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TITLE MicroSpaceXS™ connector		PAGE 1 of 14	REVISION F
		AUTHORIZED BY VALLIERE Jérôme	DATE 08/11/2024
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1.0 Objective

This specification defines the performance, test, quality and reliability requirements of the MicroSpaceXS™ product.

2.0 Scope

This specification is applicable to the termination characteristics of the MicroSpaceXS™ family of products which provides a unique design enables LV214 (Severity 2) & USCAR-2 (T2V2) compliant for Tin plating and enables LV214 (Severity 3) & USCAR-2 (T4V2) for Gold plating.
MicroSpaceXS™ will be available in:


- 1.27mm (Staggered) pitch.
- Wire-To-Board and Wire-To-Wire configuration. Unsealed and Sealed
- Top and Side latch solution.
- Wire-To-Board Sealed Panel Mount configuration with USCAR-2 (T2V2) compliant for Tin Plating

3.0 Ratings


- 3.1 Operating Voltage Rating = 12V-48V (For customer specification and more details, please contact us)
- 3.2 Operating Current Rating =
- Unsealed version : 4A max, T° rise : 30°C max
 - Sealed version : 3A max, T° rise : 30°C max
- 3.3 Operating Temperature Range =
- Tin plating: -40°C to +105°C
 - Gold plating: -40°C to +150°C

4.0 Applicable Documents

- 4.1 AFCI Specifications
- 4.1.1 Engineering drawings
 - 4.1.2 Process drawings
 - 4.1.3 Application specification(s)
 - GS-20-0657: MicroSpaceXS™ CTW application specification

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- 4.1.4 Material specification(s)
- 4.2 Industry or Trade Association standards
 - 4.2.1 VW 75174 - 2018-06: Motor Vehicle Connectors
 - 4.2.2 SAE/USCAR-2 Revision 7: Performance Specification for Automotive Electrical Connector Systems
 - 4.2.3 VW 60330: Crimp Connections – Solderless Electrical Connections

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4.3 National or International Standards

- 4.3.1 Flammability: UL94V-0 or similar applicable specification
- 4.3.2 EIA 364 : Electrical Connector/Socket Test Procedures Including Environmental Classifications.
- 4.3.3 IEC 60512 : Connectors for Electronic Equipment – Tests and Measurement
- 4.3.4 IPC-A-610D : Acceptability of Electronic Assemblies
- 4.3.5 IEC-60664-1 : Insulation coordination for equipment within low-voltage supply systems
- 4.3.6 IPC-2221 : Generic Standard on Printed Board Design

4.4 AFCI Laboratory Reports - Supporting Data

4.5 Safety Agency Approvals

5.0 Requirements

5.1 Qualification

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein.

5.2 Material

The material for each component shall be as specified herein or equivalent.

5.2.1 Header housing : LCP 30% Glass fiber reinforced Halogen free, UL94V-0, color black or other

5.2.2 Receptacle housing / Terminal Position Assurance / Connector Position Assurance :
PPA 30% Glass fiber reinforced Halogen free, UL94V-0, color black or other

5.2.3 Seals :

Liquid silicone rubber grade 50±5 shore A, color black

Solid silicone rubber grade 20±5 shore A color blue or other

5.2.4 Metallic parts :

Header contacts : Phosphor Bronze alloy

CTW terminals (Receptacle and Header) : CuproNickel alloy

Hold-down : Phosphor Bronze alloy

5.2.5 Wire cable :

Conductor : bare, stranded copper wires, material Cu-ETP1


Insulator : TPE-E

Gauge : AWG22 to AWG28. AWG22 used for qualification tests

5.3 Finish

The finish for applicable components shall be as specified herein or equivalent.

- Full Tin Plated
- Selective Gold plating


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5.4 Design and Construction


Connectors shall be of the design, construction, and physical dimensions specified on the applicable product drawing. There shall be no cracks, burrs, or other physical defects that may impair performance.

6.0 Electrical, Mechanical and Environmental Tests according to LV214 (VW 75174 - 2018-06)


ITEM	TESTS	REQUIRMENTS	TEST SUBJECT
6.1	TG 0 Inspection of as-received condition	<ul style="list-style-type: none"> - Volume resistance < 30mΩ (for 0.35mm² conductor cross section) - R_{ins} > 100 MΩ at V = 500 V, t= 60 s 	All variants
6.2	TG 1 Dimensions	<ul style="list-style-type: none"> - Dimension reports corresponding to customer drawing 	All variants
6.3	TG 2 Material and surface analysis, contacts	<ul style="list-style-type: none"> - Material specifications of contacts parts corresponding to customer drawing 	All variants
6.4	TG 3 Material and surface analysis, housings and single-wire seals	<ul style="list-style-type: none"> - Material specifications of contacts parts corresponding to customer drawing 	All variants
6.5	TG 4 Contact engagement length	<ul style="list-style-type: none"> - Contacts engagement length > 1mm - Clearance > 0mm (worst case) 	All variants
6.6	TG 5 Mechanical and thermal relaxation behavior	<ul style="list-style-type: none"> - Contact opening variation (documented) - Normal contact force variation (documented) 	All variants
6.7	TG 6 Interaction between contact and housing	<ul style="list-style-type: none"> - Drop test (stability of housing and locks) - Primary & Secondary lock/latch play - Actuation forces for the Secondary locking device (TPA) Opening : 10 to 50N (Fo) Closing for slide (correct assembled terminals) < 50N (Fc) Closing (improperly assembled terminals) > Fc + 25N or > 3xFc 	All variants

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6.8	TG 7 Handling and functional reliability of the housing	<ul style="list-style-type: none"> - Keying efficiency > 80N and > 3xFe Test condition : "free" representative orientation ⁽¹⁾ - Polarizing efficiency > 80N and > 3xFe - Positive locking retention > 60N (unequipped housings) - Insertion/actuation force < 75N (Fe) - CPA actuation force : 5 – 30 N - CPA efficiency : > 50N ⁽¹⁾ 	All variants
6.9	TG 8 Insertion and retention forces of the contact parts in the housing	<ul style="list-style-type: none"> - Terminal insertion force < 3N (unsealed), <10N (sealed) - Terminal retention force (clean body) 1st locking only > 20N ⁽¹⁾ 2nd locking only > 35N 	All variants
6.10	TG 9 Pin insertion inclination/misuse safe	<ul style="list-style-type: none"> - Examination is performed using CAD 	All variants
6.11	TG 10 Contacts: conductor pull-out strength	<ul style="list-style-type: none"> - Conductor pull-out strength : AWG 22 : > 50N (from VW 75174) AWG 24 : > 35N AWG 26 : > 25N AWG 28 : > 18N 	All variants
6.12	TG 11 Contacts: Insertion and removal forces, mating cycle frequency	<ul style="list-style-type: none"> - Mating cycles : 20 (Tin plated) 100 (Gold plated) - Contact opening variation (documented) - Insertion/Extraction force variation <25% 	All variants
6.13	TG 12 Current heating, derating	<ul style="list-style-type: none"> - Derating curve (documented) 	All variants
6.14	TG 13 Housing influence on the derating	<ul style="list-style-type: none"> - Derating curve (documented) 	All variants
6.15	TG 14 Thermal time constant (current excess temperature at n times rated current)	<ul style="list-style-type: none"> - Graph "Current over time" (documented) 	All variants

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6.16	TG 15 Electrical stress test	<ul style="list-style-type: none"> - Contact opening variation (documented) - Volume resistance < 30mΩ (for 0.35mm² conductor cross section) - Derating curve variation <20% 	All variants
6.17	TG 16 Friction corrosion	<ul style="list-style-type: none"> - Graph "Volume resistance over cycles" (documented) - Number of cycles for 300mΩ volume resistance 	All variants
6.18	TG 17 Dynamic load	<ul style="list-style-type: none"> - Severity 2 for Tin plating - Unsealed - Severity 3 for Tin plating - Sealed - Severity 3 for Gold plating - Volume resistance < 30mΩ (for 0.35mm² conductor cross section) - No functions deviations 	All variants
6.19	TG 18A Coastal climate load	<ul style="list-style-type: none"> - Volume resistance < 30mΩ (for 0.35mm² conductor cross section) 	Unsealed versions
6.20	TG 19 Environmental simulation	<ul style="list-style-type: none"> - Volume resistance < 30mΩ (for 0.35mm² conductor cross section) - For Tin version Group1 only ⁽¹⁾ 	All variants
6.21	TG 20 Climate load of the housing	<ul style="list-style-type: none"> - Insulation resistance > 100 MΩ - No functions deviations 	All variants
6.22	TG 21 Long-term temperature aging	<ul style="list-style-type: none"> - Volume resistance < 30mΩ (for 0.35mm² conductor cross section) - Conductor pull-out strength (same as TG10) - No functions deviations 	All variants
6.23	TG 22A Resistance to chemicals	<ul style="list-style-type: none"> - Insulation resistance > 100 MΩ - No functions deviations 	All variants

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6.24	TG 22B Chemical resistance, extended testing	<ul style="list-style-type: none"> - Insulation resistance > 100 MΩ - No functions deviations 	Sealed versions
6.25	TG 23 Water tightness	<ul style="list-style-type: none"> - IP68 and IP69K - Insulation resistance > 100 MΩ - No medium penetration - No functions deviations 	Sealed versions only compatible with AWG22 / AWG24 wire
6.26	TG 24 Impenetrability to paint	<ul style="list-style-type: none"> - No dip paint penetration - No functions deviations 	All variants
6.27	TG 28 Latching noise	<ul style="list-style-type: none"> - $L_{Apeak} > 50 \text{ dB(A)}$ ⁽¹⁾ 	All variants
6.28	TG 31 Holding forces for contact pins and contact blades in plastic contact housings	<ul style="list-style-type: none"> - Holding force > 5N 	Wire-To-Board configuration
6.29	Slow Motion Bending Test	<ul style="list-style-type: none"> - Max permissible resistance change ΔR $\leq 1 \text{ m}\Omega$ for $\Delta R 1$ dispersion of all test specimens (new state) $\leq 3 \text{ m}\Omega$ for $\Delta R 2$, $\Delta R 3$ for each specimen (from the start of the test to the end) 	All variants


(1) : Dedicated value. MicroSpaceXS™ connector

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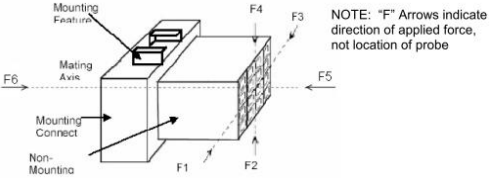
7.0 Electrical, Mechanical and Environmental Tests according to USCAR-2 Revision 7


ITEM	TESTS	REQUIRMENTS	TEST SUBJECT
7.1	A Terminal-to-Terminal Engage/Disengage Force	<ul style="list-style-type: none"> - Mating cycles : 10 - No base material exposed 	All variants
7.2	B Terminal Bend Resistance	<ul style="list-style-type: none"> - Applied bending force : 3N 	All variants
7.3	C Maximum Current/Current Cycling	<ul style="list-style-type: none"> - Maximum current capability @ $\Delta T \leq 55^\circ\text{C}$ (documented) 	All variants
7.4	D Term.-Conn. Insertion/Retention	<ul style="list-style-type: none"> - Insertion force : 30N max - Primary Lock Retention : 20N min - Prim + Second Lock Retention : 40N min 	All variants
7.5	E Misc. Component Engage/Disengage	<p><u>TPA - Pre-set to lock :</u></p> <ul style="list-style-type: none"> - TPA engagement force : 60N max (with terminals fully loaded) - TPA engagement force : 15N min (without terminals) <p><u>TPA - Lock to pre-set :</u></p> <ul style="list-style-type: none"> - TPA removal force : 60N max (with terminals fully loaded) - TPA removal force : 18N min (after 2 cycles) <p><u>TPA - Complete removal from pre-set :</u></p> <ul style="list-style-type: none"> - TPA removal force : 15N min <p><u>CPA - Pre-set to lock :</u></p> <ul style="list-style-type: none"> - CPA blocking force : > 50Nmin ⁽¹⁾ (unmated) - CPA engagement force : 22N (mated) <p><u>CPA - Lock to pre-set :</u></p> <ul style="list-style-type: none"> - CPA removal force : >10N and <30N <p><u>CPA – Complete removal from pre-set :</u></p> <ul style="list-style-type: none"> - CPA removal force : 30N min 	All variants
7.6	F Connector-to-connector audible click	<ul style="list-style-type: none"> - Audible click (documented) 	All variants

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7.7	G Conn. Conn Mating/Un- mating	<ul style="list-style-type: none"> - Mating force : 75N max - Retention force (lock engaged) : 110N min - Unmating force (lock disengaged) : 75N max - Lock disengagement force : >2N ⁽¹⁾ 	All variants
7.8	H Polarization Effectiveness	<ul style="list-style-type: none"> - Keying and Polarization efficiency : > 3xFe (Mating force) with force being >60N and <150N Test condition : “free” representative orientation ⁽¹⁾ 	All variants
7.9	I Drop	<ul style="list-style-type: none"> - No deterioration, cracks, deformities,... - No components displacement from their intended shipping position 	All variants
7.10	J Cavity Damage	<ul style="list-style-type: none"> - TPA engagement force : 60N min (with terminals in unseated position) - No deterioration, cracks, deformities,... 	All variants
7.11	AE Terminal/Cavity Polarization	<ul style="list-style-type: none"> - <u>Sealed version :</u> Receptacle terminal : Normal insertion force in incorrect orientation (90°, 180° and 270°) : 15N min Header terminal : Normal insertion force in incorrect orientation (180°) : Terminals can be fully inserted but freely pulled out from cavities ⁽¹⁾ - <u>Unsealed version :</u> Normal insertion force in incorrect orientation (90° and 270°) : 15N min Normal insertion force in incorrect orientation (180°) : Terminals can be fully inserted but freely pulled out from cavities ⁽¹⁾ - No deterioration, cracks, deformities,... 	All variants
7.12	K Header Pin Retention	<ul style="list-style-type: none"> - Retention force with a pin displacement of 0.2mm max : 15N min 	All variants

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7.13	L Mounting Feature Mechanical Strength	<ul style="list-style-type: none"> - Force required to break or separate from mounting feature : <ul style="list-style-type: none"> - 50N min (force F1 to F5) - 110N min (force F6) 	Wire-To-Wire configuration
7.15	Y Conn. Seal Retention – Unmated Connector	<ul style="list-style-type: none"> - No components (seals) displacement from their intended shipping position 	Sealed versions
7.16	Z Conn. Seal Retention – Mated Connector	<ul style="list-style-type: none"> - No components (seals) displacement from their intended shipping position 	Sealed versions
7.17	M Vibration	<ul style="list-style-type: none"> - Class : T2V2 for Tin plating - Class : T4V2 for Gold plating - Total connection resistance : 25mΩ max - Voltage drop : 50mV max 	All variants
7.18	N Thermal Shock	<ul style="list-style-type: none"> - Class : T2 for Tin plating - Class : T4 for Gold plating - Total connection resistance : 25mΩ max - Voltage drop : 50mV max 	All variants
7.19	O Temp / Humidity Cycling	<ul style="list-style-type: none"> - Class : T2 for Tin plating - Class : T4 for Gold plating - Total connection resistance : 25mΩ max - Voltage drop : 50mV max - Insulation resistance > 100 MΩ at 500 VDC 	All variants

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7.20	P High Temperature Exposure	<ul style="list-style-type: none"> - Class : T2 for Tin plating - Class : T4 for Gold plating - Total connection resistance : 25mΩ max - Voltage drop : 50mV max 	All variants
7.21	Q Fluid Resistance	<ul style="list-style-type: none"> - No functions deviations 	Sealed versions
7.22	RSAA Temp/Humidity Submersion PV Leak Submersion High Press. Spray	<ul style="list-style-type: none"> - Class : T2 for Tin plating - Class : T4 for Gold plating - IP68 and IP69K - Insulation resistance > 100 MΩ at 500 VDC 	Sealed versions only compatible with AWG22 / AWG24 wire
7.23	TUAB High Temp Exposure PV Leak Submersion High Press. Spray	<ul style="list-style-type: none"> - Class : T2 for Tin plating - Class : T4 for Gold plating - IP68 and IP69K - Insulation resistance > 100 MΩ at 500 VDC 	Sealed versions only compatible with AWG22 / AWG24 wire
7.24	USCAR 21	<ul style="list-style-type: none"> - Crimp geometry (documented) - Conductor pull-out strength : <ul style="list-style-type: none"> AWG 22 : > 50N AWG 24 : > 35N ⁽¹⁾ AWG 26 : > 25N ⁽¹⁾ AWG 28 : > 18N ⁽¹⁾ - Dry circuit resistance variation <0.47mΩ 	All variants


(1) : Dedicated value or dedicated test condition. MicroSpaceXS™ connector

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8.0 Additional Electrical, Mechanical and Environmental Tests

ITEM	TESTS	REQUIRMENTS	TEST SUBJECT /STANDARD
8.1	Breaking Voltage Test	<ul style="list-style-type: none"> - Voltage : 500VAC - no evidence of arc-over, insulation breakdown, or excessive leakage current >1mA 	All variants EIA-364-20
8.2	Tin Whisker Formation	<ul style="list-style-type: none"> - Temp cyling : -55°C/+85°C, 1500 cycles - High temp / Humidity aging : 55°C/85%RH, 4000 hr - There shall be no evidence of whiskers higher than 50µm 	WtB configuration Tin Post-plated JEDEC JESD-201A
8.3	Solderability	<ul style="list-style-type: none"> - Condition E (Dry bake preconditioning) - Solder coverage >95% 	WtB configuration JEDEC J-STD-002E
8.4	Resistance to solder heat	<ul style="list-style-type: none"> - Reflow 260°C, 3 cycles 	WtB configuration AFCI GS-22-011
8.5	MSL test	<ul style="list-style-type: none"> - Level 1 under 260°C Max - There shall be no evidence of tin reflowing and discoloration on power pins 	WtB configuration JEDEC J-STD-020E
8.6	Holding sheet push out force (from housing)	<ul style="list-style-type: none"> - Force before breakage or separation : 50N min 	WtB configuration
8.7	Pull on wire (connector soldered on PCB)	<ul style="list-style-type: none"> - Force before breakage or separation in all direction : 50N min 	WtB configuration
8.8	Connector shear force (soldered on PCB)	<ul style="list-style-type: none"> - Force before breakage or separation in parallel direction to PCB : 300N min 	WtB configuration

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9.0 QUALITY ASSURANCE PROVISIONS

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 ANSI Z-540 and ISO 9000.

9.2 Inspection Conditions

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

- a. Temperature: 25 +/- 5 deg C
- b. Relative Humidity: 30% to 60%
- c. Barometric Pressure: Local ambient

9.3 Sample Quantity And Description

Refer to called standards.

9.4 Acceptance

7.4.1 Electrical and mechanical requirements placed on test samples as indicated in paragraphs 6.0 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.

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


9.5 Qualification Testing

Qualification testing shall be performed on sample units produced with equipment and procedures normally used in production. The test sequences shall be as shown in the qualification test table. Data shall be provided with the samples noting production history: production lot codes for components and assemblies, components and assemblies produced to print revision __, verification of plating composition and thickness, etc.

9.6 Re-Qualification 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.

- a. 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.
- b. A significant change is made to the manufacturing process which impacts the product form, fit or function.
- c. 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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REVISION RECORD

Rev	Page	Description	EC#	Date
A	ALL	Creation		
B	4, 6, 8	Update of requirement for TG7 and TG28 (LV214), Group E, G, H and AE (USCAR)		02/07/2021
C	1, 6, 10	1.8mm pitch version removed. AWG22 and AWG24 wire is specified for sealing tests Mention "For product qualification latest status please contact us" added		25/08/21
D	1, 2, 4, 5, 6, 8, 9, 10, 11	Section 3.2 and 3.3 - Updated Section 5.2.3 - Updated Section 5.3 - Updated Item 6.12 - Adding Gold version Item 6.18 - TG17 severity changes Item 6.20 - TG19 modification Item 6.25 - IP68 & IP69K Item 7.11 - Header terminal polarization change Item 7.17 to 7.20 - Adding Gold version Item 7.22 - RSAA merged Item 7.23 - TUAB merged Item 7.24 - Adding USCAR 21 Item 8.6 - Change from 20N to 50N Item 8.7 - Change from 30N to 50N	F-49631	31/10/2023
E	1,9,10	Adding Gold mention Item 7.17 Vibration range change for Gold plating Item 7.18 to 7.20 Vibration range suppressed Item 7.22 & 7.23 Vibration range suppressed		21/06/2024
F	1, 3	Add variant voltage application Add WTB Sealed Panel Mount Configuration (USCAR2)	F-53654	08/11/2024