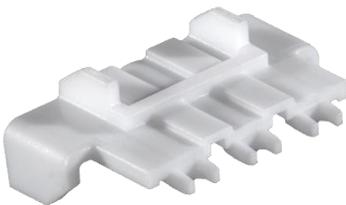


MINI-FIT TPA2

WIRE-TO-WIRE & WIRE-TO-BOARD INTER CONNECTOR SYSTEM

Receptacle Terminal	TPA
	
Series: 202988	Series: 172709

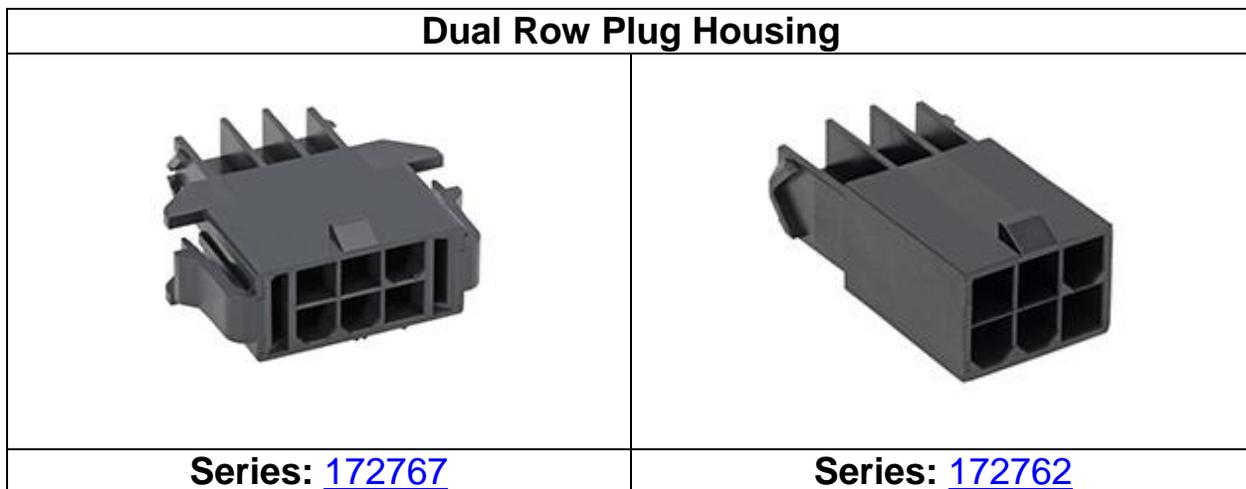
Receptacle Housing	
Dual Row	Single Row
	
Series: 172708	Series: 200453



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2029880001-PS	Jerry Wang	Nicolas Zhang	Nicolas Zhang



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Single Row Plug Housing	
	
Series: 200488	Series: 200471



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1.0 SCOPE

This Product Specification covers the performance requirements for the MINI-FIT TPA2 Wire-To-Wire, Wire-To-Board, 4.20mm pitch dual row and single row connector series using high conductive copper alloy terminals with Tin and Gold plating terminated with 16 to 24 AWG wire using Molex crimp technology. The TPA Retainer (terminal position assurance) is intended to ensure the crimp terminals are fully seated and to prevent incidence of terminal back-out due to partially seated terminals. The connector position assurance (CPA) latch optional, will prevent connector accidental un-mating.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBER (S)

WIRE-TO-BOARD			
Description	Series Number	UL / cUL (600 V)	IEC (250 V)
Mini-Fit TPA2, Receptacle Hsg, Dual Row	172708	Yes	Yes
Mini-Fit TPA2, Receptacle Hsg, Single Row	200453	Yes	Yes
Mini-Fit TPA2, Female Crimp Terminal	202988	Yes	Yes
Mini-Fit TPA2, TPA Retainer	172709	Yes	Yes
Mini-Fit TPA2, CPA	203603	Yes	Yes

MATES TO



Right Angle Hdr, Dual Row	35318	Yes	Yes
Right Angle Hdr, Dual Row	44130	Yes	Yes
Right Angle Hdr, Dual Row	87427	Yes	Yes
Right Angle Hdr, Dual Row, Glow Wire Capable	172448	Yes	Yes
Right Angle Hdr, Dual Row, Reflow Capable	46991	Yes	Yes
Right Angle Hdr, Single and Dual Row	5569	Yes	Yes
Right Angle Hdr, Single Row, Reflow Capable	172648	Yes	Yes
Test Plug	44281	n/a	n/a
Vertical Hdr, Dual Row	5566	Yes	Yes
Vertical Hdr, Dual Row	35317	Yes	Yes
Vertical Hdr, Dual Row	43460	Yes	Yes
Vertical Hdr, Dual Row	87427	Yes	Yes
Vertical Hdr, Dual Row Glow Wire Capable	172447	Yes	Yes
Vertical Hdr, Dual Row Reflow Capable	46207	Yes	Yes
Vertical Hdr, Single Row	172647	Yes	Yes



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WIRE-TO-WIRE			
Description	Series Number	UL (600 V)	IEC (600 V)
Mini-Fit TPA2, Female Crimp Terminal	202988	Yes	Yes
Mini-Fit TPA2, Receptacle Hsg, Dual Row	172708	Yes	Yes
Mini-Fit TPA2, Receptacle Hsg, Single Row	200453	Yes	Yes
Mini-Fit TPA2, TPA Retainer	172709	Yes	Yes
Mini-Fit TPA2, Male Crimp Terminal	203070	Yes	Yes
Mini-Fit TPA2, Plug Hsg, Dual Row	172762	Yes	Yes
Mini-Fit TPA2, Plug Hsg, Panel Mount, Dual Row	172767	Yes	Yes
Mini-Fit TPA2, Plug Hsg, Single Row	200471	Yes	Yes
Mini-Fit TPA2, Plug Hsg, Panel Mount, Single Row	200488	Yes	Yes
Mini-Fit TPA2, CPA	203603	Yes	Yes

ALSO, MATES TO



Male Crimp Terminal	5558	Yes	Yes
Plug Hsg, Dual Row, Glow Wire Capable	46993	Yes	Yes
Plug Hsg, Dual Row, Glow Wire Capable	172646	Yes	Yes
Plug Hsg, Single and Dual Row, Panel Mount	5559	Yes	Yes
Female Crimp Terminal	5556	Yes	Yes
Receptacle Hsg, Single and Dual Row	5557	Yes	Yes
Receptacle Hsg, Dual Row, Glow Wire Capable	46992	Yes	Yes
Receptacle Hsg, Single Row, Glow Wire Capable	46994	Yes	Yes
Receptacle Hsg, Single Row	36633	Yes	Yes

2.2 DIMENSIONS, MATERIALS, PLATING AND MARKINGS

Dimensions & Plating: See individual sales drawings.
 Material: RoHS compliant materials*.

**Refer to the "Product Environmental Compliance" section in Molex.com to know the individual Part Number RoHS compliance status.*

2.3 SAFETY AGENCY APPROVALS

UL File Number: E29179 (ECBT2 & ECBT8)



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Note: UL 1977, Component Connectors for Use in Data, Signal, Control and Power Applications. CAN/CSA C22.2 No. 182.3-M1987, Special use attachment plugs, receptacles, and connectors. Certification Informs, Ref No. I13-128 Wiring Devices No. 76.

IEC 61984 Certification:



Tested to and found in compliance with IEC 61984. NRTL type examination certificate available from Molex upon request. Contact Molex Safety Agency team for questions regarding certification on specific part numbers.

3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

3.1 MOLEX DOCUMENTS

See series specific sales drawings and the other sections of this specifications for the necessary referenced documents and specifications.

- [Mini-Fit TPA2-Fit Application Specification AS-172718-0000-001](#)
 - [Mini-Fit TPA2 Test Summary TS-2029880001](#)
 - [Mini-Fit TPA2-Fit Application Tooling Specification \(Fine Adjust Applicator\) ATS-639037100](#)
 - [Molex Quality Crimping Handbook Order No. 63800-0029](#)
 - [Molex Solderability Specification SMES-152](#)
 - [Molex Heat Resistance Specification AS-40000-5013](#)
 - [Molex Moisture Technical Advisory AS-45499-001](#)
 - [Molex Package Handling Specification 454990100-PK](#)
- Application Tooling Specification (ATS)*

* Application Tooling Specification for terminals is not provided in this document. ATS for terminals can be available from respective terminal part number page in Molex.com

3.2 INDUSTRY DOCUMENTS

- UL-1977
- CSA STD. C22.2 NO. 182.3-M1987
- IEC / EN 61984
- EIA-364-1000.

4.0 ELECTRICAL PERFORMANCE RATINGS

4.1 VOLTAGE*

See Chart in Section 2.1



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4.2 APPLICABLE WIRES

Applicable Wire Gauges And Insulation Diameter Range	16 AWG: 1.98mm (.078") – 3.14mm (.124")
	18-20 AWG: 1.42mm (.056") – 2.85mm (.112")
	22-24 AWG: 1.07mm (.042") – 2.38mm (.094")
	0.75mm ² : 1.42mm (.056") – 2.85mm (.112")
	0.50mm ² : 1.42mm (.056") – 2.85mm (.112")
	0.35mm ² : 1.07mm (.042") – 2.38mm (.094")
	0.25mm ² : 1.07mm (.042") – 2.38mm (.094")
	0.22mm ² : 1.07mm (.042") – 2.38mm (.094")

4.3 MAXIMUM CURRENT RATING

Wire to Wire Current Rating (Amp Max.) (Tested with Gold Plated Terminals)		
Connector fully loaded with all circuits powered		
AWG Wire Size	Circuit Size (Dual Row)	
	2 CKT	16 CKT
16	13 A	9 A
20	12 A	9 A

Wire to Board Current Rating (Amp Max.) (Tested with Gold Plated Terminals)		
Connector fully loaded with all circuits powered		
AWG Wire Size	Circuit Size (Dual Row)	
	2 CKT	16 CKT
16	13.5 A	9.5 A
20	9.5 A	6 A



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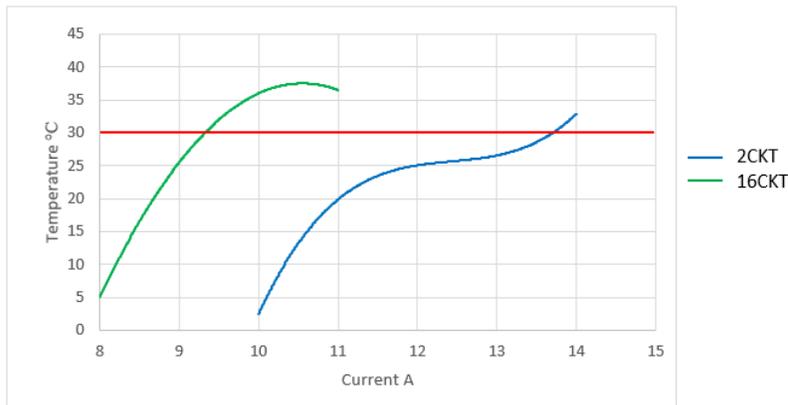
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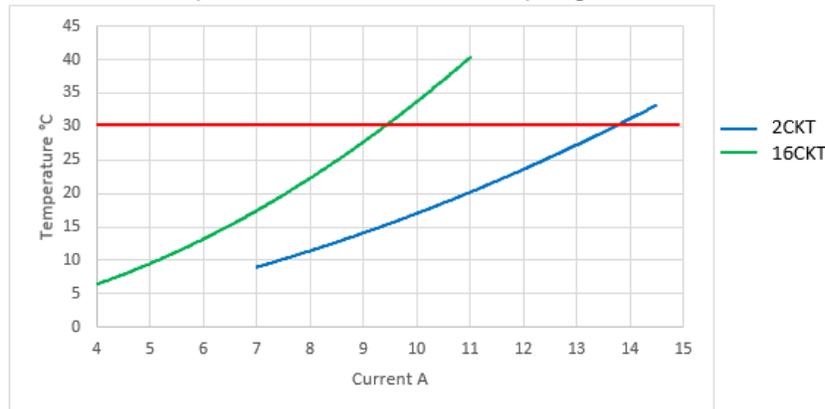
** Ratings shown represent *MAXIMUM* current carrying capacity of a fully loaded connector with all circuits powered. Ratings are based on a 30°C maximum temperature rise limit over ambient (room temperature). Above charts are intended as a guideline. Current rating is application dependent. Appropriate de-rating is required depending on factors such as higher ambient temperature, gross heating from adjacent modules or components and other factors that influence connector performance

Temperature Rise vs. Current per EIA-364-70
Tested with dual rated UI1007/1569 Tinned Wire.

Wire-to-Wire, Temperature Rise vs. Current Profile Gold plating 16 AWG



Wire-to-Board, Temperature Rise vs. Current Profile Gold plating 16 AWG



[www.molex.com/Mini-fit TPA2](http://www.molex.com/Mini-fit_TPA2)

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4.4 TEMPERATURE RATING

Operating temperature range is -40°C to 125°C*.

Field temperatures and field life: Tested per EIA 364-1000.01 to meet field temperature of 60°C for 10 years life per table-8.

Note: Temperature life test duration (section 6.3. item 1) is based on the assumption that the contact spends its entire life at the rated field maximum temperature (based on EIA-364-1000, table 8).

*The rated temperature of wire needs to be considered for the operating temperature application. for example, the rated temperature of UL 1015 wire is 105°C and can't be used at an operating temperature of 125°C.

* All Mini-Fit headers in tin and gold for wire to board applications will work at operating temperature of 125°C except for specific series 35318, 43460, 44130 and for series 5566 and 5569 with engineering number "-210" as noted on the customer prints can be used at 105°C operating temperature. For the selection of TPA 172709 series, only V-2/glow wire option can be used at operating temperature of 125°C.

4.5 DURABILITY

Tin plated: 30 mating cycles.

Gold plated: 250 mating cycles

As tested in accordance with EIA-364-1000.01 test method (see Sec. 7.0 of this specification). Durability per EIA-364-09

4.6 Glow Wire

The following series are glow capable:172708,172709, 172767, 203603.

Representative samples were tested and found compliant with EN 60695-2-11-2001 / IEC 60695-2-11-2000 Glow Wire Test Methods for End-Products. These were additionally investigated for compliance with EN 60335-1 / IEC 60335-1 750C/2 sec with no flaming. VDE Test report available upon request.

5.0 QUALIFICATION

Laboratory conditions and sample selection are in accordance with EIA-364-1000.



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6.0 PERFORMANCE

6.1 ELECTRICAL PERFORMANCE

Description	Test condition	Requirement
Initial Contact Resistance (Low Level)	Per EIA-364-23 Mate connectors apply a maximum voltage of 20 mV and a current of 100mA Wire resistance shall be removed from the measured value.	10 milliohms MAXIMUM [initial]
Insulation Resistance	Per EIA-364-21 Mate connectors: apply a voltage of 500 VDC between adjacent terminals and between terminals to ground.	1000 Mega Ohm MINIMUM
Dielectric Withstanding Voltage	Per EIA 364-20 (initial only) Mate connectors: apply a voltage of 2200 VAC for 1 minute between adjacent terminals and between terminals to ground.	No breakdown Current leakage <5mA
Temperature Rise (via current profiling)	Mate connectors, measure T- Rise @ Rated Current Per EIA-364-70, Method 2	Temperature rise: 30° C MAXIMUM
Steady State Voltage Drop (at rated current)	Per EIA 364-70B Mate connectors. Apply the rated current.	30 millivolt MAX (change from initial)



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Steady State Temperature Rise (via (18day) current cycling at rated current)	Per EIA 364-55 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°C MAXIMUM
--	--	------------------------------------

6.2 MECHANICAL PERFORMANCE

Item	Test condition	Requirement
Connector Mate and Un-mate Forces Per Circuit	Insert and withdraw (male to female) at a rate of 25 ± 6 mm ($1 \pm \frac{1}{4}$ inch) per minute. (Does not include thumb latch)	Tin plated: Mate Force: 15.6N MAX. Un mate Force: 13.8N MAX. Gold plated: Mate Force: 4.9N MAX. Un mate Force: 4.0N MAX.
Crimp Terminal Insertion Force (into Housing)	Apply an axial insertion force on the terminal at a rate of 25 ± 6 mm ($1 \pm \frac{1}{4}$ inch).	15 N (3.4 lbf) MAX. insertion force
Crimp Terminal Retention Force (in Housing w/ TPA)	Axial pullout force on the terminal in the housing at a rate of 25 ± 6 mm ($1 \pm \frac{1}{4}$ inch) per minute.	30 N (6.74 lbf) MIN retention force
Durability (w/o thumb latch) Tin Planting	Per EIA-364-09C, mate/Un-mate connectors 30 cycles at a maximum rate of 10 cycles per minute.	20 milliohms MAX. (change from initial) Visual: No Damage
Durability (w/o thumb latch) Gold Planting	Per EIA-364-09C, Mate and un-mate connectors 250 cycles at a rate of 10 cycles per minute.	20 milliohms MAX. (change from initial) Visual: No Damage



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Durability (pre-conditioning) Tin Terminals	Per EIA-364-09 Mate/un-mate connectors 20 cycles at a maximum rate of 10 cycles per minute	20 milliohms MAX. (change from initial)
Durability (pre-conditioning) Gold Terminals	Per EIA-364-09 Mate/un-mate connectors 50 cycles at a maximum rate of 10 cycles per minute	20 milliohms MAX. (change from initial)
Vibration (Random) + Mechanical Shock (Test Group 3)	Per EIA-364-28, test condition VII, Letter D (Acceleration 3.1g) Mechanical Shock- Per EIA-364- 27C Test Condition H	20 milliohms MAX (change from initial) & Discontinuity < 1 microsecond
Wire Crimp Pullout Force (Axial)	Apply an axial pullout force on the wire at a rate of 25 ± 6 mm (1 ± ¼ inch).	16 Awg = 88 N MIN. 18 Awg = 88 N MIN. 20 Awg = 59 N MIN. 22 Awg = 39 N MIN. 24 Awg = 29 N MIN.
Panel mount insertion force	Insert the connector at a rate of 25 ± 6 mm (1 ±¼ inch) per minute.	30 N MAXIMUM insertion force
Panel mount retention force	Apply an axial push force on the Plug until plug are pushed in the down form panel cutout. The test rate is 25±6 mm/min.	100 N MINIMUM withdrawal force
CPA Insertion Force with TPA	Insert the CPA at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	50 N MAX.



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CPA Extraction Force with TPA	Extract the CPA at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	4 N MIN.
TPA INSTALLATION	Insert the TPA at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	50 N MAX.
TPA RETENTION IN HOUSING	Extract the TPA at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	25 N MIN.

6.3 ENVIRONMENTAL PERFORMANCE*

Item	Test condition	Requirement
Temperature Life. (65°C field temperature life time year 10)	Per EIA-364-17 Mate Connectors expose to 108 hours at 105°C	20 milliohms MAX. (change from initial)
Temperature Life (pre-conditioning)	Per EIA-364-17 Mate Connectors expose to 200 hours at 125°C	20 milliohms MAX. (change from initial)
Thermal Shock (Test group-2)	Per EIA-364-32 Mate connectors: expose for 5 cycles Between temperatures – 55 and 105° C; Dwell 0.5 hours at each temperature.	20 milliohms MAX. (change from initial) Visual: No Damage



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<p>Cyclic Temperature and Humidity (Test group 2)</p>	<p>Per EIA-364-31 method 3 Mate connectors: expose to 24 cycles from 25 °C / 80% RH to 65 °C / 50% RH</p>	<p>20 milliohms MAX. (change from initial)</p>
<p>Mixed Flow Gas EIA-364-1000 Test Group 4</p>	<p>Per Per EIA-364-35– Test Group 4</p>	<p>20 milliohms MAX. (change from initial)</p>



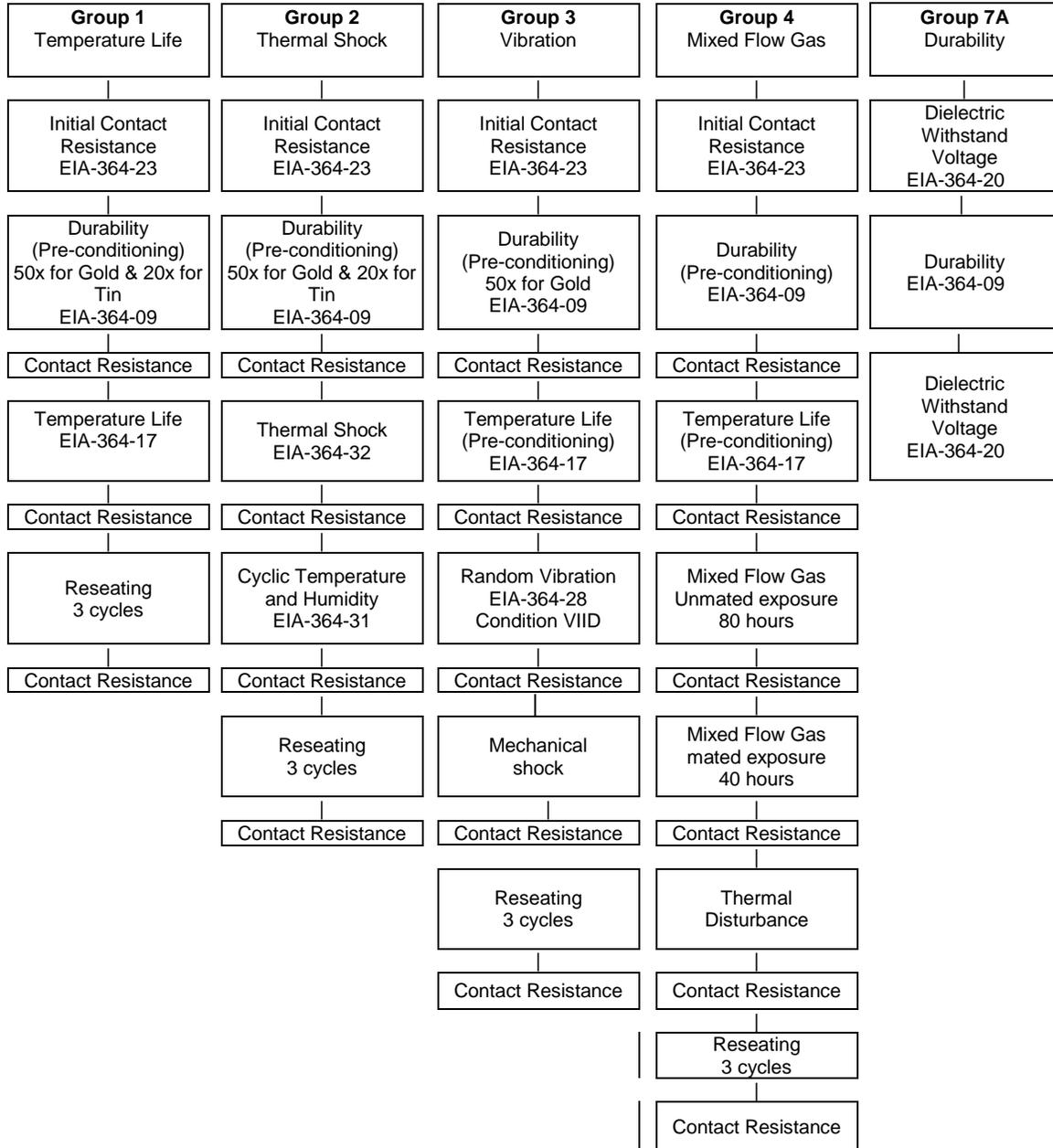
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7.0 TEST SEQUENCE GROUPS

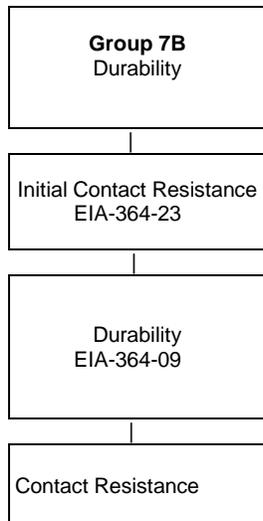
Reliability Test Sequences Per EIA-364-1000



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8.0 SOLDER INFORMATION

[Molex Solderability Specification SMES-152](#)
(Click Here)

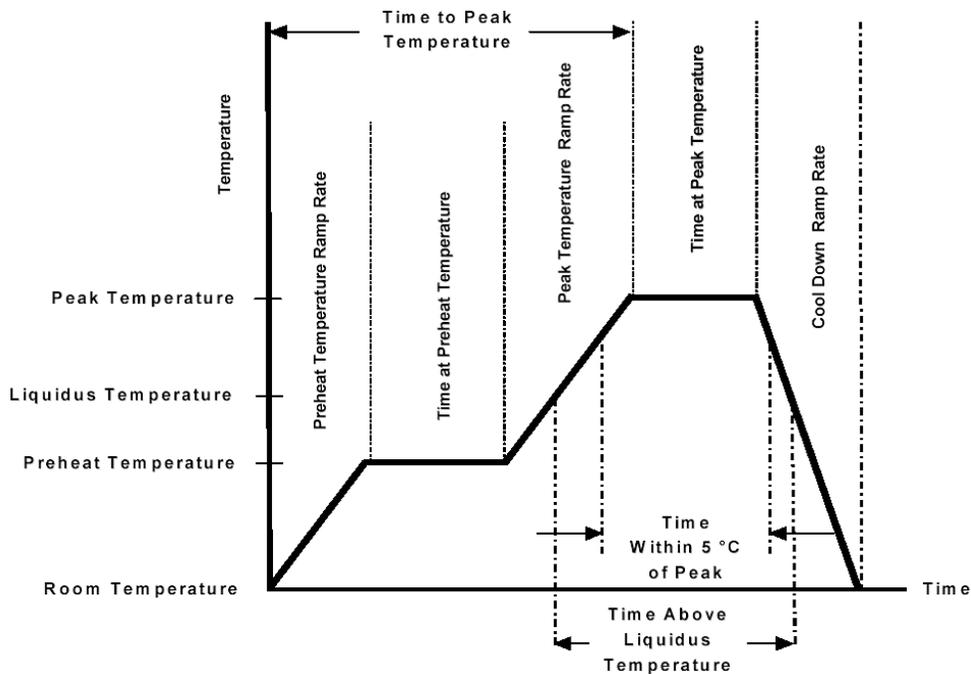
8.1 SOLDER PROCESS TEMPERATURES

Wave Solder: 265°C Max
Reflow Solder: 260°C Max

8.2 REFLOW SOLDERING PROFILE

[Molex Connector Heat Resistance Specification AS-40000-5013](#)
(Click Here)

(This profile is per AS-40000-5013 and is provided as a guideline only. Please see notes for additional information)



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Description	Requirement
Average Ramp Rate	3°C/sec Max
Preheat Temperature	150°C Min to 200°C Max
Preheat Time	60 to 180 sec
Ramp to Peak	3°C/sec Max
Time over Liquidus (217°C)	60 to 150 sec
Peak Temperature	260 +0/-5°C
Time within 5°C of Peak	20 to 40 sec
Ramp - Cool Down	6°C/sec Max
Time 25°C to Peak	8 min Max

Notes:

1. Temperature indicated refers to the PCB surface temperature at solder tail area.
2. Connector can withstand 1 reflow cycle.
3. Actual reflow profile also depends on equipment, solder paste, PCB thickness, and other components on the board. Please consult your solder paste & reflow equipment manufacturer for their recommendations to adopt a suitable process.

9.0 PACKAGING

Parts shall be packaged to protect against damage during handling, transit and storage. Nylon parts should remain in their original packaging until ready for use. Refer to Molex specification AS-45499-001 for moisturizing nylon connector parts.

10.0 OTHER INFORMATION

10.1 GAGES AND FIXTURES

It is recommended that test plugs (Series-172767/172762/200488/200471) be used for continuity testing of receptacles. Standard mating parts should not be used for harness testing.

NOTE: The use of unauthorized testing devices and/or probes with a Molex product may cause damage to and affect functionality of the Molex product, and such use may void any and all warranties, expressed or implied.



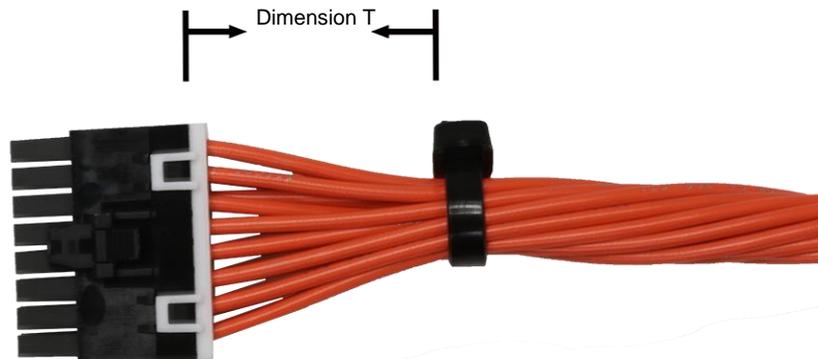
www.molex.com/Mini-fit TPA2

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10.2 CABLE TIE AND OR WIRE TWIST LOCATION

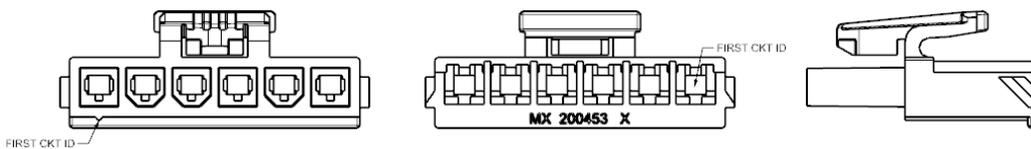
CKT Size	Dim T Min.
2-6	.50" (12.7 mm)
8	.75" (19.1 mm)
10-12	1.00" (25.4 mm)
14-16	1.34" (34.0 mm)
18-20	1.45" (37.0 mm)
22-24	1.57" (40.0 mm)



The “T” dimension defines a “free” length of wire, or a length of wire that is not subject to significant bias by external factors such as a wire tie, wire twisting, or other means of bending or deforming of the wires that repositions them from their natural relaxed state or location where they enter the housing. Wires are to be dressed in such a manner to allow the terminals to float freely in the pocket. This dimension is general recommendation and may need to be adjusted for different wire gauges and wire type and insulation thickness and insulation material.

11.0 POLARIZATION REPRESENTATION

11.1 Single Row Receptacle (Series:200453)

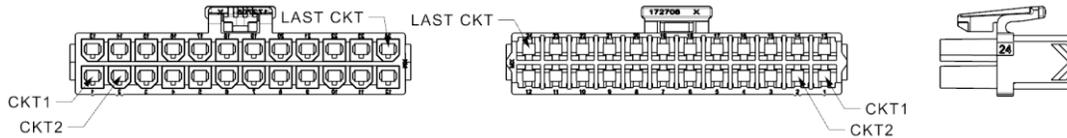


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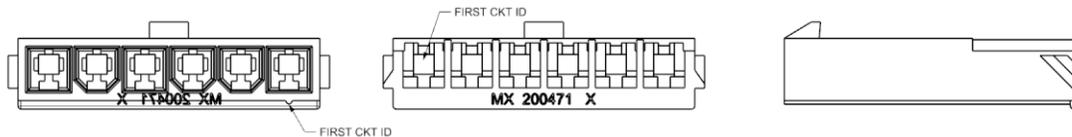
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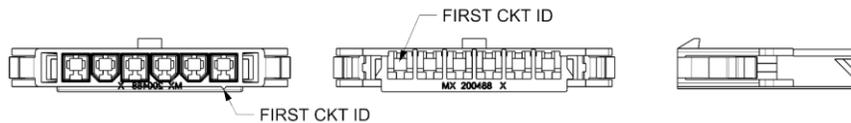
11.2 Dual Row Receptacle (Series:172708)



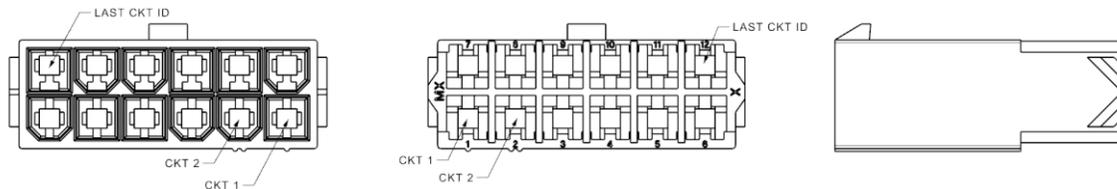
11.3 Single Row Plug (Series:200471)



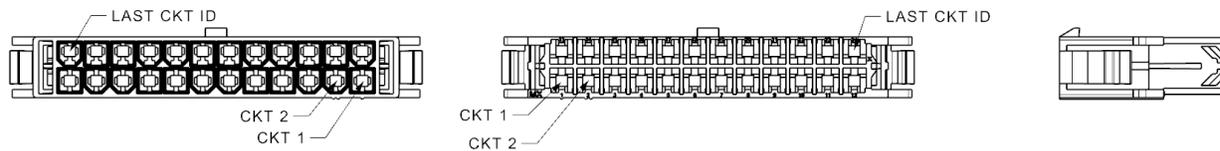
11.4 Single Row Panel Mount Plug (Series:200488)



11.5 Dual Row Plug (Series:172762)



11.6 Dual Row Panel Mount Plug (Series:172767)



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