



**CONNECTOR PERFORMANCE STANDARD  
FOR OUTLINES OF SOLID STATE AND  
RELATED PRODUCTS**

**PS-004A**

**UFS Card Socket Performance Standard**

**(For UFS Card 6Gb/s)**

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**JEDEC  
SOLID STATE TECHNOLOGY ASSOCIATION**

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## UFS CARD SOCKET PERFORMANCE STANDARD

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## UFS CARD SOCKET PERFORMANCE STANDARD

(From JEDEC Board Ballot JCB-09-15, and JCB-20-01, formulated under the cognizance of the JC-11.14 Subcommittee on Microelectronic Assemblies, and the JC-64.5 Subcommittee on UFS Measurement.)

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### **1 Scope**

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This standard defines the mechanical, electrical, and reliability requirements of the UFS card socket with data rate as high as 6Gb/s. The socket outline is defined in JEDEC SO-022. The intent of this document is to provide a performance standard to enable the socket vendors, system designers and manufacturers to build, qualify, and use the UFS card socket.

#### **1.1 Socket overview**

A UFS card socket has multiple contact pins dedicated for power, ground, high speed signal and control signal. It includes a metal shell to accept and hold a UFS card. The shell is soldered to board for mechanical stability. While there are other possible ways to design UFS card socket, this document is based on push pull type socket published in JEDEC SO-022.

#### **1.2 UFS card overview**

UFS card outline is defined in JEDEC MO-320. It exposes 12 pads for electrical contact. The pads should be plated for desired contact reliability.

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## 2 References

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The following references provide normative requirements as specified in the body of this document:

- EIA-364-09C: Durability
- EIA-364-13E: Insertion and Extraction Force
- EIA-364-17B: High Temperature life
- EIA-364-20D: Dielectric withstanding voltage Resistance
- EIA-364-21D: Insulation resistance
- EIA 364-23C: Low Level Contact Resistance Test Procedures for Electrical Connectors and Sockets
- EIA 364-26B: Salt spray
- EIA 364-27C: Mechanical Shock Test Procedure for Electrical Connectors
- EIA 364-28F: Low Level Contact Resistance Test Procedures for Electrical Connectors and Sockets
- EIA 364-29C: Contact Retention Test Procedure for Electrical Connectors
- EIA-364-31C: Humidity Test Procedure for Electrical Connectors and Sockets
- EIA-364-32F: Thermal Shock Test Procedure for Electrical Connectors and Sockets
- EIA-364-42B: Impact Test Procedure for Electrical Connectors
- EIA-364-59A: Low Temperature Life
- EIA-364-65B: Mixed Flowing Gas
- EIA-364-70B: Temperature Rise Versus Current Test Procedure for Electrical Connectors and Sockets
- EIA-364-52: Solderability of Contact Terminations
- J-STD-002D: Solderability Test for Component Leads, Terminations, Lugs, Terminals and Wires
- JEDEC JESD220-2A, Universal Flash Storage (UFS) Card Extension, Version 1.1
- JEDEC JEP95, MO-320, UFS Card Form Factor
- JEDEC JEP95, SO-022, 12 Pin UFS Card Socket Outline, 0.91mm Pitch, Rev A.
- JEDEC JESD220B, Universal Flash Storage (UFS), Version 2.1

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### 3 Acronyms, terms, and definitions

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**Table 1 — Terms and definitions**

| <b>Term</b>  | <b>Description</b>                              |
|--------------|---|
| BOL          | Beginning of Life                               |
| dB           | Given in dB-volts, i.e., $20\log_{10}(V_2/V_1)$ |
| DUT          | Device under test                               |
| EOL          | End of Life                                     |
| JEDEC        | JEDEC Solid State Technology Association        |
| System board | PCB on which the UFS card socket is mounted     |
| UFS          | Universal Flash Storage                         |
| SI           | Signal Integrity                                |



## 4 Performance requirements

Testing shall be performed per EIA 364-1000 test groups 1, 2, 3 and 4 for 5-year life cycle requirements. A minimum 5 samples are to be tested per subgroup.

### 4.1 Mechanical and process requirements

**Table 2 — Mechanical and process requirements**

| Mechanical Test Description | Procedure   | Requirement   |
|-----------------------------|---|---|
| Insertion Force             | EIA-364-13E<br>Axial Tension/Compression machine such as an Instron Tensile Tester.<br>Rate: 25.4 mm/min. | 10 N Maximum  |
| Extraction Force            | EIA-364-13E<br>Axial Tension/Compression machine such as an Instron Tensile Tester.<br>Rate: 25.4 mm/min. | 0.5 N Minimum   |
| Durability                  | EIA-364-09C<br>Perform 2000 plug and unplug cycles at a rate of 500 cycles per hour                       | No evidence of physical damage.<br>Pass LLCR requirement.   |
| Solderability - Lead Free   | J-STD-002D; Condition C, 8 hours $\pm$ 15 minutes steam precondition.                                     | 95% coverage minimum  |
| Lead Free Process Ability   | 260 °C, 5 seconds.  | No evidence of physical damage to connector per visual inspection at 24 inches. No magnification. |

### 4.2 Electrical requirements

**Table 3 — Connector electrical requirements**

| DC Electrical Requirements          | Procedure   | Requirement   |
|-------------------------------------|---|---|
| Low Level Contact Resistance (LLCR) | EIA364-23B Subject mated contacts assembled in housing to 20 mV maximum voltage at 100 mA maximum current | 100 m $\Omega$ max before the test.<br>130 m $\Omega$ max after the test. |
| Withstanding Voltage                | EIA-364-20D Condition I.<br>500 V AC at sea level.  | One-minute hold with no breakdown or flashover.                           |
| Insulation Resistance               | EIA-364 -21D measure within 1 minute after applying 500 V DC.   | 100 M $\Omega$ minimum  |
| Temperature Rise                    | EIA-364-70B Test Procedure 70, based on 30 °C rise above ambient temperature.                             | 0.5 A/pin   |

### 4.3 Reliability requirements

**Table 4 — Reliability test sequence**

| Test                               | Test Group |         |         |            |
|------------------------------------|------------|---------|---------|------------|
|                                    | 1          | 2       | 3       | 4          |
| Low Level Contact Resistance       | 1,4,6      | 1,4,6,8 | 1,3,5,7 | 1,4,6,8,10 |
| Reseating                          | 5          | 7       |         | 9          |
| Vibration                          |            |         | 4       |            |
| Mechanical Shock                   |            |         | 6       |            |
| Durability (preconditioning)       | 2          | 2       | 2       | 2          |
| Temperature Life                   | 3          |         |         |            |
| Temperature Life (preconditioning) |            |         |         | 3          |
| Thermal Shock                      |            | 3       |         |            |
| Cyclic Temp and Humidity           |            | 5       |         |            |
| Mixed Flowing Gas                  |            |         |         | 5          |
| Thermal Disturbance                |            |         |         | 7          |

### 4.3 Reliability requirements (cont'd)

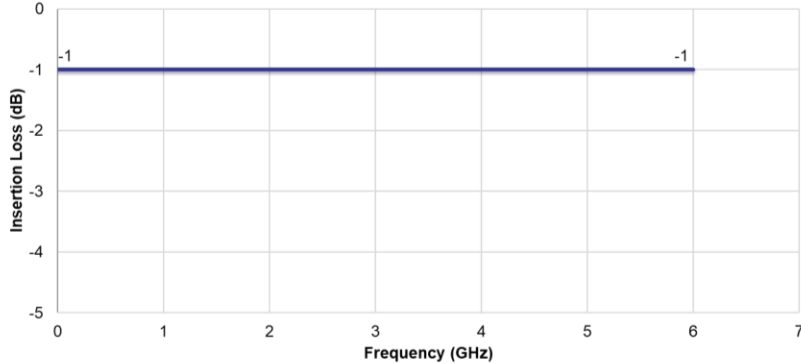
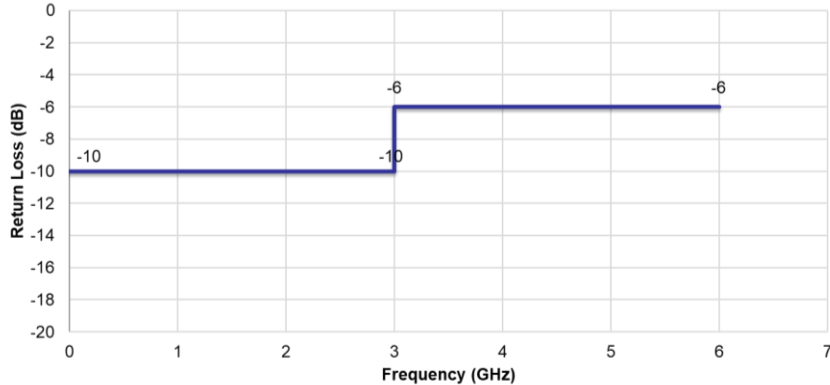
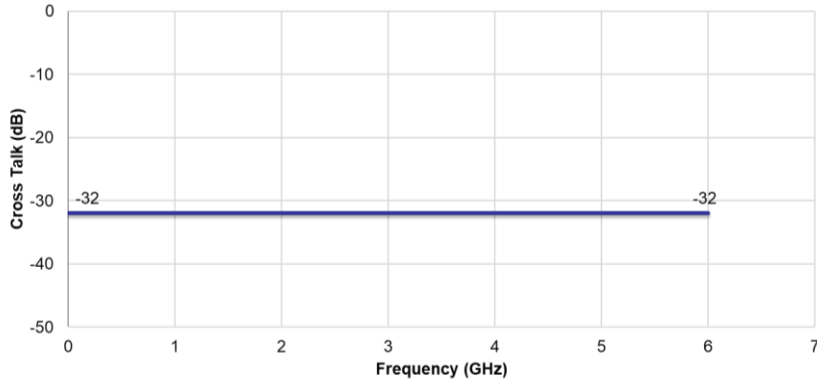
**Table 5 — Reliability test conditions**

| Reliability Test Description        | Procedure   | Requirement   |
|-------------------------------------|---|---|
| Durability (preconditioning)        | EIA-364-09C, perform 20 plug/unplug cycles  | No evidence of physical damage  |
| Temperature Life                    | EIA-364-17B, Method A (without electrical load)<br>60 °C field temperature. Test Temperature and Test Duration per EIA 364-1000 Table 8   | Electrical and mechanical criteria  |
| Temperature Life (preconditioning)  | EIA-364-17B, Method A (without electrical load)<br>60 °C field temperature. Test Temperature and Test Duration per EIA 364-1000 Table 9   | Electrical and mechanical criteria  |
| Low Level Contact Resistance (LLCR) | Refer to Table 4 LLCR   |   |
| Shock                               | EIA-364 -27C<br>Trapezoidal shock 50 g, $\pm 10\%$<br>Duration 11 ms<br>Velocity change 170 inch/sec, $\pm 10\%$<br>Three drops in each of six directions are applied to each of the three samples  | Electrical and mechanical criteria  |
| Vibration                           | EIA-364 -28F<br>Random profile:<br>5 Hz @ 0.01 g <sup>2</sup> /Hz to 20 Hz @ 0.02 g <sup>2</sup> /Hz (slope up)<br>20 Hz to 500 Hz @ 0.02 g <sup>2</sup> /Hz (flat)<br>Input acceleration is 3.13 g RMS<br>10 minutes per axis for all 3 axes on all samples<br>Random control limit tolerance is $\pm 3$ dB        | No discontinuities of $\geq 1$ microsecond.<br>Electrical and mechanical criteria |
| Cyclic Temperature and Humidity     | EIA-364-31C, Method III without conditioning, initial measurements, cold shock and vibration. Ramp times should be 0.5 hour and dwell times should be 1.0 hour. Dwell times start when the temperature and humidity have stabilized within specified levels, perform 24 cycles in mated condition                   | Electrical and mechanical criteria  |
| Thermal Shock                       | EIA-364-32F, Method A, Table 2, Test Condition 1, -55 °C to 85 °C, perform 5 cycles in mated condition  | Electrical and mechanical criteria  |
| Thermal Disturbance                 | EIA-364-1000 Cycle the connector between $15 \pm 3$ °C and $85 \pm 3$ °C, as measured on the part. Ramps should be a minimum of 2 °C/minute. Dwell times should ensure that the contacts reach the temperature extremes (a minimum of 5 minutes), humidity is not controlled; perform 10 cycles in mated condition. | Electrical and mechanical criteria  |
| Mixed Flowing Gas                   | EIA-364-65B, class IIA, Option 4. Expose all specimens in the mated condition for the total mixed flowing gas exposure duration per EIA 364-1000 Table 4.1.   | Electrical and mechanical criteria  |
| Reseating                           | Manually unplug/plug the connector.<br>Perform 3 cycles   | No evidence of physical damage  |

#### 4.4 SI requirements

The UFS card socket shall meet the signal integrity requirements in Table 6.

**Table 6 — SI requirements**

| S Parameter    | Procedure   | Requirement                              |
|----------------|---|--|
| Insertion Loss | <p>EIA 364-101, the measured differential S parameter shall be referenced to an 100 <math>\Omega</math> differential impedance.</p> <p style="text-align: center;"><b>Insertion loss</b></p>  | -1 dB<br>(0-6GHz)                        |
| Return Loss    | <p>EIA 364-108, the measured differential S parameter shall be referenced to an 100 <math>\Omega</math> differential impedance.</p> <p style="text-align: center;"><b>Return loss</b></p>    | -10 dB<br>(0-3GHz);<br>-6 dB<br>(3-6GHz) |
| Cross Talk     | <p>EIA 364-90, the measured differential S parameter shall be referenced to an 100 <math>\Omega</math> differential impedance.</p> <p style="text-align: center;"><b>Cross Talk</b></p>     | -32 dB<br>(0-6GHz)                       |

## Annex A (Informative) LLCR Measurements

A sample test setup of LLCR measurement is illustrated in Figure A.1. A PCB board with golden fingers is used to emulate UFS card. Each golden finger has two traces routed out for LLCR probes. Golden finger size and location follow JEDEC JEP95, MO-320. Golden fingers connect to contacts on UFS card socket. Following JEDEC JEP95, SO-022, each contact corresponds with solder pad on base board. Each solder pad has two traces routed out for LLCR probes.

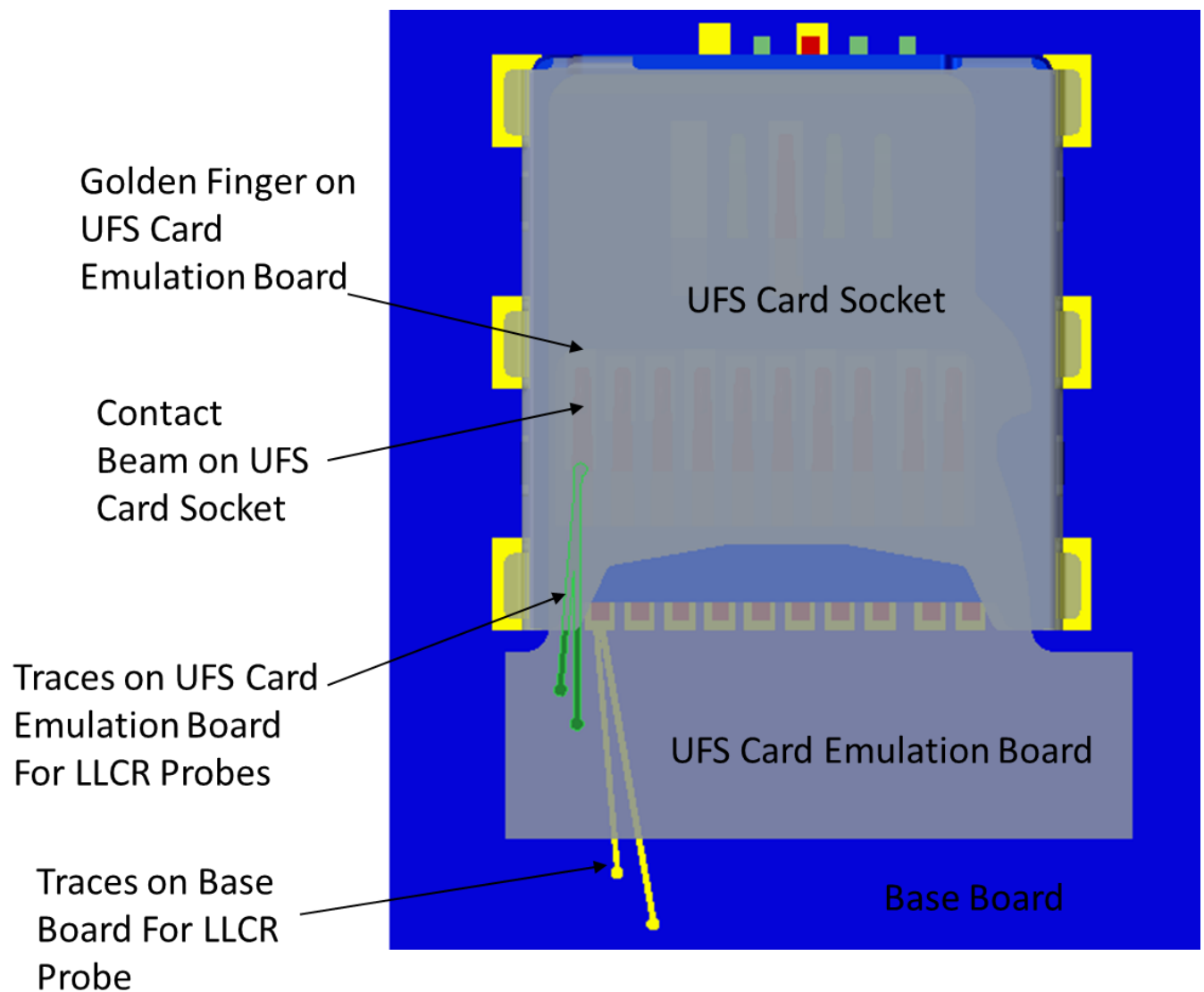


Figure A.1 — An example of 4-wire LLCR measurement setup

### Change record history

If the change involves any words added or deleted (excluding deletion of accidentally repeated words), the change is to be included below. Punctuation changes may or may not be included.

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