

FPL™ II

Part No. Plug:20437-0**T-*1 Receptacle:20439-0**E-**

Product Specification

Qualification Test Report No. TR-07048

13	S25224	May 27, 2025	Y. Kawano		M. Takemoto
12	S24239	June 10, 2024	E. Tanaka	M. Nakamura	T. Masunaga
11	S23312	September 27, 2023	H. Uchida	M. Nakamura	T. Masunaga
10	S22141	March 31, 2022	T. Ono	T. Masunaga	H. Ikari
Rev.	ECN	Date	Prepared by	Checked by	Approved by

1. Scope

This product specification defines the test conditions and the performances of the FPL II Connector , a wire-to-board connector of 0.5mm contact pitch.

2. Product Name and Parts No.

2.1 Product Name

FPL II Connector

2.2 Parts No.

Plug: 20437-0**T-*1

Receptacle: 20439-0**E-**

3. Rating

3.1 Applicable Cable

Micro-Coaxial Cable ...AWG#【40, 38, 36, 34, 32】

Discrete Wire ...AWG#【36, 34, 32】

Twinaxial Cable ...AWG#【40】

3.2 Operating Conditions

Amperage: 0.3A AC/DC [AWG#40] (Per Contact Pin / Up to 50 Contacts)

0.6A AC/DC [AWG#38] (Per Contact Pin / Up to 6 Contacts)

0.8A AC/DC [AWG#36] (Per Contact Pin / Up to 4 Contacts)

1.0A AC/DC [AWG#34,32] (Per Contact Pin / Up to 7 Contacts)

Voltage: 100V AC (Per Contact Pin)

Operating Temperature: 233 to 358K (-40 °C to 85 °C) (Containing Temperature Rise by Current)

Operating Humidity: 85% max

3.3 Storage Conditions

Storage Temperature: 248 to 333K (-25 °C to 60 °C)

Storage Humidity: 85% max. (Non-Condensing)

4. Test and Performance

Test Condition

Unless otherwise specified, all tests and measurements shall be performed under the following conditions in accordance with MIL-STD-202.

Temperature: 288K to 308K (15 °C to 35 °C)

Pressure: 866 hPa to 1066 hPa (650 mmHg to 800 mmHg)

Relative Humidity: 45 to 75% R.H.

4.1. Electrical Performance**1. Contact Resistance**

Reference Standard: MIL-STD-202-307

Test Conditions: Solder the receptacle connector to the test board and mate the plug connector together, then apply 20mV MAX. DC open circuit voltage and 10mA MAX. DC closed circuit current. Measure the contact resistance of signal and ground at the section shown in Fig.1 by the four terminal methods.

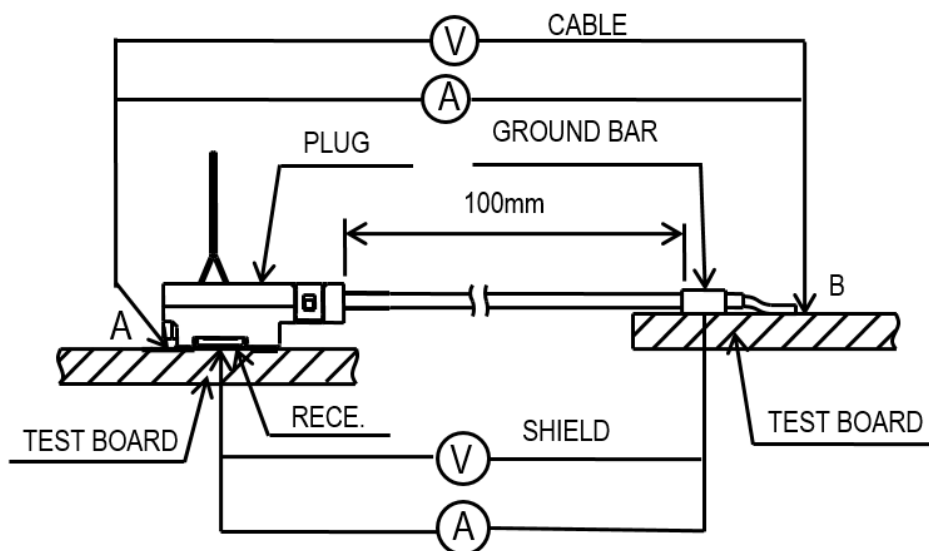


Fig.1

Pass Criteria:

Signal Contact
 Initial: 145 mΩ MAX.(AWG#32), 185 mΩ MAX.(AWG#34)
 210 mΩ MAX.(AWG#36), 575 mΩ MAX.(AWG#40)
 After Testing: ΔR 40 mΩ MAX.
 Initial value contains the following conductor resistance of a cable 100 mm.
 90 mΩ MAX.(AWG#32), 130 mΩ MAX.(AWG#34)
 155 mΩ MAX.(AWG#36), 575 mΩ MAX.(AWG#40)

Ground
 Initial: 50 mΩ MAX. After Testing: ΔR 40 mΩ MAX.

2. Insulation Resistance

Reference Standard: MIL-STD-202-302

Test Conditions: Mate the plug and receptacle connector together, and then apply DC 500 V between the neighboring contacts and between contacts and shell.

Pass Criteria: Initial: 1000 MΩ MIN. After Testing: 500 MΩ MIN.

3. Dielectric Withstanding Voltage

Reference Standard: MIL-STD-202-301

Test Conditions: Mate the receptacle and plug connector together, then apply AC 250V(rms) between the neighboring contacts and between contacts and shell for a minute.

Pass Criteria: No abnormalities such as creeping discharge, flashover, insulator breakdown occur.

4. Temperature Rising

Reference Standard: -

Test Conditions: Mate the plug and receptacle connector together, and apply rating current per contact pin. Measure delta T over ambient.

Pass Criteria: Over Ambient: ΔT 30 °C MAX.

5. Differential Impedance

Reference Standard: -

Test Conditions: Mate the plug and receptacle connector together, measuring differential impedance.
Rise time for impedance measurement: 260 ps..

Pass Criteria: Differential Impedance: $100 \pm 15 \Omega$

4.2. Mechanical Performance

1. Mating Force and Un-Mating Force

Reference Standard: -

Test Conditions: Solder the receptacle connector to the test board, then place the board and plug on push-on/pull-off machine. Repeat mating/un-mating 30 cycles at a speed 25 ± 3 mm/min. along the mating axis. Measure the mating and un-mating force at the initial and after 30 cycles.

Pass Criteria:	Mating Force	Un-Mating Force
	30 P Initial / 30 cycles: 50.0N MAX.	30 P Initial / 30 cycles: 5.0N MIN.
	40 P Initial / 30 cycles: 60.0N MAX.	40 P Initial / 30 cycles: 6.0N MIN.
	50 P Initial / 30 cycles: 70.0N MAX.	50 P Initial / 30 cycles: 7.0N MIN.

2. Durability

Reference Standard: -

Test Conditions: Solder the receptacle connector to the test board, then place the board and plug on the push-on/pull-off machine, and repeat mating and un-mating 30 cycles at a speed 25 ± 3 mm/min. along the mating axis.

Pass Criteria: Contact Resistance: Shall meet 4.1.1

3. Contact Retention Force

Reference Standard: -

Test Conditions: Place the connector on the push-on/pull-off machine, then apply force to the contact from opposite direction of the contact insertion at a speed of 25 ± 3 mm/min. Measure the force when the contact dislodges from the connector.

Pass Criteria: Plug Contact Retention Force: 1.0N MIN.
Receptacle Contact Retention Force: 0.54N MIN.

4. Cable Retention Force

Reference Standard: -

Test Conditions: Place the plug connector on the push-on/pull-off machine and pull the cable along the cable axis at a speed 25 ± 3 mm/min. Measure the force when the discontinuity occurs.

Pass Criteria: 30.0N MIN.

5. Vibration

Reference Standard: MIL-STD-202-201

Test Conditions: Solder the receptacle connector to the test board, then mate plug connector, and place them on the vibrator. Then apply the following vibration. During the testing, run 100mA DC to check electrical discontinuity.
Frequency: 10Hz→55Hz→10Hz/approx. 1min.
Directions: 3 mutually perpendicular directions.
Total Amplitude: 1.52 mm
Sweep Duration: 2 hours for each direction, a total of 6 hours.

Pass Criteria: Contact Resistance: Shall meet 4.1.1.
Electrical Discontinuity: No electrical discontinuity greater than $1\mu s$ shall occur.
Appearance: No abnormality adversely affecting the performance shall occur.

6. Shock

Reference Standard:	MIL-STD-202-213, Test Condition A.
Test Conditions:	Solder the receptacle connector to the test board, then mate plug connector, and place them on the shock machine. Then apply the following shock. MAX.G: 50G Duration: 11msec Wave Form: Half Sinusoidal Directions: 6 Mutually Perpendicular Direction Cycle: 3 cycles Each Direction
Pass Criteria:	Contact Resistance: Shall meet 4.1.1. Electrical Discontinuity: No electrical discontinuity greater than 1 μ s shall occur. Appearance: No abnormality adversely affecting the performance shall occur.

4.3. Environmental Performance**1. Thermal Shock**

Reference Standard:	MIL-STD-202-107, Test Condition A.
Test Conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: 218K(-55 °C),30min.→358K(85 °C),30min. Transition time: 5min. MAX. Cycle: 5 cycles
Pass Criteria:	Contact Resistance: Shall meet 4.1.1.

2. High Temperature Life

Reference Standard:	MIL-STD-202-108, Test Condition B.
Test Conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: 358 \pm 2K (85 \pm 2 °C) Duration: 250 hours
Pass Criteria:	Contact Resistance: Shall meet 4.1.1. Contact Retention Force: Shall meet 4.2.3. Appearance: No abnormality adversely affecting the performance shall occur.

3. Humidity (Steady State)

Reference Standard:	MIL-STD-202-103, Test Condition A.
Test Conditions:	Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment. Temperature: 313 \pm 2K (40 \pm 2 °C) Humidity: 90~95%RH Duration: 240 hours
Pass Criteria:	Contact Resistance: Shall meet 4.1.1. Insulation Resistance: Shall meet 4.1.2. Dielectric Withstanding Voltage: Shall meet 4.1.3. Appearance: No abnormality adversely affecting the performance shall occur.

4. Humidity (Cycling)

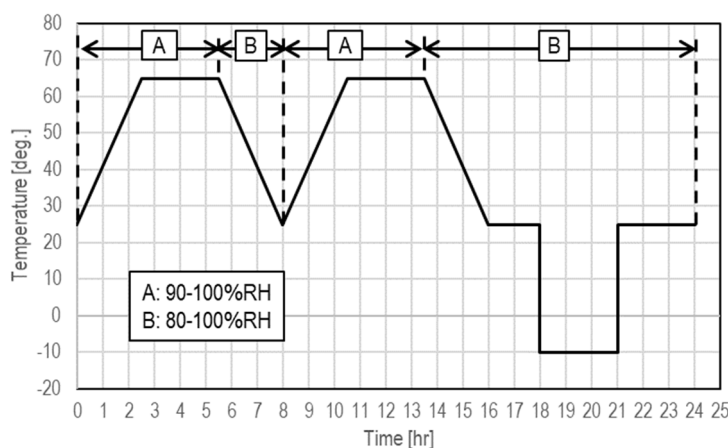
Reference Standard: MIL-STD-202-106.

Test Conditions: Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment.

Temperature: 298[263]~338K (25[-10]~65 °C)

Humidity: 90[80]~100%RH

Duration: 10 cycles (240 hours)



Pass Criteria:

Contact Resistance: Shall meet 4.1.1.

Insulation Resistance: Shall meet 4.1.2.

Dielectric withstanding Voltage: Shall meet 4.1.3.

Appearance: No abnormality adversely affecting the performance shall occur.

5. Saltwater Spray

Reference Standard: MIL-STD-202-101, Test Condition B.

Test Conditions: Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment.

Temperature: 308±2K (35±2 °C)

Saltwater Density: 5±1% [by weight]

Duration: 48 hours

Pass Criteria:

Contact Resistance: Shall meet 4.1.1.

Appearance: No abnormality adversely affecting the performance shall occur.

6. H₂S Gas

Reference Standard: -

Test Conditions: Solder the receptacle connector to the test board, then mate plug connector, and expose them to the following environment.

Temperature: 298±2K (25±2 °C)

Relative Humidity: 75±5%RH

Gas: H₂S 10±1 ppm

Duration: 24 hours

Pass Criteria:

Contact Resistance: Shall meet 4.1.1.

Appearance: No abnormality adversely affecting the performance shall occur.

4.4. Others

1. Solderability

Reference Standard: -

Test Conditions: Immerse the contact soldering part to flux of RMA or R type for 5 to 10 seconds, then dip the part into the solder bath of $518 \pm 5\text{K}$ ($245 \pm 5\text{ }^{\circ}\text{C}$) for 5 ± 0.5 seconds.

Pass Criteria: More than 95% of the dipped surface shall be evenly wet.

2. Resistance to Soldering Heat

Reference Standard: -

Test Conditions: Reflow Temperature: See Fig.2.
Cycle: 2

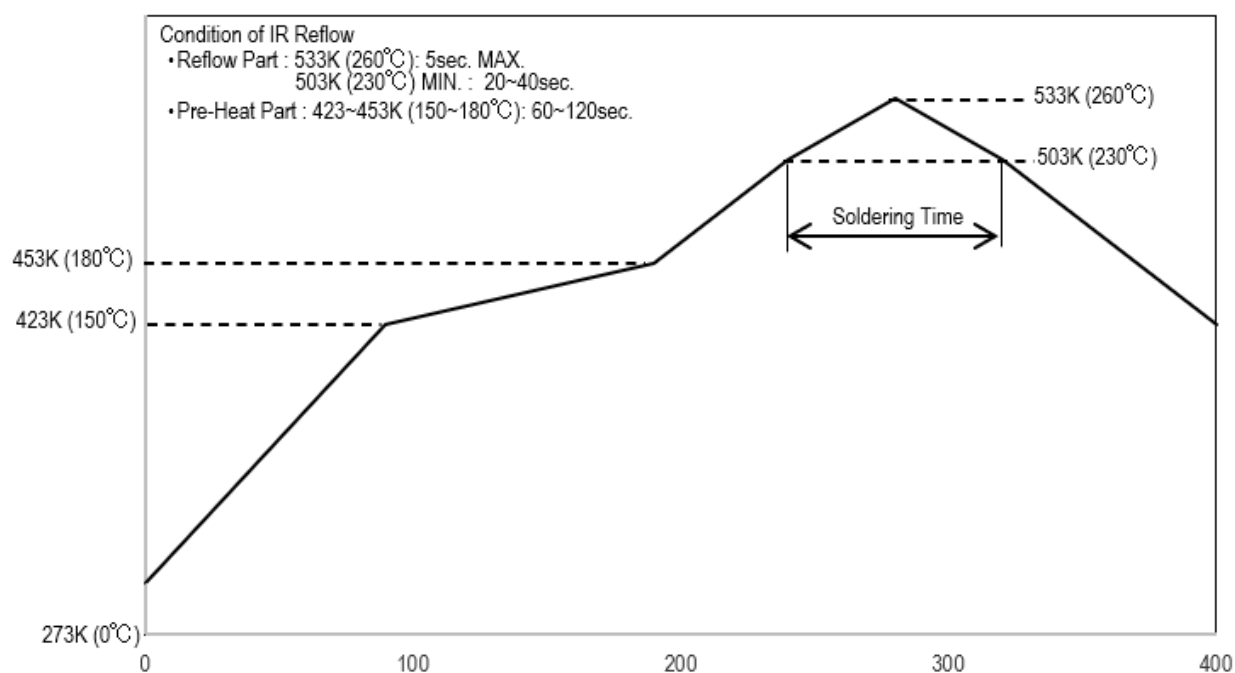


Fig.2

Pass Criteria: No deformation nor defect adversely affecting the performance occur.

3. Soldering Heat Resistance (Soldering Iron)

Reference Standard: -

Test Conditions: Operating temperature: $613 \sim 633\text{K}$ ($350\text{ }^{\circ}\text{C} \pm 10$)
Application Time of Soldering Iron: 5 ± 1 sec.
The Number of Times of Application: 3 times

Pass Criteria: No abnormality adversely affecting the performance shall not occur.

4.5 Test Sequence and Specimen Quantity

Table.1 Test Sequence and Sample Quantity

Test Item	Group												
	A	B	C	D	E	F	G	H	J	K	L	M	N
Contact Resistance		2,6		1,3,5	1,3	1,3	1,5	1,5,7	1,3	1,3			
Dielectric Withstanding Voltage							2,6	2,8					
Insulation Resistance							3,7	3,9					
Temperature Rising	1												
Mating Force		1,5											
Unmating Force		3,7											
Durability		4						4 (10cycle)					
Contact Retention Force			1,3										
Cable Retention Force		8											
Vibration				2									
Shock				4									
Thermal Shock					2								
High Temperature Life			2			2							
Humidity (Steady State)							4						
Humidity (Cycling)								6					
Saltwater Spray									2				
H ₂ S Gas										2			
Solderability											1		
Soldering Heat Resistance												1	
Differential Impedance													1
Specimen Quantity.	5 pcs.	5 pcs	20 pcs	5 pcs	5 pcs	5 pcs	5 pcs	5 pcs	5 pcs	5 pcs	10 pcs	10 pcs	5 pcs

※Numbers indicate test sequences.

5. Recommended Metal Mask

Refer to drawing for the recommended metal mask thickness and opening dimension.

6. Precautions for Handling Cable Connectors

Refer to instruction manual : HIM-09007 for the handling of FPL II Connector.