

HSAL II Interconnect System



PCB Headers

6 and 12 Circuit Sealed and Unsealed
Right Angle and Vertical and
14 Circuit Unsealed Right Angle

Cable Assemblies

6 and 12 Circuit Sealed and Unsealed
Plug and Inline and
14 Circuit Unsealed Plug

Overview

The robust HSAutoLink™ II interconnect system addresses the need for increasing bandwidth requirements in transportation applications through cost-competitive solutions that support a range of high-speed communication protocols.

Scope

This product overview contains supplemental information pertaining to the HSAutoLink™II Automotive Connector System. This product overview is broken into two main parts, sealed and unsealed connector systems. The 14-circuit products Production Part Approval Process (PPAP) is scheduled for third quarter 2020.

For more information regarding electrical information or application specification please visit www.molex.com or contact your local sales representative.



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HSAL II Interconnect System



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GENERAL SPECIFICATIONS

Reference Information

Designed In: Millimeters

RoHS: No

Halogen Free: No

Glow Wire Compliant: N/A

Electrical

Voltage (max.): 36V

Current (max.): 1.5A

*(higher current rating achievable,
contact PM for additional
technical information)*

Contact Resistance: 20 milliohms

Dielectric Withstanding Voltage: 500V AC

*Insulation Resistance (min.): 100
Megohms*

Mechanical

Insertion Force to PCB (max.): 20N

Mating Force (max.): 75N

Unmating Force (max.): 100N

Durability (min.):

Connector: 25 cycles

Terminal system: 5,000 cycles

Physical

Housing: High-Temperature Plastic

Contact: High-Performance Copper Alloy

Plating (min.):

Contact Area — 0.4 μ m Gold (Au)

Solder Tail Area — 2.5 μ m Tin (Sn)

Underplating — 1.25 μ m overall

PCB Thickness: 1.6mm nominal

Operating Temperature: -40 to +105°C

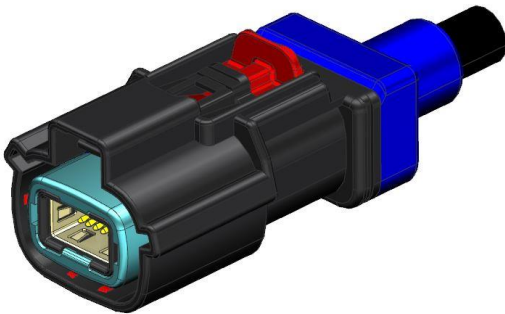
HSAL II Interconnect System



Sealed Connector Types

HSAutoLink II Connector System can be used for high speed, low speed, power and ground, or hybrid signaling applications. It is available in a variety of colors, polarizations A through D, and strain relief options. This section identifies HSAutoLink™ II configurations for Plug to Inline and Plug to header applications.

12 Circuit Sealed Plug – Polarity A - D



BLACK
POL - A



GRAY
POL - B

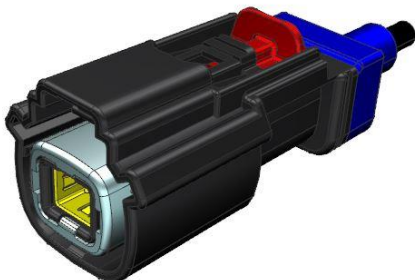


BROWN
POL - C



GREEN
POL - D

6 Circuit Sealed Plug – Polarity A - D



BLACK
POL - A



GRAY
POL - B



BROWN
POL - C



GREEN
POL - D

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12 Circuit Sealed Inline Receptacle – Polarity A - D



BLACK
POL - A



GRAY
POL - B



BROWN
POL - C



GREEN
POL - D

6 Circuit Sealed Inline Receptacle – Polarity A - D



BLACK
POL - A



GRAY
POL - B



BROWN
POL - C

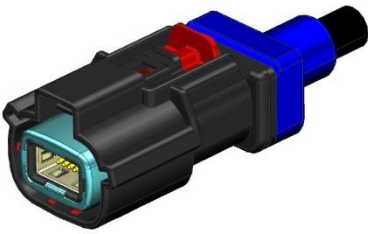


GREEN
POL - D

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Sealed Cable Assembly Variations



12CKT SEALED
PLUG
STRAIGHT



12CKT SEALED
PLUG
90° LEFT /
RIGHT



12CKT SEALED
PLUG
65° UPWARD



12CKT
SEALED
PLUG
90° DOWN



6CKT SEALED
PLUG
STRAIGHT



6CKT SEALED
PLUG
45° LEFT /



6CKT SEALED
PLUG
90° DOWN

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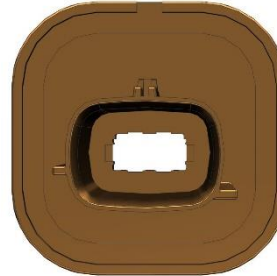
12 Circuit Sealed Vertical Header – Polarity A - D



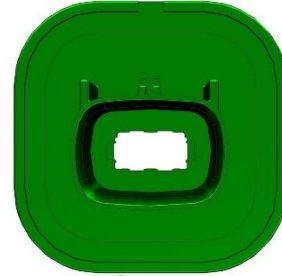
BLACK
POL - A



GREY
POL - B



BROWN
POL - C

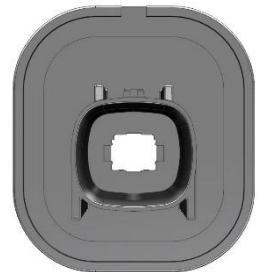


GREEN
POL - D

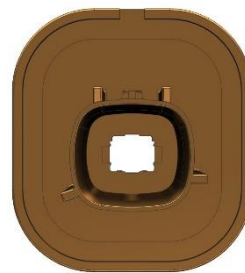
6 Circuit Sealed Vertical Header – Polarity A - D



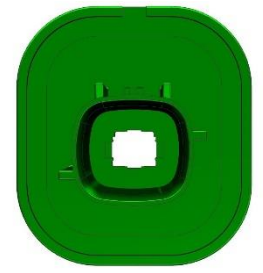
BLACK
POL - A



GREY
POL - B



BROWN
POL - C



GREEN
POL - D

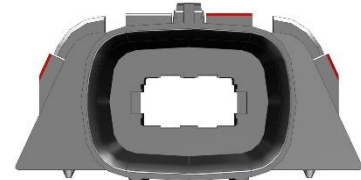
HSAL II Interconnect System



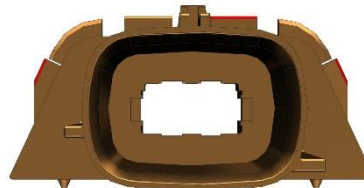
12 Circuit Sealed Right Angle Header – Polarity A - D



BLACK
POL - A



GREY
POL - B



BROWN
POL - C

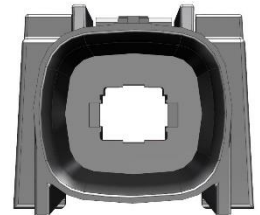


GREEN
POL - D

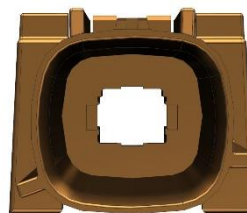
6 Circuit Sealed Right Angle Header – Polarity A - D



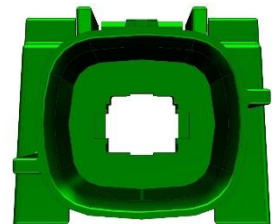
BLACK
POL - A



GREY
POL - B



BROWN
POL - C



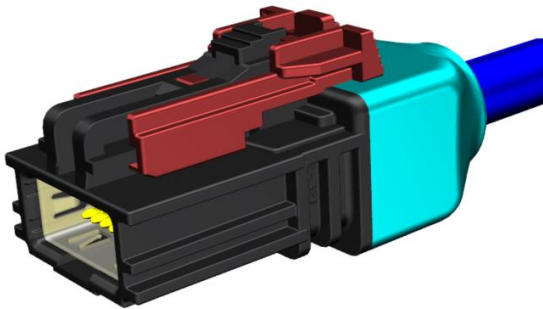
GREEN
POL - D

HSAL II Interconnect System



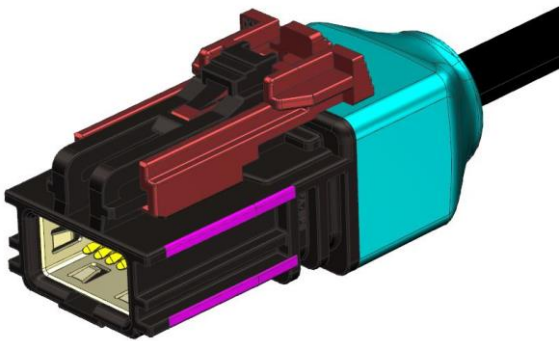
Unsealed Connector Types

14 Circuit Unsealed Plug – Polarity A

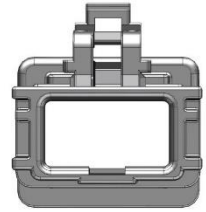


BLACK
POL - A

12 Circuit Unsealed Plug – Polarity A - C



BLACK
POL - A



GREY
POL - B



BROWN
POL - C

HSAL II Interconnect System



6 Circuit Unsealed Plug – Polarity A - F



BLACK
POL - A



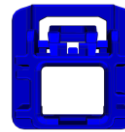
GREY
POL - B



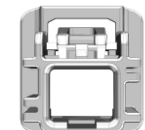
DARK GREY
POL - C



GREEN
POL - D



BLUE
POL - E



NATURAL
POL - F

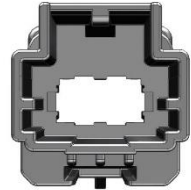
HSAL II Interconnect System



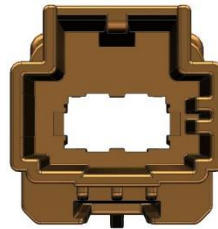
12 Circuit Unsealed Inline – Polarity A - C



BLACK
POL - A

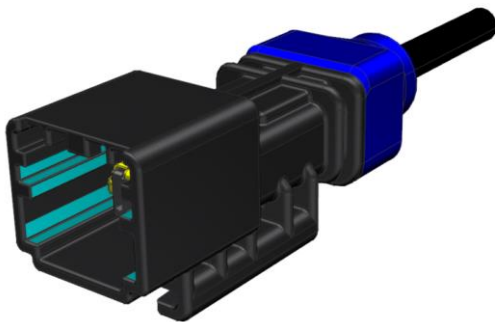


GREY
POL - B

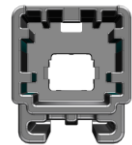


BROWN
POL - C

6 Circuit Unsealed Inline – Polarity A - F



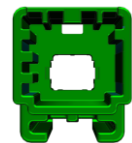
BLACK
POL - A



GREY
POL - B



DARK GREY
POL - C



GREEN
POL - D



BLUE
POL - E

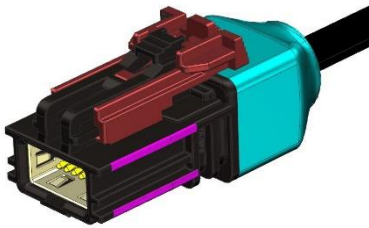


NATURAL
POL - F

HSAL II Interconnect System



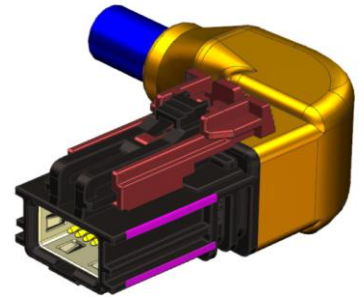
Unsealed Cable Assembly Variations



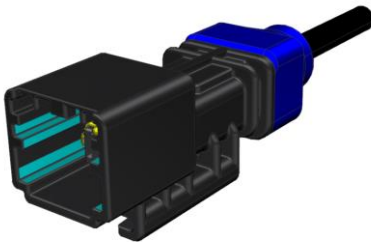
12CKT
UNSEALED
PLUG
STRAIGHT



12CKT UNSEALED
PLUG
90° DOWN



12CKT
UNSEALED
PLUG
90°
LEFT/RIGHT



6CKT UNSEALED
PLUG
STRAIGHT



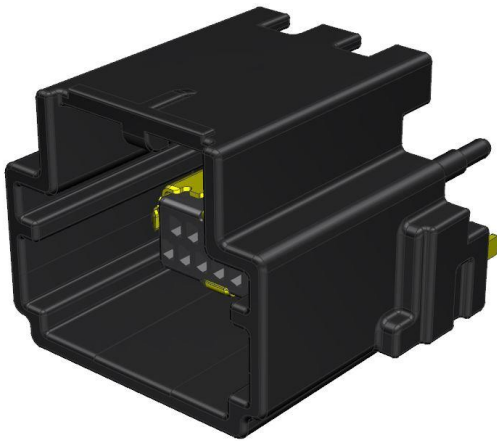
6CKT UNSEALED
PLUG
90° DOWN

HSAL II Interconnect System

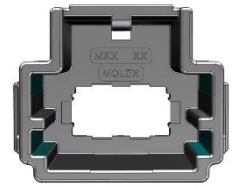


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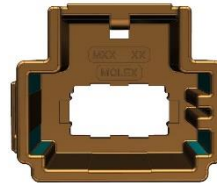
12 Circuit Unsealed Vertical Header – Polarity A - C



BLACK
POL - A

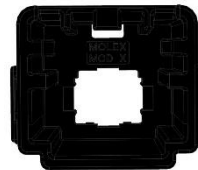
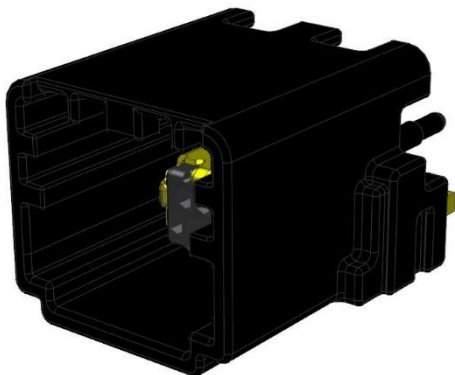


GREY
POL - B



BROWN
POL - C

6 Circuit Unsealed Vertical Header – Polarity A - F



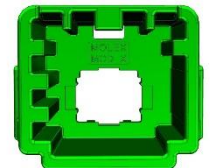
BLACK
POL - A



GREY
POL - B



DARK GREY
POL - C



GREEN
POL - D



BLUE
POL - E

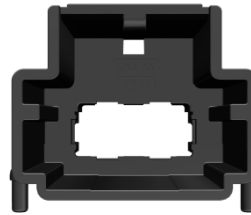


NATURAL
POL - F

HSAL II Interconnect System



14 Circuit Unsealed Right Angle Header – Polarity A



BLACK
POL - A

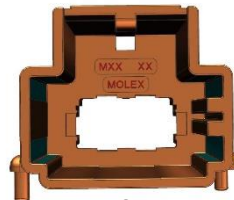
12 Circuit Unsealed Right Angle Header – Polarity A - C



BLACK
POL - A



GREY
POL - B



BROWN
POL - C

HSAL II Interconnect System



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6 Circuit Unsealed Right Angle Header – Polarity A - F



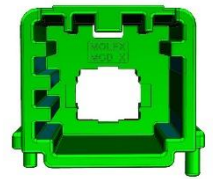
BLACK
POL - A



GREY
POL - B



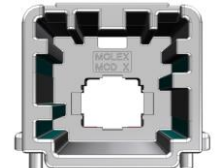
DARK GREY
POL - C



GREEN
POL - D



BLUE
POL - E



NATURAL
POL - F

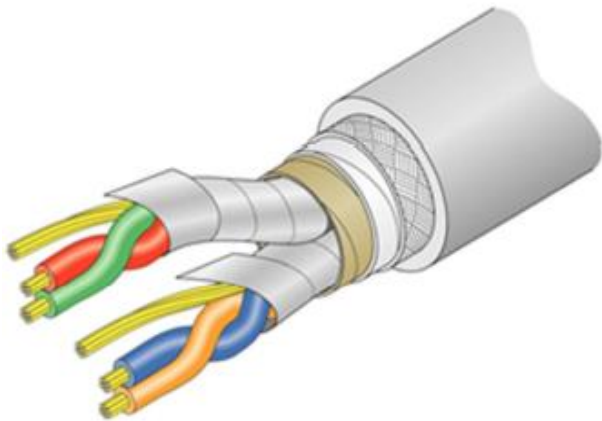
HSAL II Interconnect System



Cable Types

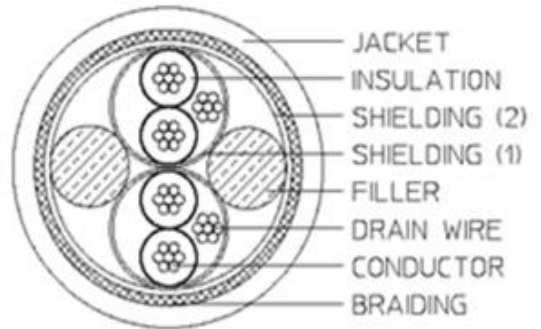
HSAutoLink™ II assemblies are available with 6 and 12 circuit cable types related to the system performance requirements. This section provides a basic description of each cable type available.

HSAutoLink™ Typical Cable



Typical Cable Appearance

RAW CABLE CONSTRUCTION



Cross Section of Typical Cable

Cable Description	# Conductors	# Drains	Cable Diameter
LVDS 2-WIRE	2	1	4.2mm
DISPLAY PORT	10	2	6.8mm
LVDS 2-PAIR	4	2	6.2mm
USB 2.0	4	1	4.9mm
LVDS 4-WIRE	4	1	5.0mm
USB 5-WIRE	5	0	4.9mm
USB 3.0	8	2	5.2mm
IPM CABLE	8	1	8.5mm
LVDS 4-PAIR	8	4	7.4mm
USB 3.0/USB 2.0 Combo Cable (14 circuit only)	12	2	6.4mm

HSAL II Interconnect System



Sealed Connector Performance

Electrical Requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
1	Dry Circuit Resistance (Contact)	Total connection resistance shall be less than 30mΩ.	Terminal Contact Resistance (Initial) < 30m Ohm Terminal Contact Resistance (Env.) < 30m Ohm, delta < 10m Ohm from initial
2	Dry Circuit Resistance (Shell)	Total connection resistance shall be less than 30mΩ.	Shield Contact Resistance (Initial) < 30m Ohm Shield Contact Resistance (Env.) < 50m Ohm
3	Isolation Resistance	Mate connectors: apply a voltage of 500 VDC between adjacent pairs of terminals and between terminals to ground. Record resistance after 15s of stabilized reading. GMW3191 Section 4.3.5	100 MΩ Minimum
4	Differential Impedance	Measure the conductors of the cable assembly	USB 2.0 90±15% Ohms with 200ps rise time filter LVDS 100 Ohms with Rise Time Filter dependent on data rate
5	Dielectric Strength	Unmated connectors. Apply 1000 AC or 1600 VDC between adjacent terminal and ground. Per GMW3191 Section 4.3.6	No breakdown
6	EMI/EMC	Application dependent	Application dependent
7	Attenuation	Application dependent	Application dependent
8	High Speed Link Performance	Intrapair Skew Performance	20 picosecond/meter maximum

HSAL II Interconnect System



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Mechanical Requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
1	Connector Audible Click	Mate/unmate connector to receiving connector and measure dB level change from ambient level. HSAutoLink II™ - GMW3191 Sec. 4.2.13	HSAutoLink II™ 30 to 50dB – unconditioned 30 to 50dB – conditioned
2	Connector Mate and Unmate Forces	Mate and unmate connector at a rate not to exceed 50mm/min. HSAutoLink II™ - GMW3191 Sec. 4.2.8, 4.2.18, & 4.2.19	HSAutoLink II™ 75 N maximum mating force & 100 N maximum un-mating forces w/ lock disengaged. 80 N minimum un-mating force w/ lock engaged 70 N maximum primary lock disengage force.
3	CPA Engage/Disengage Force	Unmated/mated connectors CPA engage force (Pre to Final lock position). GMW3191 Sec. 4.2.15	Pre to Final lock (mated) <22N Final to Pre lock (mated) 10N≤ F≤ 30N Pre to Final lock (unmated) >80N CPA removal (unmated) ≥60N
4	Connector/Terminal Cycling	Mate each connector pair 10 times.	HSAutoLink II™ - Total connection resistance <20mΩ.
5	Cable Assembly Tensile Force – Pull Out	Apply an axial pullout force of 40N on the cable for one minute minimum. USB 2.0	40 N Min. pullout force. No discontinuities > 1μs.
6	Cable Flex	100 cycles in 2 planes each; Min. Bend Radius: 10X cable radius. Per ANSI/EIA-364-41; Condition 1	Discontinuity ≤ 1μs.
7	Mechanical Shock and Vibration with Thermal Cycling	Vibration per GMW3191 Class 1 – on body or chassis. GMW3191 Sec. 4.4.8	Discontinuity ≤ 1μs, Meet dry circuit requirements <20 milliohms, No base metal apparent at contact surface or evidence of fretting corrosion.

HSAL II Interconnect System



Mechanical Requirements - Continued

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
8	Polarization Feature Effectiveness	Engage connector halves to attempt insertion. Connector must withstand minimum Force to deter mating. HSAutoLink II™ - GMW3191 Sec. 4.2.20	HSAutoLink II™ 150 N minimum
9	Drop Test	Drop 3X onto a horizontal concrete surface from a height of 1m.	No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
10	Connector Lock Mechanical Overstress	150N applied to lock in horizontal and vertical direction. GMW3191 Sec. 4.2.14	No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
11	Connector Mounting Feature Mechanical Strength	50N applied in five directions to feature 110N applied to remove clip	No breakage at ≤50N No clip removal at ≤110N
12	Flammability	UL-94	HB

HSAL II Interconnect System



Environment Requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
1	Thermal Aging	Heat age samples to Class II temperature for 1008 hours. GMW3191 Sec. 4.4.1	No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
2	Thermal Shock	300 cycles @ -40°C and 105°C for 30 minutes at each temperature. GMW3191 Sec. 4.4.2	Discontinuity $\leq 1\mu\text{s}$, Meet dry circuit requirements <20 milliohms, No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
3	Humid Heat Cyclic (HHC)	Two day cycle repeated 5 times for a total of 10 days, +25°C to +65°C, @93±3% relative humidity. GMW3191 Sec. 4.4.3	Meet dry circuit requirements <20 milliohms, No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
4	Humid Heat Constant (HHCO)	10 days, +85±3°C, @90±5% humidity. GMW3191 Sec. 4.4.4	Meet dry circuit requirements <20 milliohms, No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.

HSAL II Interconnect System



Unsealed Connector Performance

Electrical Requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
1	Dry Circuit Resistance (Contact)	Total connection resistance shall be less than 30mΩ.	Terminal Contact Resistance (Initial) <30m Ohm Terminal Contact Resistance (Env.) <30m Ohm, delta < 10m Ohm from initial
2	Dry Circuit Resistance (Shell)	Total connection resistance shall be less than 30mΩ.	Shield Contact Resistance (Initial) <30m Ohm Shield Contact Resistance (Env.) <50m Ohm
3	Isolation Resistance	Mate connectors: apply a voltage of 500 VDC between adjacent pairs of terminals and between terminals to ground. Record resistance after 15s of stabilized reading. GMW3191 Section 4.3.5	100 MΩ Minimum
4	Dielectric Strength	Unmated connectors. Apply 1000 AC or 1600 VDC between adjacent terminal and ground. GMW3191 Section 4.3.6	No breakdown
5	Electrostatic Discharge	Test unmated connectors from 1 kV to 8 kV in 1 kV steps VESA §4.2.1.4	No evidence of discharge to contacts at 8kV
6	EMI/EMC	Application dependent	Application dependent
7	Differential Impedance	Connector: NOMINAL 100Ω	Application dependent
8	Attenuation Return Loss Intra Pair Skew	Application Dependent	Depending on the high speed link technology required, Molex will provide the applicable Signal Integrity test results

HSAL II Interconnect System



Mechanical Requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
1	Connector Audible Click	Mate/unmate connector to receiving connector and measure dB level change from ambient level. GMW3191 Sec. 4.2.13	7dB Min – unconditioned 5dB Min - conditioned
2	Connector Mate and Unmate Forces	Mate and unmate connector at a rate not to exceed 50mm/min. GMW3191 Sec. 4.2.8, 4.2.18, & 4.2.19	75N Max mating force. 80N Min un-mating force to defeat primary lock 100N Max un-mating force w/locks disengaged 70N Max force to disengaged primary lock.
3	CPA Engage/Disengage Force	Unmated/mated connectors CPA engage force. GMW3191 Sec. 4.2.15	Pre to Final lock (mated)<22N Final to Pre lock (mated) 10N ≤ F ≤ 30N Pre to Final lock (unmated) >80N CPA removal (unmated) ≥60N
4	Connector/Terminal Cycling	Mate each connector pair 10 times. GMW3191 Sec. 3.3	Total connection resistance <20mΩ
5	Cable Assembly Tensile Force – Pull Out	Apply an axial pullout force of 40N on the cable for one minute minimum. USB 2.0	40 N Min. pullout force. No discontinuities > 1μs.
6	Cable Flex	100 cycles in 2 planes each; Min. Bend Radius: 10X cable radius. ANSI/EIA-364-41; Condition 1	Discontinuity ≤ 1μs.
7	Mechanical Shock and Vibration with Thermal Cycling	Vibration per GMW3191 Class 1 – on body or chassis. GMW3191 Sec. 4.4.8 VESA §4.2.1.4	No Discontinuities >7 Ω for more than 1 μS Meet dry circuit requirement Delta ≤ 30mΩ

HSAL II Interconnect System



Mechanical Requirements - Continued

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
8	Polarization Feature Effectiveness	Engage connector halves to attempt insertion. Connector must withstand minimum force to deter mating. GMW3191 Sec. 4.2.20	150N minimum
9	Connector Mounting Feature Mechanical Strength	50N applied in five directions to feature 110N applied to remove clip GMW3191 Sec. 4.2.12	No breakage at $\leq 50N$ No clip removal at $\leq 110N$

HSAL II Interconnect System



Environment Requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
1	Thermal Aging	Heat age samples to Class II temperature for 1008 hours. GMW3191 Sec. 4.4.1 VESAs §4.2.1.4	Meet dry circuit requirement $\Delta \leq 30m\Omega$. No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
2	Thermal Shock	300 cycles @ $-40^{\circ}C$ and $105^{\circ}C$ for 30 minutes at each temperature. GMW3191 Sec. 4.4.2 VESAs §4.2.1.4	No Discontinuities $>7 \Omega$ for more than $1\mu S$ Meet dry circuit requirement $\Delta \leq 30m\Omega$, No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
3	Humid Heat Cyclic (HHC)	Two day cycle repeated 5 times for a total of 10 days, $+25^{\circ}C$ to $+65^{\circ}C$, @ $93\pm 3\%$ relative humidity. GMW3191 Sec. 4.4.3 VESAs §4.2.1.4	Meet dry circuit requirement $\Delta \leq 30m\Omega$, No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
4	Humid Heat Constant (HHCO)	10 days, $+85\pm 3^{\circ}C$, @ $90\pm 5\%$ humidity. GMW3191 Sec. 4.4.4 VESAs §4.2.1.4	Meet dry circuit requirement $\Delta \leq 30m\Omega$, No evidence of deterioration, cracks, deformities, etc. that could affect functionality or distort appearance. Connector locking mechanism must function without breakage.
5	Solderability	SMES-152: Solder ability - Dip Coated Method	The solderability area as defined by the part drawing shall exhibit at the least a 95% continuous, smooth, new solder coating. Voids, pinholes, porosity, non-wetting, or dewetting, in one area shall not exceed 5% of the total solder ability area.

HSAL II Interconnect System



REVISION TABLE

Version	Date	Description
REV. A1	December 18, 2019	Added USB 3.0/2.0 combo cable on p. 16. Updated description on p. 1. Updated the Electrical Requirements on p. 17. Updated the Electrical Requirements on p. 21. Updated the Mechanical Requirements on p. 18-19.