

MHF[®] 7S Connector

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

Product Specification

Qualification Test Report No. TR-20043

| | | | | | |
|------|--------|-------------------|-------------|-------------|----------------|
| 3 | S21114 | March 11, 2021 | Y. Imaji | H. Nakamura | Hiro Takahashi |
| 2 | S20673 | December 25, 2020 | Y. Imaji | H. Nakamura | Hiro Takahashi |
| 1 | S20645 | December 9, 2020 | Y. Imaji | H. Nakamura | Hiro Takahashi |
| 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 Ω /km

Insulation resistance: 1,500M Ω ·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 Ω

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

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 (650 mmHg to 800 mmHg)

Relative humidity: 45 to 75% R.H.

4.1. Electrical Performance

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|--------------------------|---|
| 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 Contact and Ground contact at the section shown in Fig. 1 by the four terminal methods. |
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| Fig.1 Contact resistance | |
| Pass criteria: | Contact Initial: 20 mΩ MAX. After testing: ΔR 20 mΩ MAX. Ground contact Initial: 20 mΩ MAX. After testing: ΔR 20 mΩ MAX. |

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

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| 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 Contact and Ground contact. for a minute. |
| Pass criteria: | No abnormalities such as creeping discharge, flashover, and insulator breakdown occur. |

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| 4. VSWR | |
| Reference standard: | - |
| Test conditions: | Measure VSWR by network analyzer as shown in Fig. 2. Frequency: 0.1 GHz ~ 15 GHz |
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| Fig. 2 VSWR | |
| Pass criteria: | MATING CONDITION: 1.30 MAX at 0.1~3 GHz 1.35 MAX at 3~6 GHz 1.40MAX at 6~9 GHz 1.45MAX at 9~12 GHz 1.50 MAX at 12~15 GHz |

4.2. Mechanical Performance

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| 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. Repeat mating/unmating 30 cycles at a speed 25 ± 3 mm/min. along the mating axis. Measure the mating and unmating force at the initial and after 30 cycles. |
| 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. |

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| 2. Cable retention force at 0 degree | |
| Reference standard: | - |
| Test conditions: | Mate Plug with Receptacle and pull the cable by 10N as shown in 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 μ s. |

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| 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 ± 3 mm/min. along the mating axis. |
| Pass criteria: | Appearance: No abnormality. Contact resistance: Shall meet 4.1.1 |

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| 4. Receptacle shearing strength | |
| Reference standard: | - |
| Test conditions: | Solder the receptacle connector to the test board, and push the receptacle connector from each direction 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

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| 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 ² (6G) Directions, cycle: 3 mutually perpendicular directions, 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 |

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| 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 ² (75G) Duration: 11msec Wave Form: Half Sinusoidal Directions: 6 directions along 3 mutually perpendicular directions Cycle: 3 cycles 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

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| 1. Thermal shock | |
| Reference standard: | MIL-STD-202-107, 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. 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 adversely affecting the performance shall occur. |

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| 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 adversely affecting the performance shall occur. |

4.3. Environmental Performance**3. Humidity (Steady state)**

Reference standard: MIL-STD-202-103, 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 adversely affecting the performance shall occur.

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. H₂S 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: H₂S 3 ± 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

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

2. Soldering heat resistance

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| Reference standard: - | |
| Test conditions: | Reflow temperature profile: See Fig. 5 Cycle: 2. Metal mask size: See Fig. 6 |

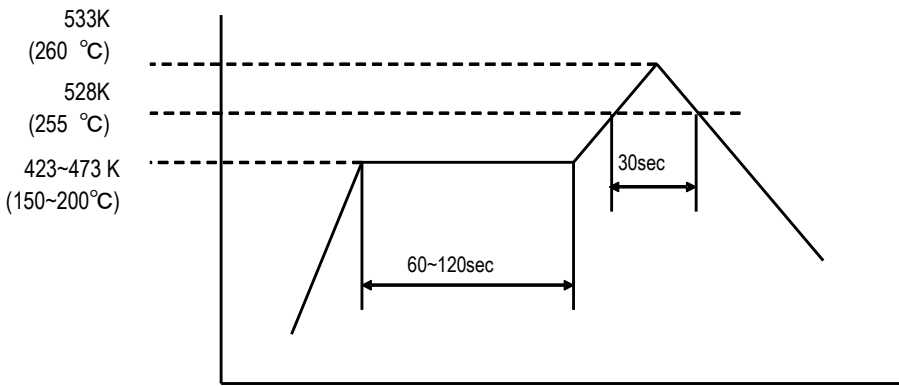
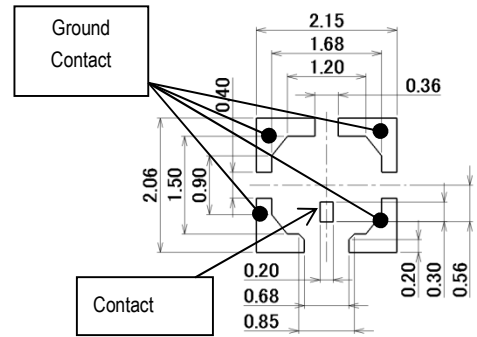


Fig. 5 Reflow Temperature Profile

Recommended thickness of METAL MASK:
 $t=0.08$



Unit: mm
Tolerance ± 0.03 mm

Fig. 6 Recommended metal mask

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| Pass criteria: | No deformation nor defect adversely affecting the performance occur. |
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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 | | | | | | | | | | | |
| Receptacle shearing strength | | | | | | 1 | | | | | | | | | | |
| Vibration | | | | | | | 2 | | | | | | | | | |
| Shock | | | | | | | | 2 | | | | | | | | |
| Thermal shock | | | | | | | | | 4 | | | | | | | |
| High temperature life | | | | | | | | | | 2 | | | | | | |
| Humidity steady state | | | | | | | | | | | 4 | | | | | |
| Salt Water Spray | | | | | | | | | | | | 2 | | | | |
| H ₂ 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 | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Test board (pcs.) | 10 | 10 | 10 | 10 | 10 | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |

※Numbers indicate test sequences.