

MHF[®] III Connector

Part No. PLUG: 20609-002R RECEPTACLE: 20369-001E

Product Specification

Qualification Test Report No. TR-15061

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1	S17452	June 15, 2017	M.A		T.M
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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 III Connector.

2. Product Name and Parts No.

2.1 Product Name

MHF III Connector

2.2 Parts No.

Plug: 20609-002R

Receptacle: 20369-001E

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 0.125mm

Outer conductor : 8/5/0.05 , 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 0.08mm

(2) Requirements

Characteristic impedance : 50(+2,-2) Ω . by TDR method

Nominal capacitance (Reference value) : 96 pF/m

Conductor resistance of inner conductor at 293K (20 $^{\circ}$ C) : 1400 Ω /km MAX.

Insulation resistance : 1000 M Ω ·km MIN.

Dielectric withstand voltage : no breakdown at AC1000V for 1 minutes.

3.2 Operating Conditions

Rated voltage: 60V AC (per contact)

Nominal characteristic impedance: 50 Ω

Frequency: DC~9GHz

VSWR: Plug: 1.30 Max at 0.1~3GHz, 1.50 Max at 3~6GHz, 1.70 Max at 6~9GHz

Receptacle: 1.30 Max at 0.1~3GHz. 1.40 Max at 3~6GHz, 1.60 Max at 6~9GHz

Operating temperature: 233 to 363K(-40 $^{\circ}$ C to 90 $^{\circ}$ C) (Containing temperature rise by current)

3.3 Storage Conditions

Storage temperature: 248 to 333K(-25 $^{\circ}$ C to 60 $^{\circ}$ 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 $^{\circ}$ C to 35 $^{\circ}$ 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 apply 20mV MAX. DC open circuit voltage and 10mA MAX. DC closed circuit current. Measure the contact resistance of signal and GROUND at the section shown in Fig.1 by the four terminal methods. Open circuit voltage : 20mV MAX. Circuit current : 10mA MAX.
Fig.1	
Pass criteria:	Signal Contact Initial: 20 mΩ MAX. After testing: ΔR 20 mΩ MAX. GROUND Initial: 20 mΩ MAX. After testing: ΔR 100 mΩ MAX.

2. Insulation resistance	
Reference standard:	MIL-STD-202-302, Test condition
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 abnormalities such as creeping discharge, flashover, insulator breakdown occur.

4. VSWR	
Reference standard:	-
Test conditions:	Measure the VSWR as shown in Fig.-2 by the network analyzer. Frequency : 100M ~ 9GHz
Fig.2	
Pass criteria:	Plug 1.30 MAX. at 0.1~3GHz, 1.50 MAX. at 3~6GHz, 1.70 MAX. at 6~9GHz Receptacle 1.30 MAX. at 0.1~3GHz, 1.40 MAX. at 3~6GHz, 1.60 MAX. at 6~9GHz

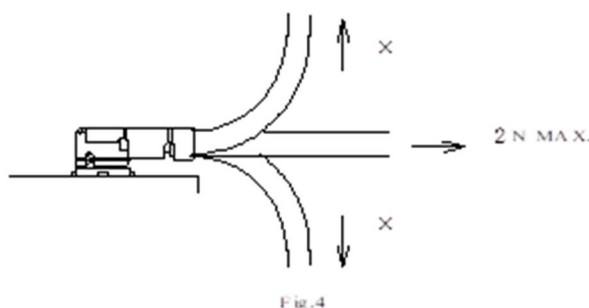
4.2. Mechanical Performance

1. Un-mating force	
Reference standard:	-
Test conditions:	Solder the receptacle connector to the test board and mate the plug connector, then measure the un-mating force at speed $25\pm 3\text{mm/minutes}$ along by the push-pull machine.
Pass criteria:	Total un-mating force 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 $25\pm 3\text{mm/minutes}$ by tensile strength machine.
Pass criteria:	7 N MIN.

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

4. Cable retention force	
Reference standard:	-
Test conditions:	Apply force on the cable as shown in Fig.-4. During the testing, run 100mA DC to check electrical discontinuity.



Pass criteria:	Contact resistance: Shall meet 4.1.1. Electrical discontinuity: No electrical discontinuity greater than $1\mu\text{s}$ shall occur. Appearance: No abnormality adversely affecting the performance shall occur.
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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: 1.5mm 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 $1\mu\text{s}$ shall occur. Appearance: No abnormality adversely affecting the performance shall occur.

6. Shock	
Reference standard:	MIL-STD-202-213, Test condition A.
Test conditions:	Apply the following vibration to the mating connector. During the testing, run 100mA DC to check electrical discontinuity. Peak value of acceleration : 735m/s ² (75G) Duration : 11msec Wave Form : half sinusoidal Directions , cycle 6 mutually perpendicular direction , 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 adversely affecting the performance shall occur.

4.3. Environmental Performance

1. Humidity (Steady state)	
Reference standard:	MIL-STD-202-103, Test 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:	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.

2. Thermal shock	
Reference standard:	MIL-STD-202-107, Test 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. Cycle: 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:	MIL-STD-202-108, Test condition A.
Test conditions:	Apply the following environment to the mating connector. Temperature: 363±2K (90±2°C) 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.

4. H ₂ S gas	
Reference standard:	-
Test conditions:	<p>Apply the following environment to the mating connector.</p> <p>Temperature: 313±2K (40±2°C) Relative humidity: 80±5%RH Gas: H₂S 3±1ppm Duration: 96 hours</p>
Pass criteria:	<p>Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur.</p>

5. Saltwater spray	
Reference standard:	MIL-STD-202-101, Test condition B.
Test conditions:	<p>Apply the following environment to the mating connector.</p> <p>Temperature: 308±2K (35±2°C) Relative Humidity: 95~98%RH Saltwater density: 5±1% [by weight] Duration: 48 hours</p>
Pass criteria:	<p>Contact resistance: Shall meet 4.1.1. Appearance: No abnormality adversely affecting the performance shall occur.</p>

4.4. Others

1. Solderability	
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 ± 0.5 seconds.
Pass criteria:	More than 95% of the dipped surface shall be evenly wet.

2. Resistance to soldering heat	
Reference standard:	-
Test conditions:	<p>(1) Reflow Part : $533 \pm 0/-5K$ ($260 \pm 0/-5^{\circ}C$) Peak $498K$ MIN. ($225^{\circ}C$ MIN.) 70sec. MIN.</p> <p>(2) Pre-heat Part $433 \sim 443K$ ($160 \sim 170^{\circ}C$) 80~100sec.</p> <p>※ Refer to reflow temperature profile. (Fig.5) ※ The number of reflow is within 2 times.</p>
<p>The graph shows a temperature profile with the following stages: <ul style="list-style-type: none"> Pre-heat: Temperature rises to $433 \sim 443K$ ($160 \sim 170^{\circ}C$) and is held for $80 \sim 100$ seconds. Reflow: Temperature rises to a peak of $533K$ ($260^{\circ}C$) for 1 second. Dwell: Temperature is held at $498K$ ($225^{\circ}C$) for 70 seconds. </p>	
<p>Fig.5</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <p>【Recommended metal mask thickness】 $t=0.12mm$ 【Recommended aperture ratio】 100%</p> </div>	
Pass criteria:	No deformation nor defect adversely affecting the performance 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	1,3	1,5	1,5	1,3	1,3	1,3			
Insulation Resistance								2,6	2,6						
Dielectric Withstanding Voltage								3,7	3,7						
VSWR	1														
Un-mating force		1													
Crimp strength			1												
Durability				2											
Cable retention force					2										
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 QTY.	Plug	10	10	10	10	10	10	10	10	10	10	10	10	-	-
	Receptacle	5		-											

※Numbers indicate test sequences.