



AUTOMOTIVE USB TYPE-C 3.1 GEN 1 SPECIFICATION

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1. SCOPE 适用范围

1.1 Content 内容

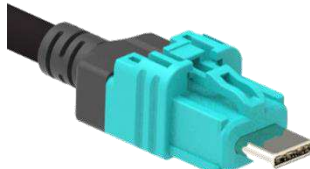
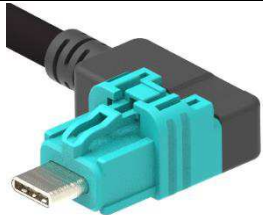
This specification covers the performance, test and quality requirements for Automotive USB Type-C (hereinafter referred to as Type-C). This specification applies to below product, but not limited to it.

本规范适用于汽车等级的 USB 3.1 Type-C Gen 1 产品(以下简称 USB Type-C) 的性能, 测试和质量要求。本规范适用但不仅限于以下零件号:

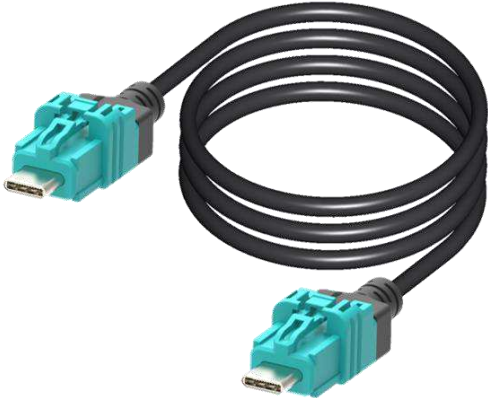
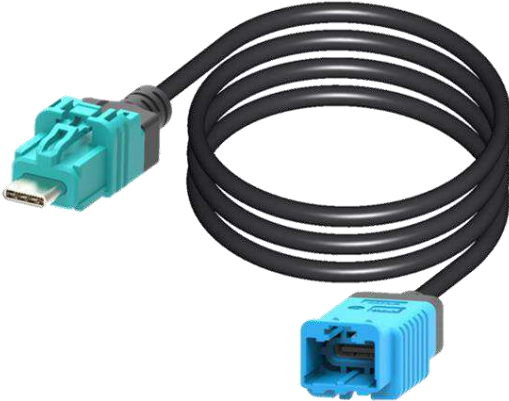
Header:

Item	Direction	Contact Type	TE-PN	Type of Fixation	Thumbnail
1	90°	SMT/TH	*-2398001-1	Through hole board mount	
2	180°	SMT/TH	*-2398005-1	Through hole board mount	

Inline Components:

Item	Cable Direction	Type	TE-PN	Thumbnail
3	180°	Plug Connector	2398010-1	
4	180°	Receptacle Connector	2398011-1	
5	90°	Plug Connector	2398013-1	

Cable assemblies:

Item	Type	TE-PN	Thumbnail
6	180° male–180° male	***	
7	180° male–180° Female	***	
8	90° male–180° Female	***	

1.2 Qualification

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

本测试规范依照下面的规范及标准执行。所有的检验应依照合适的检验计划及产品图纸执行。

2. APPLICABLE DOCUMENTS 适用文件

2.1 Usable document 使用文件

In the event of conflict between the requirements of this specification and the drawing, the drawing shall take precedent.

In the event of conflict between the requirement of this specification and the referenced documents, this specification shall take precedent.

在本规范的要求与图纸发生冲突时，以产品图纸为准。在本规范的要求与参考文件发生冲突时，以本规范为准。

2.2 TE specifications 泰科电子规范

109-1: General requirements for Test Specifications / 测试通用规范

2.3 Other specifications 其他规范

Parameter	Test Standard
Mechanical Tests	USCAR-2 Rev.6
Environmental Tests	USCAR-2 Rev.6
RF Tests	USB 3.1 (ECN#1) 10/20/2000 Universal Serial Bus Type-C Connector and Cables assemblies Compliance Document
Reflow Solderability	IPC/JEDEC J-STD-020D.1
Electrical Tests	USB 3.1 Gen1 / USB Type C / USB PD

3. REQUIREMENT 要求

3.1 Design and Construction 设计和结构

Products must meet the design, construction and physical dimensions specified in the applicable product drawings.

产品必须满足产品图纸上的设计，结构和尺寸要求。

3.2 Material 材料

Description of the material sees the related product drawings.

材料描述见相关产品图纸。

3.3 Test parameters and tolerances 测试参数与公差

Table 1: Test parameters and tolerances

Requirement 要求	Tolerance 公差
Ambient temperature 环境温度	23°C ± 5°C
Relative humidity 相对湿度	45% to 75%
Atmospheric pressure 大气压力	96kPa ± 10kPa

3.4 Ratings 等级

- A. Operating Temperature / 工作温度: -40~85°C
- B. Storage Temperature / 储存温度: -20°C to +60°C
- C. Rated voltage / 额定工作电压: 20 V

3.5 General Performance and Test description 通用性能和试验描述

The product is designed to meet the electrical, mechanical and environmental performance requirements specified in Para.4. All testes must be performed at the test condition of the TE test specification 109-1 unless otherwise specified.

产品应能满足段落 4 中的电气，机械和环境等性能要求。所有试验均需按照 TE 规范 109-1 中的测试条件进行，除非另有说明。

3.6 Tests requirement and method summary 测试要求及方法

3.6.1 Tests (For Standard Core Type-C Connector)

	Test Item	Procedures	Requirements
	Examination		
1	Visual examination	EIA-364-18 Visual, dimensional and functional aspects meet requirements of product drawing and applicable instructions on customer drawing, and application specification.	Meets requirements of product drawing and no defects.
	Electrical		
2	Low Level Contact Resistance	EIA-364-23 The low level contact resistance (LLCR) measurement is made across the plug and receptacle mated contacts and does not include any internal paddle cards or substrates of the plug or receptacle. Measure at 20 mV (max) open circuit at 100 mA	40 mΩ Max initial for VBUS, GND and all other contacts. 50 mΩ maximum after initial measurement.
3	Insulation resistance	EIA-364-21 Applicable to both receptacle and plug. Apply 500V DC Apply the above specified voltage between adjacent contacts for 1 minute.	>100 MΩ insulation resistance between adjacent contacts of unmated and mated connectors.
4	Dielectric withstanding voltage	EIA-364-20, Method B. Applicable to both receptacle and plug. 100V AC (rms) for 1 minute at sea level.	No break down shall occur when voltage is applied between adjacent contacts of unmated and mated connectors. Leakage of electricity is less than 0.5 mA.
	Mechanical		
5	Durability	EIA-364-09 10,000 cycles Test speed: 500± 50 cycles /hour Max.	Meet insertion / extraction force, no evidence of physical damage.
6	Random vibration	EIA-364-28, Condition VII-D, 2 hours in each of 3 mutually perpendicular directions. Both mating halves should be fixed rigidly. (Power Spectral Density 0.02g ² /Hz, Overall rms 3.10 g)	No evidence of physical damages and no discontinuity longer than 1 microsecond.
7	Mechanical shock	EIA-364-27B, half sine, 30 G, duration 11 ms; X, Y, Z,3 times each direction, total 18 times.	No evidence of physical damages and no discontinuity longer than 1 microsecond.
8	Insertion force	EIA-364-13 Maximum rate 12.5mm/min	Between 5 N and 20 N before and after durability.
9	Extraction force	EIA-364-13 Maximum rate 12.5mm/min	Extraction force: I: no less than 8 N and no more than 20 N before and after 1,000 cycles durability. II: no less than 6 N and no more than 20 N before and after 10,000 cycles durability.
10	Wrenching strength (Reference)	Apply a force on plug inserted into receptacle at a distance of 15 mm from the edge of the receptacle , five directions (left, right, up, down and insertion directions), speed : 25 mm/min,	≥75N; (left, right, up, down) ≥65N; (insertion direction) No evidence of physical damages.
11	Axes Continuity	Apply additional 800 g weight at a distance of 10 cm from the edge of receptacle, hold 10 seconds separately in degree 90,180, 270 and 360.	No discontinuities greater than 1 microsecond duration in any of the four orientations tested.

Environmental			
12	Thermal shock	EIA-364-32, Method A, Condition I, duration A-4 (-55°C~+85°C, 10 cycles) Recovery: 2 hours at ambient atmosphere. -55°C+0/-3°C: 30 minutes, 25°C+/-10°C: 5 minutes Max 85°C+3/-0°C: 30 minutes 25°C+/-10°C: 5 minutes Max	No mechanical damage. Low level contact resistance meets spec Insulation resistance meets spec
13	Thermal disturbance	EIA-364-32 Cycle the mated connector pair 10 times between 15°C and 85°C. Ramp > 2°C/min Dwell > 5 mins (ensure contacts reach extreme temperature) Humidity not controlled.	No mechanical damage. Low level contact resistance meets spec Insulation resistance meets spec
14	Thermal cycling	EIA-364-32 Cycle the mated connector pair 500 times between 15°C and 85°C.Ramp > 2°C/min Dwell > 5 mins (ensure contacts reach extreme temperature).Humidity not controlled.	No mechanical damage. Low level contact resistance meets spec Insulation resistance meets spec
15	Salt spray	EIA-364-26B, temp. 35+/-2°C, 100% RH, Salt Subject mated connectors to 48 hours at 35°C ± 2°C with 5%-Salt-solution concentration (for solderable Ni)	No mechanical damage. Low level contact resistance meets spec
16	Cyclic temperature and humidity	EIA-364-31B, Method IV, 25°C~65°C; 95% RH, total 240 hours S.1 25°C~65°C,90-98%RH, 2.5 hours S.2 65°C, 90-98%RH, 3 hours S.3 65°C~25°C,80-98%RH, 2.5 hours S.4 25°C~65°C,90-98%RH, 2.5 hours S.5 65°C, 90-98%RH, 3 hours S.6 65°C~25°C,80-98%RH, 2.5 hours S.7 25°C, 2 hours, 90-98%RH S.7a -10°C, 3 hours S.7 25°C, 3 hours, 90-98%RH S.1 – S.7 1 cycle 24 hours 10 cycles (240 hours)	No mechanical damage. Low level contact resistance meets spec Insulation resistance meets spec
17	Temperature life	EIA-364-17A, Method A, condition 4 105°C, 120 hours, mated condition	No mechanical damage. Low level contact resistance meets spec Insulation resistance meets spec
18	Temperature life (preconditioning)	EIA-364-17A, Method A, condition 4 105°C, 72 hours, mated condition.	No mechanical damage. Low level contact resistance meets spec Insulation resistance meets spec
19	Mixed flowing gas	EIA-364-65, class II A Samples should be placed in an environmentally controlled 'test chamber' that is monitored by a gas analyzing system for controlled concentrations of the specified gas mixture. Test coupons shall also be used and the weight gain reported. Test duration is 7 days.	No mechanical damage. No change to performance. Low level contact resistance meets spec before and after the Mixed Flowing Gas test.
20	Resistance to soldering heat	EIA-364-56, Reflow cycles: 3, 260°C for 30 seconds	No evidence of physical damages
21	Solderability	EIA-364-52, Temperature: 255+/-5°C Immersion time: 5 seconds	Solderable area shall have a minimum of 95% solder coverage.
22	RF tests	According to type c 3.1 gen 1 specification	Meet type c 3.1 gen 1 specification

3.6.2 Tests (For Automotive Grade Type-C Connector)

	Test Item	Procedures	Requirements
	Examination		
1	Visual Inspection	USCAR-2 Rev.6, 5.1.8.3	No Cracks or Deformities
2	Dimensional Inspection	N/A	Parts according Product Drawing
	Mechanical		
3	Connector Cycling	NA	10 mating cycle
4	Conn.-Conn. Audible Click	USCAR-2 Rev.6, 5.4.7.3	No value, just documentation
5	Conn.-Conn. Un-/ Mating Force	USCAR-2 Rev.6, 5.4.2.3.A USCAR-2 Rev.6, 5.4.2.3.A	F un-mating $\leq 50\text{N}$ (w/o lock); F mate $\leq 50\text{ N}$
6	Conn. Retention force	USCAR-2 Rev.6, 5.4.2.3.B	F un-mating $\geq 110\text{N}$ (w lock)
7	Force to Disengage Lock	USCAR-2 Rev.6, 5.4.2.3.C	$6\text{N} \leq X \leq 51\text{N}$
8	Polarization Feature Effectiveness	USCAR-2 Rev.6, 5.4.4.3	Force to achieve center contact continuity $\geq 80\text{N}$
9	Drop Test	USCAR-2 Rev.6, 5.4.8	Components shall not be displaced from their intended shipping position
10	Mechanical Pull and Sideload	USCAR-17 Rev 4, 4.2.1.2	No value, just documentation
11	Header Pin Retention force	USCAR-2 Rev.6, 5.7.1.4	15N Min
	Electrical		
12	Contact Resistance	EIA-364-23	40 m Ω maximum initial 50 m Ω maximum after testing
13	Dielectric Withstand Voltage	EIA-364-20, Method B.	$\geq 100\text{ VAC}$
14	Maximum Test Current Capability	USCAR-2 Rev.6, 5.3.3.3	Maximum current @55°C rise (Max. 5A)
15	Current Cycling	USCAR-2 Rev.6, 5.3.4.3	The temperature of any terminal interface must not exceed a 55°C ROA at any time during the test
16	Insulation Resistance	USCAR-2 Rev.6, 5.5.1.3	A minimum of 100 M Ω insulation resistance is required between adjacent contacts of unmated and mated connectors.
17	Circuit Continuity Monitoring	USCAR-2 Rev 6, 5.1.9.3	No loss of electrical continuity for $> 1\mu\text{s}$
18	HF/RF Parameter test	USB type c specification Rev.1.2	Meet USB type-c 3.1 Gen 1 performance
	Environmental		
19	Vibration	USCAR-2 Rev.6, 5.4.6.3 Class V1	No visible damage
20	Mechanical Shock	USCAR-2 Rev.6, 5.4.6.3 Class V1	No visible damage

21	Thermal Shock	USCAR-2 Rev.6, 5.6.1.3 -40°C~85°C, 100 cycles	No visible damage, or loss of function
22	Temp/Humidity Cycling	USCAR-2 Rev.6, 5.6.2.3 -40°C~85°C, 8H/1cycle, 40 times	No corrosion, discoloration, cracks, etc.
23	High Temp Exposure	USCAR-2 Rev.6, 5.6.3.3 85°C, 1008H	No corrosion, discoloration, cracks, etc.
24	Durability	25 cycles	No visible damage
25	Reflow soldering test	TEC-109-201 Condition B	No corrosion, discoloration, cracks, etc.

3.7 Test sequence 试验顺序

3.7.1 Type-C core connector test sequence follow USB industry standard.

3.7.2 Automotive Grade Type-C Connector test sequence follow below table definition.

Test Examination		Test Group														
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
1	Visual Inspection	1,3	1,5	1,5	1,4	1,3	1,4	1,3	1,3	1,9	1,8	1,9	1,7	1,3	1,4	1,3
2	Dimensional Inspection	2														
3	Connector Cycling		2							2	2	2	2			
4	Conn.-Conn. Audible Click					2										
5	Conn.-Conn. Un/Mating Force			2												
6	Conn. Retention force			4											3	
7	Force to Disengage Lock			3												
8	Polarization Feature Effectiveness						3									
9	Drop Test							2								
10	Mechanical Pull and Sideload				3											
11	Header Pin Retention force								2							
12	Contact Resistance									3,7	3,6	3,6	3,5			
13	Dielectric Withstand Voltage									8	7	8	6			
14	Maximum Test Current Capability		3													
15	Current Cycling		4													
16	Insulation Resistance											4,7				
17	Circuit Continuity Monitoring				2		2			4	5					
18	HF/RF Parameter test													2		
19	Vibration									5						

20	Mechanical Shock									6						
21	Thermal Shock										4					
22	Temp/Humidity Cycling											5				
23	High Temp Exposure												4			
24	Durability														2	
25	Reflow soldering test															2

Notes:

1. Sample size is 5PCS for each group.
2. Current test sequence just a staged document. Just for reference.

4. QUALITY 质量

4.1 Qualification test 鉴定

Samples must be in accordance with drawings and be taken in a random way in the production in progress.

样件必须与产品图纸一致，并且是生产过程中随机选取的。

4.2 Requalification test 重新鉴定

If changes significantly affecting form, fit, or function are made to the 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 product engineering.

如果产品或者制造过程中有显著影响外观，装配和功能的设变，质保需要协调按照原先工程部定义的测试顺序，重新验证全部或者部分测试项目。

4.3 Acceptance 验收

Acceptance is based on verification that the product meets the requirements of section **Error! Reference source not found.** 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 resubmitted.

归咎于测试设备，样件安装或者操作员的失误的失效不应判定产品不合格。当产品失效发生时，需要有纠正措施以及重新提交样件进行验证。在重新验证前，需确认已有纠正措施。

4.4 Quality conformance inspection 质量合格检验

The applicable TE Connectivity 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

TE Connectivity 的质量检验计划将指定适用的质量标准。尺寸和功能要求，应按照适用的产品图纸和本规范。