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## 2.0 PRODUCT DESCRIPTION

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## 1.0 SCOPE

This specification is applicable to the performance characteristics of QSFP+ cable to board connector system.

## 2.0 PRODUCT DESCRIPTION

### 2.1 PRODUCT NAME AND SERIES NUMBER(S)

| Product | Series P/N | Test Sections Do Not Apply |
|---|---|---|
| 10G QSFP Cable Assembly | 10093084 | |
| 14G QSFP+ Cable Assembly | 10119239 | |
| 28G QSFP+ Cable Assembly | 10121178 | |
| QSFP SMT Board Connector | 10099113/10132344 | |
| QSFP Cage | 10099114/10128765/10130975 | |
| QSFP Heat Sink | 10099115 | |
| QSFP Heat Sink Clip | 10099116 | |
| QSFP Cage with Sink and Clip Assembly | 10116015/10128764 | |
| Custom QSFP Cable Assembly | 10110113 | 3.2, 6.4, 6.5 |
| Custom QSFP Cable Assembly | 10111727 | 3.2, 6.4, 6.5 |
| 10G QSFP+ to 4xSFP+ Cable Assembly QSFP End | 10114734 | |
| 28G QSFP+ to 4xSFP+ Cable Assembly QSFP End | 10130795 | |

### 2.2 DIMENSIONS, MATERIALS, PLATING AND MARKINGS

Refer to the applicable customer drawing for the related dimensional, material, plating, and marking information.

### 2.3 ADDITIONAL GENERAL SPECIFICATIONS

Plug PCB:

- Material: FR4
- Overall thickness: 1.0mm ±0.1(over pads)
- Mating interface plating: Hard gold over nickel

Bulk Cable:

- As listed on the cable specification drawings.

## 3.0 REFERENCE DOCUMENTS

### 3.1 FCI DOCUMENTS

| | |
|---|---|
| GS-14-1272 | Cable Assembly Packaging Specification |
| GS-14-1400 | Board Connector, Cage, and Heat Sink Packaging Specification |
| GS-20-126 | Board Connector, Cage, and Heat Sink Product Application Specification. |
| SI-2009-09-004 | 10G QSFP+ Signal Integrity Performance Report (This Applies Only To Standard Part Number) |
| SI-VG-2012-04-001 | 14G QSFP+ Signal Integrity Performance Report (This only applies to the 14G QSFP+ Part Number) |
| SI-VG-2012-11-013 | 4x28G QSFP+ Signal Integrity Performance Reports (This applies only to |
| SI-VG-2012-11-021 | the 28G P/N) |
| GS-29-622 | 10G Qualification Test Report Summary |
| EL-2012-05-033 | 14G Qualification Test Report |
| EL-2012-12-023 | 28G Qualification Test Report |

### 3.2 INDUSTRY DOCUMENTS

FIT, FORM AND FUNCTION

| | |
|---|---|
| SFF-8436 | QSFP+ Copper and Optical Modules |
| SFF-8661 | QSFP+ 28 Gb/s 4X Pluggable Module (Style A) |
| SFF-8662 | QSFP+ 28 Gb/s 4X Connector (Style A) or |
| SFF-8672 | QSFP+ 28 Gb/s 4X Connector (Style B) |
| SFF-8663 | QSFP+ 28 Gb/s 4X Cage (Style A) |
| IEEE 802.3 | Gigabit Ethernet Standard |

Infiniband IBTA FDR (This applies only to the 14G QSFP+ P/N)
InfiniBand IBTA EDR (This applies only to the 4x28G QSFP+ P/N)
ITU-T G.957 Synchronous Digital Hierarchy Standard
Telcordia Technologies GR-253-CORE
JEDEC JESD22-A-114B ESD Specification

TEST SPECIFICATON(S)

EIA 364 Series Electrical Connector Test Procedures Including Environmental Classifications with Test Procedure

## 4.0 QUALIFICATION

Connector and cable assemblies furnished under this specification shall be capable of meeting the qualification test requirements specified herein and shall be uniform in quality, and void of all defects that would adversely affect life or serviceability.

## 5.0 RATINGS

### 5.1 VOLTAGE

30 Volts AC per Contact (RMS)/DC Max.

### 5.2 CURRENT

0.5 Amps Max (per contact)
1.0 Amp Max (per power pin)

### 5.3 TEMPERATURE

Operating: -40ºC to +85ºC

## 6.0 PERFORMANCE

### 6.1 ELECTRICAL CHARACTERISTICS

| ITEM | DESCRIPTION | TEST CONDITION | REQUIREMENT |
|---|---|---|---|
| **6.1.1** | **LLCR** | Mate connectors: apply a maximum voltage of **320** mV and a current of **10** mA. (EIA 364-6) | **20** milliohm maximum change from initial after environmental exposure |
| **6.1.2** | **Insulation Resistance** | After **100** VDC for 1 minute, measure the insulation resistance between adjacent mated contacts. (EIA 364-21) | 1000 mΩ Minimum between adjacent contacts |
| **6.1.3** | **Dielectric Withstanding Voltage** | Apply a voltage of **300** VDC for **1** minute hold between adjacent mated terminals. (EIA 364-20, method B) | No defect between adjacent contacts |
| **6.1.4** | **Temperature Rise (via Current Cycling)** | Mate connectors: measure the temperature rise at the rated current after **96** hours (**45** minutes ON and **15** minutes OFF per hour). Testing as required. | Temperature rise: **+30**°C MAX. |

| | | | |
|---|---|---|---|
| **6.1.5** | **Differential Impedance** | Rise time of 70ps (20% to 80%)<br>(EIA 364-108) | No significant electrical change |
| **6.1.6** | **Continuity** | Verify the continuous electrical path of all expected connections | No unexpected opens, shorts, or high resistance areas. |

### 6.2 ESD Requirements

The module shall meet ESD requirements given in EN61000-4-2, criterion B test specification such that when installed in a properly grounded cage and chassis the units are subjected to 15KV air discharges during operation and 8KV direct contact discharges to the case.

The QSFP+ module and host SFI contacts (High Speed Contacts) shall withstand 1000V electrostatic discharge based on human body model per JEDEC JESD22-A114-B.

The QSFP+ module and host SFI contacts with the exception of the SFI contacts (High Speed Contacts) shall withstand 2kV electrostatic discharge based on human body model per JEDEC JESD22-A114-B.

The QSFP+ module shall meet ESD requirements given in EN61000-4-2, criterion B test specification such that units are subjected to 15kV air discharges during operation and 8kv direct contact discharges to the case.

### 6.3 EMI Protection

The chassis ground of the QSFP+ module is isolated from the modules circuit ground to provide the equipment designer flexibility regarding connections between external electromagnetic interference shields and circuit ground of the module.

**6.4 QSFP+ Cable Assembly Pin Assignment (Figure 3). See Specification SFF- 8436 section 4. Module mechanicals meet the requirements of specification SFF-8436.**

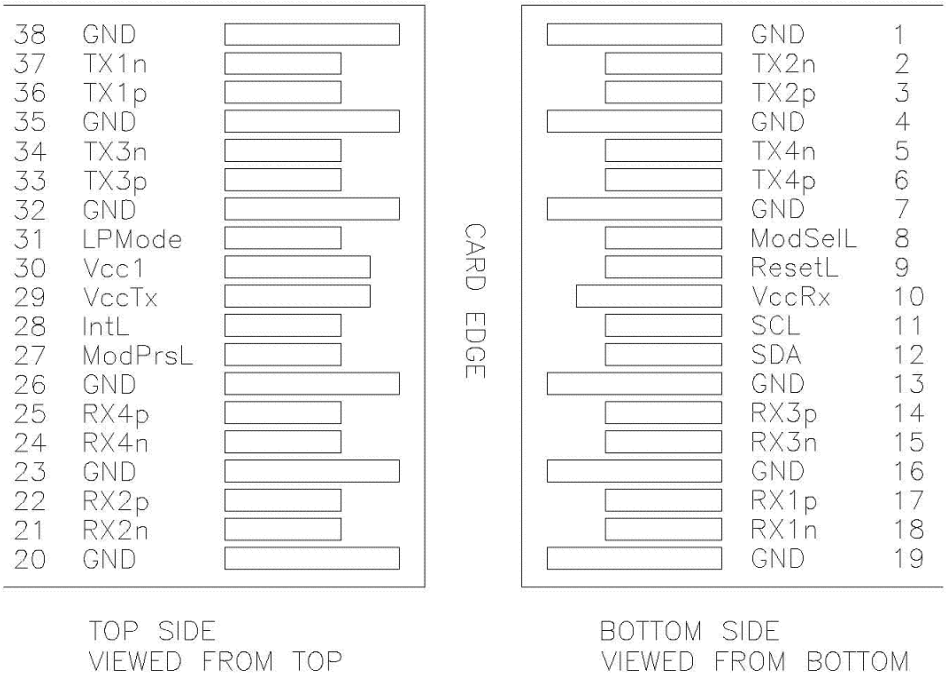


**FIGURE 3**
**QSFP+ Module Contact Definition**

### 6.5 2 Wire Interface EEPROM

The QSFP+ serial ID provides access to sophisticated identification information that describes the Transceiver's capabilities, standard interfaces, manufacturer, and other information. The EEPROM on the QSFP+ passive cable assembly is designed for 255 addresses.

**10G QSFP+ & 14G FDR & 28G EDR EEPROM information and source Refer to below document**

| TYPE | FCI PN |
|---|---|
| FCI STANDARD QSFP+ | 10093084 |
| FCI STANDARD FDR | 10119329 |
| FCI STANDARD EDR | 10121178 |

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| FCIStdEppromTemp_QSFP+_RevB.xlsx | | | | | FCI 10G QDR QSFP+ to QSFP+ | FCI 14G FDR QSFP+ to QSFP+ | FCI 28G EDR QSFP+ to QSFP+ | FCI 10G QDR QSFP+ to EYEMAX (QSFP end) | FCI 10G QDR QSFP+ to 4xSFP+ (QSFP end) | FCI 28G EDR QSFP+ to 4xSFP+ (QSFP end) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Address | | 10093084-XXXXXX | 10119239-XXXXXX | 10121178-XXXXXX | 10117984-XXXXXX | 10114734-XXXXXX | 10130795-XXXXXX |
| Name of Field | | | Addr (Dec) | Addr (Hex) | Value (Hex) | Value (Hex) | Value (Hex) | Value (Hex) | Value (Hex) | Value (Hex) |
| ID and status | Identifier | | 0 | 0 | D | D | D | D | D | D |
| | Revision Compliance | | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 |
| | Status | With MCU : 0x00; Without MCU : 0X04 ; | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 |
| Interrupt Flags | | | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 10 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 11 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 12 | C | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 13 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 14 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 15 | F | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 16 | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 17 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 18 | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 19 | 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 20 | 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 21 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 22 | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 23 | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 24 | 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 25 | 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 26 | 1A | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 27 | 1B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 28 | 1C | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 29 | 1D | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 30 | 1E | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 31 | 1F | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 32 | 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 33 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 34 | 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 35 | 23 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 36 | 24 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 37 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 38 | 26 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 39 | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 40 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 41 | 29 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 42 | 2A | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 43 | 2B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 44 | 2C | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 45 | 2D | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 46 | 2E | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 47 | 2F | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 48 | 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 49 | 31 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 50 | 32 | 0 | 0 | 0 | 0 | 0 | 0 |
| Channel Monitors | | | 51 | 33 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 52 | 34 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 53 | 35 | 0 | 0 | 0 | 0 | 0 | 0 |

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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 54 | 36 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 55 | 37 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 56 | 38 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 57 | 39 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 58 | 3A | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 59 | 3B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 60 | 3C | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 61 | 3D | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 62 | 3E | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 63 | 3F | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 64 | 40 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 65 | 41 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 66 | 42 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 67 | 43 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 68 | 44 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 69 | 45 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 70 | 46 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 71 | 47 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 72 | 48 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 73 | 49 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 74 | 4A | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 75 | 4B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 76 | 4C | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 77 | 4D | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 78 | 4E | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 79 | 4F | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 80 | 50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 81 | 51 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reserved | | | 82 | 52 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 83 | 53 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 84 | 54 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 85 | 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| Control | | | 86 | 56 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 87 | 57 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 88 | 58 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 89 | 59 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 90 | 5A | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 91 | 5B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 92 | 5C | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 93 | 5D | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 94 | 5E | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 95 | 5F | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 96 | 60 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 97 | 61 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reserved | | | 98 | 62 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 99 | 63 | 0 | 0 | 0 | 0 | 0 | 0 |
| Free Side Device Indicators and Channel Masks | | | 100 | 64 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 101 | 65 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 102 | 66 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 103 | 67 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 104 | 68 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 105 | 69 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 106 | 6A | 0 | 0 | 0 | 0 | 0 | 0 |
| Reserved | | | 107 | 6B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 108 | 6C | 0 | 0 | 0 | 0 | 0 | 0 |
| Free Side Device Properties | | | 109 | 6D | 0 | 0 | 0 | 0 | 0 | 0 |
| | Far end complies with SFF 8636: 0x08 ;<br>Far end doesn't complies with SFF 8636: 0x00 ; | | 110 | 6E | 8 | 8 | 8 | 0 | 0 | 0 |
| | | | 111 | 6F | 0 | 0 | 0 | 0 | 0 | 0 |
| Reserved | | | 112 | 70 | 0 | 0 | 0 | 0 | 0 | 0 |
| | connectivity of depopulated or break out cables | | 113 | 71 | 0 | 0 | 0 | 0 | 40 | 40 |
| | | | 114 | 72 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 115 | 73 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 116 | 74 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 117 | 75 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 118 | 76 | 0 | 0 | 0 | 0 | 0 | 0 |
| Password Change Entry Area (Optional) | | | 119 | 77 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 120 | 78 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 121 | 79 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 122 | 7A | 0 | 0 | 0 | 0 | 0 | 0 |
| Password Entry Area (Optional) | | | 123 | 7B | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 124 | 7C | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 125 | 7D | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 126 | 7E | 0 | 0 | 0 | 0 | 0 | 0 |
| Page Select Byte | | | 127 | 7F | 0 | 0 | 0 | 0 | 0 | 0 |

Base ID Fields

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Identifier | | 128 | 80 | D | D | D | D | D | D |
| Ext. Identifier | | 129 | 81 | 0 | 0 | 0 | 0 | 0 | 0 |
| Connector | | 130 | 82 | 23 | 23 | 23 | 23 | 23 | 23 |
| Specification Compliance | 10/40/100G Ethernet Compliance Code | 131 | 83 | 8 | 8 | 88 | 8 | 8 | 88 |
| | SONET Compliance codes | 132 | 84 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SAS/SATA compliance codes | 133 | 85 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Gigabit Ethernet Compliant codes | 134 | 86 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Fibre Channel link length | 135 | 87 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Fibre Channel Transmitter Technology | 136 | 88 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Fibre Channel transmission media | 137 | 89 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Fibre Channel Speed | 138 | 8A | 0 | 0 | 0 | 0 | 0 | 0 |
| Encoding | | 139 | 8B | 0 | 0 | 0 | 0 | 0 | 0 |
| BR, nominal | | 140 | 8C | 0 | 0 | 0 | 0 | 0 | 0 |
| Extended RateSelect | | 141 | 8D | 0 | 0 | 0 | 0 | 0 | 0 |
| Length(SMF) | | 142 | 8E | 0 | 0 | 0 | 0 | 0 | 0 |
| Length(OM3 50 um) | | 143 | 8F | 0 | 0 | 0 | 0 | 0 | 0 |
| Length(OM2 50 um) | | 144 | 90 | 0 | 0 | 0 | 0 | 0 | 0 |
| Length(OM1 62.5 um) | | 145 | 91 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cable Assembly Length (Passive or active) | | 146 | 92 | xx | xx | xx | xx | xx | xx |
| Device tech | | 147 | 93 | A0 | A0 | A0 | A0 | A0 | A0 |
| Vendor name | | 148 | 94 | 46 | 46 | 46 | 46 | 46 | 46 |
| | | 149 | 95 | 43 | 43 | 43 | 43 | 43 | 43 |
| | | 150 | 96 | 49 | 49 | 49 | 49 | 49 | 49 |
| | | 151 | 97 | 20 | 20 | 20 | 20 | 20 | 20 |
| | | 152 | 98 | 45 | 45 | 45 | 45 | 45 | 45 |
| | | 153 | 99 | 6C | 6C | 6C | 6C | 6C | 6C |
| | | 154 | 9A | 65 | 65 | 65 | 65 | 65 | 65 |
| | | 155 | 9B | 63 | 63 | 63 | 63 | 63 | 63 |
| | | 156 | 9C | 74 | 74 | 74 | 74 | 74 | 74 |
| | | 157 | 9D | 72 | 72 | 72 | 72 | 72 | 72 |
| | | 158 | 9E | 6F | 6F | 6F | 6F | 6F | 6F |
| | | 159 | 9F | 6E | 6E | 6E | 6E | 6E | 6E |
| | | 160 | A0 | 69 | 69 | 69 | 69 | 69 | 69 |
| | | 161 | A1 | 63 | 63 | 63 | 63 | 63 | 63 |
| | | 162 | A2 | 73 | 73 | 73 | 73 | 73 | 73 |
| | | 163 | A3 | 20 | 20 | 20 | 20 | 20 | 20 |
| Extended Module | | 164 | A4 | 7 | F | 1F | 7 | 7 | 1F |
| Vendor OUI | | 165 | A5 | FC | FC | FC | FC | FC | FC |
| | | 166 | A6 | 7C | 7C | 7C | 7C | 7C | 7C |
| | | 167 | A7 | E7 | E7 | E7 | E7 | E7 | E7 |
| Vendor PN | | 168 | A8 | 31 | 31 | 31 | 31 | 31 | 31 |
| | | 169 | A9 | 30 | 30 | 30 | 30 | 30 | 30 |
| | | 170 | AA | 30 | 31 | 31 | 31 | 31 | 31 |
| | | 171 | AB | 39 | 31 | 32 | 31 | 31 | 33 |
| | | 172 | AC | 33 | 39 | 31 | 37 | 34 | 30 |
| | | 173 | AD | 30 | 32 | 31 | 39 | 37 | 37 |
| | | 174 | AE | 38 | 33 | 37 | 38 | 33 | 39 |
| | | 175 | AF | 34 | 39 | 38 | 34 | 34 | 35 |
| | | 176 | B0 | 2D | 2D | 2D | 2D | 2D | 2D |
| | | 177 | B1 | 58 | 58 | 58 | 58 | 58 | 58 |
| | | 178 | B2 | 58 | 58 | 58 | 58 | 58 | 58 |
| | | 179 | B3 | 58 | 58 | 58 | 58 | 58 | 58 |
| | | 180 | B4 | 58 | 58 | 58 | 58 | 58 | 58 |
| | | 181 | B5 | 58 | 58 | 58 | 58 | 58 | 58 |
| | | 182 | B6 | 58 | 58 | 58 | 58 | 58 | 58 |
| | | 183 | B7 | 58 | 58 | 58 | 58 | 58 | 58 |
| Vendor Rev | | 184 | B8 | 58 | 58 | 58 | 58 | 58 | 58 |
| | | 185 | B9 | 58 | 58 | 58 | 58 | 58 | 58 |
| Wavelength or Copper Cable | Attenuation @2.5G | 186 | BA | XX | XX | XX | XX | XX | XX |
| | Attenuation @5G | 187 | BB | XX | XX | XX | XX | XX | XX |
| Wavelength tolerance or Copper Cable Attenuation | the copper cable attenuation at 7.0 GHz | 188 | BC | XX | XX | XX | XX | XX | XX |
| | the copper cable attenuation at 12.9 GHz | 189 | BD | XX | XX | XX | XX | XX | XX |
| Max case temp. | | 190 | BE | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upper Page-----Upper Page-----Upper Page-----Upper Page-----Upper Pa | | CC_BASE | | 191 | BF | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| Extended ID | | Options | Extended Ethernet Compliance Codes | 192 | C0 | 0 | 0 | B | 0 | 0 | B |
| | | | RX output amplitude programming | 193 | C1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 194 | C2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 195 | C3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Vendor SN | | 196 | C4 | 43 | 43 | 43 | 43 | 43 | 43 |
| | | | | 197 | C5 | 4E | 4E | 4E | 4E | 4E | 4E |
| | | | | 198 | C6 | 31 | 31 | 31 | 31 | 31 | 31 |
| | | | | 199 | C7 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | | | 200 | C8 | 33 | 33 | 33 | 33 | 33 | 33 |
| | | | | 201 | C9 | 33 | 33 | 33 | 33 | 33 | 33 |
| | | | | 202 | CA | 51 | 51 | 51 | 39 | 39 | 39 |
| | | | | 203 | CB | 41 | 4B | 56 | 4A | 41 | 52 |
| | | | | 204 | CC | 58 | 58 | 58 | 58 | 58 | 58 |
| | | | | 205 | CD | 58 | 58 | 58 | 58 | 58 | 58 |
| | | | | 206 | CE | 58 | 58 | 58 | 58 | 58 | 58 |
| | | | | 207 | CF | 58 | 58 | 58 | 58 | 58 | 58 |
| | | | | 208 | D0 | 30 | 30 | 30 | 30 | 30 | 30 |
| | | | | 209 | D1 | 30 | 30 | 30 | 30 | 30 | 30 |
| | | | | 210 | D2 | 30 | 30 | 30 | 30 | 30 | 30 |
| | | | | 211 | D3 | 31 | 31 | 31 | 31 | 31 | 31 |
| | | Date Code | | 212 | D4 | 31 | 31 | 31 | 31 | 31 | 31 |
| | | | | 213 | D5 | 35 | 35 | 35 | 35 | 35 | 35 |
| | | | | 214 | D6 | 30 | 30 | 30 | 30 | 30 | 30 |
| | | | | 215 | D7 | 38 | 38 | 38 | 38 | 38 | 38 |
| | | | | 216 | D8 | 31 | 31 | 31 | 31 | 31 | 31 |
| | | | | 217 | D9 | 34 | 34 | 34 | 34 | 34 | 34 |
| | | | | 218 | DA | 20 | 20 | 20 | 20 | 20 | 20 |
| | | | | 219 | DB | 20 | 20 | 20 | 20 | 20 | 20 |
| | | Diagnostic Monitoring Type | | 220 | DC | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Enhanced Options | | 221 | DD | 0 | 0 | 0 | 0 | 0 | 0 |
| | | BR, nominal | | 222 | DE | 0 | 0 | 0 | 0 | 0 | 0 |
| | | CC_EXT | | 223 | DF | 83 | 8D | A3 | 74 | 6B | 87 |
| Vender Specific ID | | | | 224 | E0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 225 | E1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 226 | E2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 227 | E3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 228 | E4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 229 | E5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 230 | E6 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 231 | E7 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 232 | E8 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 233 | E9 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 234 | EA | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 235 | EB | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 236 | EC | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 237 | ED | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 238 | EE | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 239 | EF | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 240 | F0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 241 | F1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 242 | F2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 243 | F3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 244 | F4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 245 | F5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 246 | F6 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 247 | F7 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 248 | F8 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 249 | F9 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 250 | FA | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 251 | FB | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 252 | FC | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 253 | FD | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 254 | FE | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | 255 | FF | 0 | 0 | 0 | 0 | 0 | 0 |

## MECHANICAL CHARACTERISTICS

| ITEM | DESCRIPTION | TEST CONDITION | REQUIREMENT |
|---|---|---|---|
| **6.6.1** | **Durability** | Cable Assembly: 50 Cycles<br>Board Connector: 100 cycles<br>Test Condition: 10 cycles per minute max.<br>Latches to be disabled.<br>(EIA 364-09, 364-23) | 1. Max. 20mΩ change from initial readings<br>2. No visual damage |
| **6.6.2** | **Pre-conditioning** | Mate and un-mate samples 25 times.<br>Test condition: 10 cycles per minute max. (EIA 364-09, 364-23) | No Physical Damage |
| **6.6.3** | **Mechanical Shock** | Mated samples subject to 30G, half-sine shock pulses of 11 milliseconds duration. 3 shocks in each direction applied in 3 mutually perpendicular planes (18 total). EIA 364-27, Method H | No Physical Damage |
| **6.6.4** | **Random Vibration** | Mate samples subjected to 3.10G rms between 20 and 500 Hz for 15 minutes in each of 3 mutually perpendicular planes EIA 364-28, Test Condition: VII | 1. Max. 20mΩ change from initial readings<br>2. No visual damage<br>3. No discontinuances greater than 1μs |
| **6.6.5** | **(Insertion & Extraction) Mating & Un-mating Forces** | Mate and un-mate samples 5 times. Measure the forces with the kick-out springs and latches disengaged. | 1. 40N max mating force<br>2. 30N max un-mating force |
| **6.6.6** | **Cable Strain Relief** | Place axial load on cable.<br>Test Condition: 25mm/min head speed | 1. 90N Minimum<br>2. No physical damage.<br>3. Verify continuity<br>4. No significant electrical change (Diff Impedance) |
| **6.6.7** | **Wire Flex** | Cable flex 180º - 15 Cycles<br>Test Condition : See Table 1 and Figure 2<br>(EIA 364-41) | 1. No physical damage.<br>2. No loss of continuity during test.<br>3. No significant electrical change (Diff Impedance) |
| **6.6.8** | **Cable Minimum Bend Radius** | The cable is bent one time over the correct mandrel of size specified in Table 1 in each of 4 perpendicular directions. (Figure 1) | 1. No physical damage.<br>2. Verify continuity<br>3. No significant electrical change (Diff Impedance) |
| **6.6.9** | **Latch Strength** | Mate connectors and place an axial load on the cable connector. | 1. 90N Minimum<br>2. No physical damage to the module or cage. |
| **6.6.10** | **Cage Press Fit Insertion & Withdrawal Force** | Place axial load on the cage to measure the insertion and withdrawal force of the press-fit sections into and out of the PCB. | 1. 550N Max. Insertion per press-fit section.<br>2. 114N Min. Extraction per press-fit section. |

| Raw Cable AWG 8 Pair Standard | Minimum Bending Radius Repeated | Minimum Bending Radius Single |
|---|---|---|
| **32AWG** | 2.007" ( 51mm ) | 1.004" ( 25.5mm ) |
| **30AWG** | 2.598" ( 66mm ) | 1.299"( 33mm ) |
| **28AWG** | 2.952" ( 75mm ) | 1.476" ( 37.5mm ) |
| **26AWG** | 3.385" ( 86mm ) | 1.693" ( 43mm ) |
| **24AWG** | 3.818" ( 97mm ) | 1.909" ( 48.5mm ) |
| **Raw Cable AWG 8 Pair 4x28G** | **Minimum Bending Radius Repeated** | **Minimum Bending Radius Single** |
| **30AWG** | 2.520" ( 64mm ) | 1.260" ( 32mm ) |
| **26AWG** | 3.189" ( 81mm ) | 1.614" ( 41mm ) |

*** Minimum Bend Radius for all non standard cables will use the following formula: Repeated Bending = 10 X Cable Diameter and Single Bending = 5 X Cable Diameter**

**Table 1 – Cable Minimum Bend Radius (See Figure 1 & 2)**

### 6.6 ENVIRONMENTAL REQUIREMENTS

| ITEM | DESCRIPTION | TEST CONDITION | REQUIREMENT |
|---|---|---|---|
| **6.7.1** | **Thermal Shock** | Test Condition: 10 cycles -55ºC to +85ºC. (EIA 364-32C, condition I) | Max. 2**0** milliohm change from initial readings |
| **6.7.2** | **Temperature Life** | Cable should be mated and subject 70ºC for 500 hours EIA 364-17, Method A, Condition 2, Time Condition C | Max. **20** milliohm change from initial readings |
| **6.7.3** | **Humidity Temperature Cycling** | Cables unmated specimens to 10 cycles between 25ºC and 65ºC at 80% to 100% relative humidity EIA 364-31, Method III excluding steps 7a & 7b | Max. 2**0** milliohm change from initial readings |
| **6.7.4** | **Mixed Flowing Gas** | Subject the board mounted receptacle to environmental Class IIA for 7 days unmated followed by 7 days mated (14 days total ) EIA 364-65, Class IIA | Max. 2**0** milliohm change from initial readings |
| **6.7.5** | **Thermal Disturbance** | Cables are cycled between 15±3 and 85±3ºC as measured on the part. Ramps at min 2ºC/minute and dwells ensuring contacts reach extremes for 5 minutes minimum. Humidity not controlled. 10 cycles | Max. **20** milliohm change from initial readings |

## 7.0 QUALITY ASSURANCE PROVISIONS

### 7.1 Equipment Calibration

All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with MIL-C-45662.

### 7.2 Inspection Conditions

Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions:

a. Temperature: 25 +/- 5 degrees Celsius
b. Barometric Pressure: Local ambient

### 7.3 Sample Quantity And Description

| Test Group | Number of Cables | Cable Description | Number of Board Connectors |
|---|---|---|---|
| 1 | 3 | Each AWG, double ended, 1 meter min | 1 |
| 2 | 3 | Any AWG, single ended, 0.5 meter | 3 |
| 3 | 1 | Any AWG, single ended, 0.5 meter | 6 Cages and 3 PCB |
| 4 | 6 | Any AWG, single ended, 0.5 meter | 3 Board Connectors and 3 Loose Piece connectors |
| 5 | 3 | Any AWG, single ended, 0.5 meter | 3 |
| 6 | 3 | Any AWG, single ended, 0.5 meter | 3 |
| 7 | 3 | Smallest AWG, single ended, 0.5 meter | 3 |
| | 3 | Largest AWG, single ended, 0.5 meter | 3 |
| | 3 per wire gage tested | Non-terminated cables for board side connector durabilty | 3 Paddle Boards and 1 Cage |

For qualification test samples, DC blocking capacitors on the receive channels are to be replaced by 0 ohm resistors so that LLCR measurements can be taken on the receive channels.

### 7.4 Acceptance

7.4.1 Electrical and mechanical requirements placed on test samples as indicated in section 6.0 shall be established from test data using appropriate statistical techniques. All samples tested in accordance with this product specification shall meet the stated requirements.

7.4.2 Failures attributed to equipment, test set-up, or operator error shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification.

### 7.5 Qualification Testing

Qualification testing shall be performed on sample units produced with equipment and procedures normally used in production. The test sequence shall be as shown in Table 2.

### 7.6 Requalification Testing

If any of the following conditions occur, the responsible product engineer shall initiate requalification testing consisting of all applicable parts of the qualification test matrix, Table 2.

a. A significant design change is made to the existing product, which impacts the product form, fit or function.
b. A significant change is made to the manufacturing process, which impacts the product form, fit or function.
c. A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process.

## TABLE 2 - QUALIFICATION TESTING MATRIX

| TEST | PARA | TEST GROUP | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | TEST SEQUENCE | | | | | | |
| Examination of Product | | 1,12 | 1,3 | 1,4 | 1,11 | 1,5 | 1,14 | 1,11 |
| LLCR | 6.1.1 | | | | 2,6,8 | 2,4 | 2,5,7,9,11,13 | 2,5,7,9 |
| Insulation Resistance (IR) | 6.1.2 | | | | 3,9 | | | |
| Dielectric Withstanding Voltage (DWV) | 6.1.3 | | | | 4,10 | | | |
| Differential Impedance | 6.1.5 | 3,6,8, 11 | | | | | | |
| Continuity | 6.1.6 | 2,5,10 | | | | | | |
| Durability | 6.6.1 | | | | | | | 4 |
| Pre-conditioning | 6.6.2 | | | | | | 4 | |
| Mechanical Shock | 6.6.3 | | | | | | | 6 |
| Random Vibration | 6.6.4 | | | | | | | 8 |
| Mating/Un-mating Force | 6.6.5 | | | | | | 3,12 | 3,10 |
| Cable Strain Relief | 6.6.6 | 9 | | | | | | |
| Wire Flex | 6.6.7 | 7 | | | | | | |
| Minimum Bend Radii | 6.6.8 | 4 | | | | | | |
| Latch Strength | 6.6.9 | | 2 | | | | | |
| Cage Press-fit Insertion Force | 6.6.10 | | | 2 | | | | |
| Cage Press-fit Withdrawal | | | | 3 | | | | |
| Thermal Shock | 6.7.1 | | | | 5 | | | |
| Temperature Life | 6.7.2 | | | | | 3 | | |
| Humidity Temperate Cycling | 6.7.3 | | | | 7 | | | |
| Mixed Flowing Gas | 6.7.4 | | | | | | 6,8 | |
| Thermal Disturbance | 6.7.5 | | | | | | 10 | |

## 8.0 SUPPORTING INFORMATION

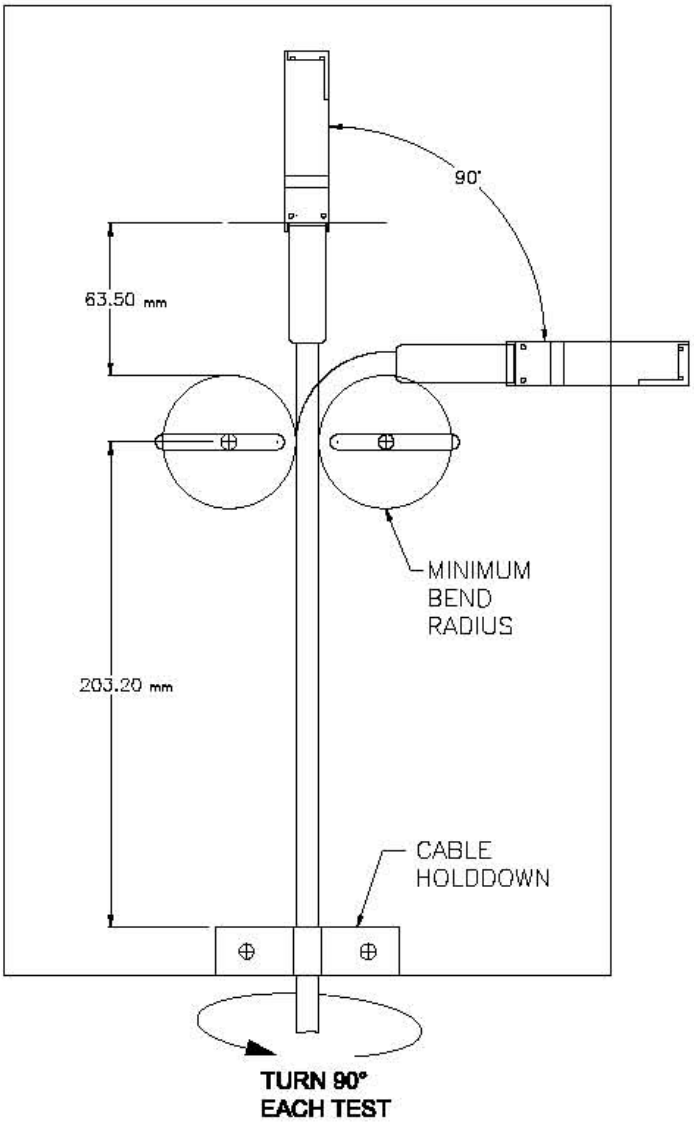


**Figure 1 – Single Minimum Bending Radius**
**( See Mechanical Characteristics 6.1.9 and Table 1 )**

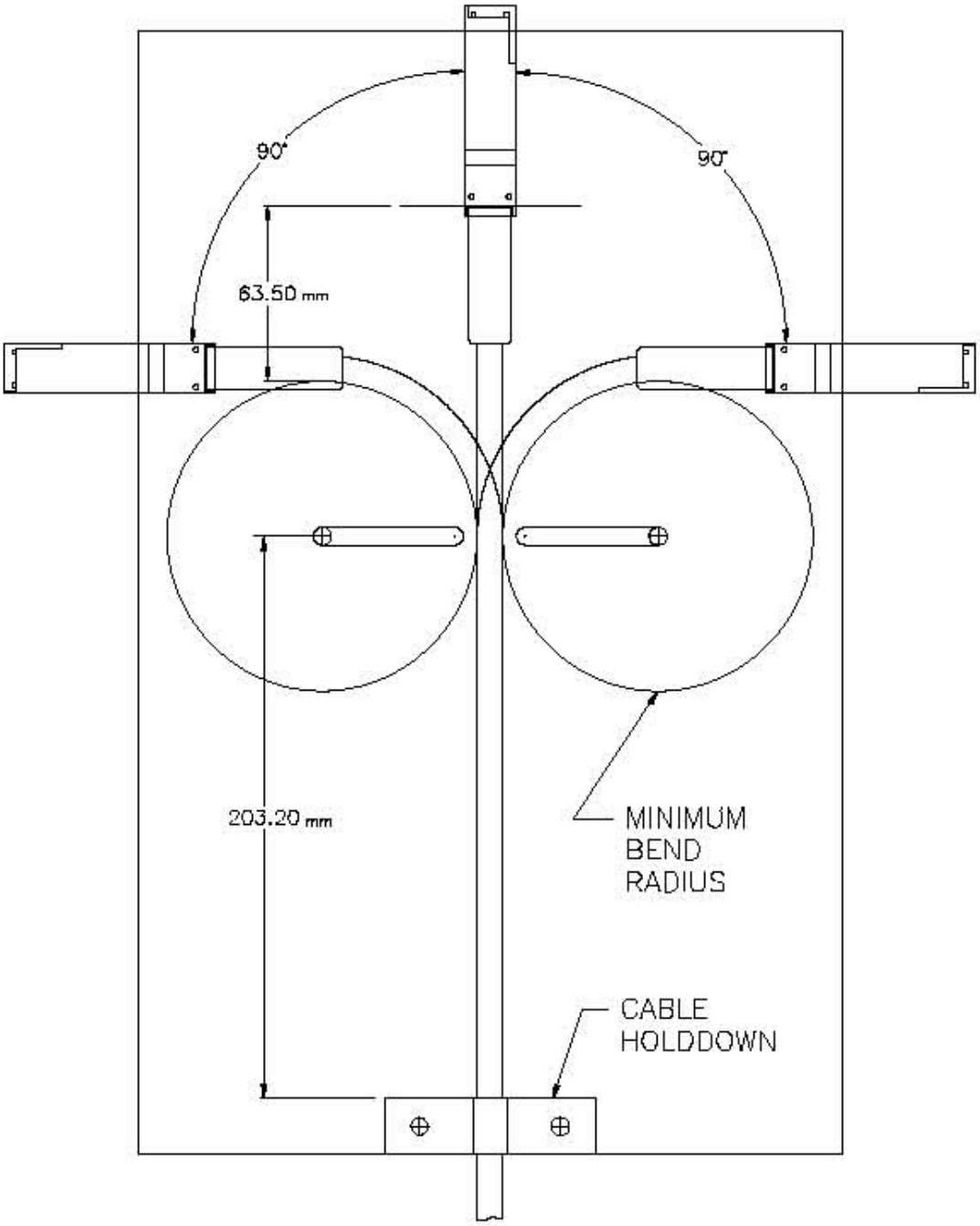


**Figure 2 – Repeated Wire Flex Test**
**( See Mechanical Characteristics 6.1.8 and Table 1 )**

## 9.0 REVISION RECORD

| REV. | PAGE | DESCRIPTION | ECR | DATE |
|---|---|---|---|---|
| A | All | Release from Preliminary | V10-0131 | 2004/5/10 |
| B | All | Rev. A to B, Changed bend radius in Table 1 Repeatable .97 to 2.007, 1.61 to 2.598, 1.69 to 2.952, 1.93 to 3.385, 2.20 to 3.818 and Single, .69 to 1.004, .81 to 1.299, .85 to 1.476, .96 to 1.693, 1.10 to 1.909 | V10-0290 | 2007/7/10 |
| C | 2 | Adding new P/N 10116015 | ECN-ELX-N-003201-1 | 3-14-11 |
| D | All | Removed E-Prom Address from specification. | ECN-ELX-V-010413-1 | 2-27-12 |
| E | 3 | Added applicable information for 14G QSFP+ Cable Assembly<br>Add EEPROM Section back into Spec | ECR-ELX-V-011521 | 2005/2/12 |
| F | 8 | Updated contents of address 131 to comply with the latest rev of SFF-8436 | ECR-ELX-V-13361 | 2011/2/12 |
| G | 29 | Update Test Plan to remove LLCR Step 11 from Test Group 4 | ECN-ELX-V-14334-1 | 3-25-13 |
| H | All, 5, 7, 26, 27 | Added applicable information for 28G QSFP+ Cable Assembly<br>Updated Impedance requirement, 6.1.5, 6.6.6, 6.6.7, 6.6.8; Added 6.1.6, Updated memory map, Updated the table in section 7.3, Change repeated bend radius | ECN-ELX-V-15186-1 | 2007/9/13 |
| J | 5, 8, 15, 29, 32 | Corrected revision change description for Rev H.<br>Changed requirement in section 6.1.5, Corrected dec equivalent on address 131, Corrected Vendor OUI, Updated table 2 to add continuity and update sequence of test group 1 | ECN-ELX-N-15503-1 | 8-27-13 |
| K | 15 | Delete previous EEPROM content and add FCI standard QDR & FDR & EDR EEPROM | ECN-ELX-N-16985-1 | 2005/6/14 |
| L | 11 | Update the QSFP Plus Attenuation table | ECN-ELX-N-17658-1 | 7-18-14 |
| M | 2 | Adding new P/N 10132344、10128764、10128765、10130975 | ECN-ELX-DG-20036-1 | 1-21-15 |
| N | 2,8,10 | Revise the map content per the latest industrial spec | ECN-ELX-N-21737-1 | 8-21-15 |
| P | 2 | Add the QSFP to 4xSFP+ Cable Assembly P/N | ECN-ELX-N-24491-1 | 7-13-16 |