

NUMBER GBUS-12-121S-12 A 282 FCI	TYPE PRODUCT SPECIFICATION	NUMBER FCI GS-12-282194
TITLE SCA Product Specification Serial Attached SCSI (SAS) Serial ATA Connector		PAGE 1 of 16212121 REVISION 2 AUTHORIZED BY GL LOO DATE 05 Jan 2011 143 MAY 10 NOV 2003 05 MAR 2008 04 CLASSIFICATION UNRESTRICTED CONFIDENTIAL

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— OBJECTIVE

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— SCOPE

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— GENERAL

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— DEFINITIONS

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— PROCEDURE

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— REFERENCE DOCUMENTS (If Applicable)

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— NOTES (Optional)

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— RECORD RETENTION (If Applicable)

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1.0 OBJECTIVE

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This specification defines the performance, test, quality and reliability requirement of the SCA (Single Connect Attach) system. Serial Attached SCSI Serial ATA A host host and device connectors.

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2.0 SCOPE

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This specification is applicable to the termination characteristics of the SCAATAS family of products which provides for direct blind mate interconnection of disk drives to backplanes. both plug and receptacle of the Serial ATA connector series, with Tin/Lead plated terminals. A new product specification for Serial ATA connector series, with Lead free plated terminal shall be stated otherwise.

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3.0 GENERAL

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Rev F Form E-3005
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V20603

GS-01-001

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This document is composed of the following sections:

Paragraph	Title
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2.0	SCOPE
3.0	GENERAL
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7.0	MECHANICAL CHARACTERISTICS
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FIGURE 1	TABLE 1— QUALIFICATION TESTING MATRIX
FIGURE 2	METHOD OF CONTACT RESISTANCE MEASUREMENT
FIGURE 3	INSERTION/ WITHDRAWAL TEST GAGE

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4.0 DEFINITION APPLICABLE DOCUMENTS

4.1 A. Specification application

- 4.1.1 Engineering drawings
- 4.1.2 Process drawings

4.2 Military Standards

- 4.2.1 MIL-STD-202F: Test Methods for Electronic Components Parts
- 4.2.2 MIL-STD-1344A: Test Methods for Electrical Connectors
- 4.2.3 MIL-C-45662: Equipment Calibration
- MIL-STD-2166: Connections, Electrical and Compliant Pin

4.3 Federal Specifications Specifications and Test Standards

- 4.3.1 QQ-N-290: Nickel Plating (Electrodeposited)
- 4.3.2 QQ-B-750: Phosphor Bronze Alloy Strip High Speed Serial ATA Specification
- Revision 1.0a
- 4.3.2 QQ-B-750: Phosphor Bronze Alloy Strip EIA Test Standards
- 4.3.3 QQ-B-xxx: Brass Alloy Strip
- 4.3.32 QQ-S-571: Solder

4.3 4.4 Other Standards and Specifications

- 4.4.1 UL94-V0: Flammability
- 4.4.2 ASTM B-103: Phosphor Bronze
- 4.4.3 ISO 9000:
- 4.4.4 EIA P/N-3651: Single Connect Attach (SCA) Connectors
- 4.4.2 ASTM B-103: Phosphor Bronze
- 4.4.3 ASTM B-xxx: Brass
- 4.4.52 EIA 364: Electrical cConnector/sSocket tTest pProcedures Including Environmental
- including environmental cClassifications
- 4.4.63 Serial ATASFF-8045482: 40 pin SCA connector w/parallel Internal Serial Attac selection
- 4.4.7 SFF-8046: 80 pin SCA connector for SCSI disk drives
- 4.4.8 SFF-8047: 40 pin SCA-2 connector w/serial selection
- 4.4.9 SFF-8048: 80 pin SCA-2 connector w/parallel ESI
- 4.4.10 SFF-8451: SCA-2 Unshielded Connections hment Connector (R1.0a1.5)3
- 4.4.11 SS-00254: Test Methods for Electronic Components, Lead-Free Soldering Part Design Standards

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4.5 FCI SpecificationsFCI Specifications

- 4.5.1 BUS-03-114: Capacitance Measurement
- 4.5.2 BUS-03-404: Normal Force Measurement
- 4.5.3 BUS-03-405: Insertion / Withdrawal Force Measurement
- 4.5.4 BUS-16-016: Phosphor Bronze Strip
- 4.5.5 BUS-16-068: Liquid Crystal Polymer
- 4.5.6 BUS-19-002: Solderability (GS-19-037)
- 4.5.7 BUS-19-020: Porosity (GS-19-049)
- 4.5.8 BUS-19-040: Plating Adhesion (GS-19-039)
- 4.5.9 BUS-19-122: Solder Joint Reliability
- 4.5.4 BUS-15-002/X: Nickel Plating
- 4.5.5 BUS-15-006/X: Tin/Lead Plating
- 4.5.6 BUS-15-003/X: Electrodeposited Tin
- BUS-15-005/X: Gold in Contact Plating
- BUS-16-016: Phosphor Bronze Strip
- 4.5.7 BUS-19-002: Solderability
- 4.5.8 BUS-19-020: Porosity
- 4.5.9 BUS-19-040: Plating Adhesion
- 4.5.10 BUS-19-122: Solder Joint Reliability
- 4.5.11 GS-19-027: Moisture Sensitivity Level
- 4.5.12 GS-22-011: Pb-free Solder Heat Resistance Procedure — Convection Oven Flow
- 4.5.13 GS-22-012: Pb-free Solder Heat Resistance Procedure — Wave Solder

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5.2.5 Receptacle ESD Clip Hold-down Clip Terminal.— The base material shall be C51000 C5100/C5210 phosphor-bronze or C2600/C2680 brass. See applicable product drawing for material. receptacle connector housing shall be molded of PA9T that is rated UL94V-0 for Flame-Retardant capability. See applicable product drawings for material.

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5.3 Finish

The plug and receptacle terminals

5.3.1 Plated finished for qualification components shall be plated in the contact area with 0.76um/30u" palladium nickel with gold flash minimum or 0.76um/30u" gold minimum over 1.27um/50u" minimum nickel. as specified herein or equivalent. The plug and receptacle terminals shall be plated in the contact area to the minimum gold or palladium nickel with gold flash plating thickness specified on product prints (over 1.27um/50u" minimum nickel underplate). The plug and receptacle terminal soldertail sections shall be plated with 2.54um/100u" 90/10 tin-lead minimum or 2.54um/100u" tin minimum over as specified on product print (over 1.27um/50u" nickel minimum nickel. The terminal areas outside off the contact areas and the soldertail areas shall be plated with 1.27um/50u" nickel minimum. underplate). The plug and receptacle plug and ss-5.08um/200u" 90/10 tin-lead minimum or The plug's terminals soldertail sections shall be plated with 1.91um/75u" tin as specified on product prints (over 1.27um/50u" nickel minimum — 2.54um underplate). pterminal press fit sections area shall be plated with 0.5um/20u" minimum — 1.5um/60u" max. 90/10 tin-lead or 0.5um/20u" min. — 1.5um/60u" max. tin over 1.27um/50u" minimum nickel. inum 90/10 tin-lead or tin (over 1.27um/50u" nickel minimum underplate). No plating at cut-off point. See applicable product drawing.

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The press fit areas shall be plated with 0.5um/20u" minimum — 1.5um/60u" maximum 90/10 tin-lead or tin.

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5.3.2 The ESD metal hold down terminals for the plug and receptacle connectors shall be plated with 2.54um/100u" 90/10 tin-lead minimum or 2.54um/100u" 5.08um/200u" 90/10 tin-lead minimum or tin minimum as specified on product prints (over 1.27um/50u" minimum nickel underplate). For press fit area, the plating shall be 1.27um/50u" minimum — 3.81 um/150u" Tin (over 1.27um/50u" minimum nickel underp. See applicable product drawing. No plating at cut-off point. late).

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- ~~The receptacle terminal shall be plated with 1.27µm of Nickel all over the terminal as under plating, as illustrated by area 'D'.~~
- ~~Press-fit or solder area shall be over plate with 0.5µm(min)~1.5µm(max) of Alloy 90/10 Tin/Lead, as illustrated by area 'E'.~~
- ~~Contact or mating area shall be over plate with 0.76µm(min) of Gold, as illustrated by area 'B'.~~
- ~~Near contact end tip area shall be over plate with 0.05µm(min) of Gold Flash, as illustrated by area 'A'.~~

5.4 Design and Construction

~~The receptacle plug-receptacle connector shall be a multi-piece assembly having two single double single rows of contacts in the connector mating area which transition out to a 1.905mm (0.075") row-to-row x 1.27mm (0.050") column-to-column offset stagger through hole pattern. The contact pattern in the mating area will have short and long terminals in a specific pattern that results in a 0.5mm (0.020") differential between contact points in the long and short terminals. (This allows for first mate-last break capability – see respective product prints for location of short and long terminals.) The receptacle ESD clip terminal has the "active" beam of the ESD grounding system and also has board retention features that secures the connector to the board in preparation for solder reflow (through-hole) or board termination (press-fit).~~

~~A polarization peg (optional) on the bottom of the connector housing assures proper connector orientation during board mounting. The receptacle through hole connector is designed to accommodate P.C. board thicknesses of 1.57mm (0.062"), 2.36mm (0.093") and 3.18mm (0.125"). The receptacle press-fit connector is designed to terminate to board thicknesses of 2.36mm (0.093") and 3.18mm (0.125"). Visual examination of connectors to be done per EIA 364-18. g area which dividing into two signal segments (S1-S7, S8-S14) and power segment (P1-P15) or either one which transition out to either surface mount style or solder style solder tail to accommodate various P.C. board thickness. The second row consists of another signal segment (S8-S14), which transition out to either surface mount style or solder style solder tails to accommodate various P.C. board thickness. The contact pattern in the mating area will have short and long terminals in a specific pattern that results in a 0.5mm (0.020") differential between contact points in the long and short terminals. (This allows for first mate-last break capability – see respective product prints for location of short and long terminals.) – consists of two sets of contacts, power supply portion and signal portion.~~

~~The plug receptacle connector shall be a multi-piece assembly having two rows of single double single rows of contacts in the mating area which transition out to a straddle mounting style with the contact solder tails on 1.27mm (0.050") centers. The ESD terminal has termination legs that are designed to accept P.C. boards and compliment the straddle mount style. Features on the connector housing (and the pattern required on the routed edge of the P.C. board) assure proper connector mounting and orientation. The straddle mount plug connector is designed to accommodate various P.C. board thicknesses. See applicable product drawing for specified P.C. board thickness. dividing into two signal segments in the first row are designated (S1-S7, S8-S14)~~

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and a power segment (P1-P15) or either one which transition out to a in-line or stagger through hole pattern or surface mount pad. The second row consists of another signal segment (S8-S14), which transit out to an in-line through hole or surface mount pad. The contact pattern in the mating area will have short and long terminals in a specific pattern that results in a 0.5mm (0.020") differential between contact points in the long and short terminals. (This allows for first mate last break capability — see respective product prints for location of short and long terminals.) The receptacle hold down terminal has the board retention features that secures the connector to the board in preparation for solder reflow (through hole) or board termination (press fit or SMT).

A polarization peg (optional) on the bottom of the connector housing assures proper connector orientation during board mounting. The receptacle through hole connector and press fit connector are designed to terminate to board thickness of 1.57mm (0.062"), 2.36mm (0.093") and 3.18mm (0.125"). Visual examination of connectors examinations of connectors are to be done per EIA 364-18 power supply portion, solder tail side consists of staggered terminals, and mating side consists of first (1st) mate and second (2nd) mate contacts.

As for signal portion, solder tail side consists of in-line terminals, and mating side consists of first (1st) mate and second (2nd) mate contacts.

- 5.4.1 Mating. The connectors shall be capable of mating and unmating manually without the use of special tools.
- 5.4.2 Workmanship. Connectors shall be uniform in quality and shall be free from burrs, scratches, cracks, voids, chips, blisters, pin holes, sharp edges, and other defects that will adversely affect product's life or serviceability.

REFERENCE DOCUMENTS (If Applicable)ELECTRICAL CHARACTERISTIC

6

6.1 Current Rating. The temperature rise above ambient shall not exceed 30°C at any point in the system when contact positions specified are powered at the levels specified in Table 2. Specific contact positions are also specified in Table 2. Applicable temperature rise de-rating graph is shown in Figure 1. The following details shall apply power levels specified herein:

a)

Ambient Conditions : still air at 25 degrees° C

bb) — Reference: EIA 364-70, method BCurrent Rating :Rating : 1.5A min per contact continuous

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cc) Preparation : (i) Mount the connector to a test PCB.

(ii) Wire power pins P1, P2, P8 and P9 in parallel for power.

(iii) Wire ground pins P4, P5, P6, P10 and P12 in parallel for return.

(iv) Supply 6A in total of DC current to the power pins in parallel, returning from the parallel ground pins (P4, P5, P6, P10 and P12).

(v) Measure and record the temperature after 96 hours (45 minutes ON and 15 minutes OFF per hour). Record temperature rise when thermal equilibrium is reached.

Measure and record the temperature after 96 hours (45 minutes ON and 15 minutes OFF per hour)

d) Reference : EIA-364-70A

Reference : EIA 364-70A

6.2 Low Level Contact Resistance. The low-level contact resistance of an SCA receptacle connector mated with an SCA plug n Serialerial-ATAS receptacle connector mated with a Serialerial-ATAS plug connector shall not exceed a change of 15 30 milliohmsΩ after environmental exposure when measured in accordance with EIA 364-23. The following details shall apply: maximum initial signal contact resistance is prior to test. A maximum incremental change of 1305mΩ shall not be exceeded after environmental exposure when measured in accordance with EIA 364-23. The following details shall apply:

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- a) Method of Connection: see current and voltage lead set-ups as shown in Figure 2. Test Voltage: Voltage : DC 20mV DC maximum at open circuit.
- b) Test Voltage: 50 millivolts maximum open circuit Current : Current : not to not to exceed 100mA.
- c) Test Current: Not to exceed 100 milliamps

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6.3 Insulation Resistance. The insulation resistance of mated connectors shall not be less than 1000 megaohms when measured in accordance with EIA 364-21 in accordance with EIA 364-21. The following details shall apply:

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- a) Test Voltage :- 500 voltsV- DC
- b) Preparation:-aration :- The connectors shall be mated but not soldered to a P.C. board
- c) Electrification Time :- 24 minutes, unless otherwise specified.
- Point of Measurement :- Between adjacent contacts.
- d) —

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6.4 Dielectric Withstanding Voltage: - There shall be no temperature rise shall not exceed 30°C. evidence of arc-over, insulation breakdown, or excessive leakage current (> 1 milliampere0.5mA max) when the mated connectors are tested in accordance with EIA 364-20, Method B. The following details shall apply:

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- a) Test Voltage :- DC 500V or 500 volts (DC)V- AC or AC 500V_{rms}
- b) Test Duration :- 604 seconds minute
- c) Preparation:-Preparation :- The connectors shall be mated but not soldered to a PC board
- d) Test Condition:-Condition :- 1 (760 Torr, or sea level)
- e) Points of measurement:-measurement :- Between adjacent contacts

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6.5 LL Contact Resistance, Low Level (LLCR) :Press-fit Interface ResistanceContact Resistance. Low(LLCR).Contact Resistance (Press-fit). The interface between is characteristic shall apply to compliant (compliant section and section and plated through hole. press fit) are and plated through hole. The change in low-level contact resistance shall not exceed 1.0 milliohmQ after environmental exposure when measured in accordance with EIA 364-TP-23, Method 3002.1. The following details shall apply:

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—Method of Connection – Attach current and voltage leads as shown in Figure 2.Method of connection: Measurement taken in between receptacle terminal and plated through hole at PWB.

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- a) Test Voltage - DC 20mV DC maximum at open circuit.
- b) Test Voltage - 20 millivolts DC max open circuit Current - not to exceed 100mA.
- c) Test Current - not to exceed 100 milliamps

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Insulation Resistance. The insulation resistance of mated connectors throughout the test shall not be less than 1000MΩ when measured in accordance with EIA 364-21. The following details shall apply:

- Test Voltage: DC 500V
- Preperation: The connectors shall be mated but not soldered to a PC board
- Electrification Time: 2 minutes, unless otherwise specified
- Point of Measurement: Between adjacent contacts.

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7.0. MECHANICAL REQUIREMENTSCHARACTERISTIC

7.1 Mating / Unmating Force (Insertion / Removal) - The force to mate a receptacle connector and compatible plug connector shall not exceed 120 grams maximum per contact position. The unmating force shall not be less than 15 grams minimum per contact position. The following details shall apply;

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Dielectric Withstanding Voltage: There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (0.5mA or more) when mated connectors are in accordance with EIA 364-20, method B. The following details shall apply:

- Test Voltage: DC 500V or AC 500V_{rms}
- Test Duration: 60seconds
- Preperation: The connectors shall be mated but not soldered to a PC board
- Test Condition: 1 (760 Torr, or sea level)
- Points of measurement: Between adjacent contacts

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Operating Temperature Range: 0°C ~ +65°C

Storage Temperature Range: -50°C ~ +100°C

NOTES (Optional)MECHANICAL CHARACTERISTIC

Mating / Unmating Force(Withdraw/Remov) : The force to mate a receptacle connector and compatible plug connector shall not exceed 45N (4.6kgf). The unmating force shall be less than 10N (1.0kgf). The following details shall apply:

CCross Head Speed : max. rate 2512.5 mm per minute

- Cross Head Speed – 0.5 inch per minuteMating and unmating speed: 25mm per minute
- Utilise free floating fixtures

- a) Utilize free floating fixturesReference: EIA 364-13
- b) Reference - EIA 364-13
- c) Reference - EIA 364-13

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Backplane/Blindmate : The force to mate a receptacle connector and compatible plug connector shall not exceed 50N (5.1kgf). The unmating force shall not be less than 5N (0.51kgf) after 500 cycles.

Cable : The force to mate a receptacle connector and compatible plug connector shall not exceed 50N (5.1kgf). The unmating force shall not be less than 20N (2.04kgf) after 25 cycles.

7.2 Contact Retention – Individual contacts (signal and ESD) in the plug and receptacle housing shall withstand an axial load of 0.5lbs. (227 grams) minimum applied at a rate of 0.20 inches/minute without dislodging from the housing cavity.

a) Reference: EIA 364-29

Durability: EIA 364-09C

Durability: EIA 364-09C

Number of cycles: Device / Host Connectors : 500 cycles

Internal Cabled Connector : 25 cycles

Mating and unmating speed: 25mm per minute

Cycling Rates: Automated Equipment : 200 cycles per hour

Preconditioning Cycles : Device / Host connectors : 50 cycles

Internal Cabled Connector : 20 cycles

d) No physical damage shall be observed

and an initial contact resistance difference of not more than 15 mΩ.

7.3 Contact Normal Force - The contact normal force shall not be less than 60 grams (nor greater than 200 grams) when tested in accordance with FCI test specification BUS-03-404.

Contact Retention : Individual contacts (signal and hold down terminal) in the plug and receptacle housing shall withstand an axial load of 1.1 lbs (500 grams) minimum applied at a rate of 0.20 inches/ minute without dislodging from the housing cavity.

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Reference : EIA-364-29B

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7.4 Individual Pin Insertion / Retention Force - The force required to insert an individual compliant pin into a plated thru hole in a printed circuit board at a rate of 0.2 inches/ minute shall not exceed 60N (13.5 pounds). The retention force in the axial direction opposite that of insertion shall not be less than 6.7N. (1.5 pounds).

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Normal Force : The contact normal force shall not be less than 60 grams (nor greater than 200 grams) when tested in accordance with FCI test specification BUS-03-404.

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Individual Pin Insertion / Retention Force - The force required to insert an individual compliant pin into a plated through hole in a printed circuit board at a rate of 5mm/ 0.2 inches per minute shall not exceed 50N. The retention force in the axial direction opposite that of insertion shall not be less than 5N.

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7.5 PCB Hole Deformation Radius - Cross-section parallel to board surface. Photograph and measure the hole deformation (deformation on board material) radius at a point 0.25 mm/ 0.010" from the surface, and at the center of the compliant pin section. Include 10 holes. The minimum average (of 10 holes) hole deformation radius shall be no greater than 37.5um/ 0.0015" when measured from the drilled hole. The absolute maximum deformation radius shall not exceed 50um/ 0.002". Reference MIL-STD-2166.

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7.6 PCB Hole Wall Damage : Cross-section perpendicular to board surface, -and through the compliant section wear track. Photograph and measure the copper thickness remaining between the compliant section and the printed wiring board laminate. Include 10 holes. The minimum average (of 10 holes) copper thickness remaining between the compliant pin and the printed wiring board laminate shall not be less than 7.5um/ 0.0003". -In addition, there shall be no copper cracks, separations between conductive interfaces, or laminate-to-copper separations. Reference MIL-STD-2166.

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Vibration (Random). EIA 364 – 28, Test Condition VII, Letter A

- Test Condition: Connectors mated and vibrate
- Random 50 Hz – 2000 Hz, 5.35 g's RMS overall
- Duration : 30 minutes per axis
- Direction : each of 3 orthogonal axis
- Power Spectral Density : 0.02G²/Hz
- Mounting : Rigidly mount assemblies.

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No discontinuities greater than 1 ms. And an initial contact resistance difference of less than 15 mΩ.

Shock (Mechanical). Connectors are mated and shock with the following conditions as per EIA 364.

- Test conditions: 50 g's with ½ sine wave (11 milliseconds) shock in each X,Y and Z axis (18 shocks total)
- No discontinuities greater than 1 ms. And an initial contact resistance difference of less than 15 mΩ.

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7.5 Retention : Retention: 7.6 force : force: 7.7 Force : Force: 7.8 Radius : Radius: 7.9

Durability. EIA 364-09C

- Number of Cycles: Device / Host connectors: 500 cycles
- Internal cabled application: 50 cycles
- Cycling Rates: Maximum 200 cycles/hour

EIA 364-29B, hold down terminal (ESD)) 1.1 0.5 500227

a) Reference : EIA 364-29B

—e0
—(press fit)oughu5mm/ .h per / 50N6.0 pounds7N1.5 pounds
—deformation 0.25 mm/ , at Include 10 holes. Include 10 holes. r37.5um/ 50um/

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perpendicular parallel, ogh 7.5um/ poeae

Visual and Dimensional Inspections: EIA 364-18

All visual, dimensional and functional per applicable quality inspection plan shall meet requirements in product drawing

Cable Pull-out Test: EIA 364-38, Condition A

There shall not be any physical damage when the Serial ATA cable assembly under test is subjected to a 40N axial load for a minimum of one (1) minute while clamping one end of the cable plug.

Cable Flexing Test: EIA 364-41

Condition I: Round cable:

Dimension x=3.7 x cable diameter, 100 cycles in each of two planes.

Condition II: Flat cable:

250 cycles using either Method 1 or Method 2.

For both Condition I and Condition II, there shall be no physical damage, no discontinuity over 1 usec during flexing of the test cable connector.

8.0 RECORD RETENTION (If Applicable)ENVIRONMENTAL CHARACTERISTIC

After exposure to the following environmental conditions in accordance with the specified test procedures and/or details, the product shall show no physical damage and shall meet the electrical and mechanical requirements per paragraphs 6.0 and 7.0 as specified in Figure 1.0 TableFigure 1.0 ttest ssequence. Product subjected to these environmental tests must be applied to printed circuit boards. Unless otherwise specified, the assemblies shall be mated during exposure.

8.1 Thermal Shock. EIA 364-32, Test Condition-I

For mated connector:

a) Number of cycles: 105

b) Temperature Range: Range: Between -55°C +0/-3°C and +1085°C +3/-0°C

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- c) Time at Each Temperature : 30 minutes
- Transfer Time : (at room temperature of 25°C): Approx. 52~3 minutes, maximum
- d) No damage notice and a maximum difference of 15mΩ from initial contact resistance.

8.2 Humidity-Temperature Cycling, EIA 364-31, Method III, Test Condition AB

For mated connector:

- a) Number of Duration of Cycles : 1096 dayshours
- b) Duration of Cycle: 24 hoursRelative Humidity : 90% ~ 95%
- c) Relative Humidity: 95% to 90% RH During dwells, 80% to 95% during tTemperature
Rangramping : +40°C ± 2°C
- d) Temperature Range: between +25°C and +65°C
- No damage notice and a maximum difference of 15mΩ from initial contact resistance

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8.3 High Temperature Life, EIA 364-17, Test Condition 4III, Method A

- a) Test Duration : 1,0500 hours
- b) Temperature : -105+85°C ± 2°C

No damage notice and a maximum difference of 15mΩ from initial contact resistance

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8.4 Industrial Mixed Flowing Gas (IMFG) (IMFG) - EIA 364-65, Class II A

Class: III 2

- a) —a) Class: IIA Temperature: 30°C ± 1°C, 70± 2% RH
—Duration: 20 days (mated) Gas Concentration : Cl₂ 10±3ppb, NO₂ 200±50ppb, H₂S 10±5ppb, SO₂ 100±20ppb : 30°C ± 1°C, 70± 2% RH
- b) Half of the samples are exposed unmated for seven days, then mated for remaining seven days. Other half of the samples are exposed mated during entire testing.

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8.5 Physical Shock: - EIA 364 - 27, Test Condition HA

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- a) Condition: **AH (50G, 11 millisecond, half-sine) 294 m/s² - 30G, 11 msec, half sine)**
- b) Shocks: 3 shocks in both directions along each of three orthogonal axes (18 total)
- c) Mounting: Rigidly mount assemblies
- d) No discontinuities greater than 1 microsecond and no physical damage observed.
- e) **Free Figure 3 from any defect such as break, deformation, loosening and falling off etc. on each portion of the connector.**

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8.6 Vibration (Random) - EIA 364 - 28, Test Condition V, Letter A

- a) Test Condition : Random 50 Hz - 2000 Hz, 5.35 G Minimumg's RMS overall
- b) Duration : 1 3hour per axis 0 minutes per axis
- c) Direction : each of 3 orthogonal axis
- d) Power Spectral Density : 0.02G²/Hz
- e) Mounting : Rigidly mount assemblies
- f) No discontinuities greater than 1 microseconds.
- g) See Figure 3

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8.7 Durability - EIA 364-09

- a) Number Cycles: 500 cycles
- b) Cycling Rate: 600 cycles/hour
- c) Preconditioning Cycles: 25
- b) Gas Concentration : Cl₂ 10±3ppb, NO₂ 200±50ppb, H₂S 10±5ppb, SO₂ 100±20ppb
- e)

Half of the samples are exposed unmated for seven days, then mated for remaining seven days.
Other half of the samples are mated during entire testing.

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8.5 Physical Shock- EIA 364 - 27, Test Condition H

Condition: H (294 m/s² - 30G, 11 msec, half sine)

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Shocks: 3 shocks in both direction along each of three orthogonal axes (18 total)

Mounting: Rigidly mount assemblies

No discontinuities greater than 1 μ s sec. and no physical damage observed.

Free from any defect such as break, deformation, loosening and falling off etc. on each portion of the connector.

8.6 Vibration (Random Vibration). EIA 364 -- 28, Test Condition V, Letter A

Test Condition : Random 50 Hz ~ 2000 Hz, 5.35 g's RMS overall

Duration : 30 minutes per axis

Direction : each of All of the 3 orthogonal axis es, including axis normal to sitting plane (z-plane)

Power Spectral Density : 0.02G²/Hz

Mounting : Rigidly mount assemblies.

No discontinuities greater than 1 μ sec

No physical damage shall be observed

8.7

Solderability. JIS C 0050 or ANSI J-002 Test Condition A

Pre-heating : +150°C $\pm$ 10°C, 60 ~ 120 sec

Soldering : 215°C $\pm$ 5°C MIN, 10 $\pm$ 1 sec

Solder paste to be used is JIS Z 3282 H60A or H63A, compliant

Soldering particle is more than 200 mesh.

Flux used shall be from Inactive Rosin family

Acceptable Wet Solder Coverage: 95% minimum

8.7.5.8 Resistance to Soldering Heat. EIA 364-56

For Reflow Solder :

Preheating : 100°C ~ 150°C, 60 seconds MAX

Soldering : 210°C MIN, 60 seconds MAX

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~~The temperature shall be measured at contact terminal portion and the peak temperature on the upper surface of printed circuit board shall be less than 240°C~~

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~~For Dip and Wave Solder :~~

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~~Reference : EIA 364-56 Test Condition E.~~

~~There shall be no evidence of physical or mechanical damage~~

8.9 Solderability - ANSI-J-002, Test Condition A(Lead-Free)

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a) Steam Aging - 4 hoursPre-heating : +150°C ± 10°C, 60 ~ 120 sec

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b) Contact areas evaluated shall meet the ANSI-J-002 requirements.Soldering : 230°C ± 5°C MIN, 10 ± 1 sec

c) Acceptable Coverage: 95% minimumSolder paste to be used is JIS Z 3282 H60A or H63A. Soldering particle is more than 200 mesh. Flux used shall be from Inactive Rosin family

d) Acceptable Wet Solder Coverage: 95% minimum

8.91068 -Resistance to Soldering Heat - EIA 364-56(Lead-Free)

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Test Condition: E - For reflow Solder :

a) Pre-heating : 150°C ~ 200°C, 60 ~ 180 sec

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b) There shall be no evidence of physical or mechanical damageSoldering : 230°C min, 60 sec max

c) Peak Temperature : 260°C ± 5°C MIN, 10 ± 1 sec

d) Number of times : 3 times

e) Reference : GS-22-011 Peak Reflow - 260 °C

For Dip and Wave Solder :

a) Test Temperature : 260°C ± 5°C, 5 ~ 10 sec ± 1 sec

b) Reference : GS-22-012

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8.10 9711 WResistance to SolventsWhisker Test (Lead Free) - EIA 364-11

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Solvents: Trichloroethylene8.9.1 Thermal Shock

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- a) Temperature Range : -35°C to +125°C
- b) Solvent Temperature: Boiling pointTime at Temperature : Min 7 minutes
- c) Immersion Time: approximately 78 secondsTime Duration : 500 cycles ± 4 cycles
- d) Number of Immersions: one

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8.9.2 Humidity Steady State:

- Temperature : +85°C
- Relative Humidity : 95%
- e) Test Duration : 500 hours ± 4 hours

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No whisker growth greater than 50 µm

8.11 08 MSurface mount connector solder joint reliabilityMoisture Sensitivity Testing (For lead free SMT)

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- BUS-19-122

Refer to BUS-19-122 for specific test details, sample quantities and acceptance criteria8.10.1

Baking:

- a) Temperature : +125°C ± 5°C
- b) Test Duration : 24 hours ± 2 hours

For Reflow Solder

8.10.2 Gas-Tight-Joint-Test – EIA 364-TP36Humidification:

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- a) Reference EIA-364-TP36 (nitric acid solution)Temperature : +85°C
- b) Duration: 30 minutesRelative Humidity : 85%

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c) -Temperature: 25° Cst Duration : 168 hours ± 4 hours

d) Relative Humidity: 75%

8.10.3 Solderability (Lead Free)Reflow Soldering

a) Reference SS-00254-2 (Reflow Solder)Pre heating : 150°C ~ 200°C, 60 ~ 180 sec / GS-22-011

b) Reference SS-00254-1 (Dip and Wave Solder)Soldering : 217°C min, 60 ~ 150 sec / GS-22-012

c) Peak Temperature (at solder joint) : 260°C , 10 ± 1 sec

d) Number of times : 3 times

Reference : GS-19-027

a) GS-19-027

8.14 SWhisker Testalt Spray Test. After exposure of the mate connec
tors to a salt fog atmosphere, the LLCR shall not exceed 30 milliohms. The test shall be in
accordance with EIA 364-26.

a) Reference: SS-00254-8 / GS-19-028Mate connectors

Salt Solution : 5 percent (by weight)

Test Condition (Duration) : B (48 hours)

Resistance to Solvents. EIA 364-11

Solvents : Trichloroethylene

Solvent Temperature : Boiling point

Immersion Time : Approximately 78 seconds

Number of Immersions : one

Solderability (Lead free): SS-00254

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- Pre heating : $+150^{\circ}\text{C} \pm 10^{\circ}\text{C}$, 60 ~ 120 sec
- Soldering : $215^{\circ}\text{C} \pm 5^{\circ}\text{C}$ MIN, 10 $\pm$ 1 sec
- Solder paste to be used is JIS Z 3282 H60A or H63A. Soldering particle is more than 200 mesh. Flux used shall be from Inactive Rosin family
- Acceptable Wet Solder Coverage: 95% minimum

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Resistance to Soldering Heat. EIA 364-56

For Reflow Solder :

- Preheating : $100^{\circ}\text{C} \sim 150^{\circ}\text{C}$, 60 seconds MAX
- Soldering : 210°C MIN, 60 seconds MAX
- The temperature shall be measured at contact terminal portion and the peak temperature on the upper surface of printed circuit board shall be less than 240°C

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For Dip and Wave Solder

- Reference : EIA 364-56 Test Condition E.
- There shall be no evidence of physical or mechanical damage

Resistance to Solvents. EIA 364-11

- Solvents : Trichloroethylene
- Solvent Temperature : Boiling point
- Immersion Time : Approximately 78 seconds
- Number of Immersions : one

9.0

QUALITY ASSUANCE PROVISIONS

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9.1 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 and ISO 9000.

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

a) Temperature : $25 \pm 5^{\circ}\text{C}$

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- b) Relative Humidity : 30% ~ 680%
- c) Barometric Pressure: Local ambient

9.3 Sample Quantity and Description

The numbers of samples to be tested in each group shown in Figure Table Figure-1 are defined as follows:

Groups 1 through 8127 :

5 5-samples in each group: All samples must be free of defects that would impair normal connector operation. All samples must meet dimensional requirements of connector.

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Groups 9 through 11

5 samples in each group: All samples must be free of defects that would impair normal connector operation. All samples must meet dimensional requirements of connector. 25 contacts from each sample is to be tested. All contact positions should be tested under this distribution.

Group 12

5 samples in each group: All samples must be free of defects that would impair normal connector operation. All samples must meet whisker test requirements of connector.

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9.4 Acceptance

9.4.1

Electrical and mechanical requirements placed on test samples as indicated in Paragraphs 6.0 and 7.0 shall be established from test data using appropriate statistical techniques or shall otherwise be customer specified, and all samples tested in accordance with this product specification shall meet the stated requirements.

9.4.2

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

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9.5 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 1.

Visual Examination : EIA-364-18

9.6 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 1.

- A significant design change is made to the existing product -which impacts the product form, fit or function. Examples of significant changes shall include, but not be limited to, changes in the plating material composition or thickness, contact force, contact surface geometry, insulator design, contact base material, or contact lubrication requirements.
- A significant change is made to the manufacturing process, which impacts the product form, fit or function.
- A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process.

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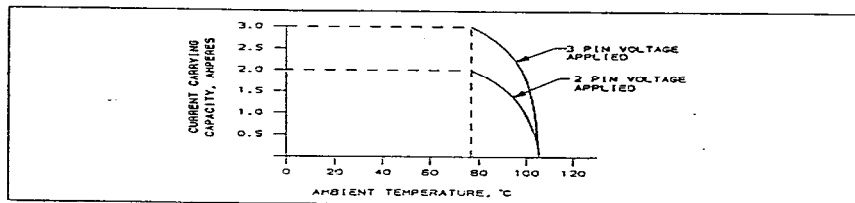


FIGURE 1
CURRENT VS. TEMPERATURE RISE DERATING GRAPH

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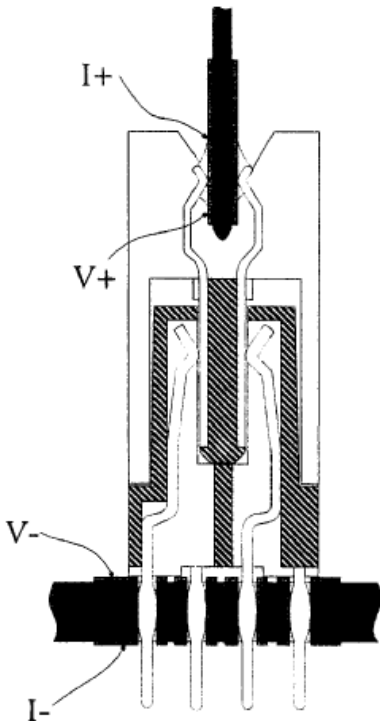


FIGURE 2
Method of Connection, Contact Resistance

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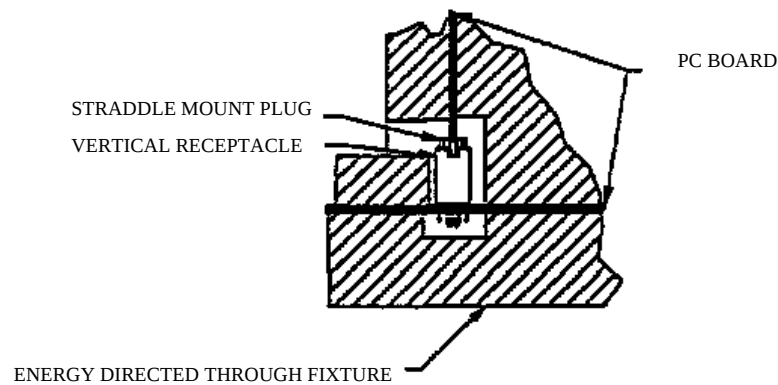


FIGURE 3
VIBRATION AND PHYSICAL SHOCK TEST FIXTURE STRAIGHT TYPICAL

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Table 1- Test Groups and Sequences

		TEST GROUP													
		1	2	3a	3b	4	5	6	7	8	9	10	11	12	
	PAR A														
Examination of Product	5.4	1.10	1.9	1.10	1.10	1.9	1.3	1.4	1.5	1.3	1	1.7	1	1.3	
L. L. Contact Resistance	6.2	3.8	3.7	3.6		3.7						2.5			
Insulation Resistance	6.3				2.5										
Dielectric Withstanding V.	6.4				3.6										
Current Rating	6.1												2		
L. L. Press Fit Interface Resist.	6.5	4.9	4.8	4.9		4.8						3.6			
Mating/Unmating Force	7.1	2	2	2		2									
Normal Force	7.3								2.6						
Contact Retention	7.2								3.7						
Insertion Force (Press Fit Only)	7.4										2.4				
Retention Force (Press fit Only)	7.4										.6				
PCB Hole Deformation Radius	7.5										3.5				
PCB Hole Wall Damage	7.6										.7				
Thermal Shock	8.1			5	4						8				
Humidity, Temperature Cycling	8.2			7	7						9				
High Temperature Life	8.3		6						4						
Industrial Mixed Flowing Gas	8.4					6									

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Vibration	8.6	6												
Physical Shock	8.5	7												
Durability	8.7	5												
Solderability	8.8					2								
Resistance to Soldering Heat	8.9						2							
Resistance to Solvents	8.10						3							
Solder Joint Reliability	8.11							2						
Durability (Pre-Condition)	8.7		5		5				3					
Gas-Tight Joint Test	8.12									4				
Solderability (Lead Free)	8.13					2(a)								
Whisker Test	8.14												2	

NOTE : PRESS FIT RESISTANCE WAS MEASURED ON 50 OF THE 400 TERMINALS.

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Table 1 TABLE 1 — Qualification Testing Matrix QUALIFICATION TESTING MATRIX

POSITION	CURRENT, AMPS	VOLTAGE, VOLTS	CONTACT POSITION (+) ENERGIZED (IN PARALLEL)	CONTACT POSITIONS (-)
40	2	5	19,20	32,35
40	2.5	12	2,3,4	22,23,26,29
80	2	5	34,35	75,76
80	3	12	2,3,4	41,42,43

TABLE 2
CONTACT CURRENT RATING

* Press-Fit Connector

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REVISION RECORD

REV	PAGE	DESCRIPTION	EC#	DATE
A	ALL	New Release	V80296	02/16/98
B	14	Add test group 8 into chart/table	V80889	05/29/98
C	2	Delete Plug & Receptacle 71292,71780,71781,87566 & 87567 and add 4.1.2	V80977	06/09/98

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Form E-3334
 Rev F Form E-3005
 Rev A - 02/12/04
 V20603

GS-01-001

NUMBER GBUS-12-121S-12 	TYPE PRODUCT SPECIFICATION	NUMBER  GS-12-282194
TITLE SCA Product Specification		PAGE 33 of 16212424 REVISION 2 AUTHORIZED BY GL LOO DATE 05 Jan 2011 143 MAY 10 NOV 2003 05 MAR 2008 04
		CLASSIFICATION UNRESTRICTED CONFIDENTIAL

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<u>D</u>	<u>2,3,4,6,7,8</u>	<u>Add 4.4.10, Modify 5.2.3 to add LCP. Modify 5.4 noting Straddle Mount plug for various PCB thickness. 7.1 "per contact position" to "per contact pair". 8.0 state "applied" to PCB. 8.6a to 50-2000Hz, 5.35B minimum.</u>	<u>V82162</u>	<u>12/23/98</u>
<u>E</u>	<u>ALL</u>	<u>Revised format to be consistent with GS-01-001, and change BERG, Dupont, etc. references to FCI.</u>	<u>V01904</u>	<u>08/03/00</u>
<u>F</u>	<u>3</u>	<u>Add to Section 5.3.1- "The Plug and receptacle terminal press-fit sections shall be plated with 0.5um/20u" min. -1.5um/60u" max. 90/10 tin-lead"</u>	<u>V02700</u>	<u>11/10/00</u>
	<u>2 Section 4.5</u>	<u>Replaced GES-19-002 with BUS-19-122</u>		
<u>G</u>	<u>14</u>	<u>5.3.1 - Add contact area with 0.76um/30u" gold minimum, solder tail section with 2.54um/100u" tin minimum and press fit section with 0.5um/20u" min - 1.5um/60u" max. tin over 1.27um/50u" minimum nickel. No plating at cutting point. Add 8.13, 8.14 & test group 12</u>	<u>S04-0281</u>	<u>12/29/04</u>
<u>H</u>	<u>6</u>	<u>7.4 - Individual Pin Insertion shall not exceed 60N (13.5 pounds) was 6 pounds.</u>	<u>S05-0061</u>	<u>02/28/05</u>
<u>J</u>	<u>ALL</u>	<u>Revised format to the latest FCI document form.</u>	<u>ECN-ELX-</u>	<u>01/05/11</u>
	<u>2, 9</u>	<u>4.5.6, 4.5.7 & 4.5.8: Add (GS-19-037), (GS-19-049) & (GS-19-039) respectively; 8.13 & 8.14: Add GS-22-011, GS-22-012 & GS-19-028 respectively</u>	<u>S-002406-1</u>	
	<u>6</u>	<u>7.1- ...The force to mate a receptacle...shall not exceed 120 grams max.... was 90 grams max....</u>		

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Form E-3334
Rev F Form E-3005
Rev A-02/12/04
V20603

GS-01-001

NUMBER GBUS-12-121S-12	TYPE PRODUCT SPECIFICATION	NUMBER FCI GS-12-282194
TITLE SCA Product Specification Serial Attached SCSI (SAS) Serial ATA Connector		PAGE 34 of 16212121 REVISION 2 AUTHORIZED BY GL LOO DATE 05 Jan 2011 143 MAY 10 NOV 2003 05 MAR 2008 04 CLASSIFICATION UNRESTRICTED CONFIDENTIAL

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REVISION RECORD

REV.	PAGE	DESCRIPTION	ECR #
DATE			
AA1	ALL	New Release New Release Preliminary	
S03-0106		S05-0028	0822 JUL 0305 Marr 045
B	2	Remove 4.4.4 SS 00254, Add 4.5.12 GS 22-011,	S05-0128
28APR05		4.5.13 GS 22-012	
8, 9		Update 8.7, 8.8, 8.9 and 8.10 to GS specs	
C	6	7.4 Normal force: ... shall not be less than 60 grams	S05-0346
23NOV05		(was GS-12-194 Rev 1 by H.Shindo)	A 1.1 6,7,9 to 12 Add Clauses
7.3 to 7.7, 8.9 to 8.11		TBA	26 SEP 03
		Test Group 8 to 12	
A 1.2	6	7.3 Retention 5N was 7N	TBA
10 NOV 03			
A 1.3	7	7.1 The unmating force shall not be less	TBA
06 FEB 04		Than 10N (1.0kgf).	
		Was ... shall not be less than 30grams	
D	ALL	Update the spec. to the latest company logo	S08-0142
13MAY08			
11		Table 1 - cancell the repeated test group 11	

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NUMBER GBUS-12-121S-12  282 FCI	TYPE PRODUCT SPECIFICATION	NUMBER  GS-12-282194
TITLE SCA Product Specification erial Attached SCSI (SAS) erial ATA Connector		PAGE 35 of 16212424
		REVISION 2  AUTHORIZED BY GL LOO
		DATE 13-05-03 05 Jan 2011 MAY 10 NOV 2003 MAR 2008
		CLASSIFICATION UNRESTRICTED CONFIDENTIAL

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The following constitutes the recommended order and paragraph numbering scheme in compliance with GS-01-001. Paragraphs that are not needed shall be eliminated, and subsequent paragraphs renumbered. Please delete this note after reading.

1.0 OBJECTIVE

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2.0 SCOPE

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3.0 GENERAL

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4.0 DEFINITIONS

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5.0 PROCEDURE

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6.0 REFERENCE DOCUMENTS (If Applicable)

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7.0 NOTES (Optional)

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8.0 RECORD RETENTION (If Applicable)

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