

MHF[®] 4 Connector

Part No. Plug: 20448-001R Receptacle: 20449-001E-**

Product Specification

Qualification Test Report No. TR-12118

5	S21508	October 22, 2021	K. Ikeshita		M. Takemoto
4	S20023	January 16, 2020	S.Kamada	S.Suzuki	Y.Shimada
3	S19752	December 13, 2019	S.Kamada	S.Suzuki	Y.Shimada
2	S15104	March 10, 2015	K.Hashiba		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 4 Connector

2. Product Name and Parts No.

2.1 Product Name

MHF 4 PLUG
MHF 4 RECEPTACLE (Pd-Ni)

2.2 Parts No.

Plug: 20448-001R
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)

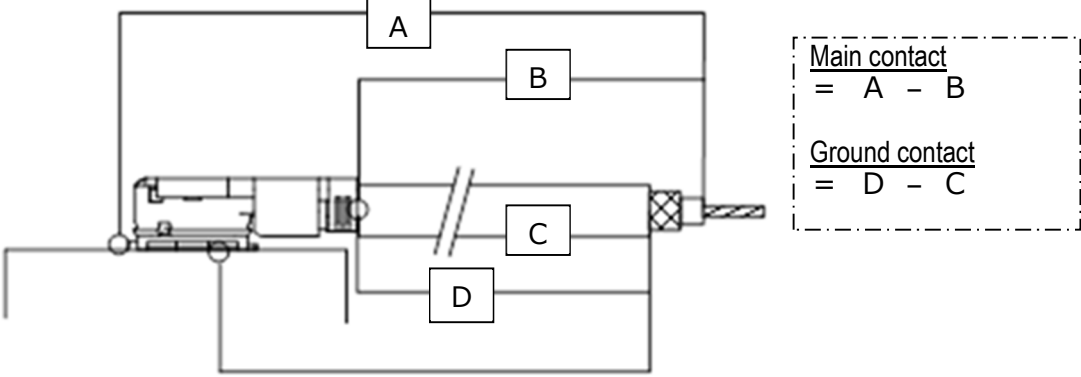
4. Test and Performance

Test Condition

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.

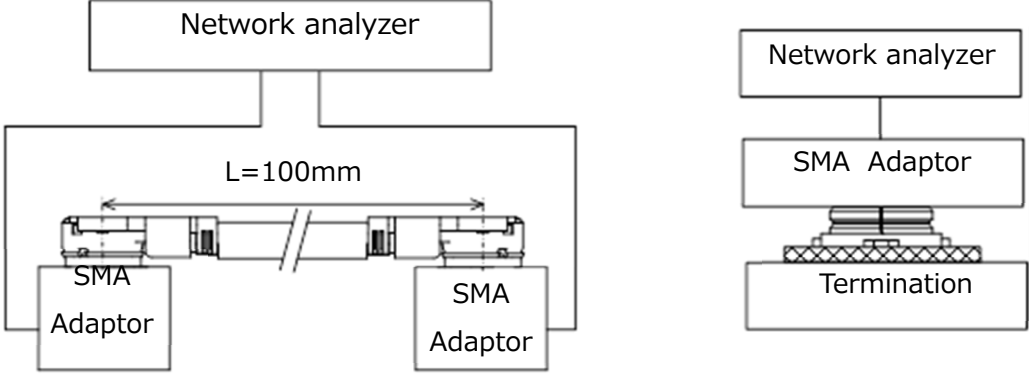
4.1. Electrical Performance

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 method. Open circuit voltage : 20mV MAX. Circuit current : 10mA MAX.
	
Fig. 1	
Pass criteria:	Main Contact Initial: 20 mΩ MAX. After testing: $\triangle R$ 20 mΩ MAX. Ground contact Initial: 20 mΩ MAX. After testing: $\triangle R$ 20 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.

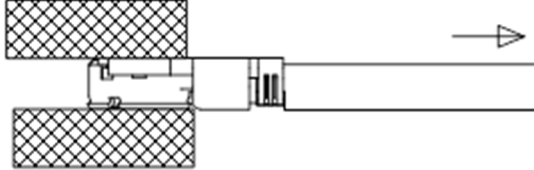
3. Dielectric withstanding voltage	
Reference standard:	MIL-STD-202-301
Test conditions:	Mate the plug and receptacle connector together, then, apply AC 200 V rms between the inner contact and the ground contact for a minute.
Pass criteria:	No creeping discharge, flashover, no insulator breakdown shall 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~6.0GHz
	
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

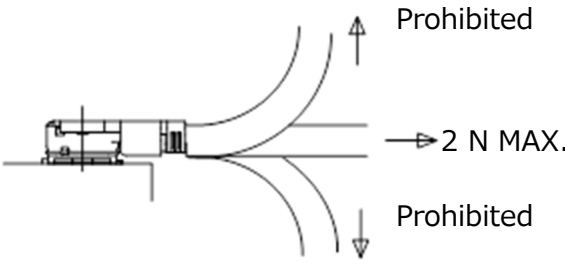
4.2. Mechanical Performance

1. Un-mating force	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board and mate the plug connector together then, measure the un-mating force at speed of 25±3mm/minutes in parallel with the mating axis by the push-pull machine.
Pass criteria:	Initial: 4 N MIN. 30cycles:2 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	
Pass criteria:	5 N MIN.

4.2. Mechanical Performance

3. Durability	
Reference standard:	-
Test conditions:	Mate and un-mate 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 the cable as shown in Fig. 4. During the testing, run 100mA DC to check electrical discontinuity.
 <p>The diagram shows a cross-section of a cable connector. A horizontal force of 2 N MAX. is applied to the cable. Upward and downward forces are labeled as 'Prohibited'.</p>	
Fig. 4	
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:	-
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: 1.5mm or 59m/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] See 4.1.1. [Electrical discontinuity] No electrical discontinuity greater than $1\mu\text{s}$.

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

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] See 4.1.1. [Insulation Resistance] See 4.1.2. [Dielectric Withstanding Voltage] See 4.1.3.

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

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] See 4.1.1.

4. H2S 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 ₂ S 3±1ppm Duration : 96 hours
Pass criteria:	[Appearance] No abnormality adversely affecting the performance shall occur [Contact Resistance] See 4.1.1.

5. Salt water spray	
Reference standard:	MIL-STD-202-101E, Condition B
Test conditions:	Apply the following environment to the mating connector. Temperature: 308±2K (35±2°C) Salt water density: 5±1% [by weight] Duration: 48 hours
Pass criteria:	[Appearance] No abnormality adversely affecting the performance shall occur [Contact Resistance] See 4.1.1.

4.4. Others

1. Solder ability	
Reference standard:	MIL-STD-202-208E
Test conditions:	Dip the solder tine of the contact in the solder bath at $518 \pm 5K$ ($245 \pm 5^\circ C$) for 5 ± 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 becomes wet and the pinhole that should not gather at one point is less than 5%.

2. Soldering heat resistance	
Reference standard:	-
Test conditions:	Reflow temperature profile. : Fig. 5 The number of reflow is 2 times.
<p>The graph shows a reflow temperature profile with two cycles. The first cycle starts with a ramp up to a plateau at 403~443K (130~170°C), which lasts for 60~120 seconds. This is followed by a second ramp up to a higher plateau at 553K (260°C), which lasts for 10±5 seconds. Both cycles end with a ramp down.</p>	
Fig.5	
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					
D. W. 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				
H2S Gas												2			
Salt Water Spray													2		
Solder ability														1	
Soldering Heat Resistance															1
Sample Quantity (pcs.)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

※Numbers indicate sequence in which tests are performed.

5. Recommended Metal Mask

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