PRODUCT SPECIFICATION

MINI-FIT PLUS HCS

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1.0 SCOPE

This Product Specification covers performance requirements for the **Mini-Fit Plus HCS**™ 4.20 mm (.165 inch) centerline (pitch) connector series. The **Mini-Fit Plus HCS**™ use contacts stamped in High Performance Alloy for increased current carrying capacity which come available in Tin or Gold plating. Connector options allow for both Wire-To-Wire and Wire-to-Board configurations. Crimp terminals accept 16 to 20 AWG stranded wire.

2.0 PRODUCT DESCRIPTION

2.1 NAMES AND SERIES NUMBER(S)

Table 1: WIRE-TO-WIRE

Description	Series Number	RoHS	UL	CSA	TUV
Female Crimp Terminal	45750	Yes	n/a	n/a	n/a
Receptacle Housing	5557	Yes	Yes	Yes	Yes
Male Crimp Terminal	46012	Yes	n/a	n/a	n/a
Plug Housing	5559	Yes	Yes	Yes	Yes

Table 2: WIRE-TO-BOARD

Description	Series Number	RoHS	UL	CSA	TUV
Female Crimp Terminal	45750	Yes	n/a	n/a	n/a
Receptacle Housing	5557	Yes	Yes	Yes	Yes
Vertical Header, Single Row	46014	Yes	Yes	No	No
Vertical Header, Dual Row	46015	Yes	Yes	No	No
Right Angle Header	5569	Yes	Yes	Yes	Yes

2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKINGS

For details regarding dimensions, materials and terminal platings, refer to the appropriate sales drawings for further information.

2.3 SAFETY AGENCY APPROVALS

UL File: TBD
CSA Certificate: TBD
TUV Certificate: TBD

3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

See TS-45750-001 for test summary results.

See Sales Drawings and the other sections of this specification for the necessary referenced documents and specifications.

4.0 RATINGS

4.1 VOLTAGE

600 Volts AC RMS or 600 Volts DC

4.2 APPLICABLE WIRES

WIRE GAUGE	INSULATION DIAMETER
16 AWG	3.15mm / .124in MAXIMUM
18-20 AWG	2.95mm / .116in MAXIMUM

4.3 MAXIMUM CURRENT RATING **

Table 3: WIRE-TO-WIRE STYLE CURRENT RATINGS (amperes)

Wire Size	Single Row Circuit Size			Dual Row Circuit Size				
	3	4	5	2	4, 6	8, 10, 12	14, 16, 18	20, 22, 24
16 AWG	13	12.5	12	13	12	10.5	10	9.5
18 AWG	11	10.5	10	11	10	8	8	8
20 AWG	9.5	9	8.5	9.5	8	7.5	7	7

Table 4: WIRE-TO-BOARD CURRENT RATINGS (amperes)

Wire Size	Single Row Circuit Size			Dual Row Circuit Size				
	3	4	5	2	4, 6	8, 10, 12	14, 16, 18	20, 22, 24
AWG #16	13	12.5	12	13	12	10.5	10	9.5
AWG #18	11	10.5	10	11	10	8	8	8
AWG #20	9.5	9	8.5	9.5	8	7.5	7	7

** Current rating is application dependent. Ratings shown in charts are intended as a guideline. Ratings are based on testing conducted with tinned copper conductor wire. Appropriate de-rating is required depending on factors such as higher ambient conditions, copper weight of PCB traces, gross heating from adjacent modules/components and other factors that influence connector performance.

4.4 TEMPERATURE RATINGS

Operating: - 40℃ to + 105℃ (includes 30℃ tempe rature rise from applied current)
Nonoperating: - 40℃ to + 105℃

4.5 WAVE SOLDER PROCESS TEMPERATURE

Headers with molded pegs: 240℃ MAX.
Headers without pegs: 260℃ MAX.

4.6 MATING CYCLES

Tin: 30 cycles
Gold: 100 cycles

5.0 WIRE-TO-WIRE PERFORMANCE

5.1 ELECTRICAL REQUIREMENTS

ITEM	TEST	TEST PROCEDURE	REQUIREMENT
1	**Contact Resistance (Low Level)**	EIA-364-23: Mate connectors; apply a maximum voltage of 20 mV and a current of 100 mA. Wire resistance shall be removed from the measured value.	Initial measurement: None. Measurement following test criteria: As specified in requirement for test sequence.
2	**Insulation Resistance**	Mate connectors: apply a voltage of 500 VDC between adjacent terminals and between terminals to ground.	1000 Megohms MINIMUM
3	**Dielectric Withstanding Voltage**	EIA-364-20: Apply a voltage of 1500 VAC for 1 minute between adjacent contacts.	No breakdown. Current leakage < 5 mA
4	**Temperature Rise (via Current Cycling)**	Mate connectors. Measure the temperature rise at the rated current after 96 hours, during current cycling (45 minutes ON and 15 minutes OFF per hour) for 240 hours, and after final 96-hour steady state.	Temperature rise: +30℃ MAXIMUM

5.2 MECHANICAL REQUIREMENTS

ITEM	TEST	TEST PROCEDURE	REQUIREMENT	
1	**Terminal Mate and Unmate Forces Per Circuit**	Mate and unmate terminals (male to female) at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute for 5 mating cycles.	Tin	11.1 N (2.5 lbf) MAX. insertion force; 2.2 N (0.5 lbf) MIN. withdrawal force
			Gold	4.4 N (1.0 lbf) MAX. insertion force; 1.11 N (0.25 lbf) MIN. withdrawal force
2	**Crimp Terminal Retention Force (in Housing)**	Axial pullout force on the terminal in the housing at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	30 N (6.74 lbf) MINIMUM retention force	
3	**Durability (preconditioning)**	Mate connectors by hand, 20 cycles for Tin or 50 cycles for Gold prior to Environmental test.	Visual: no damage	
4	**Durability**	Mate connectors up to 100 (Sn) or 250 (Au) cycles at a maximum rate of 10 cycles per minute prior to Environmental Tests.	10 milliohms MAXIMUM	
5	**Reseating**	Unmate / mate connectors by hand per number of cycles specified in Test Sequence.	Visual: no damage	
6	**Vibration (Random)**	EIA 364-28: Mate connectors and vibrate per, test condition VII.	10 milliohms MAXIMUM (change from initial); Discontinuity < 1 microsecond	
7	**Wire Crimp Retention Pullout Force (Axial)**	Apply an axial pullout force on the wire at a rate of 25 ± 6 mm (1 ± ¼ inches) per minute.	16 Awg = 68.4 N (15.4 lbf) Min. 18 Awg = 68.4 N (15.4 lbf) Min. 20 Awg = 58.7 N (13.2 lbf) Min.	
8	**Crimp Terminal Insertion Force (into Housing)**	Apply an axial insertion force on the terminal at a rate of 25 ± 6 mm (1 ± ¼ inches).	15.0 N (3.37 lbf) MAXIMUM insertion force	
9	**Normal Force**	Apply a perpendicular force simultaneously to each beam until the desired total deflection is achieved. Return to original size, then deflect beams a second time and measure normal force.	Tin	1.96 N (200 grams) MINIMUM
			Gold	0.49 N (50 grams) MINIMUM
10	**Thumb latch Operation Force**	Depress latch at a rate of 25 ± 6mm (1 ± ¼ inches) per minute.	16.67 N (3.75 LBF) MAX.	
11	**Thumb latch Yield Strength**	Mate unloaded housings fully. Pull apart in an axial direction at a rate of 25 ± 6mm (1 ± ¼ inches) per minute.	68 N (15.29 LBF) MIN.	

5.3 ENVIRONMENTAL REQUIREMENTS			
ITEM	**TEST**	**TEST PROCEDURE**	**REQUIREMENT**
1	**Thermal Shock**	Mate connectors: expose for 5 cycles Between temperatures –55 and 105°C; Dwell 0.5 hours at each temperature.	20 milliohms MAXIMUM Visual: No Damage Dielectric Strength per 5.1.5 Insulation Resistance per 5.1.4
2	**Thermal Aging**	Mate connectors; expose to: 96 hours at 105 ± 2℃	20 milliohms MAXIMUM & Visual: No Damage
3	**Humidity (Steady State)**	Mate connectors: expose to a temperature of 60 ± 2℃ with a relative humidity of 90-95% for 96 hours.	20 milliohms MAXIMUM Dielectric Strength per 5.1.5 Insulation Resistance per 5.1.4 Visual: No Damage
4	**Mixed Flowing Gas**	EIA-364-65 with Class IIa Gas concentrations (Gold plated only)	20 milliohms MAXIMUM Visual: No Damage

6.0 WIRE-TO-BOARD PERFORMANCE

6.1 ELECTRICAL REQUIREMENTS			
ITEM	**TEST**	**TEST PROCEDURE**	**REQUIREMENT**
1	**Contact Resistance (Low Level)**	EIA-364-23: Mate connectors: apply a maximum voltage of 20 mV and a current of 100 mA. Wire resistance shall be removed from the measured value.	Initial measurement: None; Measurement following test criteria: As specified in requirement for test sequence.
2	**Insulation Resistance**	Mate connectors: apply a voltage of 500 VDC between adjacent terminals and between terminals to ground.	1000 Megohms MINIMUM
3	**Dielectric Withstanding Voltage**	Mate connectors: apply a voltage of 2200 VAC for 1 minute between adjacent terminals and between terminals to ground.	No breakdown. Current leakage < 5 mA
4	**Temperature Rise (via Current Cycling)**	Mate connectors. Measure the temperature rise at the rated current after 96 hours, during current cycling (45 minutes ON and 15 minutes OFF per hour) for 240 hours, and after final 96-hour steady state.	Temperature rise: +30℃ MAXIMUM

6.2 MECHANICAL REQUIREMENTS

ITEM	TEST	TEST PROCEDURE	REQUIREMENT	
1a	**Terminal Mate and Unmate Forces Per Circuit (solid pin headers)**	Mate and unmate terminals (male to female) at a rate of 25 ± 6 mm (1 ± ¼ inches) per minute for 5 mating cycles.	Tin	11.1 N (2.5 lbf) MAX. insertion force; 2.2 N (0.5 lbf) MIN. withdrawal force
			Gold	4.4 N (1.0 lbf) MAX. insertion force; 1.11 N (0.25 lbf) MIN. withdrawal force
1b	**Terminal Mate and Unmate Forces Per Circuit (formed pin headers)**	Mate and unmate terminals (male to female) at a rate of 25 ± 6 mm (1 ± ¼ inches) per minute for 5 mating cycles.	Tin	11.1 N (2.5 lbf) MAX. insertion force; 2.2 N (0.5 lbf) MIN. withdrawal force
			Gold	4.4 N (1.0 lbf) MAX. insertion force; 1.11 N (0.25 lbf) MIN. withdrawal force
2	**Crimp Terminal Retention Force**	Axial pullout force on terminal from housing at a rate of 25 ± 6 mm (1 ± ¼ inch) per min.	30 N (6.74 lbf) MINIMUM retention force	
3	**PC Tail Header Solid Pin Retention Force (in Housing)**	Axial pullout force on the terminal in the housing at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	Tin	4.45 N (1.00 lbf) MINIMUM
			Gold	4.45 N (1.00 lbf) MINIMUM
4	**Header Stamped Terminal Retention Force**	Axial pullout force on terminal from housing at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	30 N (6.74 lbf) MINIMUM retention force	
5	**Durability (preconditioning)**	Mate connectors by hand, 20 cycles for Tin or 50 cycles for Gold prior to Environmental test.	Visual: no damage	
6	**Durability**	Mate connectors up to 100 (Sn) or 250 (Au) cycles at a maximum rate of 10 cycles per minute prior to Environmental Tests.	10 milliohms MAXIMUM	
5	**Reseating**	Unmate / mate connectors by hand per number of cycles specified in Test Sequence.	Visual: no damage	
6	**Vibration (Random)**	Mate connectors and vibrate per EIA 364-28, test condition VII.	10 milliohms MAXIMUM (change from initial); Discontinuity < 1 microsecond	
7	**Wire Crimp Retention Force (Axial)**	Apply an axial pullout force on the wire at a rate of 25 ± 6 mm (1 ± ¼ inch).	16 Awg = 68.4 N (15.4 lbf) Min. 18 Awg = 68.4 N (15.4 lbf) Min. 20 Awg = 58.7 N (13.2 lbf) Min.	

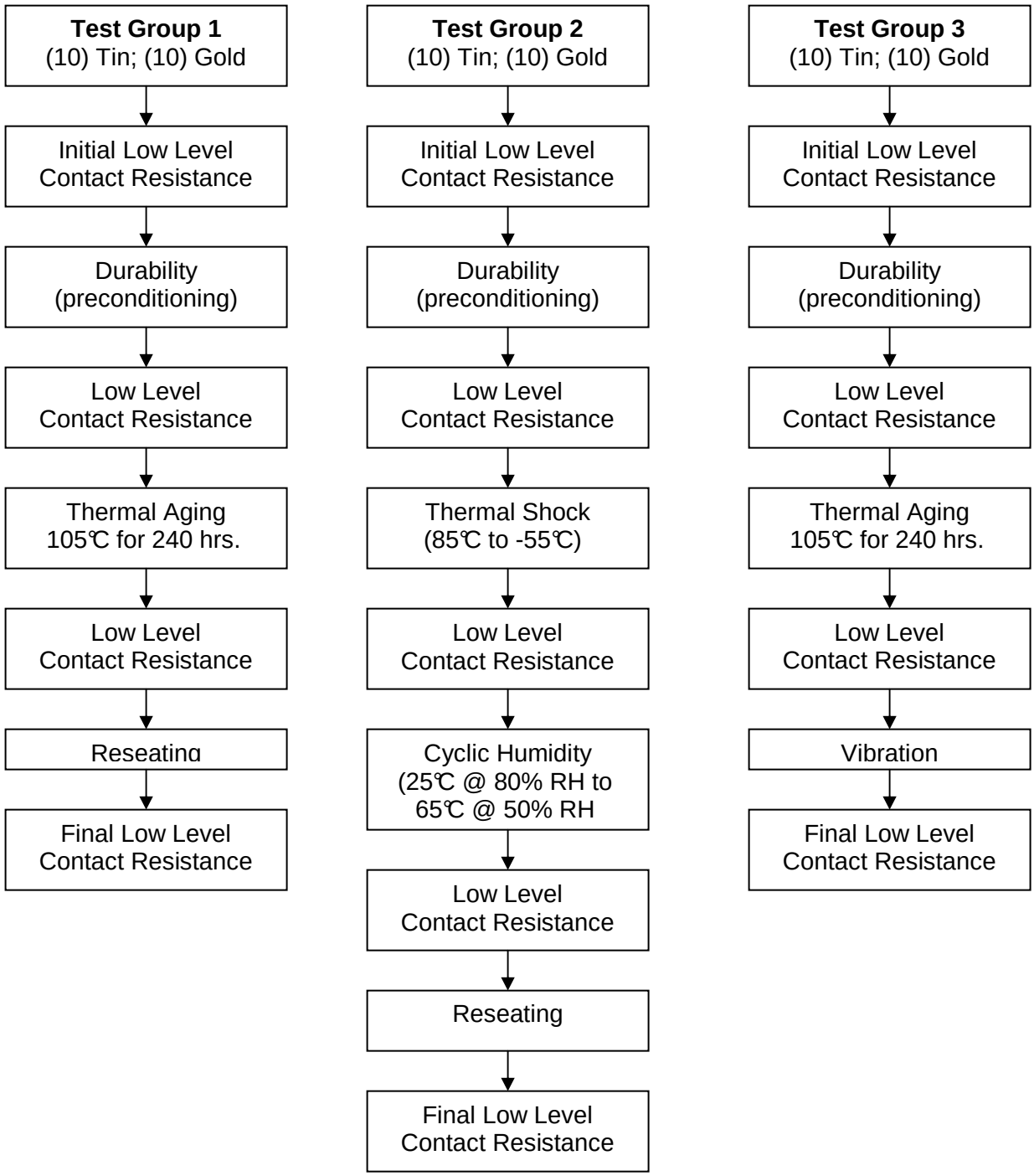
8	**Crimp Terminal Insertion Force (into Housing)**	Apply an axial insertion force on the terminal at a rate of 25 ± 6 mm (1 ± ¼ inch).	15.0 N (3.37 lbf) MAXIMUM insertion force	
9	**Normal Force**	Apply a perpendicular force simultaneously to each beam until the desired total deflection is achieved. Return to original size, then deflect beams a second time and measure normal force.	Tin	1.96 N (200 grams) MINIMUM
			Gold	0.49 N (50 grams) MINIMUM
10	**PCB Peg Engagement and Separation Forces**	Engage and separate a connector at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute. (Applies to parts with PCB retention features only)	98.0 N (22.0 lbf) MAX. insertion force; 10.0 N (2.24 lbf) MIN. withdrawal force	
11	**Thumb latch Operation Force**	Depress latch at a rate of 25 ± 6mm (1 ± ¼ inch) per minute.	16.67 N (3.75 LBF) MAX.	
12	**Thumb latch Yield Strength**	Mate loaded connectors. Pull connectors apart at a rate of 25 ± 6mm (1 ± ¼ inch) per minute.	68 N (15.29 LBF) MIN.	

6.3 ENVIRONMENTAL REQUIREMENTS

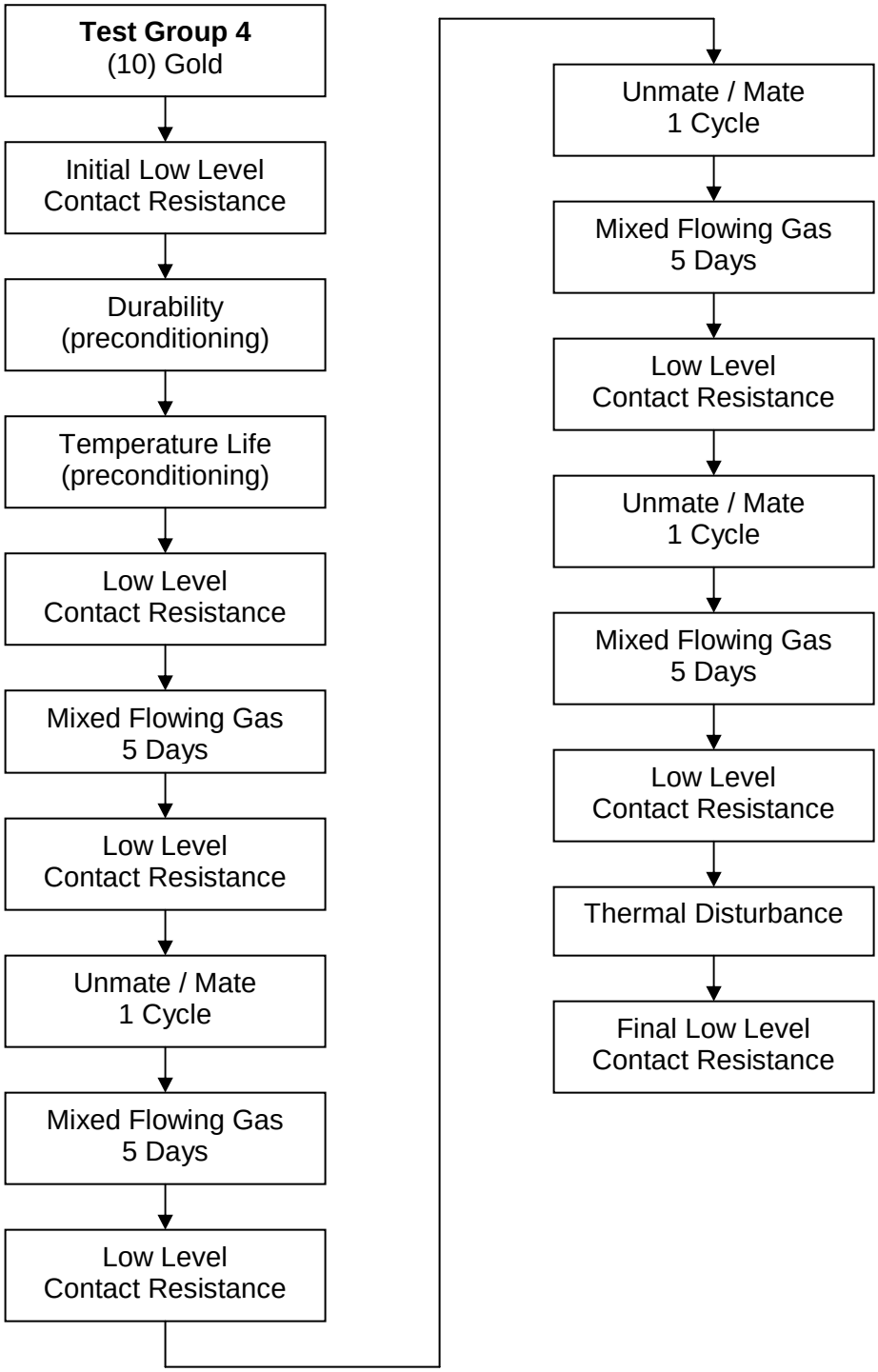
ITEM	TEST	TEST PROCEDURE	REQUIREMENT
1	**Thermal Shock**	Mate connectors: expose for 5 cycles Between temperatures –55 and 105°C; Dwell 0.5 hours at each temperature.	20 milliohms MAXIMUM Visual: No Damage Dielectric Strength per 5.1.5 Insulation Resistance per 5.1.4
2	**Thermal Aging**	Mate connectors; expose to: 96 hours at 105 ± 2℃	20 milliohms MAXIMUM & Visual: No Damage
3	**Humidity (Steady State)**	Mate connectors: expose to a temperature of 60 ± 2℃ with a relative humidity of 90-95% for 96 hours.	20 milliohms MAXIMUM Dielectric Strength per 5.1.5 Insulation Resistance per 5.1.4 Visual: No Damage
4	**Solderability**	Per SMES-152	Solder coverage: 95% MINIMUM (per SMES-152)
5	**Solder Temperature Heat Transfer Resistance**	Dip connector terminals tail in solder: Solder Duration: 5 ± 0.5 seconds; Solder Temperature: 260 ± 5℃	Visual: No Damage to the insulator where terminal or pin locks to the connector housing.
6	**Mixed Flowing Gas**	(Gold plated only) Class IIA Gas concentrations per ES-364-65A	20 milliohms MAXIMUM Visual: No Damage

7.0 TEST SEQUENCES

Environmental test sequences performed in accordance with EIA-364-1000.01



7.0 TEST SEQUENCES (CON'D)



7.0 TEST SEQUENCES (CON'D)

Test Group 5 (10) Tin	Test Group 7 (10) Tin; (10) Gold	Individual Tests
Initial Low Level Contact Resistance	Initial Low Level Contact Resistance	Mating / Unmating Force (individual ckts.)
Durability (preconditioning)	Dielectric withstanding voltage	Temperature Rise
Low Level Contact Resistance	Low Level Contact Resistance	Crimped Wire Retention
Thermal Aging 105℃ for 240 hrs.	Durability 100 cycles tin; 250 cycles gold	PC Tail Retention in Housing
Low Level Contact Resistance	Final Low Level Contact Resistance	Crimped Terminal Insertion / Retention Force in Housing
Thermal Cycling 15℃ to 85℃	Dielectric withstanding voltage	Solder Heat Transfer Resistance
Low Level Contact Resistance		Solderability
Reseating		Insulation Resistance
Final Low Level Contact Resistance		PCB Peg Engagement and Separation Forces
		Thumb Latch Operation Force
		Thumb Latch Yield Strength
		Normal Force

8.0 PACKAGING

Parts shall be packaged to protect against damage during normal handling, transit and storage. Refer to appropriate Packaging Specification as called out on product Sales Drawing.