 1.35 MAX at 3~6 GHz 1.40 MAX at 6~9 GHz 1.45 MAX at 9~12 GHz 1.50 MAX at 12~15 GHz

**4.2. Mechanical Performance**

<b>1. Mating force and Un-mating force</b>	
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 $25\pm 3$ mm/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.

<b>2. Cable retention force at 0 degree</b>	
Reference standard:	-
Test conditions:	Mate Plug with Receptacle and pull the cable by 10N force toward horizontal direction. (Fig. 3)
<p>Fig. 3 Cable retention force at 0 degree</p>	
Pass criteria:	Appearance: No abnormality Electrical discontinuity: No electrical discontinuity greater than 1 $\mu$ s.

<b>3. Durability</b>	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then place the board and plug on the push-on/pull-off machine, and repeat mating and unmating 30cycles at a speed $25\pm 3$ mm/min. along the mating axis.
Pass criteria:	Appearance: No abnormality. Contact resistance: Shall meet 4.1.1

<b>4. Receptacle shearing strength</b>	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, push the receptacle connector from each directions as Shown in Fig. 4. Measure the strength when the connector is broken.
<p>Fig. 4 Receptacle shearing strength</p>	
Pass criteria:	Shearing strength: 20 N MIN.

## 4.2. Mechanical Performance

5. Vibration	
Reference standard:	-
Test conditions:	Apply the following vibration to the mating connector. During the testing, run 100mA DC to check electrical discontinuity. Frequency: 10Hz →100Hz → 10Hz / approx. 15minutes. Half amplitude, Peak value of acceleration: 1.5mm or 59m/s <sup>2</sup> (6G) Directions, cycle: 3 mutually perpendicular direction, 5 cycles (approx. 75minutes.) for each direction.
Pass criteria:	Contact resistance: Shall meet 4.1.1. Electrical discontinuity: No electrical discontinuity greater than 1μs shall occur. Appearance: No abnormality

6. Shock	
Reference standard:	-
Test conditions:	Apply the following shock to the mating connector. During the testing, run 100mA DC to check electrical discontinuity. MAX.G: 735m/s <sup>2</sup> (75G) Duration: 11msec Wave Form: Half Sinusoidal Directions: 6 mutually perpendicular direction Cycle: 3 cycles about each direction
Pass criteria:	Contact resistance: Shall meet 4.1.1. Electrical discontinuity: No electrical discontinuity greater than 1μs shall occur. Appearance: No abnormality

## 4.3. Environmental Performance

1. Thermal shock	
Reference standard:	MIL-STD-202G, Method 107, Condition A.
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: 218K(-55°C),30min.→358K(85°C),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

2. High temperature life	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: 363±2K (90±2°C) Duration: 96 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality

## 4.3. Environmental Performance

### 3. Humidity (Steady state)

Reference standard:	MIL-STD-202G, Method 103, Condition B.
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

### 4. Saltwater spray

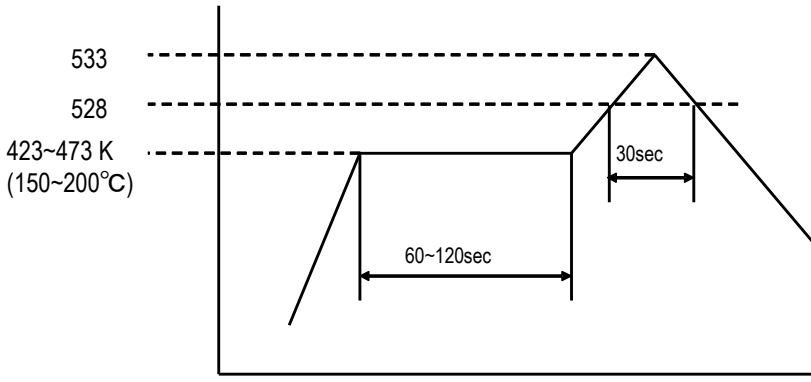
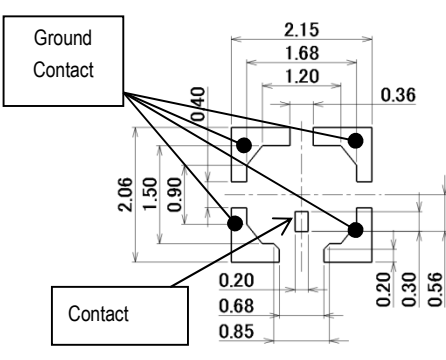
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: $308\pm 2\text{K}$ ( $35\pm 2^\circ\text{C}$ ) Saltwater density: $5\pm 1\%$ [by weight] Duration: 48 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur.

### 5. H<sub>2</sub>S gas

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 $3\pm 1\text{ppm}$ 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:	-
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:	More than 95% of the dipped surface shall be evenly wet.

2. Soldering heat resistance	
Reference standard:	-
Test conditions:	Reflow temperature profile as shown in Fig. 5. The number of times of reflow is within 2. Metal mask size Fig. 6
 <p>Fig. 5 Reflow Temperature Profile</p>	<p>Recommended thickness of METAL MASK: <math>t=0.08</math></p>  <p>Fig. 6 Recommended metal mask</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	1,3	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													
Cabel retention force at 0 degree				1												
Durability					2											
Shearing strength						1										
Vibration							2									
Shock								2								
Thermal shock									4							
High temperature life										2						
Humidity steady state											4					
Salt Water Spray												2				
H <sub>2</sub> S Gas													2			
Solder ability														1		
Soldering Heat Resistance															1	
Sample Quantity (pcs.)	Plug	10	10	10	10	10	—	10	10	10	10	10	10	10	—	—
	Receptacle	10	10	10	10	10	12	10	10	10	10	10	10	10	10	10
Test board (pcs.)		10	10	10	10	10	12	10	10	10	10	10	10	10	10	10

※Numbers indicate test sequences.