
MATE-AX 50-Ohm Coaxial Connector

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the TE MATE-AX Connector system. Application product description and part numbers are shown in Fig 3

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

Standards and Specifications

- SAE/USCAR-2, Revision 6: Performance Standard for Automotive Electrical Connector Systems
- SAE/USCAR-17, Revision 5: Performance Specification for Automotive RF Connector Systems

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Temperature: -40 to +105°C
- Characteristic Impedance: 50 ohms
- Frequency Range: 0 to 9.0 GHz

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions per SAE/USCAR-2.

3.5. Test Requirements and Procedures Summary

| Test Description | Requirement | Procedure |
|---|--|--|
| 3.5.1. Visual inspection. | No defects | SAE/USCAR-2, Rev.6, 5.1.8.3. |
| ELECTRICAL | | |
| 3.5.2 Contact resistance. | Before exposure Max. 15 mOhm for signal Max. 7.5 mOhm for outer contact After exposure Max. 40 mOhm for signal and ground contacts. | SAE/USCAR-2, Rev.6, 5.3.1.3. |
| 3.5.3 Isolation resistance. | 100 M Min. | SAE/USCAR-2, Rev.6, 5.5.1.3. |
| 3.5.4 Current Capability | 1.0 A RG174 Cable 3.0 A RTK 031 Cable | DIN EN 60512-5-1 |
| 3.5.5 Dielectric withstanding voltage. | 800 volts AC/ 60s No dielectric breakdowns | SAE/USCAR-17, Rev.5, 4.3.2.2. |
| MECHANICAL | | |
| 3.5.6 Solderability, dip test. | Solderable area shall have a minimum of 95% solder coverage. | AMP Spec 109-11-10 Test Method B (JEDEC JESD22-B102E Method 1). |
| 3.5.7 Reflow Solder | no defects | TEC-109-201 Rev E 3.3.C.2.b |
| 3.5.8 Connector engagement force. | 75 N max. | SAE/USCAR-2, Rev.6, 5.4.2.3. |
| 3.5.9 Connector disengagement force with lock disabled. | 75 N max. | SAE/USCAR-2, Rev.6, 5.4.2.3. |
| 3.5.10 Connector disengagement force with lock enabled | 110 N min. | SAE/USCAR-2, Rev.6, 5.4.2.3. |

| Test Description | Requirement | Procedure |
|---|--|--|
| 3.5.11 Polarization effectiveness. | 130 N maximum with no center contact continuity. | SAE/USCAR-2, Rev.6, 5.4.4.3. |
| 3.5.12 Mechanical pull test- 110N axial | No defects or loss of continuity. | SAE/USCAR-17, Rev.5, 4.2.1.2. |
| 3.5.13 Mechanical pull test- 75N off-angle | No defects or loss of continuity. | SAE/USCAR-17, Rev.5, 4.2.1.2. |
| 3.5.14 Connector cycling. | No defects | SAE/USCAR-2, Rev.6, 5.1.7.3. |
| 3.5.15 Mechanical shock / Vibration | No defects or loss of continuity. | DIN IEC 60068-2-27 Severity 1(Unsealed) DIN IEC 60068-2-27 Severity 2(Sealed) DIN IEC 60068-2-64 Severity 1(Unsealed) DIN IEC 60068-2-64 Severity 2(Sealed) |
| 3.5.16 Header pin retention. | 15 N min. | SAE/USCAR-2, Rev.6, 5.7.1.3. |
| 3.5.17 Connector Lock Manipulation Force | 6Nmin, 51Nmax | SAE/USCAR-2, Rev.6, 5.4.2.3. |
| 3.5.18 Cap retention force | 150N min | TE 109-18341 8.2.12.3 |
| ENVIRONMENTAL | | |
| 3.5.19 Thermal shock. | SAE/USCAR-2, Rev.6, 5.6.1.4. | SAE/USCAR-2, Rev.6, 5.6.1.3. |
| 3.5.20 Temperature-humidity cycling. | SAE/USCAR-2, Rev.6, 5.6.2.4. | SAE/USCAR-2, Rev.6, 5.6.2.3. |
| 3.5.21 High temperature exposure. | SAE/USCAR-2, Rev.6, 5.6.3.4. | SAE/USCAR-2, Rev.6, 5.6.3.3. |

| Test Description | Requirement | Procedure |
|--------------------------|---|-------------------|
| RF-Parameter | | |
| 3.5.22 Impedance | 50±10 Ohm | DIN EN 60512-25-7 |
| 3.5.23 Insertion Loss | ≤ 0,25 dB 0.03 GHz < f ≤ 1 GHz ≤ 0,35 dB 1 GHz < f ≤ 2.5 GHz ≤ 0,45 dB 2.5 GHz < f ≤ 4 GHz ≤ 0,55 dB 4 GHz < f ≤ 5.5 GHz ≤ 0,65 dB 5.5 GHz < f ≤ 7 GHz ≤ 0,75 dB 7 GHz < f ≤ 8.5 GHz ≤ 0,85 dB 8.5 GHz < f ≤ 1 GHz | DIN EN 60512-25-2 |
| 3.5.24 Return Loss | ≥ 25 dB 0 < f ≤ 1 GHz ≥ 29-4*f dB 1 GHz < f ≤ 3 GHz ≥ 17 dB 3 GHz < f ≤ 5.5 GHz ≥ 44.5-5*f dB 5.5 GHz < f ≤ 6.5GHz ≥ 12 dB 6.5 GHz < f ≤ 8 GHz ≥ 36-3*f dB 8 GHz < f ≤ 9 GHz *Where f in GHz | DIN EN 60512-25-5 |
| 3.5.25 Cross Talk | ≥ 60 dB 0,08 GHz < f ≤ 4 GHz ≥ 50 dB 4 GHz < f ≤ 9 GHz | DIN EN 60512-25-1 |

(Figure 1)

3.6. Product Qualification and Requalification Test Sequence

| Test or Examination | Test Group (i) | | | | | | | | | | | |
|---|--------------------|-----|-----|------|------|------|------|-----|-----|-----|-----|-----|
| | A | B | C | D | E | F | G | H | J | K | L | M |
| | Test Sequence (ii) | | | | | | | | | | | |
| 3.5.1 Visual inspection | 1,6 | 1,3 | 1,4 | 1,17 | 1,17 | 1,17 | 1,17 | 1,3 | 1,3 | 1,3 | 1,3 | 1,3 |
| 3.5.2 Contact resistance | | | | 2,10 | 2,10 | 2,10 | 2,10 | | | | | |
| 3.5.3 Isolation resistance | | | | 3,11 | 3,11 | 3,11 | 3,11 | | | | | |
| 3.5.4 Current capacity (Temperature rise , derating) | | | | | | | | 2 | | | | |
| 3.5.5 Dielectric withstanding voltage | | | | 16 | 16 | 16 | 16 | | | | | |
| 3.5.6 Solderability dip test | | | | | | | | | | 2 | | |
| 3.5.7 Reflow solder | | | | | | | | | | | 2 | |
| 3.5.8 Connector engagement force | 2 | | | | | | | | | | | |
| 3.5.9 Connector disengagement force with lock enabled | 3 | | | | | | | | | | | |
| 3.5.10 Connector disengagement force with lock disabled | 4 | | | | | | | | | | | |
| 3.5.11 Polarization effectiveness | | 2 | | | | | | | | | | |
| 3.5.12 Mechanical pull test-110 N axial | | | 2 | | | | | | | | | |
| 3.5.13 Mechanical pull test-75 N off-angle | | | 3 | | | | | | | | | |
| 3.5.14 Coding cap retention force | | | | | | | | | | | | 2 |
| 3.5.15 Connector cycling | | | | 8 | 8 | 8 | 8 | | | | | |
| 3.5.16 Vibration/mechanical shock | | | | 9 | | | | | | | | |
| 3.5.17 Header pin retention | | | | | | | | | 2 | | | |
| 3.5.18 Connector lock manipulation force | 5 | | | | | | | | | | | |
| 3.5.19 Thermal shock | | | | | 9 | | | | | | | |
| 3.5.20 Temperature-humidity cycling | | | | | | 9 | | | | | | |
| 3.5.21 High temperature exposure | | | | | | | 9 | | | | | |
| 3.5.22 Impedance | | | | 4,12 | 4,12 | 4,12 | 4,12 | | | | | |
| 3.5.23 Insertion loss | | | | 5,13 | 5,13 | 5,13 | 5,13 | | | | | |
| 3.5.24 Return loss | | | | 6,14 | 6,14 | 6,14 | 6,14 | | | | | |
| 3.5.25 Cross talk | | | | 7,15 | 7,15 | 7,15 | 7,15 | | | | | |

NOTE

- (i) See paragraph 4.1.A.
- (ii) Numbers indicate sequence in which tests are performed.
(Figure 2)

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2.

4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

5. Change Log

| Revision | Date | Remark | Engineer |
|----------|-------------|--|-----------|
| A | 26-Oct-2018 | Initial draft | Denny Zhu |
| B | 06-Sep-2019 | Chapter 2 changed | Denny Zhu |
| C | 10-May-2021 | Chapter 3.5.24 add requirement | Alice Cai |
| D | 21-Sep-2022 | Chapter 3.5.15 add vibration severity 2(unsealed) | Toddy Xu |
| E | 22-May-2023 | Chapter 3.5.15 add vibration severity 1&2 (sealed) | Toddy Xu |
| E1 | 12-Mar-2024 | Version corrections | Toddy Xu |

(Figure 3)