



GEMnet Headers, unsealed

The products described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore, TE Connectivity (TE) makes no representation or warranty, express or implied, that the product will comply with these requirements. Further, TE may change these requirements based on the results of additional testing and evaluation. Contact TE Engineering for further details.

1. SCOPE	2
1.1 Content	2
1.2 Qualification	2
1.3 Qualification Test Results	2
2. APPLICABLE DOCUMENTS	2
2.1 TE Documents	2
2.2 Industry Documents	2
2.3 Reference Document	2
2.4 Interface Drawings	2
3. REQUIREMENTS	2
3.1 Design and Construction	2
3.2 Ratings	3
3.2.1 Mechanical Data	3
3.2.2 Electrical Data	3
3.2.3 RF Parameters - 1Gbps Ethernet-STP Class2	4
3.2.4 RF Parameters - 10Gbps Ethernet	4
3.2.5 RF Parameters - 25Gbps Ethernet (Proposal)	5
3.2.6 Environmental Data	5
4. TEST MATRIX	6
5. HISTORY OF CHANGE	8

PRELIMINARY

1. SCOPE**1.1 Content**

This specification covers performance, tests and quality requirements of TE GEMnet unsealed Headers.

1.2 Qualification

The specified requirements should be used when performing tests on GEMnet unsealed headers products. All tests shall be performed using product that meets the applicable inspection plans and product drawings.

1.3 Qualification Test Results

Successful qualification testing on the subject product line has not been completed. The Qualification Test Report number will be issued upon successful qualification testing.

2. APPLICABLE DOCUMENTS

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

2.1 TE Documents

- 114-160325: Application Specification
- 501-TBD: Qualification Test Report (TBD)

2.2 Industry Documents

- VW75174 2018-10 Motor Vehicle Connectors tests
- SAE/USCAR-2 Rev 6 Automotive testing specification
- DIN EN 60068 Environmental testing
- JEDEC JESD22-B102E Test Methods and Procedures for Solid State Devices Used in Transportation/Automotive Applications

2.3 Reference Document

- 109-197: Test Specification (TE Test Specification vs EIA and IEC Test Methods)

2.4 Interface Drawings

- USCAR-EWCAP – 1 Port unsealed – P/N 777-U-002-1-Z01
- USCAR-EWCAP – 1x2 Port unsealed – P/N 777-U-004-1-Z01
- USCAR-EWCAP – 2x2 Port unsealed – P/N 777-U-008-2-Z01
- USCAR-EWCAP – 2x3 Port unsealed – P/N 777-U-012-2-Z01

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 Ratings

3.2.1 Mechanical Data

Characteristic	Acceptance Criteria
Mating cycles	≥ 25
Connector Engagement Force	≤ 25 N (1 Position) ≤ 35 N (2 Position) ≤ 50 N (4 Position) ≤ 75 N (6 Position)
Connector Disengage Force with Lock Enabled	≥ 110 N
Connector Disengage Force with Lock Disabled	≥ 5N and ≤ 75 N
Polarization Feature Effectiveness	≥ 150 N (1 Position) ≥ 150 N (2 Position) ≥ 150 N (4 Position) ≥ 225 N (6 Position)

3.2.2 Electrical Data

Electrical Data		Acceptance Criteria
Contact resistance	Center contact	Before exposure – 25 mΩ max After exposure – 40 mΩ max
	Outer contact	Before exposure – 15 mΩ max After exposure – 25 mΩ max
Circuit Continuity Monitoring		No loss of electrical continuity for > 1μs
Isolation Resistance		≥100MΩ (500 VDC for t = 60 s)
Current Capacity at 80°C		2 A
Operating Voltage		60V DC maximum
Dielectric Withstanding Voltage		500V DC

3.2.3 RF Parameters - 1Gbps Ethernet-STP Class2

Characteristic	Condition	Acceptance Criteria
CIDM (Characteristic impedance differential mode)	Signal rise time at 500 ps	100Ω±5Ω
Propagation Delay	2 ≤ f ≤ 600, f in MHz	≤ 667ps
Insertion Loss	1 ≤ f ≤ 600, f in MHz	≤ 0.01*√f
Return Loss	1 ≤ f < 190, 190 ≤ f ≤ 600, f in MHz	≥ 30 dB ≥ 20-20*log ₁₀ (f/600)
PSANEXT (Power sum alien near end crosstalk)	1 < f < 100, 100 < f < 600, f in MHz	≥ 57-10*log ₁₀ (f/100) ≥ 57-15*log ₁₀ (f/100)-6*(f-100)/400
PSAFEXT (Power sum alien far end crosstalk)	1 < f < 600, f in MHz	≥ 46.67-20*log ₁₀ (f/100)
Coupling Attenuation	30 ≤ f ≤ 600, f in MHz	≥ 70
Screen Attenuation	30 ≤ f ≤ 600, f in MHz	≥ 45

3.2.4 RF Parameters - 10Gbps Ethernet

Characteristic	Condition	Acceptance Criteria
CIDM (Characteristic impedance differential mode)	Signal rise time at 75 ps	100Ω±5Ω(For reference)
Propagation Delay	2 ≤ f ≤ 4000, f in MHz	≤ 667 ps
Insertion Loss	1 ≤ f ≤ 4000, f in MHz	≤ 0.01*√f
Return Loss	1 ≤ f < 1500, 1500 ≤ f < 3000, 3000 ≤ f ≤ 4000, f in MHz	≥ 25 dB ≥ 25-16.6*log ₁₀ (f/1500) ≥ 20 dB
PSANEXT (Power sum alien near end crosstalk)	1 < f < 215, 215 < f < 4000, f in MHz	≥ 78 dB ≥ 83-15*log ₁₀ (f/100)
PSAFEXT (Power sum alien far end crosstalk)	1 < f < 355, 355 < f < 4000, f in MHz	≥ 78 dB ≥ 89-20*log ₁₀ (f/100)
Coupling Attenuation	30 < f < 750, 750 < f < 4000, f in MHz	≥ 75 dB ≥ 55-20*log ₁₀ (f/7500)
Screen Attenuation	30 ≤ f ≤ 4000, f in MHz	≥ 50

3.2.5 RF Parameters - 25Gbps Ethernet (Proposal)

Mated Connector limit only applicable up to maximum frequency of terminated cable.

Characteristic	Condition	Acceptance Criteria
CIDM) ² (Characteristic impedance differential mode)	Signal rise time at 75 ps	100Ω±5Ω(For reference)
Insertion Loss) ²	1 ≤ f ≤ 15000, f in MHz	≤ 0.01*√f
Return Loss) ¹	1 ≤ f <1500, 1500 ≤ f <3000, 3000 ≤ f ≤ 4000, f in MHz 7000MHz 10000MHz 13000MHz 15000MHz	≥ 25 dB ≥ 25-16.6*log ₁₀ (f/1500) ≥ 20 dB 15dB 11dB 10dB 10dB
PSANEXT (Power sum alien near end crosstalk)	1 < f <215, 215 < f < 7500, f in MHz	≥ 78 dB ≥ 83-15*log ₁₀ (f/100)
PSAFEXT (Power sum alien far end crosstalk)	1 < f <355, 355 < f < 7500, f in MHz	≥ 78 dB ≥ 89-20*log ₁₀ (f/100)
Coupling Attenuation	30 < f <750, 750 < f < 7500, f in MHz	≥ 75 dB ≥ 55-20*log ₁₀ (f/7500)
Screen Attenuation	30 ≤ f ≤ 7500, f in MHz	≥ 50

¹ linear interpolation for limit value at linear frequency axis between 4000 MHz and 15000 MHz

² Impedance and Insertion Loss limits are informative and for reference only.

3.2.6 Environmental Data

Characteristic	Acceptance Criteria
Temperature range	-40°C to 105°C
Vibration	DIN IEC 60068-2-64, S1
Mechanical Shock	DIN IEC 60068-2-27, S1
Thermal Shock	DIN IEC 60068-2-14, -40°C - +105°C
Dry Heat	DIN IEC 60068 2-2 Test B, Temperature +105°C
Humidity	DIN IEC 60068-2-30 @ +40 °C
High Temperature Exposure	SAE/USCAR-2 Rev 6, 5.6.3.3 Hold at +105°C
Soldering profile	acc. to IEC 60068-2-58; Group 3 (250°C/ 30 sec)
Storage temperature	23±5°C
Storage humidity	relative 30%-70%

4. TEST MATRIX

TEST SPECIFICATION SECTION	Test group	0	1	2	3	7	11	13	17	18A	19	20	21	28	31	Z1	Z2	Z3
		Inspection of as-received condition (PG0)	Dimensions (PG1)	Materials and surface analysis, contacts (PG2)	Materials and surface analysis, contact housings and seals (PG3)	Handling and Functional Reliability of the Housing (PG7)	Contacts: Insertion and extraction forces; number of mating cycles (PG11)	Housing influence of the derating (PG13)	Dynamic Load (PG17)	Coastal Climate Load (PG18A)	Environmental Simulation (PG19)	Climate Load (PG20)	Long-term temperature aging (PG21)	Audible Click (PG28)	Holding forces for contact pins (PG31)	Mechanical Pull Test and Side Load Test (PGZ1)	Solderability dip test (PGZ2)	Reflow Solder heat resistance (PGZ3)
	Sample size	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P0.1	Visual inspection	1, 5	1	1	1	1,7	1, 7	1, 4	1, 6, 8, 13	1, 6	1, 8, 11, 18	1, 6, 9, 11	1, 8, 13, 15	1, 4	1	1,3	1,3	1,3
P0.2	Contact Resistance	2							2, 9	3, 5	2, 15, 17		3, 10					
P0.3	Insulation resistance	3							3, 10			2, 5	2, 9					
P1.1	Dimensions		2															
P2.1	Materials testing, contact parts			2														
P3.1	Materials testing for contact housings				2													
P3.2	Markings on the surface				3													
P5.1	Contact opening dimensions						2, 5											
P7.1	Error-proof design of housings (keying)					2												
P7.1	Error-proof design of housings (polarizing)					3												
P7.4	Connector mating force					4												
P7.4	Connector un-mating force with lock disabled					5												
P7.4	Connector un-mating force with lock enabled					6												
P11.1	Insertion and extraction force						3, 6											
L11.1	Mating cycle frequency						4											
P13.1	Current overtemperature with contact housing							2										
P13.2	Derating with contact housing							3										
R1 ¹⁾	RF parameter Impedance/Insertion loss/Return loss/PSNEXT	4							4, 12		3, 12		5, 12					
L17.2	Dynamic load, broadband random vibration								5									

TEST SPECIFICATION SECTION	Test group	0	1	2	3	7	11	13	17	18A	19	20	21	28	31	Z1	Z2	Z3
		Inspection of as-received condition (PG0)	Dimensions (PG1)	Materials and surface analysis, contacts (PG2)	Materials and surface analysis, contact housings and seals (PG3)	Handling and Functional Reliability of the Housing (PG7)	Contacts: Insertion and extraction forces; number of mating cycles (PG11)	Housing influence of the derating (PG13)	Dynamic Load (PG17)	Coastal Climate Load (PG18A)	Environmental Simulation (PG19)	Climate Load (PG20)	Long-term temperature aging (PG21)	Audible Click (PG28)	Holding forces for contact pins (PG31)	Mechanical Pull Test and Side Load Test (PGZ1)	Solderability dip test (PGZ2)	Reflow Solder heat resistance (PGZ3)
P14.0	Monitoring for current interruption								5, 7							2		
L17.3	Dynamic load, Shock durability								7									
L18.1	Insert and remove									2								
L18.2	Salt spray									4								
L19.0	Inserting and extracting										4, 11, 16							
L19.1	Thermal shock										5							
L19.2	Temperature cycle										6							
L19.3	Aging in dry heat										7							
L19.4	Industrial climate										9							
L19.5	Damp heat, cyclic										10							
L19.6	Dynamic load, broadband noise										13							
L19.7	Mechanical shock										14							
L20.1	Aging in dry heat											3						
L20.2	Aging in damp heat, constant											4						
L20.3	Low-temperature aging											7						
L20.4	Extracting and inserting at -20 ° C											8						
L20.5	Aging in dry heat											10						
E0.4	Dielectric strength												4, 11					
L11.1	Mating cycles												6					
L21.1	Long-term aging in dry heat												7					
P21.1	Functional test												14					
L28.1	Aging													2				
P28.1	Locking noise													3				
L31.1	Aging process														2			
P31.1	Pin holding force														3			
4.2.1 ²⁾	Mechanical Pull Test and Side Load Test															2		
S1 ³⁾	Solderability, dip test																2	
R2 ⁴⁾	Reflow solder																	2

- 1) Measurement in accordance with TE Test Specification 109-160110, revision published at date of testing.
- 2) Measurement in accordance with SAE/USCAR-17 REVISION 5 section 4.2.1.
- 3) Measurement in accordance with TE Test Specification 109-11-10, revision published at date of testing.
- 4) Measurement in accordance with TE Test Specification 109-201, revision published at date of testing.

5. HISTORY OF CHANGE

Revision	Chapter	Change	Date
1	Macy.Xu	Initial	Nov. 05, 2020
2	Macy.Xu	Add unsealed	May.12.2022
3	Anor.Zhao	Add test matrix & RF Parameters	Dec.08.2022
4	Melody.Xu	Add GEMnet 180Deg Headers	Aug.08.2023
6	Melody.Xu	Add RF Parameters - 25Gbps Ethernet (Proposal)	Apr.03.2024
7	Anor.Zhao	Add test group PG0/PG1/PG2/PG3/PG11/PG13/PG20/PG28 in test matrix	May.22.2024