
High Speed Data, Pin Headers 90° / 180°, die-casting

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1. CONTENT

This specification covers the performance, tests and quality requirements for the High Speed Data pin headers 90° and 180° pos., die-casting, shielded. These products are only permissible for car interior. They are used for soldering on PC-boards or other applications.

1.1 Product Table

Different versions are available.

- Order No. See drawing

1.2 Qualification

When tests are performed the following specified specifications and standards shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. In the events of conflict between the requirements of this specification and the product drawing or of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1 TE Documents

A	109-1	General Requirements for Test Specifications
B	Customer Drawings and Name	
	2291362	HSD header 90degree
	2291364	HSD header 180degree
	2304935	HSD header 180degree w/ cap
	2315239	HSD header 180degree + 2MQS
	2315834	HSD header 90degree + 2MQS
C	Product Specifications	
	108-94106	Product specification for the HSD Connector System
D	HSD-Test-Specification	
	109-18261	Test-Specification for the HSD Connector System
E	Application Specification	
	114-32195	Application specification for the HSD, Pin Headers 90°/180° die-casting

2.2 Other Documents

A	DIN IEC 512	Electromechanical components for electronic equipment, basic testing procedures and measuring methods, Edition May 1994
B	DIN IEC 68	Electrical engineering, basic environmental testing procedures, Edition August 1991
C	IDB 1394	1394 Copper Automotive Standard (Supplement to IDB 1394) Document number TS 2008001, Edition June 2008

3. REQUIREMENTS

3.1 Design and Construction

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

3.2 Materials

Descriptions for material see in production drawing.

3.3 Performance and Test Description

The product is designed to meet the electrical, mechanical and environmental performance requirements specified in paragraph 3.4. All tests are performed at ambient environmental conditions per IEC 512 unless otherwise specified.

3.4 Test Requirements and Procedures Summary

- acc. TE HSD-Test-Specification 109-18261

	Acceptance Criteria	Characteristic
Mechanical Data	min 25	Mating cycles
	max. 30N	Mating Force Connector Pair
	max. 60N	Mating Force with MQS module
	min. 5N	Unmating Force Connector Pair
	min. 110N	Retention Force Connector Lock
	min. 3N max. 15N	Connector Lock Manipulation Force
	min. 80N	Polarization Feature Effectiveness

Electrical Data	max. 7.5 mOhm max. 10 mOhm max. 15 mOhm	Contact Resistance before exposure: Outer Contact Signal Contact straight Signal Contact angled
	max. 40 mOhm max. 40 mOhm max. 40 mOhm	Contact Resistance after exposure: Outer Contact Signal Contact straight Signal Contact angled
	min. 1,000 MOhm	Isolation Resistance
	max. 2.5 A	Current Capability at 80°C
	max. 5.0 A at MQS pins	Dependent on mating connector and cable
	100 Vrms	Operating Voltage
	500 Vrms	Test Voltage

Signal Propagation Data	100 +/- 15 Ohm	Impedance Pin Header only
	max.50 ps max.125 ps	Propagation Delay Header straight Header angled
	max. 5 ps max. 25 ps	Propagation Delay Skew in a wire pair Pin Header straight Pin Header angled
	max. 5 ps max. 5 ps	Propagation Delay Skew between Wire pairs Pin Header straight Pin Header angled
	max. 0.2 dB @ 1GHz max. 0.1 dB @ 1GHz	Insertion Loss mated with Connector Insertion Loss for header Connector
	max. -20 dB max. -17 dB	Return Loss Mated with Connector 0 - 1 GHz 0 - 2 GHz
	max. 5% / < -30 dB to 1 GHz	Cross Talk
	min. 75dB min. 65dB	Shielding Effectiveness 0 - 1 GHz 0 - 2 GHz
	min. 65dB min. 60dB	Bulkhead Feedthrough 0 - 1 GHz 0 - 2 GHz

Environmental Data	DIN IEC 60068-2-27	Mechanical Shock
	DIN IEC 60068-2-64 (Class 2)	Vibration
	1m	Drop from height
	DIN IEC 60068-2-14 -40°C - +105°C	Thermal Shock
	USCar 2.6 -5.6.2. Test Temperature +105°C	Temperature Humidity Cycling
	DIN IEC 60068 2-2 Temperature +105°C	Dry Heat

Materials	CuZn, CuSn	Outer Contacts
	CuSn	Inner Contacts
	PA	Dielectric
	PA	Housings

Platings	Ni or Sn	Outer Contacts Contact Area
	Au	Signal Contacts Contact Area
	Sn	Outer Contacts Soldering Area
	See Drawing	Signal Contacts Soldering Area

This table is part of the TE HSD-Test-Specification, all values apply to the test conditions specified there.

- acc. IDB 1394

Performance Group A: Basic Construction, workmanship, dimensions, and plating thickness

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
A.1				Visual Inspection	USCAR-2, Rev. 6, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance. No deviation from dimensional tolerances of critical dimensions.
A.2				Plating Thickness Measurements		No deviation from plating materials and thickness specifications.

Performance Group B: Copper Socket DC Electrical Functionality when subjected to Mechanical Shock and Vibration

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
B.1	None		Mount socket rigidly. Insert plug by hand.	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	50 milliohms maximum initial per mated contact
B.2	Connector Cycling	USCAR-2, Rev. 6, 5.1.7	Cycle connector 25x.	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	30 milliohms maximum change from initial per mated contact
B.3	Vibration	USCAR-2, Rev. 6, 5.4.6	Vibration per Figure 5.4.6.3, For components not coupled to engine. Grms=1.81	Circuit Continuity Monitoring 7 ohms greater than 1micro-second	USCAR-2, Rev. 6, 5.1.9	No resistance change exceeding FFS ohms for more than 1 microsecond. (Each contact)
B.4	Mechanical Shock (Specified Pulse)	USCAR-2, Rev. 6, 5.4.6	10 half-sine wave impulses (10 milliseconds duration at 35 Gs force)	Circuit Continuity Monitoring 7 ohms greater than 1micro-second	USCAR-2, Rev. 6, 5.1.9	No resistance change exceeding FFS ohms for more than 1 microsecond. (Each contact)
B.5	None			Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	30 milliohms maximum change from initial per mated contact
				Visual Inspection	USCAR-2, Rev. 6, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

Performance Group C.1: Copper Socket DC Electrical Functionality when subjected to Humidity Stress

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
C.1.1	None		Mount socket rigidly. Insert plug by hand.	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	50 milliohms maximum initial per mated contact
C.1.2	Connector Cycling	USCAR-2, Rev. 6, 5.1.7	Cycle connector 25x.	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	30 milliohms maximum change from initial per mated contact
C.1.3	Temperature/ Humidity Cycling	USCAR-2, Rev. 6, 5.6.2	-40 to 100C per class 2 environment. Maximum humidity per Figure 5.6.2.3. Total duration 320 hours (40 cycles).	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	30 milliohms maximum change from initial per mated contact
				Visual Inspection	USCAR-2, Rev. 6, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

Performance Group C.2: Copper Socket Isolation Resistance Functionality when subjected to Humidity Stress

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
C.2.1	Connector Cycling	USCAR-2, Rev. 6, 5.1.7	Cycle connector 25x.	Isolation Resistance	USCAR-2, Rev. 6, 5.5.1.4	Resistance between adjacent terminals must exceed 20 megohm at 500 VDC.
C.2.2	Temperature/ Humidity Cycling	USCAR-2, Rev. 6, 5.6.2	-40 to 100C per class 2 environment. Maximum humidity per Figure 5.6.2.3. Total duration 320 hours (40 cycles).	Isolation Resistance	USCAR-2, Rev. 6, 5.5.1.4	Resistance between adjacent terminals must exceed 20 megohm at 500 VDC.

Performance Group C.3: Copper Socket Signal Integrity Functionality when subjected to Humidity Stress

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
C.3.1	Mated Connector and Termination Impedance		160 ps rise time at 50 ps, 100ps, and 150 ps beyond the connector launch plane	Impedance –Differential Mode (Connector Only)	IEEE Std 1394-2000 Annex K.3	System Impedance (ZTP) = 100 Ω: ZPTAConn =100Ω +/- 15Ω System Impedance (ZTP) =110 Ohms : ZPTAConn =110Ω +/- 15Ω
C.3.3	Propagation Delay			Propagation Delay		≤ 125 ps for Pin Header 90° ≤ 50 ps for Pin Header 180°
C.3.4	Propagation Delay			Propagation Skew – Differential Mode	IEEE Std 1394- 2000 Annex K.6	≤ 25 ps for Pin Header 90° ≤ 5 ps for Pin Header 180°
C.3.7	Insertion Loss (Mated Connector Pair)			Attenuation	IEEE Std 1394-2000 Annex K.4	max. 0,2 dB (0 – 1 GHz)
C.3.8	Return Loss (Mated Connector Pair)			Return Loss	ANSI/EI 364-108	max. -20 dB (0 – 1 GHz)
C.3.9	Cross Talk (Mated Connector Pair)			Cross Talk	IEEE Std 1394-2000 Annex K.8	max. 5 % (differential TDT at 160 ps, 10-90% rise time) max. -30 dB (0 – 1 GHz)
C.3.11	Connector Cycling	USCAR-2, Rev. 6, 5.1.7.	Cycle connector 25x			
C.3.12	Temperature/ Humidity Cycling	USCAR-2, Rev. 6, 5.6.2	-40 to 100C per class 2 environment. Maximum humidity per Figure 5.6.2.3. Total duration 320h (40 cycles)			
C.3.13 - C.3.22	Repeat C.3.1 through C.3.10					

NOTE – Phase C.1, C.2 and/or C.3 can be combined if the sample configuration is suitable for the laboratory.

Performance Group D: Copper Socket DC Electrical Functionality when subjected to Thermal Shock

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
D.1	None		Mount socket rigidly. Insert plug by hand.	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	50 milliohm maximum initial per mated contact
D.2	Connector Cycling	USCAR-2, Rev. 6, 5.1.7	Cycle connector 25x.	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	30 milliohm maximum change from initial per mated contact
D.3	Thermal Shock	USCAR-2, Rev. 6, 5.6.1	-40 to 100C per class 2 environment. Total duration 100 cycles, 30 minute dwell.	Dry Circuit Resistance	USCAR-2, Rev. 6, 5.3.1	30 milliohm maximum change from initial per mated contact
				Visual Inspection	USCAR-2, Rev. 6, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

Performance Group E: Copper Socket Mechanical Functionality when subjected to Temperature Life Stress

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
E.1	None		Mate Force Only	Connector-Connector Mating/Un-mating Force	USCAR-2, Rev. 6, 5.4.2	55N Max Mate Force
E.2	Connector Cycling	USCAR-2, Rev. 6, 5.1.7	Cycle connector 25x.			
E.3	High temperature exposure	USCAR-2, Rev. 6, 5.6.3	100 C for 1008 hours mated			
E.4	None		Un-mate Force w/ & w/o Lock & Lock Actuation Force	Connector-Connector Unmating Force Only	USCAR-2, Rev. 6, 5.4.2	Connectors with locks: Un-mating force w/ Locke engaged; 100N min, Connector Lock Manipulation Force; 3N min to 60N max Connectors without locks: Un-mating force w/o Lock; 5N min

Note: Phase E.1 and E.2 can be combined if the sample configuration is suitable for the laboratory.

Performance Group F: General Tests

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
F.1	Connector/ Cable Axial Pull test (5 cable assemblies with connector at one end 1m long, 5 mating connectors.)		Fix connector housing and apply a 100N load to the cable for one minute on cable axis.	Continuity	ANSI/EIA 364-46B	No discontinuity 1 microsecond or longer. (Each contact).
				Visual Inspection	USCAR-2, Rev. 6, 5.1.8	No jacket tears or visual exposure of shield. No jacket movement greater than 1.5 mm at point of exit from the connector or over mold.
F.3	Audible Click (8 mating connector pairs w/o humidity aging, 8 mating connector pairs w/ humidity aging.)	USCAR-2, Rev. 6, 5.4.7	95% - 98% RH @ 40C, 6 hours Minimum	Audible Click	USCAR-2, Rev. 6, 5.4.7	Report Data - Desired Goal: 7 dB above Ambient unconditioned, 5 dB above Ambient conditioned
F.4	Polarization Feature Effectiveness (1 mating connector pair per mis- mating orientation)	USCAR-2, Rev. 6, 5.4.4	80N	Continuity	USCAR-2, Rev. 6, 5.4.4	No contact with mating contacts during mis-mating.
				Visual Inspection	USCAR-2, Rev. 6, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance. No deviation from dimensional tolerances of critical dimensions.
F.6	Connector Drop (10 Plug & Socket Connector Cable Assemblies)	USCAR-2, Rev. 6, 5.4.8	3 Drops of each unmated connector @1m	Visual Inspection	USCAR-2, Rev. 6, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

Notes:

- 1) Test Group F is not sequential. Each phase above is an independent test with separate sets of samples for each phase.
- 2) Cable length for Test Phase F.1 may be changed to facilitate laboratory and test equipment requirements.
- 3) Phase F.5 is applicable to connector systems with secondary locks (TPA's).

- acc. TE (internal Test)

Solderability and Resistance to soldering heat

Test Description	Requirement	Procedure
Visual- and dimensional examination	Meets requirements of product drawing	according to DIN IEC 60512-1-1 Tests 1a + 1b
Solderability	acc. to DIN EN60068-2-20 Ta	Sample pre conditioning Method 1: Solderbath Solder bath temp.: 245°C +/- 3°C Dip duration: 3s +/-0.3s Flux acc. DIN EN60068-2-20
Resistance to soldering heat	109-201, Test Method B, Condition A	Reflow Soldering Simulation, following reflow profile: -Average ramp rate: 3°C per second max. -Preheat temperature (minimum): 150°C -Preheat temperature (maximum): 200°C -Preheat time: 60 to 180 seconds -Ramp to peak: 3°C per second maximum -Time over liquidus (217°C): 60 to 150 seconds -Peak temperature: 245 +0/-5°C -Time within 5°C of peak: 20 to 40 seconds -Ramp - cool down: 6°C per second max. -Time 25°C to peak: 8 minutes maximum

3.5 Qualification and Requalification Test Sequence

- acc. TE HSD-Test-Specification 109-18261

	Test group	1	3	4	8	14	15	16	17	18	TE
TEST SPECIFICATION SECTION		MATING/UNMATING FORCE	POLARIZATION EFFECTIVENESS	PULL TEST	MECHANICAL SHOCK, VIBRATION	SHIELDING EFFICIENCY BULKHEAD FEEDTHROUGH	MAXIMUM TEST CURRENT	THERMAL SHOCK	TEMPERATURE / HUMIDITY CYCLING	HIGH TEMPERATURE EXPOSURE	SOLDERABILITY
	Sample size	10	10 ¹⁾	10 ²⁾	5	5	5	10	10	10	10
	Test sequence										
5.1.	General	1	1	1	1	1	1	1	1	1	1
5.1.5.	Connector Cycling			4	4		4	4	4	4	
5.1.6.	Visual Inspection	2 5	2 5	2 8	2 23	2 5	2 6	2 23	2 23	2 23	2 5
5.1.7.	Critical Dimensions	3	3	3 9	3 14	3	3	3 14	3 14	3 14	
5.1.8.	Circuit Continuity Monitoring			7	13						
5.2.1.	Mating/Unmating Force Connectors	4									
5.2.3.	Polarization Effectiveness		4								
5.2.4.	Pull Test			7							

5.2.8.	Mechanical Shock, Vibration				13						
5.3.1.	Contact Resistance			5 10	11 21			11 21	11 21	11 21	
5.3.2.	Isolation Resistance			6 11	12 22			12 22	12 22	12 22	
5.3.3.	Maximum Test Current (Derating)						5				
5.4.1.	Cable Assembly Impedance				5 15			5 15	5 15	5 15	
5.4.2.	Propagation delay										
5.4.3.	Propagation Delay Skew				6 16			6 16	6 16	6 16	
5.4.4.	Attenuation				7 17			7 17	7 17	7 17	
5.4.6.	Return Loss				8 18			8 18	8 18	8 18	
5.4.7.	Maximum Jitter				9 19			9 19	9 19	9 19	
5.4.8.	Cross Talk				10 20			10 20	10 20	10 20	
5.4.9. 5.4.10.	Shielding Effectiveness Bulkhead Feedthrough ³⁾					4					
5.5.1.	Thermal Shock							13			
5.5.2.	Temperature Humidity Cycling								13		
5.5.3.	High Temperature Exposure									13	
5.5.4	Soldering capability										3
5.5.5	Resistance to soldering heat										4

1) Minimum 10 samples resp. min. 3 samples per coding per existing coding.

2) Cable assemblies and test setup have to be selected regarding the parameters to be evaluated and to be documented in test report.

3) Bulkhead feed through only applied on 2291366.

- acc. IDB 1394

Cable Plug to Board Socket Header Configurations

Cable Plug to Board Socket Header Configurations	A	B	C.1	C.2	C.3	D	E.1	E.2 (5)	F.1	F.3	F.4 (4)	F.6	Total
Pin header, not assembled to PCB	3		10	10		10	10	10	5		3	10	71
Pinheader assembled to PCB		10			3								13
Plug Housings with TPA's w/o Terminals Installed										10			10
Plugs assemblies, not terminated to cable	3												3
Cable assemblies with a Plug assembled to one end, ~ 75 mm long										10	3		13
Cable assemblies with a Plug assembled to one end, > 75 mm long (1).			10	10		10	10	10					50
Cable assemblies with a Plug assembled to one end, > 100 mm long (2).		10											10
Cable assemblies with a Plug assembled to one end, >= 1m long.									5			10	15
Socket and Plug assemblies configured for signal integrity measurements (3).					3								3

Numbers of sample required by each performance group regardless of circuit size

Notes:

- (1) Samples are to be prepared to facilitate resistance measurements made at points on the wire 75 mm back from the contact/wire termination.
- (2) Samples are to be prepared to facilitate clamping the cable 100mm back from the connector housing in a vibration fixture and resistance measurements made at points on the wire 75 mm back from the contact/wire termination.
- (3) Samples are to be prepared to facilitate high speed signal integrity measurements. Configurations are to include any necessary SI fixtures.
- (4) One connector pair mis-mate orientation. See Test Group F.4
- (5) The same samples are used for phases E.2, E.3, and E.4

4. QUALITY ASSURANCE PROVISIONS

4.1 Qualification Testing

A Sample Selection

The samples shall be prepared in accordance with product drawings. They shall be selected at random from current production.

B Test Sequence

Qualification inspection shall be verified by testing samples as specified in Paragraph 3.5.

4.2 Requalification Testing

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

4.3 Acceptance

Acceptance is based on verification that the product meets the requirements of Paragraph 3.4. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4 Conformance Inspection

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