

High Speed 0.8mm pitch Board to Board Connectors

FX18 Series

Design Guide Line

OCT, 2014



HRS

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1. Preface

1-1 Purpose

The FX18 Series Instruction Manual is intended to provide information on basic features of the FX18 Series and the method of use, as well as to provide information on the method of designing products efficiently and improving the assembling process when the FX18 Series is used.

Hirose expects that this Instruction Manual will significantly contribute to your product development, quality, and cost reduction of the entire system.

Because this Instruction Manual intends only to provide general information, it does not restrict your design and does not guarantee results in all circumstances.

If there is anything that does not conform to the description in this Instruction Manual, consult us for alternative solutions individually.

1-2 Scope

This Instruction Manual provides useful information for the product using the FX18 Series.

It describes the basic connector design information, recommended board dimensions, and requirements.

This Instruction Manual will be revised on a continuing basis as technical and manufacturing capability is changed.

2. Product Information

2-1 Basic Specifications

- 0.8mm pitch
- High-speed transmission compliant
- Connection type: Coplanar, vertical, stacking (stacking height: 10 to 45mm)
- Number of contacts: 40/60/80/100/120/140
- Multi-functional contacts (MF contacts) that can be used for a variety of applications
- Signal contact (Effective contact length: 2mm)
- Enhanced wrenching strength due to DIP connection of MF contacts
- Excellent mating self-alignment performance by a large guide shape (mating self-alignment range: ± 1 mm)

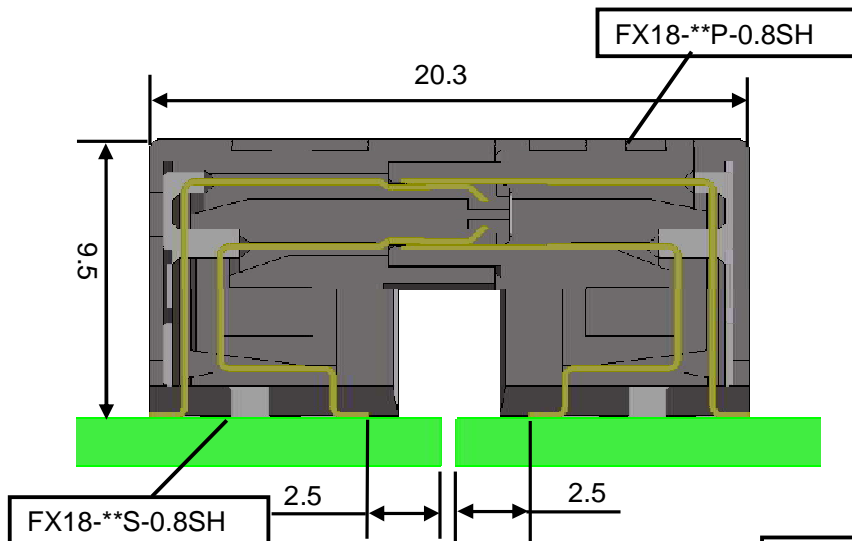
2-2 Ordering Information

- Right Angle Receptacle
FX18 - 60 S - 0.8 SH
(1) (2)(3) (4) (5)
- Straight Receptacle
FX18 - 60 S - 0.8 SV 15
(1) (2)(3) (4) (5) (6)
- Right Angle Header
FX18 - 60 P - 0.8 SH
(1) (2)(3) (4) (5)
- Interposer
FX18 - 60 PS - 0.8 H 15
(1) (2) (3) (4) (5)(6)
- Straight Header
FX18 - 60 P - 0.8 SV 10
(1) (2)(3) (4) (5) (6)

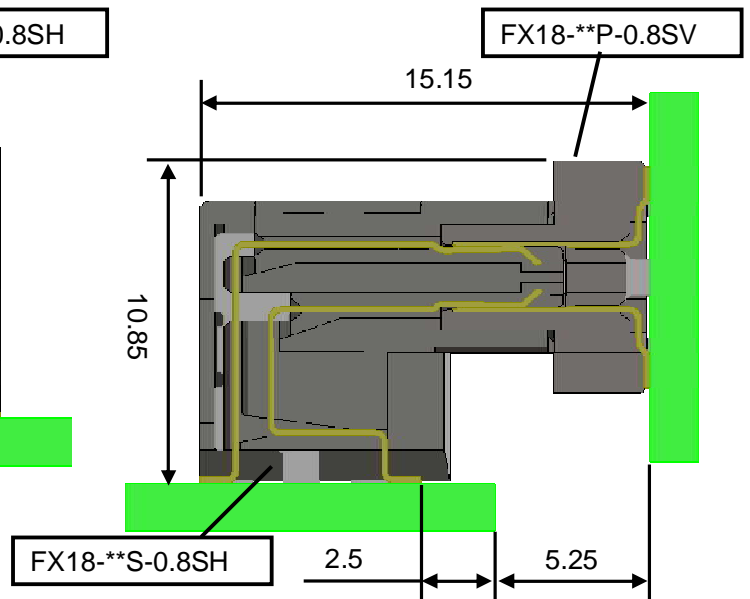
| | |
|--------------------------|--|
| (1) Series name | : FX18 |
| (2) Number of contacts | |
| (3) Connector type | S : Receptacle P : Header PS : Interposer Type |
| (4) Contact pitch | : 0.8 mm |
| (5) Product Shape | SH : Right-Angle Type SV : Straight Type H : Interposer Type |
| (6) Stacking Height Type | |

2-3 Connection Types & Dimension Drawings

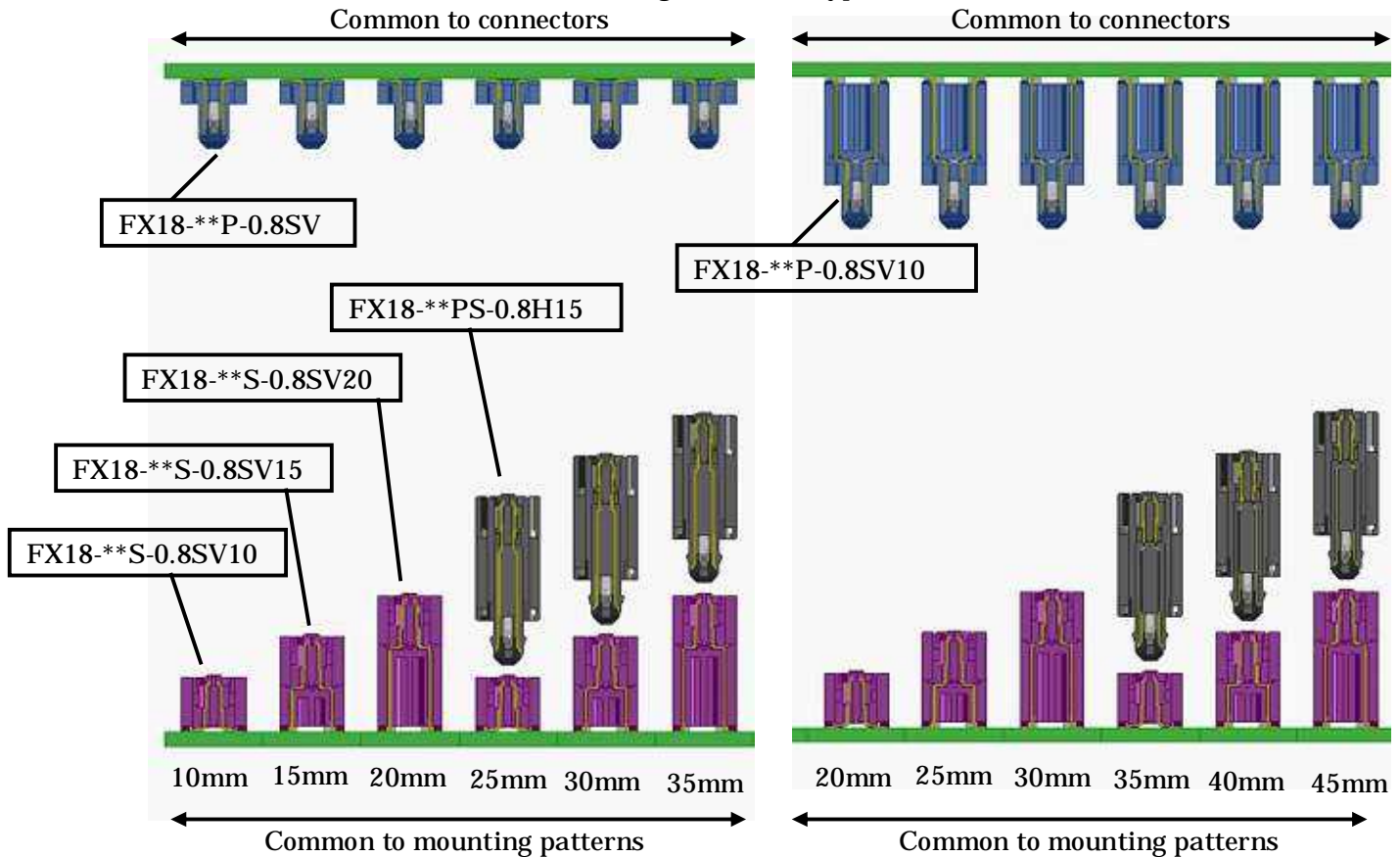
[Coplanar connection type]



[Vertical connection type]



[Stacking connection type]

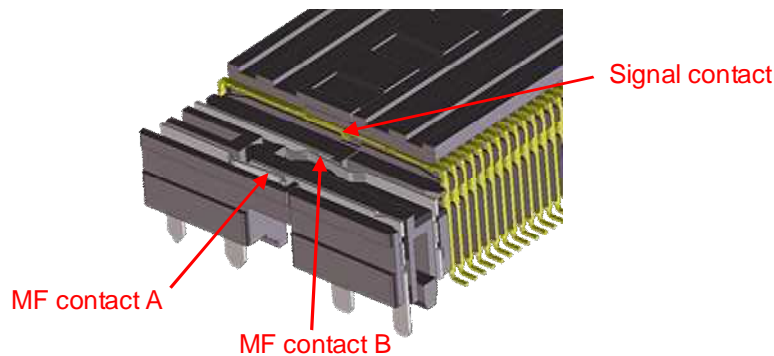


2-4 MF Contact Structure (Example: Coplanar Connection Type)

On the guide posts on both sides of the connector, two rows of multi-functional (MF) contacts are placed for the following uses.

* The vertical connection and stacking connection types also have the same product configuration.

1. Enhancing ground connection between boards
2. Using as a power line (3A/line)
3. Three-step sequence structure including signal contacts.



Note: One contact can have only one function.

Example: If an MF contact is used as a power contact, it cannot be further used as a detection contact.

[Image of three-step sequence structure]

First step contact

Grounding

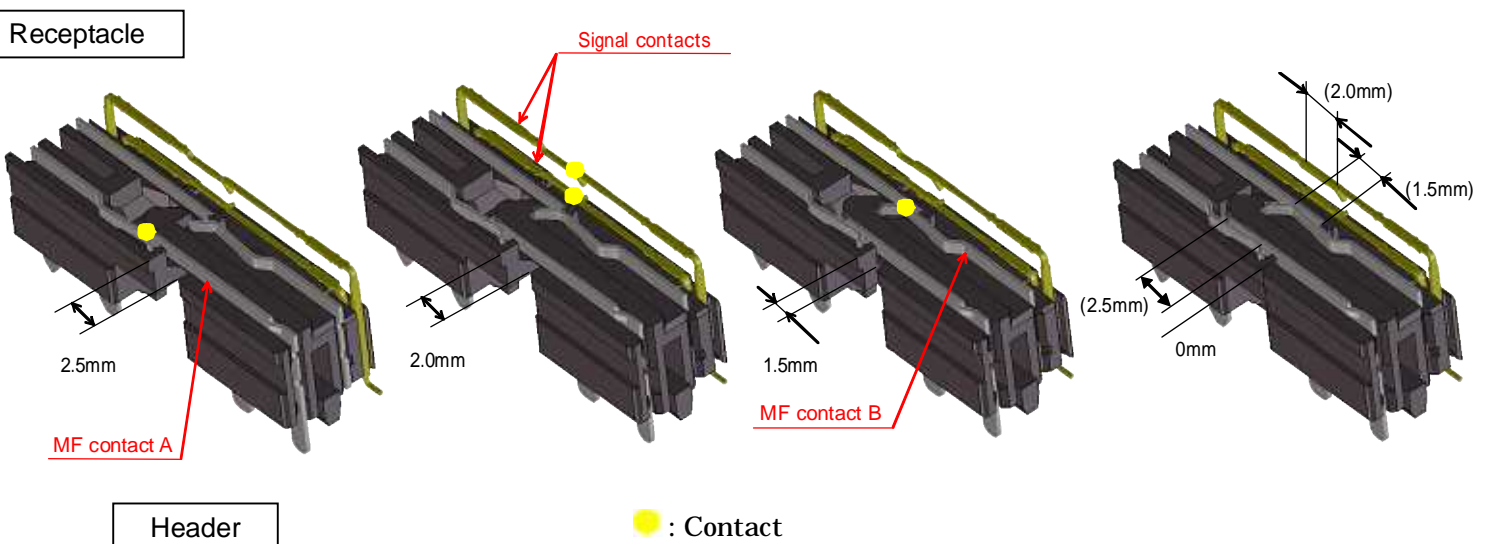
Second step contact

Signal contact

Third step contact

Detecting

Mating
(Effective mating length)



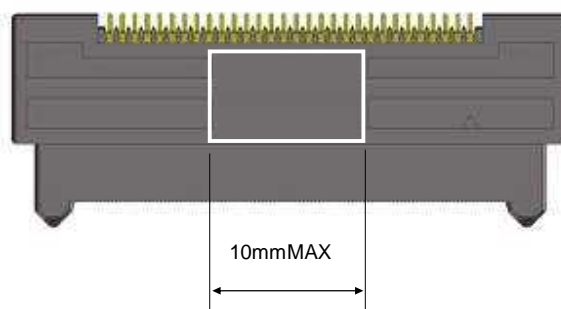
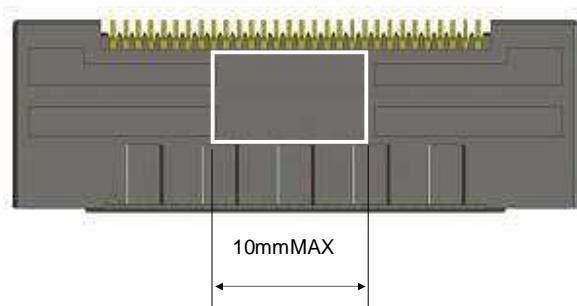
3. Connector Mounting

3-1 Absorption Area

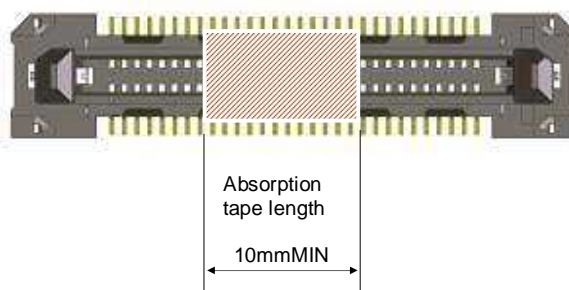
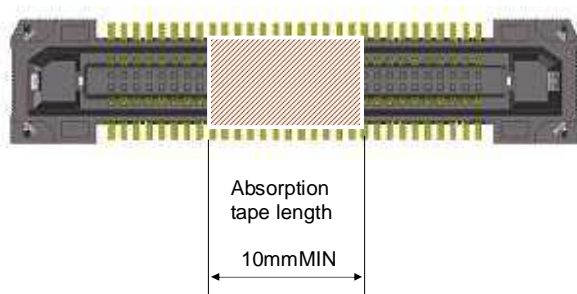
When performing automatic mounting, see the following absorption area as reference.

For the straight type, absorption tape is attached.

[Right Angle Type]



[Straight Type]

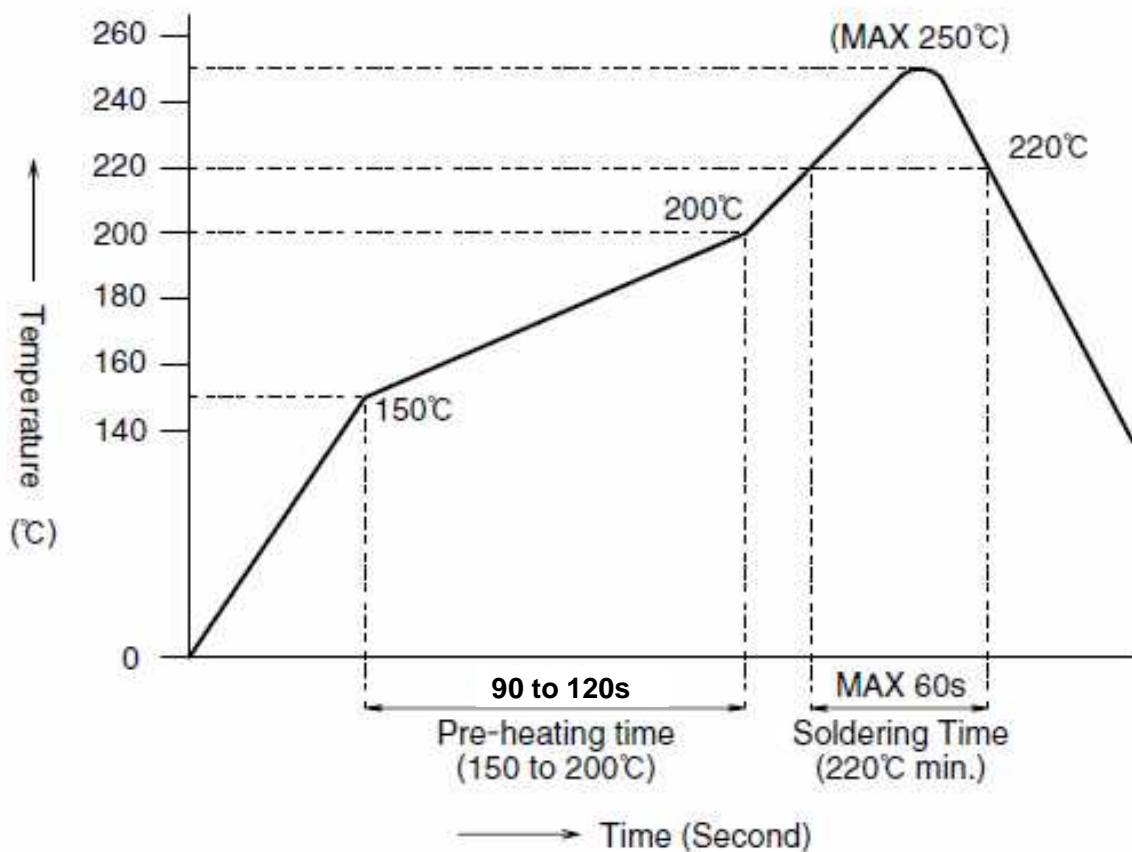


3-2 Recommended Temperature Profile

Mounting temperature profile (reference)

(Reflow setting condition)

- Board Dimensions: 110 x 50 x 1.6mm
Material: FR-4
- Solder paste composition Sn-3Ag-0.5Cu (flux content: 11wt%)
- Metal mask thickness $t=0.12\text{mm}$



Note 1: This temperature profile is a reference value.

Note 2: Up to two cycles of reflow process are permitted.

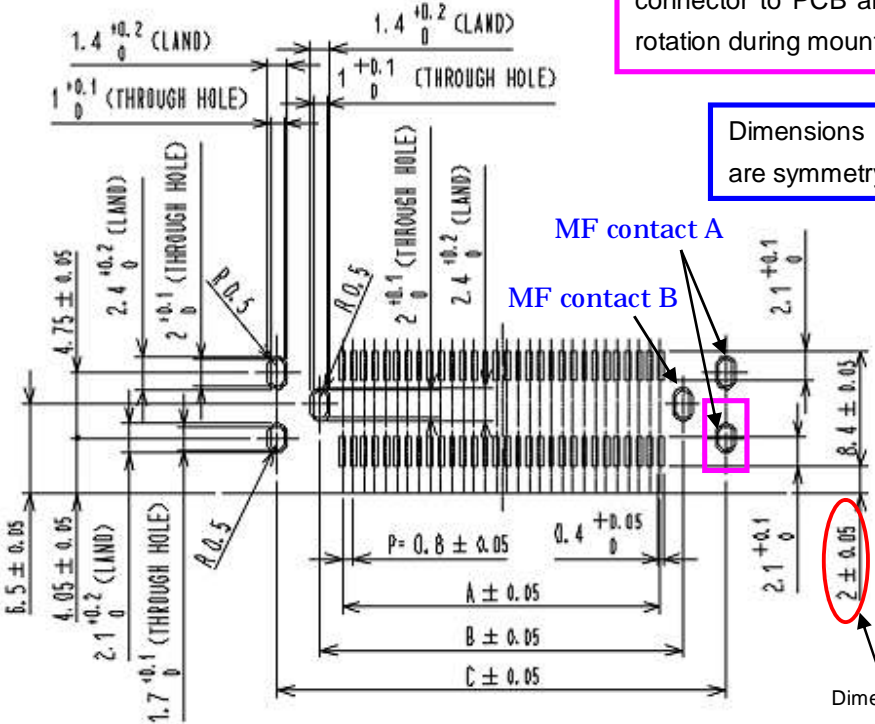
Note 3: The actual temperature may vary depending on the solder paste type and volume.

3-3 Recommended Land Pattern Dimension of PCB (PCB Thickness : 1.6mm)

[FX18-**-P-0.8SH / FX18-**-S-0.8SH]

Through hole size is reduced at □ in order to stabilize the connector to PCB and prevent connector mis-position and rotation during mounting process.

Dimensions for both of MF contact A and B are symmetry with the center line.



Unit:[mm]

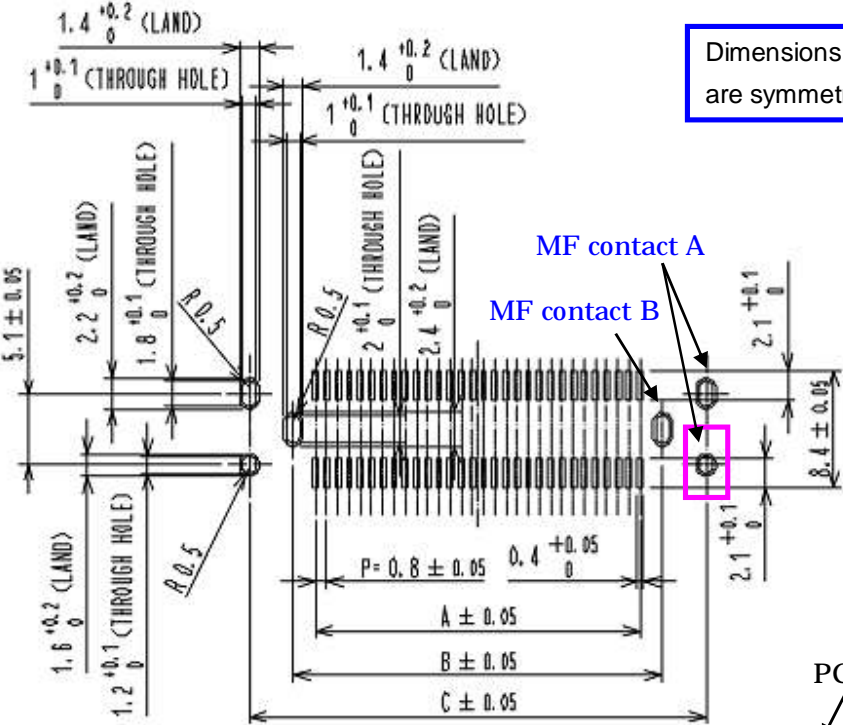
| No. of pos | A | B | C |
|------------|------|------|-------|
| 40 | 15.2 | 18.4 | 24.65 |
| 60 | 23.2 | 26.4 | 32.65 |
| 80 | 31.2 | 34.4 | 40.65 |
| 100 | 39.2 | 42.4 | 48.65 |
| 120 | 47.2 | 50.4 | 56.65 |
| 140 | 55.2 | 58.4 | 64.65 |

Maximum allowable rotational angle of the connector after mounting by using the recommended pattern layout to be 0.2°.

Dimension from PCB end

[FX18-**-P-0.8SV]

Dimensions for both of MF contact A and B are symmetry with the center line.



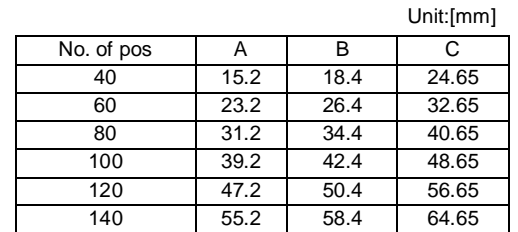
Unit:[mm]

| No. of pos | A | B | C |
|------------|------|------|-------|
| 40 | 15.2 | 18.4 | 24.65 |
| 60 | 23.2 | 26.4 | 32.65 |
| 80 | 31.2 | 34.4 | 40.65 |
| 100 | 39.2 | 42.4 | 48.65 |
| 120 | 47.2 | 50.4 | 56.65 |
| 140 | 55.2 | 58.4 | 64.65 |

Maximum allowable rotational angle of the connector after mounting by using the recommended pattern layout to be 0.2°.

PCB end

Through hole size is reduced at \square in order to stabilize the connector to PCB and prevent connector mis-position and rotation during mounting process.



Dimensions for MF contact A is line symmetry and MF contact B is point symmetry.

- PCB end

1.4 ± 0.2 (LAND)

1 ± 0.1 (THROUGH HOLE)

1.4 ± 0.2 (LAND)

1 ± 0.1 (THROUGH HOLE)

2.4 ± 0.2 (LAND)

2 ± 0.1 (THROUGH HOLE)

2 ± 0.05

R0.5

1.8 ± 0.2 (LAND)

1.4 ± 0.1 (THROUGH HOLE)

4.9 ± 0.05

1.4 ± 0.1 (THROUGH HOLE)

2.4 ± 0.2 (LAND)

2 ± 0.1 (THROUGH HOLE)

2 ± 0.05

R0.5

P=0.8 ± 0.05

0.5 ± 0.05

A ± 0.05

B ± 0.05

C ± 0.05

2.1 ± 0.1

2 ± 0.05

2.1 ± 0.1

8.4 ± 0.05

MF contact A

MF contact B

PCB end

| No. of |
|--------|
| 40 |
| 60 |
| 80 |
| 100 |
| 120 |
| 140 |

Maximum
connec
recomm

Dimension
and MF c

| Unit:[mm] | | | |
|------------|------|------|-------|
| No. of pos | A | B | C |
| 40 | 15.2 | 18.4 | 26.05 |
| 60 | 23.2 | 26.4 | 34.05 |
| 80 | 31.2 | 34.4 | 42.05 |
| 100 | 39.2 | 42.4 | 50.05 |
| 120 | 47.2 | 50.4 | 58.05 |
| 140 | 55.2 | 58.4 | 66.05 |

Dimensions for MF contact A is line symmetry and MF contact B is point symmetry.

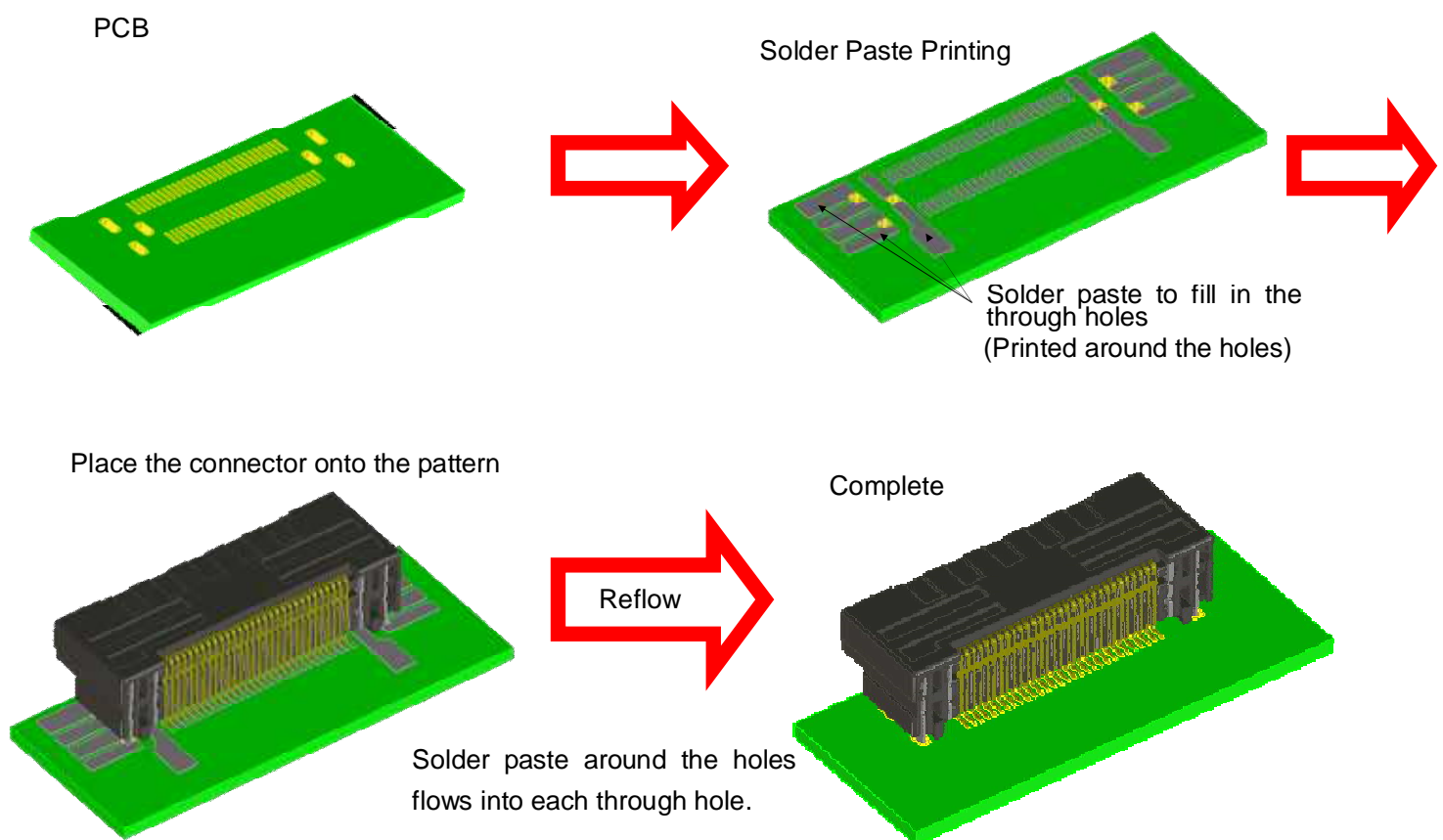
- PCB end

3-4 Intrusive Reflow of MF Contacts (Stencil Design)

Intrusive reflow applied to MF contacts of FX18 is that the solder paste around the through holes flows into the through holes. Please refer to this guideline prior to your stencil design.

This guideline is based on our evaluation results under certain conditions, and it does not cover all the soldering and reflow conditions. Therefore, prior confirmation of solder and reflow conditions according to this guideline as reference is highly recommended.

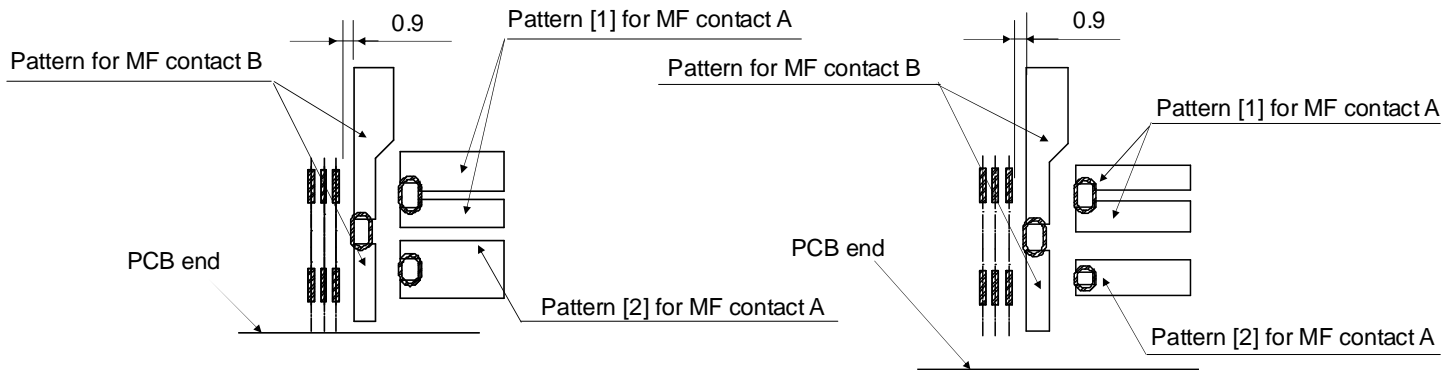
【Intrusive Reflow Process】



Recommended Pattern Layout / Reference Stencil Design

Example: Right Angel Header / Receptacle
(FX18-P-0.8SH / FX18-S-0.8SH)

Example: Straight Header
(FX18-P-0.8SV)



*) Pattern herein refers to the solder printing area.

< Note >

1. Reference stencil design is designed on the condition that the recommended pattern layout is applied for reflow.
2. Avoid excessive solder flow into through holes, or solder bridge could occur.
3. Keep the distance 0.9 mm or more between the pattern for signal contact and that of MF contact B, or solder bridge on signal contact or solder shortage on MF contact B caused by excessive solder supply to signal contact from MF contact B, could occur.
4. Pattern area of MF contact A/B should be solid with copper foil layer with resist pattern coating etc.
In case of PCB with patterns across solder printed area and/or via holes, PCB surface becomes unflat, and ball-shaped solder paste could remain on the PCB, inducing solder shortage.
For the reasons set forth above, hatched area shown in the following pages shall be flat surface as well.
5. Necessary solder amount is specified in the next page.
In case that through hole dia., PCB thickness do not meet this guideline, solder amount will change.
6. Specified solder amount is applicable for solder paste indicated in the next page.
Please note that solder amount could change depending on the solder paste composition.

3-5 Reference Stencil Design

Stencil Thickness (Reference) : 0.12mm

Right Angel Header / Receptacle

(Example : FX18-60P-0.8SH / FX18-60S-0.8SH)

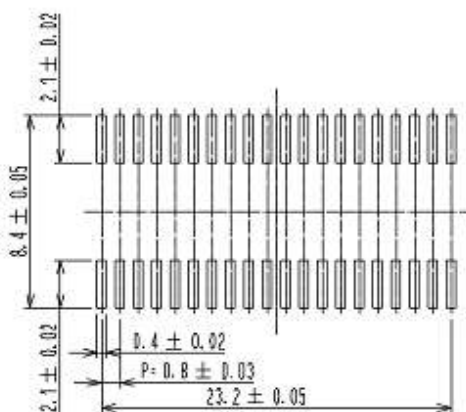
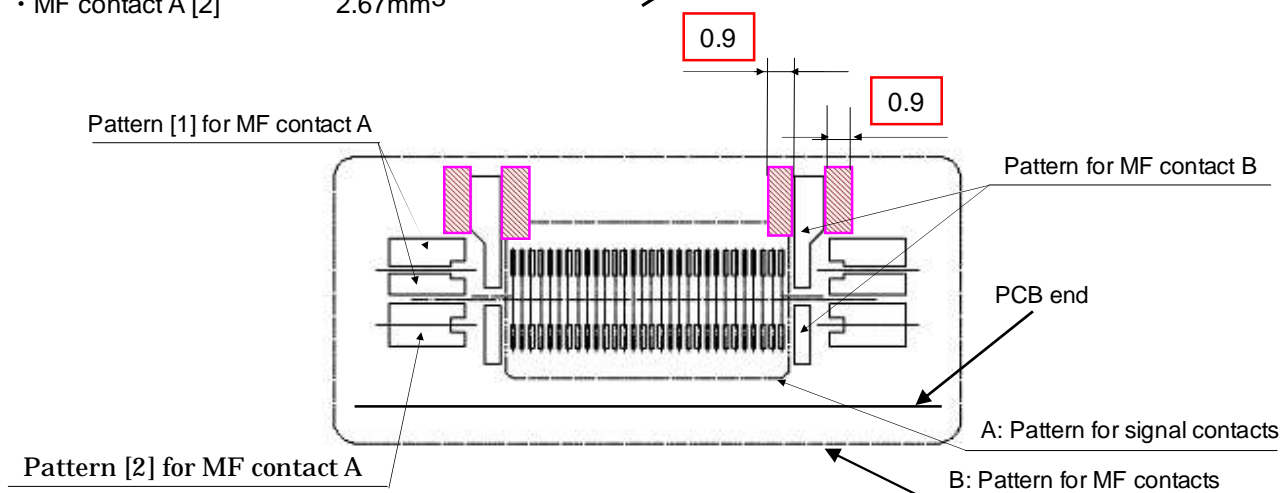
【Solder Paste】

| | |
|--------------|---|
| Manufacturer | : Senju metal industry |
| TYPE | : M705-GRN360-K2-V |
| Material | : Sn96.5/Ag3.0/Cu0.5 Flux is contained by 11.5% |

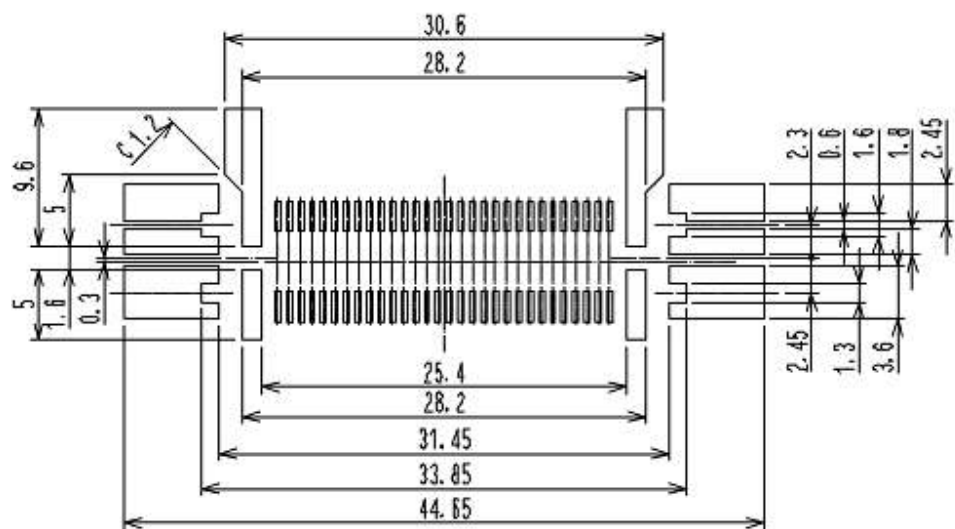
[Solder amount]

| | |
|--------------------|------------------------------------|
| • Signal contact | 0.1mm ³ / (per pattern) |
| • MF contact B | 3.21mm ³ |
| • MF contact A [1] | 3.23mm ³ |
| • MF contact A [2] | 2.67mm ³ |

Amount for our recommended PCB layout



A: Pattern for signal contacts (Details)



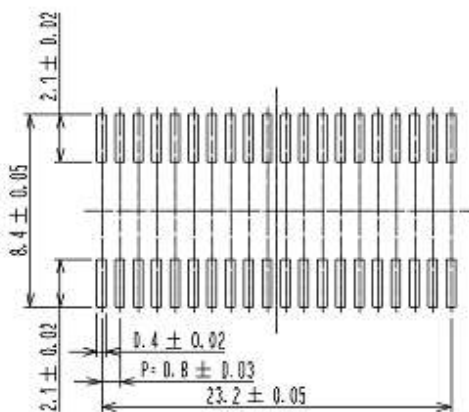
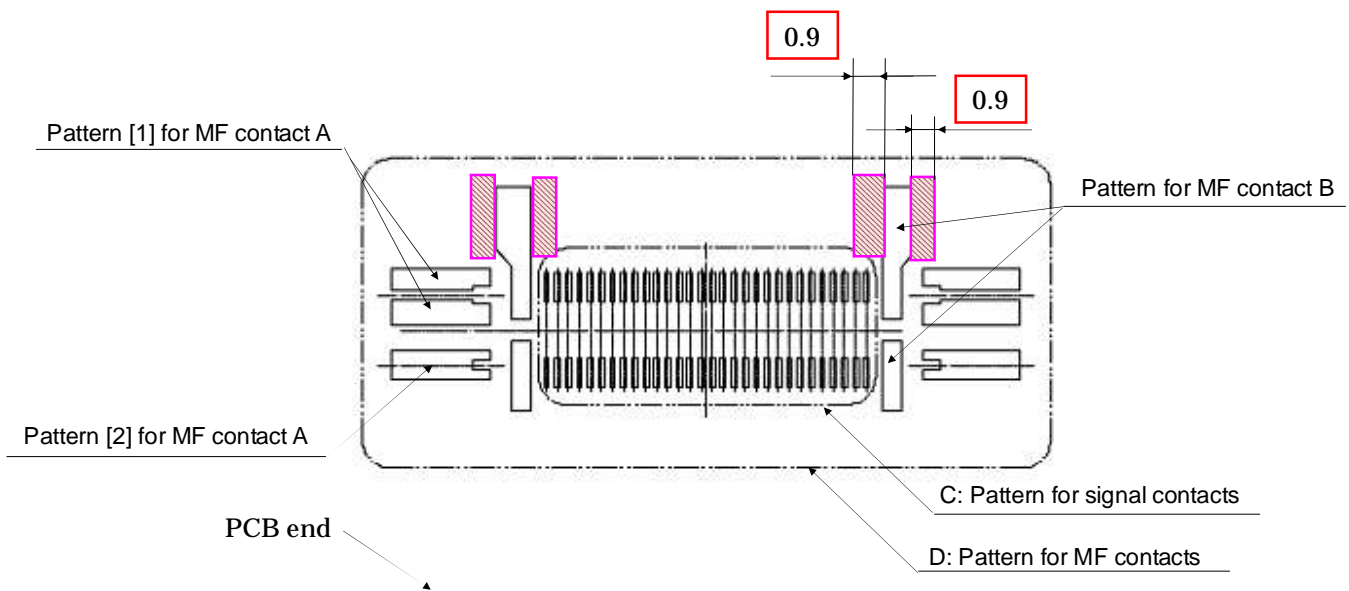
B: Pattern for MF contacts (Details)

Straight Header(Example : FX18-60P-0.8SV)

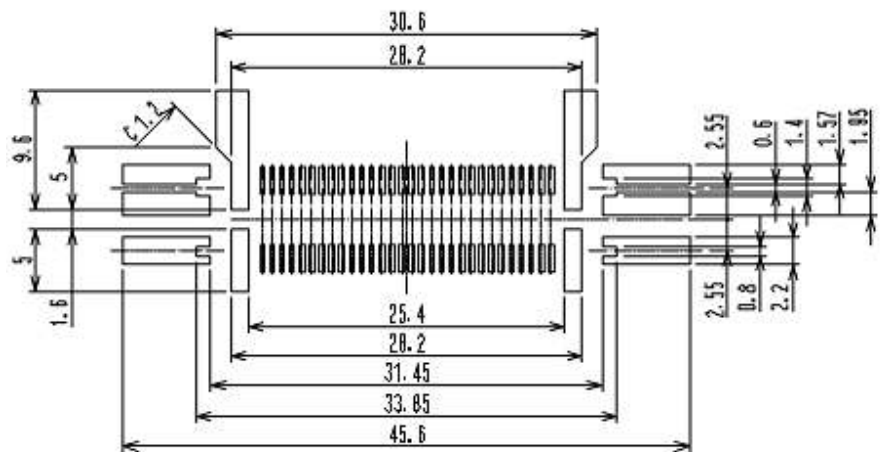
[Solder amount]

- Signal contact 0.1mm^3 / (per pattern)
- MF contact B 3.21mm^3
- MF contact A [1] 2.88mm^3
- MF contact A [2] 1.76mm^3

> Amount for our recommended PCB layout



C: Pattern for signal contacts (Details)



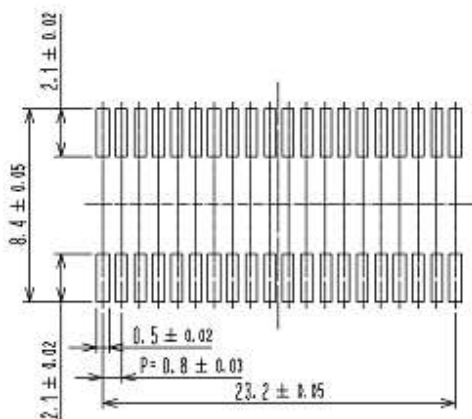
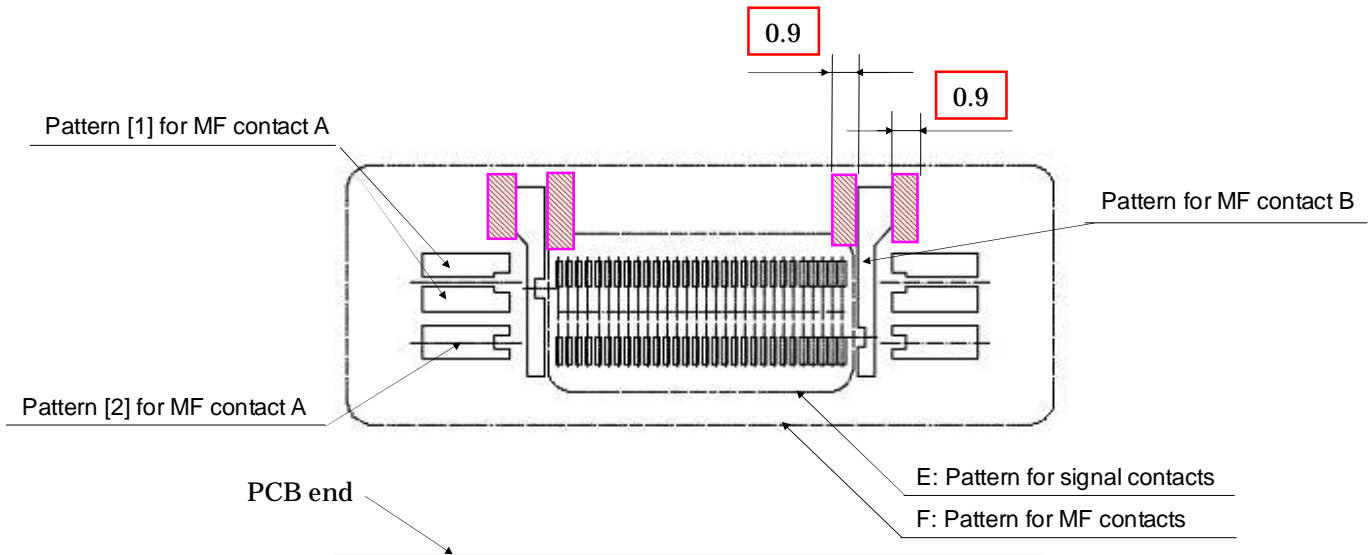
D: Pattern for MF contacts (Details)

Straight Header (Example : FX18-60P-0.8SV10)

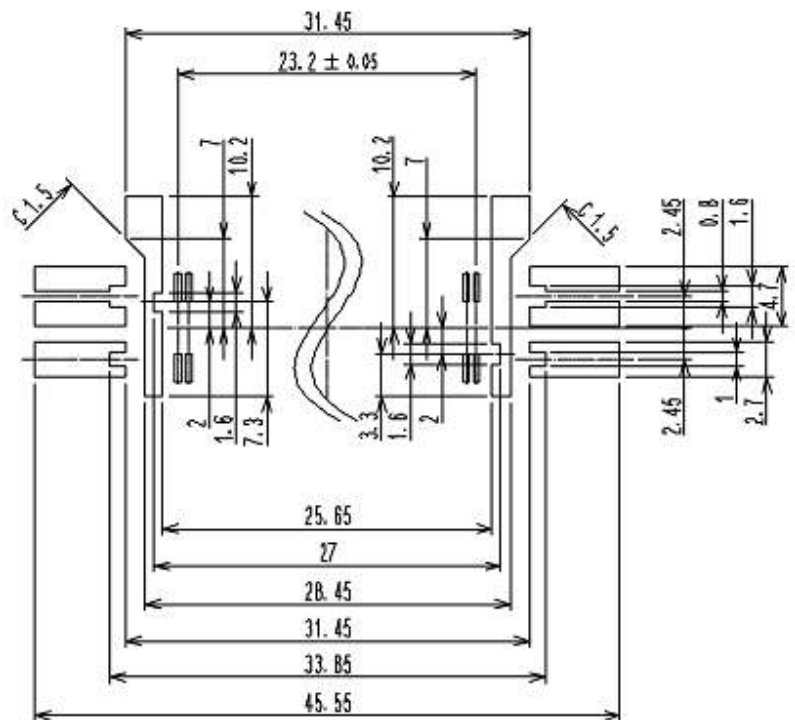
[Solder amount]

- Signal contact 0.1mm³ / 1 (per pattern)
- MF contact B 3.19mm³
- MF contact A [1] 3.19mm³
- MF contact A [2] 2.14mm³

Amount for our recommended PCB layout



E: Pattern for signal contacts (Details)



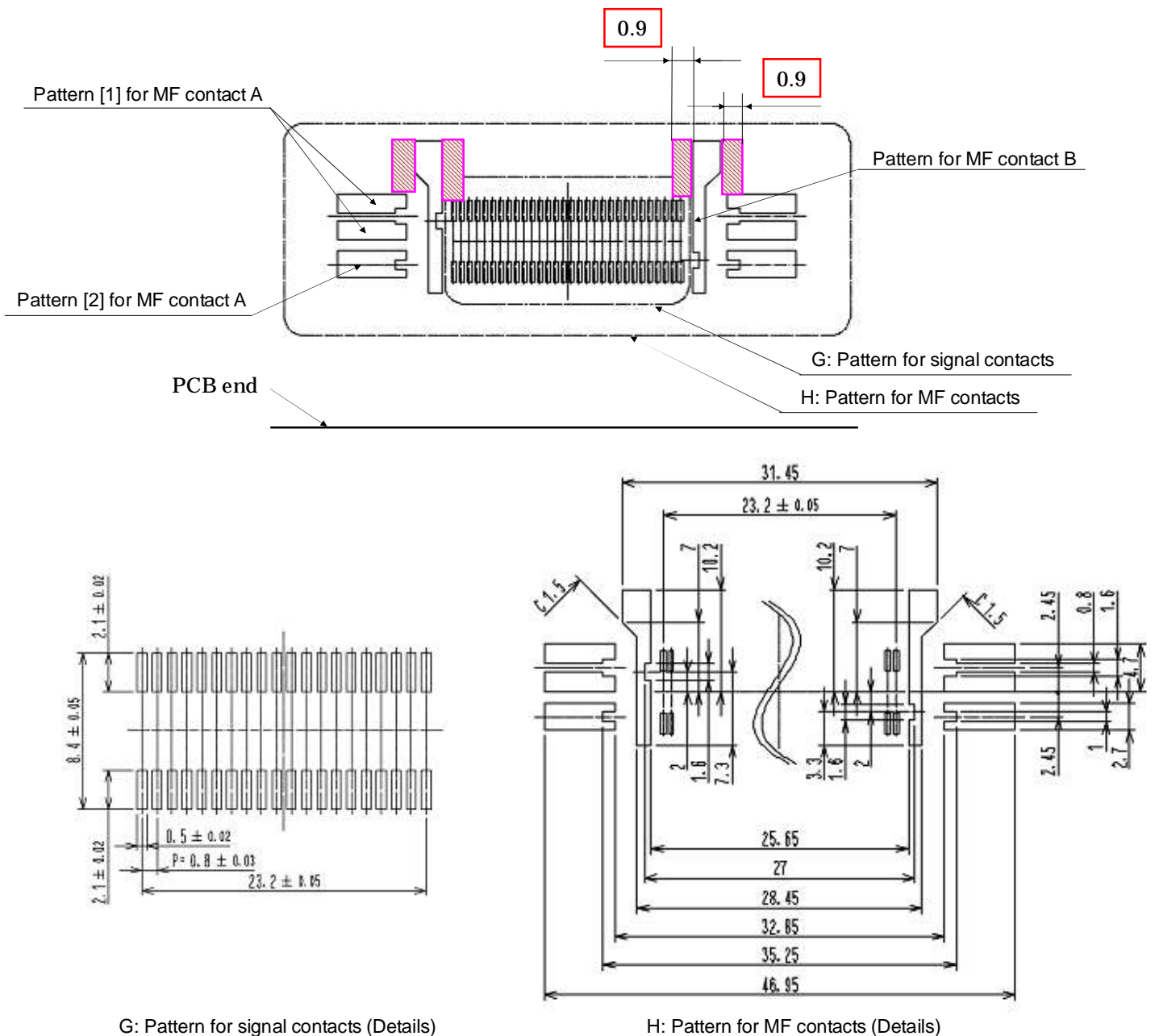
F: Pattern for MF contacts (Details)

Straight Receptacle (Example : FX18-60S-0.8SV15 / FX18-60S-0.8SV20)

[Solder amount]

| | |
|--------------------|------------------------------------|
| • Signal contact | 0.1mm ³ / (per pattern) |
| • MF contact B | 3.19mm ³ |
| • MF contact A [1] | 3.19mm ³ |
| • MF contact A [2] | 2.14mm ³ |

Amount for our recommended PCB layout



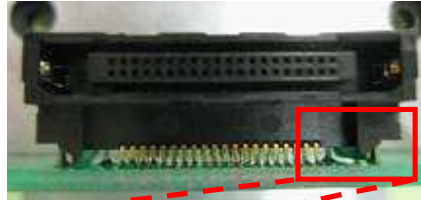
G: Pattern for signal contacts (Details)

H: Pattern for MF contacts (Details)

3-6 MF Contact Mounting Status Check Criteria

The judgment criteria for mounting at the MF contact of the FX18 is shown below.

[Places at which mounting status is checked] Common to FX18 Series



Are fillets formed on the
connector-mounted face?

or



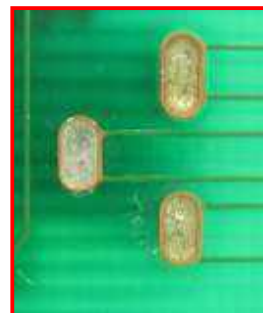
When viewed from the rear side,
are the through-holes filled with
solder without clearance?

[Judgment example]

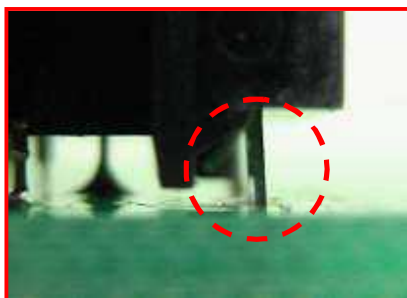
Pass product



or

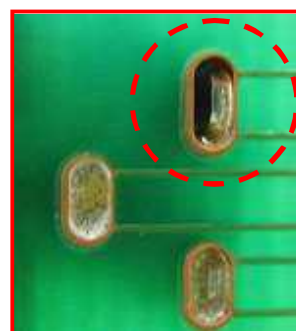


Fail product



Fillets are not formed

&



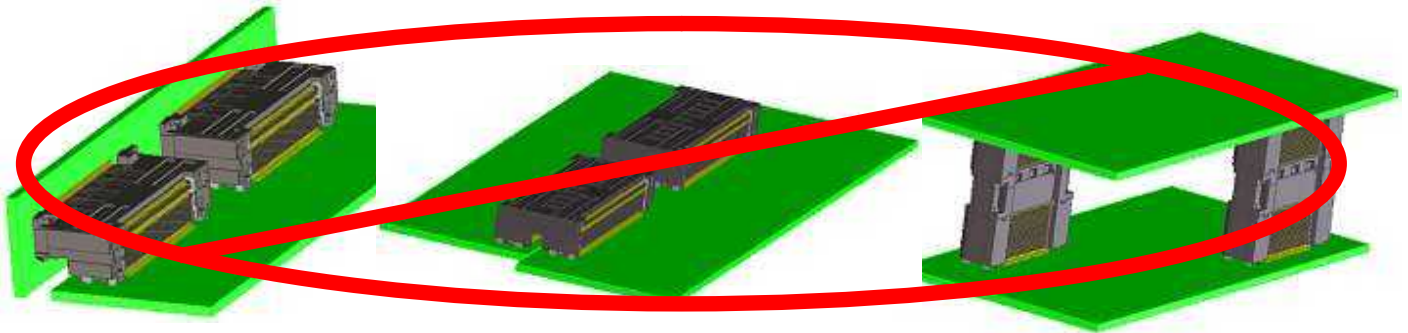
Not filled with solder

3-7 Mounting of Multiple Connectors

Note that multiple connectors of the FX18 Series cannot be mounted on one board.

Permitted board designs are shown in the next section.

<Not allowed>



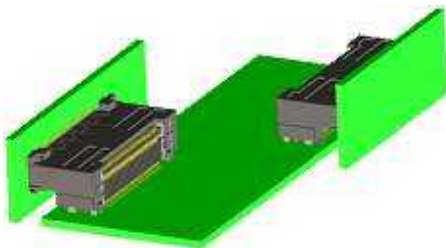
Vertical connection type

Coplanar connection type

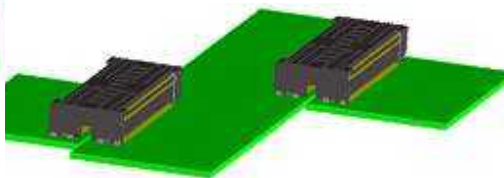
Stacking connection type

■ Two or more connectors are used on one board

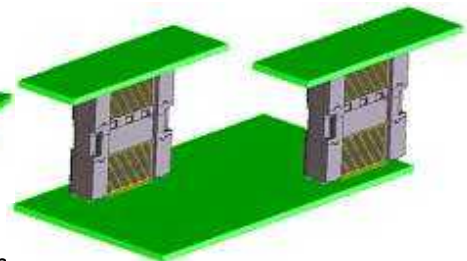
<Permitted>



Vertical connection type

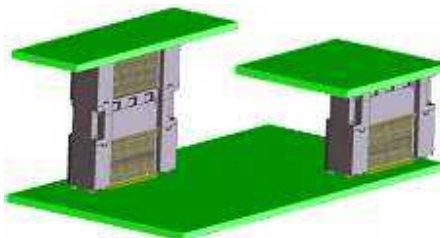


Coplanar connection type



Stacking connection type

■ Boards are separated



Stacking connection type

■ Boards are separated (when stacking types with different heights are used)

3-8 Soldering Repair Procedure

If a soldering defect such as insufficient solder or solder bridge occurs when reflowing an FX18 Series connector, there are cases where it can be repaired. Its procedure is shown below as reference.

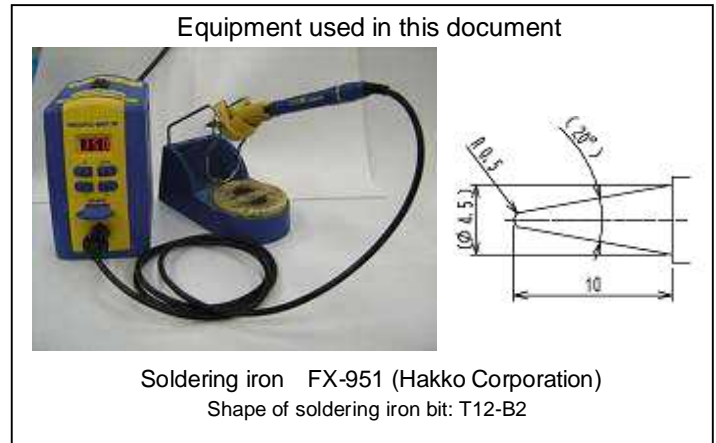
[Required equipment]

- Soldering iron (a product with a bit temperature adjustment function is recommended)
- Fixing jig of the repair target board

[Required consumables]

- Solder absorbent wire (solder wick wire)
- Lead-free wire solder ($\phi 0.2\text{mm}$)

[Work procedure]



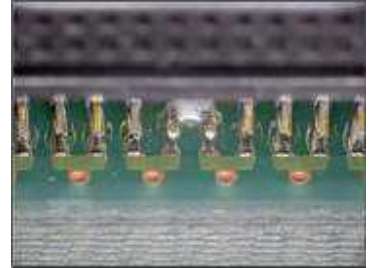
- (1) Fix the repair target board with a fixing jig to facilitate repair work.
For the inner contacts of the FX18-**P/S-0.8SH, the leads of the contacts are placed in a recessed position.
Therefore, fixing the board with about 45 degrees tilted makes repair work easier.



- (2) Perform repair work. For the detailed work method, follow the steps in the subsequent sections.

[When a bridge is formed <when the volume of solder is large>]
If a bridge is formed between adjacent leads due to excess solder,
use a commercially available solder absorbent wire (solder wick wire).

[Detailed work procedure]



(1) Place a solder absorbent wire on the bridged portion.



(2) Place the soldering iron on the solder absorbent wire lightly and

(3) Slide the iron bit and the absorbent wire toward you at the same time promptly
while absorbing excess solder.



(4) Repair work is completed.

Caution!

Take care not to cause thermal deformation of the housing and deformation of leads.

After repair work is completed, check that sufficient soldering fillets are formed.

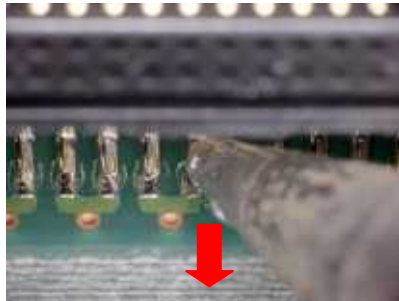
For the operating condition and iron bit shape, make an adjustment in accordance with the situation.

(Reference work condition) Iron bit temperature: 350 °C, Iron bit contact time: 3 seconds

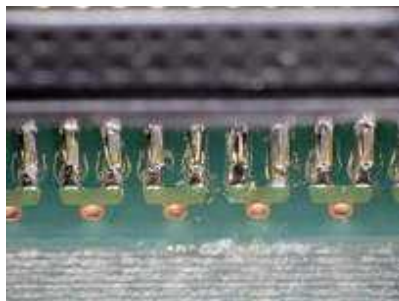
[When a bridge is formed <when the volume of solder is small>]

If excess solder is small, there are cases where the bridge can be removed without using a solder absorbent wire.

[Detailed work procedure]



- (1) Place the iron bit directly on the bridged portion.
- (2) Slide the iron bit toward you promptly.



- (3) Repair work is completed.

Caution!

Take care not to cause thermal deformation of the housing and deformation of leads.

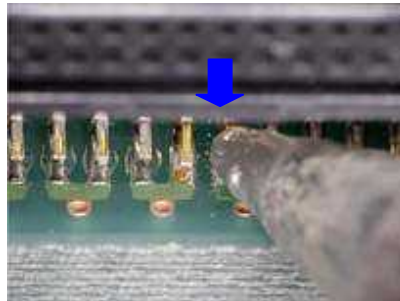
After repair work is completed, check that sufficient soldering fillets are formed.

For the operating condition and iron bit shape, make an adjustment in accordance with the situation.

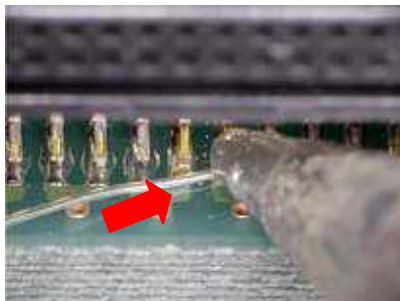
(Reference work condition) Iron bit temperature: 350 °C, Iron bit contact time: 2 seconds

[Insufficient solder]

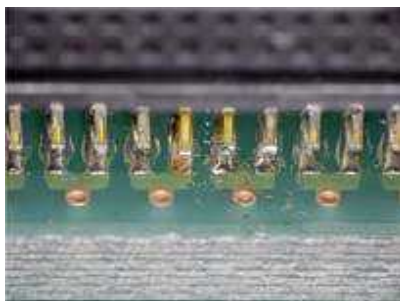
When there is a place where no solder is applied partially as shown in the photograph at right, use commercially available lead-free wire solder (ϕ 0.2mm).

**[Detailed work procedure]**

- (1) Place the iron bit directly between the lead where no solder is applied and the board pad.
(The work target in the photo is the place at right where no solder is applied.)



- (2) Add an appropriate amount of wire solder by pouring it.



- (3) Repair work is completed.

Caution!

Take care not to cause thermal deformation of the housing and deformation of leads.

After repair work is completed, check that sufficient soldering fillets are formed.

For the operating condition and iron bit shape, make an adjustment in accordance with the situation.

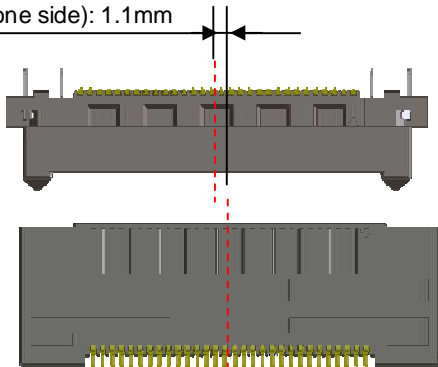
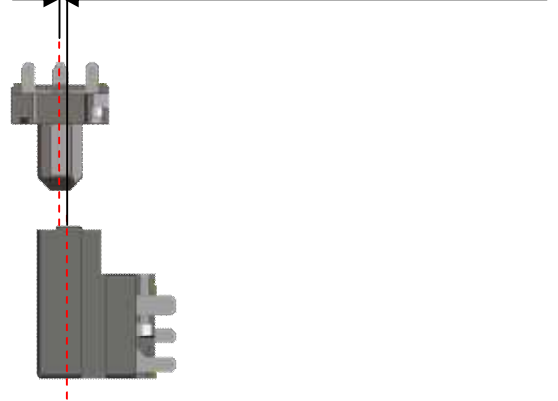
(Reference work condition) Iron bit temperature: 350 °C, Iron bit contact time: 3 seconds

(including the time required for pouring solder)

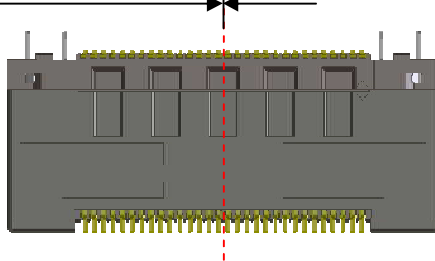
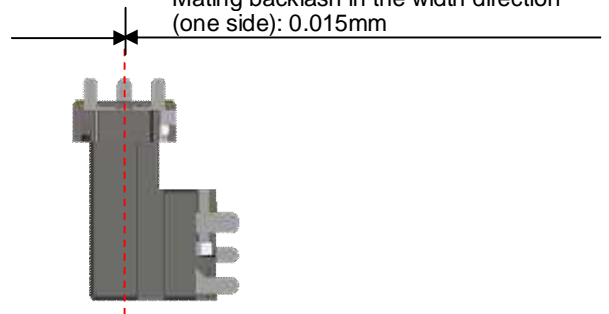
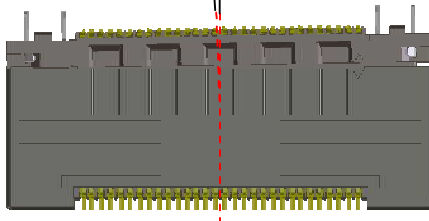
4. Requirements

4-1 Requirements on Mating

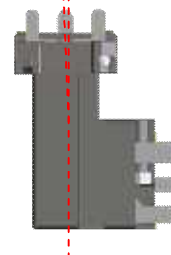
(1) Requirements on self-alignment range (in the worst case)

Longitudinal direction
self-alignment range (one side): 1.1mmWidth direction
self-alignment range (one side): 0.7mm

(2) Requirements on mating status (in the worst case)

Mating backlash in the longitudinal
direction (one side): 0.015mmMating backlash in the width direction
(one side): 0.015mmMating tilt in the longitudinal direction:
1 degree max.

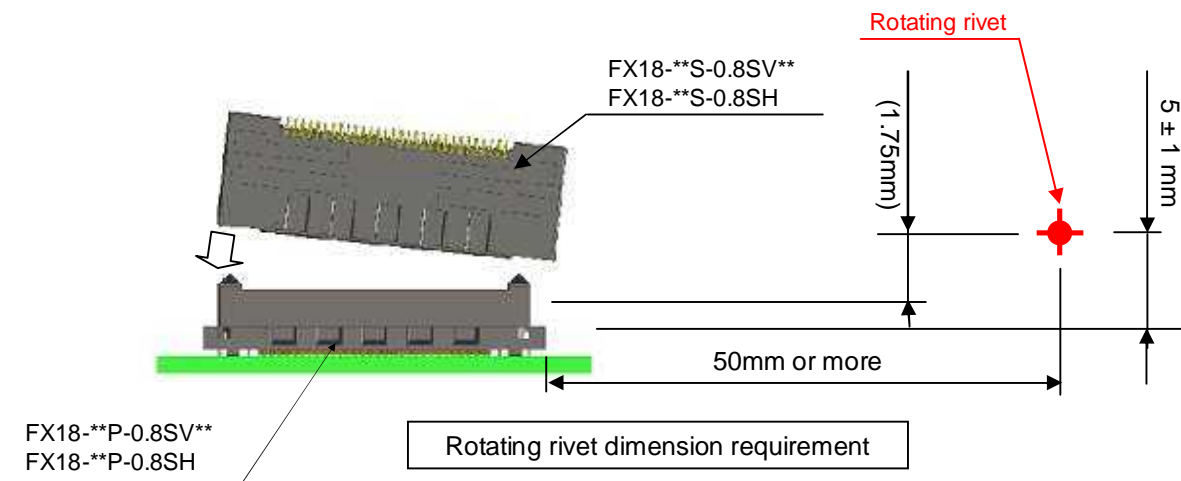
Mating clearance: 1mm max.

Mating tilt in the longitudinal direction:
0.5 degrees max.

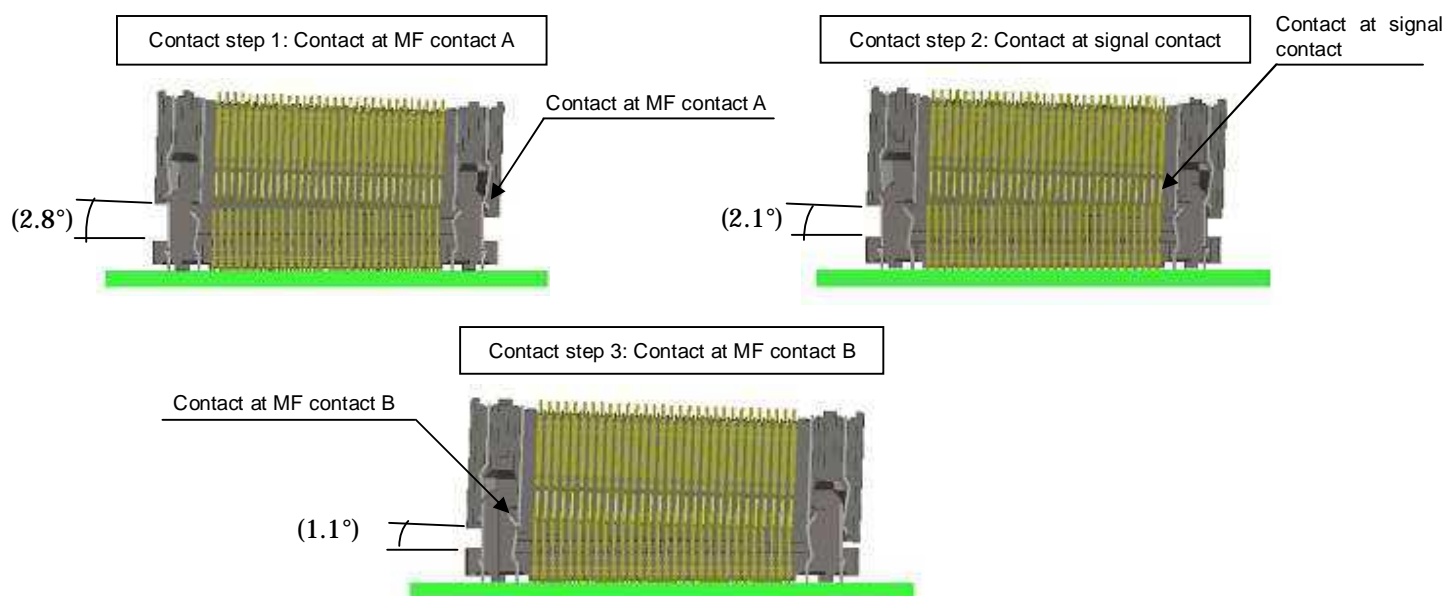
4-2 Requirements on Rotating Insertion and Withdrawal (TADC4-210630)

When using a connector in rotating mating, design the housing while taking the following into account.

- (1) Set the location of the mating rivet within the following dimensions.



- (2) For rotating insertion and withdrawal in this requirement, the contact timing in three-step sequence is as follows:



- (3) Float either or both of the connectors to prevent excess wrenching strength from being applied when mating connectors or design the housing structure that ensures smooth mating by allowing a play in the mating rivet.
- (4) Set the final mating state by referencing "Requirements on Mating."
- (5) The board and housing cannot be supported only with connectors.
It is necessary to take measures to fix the housing on the housing side (complete lock structure, etc.).

4-3 Recommended Spacer Dimensions (Stacking Connection Type)

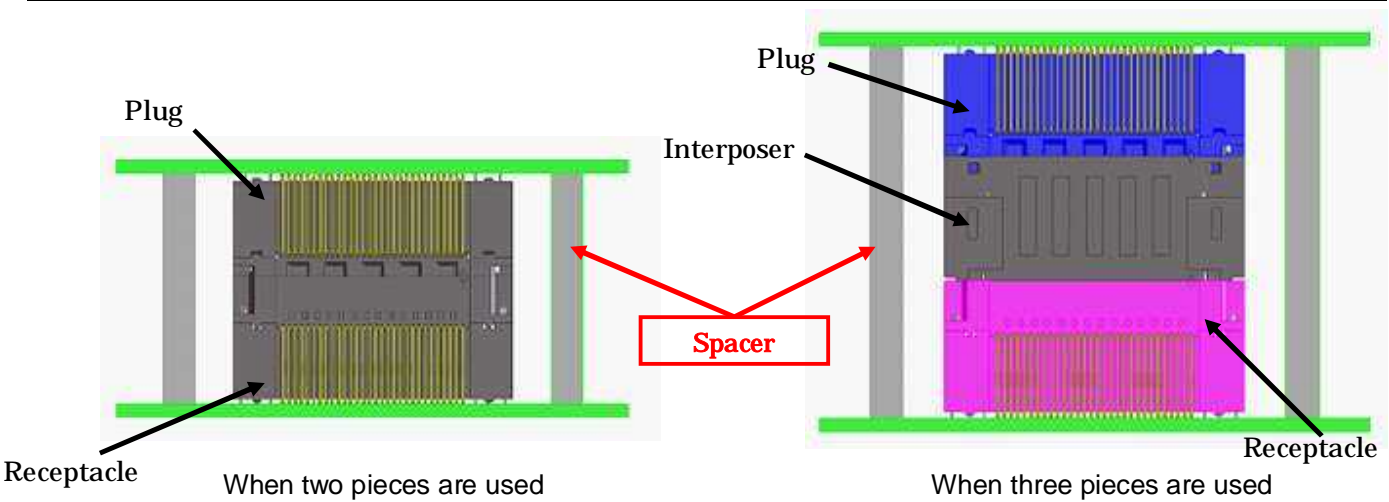
Be sure to use a spacer between boards using the FX18 Series stacking type connectors so that load is not applied to the solder joint parts and connectors.

[When two pieces are used]

| Stacking height | Plug/receptacle product name | Recommended spacer height dimensions |
|-----------------|-------------------------------------|--------------------------------------|
| 10 mm | FX18-**-P-0.8SV/FX18-**-S-0.8SV10 | 10.3 ± 0.127 mm |
| 15 mm | FX18-**-P-0.8SV/FX18-**-S-0.8SV15 | 15 ± 0.127 mm |
| 20 mm | FX18-**-P-0.8SV/FX18-**-S-0.8SV20 | 20 ± 0.127 mm |
| 20 mm | FX18-**-P-0.8SV10/FX18-**-S-0.8SV10 | 20.3 ± 0.127 mm |
| 25 mm | FX18-**-P-0.8SV10/FX18-**-S-0.8SV15 | 25 ± 0.127 mm |
| 30 mm | FX18-**-P-0.8SV10/FX18-**-S-0.8SV20 | 30 ± 0.127 mm |

[When three pieces are used]

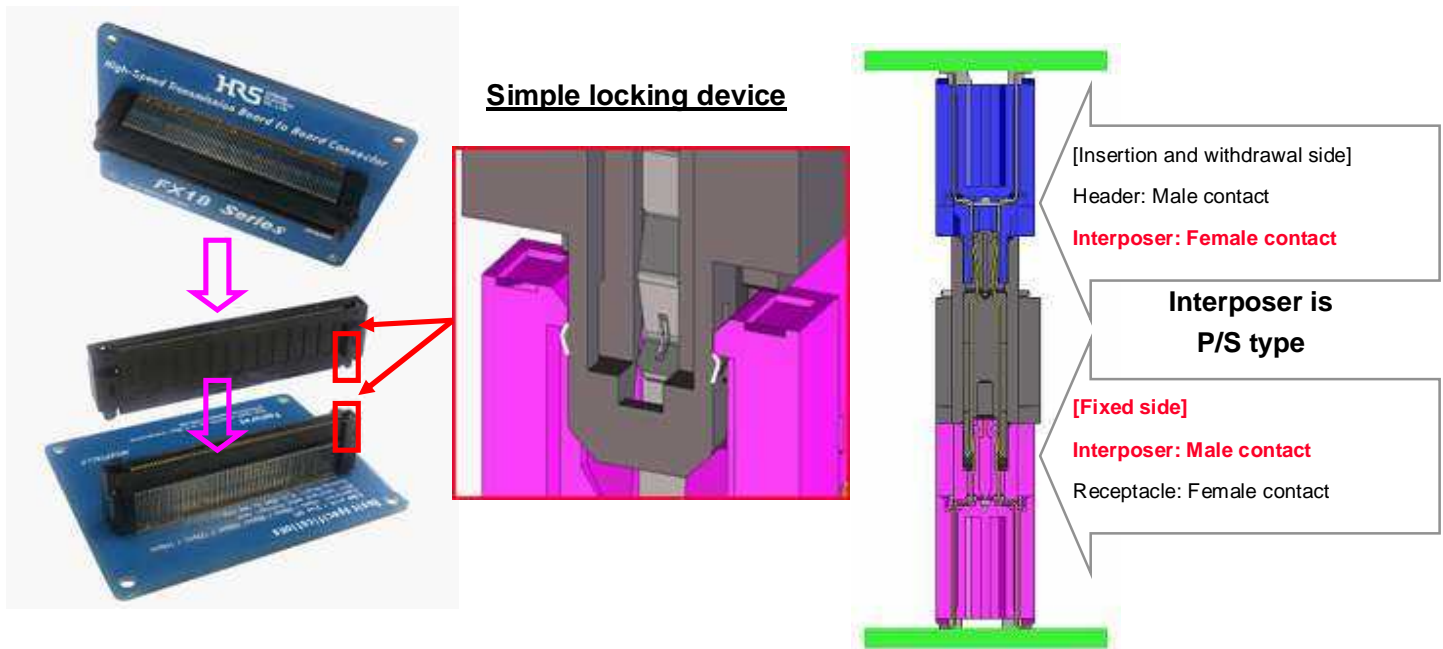
| Stacking height | plug | Interposer | Receptacle | Recommended spacer height dimensions |
|-----------------|-------------------|-------------------|-------------------|--------------------------------------|
| 25 mm | FX18-**-P-0.8SV | FX18-**-PS-0.8H15 | FX18-**-S-0.8SV10 | 25.3 ± 0.127 mm |
| 30 mm | FX18-**-P-0.8SV | FX18-**-PS-0.8H15 | FX18-**-S-0.8SV15 | 30 ± 0.127 mm |
| 35 mm | FX18-**-P-0.8SV | FX18-**-PS-0.8H15 | FX18-**-S-0.8SV20 | 35 ± 0.127 mm |
| 35 mm | FX18-**-P-0.8SV10 | FX18-**-PS-0.8H15 | FX18-**-S-0.8SV10 | 35.3 ± 0.127 mm |
| 40 mm | FX18-**-P-0.8SV10 | FX18-**-PS-0.8H15 | FX18-**-S-0.8SV15 | 40 ± 0.127 mm |
| 45mm | FX18-**-P-0.8SV10 | FX18-**-PS-0.8H15 | FX18-**-S-0.8SV20 | 45 ± 0.127 mm |



5. Caution

5-1 Use of Interposers

An interposer is equipped with a simple locking device to improve the mating strength. It is designed to be always left on the receptacle side when the header is removed away.



Before using the interposer, read the following caution.

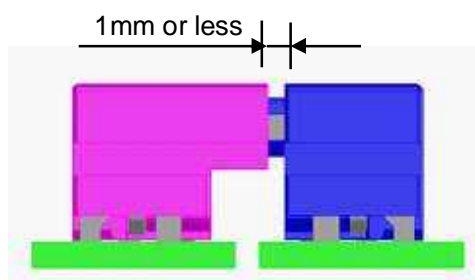
- (1) Because the mating fixed side is equipped with a simple lock, it is not removed easily.
The number of times of insertion and withdrawal should not exceed five times.
- (2) When mating connectors, be sure to mate the mating fixed side first, and then mate the insertion and withdrawal side.
- (3) Only for the insertion and withdrawal side, the effective mating length of each contact is 2.5mm for an MF contact A, 2mm for a signal contact, and 1.5mm for an MF contact B.
- (4) For the allowable clearance between the mated pair, zero on the mating fixed side and 1mm or less only on the insertion and withdrawal side.

5-2 Allowable Clearance between the Mated Pair

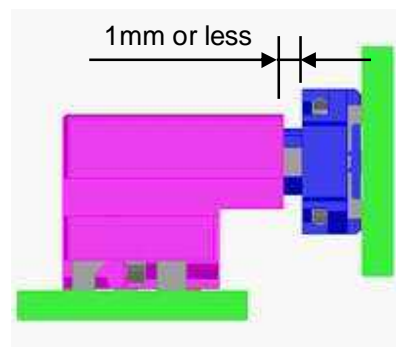
The effective mating length of each contact is 2.5mm for an MF contact A, 2mm for a signal contact, and 1.5mm for an MF contact B. (*1)

Make certain that the clearance between the header and the receptacle at the time of mating does not exceed 1mm.

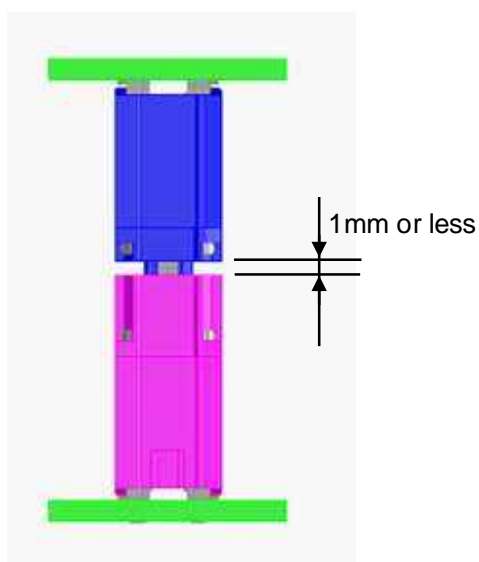
[Coplanar connection type]



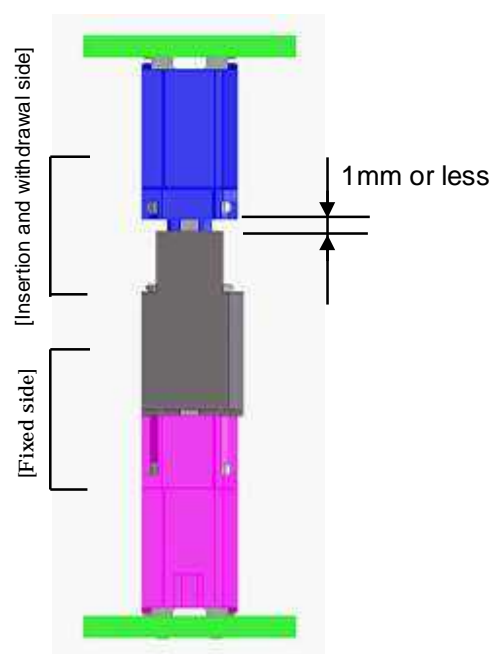
[Vertical connection type]



[Stacking connection type (two pieces)]



[Stacking connection type (three pieces)]



- (* 1) Because the effective mating length is set to 1.5mm for an MF contact A, 1mm for a signal contact, and 1mm for an MF contact B only on the interposer fixed side, there is no allowable clearance between the mated pair on the mating fixed side.

FX18 Series Design Guide Line

| | |
|----------------|---------------|
| Version number | 0.1 |
| Prepared by | PCC Asao |
| Reviewed by | PCC Yamaguchi |
| Approved by | PCC Okawa |

Revision history

| Revision | Date | Handled by | Comments |
|----------|-------------|------------|---------------|
| 0.1 | Oct 7, 2014 | PCC Asao | First edition |
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