

# MHF<sup>®</sup> I Connector with Lock

Part No. Plug: 20278-112R-\*\*,20351-112R-37

Receptacle: 20279-001E-\*\* / 20431-001E-01 / 20441-001E-01

Lock part:3376-000\*

## Product Specification

Qualification Test Report No. TR-21009 (20278-112R-08)

TR-17057 (20278-112R-13)

TR-19088 (20278-112R-32)

TR-20036 (20351-112R-37)

TR-21010 (20278-112R-18)

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4	S21595	November 11, 2021	S.Taguchi	-	M.Takemoto
3	S21071	February 16, 2021	S.Taguchi	-	M.Takemoto
2	S20485	September 11, 2020	J.Tonai	-	M.Takemoto
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## 1. Scope

This product specification defines the test conditions and the performances of the MHF I Connector with Lock.

## 2. Product Name and Parts No.

### 2.1 Product Name

MHF I Connector with Lock

### 2.2 Parts No.

Plug : 20278-112R-08  
20278-112R-13  
20278-112R-32  
20351-112R-37  
20278-112R-18

Lock part: 3376-000\*

Receptacle : 20279-001E-\*\* / 20431-001E-01 / 20441-001E-01

## 3. Rating

### 3.1 Applicable Cable

#### 3.1.1 Plug part No.20278-112R-08

##### (1) Description

Inner conductor : AWG#36(7/0.05) ,Silver plating copper wire  
Dielectric core : Fluoro-plastics ,diameter 0.40(+0.04,-0.02)mm  
Outer conductor : Braid of 0.05mm, diameter 0.65(±0.1)mm , silver plating copper wire or tin plating copper wire  
Jacket : Fluoro-plastics , diameter 0.81(+0.04,-0.03)mm

##### (2) Requirements

Characteristic impedance :  $50 \pm 3 \Omega$  by TDR method  
Nominal capacitance(Reference value): 96 pF/m  
Dielectric withstand voltage : no breakdown at AC 1,000V for 1 minutes.

#### 3.1.2 Plug part No.20278-112R-13

##### (1) Description

Inner conductor : AWG#32(7/0.08) , Silver plating copper wire  
Dielectric core : Fluoro-plastics , diameter 0.70mm  
Outer conductor : Braid of 0.05mm, diameter0.93mm , silver plating copper wire or tin plating copper wire  
Jacket : Fluoro-plastics , diameter 1.13mm

##### (2) Requirements

Characteristic impedance :  $50 \pm 2 \Omega$  by TDR method  
Nominal capacitance(Reference value) : 97 pF/m  
Dielectric withstand voltage : no breakdown at AC 1,000V for 1 minutes.

#### 3.1.3 Plug part No.20278-112R-32

##### (1) Description

Inner conductor : AWG#32(7/0.08) , Silver plating copper wire  
Dielectric core : Fluoro-plastics , diameter 0.66mm  
First outer conductor : Braid of 0.05mm, tin plating copper wire  
Second outer conductor : Braid of 0.05mm, diameter 1.12mm , tin plating copper wire  
Jacket : Fluoro-plastics , diameter 1.32mm

##### (2) Requirements

Characteristic impedance :  $50 \pm 2 \Omega$  by TDR method  
Nominal capacitance(Reference value): 95 pF/m  
Dielectric withstand voltage : no breakdown at AC 1,500V for 1 minutes.

## 3.1.4 Plug part No.20351-112R-37

## (1) Description

Inner conductor : AWG#30(7/0.105), Silver plating copper wire  
Dielectric core : Fluoro-plastics , diameter 0.925mm  
Outer conductor : Braid of 0.05mm, diameter 1.15mm , tin plating copper wire  
Jacket : Fluoro-plastics , diameter 1.37mm

## (2) Requirements

Characteristic impedance :  $50\pm 2\Omega$  by TDR method  
Nominal capacitance(Reference value): 96 pF/m  
Dielectric withstand voltage : no breakdown at AC 1000V for 1 minutes.

## 3.1.5 Plug part No.20278-112R-18

## RG178 B/U

## (1) Description

Inner conductor : AWG#30(7/0.102), silver plating copper clad steel wire  
Dielectric core : Fluoro-plastics , diameter  $0.84(\pm 0.03)$ mm  
Outer conductor : Braid of 0.1mm , diameter  $1.35(\pm 0.14)$ mm , silver plating copper wire  
Jacket : Fluoro-plastics , diameter  $1.8(\pm 0.1)$ mm

## (2) Requirements

Characteristic impedance :  $50\pm 2\Omega$  by TDR method  
Nominal capacitance(Reference value): 95 pF/m  
Dielectric withstand voltage : no breakdown at AC 2,000V for 1 minutes.

**3.2 Operating Conditions**

Voltage : 60V AC (per a contact)

Nominal characteristic impedance :  $50\Omega$

Frequency : DC~9GHz

VSWR :

Plug : 1.3 Max at 0.1~3GHz, 1.5 Max at 3~6GHz, 1.9 Max at 6~9GHz (0.81 O.D., 1.13 O.D., 1.80 O.D.)  
1.3 Max at 0.1~3GHz, 1.5 Max at 3~6GHz, 1.6 Max at 6~9GHz (1.32 O.D.)

Receptacle : 1.3 Max at 0.1~3GHz, 1.4 Max at 3~6GHz, 1.8 Max at 6~9GHz

Operating Temperature : 233~363K(-40°C to 90°C) (including temperature rise due to energization)

**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**

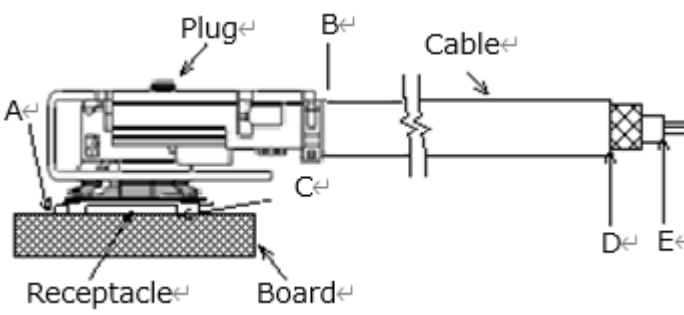
Unless otherwise specified, all tests and measurements shall be performed under the following conditions in accordance with MIL-STD-202.

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:	<p>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.</p> <p>Open circuit voltage: 20mV MAX</p> <p>Circuit current: 10mA MAX.</p> <p>(DC or AC1kHz)</p> <p>Contact resistance of inner contact &lt;resistance of A-E&gt; - &lt;resistance of B-E&gt;</p> <p>Contact resistance of ground contact &lt;resistance of C-D&gt; - &lt;resistance of B-D&gt;</p>
 <p>Fig.1</p>	
Pass criteria:	<p>Contact Initial: 20 mΩ MAX. After testing: 25 mΩ MAX.</p> <p>Ground contact Initial: 10 mΩ MAX. After testing: 15 mΩ MAX.</p>

2. Insulation resistance	
Reference standard:	MIL-STD-202-302, Test 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: 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 inner contact and the ground contact for a minute in accordance for a minute.
Pass criteria:	No abnormalities such as creeping discharge, flashover, insulator breakdown 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~9GHz
Fig.2	
Pass criteria:	Plug 0.1~3GHz 1.30 MAX./ 3~6GHz 1.50 MAX./ 6~9GHz 1.90 MAX. (0.81 O.D., 1.13 O.D., 1.80 O.D.) Receptacle 0.1~3GHz 1.30 MAX./ 3~6GHz 1.40 MAX./ 6~9GHz 1.60 MAX. (1.32 O.D.)

4.2. Mechanical Performance

1. 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, Repeat mating/unmating 30 cycles at a speed 25±3mm/min. along the mating axis. Measure the unmating force at the initial and after 30cycles.
Pass criteria:	Unmating force <Unlock state> Initial: 5 N MIN. 30cycles: 3 N MIN. Unmating force <Lock state> Initial: 20 N MIN. Unmating force of inner contact Initial : 0.15N Min. 30 cycles : 0.10N MIN.
2. Crimp strength	
Reference standard:	-
Test conditions:	Pull the cable as shown in Fig.3 at a speed 25±3mm/minutes by tensile strength machine.
Fig.3	
Pass criteria:	Plug part No.20278-112R-08,13,32 : 10N MIN., Plug part No. 20278-112R-18, 20351-112R-37 :15N MIN.

## 4.2. Mechanical Performance

3. Durability	
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:	Contact resistance: Shall meet 4.1.1

4. Contact resistance with force on the cable	
Reference standard:	-
Test conditions:	Apply force on the cable as shown in Fig.4. During the testing, run 100mA DC to check electrical discontinuity.
<p>Fig.4</p>	
Pass criteria:	Contact resistance: Shall meet 4.1.1 Electrical discontinuity: No electrical discontinuity greater than $1\mu s$ shall occur. Appearance: No abnormality adversely affecting the performance shall occur.

5. Vibration	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and place them on the vibrator. Then apply the following vibration. During the testing, run 100mA DC to check electrical discontinuity. Frequency: 10Hz→100Hz→10Hz/approx. 20min. Half amplitude ,Peak value of acceleration 1.5mm or $59m/s^2$ (6G) Directions , cycle 3 mutually perpendicular direction 3 cycles about each direction
Pass criteria:	Contact resistance: Shall meet 4.1.1. Electrical discontinuity: No electrical discontinuity greater than $1\mu s$ shall occur. Appearance: No abnormality adversely affecting the performance shall occur.

6. Shock	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and place them on the shock machine. Then apply the following shock. During the testing, run 100mA DC to check electrical discontinuity. MAX.G: $735m/s^2$ (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 $1\mu s$ shall occur. Appearance: No abnormality adversely affecting the performance shall occur.

## 4.3. Environmental Performance

1. Thermal shock	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: 233K(-40°C)/30 minutes→278~308K(5~35°C)/ 5 minutes Max.→363K(90°C)/30 minutes→278~308K(5~35°C)/5 minutes Max. No. of cycles: 5 cycles
Pass criteria:	Contact resistance: Shall meet 4.1.1 Insulation resistance: Shall meet 4.1.2 Appearance: Looseness between the parts, chipping, breakage or other abnormality shall not occur.

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

3. Salt water spray	
Reference standard:	MIL-STD-202-101, Test 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±2K (35±2°C) Salt water density: 5±1% [by weight] Duration: 48 hours
Pass criteria:	Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur.

4. 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 adversely affecting the performance shall occur.

4.4. Others

1. Solder ability	
Reference standard:	-
Test conditions:	Immerse the contact soldering part to flux of RMA or R type for 5 to 10 seconds, then dip the part into the solder bath of $518 \pm 5K$ ( $245 \pm 5^{\circ}C$ ) for $5 \pm 0.5$ seconds.
Pass criteria:	More than 95% of the dipped surface shall be evenly wet.

2. Soldering heat resistance	
Reference standard:	-
Test conditions:	Put on the receptacle connector to PCB , apply the heat 2 cycles as shown in Fig.5
Fig.5	
Pass criteria:	No abnormality adversely affecting the performance shall not occur.



## 4.5 Test Sequence and Specimen Quantity

Details of the Testing Groups A to Q are indicated in test report

**Table.1 Test Sequence and Sample Quantity**

No.	Test Item	Test Groups															
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	
4.1 Electrical Performance	1	Contact resistance						1,3	1,3	1,3	1,3	1,4	1,4	1,3	1,3		
	2	Insulation resistance									2,5	2,5					
	3	Dielectric Withstanding Voltage	1														
	4	VSWR		1													
4.2 Mechanical Performance	1	Un-mating force <Unlock state>			1												
	2	Un-mating force <Lock state>				1											
	3	Crimp strength					1										
	4	Durability						2									
	5	Contact resistance with force on the cable							2								
	6	Vibration								2							
4.3 Environmental Performance	1	Shock								2							
	2	Thermal shock									3						
	3	Humidity(Steady state)										3					
	4	Salt water spray											2				
	5	High temperature life													2		
4.4 Others	1	Solder ability														1	
	2	Soldering heat Resistance															1
Specimen quantity			10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

※Numbers indicate test sequences.

## 5. Recommended Metal Mask

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