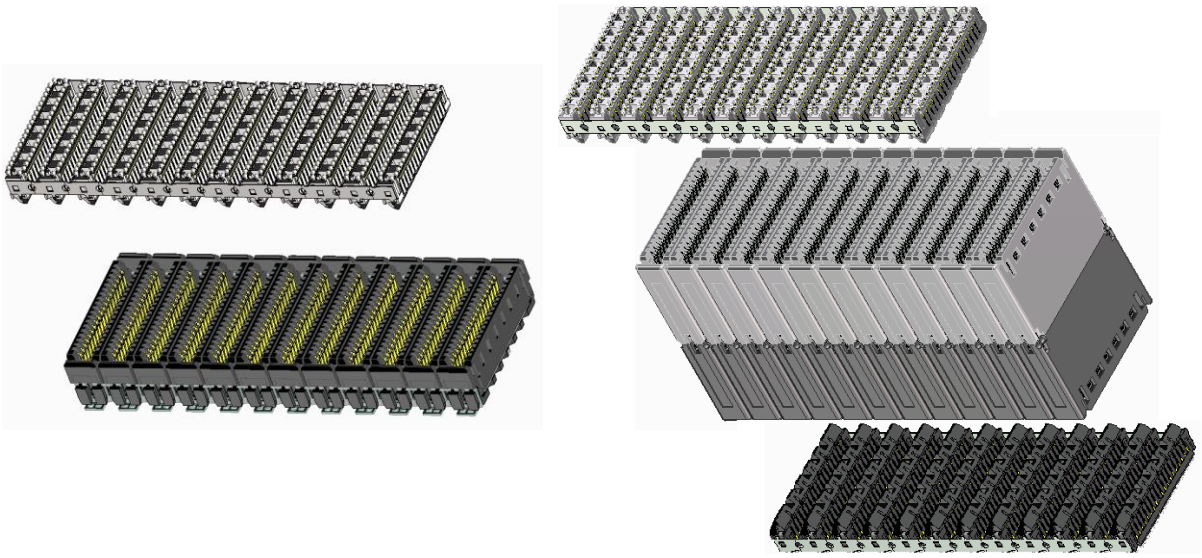
Hirose *IT8* ™

Connector System

Design Notes



	Initial Release	Last Update
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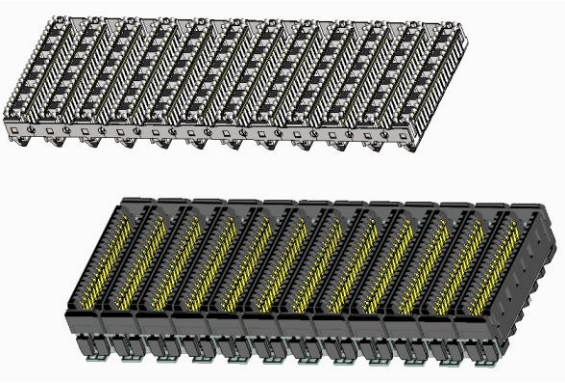
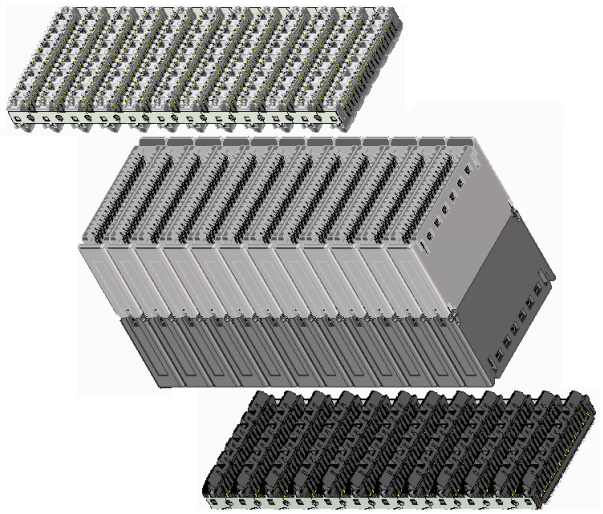
Revision No.	***Description (Major changes)***	***Date***
0.0	Initial release	Feb. 25th, 2016
0.1	Mating force spec. change (page 15)	Aug. 9th, 2018
1.0	IT8M → IT8MB Added "Typical Value" of LLCR (page 14) Added "Interposer Removal by Tool" (page 69)	June 22th, 2021
2.0	Revised weight of interposers and plugs(page 8～9)	Sept. 13th, 2021

Section 1 Introduction

*The Hirose **IT8** connector system is available in two configurations to accommodate different stacking heights: Three-piece type and two-piece type. A two-piece type is composed of a solder process friendly BGA plug and receptacle. The three-piece type has two plugs assembled onto PWBs, and a separate, configurable interposer completes the connections between circuit boards. Position counts of 120, 192and 288, with lead-free alloy, are available as standard variations. Please refer to individual product drawings and Assembly note in detail.*



Stack Height 10mm ~13mm
Two-piece type



Stack Height 14mm ~46mm
Three-piece type

Figure 1-1 Overview of IT8 Series

This section of the Design Note discusses the purpose, scope, and application and interpretation.

1.1 Purpose

This technical bulletin is intended to provide basic information and product features of the Hirose ***IT8*** BGA connector system. By providing this information, Hirose believes it can help its customers to speed product development, improve quality and reliability, and limit overall system costs.

1.2 Scope

This guideline provides information useful for applications using the ***IT8*** BGA connector system. It provides information pertaining to:

a) General Information
b) Operating Characteristics
c) Signal Integrity
d) PWB design Information
e) Assembly process

This document will be updated by Hirose as required to reflect current technologies and manufacturing capabilities. Please refer to individual product drawings and Assembly note in detail.

1.3 Application and Interpretation

This technical bulletin is intended to offer only general guidance and design concepts to customers. It does not limit customer designs nor guarantee results under all situations. Development of actual designs is the responsibility of each customer. Customers should consult with Hirose regarding their specific application, when, or if, any questions arise relating to these guidelines. Use of this technical bulletin is at customer's sole risk. This bulletin is provided *"AS IS"* and without warranty of any kind and Hirose *EXPRESSLY DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HIROSE DOES NOT WARRANT THAT THE GUIDELINES CONTAINED IN THIS BULLETIN WILL MEET ANY CUSTOMER'S REQUIREMENTS. FURTHERMORE, HIROSE DOES NOT WARRANT OR MAKE ANY REPRESENTATIONS REGARDING THE USE OR THE RESULTS OF THE USE OF INFORMATION CONTAINED IN THIS BULLETIN IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. UNDER NO CIRCUMSTANCE SHALL HIROSE OR ITS DIRECTORS, OFFICERS, EMPLOYEES OR AGENTS BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING DAMAGES FOR LOSS OF BUSINESS, LOSS OF PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION AND THE LIKE) ARISING OUT OF THE USE OF THE INFORMATION CONTAINED IN THIS BULLETIN.*

Section 2 General Information

*Hirose's **IT8** connector system is designed to provide modular high-speed differential and single-ended between two parallel boards. The interconnection to the PWBs utilizes process-friendly Ball Grid Array plugs and receptacles, while the stacking height of 10 to 46mm is set by an interposer or receptacle with quasi-coaxial structure that is added at the system level.*

*The **IT8** connector system has two types of combinations. One consists of a plug and a receptacle for stacking height from 10mm to 13mm, and the other is a combination of two plugs and an interposer for stacking height from 14mm to 46mm. The plugs and receptacles have low profiles and open bodies. The BGA balls are mounted on compliant pins and are set on a grid of 1.0mm x 2.5mm pitch. The plugs and receptacles are available in lead-free configurations, and can be used in no-clean or water-wash assembly processes.*

The interposer is an assembly consisting of individual units, each carrying 24 signal and 14 ground connections. The interposer is mated to the mounting plug and locked in with mechanical latches to create highly reliable and stable mechanical and electrical connections.

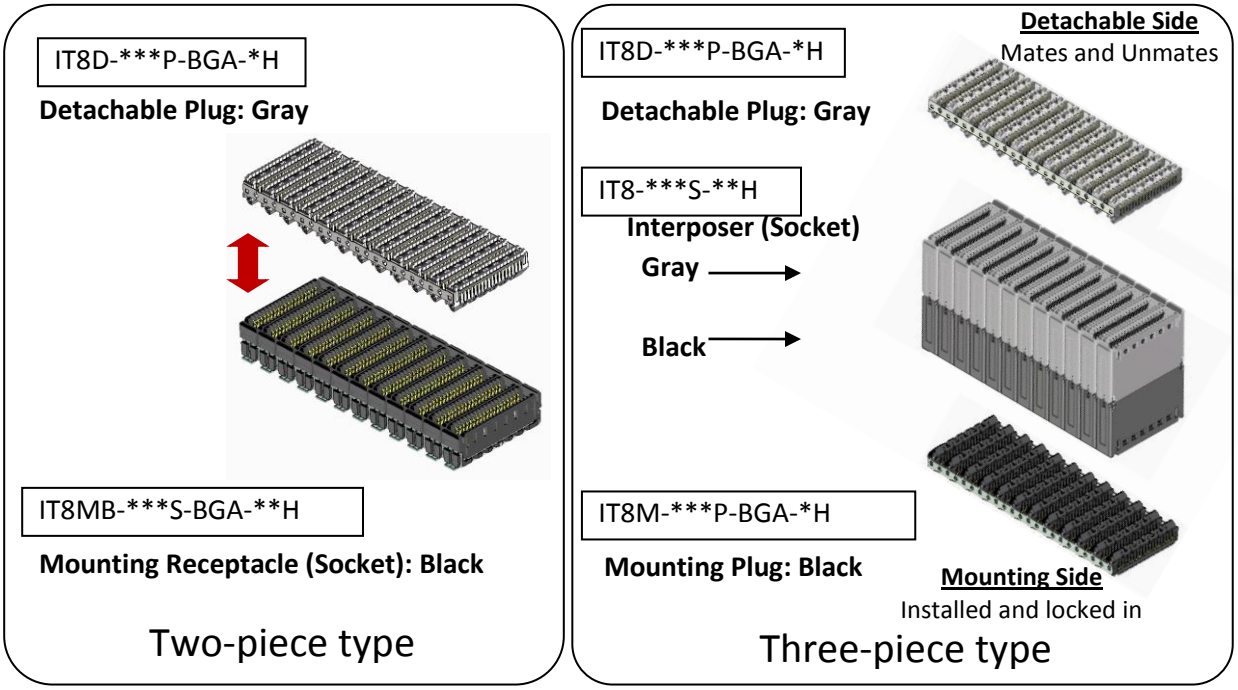


Figure 2-1 General Information

For the three-piece combination, the gray side of the interposer must be mated with the gray detachable plug, and the black side must be mounted on the black mounting plug as shown in the drawing in the upper Figure. Otherwise, signal pin-out will change and cause a system error.

This section of the Design Note discusses part number designation, stacking height variations, component weights, manufacturing lot number, and general dimensions.

2.1 Part Number Designation / Stacking Height Variations

2.1.1 Part Number Designation

Table 2-1 Part Number Designation

Plug Mounting Side

IT8M - xxx P - BGA - x H
(1)(2) (3) (4) (5) (6)

Interposer

IT8 - xxx S - xxH
(1) (3) (4) (6)

Plug Detachable Side

IT8D - xxx P - BGA - x H
(1)(2) (3) (4) (5) (6)

Mounting Receptacle

IT8MB - xxx S - BGA - xx H
(1)(2) (3) (4) (5) (6)

(1) Series name: *IT8*	
	No Further Designation
(2) Connector Type	
	IT8M-xxxP-BGA: Mounting Plug IT8D-xxxP-BGA : Detachable Plug IT8MB-xxxS-BGA : Mounting Receptacle
(3) Signal Contact Positions	
	120, 192, 288
(4) Connector Gender	
	S : Female (Receptacle or Interposer) P : Male (Plug)
(5) BGA: Ball Grid Array	
	No Further Designation
(6) Stacking Height (mm)	
	Mounting Plug: 0, 1 Detachable Plug : 0, 1 Mounting Receptacle: 10, 12 Interposer : 14, 18, 22, 25, 28, 32, 35, 38, 41, 44, Stacking Height : Calculated based on following formula Three piece type ;(6)Interposer+(6)Mounting Plug+(6)Detachable Plug Two piece type ;(6)Mounting Receptacle+(6) Detachable Plug

2.1.2 Stacking Height Variations

Two-piece type (From 10mm to 13mm)

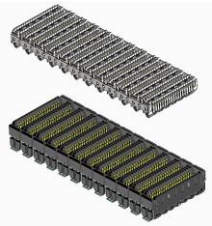


Table 2-2 Two-piece Type Product Family

Stacking Height(mm)	Detachable Plug (IT8D)	Receptacle (IT8M-***S)
10	IT8D-***P-BGA-0H	IT8MB-***S-BGA-10H
11	IT8D-***P-BGA-1H	
12	IT8D-***P-BGA-0H	IT8MB-***S-BGA-12H
13	IT8D-***P-BGA-1H	

Three-piece type (From 14mm to 46mm)

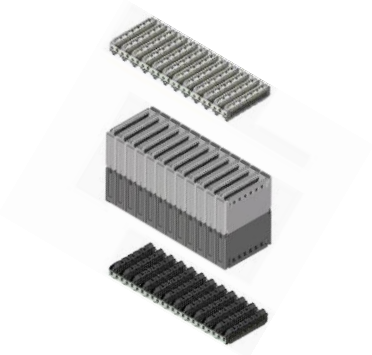


Table 2-3 Three-piece Type Product Family

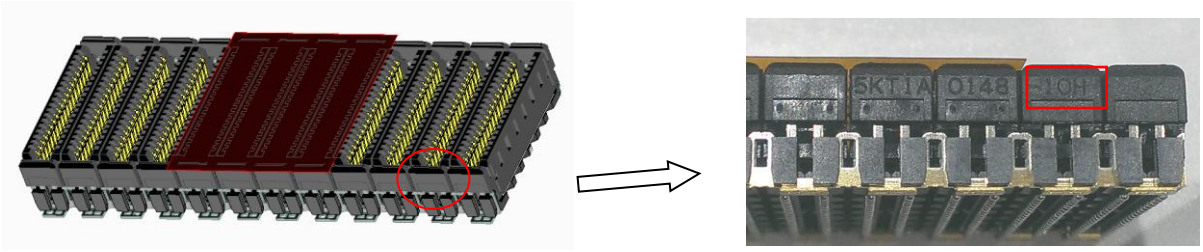
Stacking Height (mm)	Detachable Plug (IT8D)	Interposer (IT8-***S)	Mounting Plug (IT8M)
14	IT8D-***P-BGA-0H	IT8-***S-14H	IT8M-***P-BGA-0H
15	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
16	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
18	IT8D-***P-BGA-0H	IT8-***S-18H	IT8M-***P-BGA-0H
19	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
20	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
22	IT8D-***P-BGA-0H	IT8-***S-22H	IT8M-***P-BGA-0H
23	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
24	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H

Stacking Height (mm)	Detachable Plug (IT8D)	Interposer (IT8-***S)	Mounting Plug (IT8M)
25	IT8D-***P-BGA-0H	IT8-***S-25H	IT8M-***P-BGA-0H
26	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
27	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
28	IT8D-***P-BGA-0H	IT8-***S-28H	IT8M-***P-BGA-0H
29	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
30	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
32	IT8D-***P-BGA-0H	IT8-***S-32H	IT8M-***P-BGA-0H
33	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
34	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
35	IT8D-***P-BGA-0H	IT8-***S-35H	IT8M-***P-BGA-0H
36	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
37	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
38	IT8D-***P-BGA-0H	IT8-***S-38H	IT8M-***P-BGA-0H
39	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
40	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
41	IT8D-***P-BGA-0H	IT8-***S-41H	IT8M-***P-BGA-0H
42	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
43	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H
44	IT8D-***P-BGA-0H	IT8-***S-44H	IT8M-***P-BGA-0H
45	IT8D-***P-BGA-0H		IT8M-***P-BGA-1H
46	IT8D-***P-BGA-1H		IT8M-***P-BGA-1H

2.2 Component Weights

2.2.1 Mounting Receptacle with/without tape

ex. IT8MB-288S-BGA-10H



10H or 12H; Receptacle height

Table 2-4 Component Weight of Receptacles

Stacking Height(mm)	Contact Positions	Part Number	Weight (g)	
			With tape	w/o tape
10	120 (120 sig/70 gnd)	IT8MB-120S-BGA-10H	5.9	5.8
	192 (192 sig/112 gnd)	IT8MB-192S-BGA-10H	9.5	9.4
	288 (288 sig/168 gnd)	IT8MB-288S-BGA-10H	14.2	14.1
12	120 (120 sig/70 gnd)	IT8MB-120S-BGA-12H	7.5	7.4
	192 (192 sig/112 gnd)	IT8MB-192S-BGA-12H	11.9	11.8
	288 (288 sig/168 gnd)	IT8MB-288S-BGA-12H	17.9	17.8

2.2.2 Interposer

ex. IT8-288S-35H

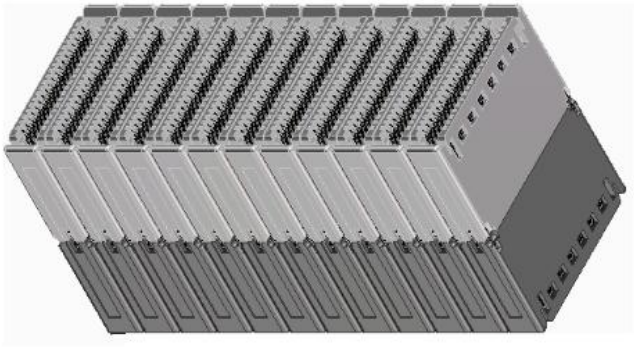
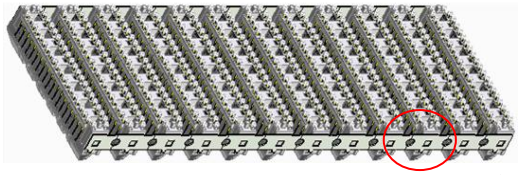


Table 2-5 Component Weight of Interposers

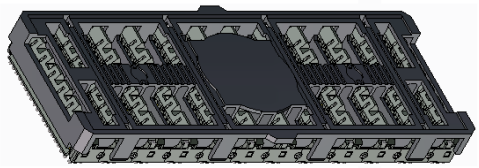
Stacking Height (mm)	Signal Contact Positions					
	120		192		288	
	Part Number	Weight(g)	Part Number	Weight(g)	Part Number	Weight(g)
14	IT8-120S-14H	8.3	IT8-192S-14H	13.3	IT8-288S-14H	19.8
18	IT8-120S-18H	13.4	IT8-192S-18H	21.4	IT8-288S-18H	32.0
22	IT8-120S-22H	17.9	IT8-192S-22H	28.7	IT8-288S-22H	43.0
25	IT8-120S-25H	20.3	IT8-192S-25H	32.5	IT8-288S-25H	50.6
28	IT8-120S-28H	25.7	IT8-192S-28H	41.1	IT8-288S-28H	61.7
32	IT8-120S-32H	29.0	IT8-192S-32H	46.4	IT8-288S-32H	69.6
35	IT8-120S-35H	35.3	IT8-192S-35H	56.5	IT8-288S-35H	84.7
38	IT8-120S-38H	37.0	IT8-192S-38H	59.2	IT8-288S-38H	88.8
41	IT8-120S-41H	41.0	IT8-192S-41H	65.7	IT8-288S-41H	98.5
44	IT8-120S-44H	45.1	IT8-192S-44H	72.1	IT8-288S-44H	108.2

2.2.3 Plug

***ex. IT8D-288P-BGA-0H* (Detachable plug)**

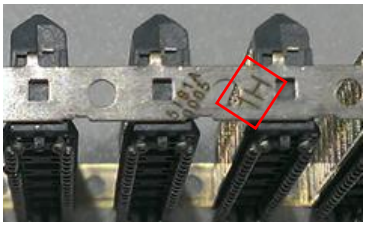


Plug with Cap



The cap should be attached during both of soldering and repairing process to protect the mating portion from contamination with solder/flux.

ex. IT8M-288P-BGA-0H (Mounting plug)



0H or 1H; Plug height indication

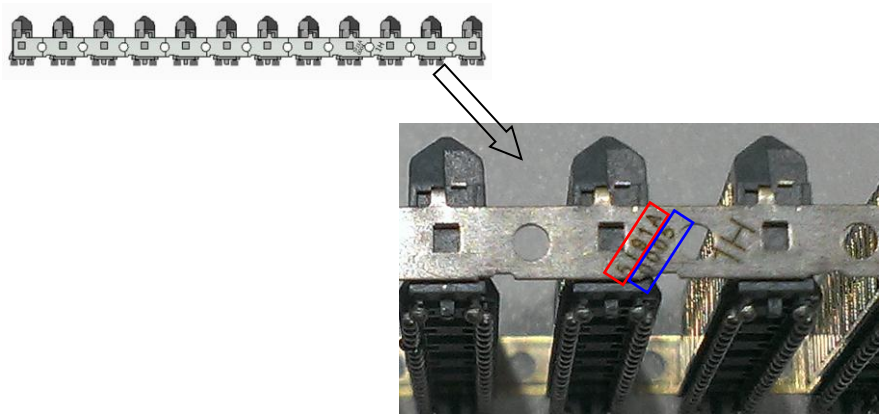
Table 2-6 Component Weight of Plugs

Stacking Height(mm)	Contact Position	Part Number		Weight (g)	
		Detachable	Mounting	With cap	w/o cap
Interposer or receptacle height + 0mm	120 120 sig/70 gnd	IT8D-120P-BGA-0H	IT8M-120P-BGA-0H	4.3	3.3
	192 192 sig/112 gnd	IT8D-192P-BGA-0H	IT8M-192P-BGA-0H	6.9	5.3
	288 288 sig/168 gnd	IT8D-288P-BGA-0H	IT8M-288P-BGA-0H	10.1	8.0
Interposer or receptacle height + 1mm	120 120 sig/70 gnd	IT8D-120P-BGA-1H	IT8M-120P-BGA-1H	4.5	3.5
	192 192 sig/112 gnd	IT8D-192P-BGA-1H	IT8M-192P-BGA-1H	7.2	5.6
	288 288 sig/168 gnd	IT8D-288P-BGA-1H	IT8M-288P-BGA-1H	10.5	8.4

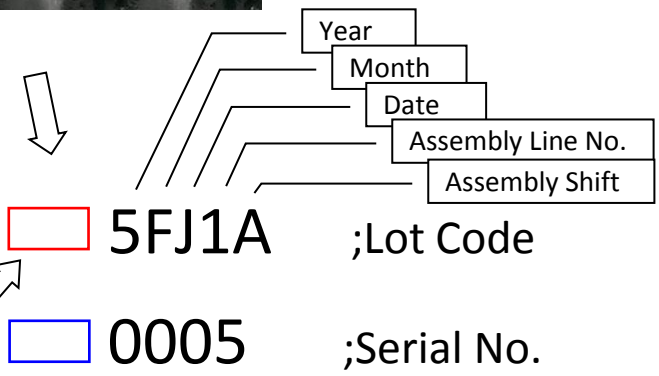
2.3 Manufacturing Lot Number and Serial Number

2.3.1 Manufacturing Lot number and Serial Number

Example: Plug (288pos)



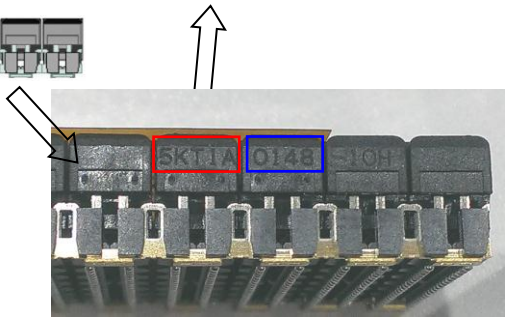
Example: Interposer (288pos)



Serial number counts up from 1 for each lot.

Interposer does not have the indication of the serial number.

Example: Receptacle (288pos)



* Lot number indication may subject to change.

Figure 2-2 Indication

Table 2-7 Manufacturing Lot number

Year						Month		Date						Shift	
Year	Code	Year	Code	Year	Code	Month	Code	Date	Code	Date	Code	Date	Code	Shift	Code
2010	0	2020	D	2030	P	January	A	1	1	11	B	21	M	Daytime	A
2011	1	2021	E	2031	Q	February	B	2	2	12	C	22	N	Nighttime	B
2012	2	2022	F	2032	R	March	C	3	3	13	D	23	P		
2013	3	2023	G	2033	S	April	D	4	4	14	E	24	Q		
2014	4	2024	H	2034	T	May	E	5	5	15	F	25	R		
2015	5	2025	J	2035	U	June	F	6	6	16	G	26	S		
2016	6	2026	K	2036	V	July	G	7	7	17	H	27	T		
2017	A	2027	L	2037	W	August	H	8	8	18	J	28	U		
2018	B	2028	M	2038	X	September	I	9	9	19	K	29	V		
2019	C	2029	N	2039	Y	October	J	10	A	20	L	30	W		
						November	K					31	X		
						December	L								

2.4 General Dimensions

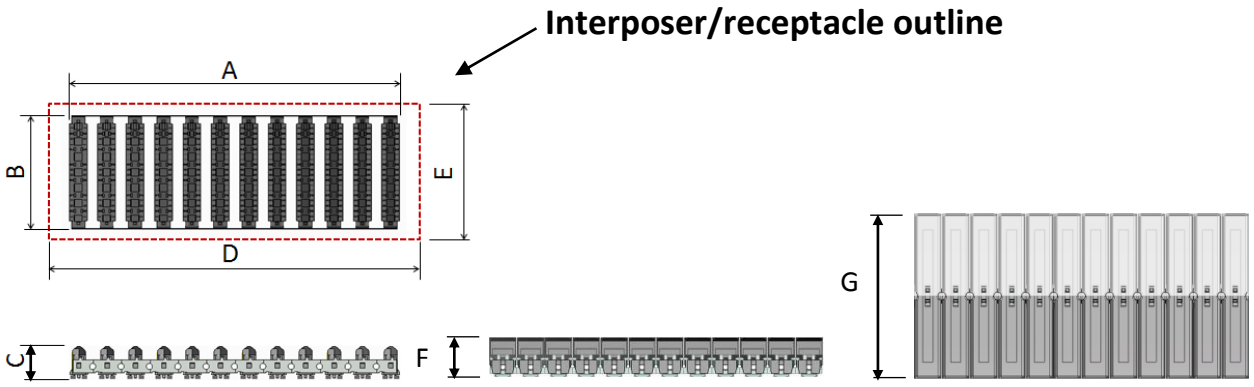


Table 2-8 General Dimensions

		Unit	Contact Positions		
		pos	120	192	288
	No. of signal contact	pos	120	192	288
	No. of ground contact	pos	70	112	168
A	Plug length	mm	25.5	42.0	64.0
B	Plug width	mm	22.0	22.0	22.0
C	Plug height(including solder ball)	mm	6.49	6.49	6.49
D	Interposer/Receptacle outline length	mm	27.3	43.8	65.8
E	Interposer/Receptacle outline width	mm	25.6	25.6	25.6
F	Receptacle height	-	See Section 2.1.2		
G	Interposer height	-	See Section 2.1.2		

Note: Please refer to individual product drawings in detail.

Section 3 Operating Characteristics

This section of the Design Note discusses material, electrical, mechanical, and environmental characteristics. It also discusses BGA reliability testing.

3.1 Material

Numbering of component is same as customer drawing.

3.1.1 Receptacle

Table 3-1 Receptacle Material and Finish

No.	Component	Material	Finish & Remarks
1	Housing	PPS	Black , UL 94V-0
2	Blade	LCP	Black , UL 94V-0
3	Contact	Copper Alloy	Contact Area : Gold (0.76µm min) over Nickel (1.27µm min) Other : Nickel (1.27µm min)
4	Ground Shield	Stainless Steel	-
5	Ground Shield	Stainless Steel	-
6	Retention Peg	Copper Alloy	Gold (0.03µm min) over Nickel (1.0µm min)
7	Solder Ball	Tin (Pb-Free)	Sn(96.5)-Ag(3)-Cu(0.5)
8	Pick Up Tape	Heat Resistant Tape	Polyamide
9	Tray	HIPS	Black

3.1.2 Interposer

Table 3-2 Interposer Material and Finish

No.	Component	Material	Finish & Remarks
1	Housing(Detachable Side)	PPS	Gray , UL 94V-0
2	Housing(Mounting Side)	PPS	Black , UL 94V-0
3	Guide Plate	Stainless Steel	-
4	Blade	LCP	Black, UL 94V-0
5	Contact	Copper Alloy	Contact Area : Gold (0.76µm min) over Nickel (1.27µm min) Other : Nickel (1.27µm min)
6	Ground Shield	Stainless Steel	–
7	Ground Shield	Stainless Steel	–
8	Tray	HIPS	Not shown in the customer drawing

3.1.3 Plug

Table 3-3 Plug Material and Finish

No.	Component	Material	Finish & Remarks
1	Ground Shield	Copper Alloy	Nickel (1.27µm min)
2	Housing	LCP	Black or Gray , UL 94V-0
3	Contact	Copper Alloy	Contact Area : Gold (0.76µm min) over Nickel (1.27µm min) Other : Nickel (1.27µm min)
4	Solder Ball	Tin	Sn(96.5)-Ag(3)-Cu(0.5)
5	Pick Up Cap	PA-M	Black , UL94V-0
6	Tray	HIPS	–

3.2 Electrical

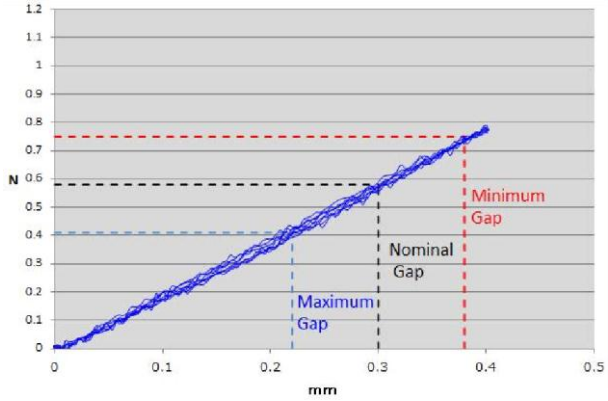
Table 3-4 Electrical Test Conditions and Requirements

Test	Test Condition	Requirement	Typical Value
Low Level Contact Resistance* (LLCR)	EIA-364-23	50mΩ max (*1) (Height:10 ~ 19mm) 60mΩ max (*1) (Height:20 ~ 29mm) 70mΩ max (*1) (Height:30 ~ 39mm) 80mΩ max (*1) (Height:40 ~ 46mm)	(n=5CN) Ex. 10H:27.85mΩ 27H:29.60mΩ 35H:35.45mΩ 46H:47.59mΩ
Insulation Resistance (IR)	EIA-364-21	1000MΩ min	(n=10) EX. 10H:5.00E+06MΩ
Dielectric Withstanding Voltage (DWV)	EIA-364-20 AC 150V for 60 seconds Different contacts than LLCR	No flashover or breakdown	(n=10) EX. 10H:Pass
Current Rating	EIA-364-70	30℃ temperature rise	-

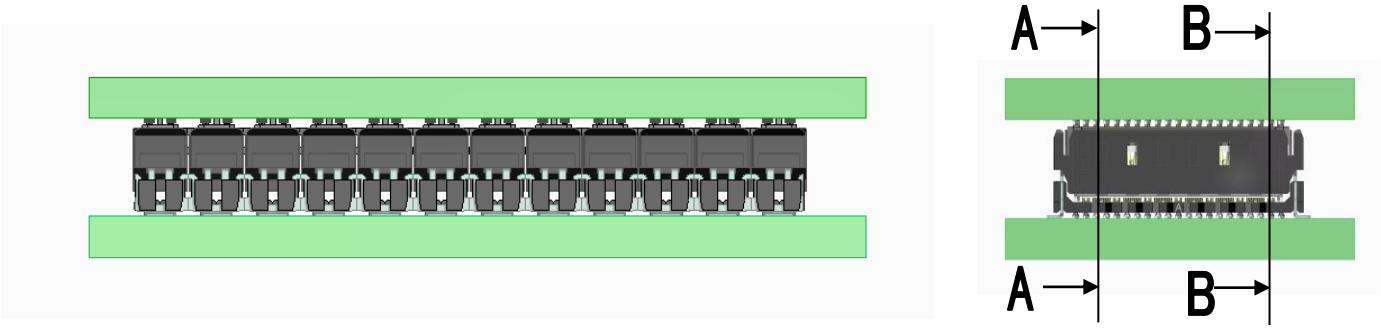
***** The value of contact resistance includes contact point and the bulk resistance.

3.3 Mechanical

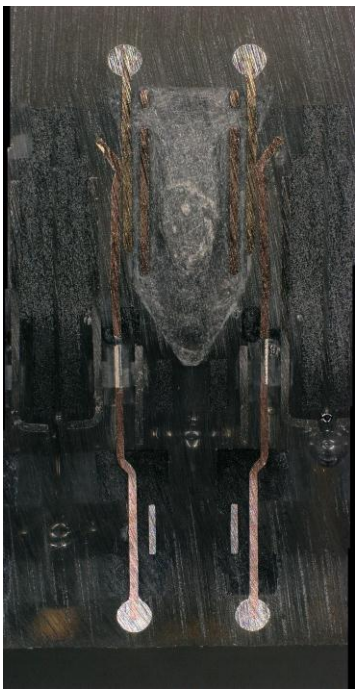
Table 3-5 Mechanical Test Conditions and Requirements

Test	Test Condition	Requirement	Typical Value
Mating / Unmating Force	EIA-364-13	Mating : 85 N max (120pos) 135 N max (192pos) 200 N max (288pos) Unmating : 7N min (120pos) 10N min (192pos) 15N min (288pos)	-
Mechanical Operation	EIA-364-09 Cycle rate : 300 max per hour 100 times	1) Contact resistance change:20mΩ or less 2) No damage, crack or looseness of parts	(n=5CN) EX. 10H 1) <5.0mΩ 2) Pass
Random Vibration	EIA-364-28, Frequency:50 TO 2000Hz Power Special Dencity:0.1G²/Hz for 90 min in 3 directions	1) No electrical discontinuity of 1 microsecond or more 2) No damage, crack or looseness of parts	-
Mechanical Shock	EIA-364-27 490m/s², Duration of pulse: 11ms 18 times total, 3 each direction, 3 axis	1) No electrical discontinuity of 1 microsecond or more 2) No damage, crack or looseness of parts	-
Packing	ISTA-3A	No evidence of physical damage BGA co-planarity: 0.18mm max	(n=120CN each) Ex. 10H 192pos:Pass 288pos:Pass
Contact Normal Force	-	0.3N min	0.45N
	 Ex. IT8M-***S-BGA-10H		
Contact Wiping Length	1.2+/-0.3 mm (with recommended spacers) Refer to Section 5.3 for recommended spacer information		Ex. 10H 1.17mm
Contact Retention Force	1.5N min / signal contact		(n=96) 5.46N
BGA Co-planarity	0.18 mm max		-

3.3.1 Cross Section



Section A Signal contact



Section B Ground contact

Figure 3-1 Cross Section

3.4 Environmental

Based on accelerated high temperature tests that store connectors at 105 °C for more than 120 hours according to EIA-364-1000.01, the IT8 can be stored for up to 10 years. Reference Table 6 for the environmental standards and conditions that the IT8 has been tested to meet.
The IT8 has been tested and meets the requirements for environmentally-related corrosive atmosphere according to EIA-364-65. These test procedure that demonstrate how plated and unplated surfaces react when exposed to different concentrations of flowing gas mixtures.

Table 3-6 Environmental Test Conditions and Requirements

Test	Test Condition	Requirement	Remarks
Thermal Shock	EIA-364-32 Condition II Temperature (°C): -55 →20 - 35 → 85 →20 - 35 Time (min): 30 → 5 max → 30 → 5 max under 10 cycles	1) Contact resistance change: 20mΩ or less 2) No damage, crack or looseness of parts	-
Cyclic Temperature & Humidity	EIA-364-31 @ 25°C, 80% RH:60 min DWELL TIME ↓ 30 min RAMP TIME @ 65°C, 50% RH:60 min DWELL TIME UNDER 24 CYCLES	1) Contact resistance change: 20mΩ or less 2) No damage, crack or looseness of parts	-
Dry Heat	EIA-364-17 105 °C, 120h	1) Contact resistance change: 20mΩ or less 2) No damage, crack or looseness of parts	-
Mixed Flowing Gas	EIA-364-65 Exposed at 30°C, 70% RH Cl_2: 10ppb, NO_2: 200ppb, H_2S: 10ppb, SO_2: 100ppb Unmated 7 days → Mated 7 days	1) Contact resistance change: 20mΩ or less 2) No heavy corrosion	-
Reflow Temperature Condition	IPC/JEDEC STD-020 Precondition at 60°C, 60% RH for 120h Reflow peak temperature: 260°C at connector surface	No blister or evidence of melting	

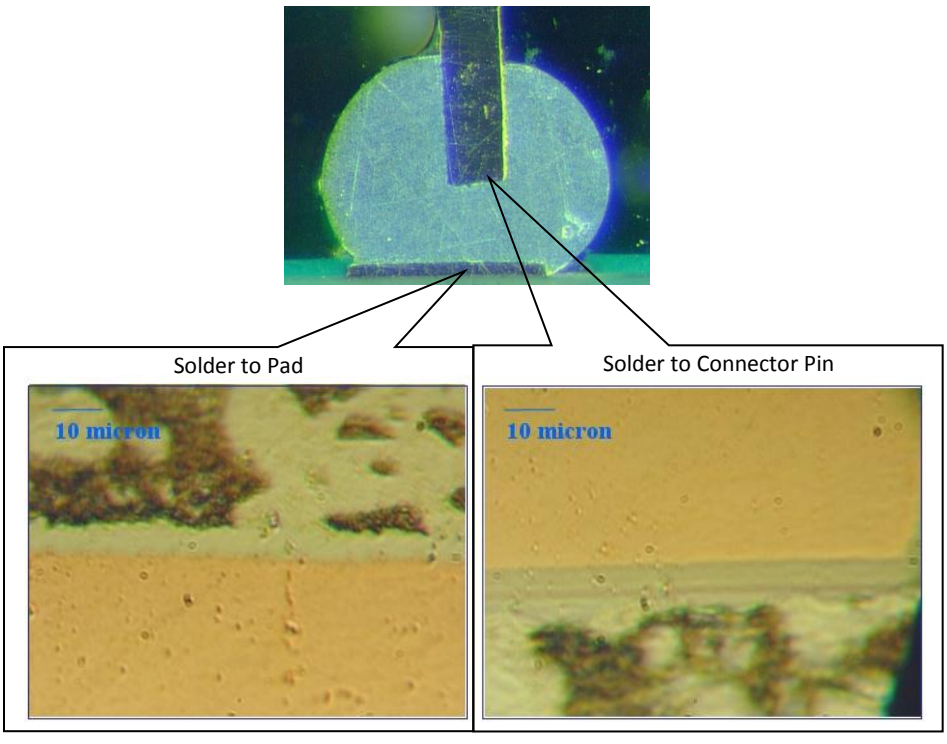
3.5 BGA Reliability

These tests apply to both eutectic and lead free applications.

Table 3-7 BGA Reliability Test Conditions and Requirements

Test	Test Condition	Requirement	Remarks
Thermal Shock	IPC-9701 6000 cycles between 0 and 100 °C	No more than 20% increase from the initial resistance while monitored for five consecutive reading scans	-
Solder Ball Shearing	IPC-9701, 6000 cycles between 0 and 100 °C Shearing speed is 500 mm / second	No inter metallic failure between contacts and balls	-
High Temperature Storage	Refer to IPC-9701, 105 °C, 1000 hours	No more than 20% increase from the initial resistance while monitored for five consecutive reading scans	-
Cross Section	IPC-9701 6000 cycles between 0 and 100 °C	SnCu inter-metallic layers observed at 'Solder to Connector Pin' interface, and at 'Solder to Pad' interface	-

Typical Solder Joints after Thermal Shock

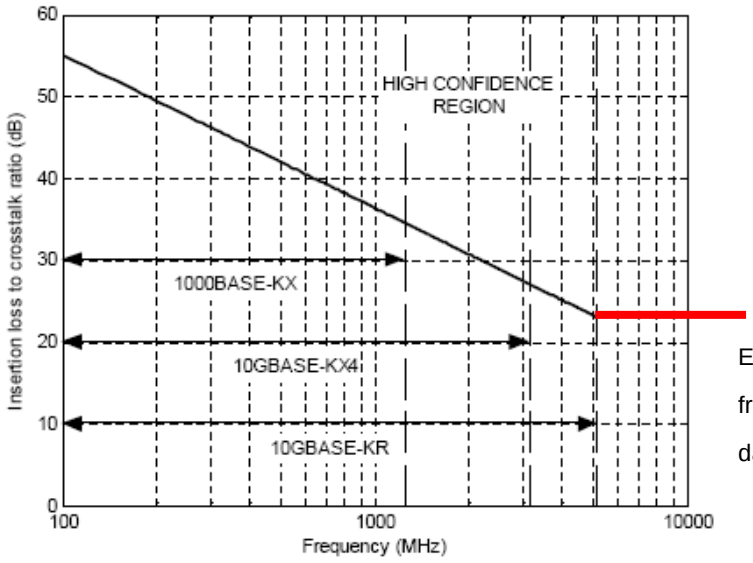


Section 4 Signal Integrity

This section of the Design Note contains the overview, 28Gbps(Two-piece type) and 56Gbps(Three-piece type) solution, differential performance, and propagation delay of Hirose's IT8 signal integrity performance.

4.1 Overview

By meeting the stringent (extended) insertion-loss-to-crosstalk-ratio (ICR) specifications as defined in the IEEE802.3ap standard, IT8 is fully capable of supporting 28 or more Gbps differential data transmission.



For high-speed data transmission, the transmitters (TX) and receivers (RX) are usually grouped separately and each differential signal pairs are surrounded by ground blades separately to form quasi-coaxial structures, in order to minimize the effect of near-end crosstalk (NEXT). As for the Three-piece type, its structure utilizes FEXT cancelling feature to achieve over 50Gbps signal transmission even for 40mm+ board spacing. Actual measurements were taken on 130mil test boards (Figure 4-2) with IT8-10mm and IT8-35mm connectors, 2 via transitions through bottom routing layers, and 5"+5" Megtron 6 PCB traces.

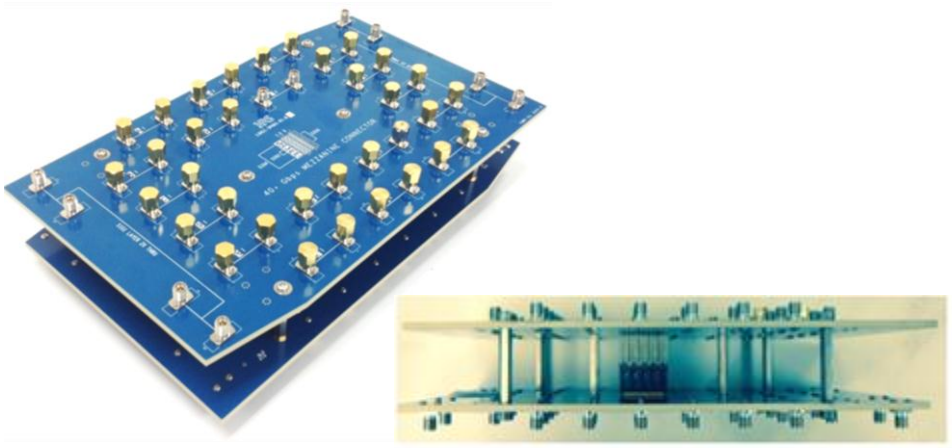


Figure 4-2 Demo board

The following ICR curves (Figure 4-3) correspond to the power sum of near-end crosstalk (NEXT, blue) and far-end crosstalk (FEXT, red) from 8 aggressor pairs and 1 victim pair in 3 connector columns of IT8-10mm. It is clear that IT8 meets the ICR spec. for 28 Gbps data rate in a fully-populated configuration (Figure 4-4).

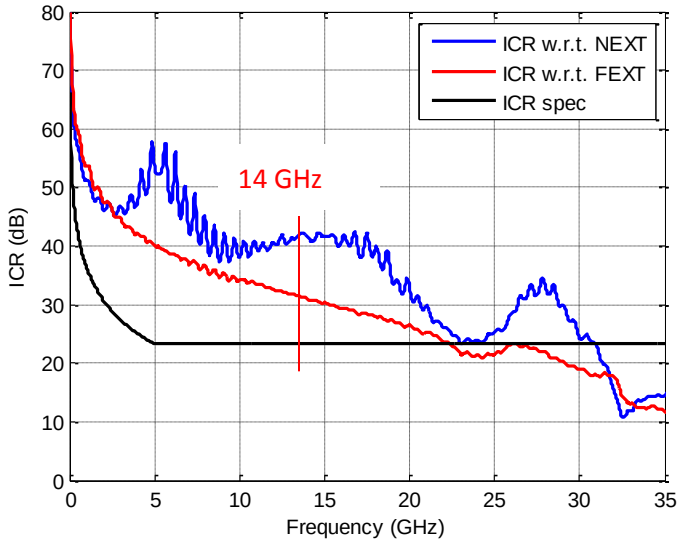


Figure 4-3 IT8-10mm insertion loss to crosstalk ratio

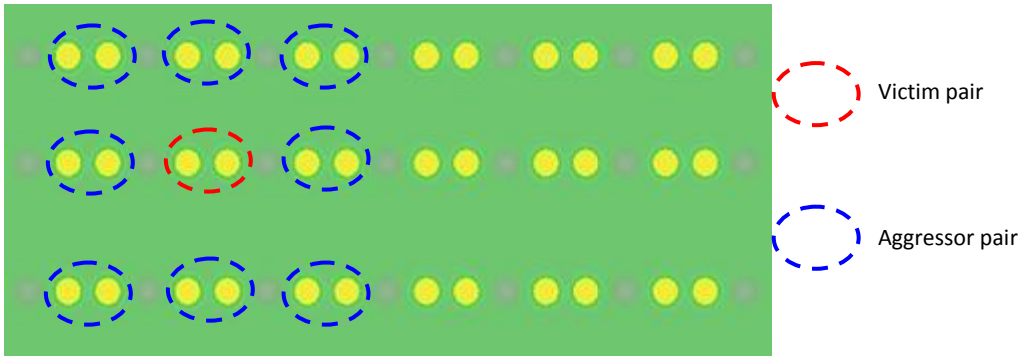


Figure 4-4 Fully-populated pin configuration

The following ICR curves (Figure 4-5) correspond to the power sum of near-end crosstalk (NEXT, blue) and far-end crosstalk (FEXT, red) from 8 aggressor pairs and 1 victim pair in 3 connector columns of IT8-35mm. It is clear that IT8 meets the ICR spec. for 56 Gbps data rate in a fully-populated configuration with respect to FEXT.

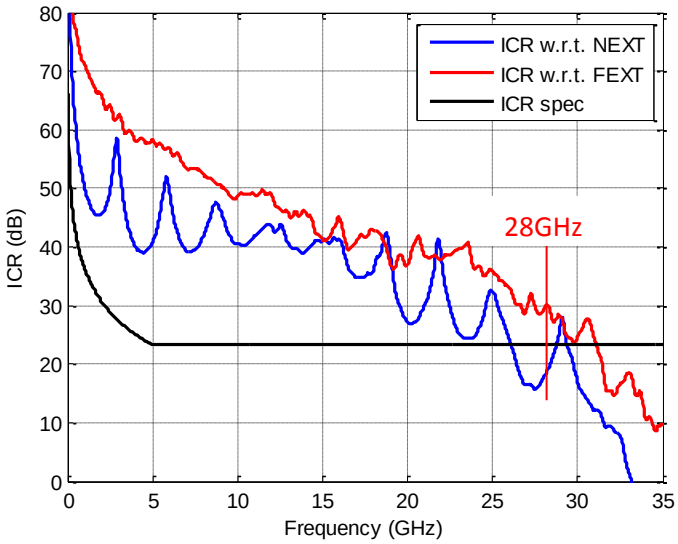


Figure 4-5 IT8-35mm insertion loss to crosstalk ratio

4.2 Differential Signals

To examine the behavior of the IT8 connector by itself, 60mil characterization boards were measured with their 2.8” lead-in traces de-embedded.

Figure 4-6 Characterization board

Figures 4-8 to 4-11 show the measured vs. simulated differential insertion loss (IL), return loss (RL), near-end crosstalk (NEXT), and far-end crosstalk (FEXT) between two nearest neighbors in an IT8-35mm connector (Figure 4-7).

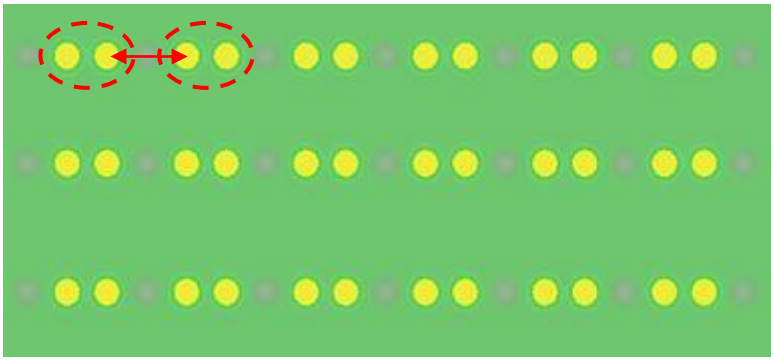


Figure 4-7 Nearest neighbors of IT8-35mm

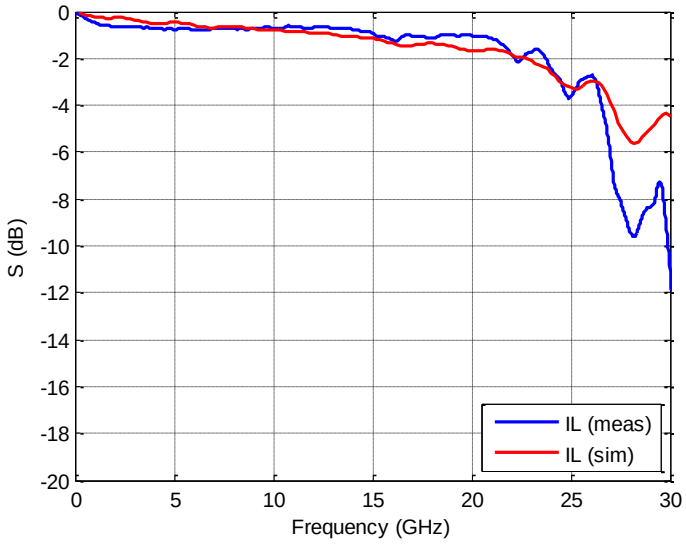


Figure 4-8 Differential insertion loss of IT8-35mm – measurement vs. simulation

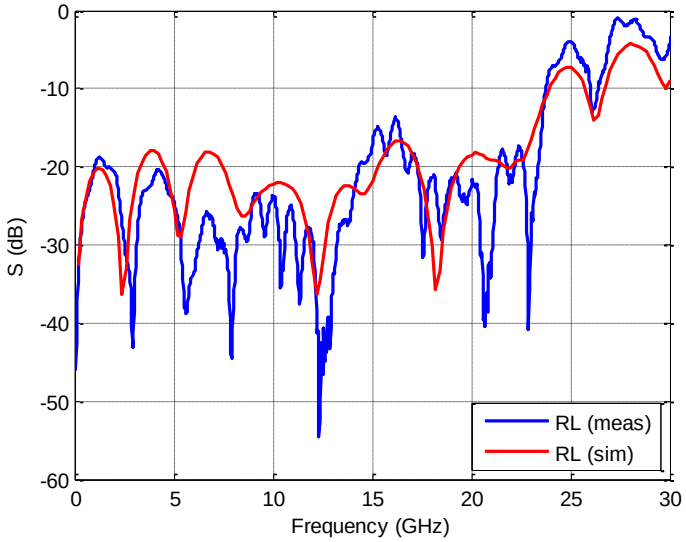


Figure 4-9 Differential return loss of IT8-35mm – measurement vs. simulation

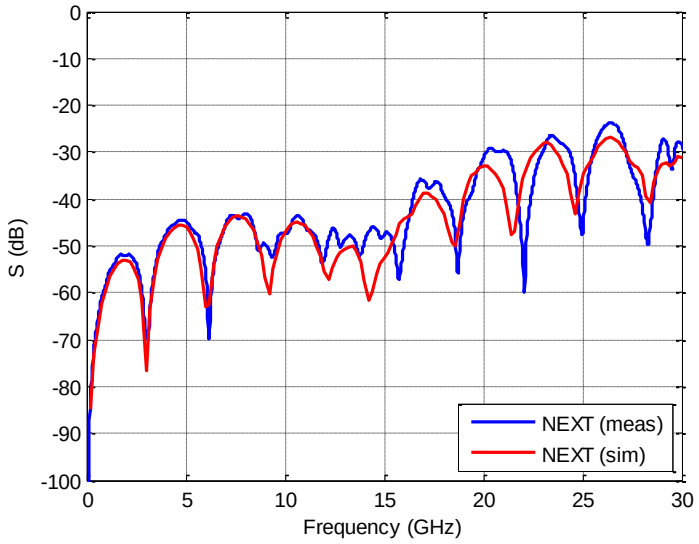


Figure 4-10 Differential NEXT of IT8-35mm – measurement vs. simulation

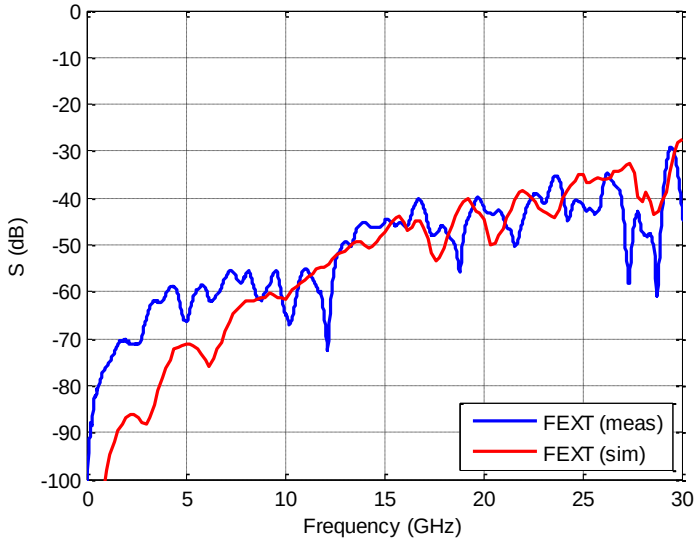


Figure 4-11 Differential FEXT of IT8-35mm – measurement vs. simulation

Figures 4-13 and 4-14 show the simulated NEXT and FEXT among various differential pairs of an IT8-35mm connector in a fully-populated configuration (Figure 4-12).

Figure 4-12 Fully populated configuration

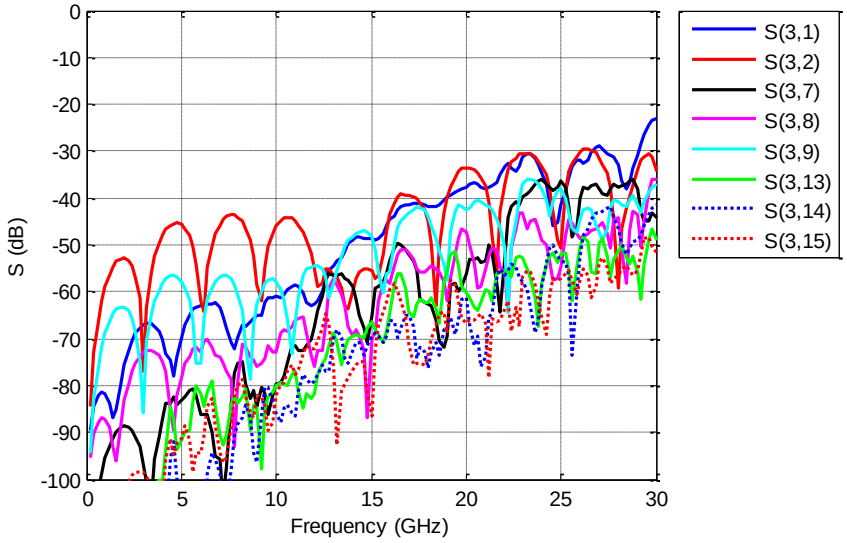


Figure 4-13 Simulated differential NEXT of IT8-35mm

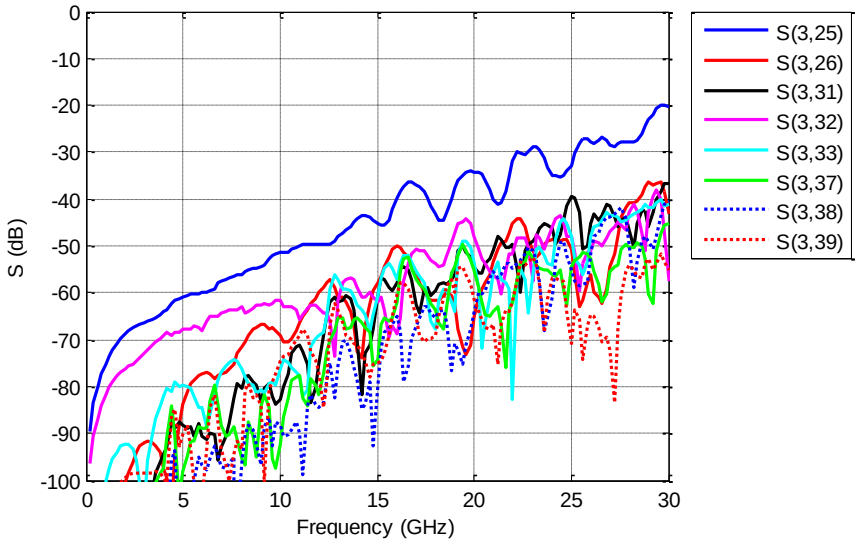


Figure 4-14 Simulated differential FEXT of IT8-35mm

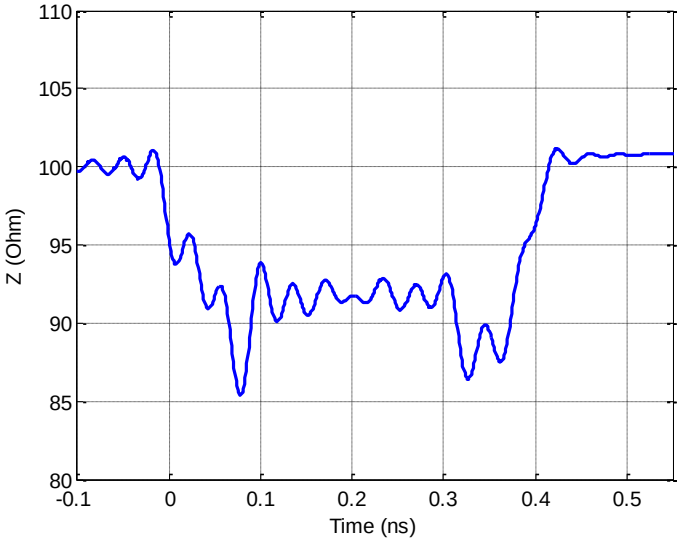


Figure 4-15 Simulated differential impedance of IT8-35mm @12ps (20-80%) rise time

Figures 4-16 and 4-17 show the simulated NEXT and FEXT among various differential pairs of an IT8-10mm connector in a fully populated configuration (Figure 4-12).

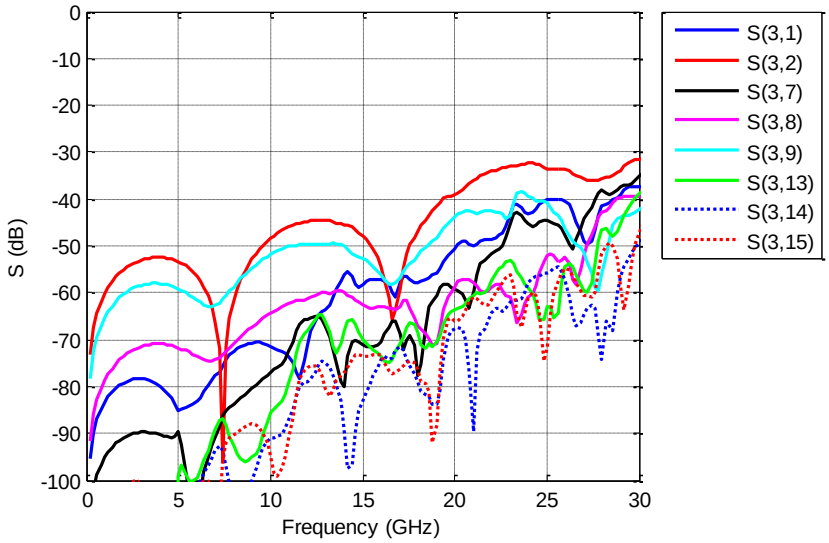


Figure 4-16 Simulated differential NEXT of IT8-10mm

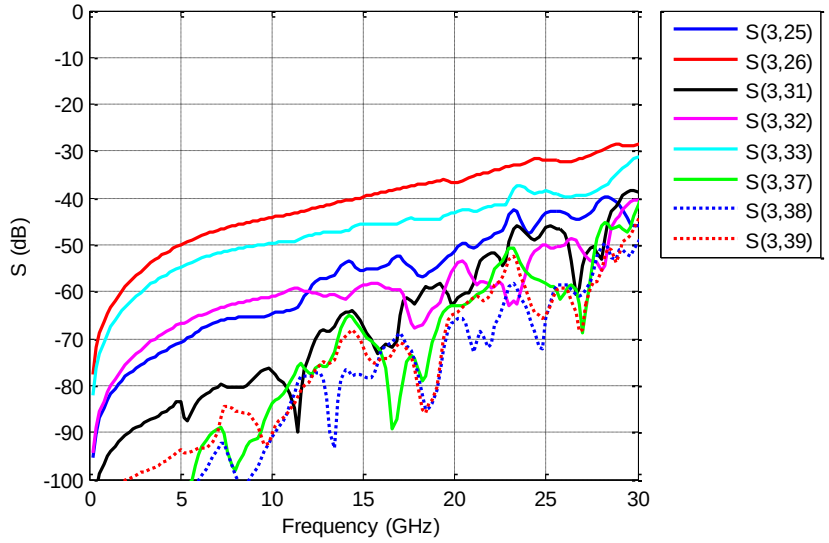


Figure 4-17 Simulated differential FEXT of IT8-10mm

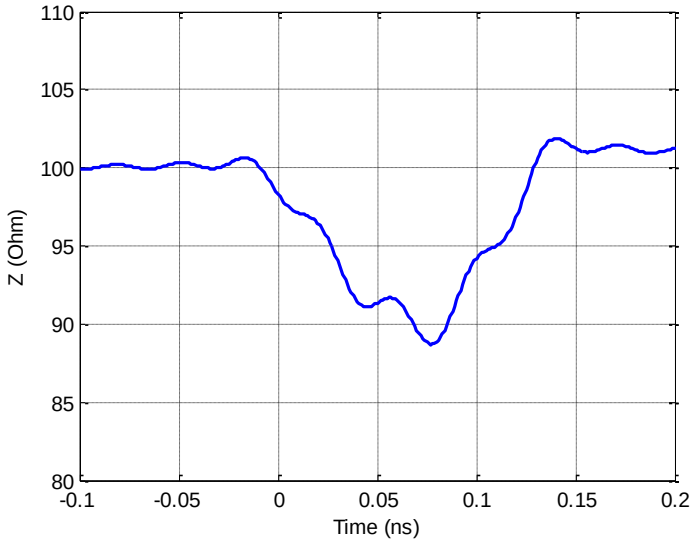


Figure 4-18 Simulated differential impedance of IT8-10mm @12ps (20-80%) rise time

4.3 Propagation Delay

Table 4-1 shows the simulated propagation delay through IT8-10mm connector of the first 4 columns. Delay at 1 GHz is shown. Table 4-2 shows the simulated propagation delay through IT8-35mm.

Table 4-1 Propagation Delay (ps) of IT8-10mm												
Row / Column	B	C	E	F	H	I	K	L	N	O	Q	R
1	61.63	61.57	61.6	61.59	61.6	61.64	61.64	61.6	61.59	61.6	61.57	61.63
2	60.89	60.92	60.89	60.88	60.87	60.92	60.92	60.87	60.88	60.89	60.92	60.89
3	60.93	60.97	60.9	60.87	60.88	60.97	60.97	60.88	60.87	60.9	60.97	60.93
4	61.62	61.61	61.54	61.55	61.53	61.62	61.62	61.53	61.55	61.54	61.61	61.62

Table 4-2 Propagation Delay (ps) of IT8-35mm												
Row / Column	B	C	E	F	H	I	K	L	N	O	Q	R
1	197.3	196.8	196.6	196.9	197	196.9	196.9	196.5	196.9	196.5	196.8	196.7
2	196.4	197.1	196.7	196.5	196.3	196.7	196.4	196.6	196.6	196.2	197.4	196.8
3	197.1	196.9	196.3	196.6	196.4	196.5	196.1	196.1	197.2	196.3	196.8	196.9
4	197	197.2	196.9	197.4	196.6	196.5	196.8	197.1	196.8	197	196.4	197.5

Section 5 PWB Design

The Hirose IT8 connector's footprint is a grid area array that allows space for easy via placement and signal routing between pads. I/Os of each row alternates signal and ground interconnections. According to height, there are two families with different configurations. For heights from 10mm to 13mm, the connector consists of two pieces with a lightweight plug and a receptacle. For heights that range from 14mm to 46mm, there is a three piece system composed of a plug, an interposer and a second plug. With any IT8 connector, it is necessary to utilize spacers to help reinforce the structure of the final multi-PWB assembly.

This section of the Design Note discusses multi-connector systems, clearance between connectors, interposer direction, and alignment tolerances.

Please refer to individual product drawings and Assembly note in detail.

5.1 Footprint

5.1.1 Polarity

Each plugs, receptacle and interposer have no polarization features except for its body color. The body color should be matched as shown in the figure shown below; otherwise signal pin-out may be incorrect and cause a system error.

Also, it is recommended to have some polarization feature on PWB design to prevent 180° rotation between Mating PWB and Mounting PWB.

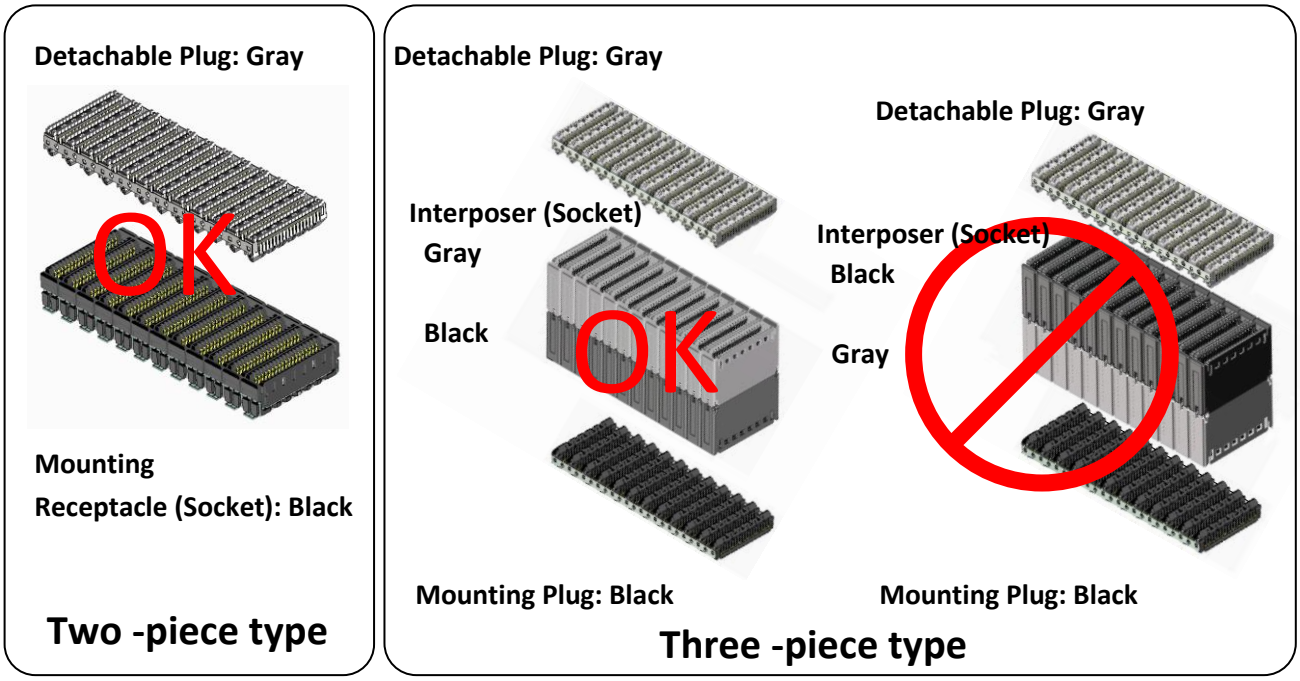


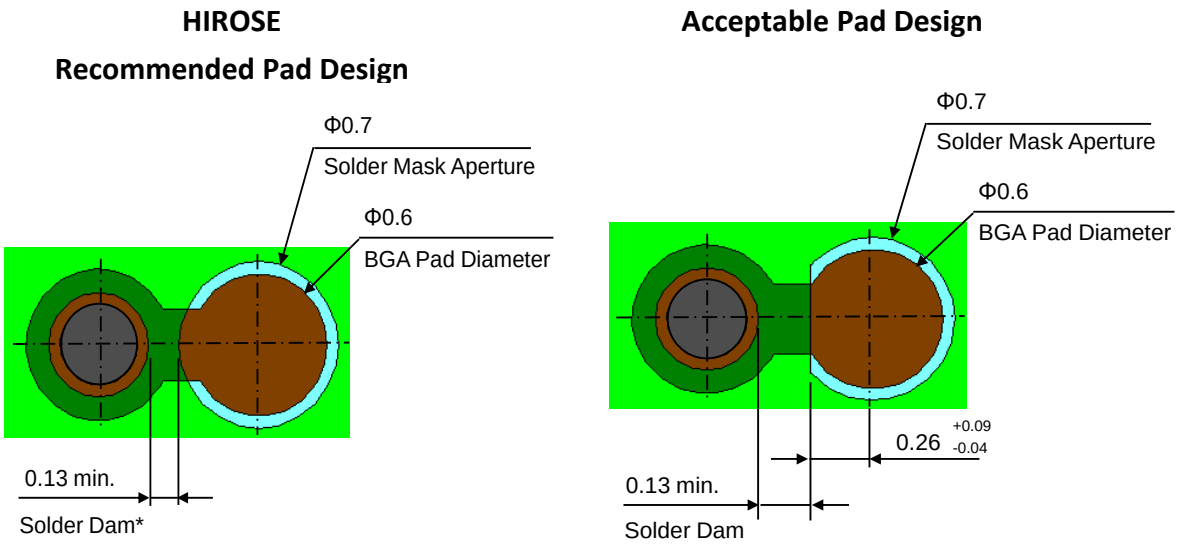
Figure 5-1 Polarity

Annotation

For visual inspection purposes, “Pin 1” should be denoted on the silkscreen of the PWB by a specific marking (e.g. asterisk or other accepted symbol) near the A1 contact location.

5.1.2 Pad Specification

Recommended pads are 0.6mm diameter Non-Solder Mask Defined (NSMD), also known as *copper defined* or *metal defined*. Recommended sizes and clearances are shown below:



* All dimensions shown are in mm

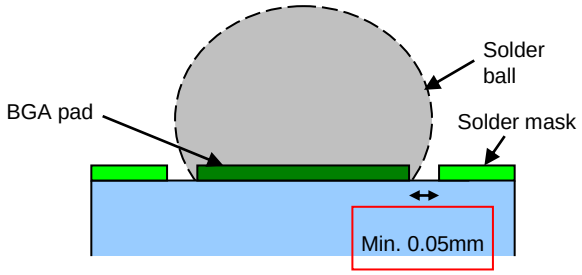
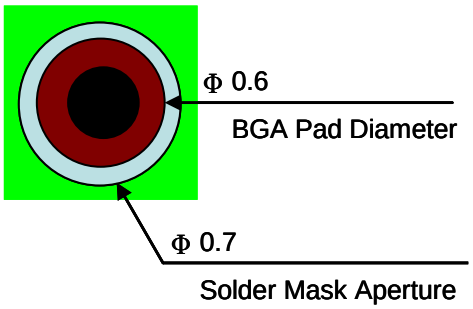


Figure 5-2 Cross Section of Pad and Solder ball

- Keep minimum clearance 0.05mm between BGA pad and solder mask to achieve "copper defined BGA pad".
- BGA pad finish: OSP (Organic Solderability Preservative) or HASL (Hot Air Solder Leveler).
- The drill diameter of 0.34mm is for reference only. Use the proper aspect ratio of board thickness to via drill diameter for each PCB fabricator.

The recommendations remain the same for via-in-pad designs. Suggested dimensions are as follows:

HIROSE Via-in-pad Recommend Pad Design



* All dimensions shown are in mm

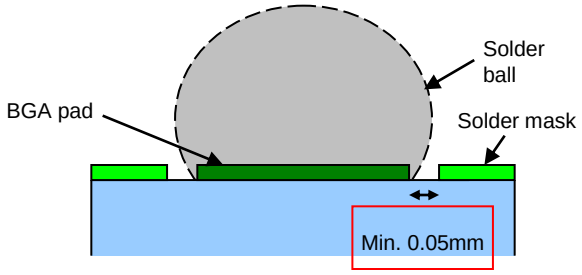


Figure 5-3 Cross section of PAD and Solder ball

- Keep minimum clearance 0.05mm between BGA pads and solder mask to achieve “copper defined BGA pad”.
- BGA pad finish: OSP (Organic Solderability Preservative) or HASL (Hot Air Solder Leveler).
- The drill diameter of 0.25mm is for reference only. Use the proper aspect ratio of board thickness to via drill diameter for each PCB fabricator.

PWB pad finish is typically Organic Solderability Preservative (OSP) or Hot Air Solder Level (HASL), but the component can also be used with Electroless Nickel-Immersion Gold (ENIG), Immersion Silver, and Immersion Tin.

Recommendations for the stencil apertures are 0.54mm circles, concentric with the copper pads, and the thickness is from 0.127mm to 0.15mm. Stencil aperture size and/or thickness may need to be adjusted according to circumstances of each assembly line.

The specified clearance, or solder mask relief, from the copper feature is 0.05mm.

Precaution

Verify fabricator capability. Solder mask registration must be accurate to at least 0.05mm. PWB fabricator's registration capability should be verified. Depending on the thickness of PWB, fabricator's aspect ratio capabilities for through vias should also be verified.

5.1.3 Component Footprint and Contact Assignment

Mounting Receptacle – ***IT8MB-***S***

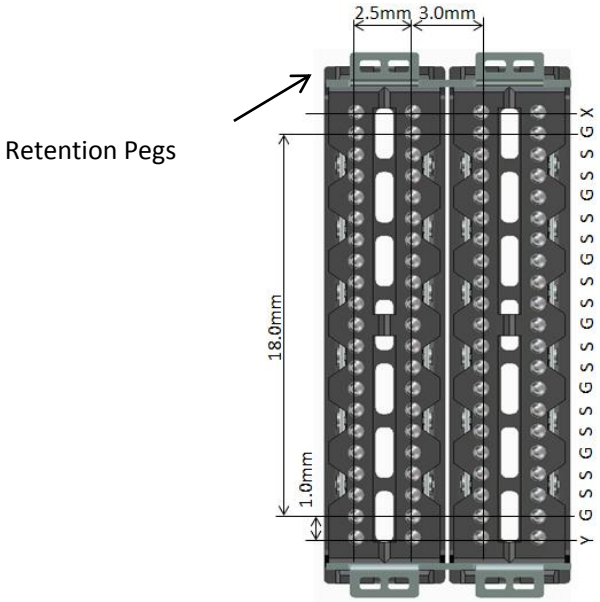
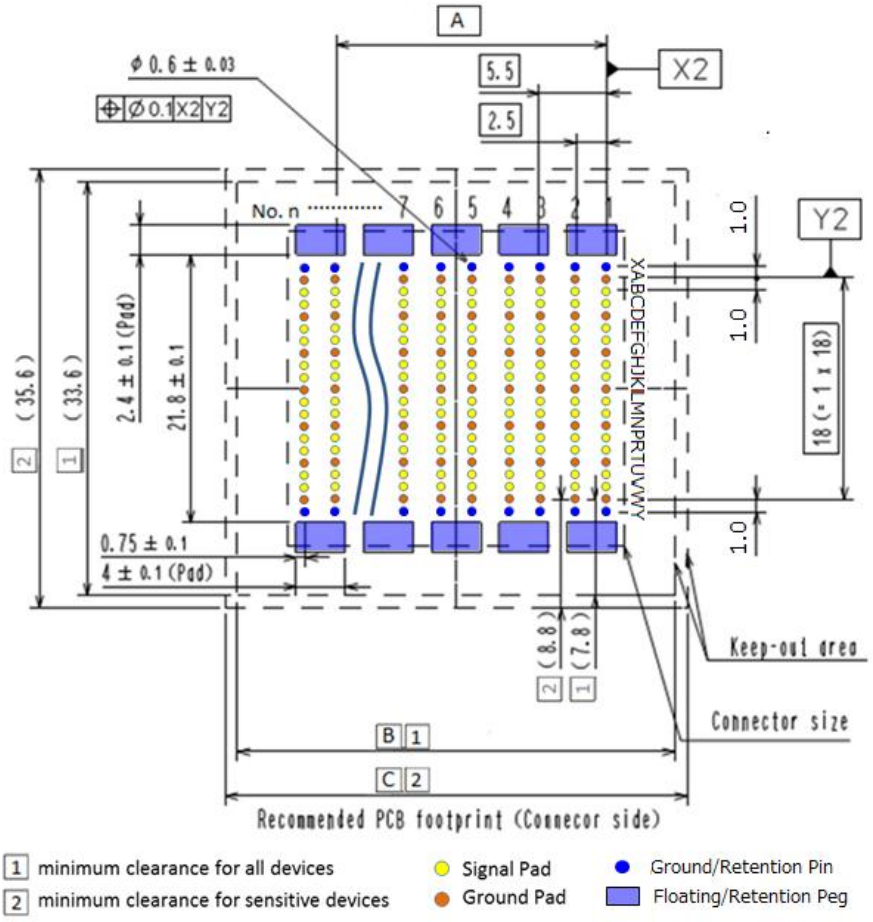


Figure 5-4 Mounting Receptacle – IT8

Precaution

Assign all ground pins to ground, as all ground pins are connected in the IT8 plug. Assigning some ground pins to power and some to ground will cause power and ground to be shorted. When power is assigned to all ground pins, there is potential for signal degradation in high speed pairs.

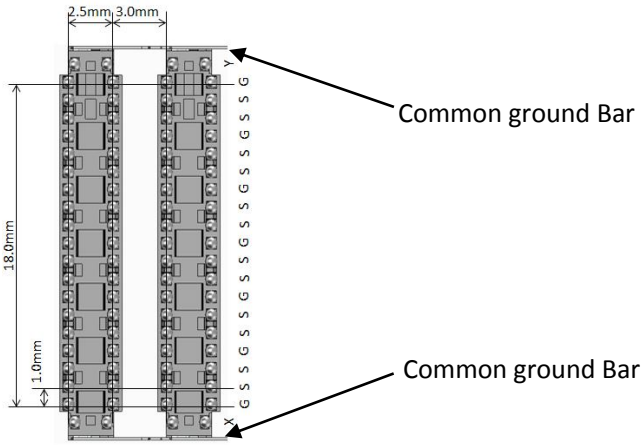


Dimension (mm)	120 pos	192 pos	288 pos
A	22	38.5	60.5
B	35.5	52	74
C	37.5	54	76

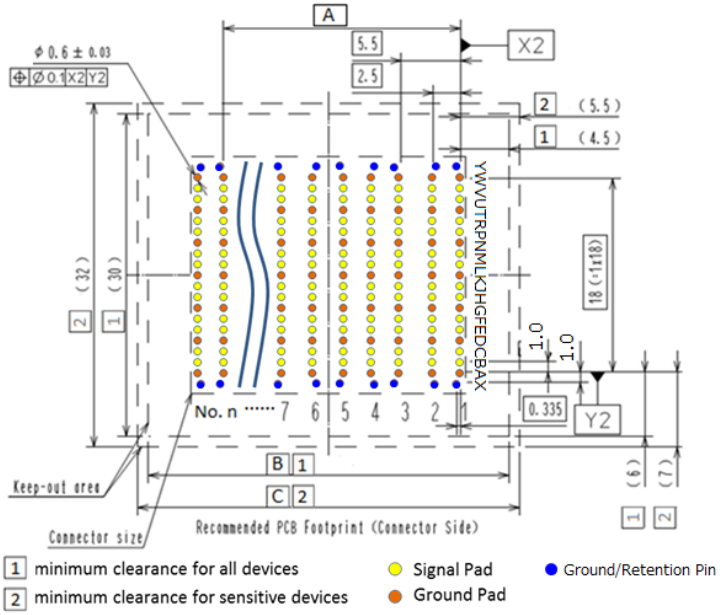
Figure 5-5 IT8M-***S-BGA-1*H Footprint (dimensions in mm)

***Remarks:** It is recommended to leave SMT pads for the Retention Pegs unconnected. Connecting pads to ground requires vias, which reduce space for signal routing. Please refer to individual product drawings in detail.

Detachable Plug – *IT8D-*P***



Pin assignment
Y – Ground
W - Ground
V - Signal
U - Signal
T - Ground
R - Signal
P - Signal
N - Ground
M - Signal
L - Signal
K - Ground
J - Signal
H - Signal
G - Ground
F - Signal
E - Signal
D - Ground
C - Signal
B - Signal
A - Ground
X – Ground



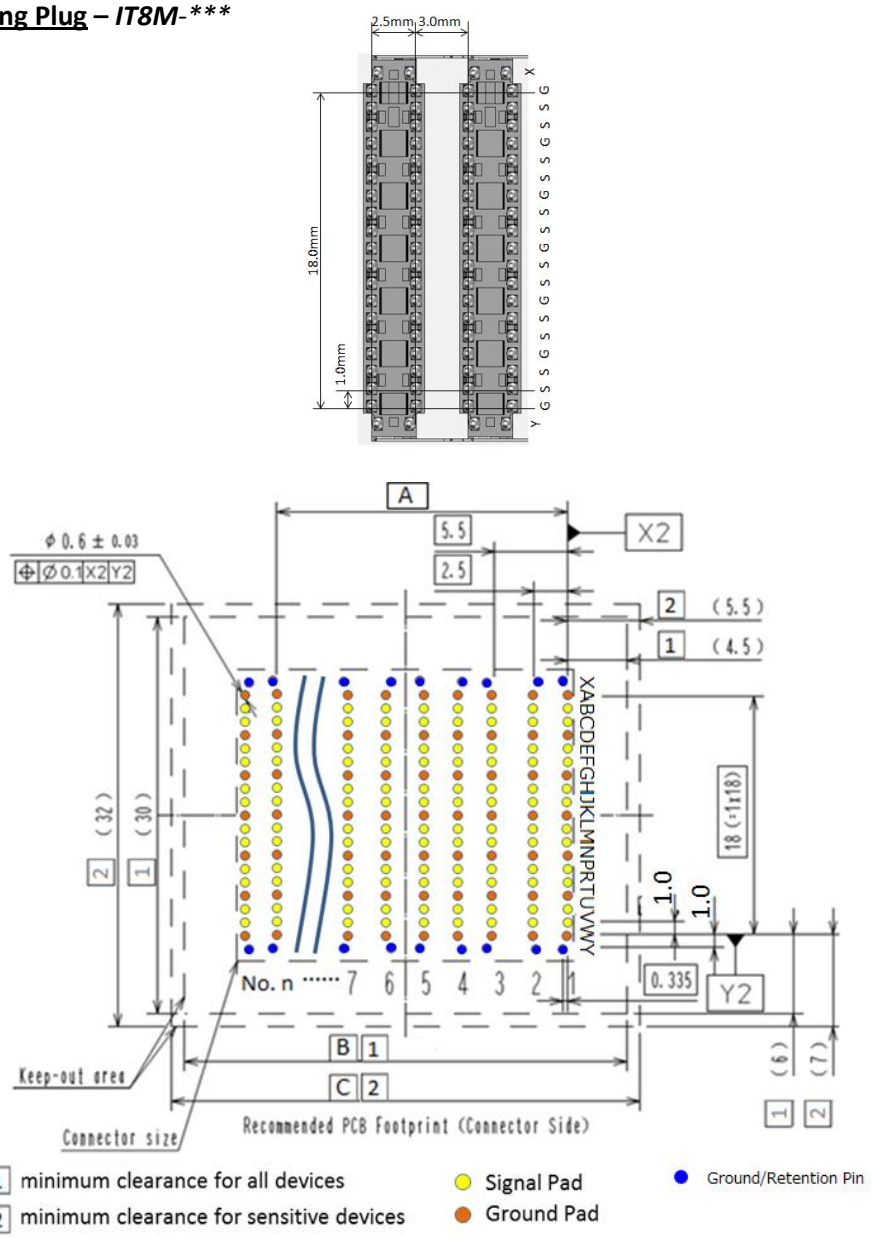
Dimension (mm)	120 pos	192 pos	288 pos
A	22	38.5	60.5
B	33.5	50	72
C	35.5	52	74

Figure 5-6 IT8D-***P-BGA-*H Footprint (dimensions in mm)

Precaution

Assign all ground pins to ground, as all ground pins are connected in the IT8 plug. Assigning some ground pins to power and some to ground will cause power and ground to be shorted. When power is assigned to all ground pins, there is potential for signal degradation in high speed pairs. Please refer to individual product drawings in detail.

Mounting Plug – *IT8M-**



Dimension (mm)	120 pos	192 pos	288 pos
A	22	38.5	60.5
B	33.5	50	72
C	35.5	52	74

Figure 5-7 IT8M-***P-BGA-*H Footprint (dimensions in mm)

Please refer to individual product drawings in detail.

5.1.4 Pin Connections

For stack heights from 10-13mm, IT8 consists of 2 pieces: mounting receptacle and detachable plug. This Two-piece type is shown in Figure 5-8.

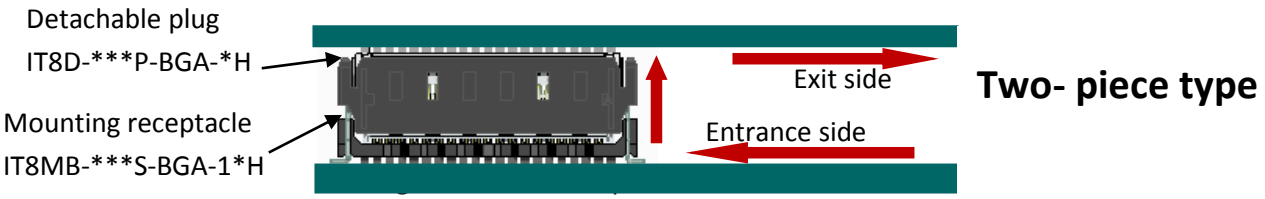


Figure 5-8 IT8 two-piece connector side view

The pins of the mounting receptacle connect straight through to the pins of the detachable plug. An example of connections of the Two- piece IT8 120 pin connector is shown in Figure 5-9.

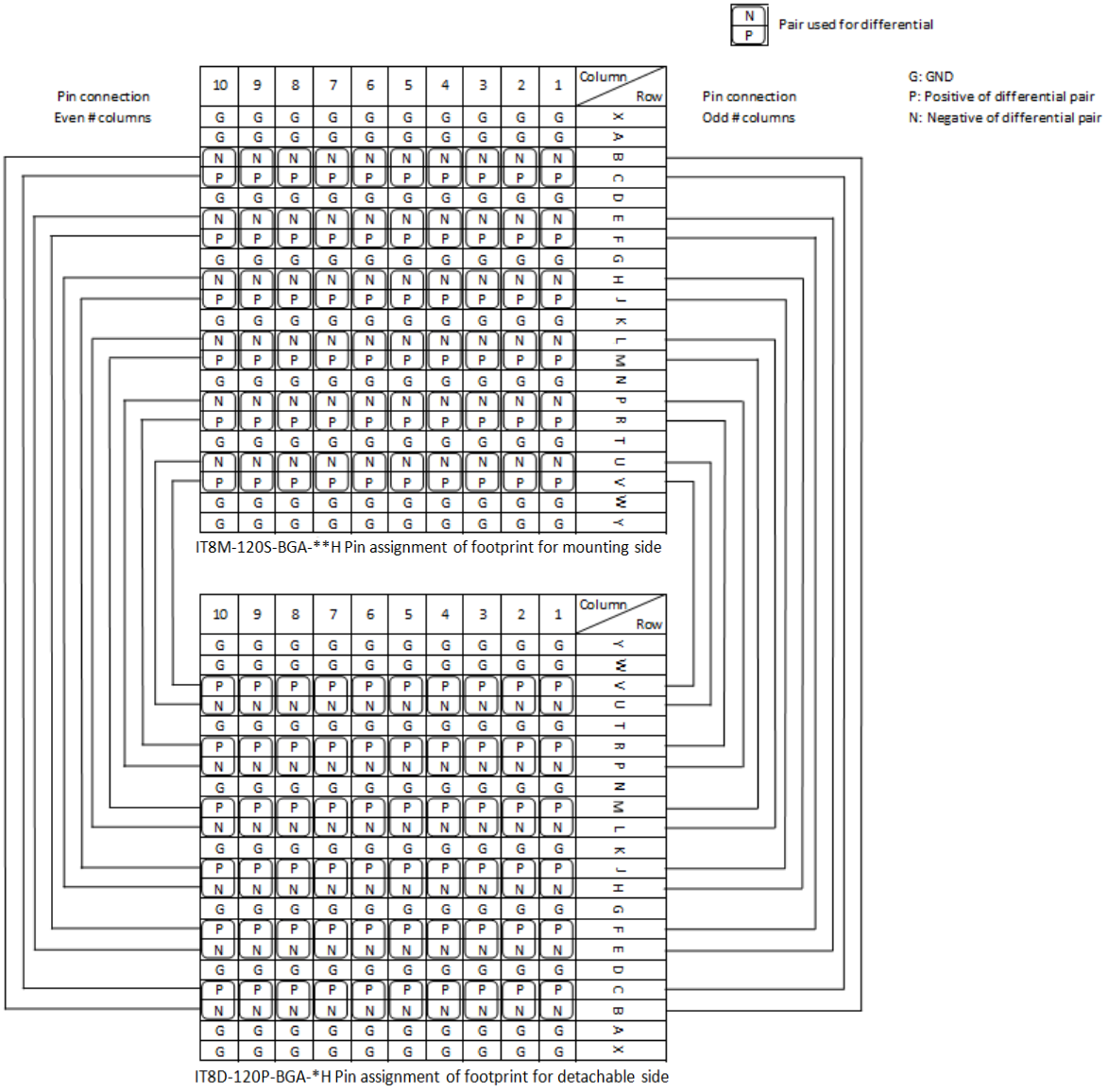


Figure 5-9 IT8 Two-piece pin connections

For stack heights of 14mm and up, IT8 consists of 3 pieces: mounting plug, interposer, and detachable plug. This Three-piece type is shown in Figure 5-10.

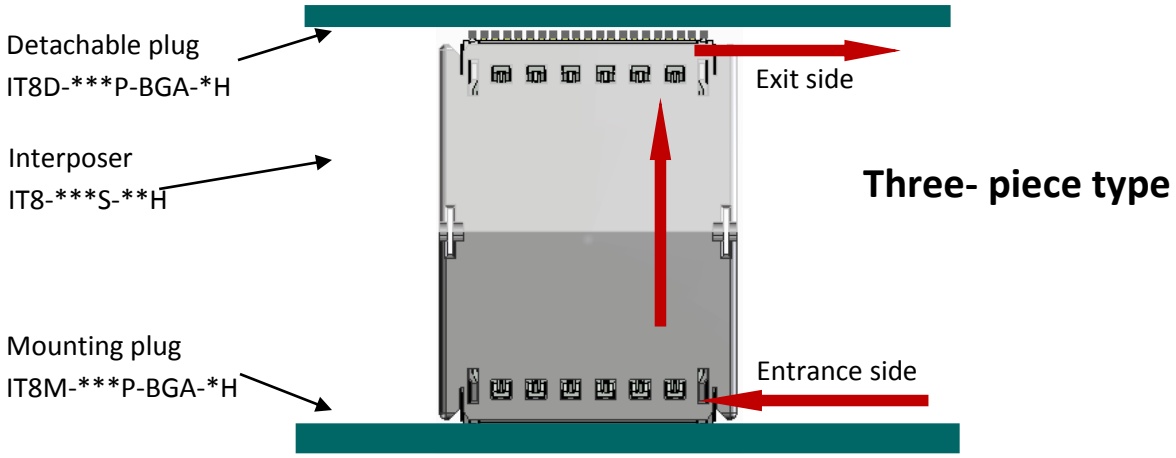


Figure 5-10 IT8 Three-piece connector side view

Figure 5-11 shows an example of pin connections of the three- piece IT8 120 pin connector. For the best use of FEXT cancellation technology, twisted pairs and non-twisted pairs are placed alternately in the same column and staggered between adjacent columns.

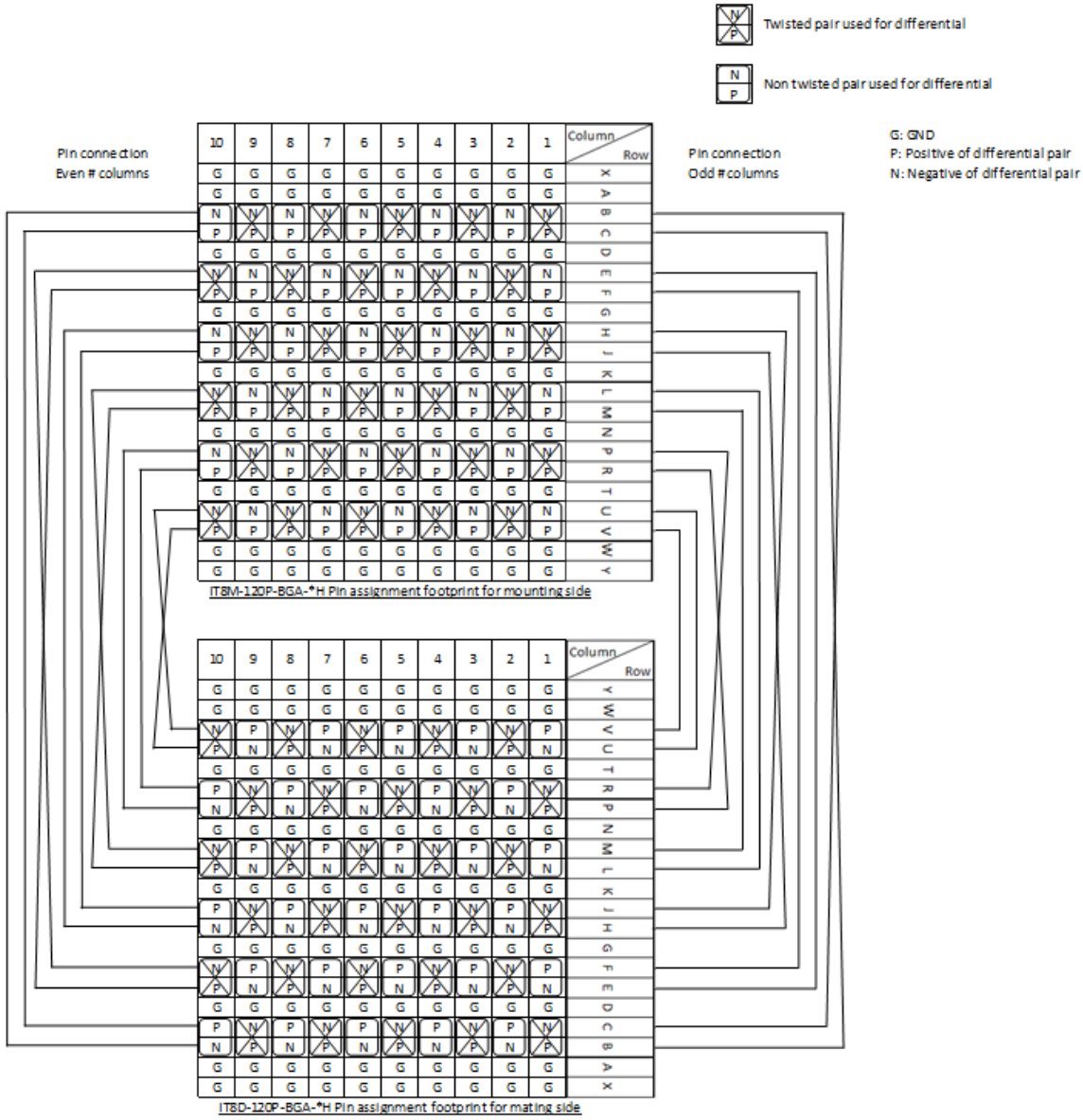


Figure 5-11 IT8 Three-piece pin connections

5.1.5 Routing Suggestions and Examples

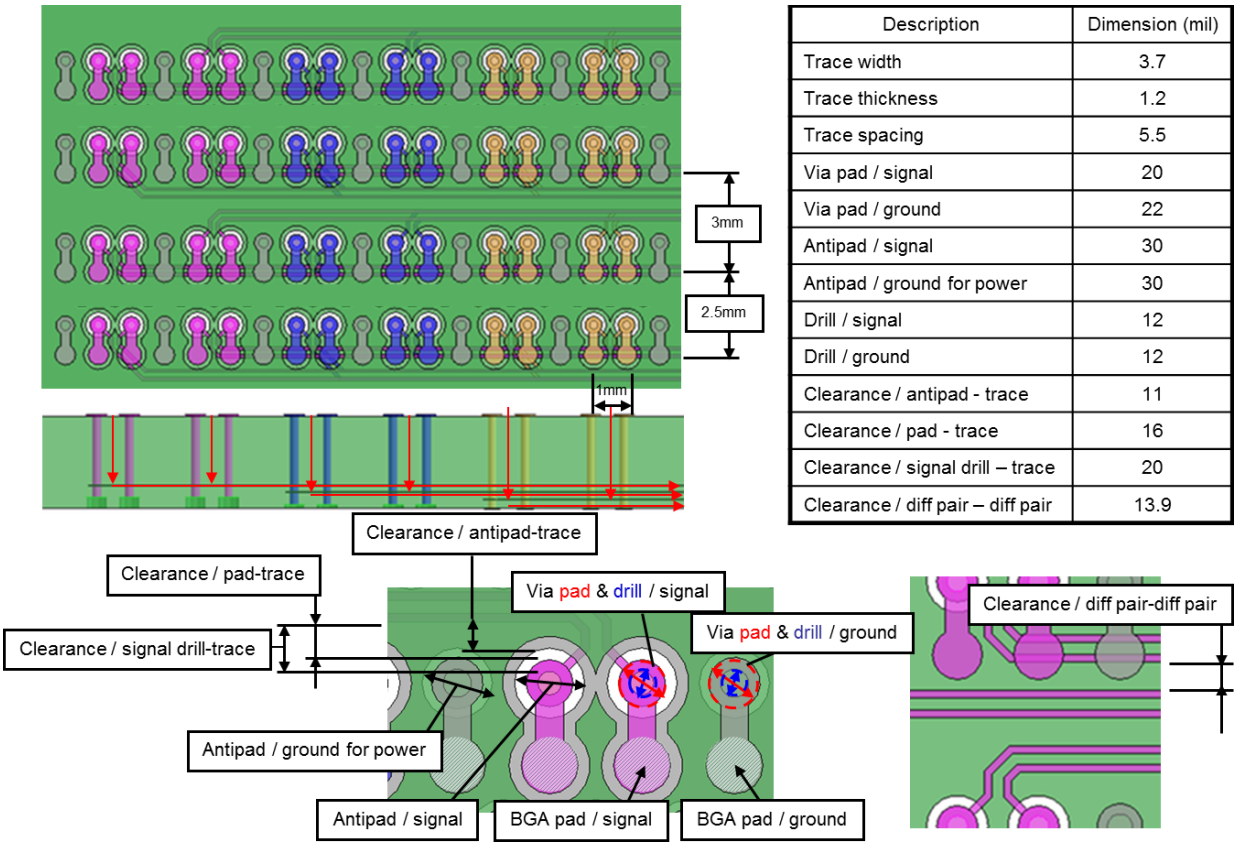
The traces are routed in the column direction, avoiding going over the anti-pad. To avoid intra-pair skew, the trace lengths are matched. All trace bends are at 45-degree angles. Routing on adjacent dual strip line layers is not recommended and non-functional signal pads should be removed. The following examples detail suggested routing for dogbone and via-in-pad style signal breakouts.

Routing Example 1: Dogbone Vias

This example, shown in Figure 5-12, takes the layout approach of employing a “dogbone” style of breakout where the via is offset from the BGA pad. This type of footprint is best when the manufacturing process does not allow for a via-in-pad design.

This example uses the minimum number of ground vias required. This maximizes the routing space for trace breakouts, requiring only 3 routing layers to exit one side of the connector, and maximizes the amount of copper remaining on the power planes.

A ground void should be placed beneath the dogbone pads in the first ground plane from the connector to reduce the capacitive effect of the BGA pads.



Description	Dimension (mil)
Trace width	3.7
Trace thickness	1.2
Trace spacing	5.5
Via pad / signal	20
Via pad / ground	22
Antipad / signal	30
Antipad / ground for power	30
Drill / signal	12
Drill / ground	12
Clearance / antipad - trace	11
Clearance / pad - trace	16
Clearance / signal drill – trace	20
Clearance / diff pair – diff pair	13.9

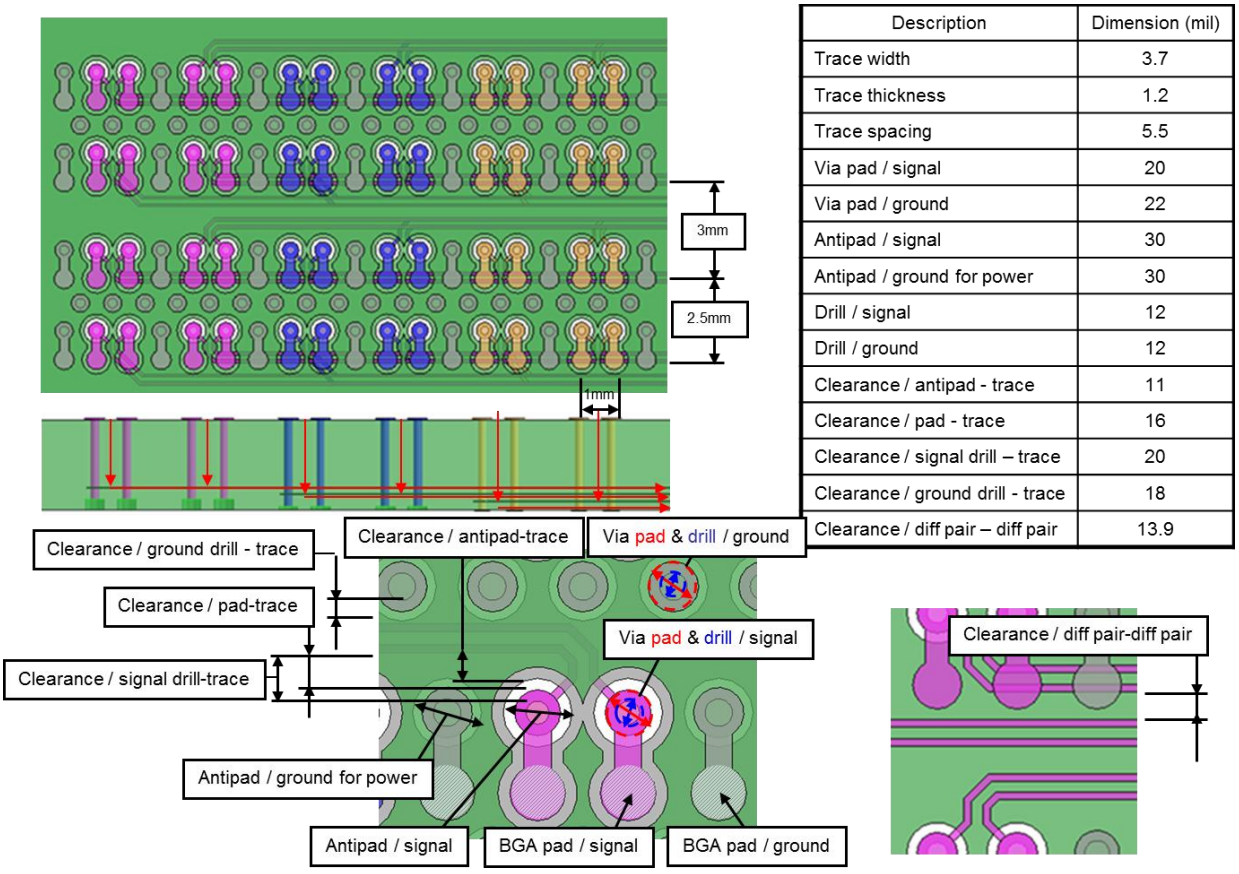
Figure 5-12 Routing Example 1- Dogbone vias

Routing Example 2: Dogbone with Additional Ground Vias

This example, shown in Figure 5-13, also takes the layout approach of employing a “dogbone” style of breakout, and uses an additional row of ground vias located within the narrowest column of the footprint. This will help mitigate crosstalk between adjacent signal vias. In the wider 3mm wide column, up to three differential pairs can be routed. Only three signal layers are required to route all differential pairs out one end of the connector.

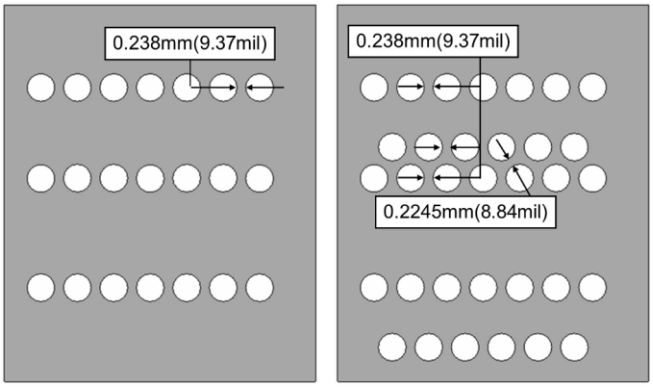
Even with the additional ground vias, the power plane still maintains copper web in both the x and y directions, as shown in Figure 5-14.

A ground void should be placed beneath the dogbone pads in the first ground plane from the connector to reduce the capacitive effect of the BGA pads.



Description	Dimension (mil)
Trace width	3.7
Trace thickness	1.2
Trace spacing	5.5
Via pad / signal	20
Via pad / ground	22
Antipad / signal	30
Antipad / ground for power	30
Drill / signal	12
Drill / ground	12
Clearance / antipad - trace	11
Clearance / pad - trace	16
Clearance / signal drill – trace	20
Clearance / ground drill - trace	18
Clearance / diff pair – diff pair	13.9

Figure 5-13 Routing Example 2- Dogbone with additional ground vias

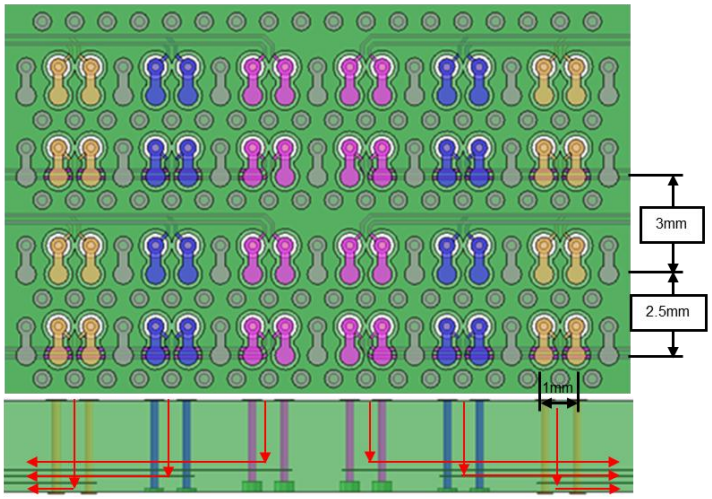


Routing example 1 Routing example 2

Figure 5-14 Power plane views of routing examples 1 and 2

Routing Example 3: Dogbone with Ground Vias Between All Columns

In this example, ground vias are added between all columns. This will minimize crosstalk among adjacent signal vias. If signal traces are able to extend out of both sides of the connector, only three signal layers are needed.



Description	Dimension (mil)
Trace width	3.7
Trace thickness	1.2
Trace spacing	5.5
Via pad / signal	20
Via pad / ground	22
Antipad / signal	30
Antipad / ground for power	30
Drill / signal	12
Drill / ground	12
Clearance / antipad - trace	11
Clearance / pad - trace	16
Clearance / signal drill – trace	20
Clearance / ground drill - trace	18

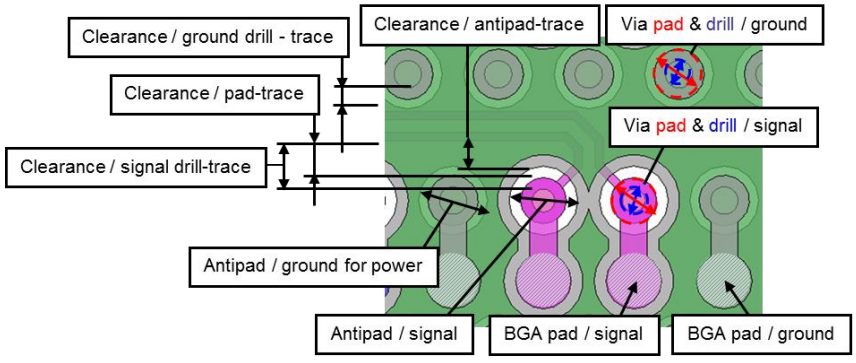


Figure 5-15 Routing Example 3 - Dogbone with additional ground vias between all columns

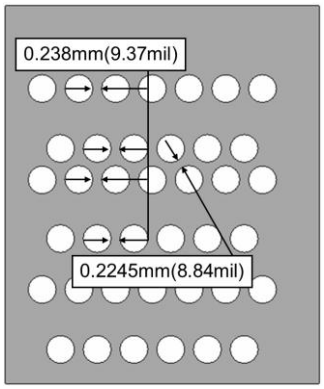
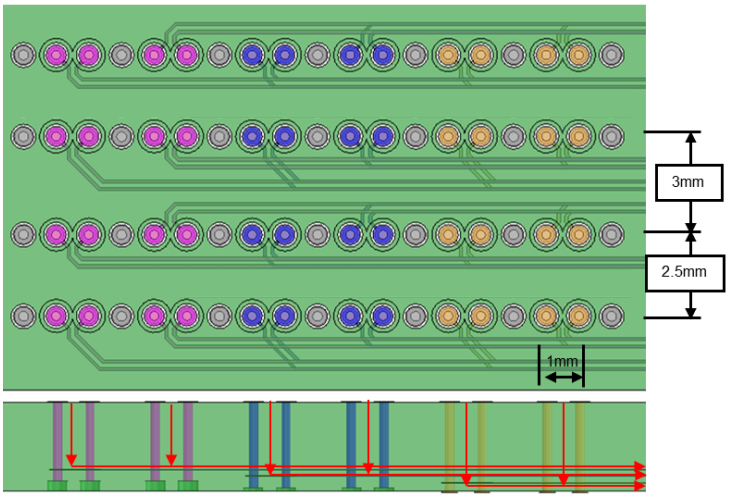


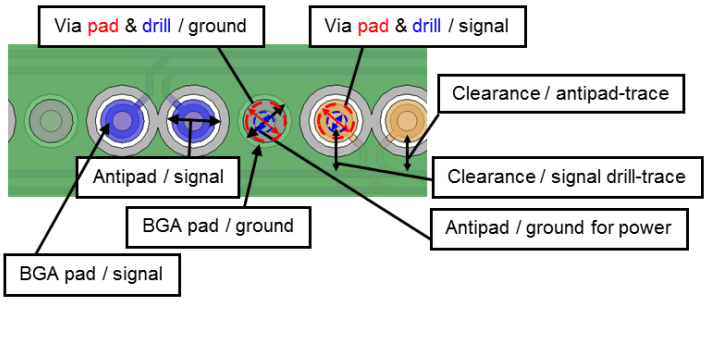
Figure 5-16 Power plane view of routing example 3

Routing Example 4: Via-in-Pad Vias

The via-in-pad footprint, shown in Figure 5-17, uses the top pad of the signal via as the BGA footprint pad. Via-in-pad can be used to improve signal integrity performance. In this example, all signals escape out one side of the connector and require only three signal layers.



Description	Dimension (mil)
Trace width	3.7
Trace thickness	1.2
Trace spacing	5.5
Via pad / signal	19
Via pad / ground	22
Antipad / signal	30
Antipad / ground for power	30
Drill / signal	11
Drill / ground	12
Clearance / antipad - trace	11
Clearance / signal drill – trace	20.5
Clearance / diff pair – diff pair	13.9



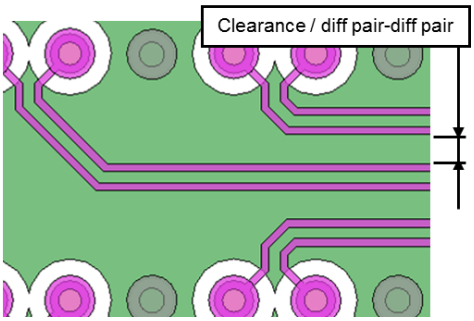
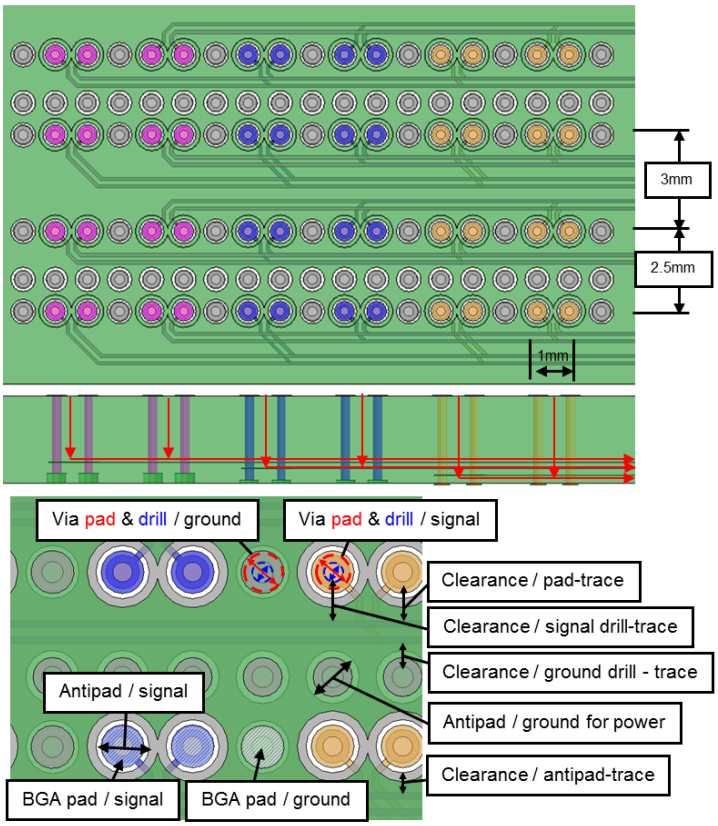


Figure 5-17 Routing example 4 – Via-in-pad vias

Routing Example 5: Via-in-Pad with Additional Ground Vias

By adding an optional row of ground vias in the narrow-most column, as shown in Figure 5-18, crosstalk can be reduced between adjacent signal vias. The wider 3mm spaced column does not use additional vias so that up to three signal traces can be run through the column space. This arrangement allows for all signals to escape out one side of the connector and requires three signal layers. Even with additional ground vias, there is sufficient copper between vias for power distribution in both the x and y directions, as seen in Figure 5-19.



Description	Dimension (mil)
Trace width	3.7
Trace thickness	1.2
Trace spacing	5.5
Via pad / signal	19
Via pad / ground	22
Antipad / signal	30
Antipad / ground for power	30
Drill / signal	11
Drill / ground	12
Clearance / antipad - trace	11
Clearance / pad - trace	16.5
Clearance / signal drill – trace	20.5
Clearance / ground drill - trace	18
Clearance / diff pair – diff pair	13.9

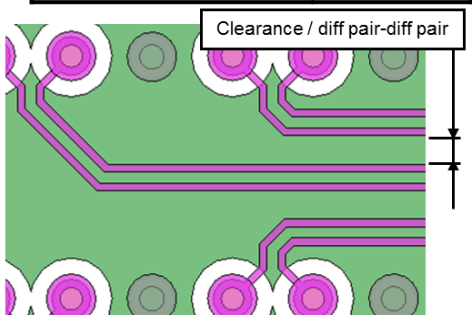
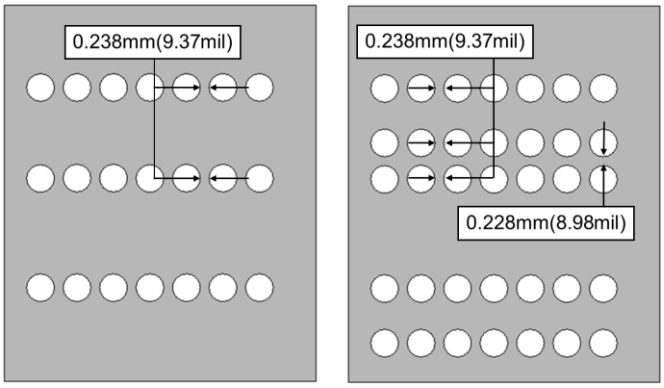


Figure 5-18 Routing example 5: Via-in-Pad with additional ground vias



Routing example 4 Routing example 5

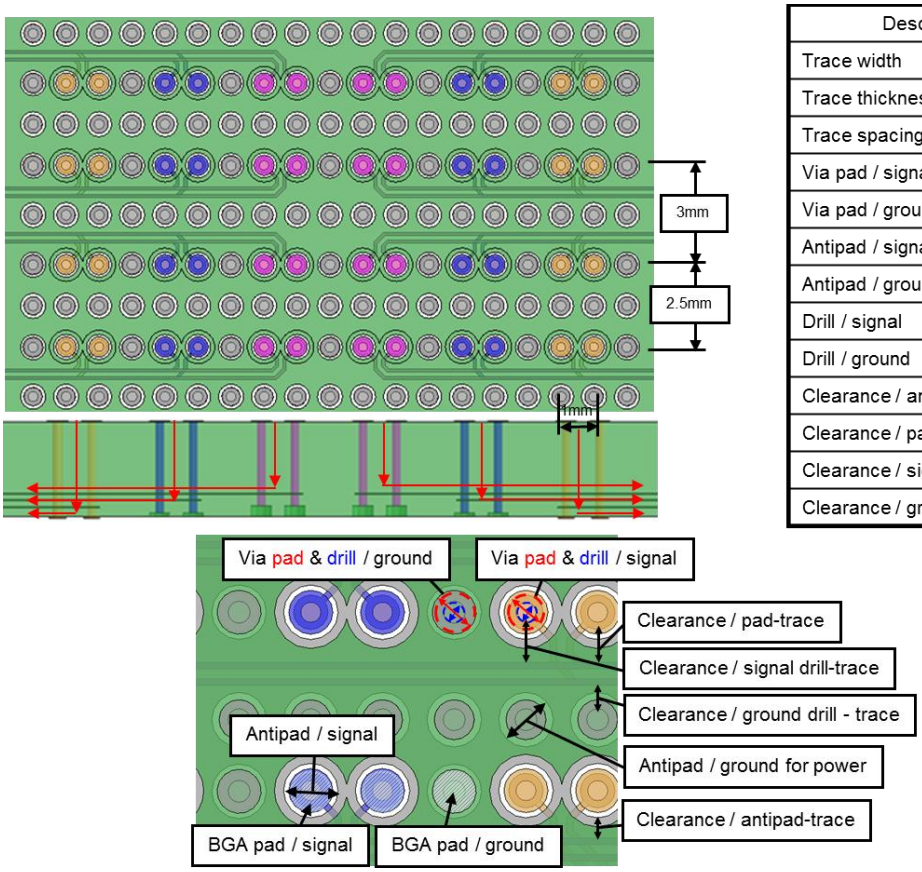
Figure 5-19 Power plane views of routing examples 4 and 5

Routing Example 6: Via-in-Pad with Ground Vias within All Columns

This example, shown in Figure 5-20, is employed to maximize signal integrity (SI) performance. The addition of ground vias between all columns help alleviate crosstalk between adjacent vias.

The example has the signal traces escaping out of each end of the connector which requires only three signal layers in the PCB stackup.

This example has the highest density and quantity of drills, but the power plane still shows continuity throughout the pinfield, as seen in Figure 5-21.



Description	Dimension (mil)
Trace width	3.7
Trace thickness	1.2
Trace spacing	5.5
Via pad / signal	19
Via pad / ground	22
Antipad / signal	30
Antipad / ground for power	30
Drill / signal	11
Drill / ground	12
Clearance / antipad - trace	11
Clearance / pad - trace	16.5
Clearance / signal drill – trace	20.5
Clearance / ground drill - trace	14.4

Figure 5-20 Routing Example 6: Via-in-Pad with additional ground vias between all columns

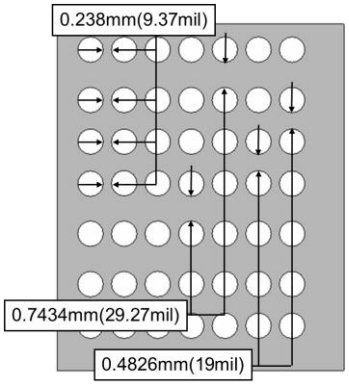


Figure 5-21 Power plane view of routing example 6

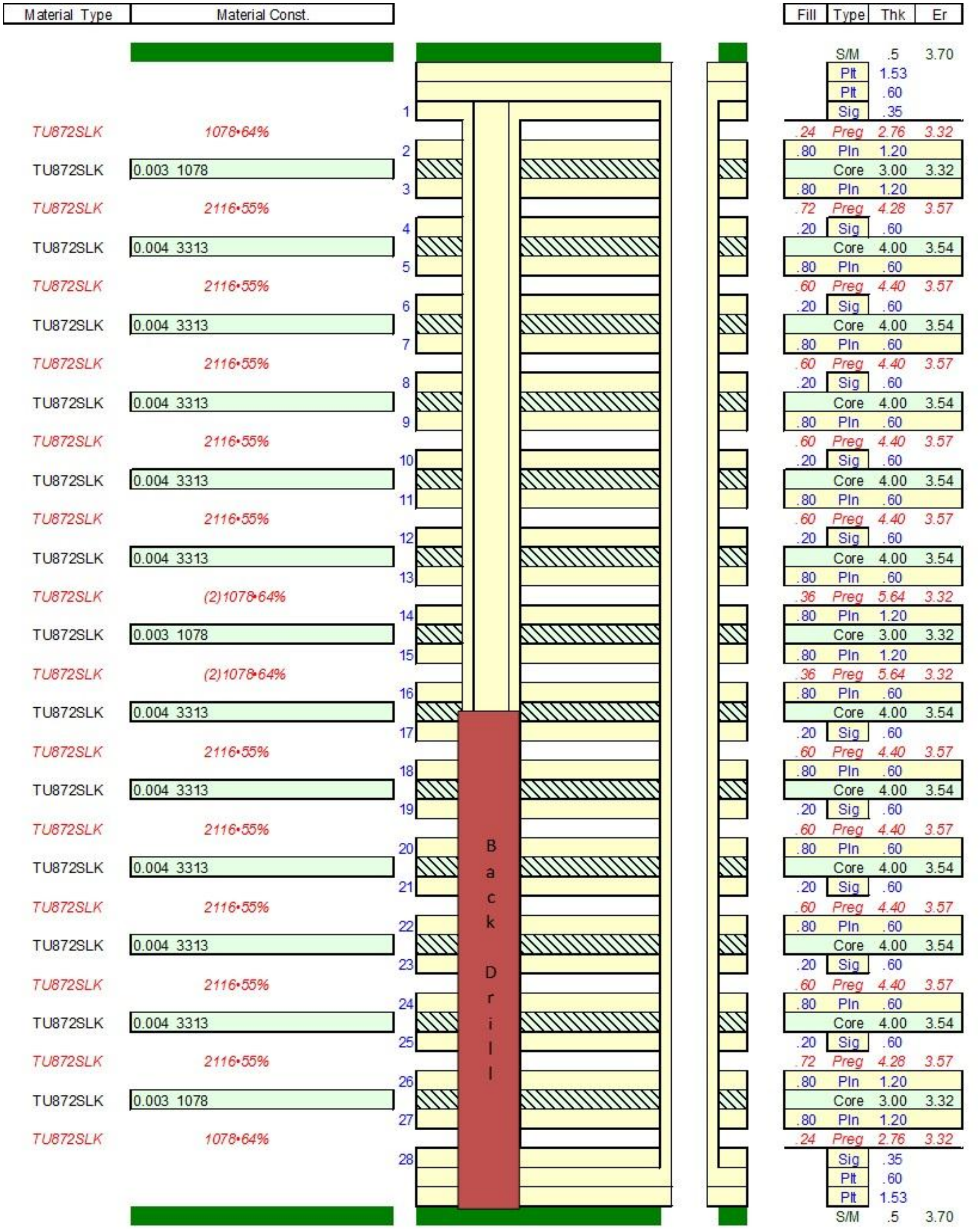


Figure 5-22 PCB stack up example

5.2 Multi-Connector Systems

The **IT8** connectors can be used alone or in combination with compatible connectors.

If multiple connectors are used on the same PWB, they must be oriented in the same direction, as shown below:

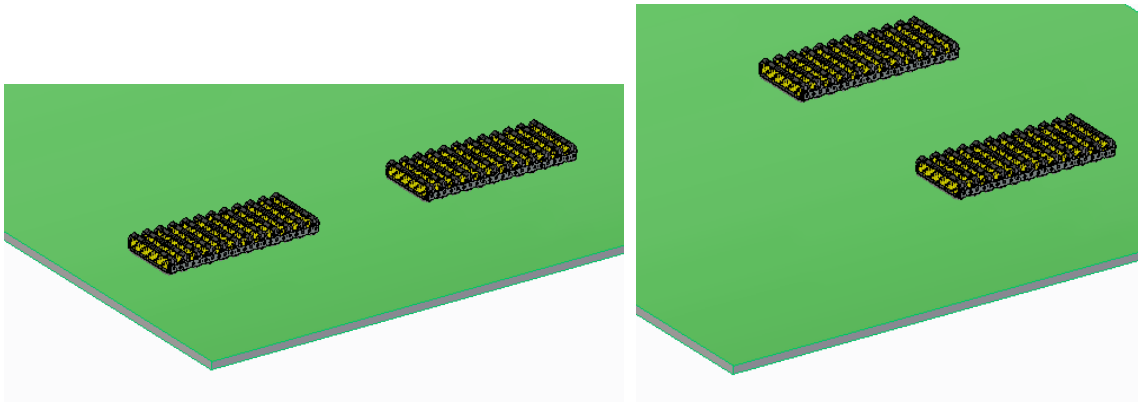


Figure 5-23 Correct orientations

Figure 5-24 Incorrect orientation

It is not recommended to mix orientations

5.3 Spacers

Spacers are necessary to support the PWB's and protect the BGA solder joints and connectors.

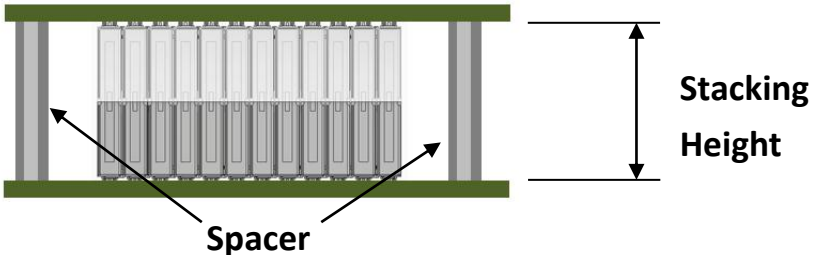


Figure 5-25 Spacers

Utilizing Male type spacers as in below is strongly recommended.

Spacer, male-male, M3 thread

Figure 5-26 Suggested spacer

The spacer heights must correspond to the interposer stacking heights shown below. Adopting insufficient height spacer may cause breakage of connectors, solder joints, PWBs or other parts.

Please refer to individual product drawings in detail.

Table 5-1 Spacer Height

Stacking Height	Spacer Height
XX mm	XX +/-0.127 mm

Note: XX is the value of stacking height.

5.3.1 Spacer Location

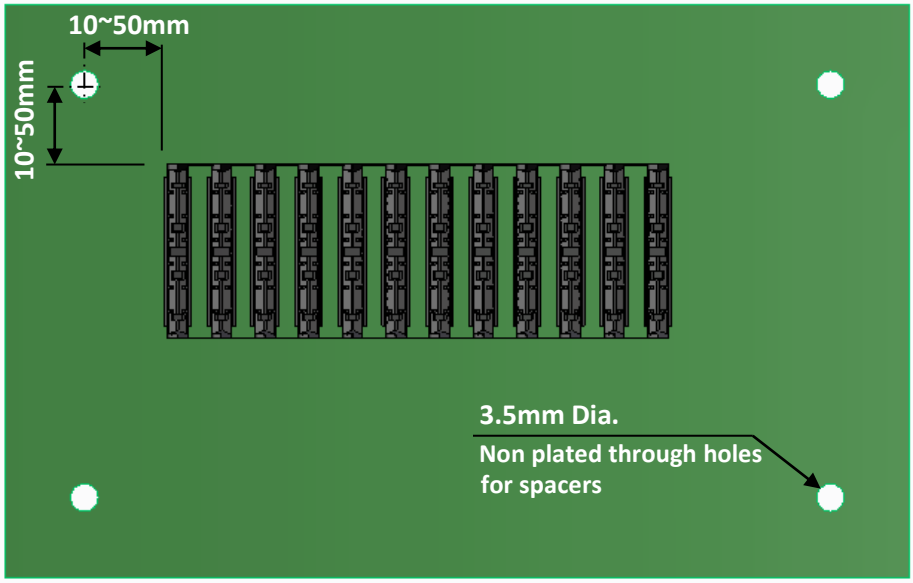


Figure 5-27 Spacer location

Four spacers located rectangularly or simmiler are required. Spacers should be located 10 – 50 mm from the corners of the plugs or receptacles to prevent excessive mechanical loading on the interconnections.

If assembly will be subjected to vibration, spacers should be located to prevent resonance, and additional spacers may be required.

Please refer to individual product drawings in detail.

5.4 Clearance between Connectors and Other Components/PCB Edge

Parallel Mounting

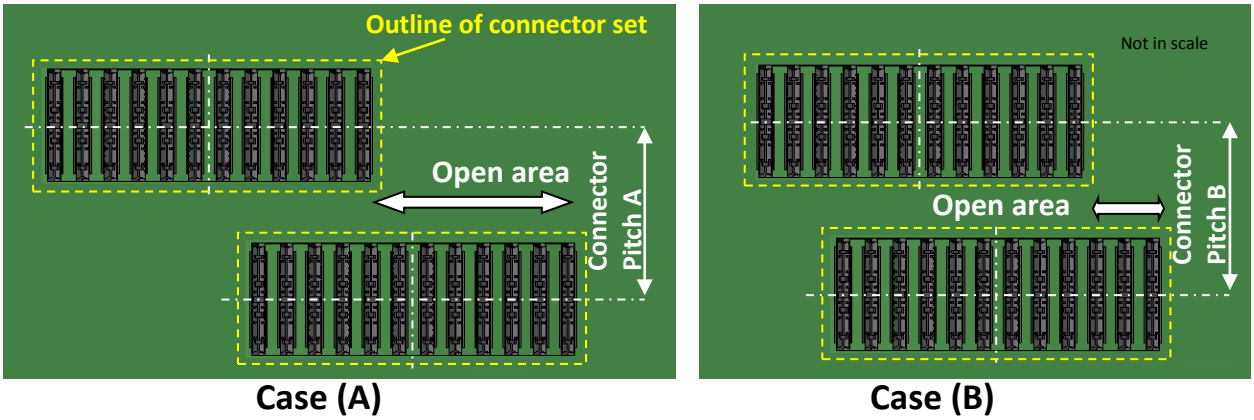


Figure 5-28 Parallel nounting

(A) If open area length is greater than 11mm:

Table 5-2 Connector Pitch A

Plug Combinations	Connector Pitch A (Min)	Connector Pitch A (Max)
All combinations	**30.6** mm	**209.20** mm

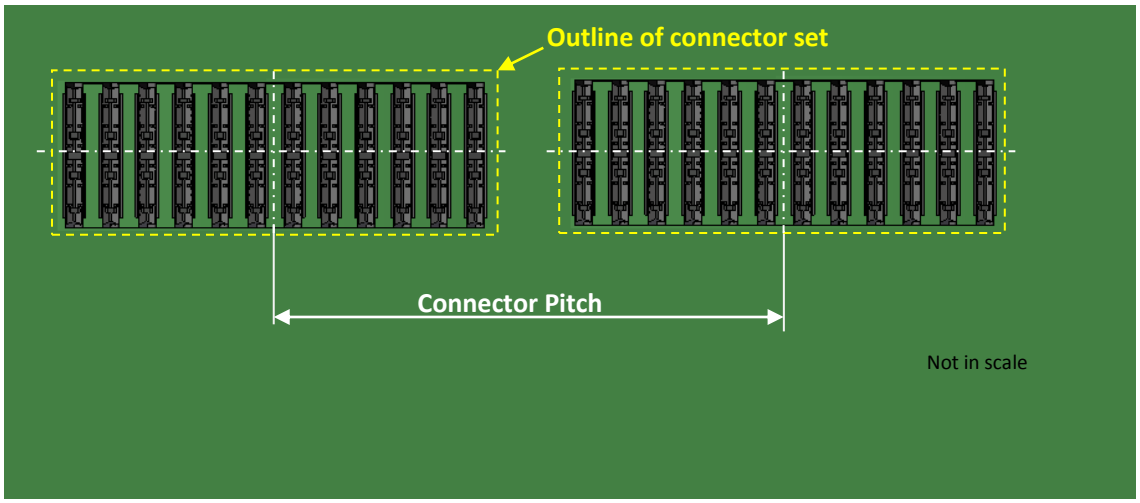
(B) If open area length is less than 11mm:

Table 5-3 Connector Pitch B

Plug Combinations	Connector Pitch B (Min)	Connector Pitch B (Max)
All combinations	**35.6** mm	**209.20** mm

Suggested clearances are based on accessibility to grip interposer for purposes of disassembly and field replacement.

Tandem Mounting



Plug Combinations	Connector Minimum Pitch (mm)	Connector Maximum Pitch (mm)
IT8-120pos + IT8-120pos	32.4	214.3
IT8-120pos + IT8-192 pos	40.65	222.55
IT8-120pos + IT8-288 pos	51.65	233.55
IT8-192pos + IT8-192 pos	48.9	230.8
IT8-192pos + IT8-288 pos	59.9	241.8
IT8-288pos + IT8-288 pos	70.9	252.8

Figure 5-29 Tandem mounting

Clearances between a connector and other components

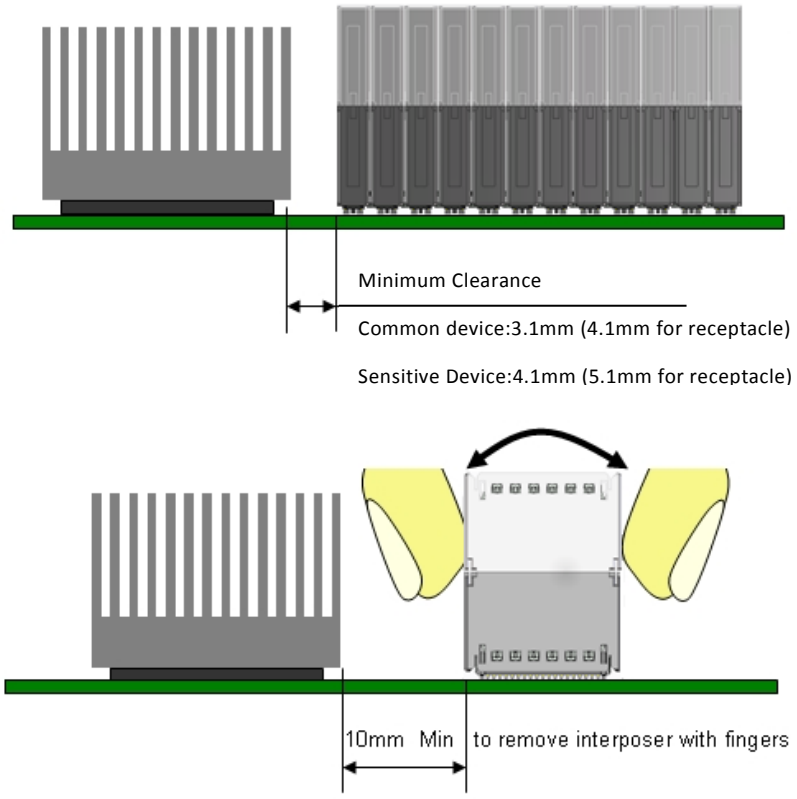


Figure 5-30 Clearance between connector and other parts

Clearance between the receptacle and PCB edges

Please communicate CEM regarding the clearance, especially when requiring the top side reflow.

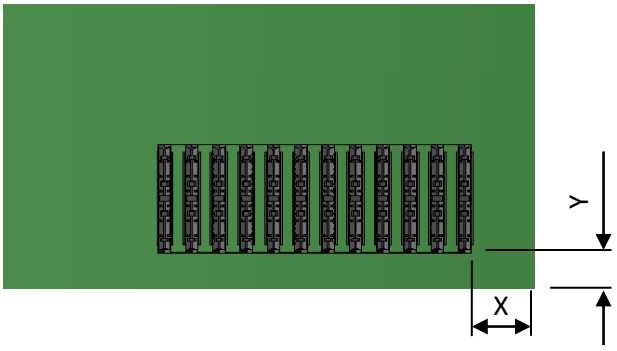


Figure 5-31 Clearance between connector and PCB edges

5.5 Interposer Direction

Do not mix detachable and mounting plugs on the same PWB.

All interposers must engage in the same direction, as shown below.

Mate/ Unmate

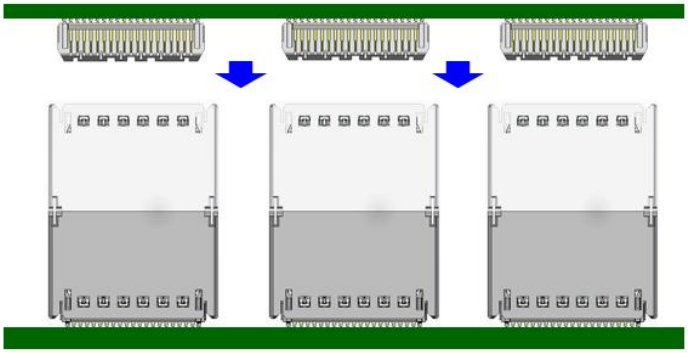


Figure 5-32 Correct direction

Mate/ Unmate

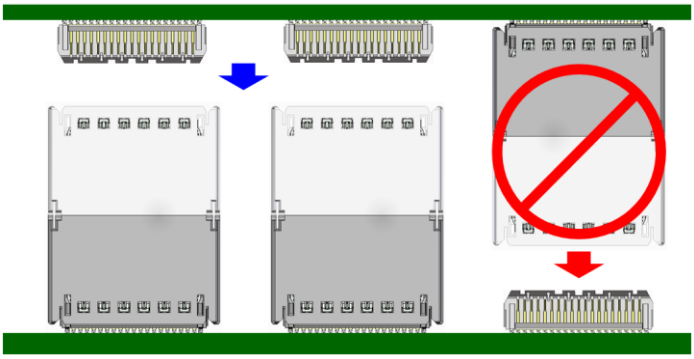


Figure 5-33 Incorrect direction

5.6 Alignment Tolerances

5.6.1 Mounting Tolerances

Mounting tolerances of ± 0.05mm are required for robust SMT assembly and to ensure proper mating fits in cases of multiple connectors:

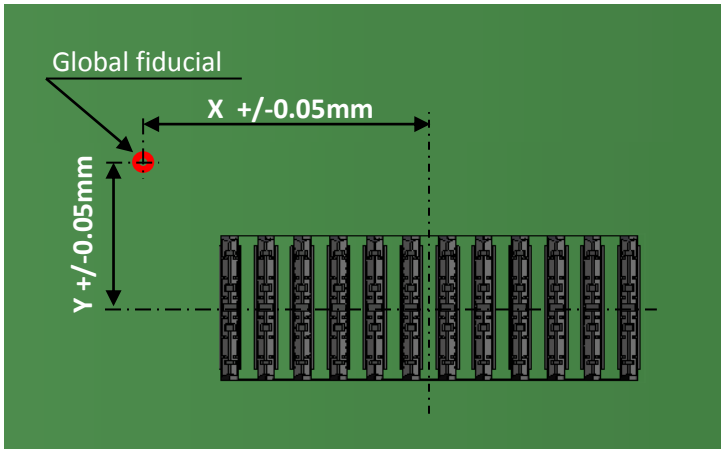


Figure 5-34 Mounting tolerances

Please refer to individual product drawings in detail.

5.6.2 Mating Self Alignment

The Two-piece and the Three-piece design can accept mating self-alignment of up to ±1.5mm tolerance in the X-axis and up to ±1.5mm in the Y-axis. Sufficient spacers are necessary to support the PWB's and protect the BGA solder joints and connectors.

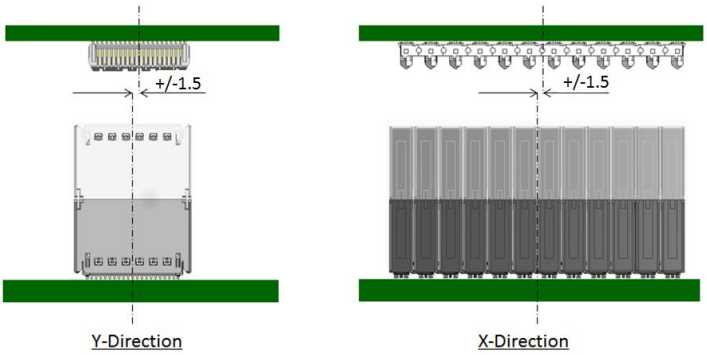


Figure 5-35 Self Alignment

These values do not include the influence of misalignment in other axis nor rotation/inclination in the same time, except for the misalignment in the single axis shown in each figure.

5.6.3 Mated State Tolerances

The Two-piece and the Three-piece design can accept mating tolerances of up to ±0.2mm tolerance in the X-axis and up to ±0.2mm in the Y-axis.

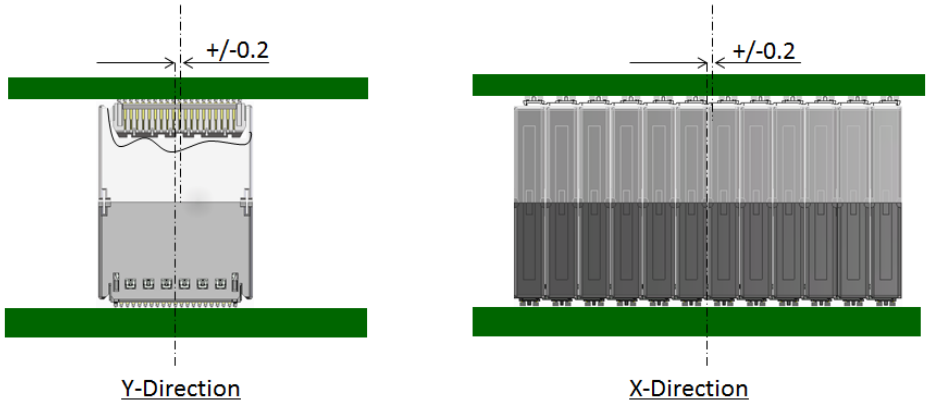


Figure 5-36 Mating tolerances

These values do not include the influence of misalignment in other axis nor rotation/inclination in the same time, except for the misalignment in the single axis shown in each figure.

Section 6 Assembly Process

This section of the Design Note discusses summarized IT8 assembly process and interposer installation / removal. As for details, please refer to Assembly note. Unless specifically mentioned, IT8 receptacle (two piece type) and plug (two and three piece type) share the same capability and requirement.

6.1 Overall Assembly Process

6.1.1 Difference between detachable plug and mounting plug

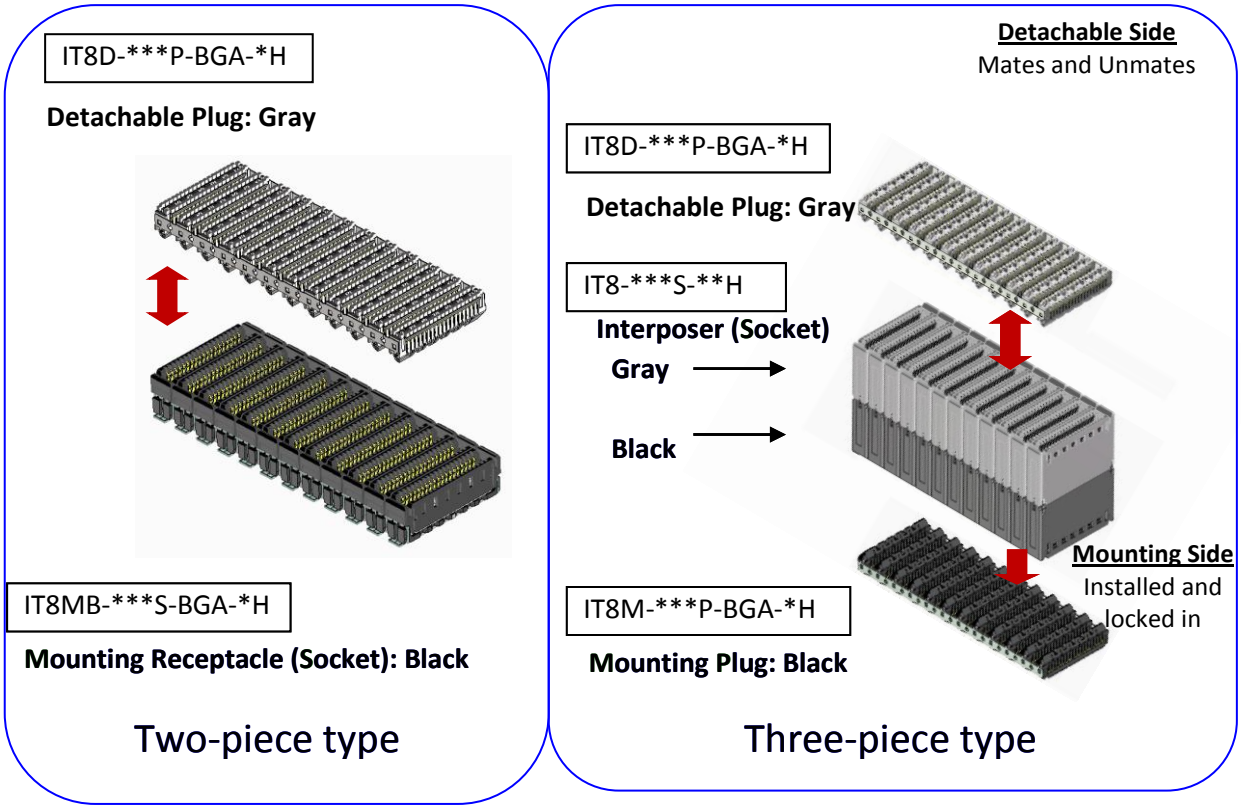
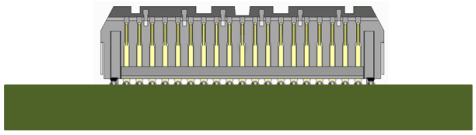


Figure 6-1 Differences Between Detachable and Mounting Plug

6.1.2 Assembly Process

IT8 Assembly Process (Three-piece type)

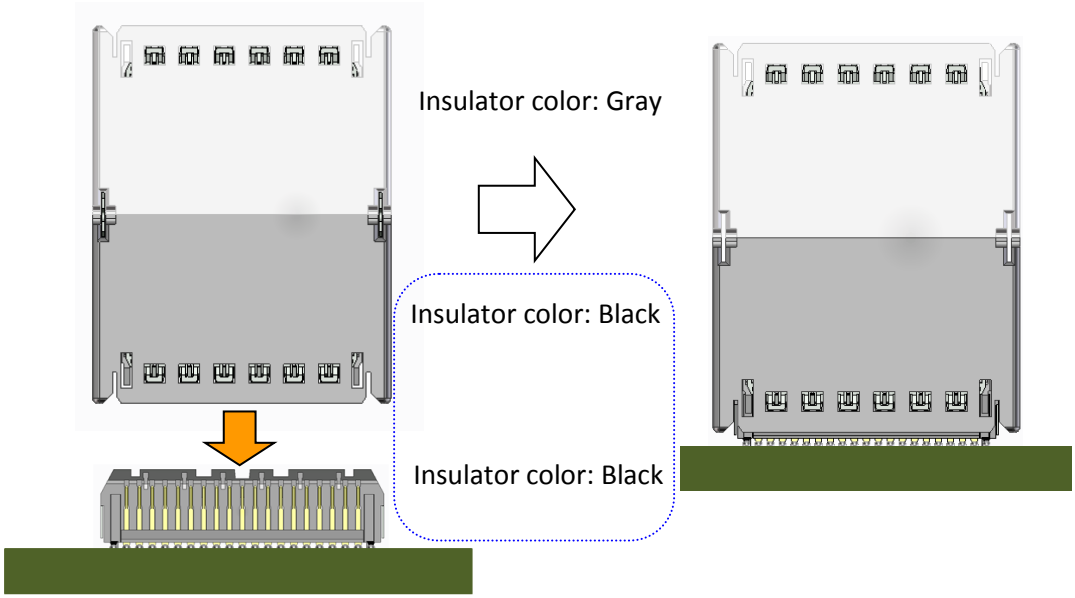
1) Reflow Mounting Plug (IT8M) on PCB



Insulator color: Black

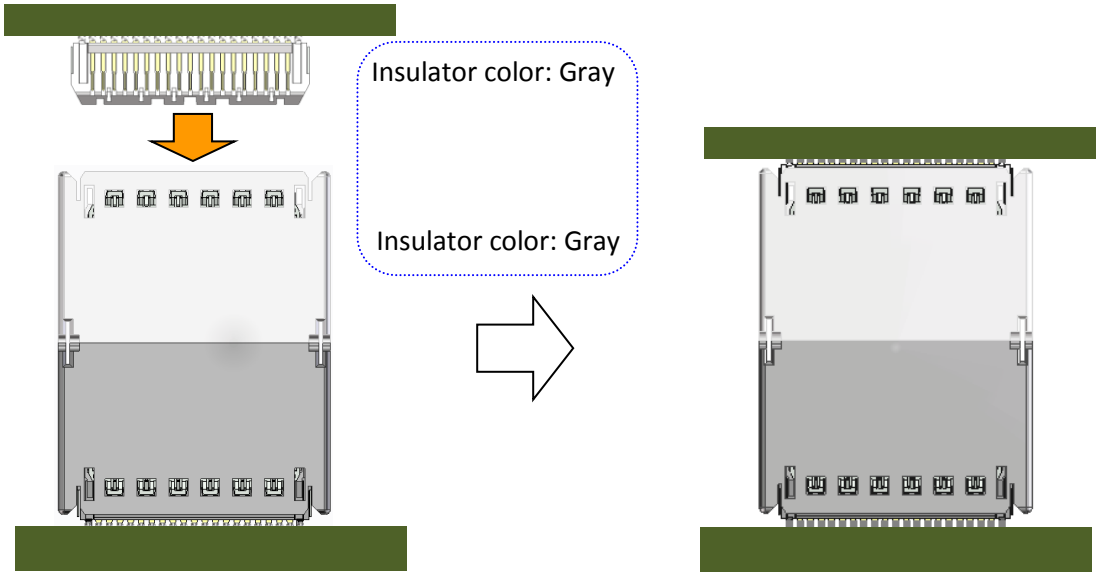
Caution: The interposer should not be reflowed

2) Mate Interposer onto Mounting Plug



Caution: Do not touch and push contacts in Interposer
Mate black side of the interposer with the black mounting plug, otherwise signal pin-out will change and cause a system error

3) Insert Detachable Plug (IT8D)



Caution:Insulator color of the datachable plug is gray, and the detachable plug must mate with the gray side of the interposer.

6.2 Interposer Installation

The interposer snaps onto the mounting plug as shown below:

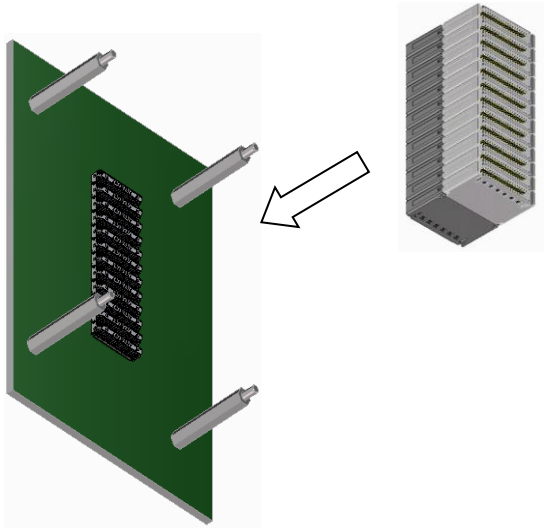


Figure 6-2 Interposer Installation

The spacers should be installed prior to the operation. The detachable plug shall be aligned with the interposer and pressed on as shown below:

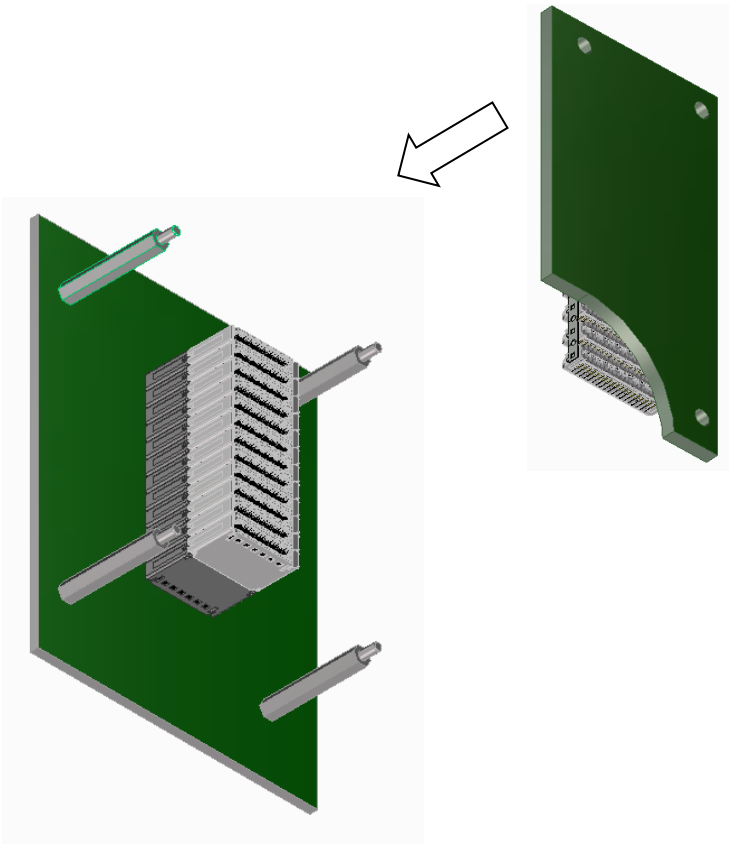


Figure 6-3 Detachable Plug Installation

It is very important to provide sufficient support under the board when installing the interposers. A simple tooling plate can be fabricated to support the PWB and prevent it from flexing when the interposers are installed:

System Assembly Support Fixture

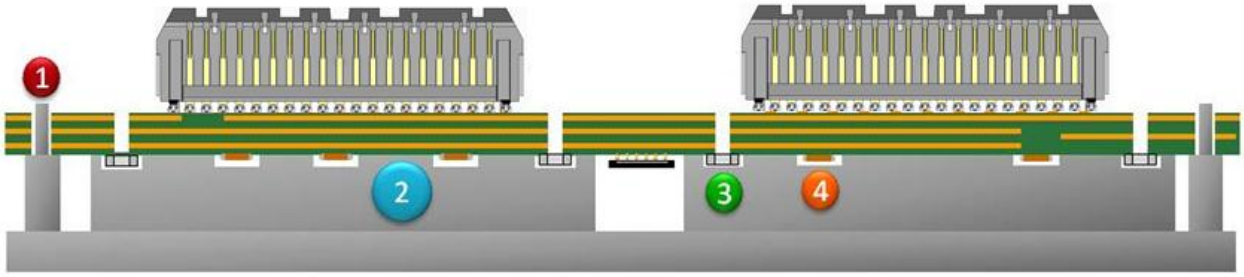


Figure 6-4 System Assembly Support Fixture

1. Guide pins for PWB tooling holes align motherboard to support fixture (shown 2 places)
2. Support blocks directly under mounting plugs to prevent board from flexing during interposer and daughter card assembly* (shown 2 places)
3. Nests in blocks for spacer nuts hold the nuts in place while the spacer is tightened (shown 4 places)
4. Openings in block provide ample clearance for components (shown 5places)

* For more information on PWB support and allowable deflections, reference IPC-JEDEC 9704, *Printed Wiring Board Strain Gage Test Guideline.*

In mating operation, 0° for following angles are preferred. In case keeping 0° is difficult, following maximum angles should not be exceeded during manual installation of the daughter card as shown below:

- Longitudinal: 3º
- Lateral: 3º

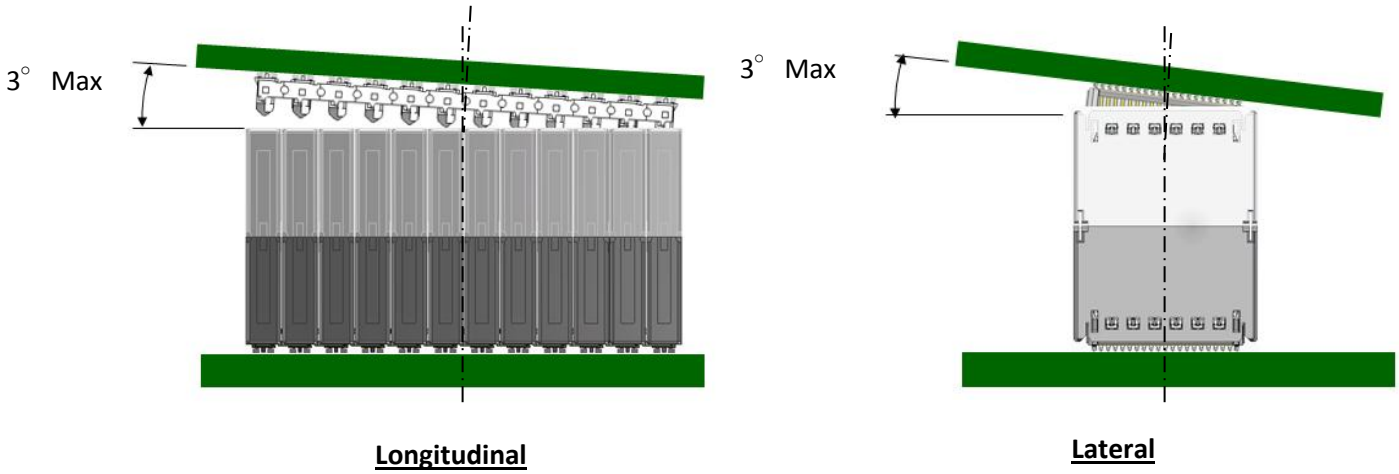


Figure 6-5 Angles During Manual Installation

Please consider to keep allowable angles (Figure 6-5) and the orientation of the daughter card for manual assembly during the design process. These values do not include the influence of other misalignment nor rotation/inclination in the same time, except for the angle along the single axis shown in each figure. Hirose also strongly recommends the use of spacers as mentioned on Chapter 5.3. The tips of the spacers will serve as fulcrum points that allow operators to accomplish daughter card assembly with small angles.

Position the interposer directly over the mounting plug and align it with mating guide of the connector. If positioned properly, the interposer should slide easily onto the mounting plug. Push the interposer down to the end. Please be sure to hold the interposer on the side walls during the operation without touching the contacts.

6.3 Overall Disassembly Process

The Hirose **IT8** connector system can be disassembled if a mother board or daughter card requires replacement. In case of the three-piece type, both the detachable plug and the interposer are removable. When removing a card or a connector component, the circuit boards should be handled with great care to prevent damage to them. Failure to properly remove the circuit boards or interposers can result in permanent damage to the circuit assemblies.

To remove a daughter card, first remove the nuts from the reinforcing spacers.

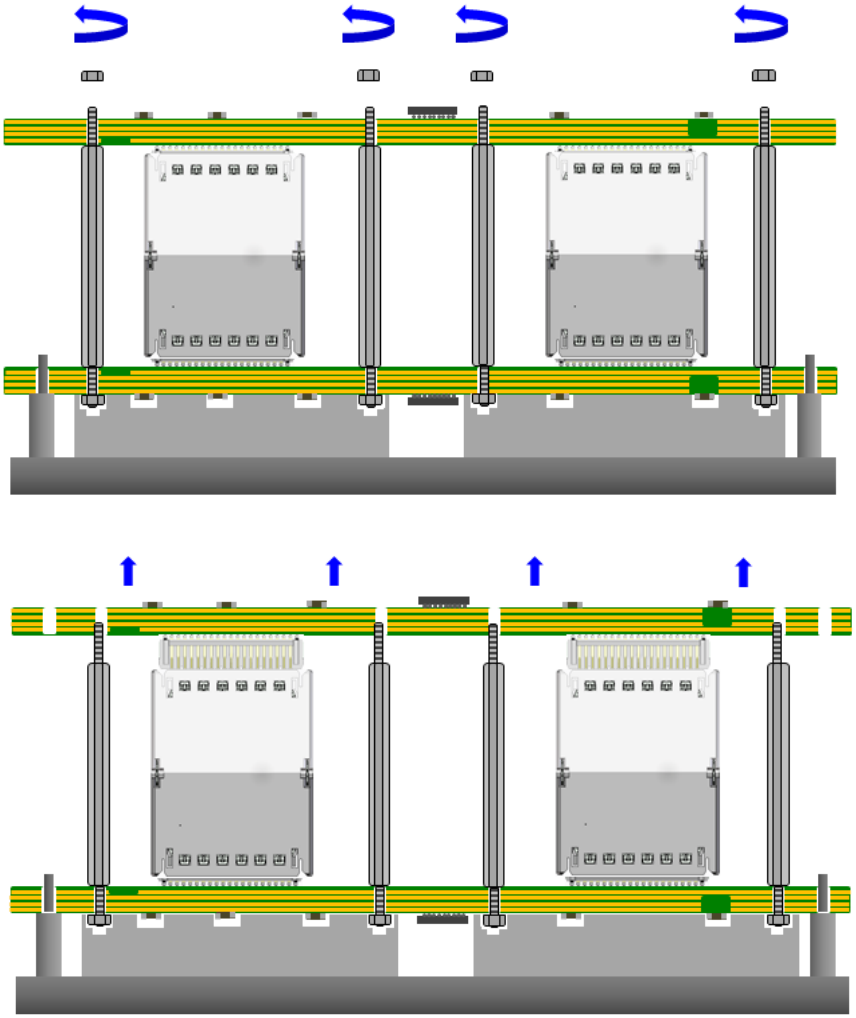


Figure 6-6 Daughter Card Removal 1

It is very important to prevent excessive flexing of the circuit assemblies during disassembly operations. To minimize flexing of the mother board, a simple tooling plate is suggested.

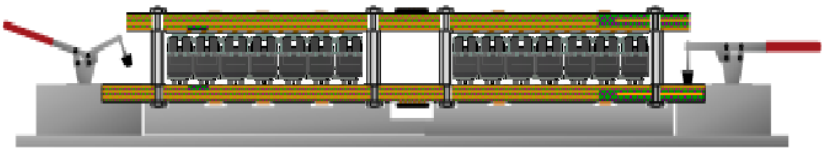


Figure 6-7 Daughter Card Removal 2

The tooling plate has clamps to stabilize the mother board while the daughter card (and possibly the interposer) is removed. The daughter card should be lifted straight up off the interposers/receptacles.

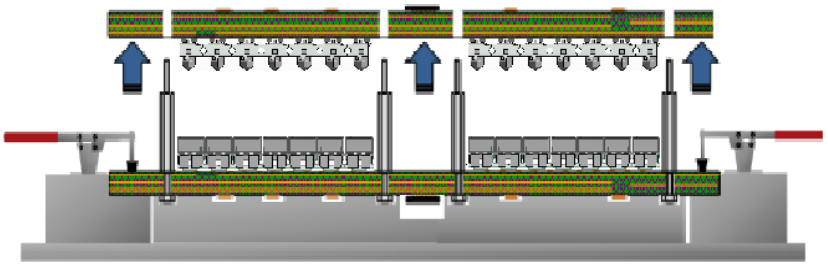


Figure 6-8 Daughter Card Removal 3

To minimize unnecessary flexing of the daughter card, the removal forces should be applied as close to the connector/interposer as possible without contacting any components. On densely populated assemblies, the edges may be the only open area that can be grasped.

The following maximum angles should not be exceeded during disassembly of the daughter card as shown below:

- Longitudinal: 3°
- Lateral: 3°

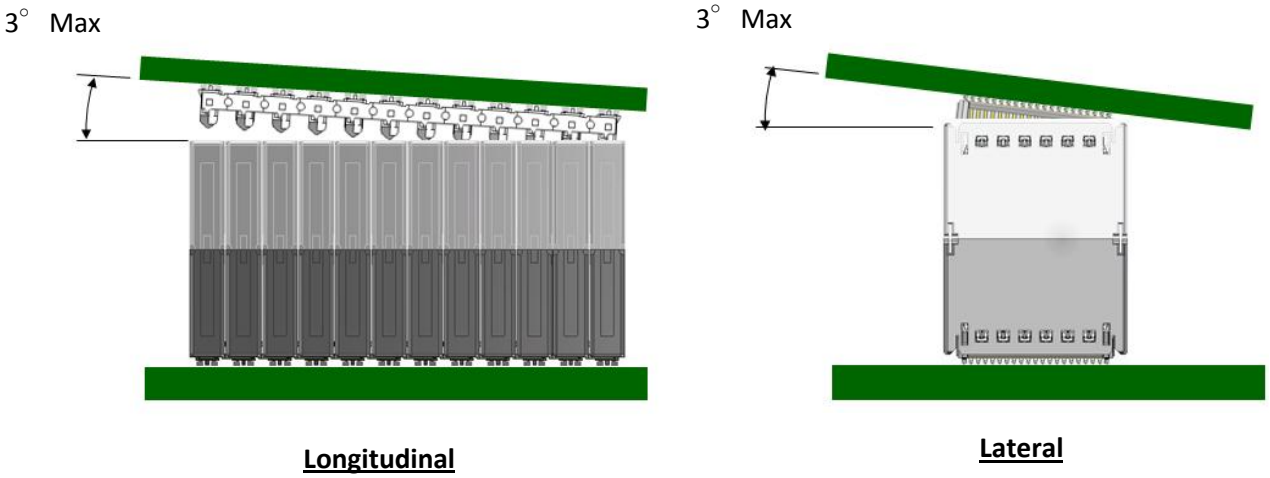


Figure 6-9 Angles During Manual Disassembly

Please consider to keep above allowable angles (Figure 6-9) and the orientation of the daughter card for manual assembly during the design process. These values do not include the influence of other misalignment nor rotation/inclination in the same time, except for the angle along the single axis shown in each figure. Please use spacers as mentioned on Chapter 5.3 so the tip of the spacers that will allow operators to accomplish daughter card disassembly with small angles.

6.4 Interposer removal

The removal of interposer shall be 5 times max.
For removal, hold the Interposer on the walls as shown below.

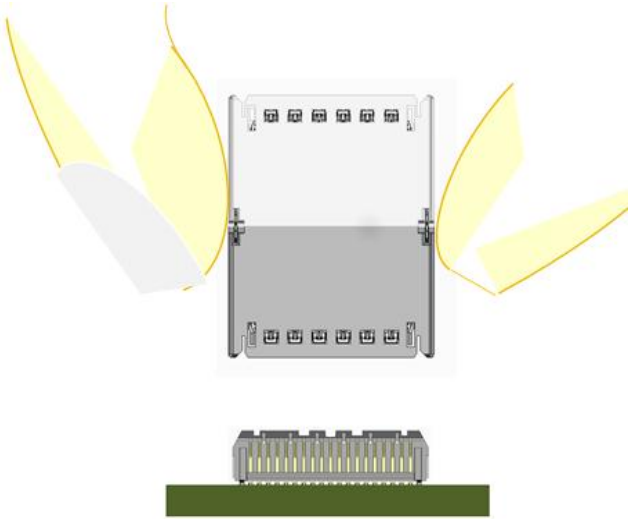


Figure 6-10 Interposer Removal

Also, please grab the walls close to the gravity center of the interposer to prevent tilting of the interposer during removal operation.

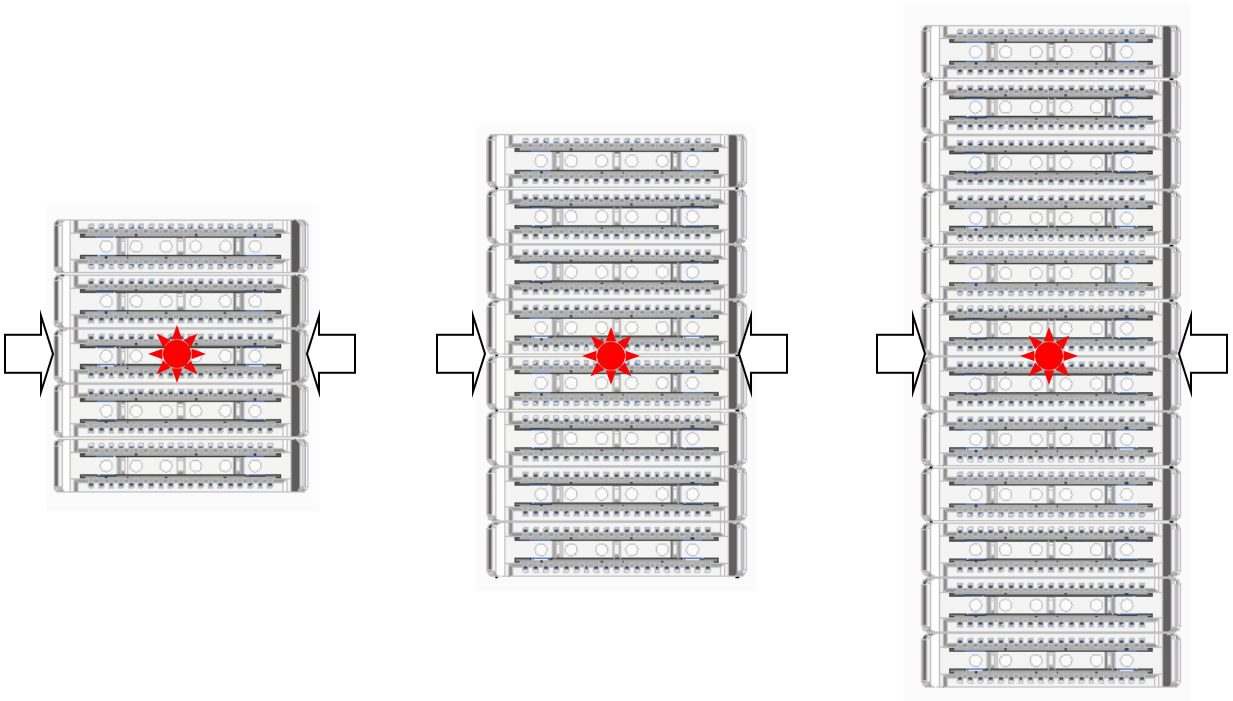
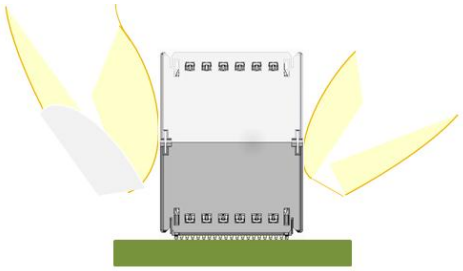


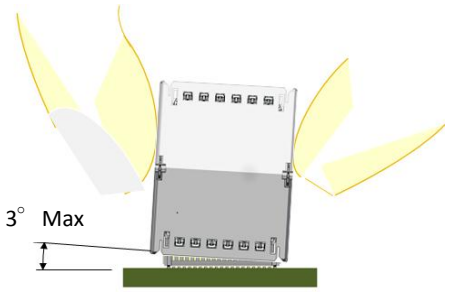
Figure 6-11 Interposer Holding

Interposer Removal by Hand

1) Hold the Interposer on the walls.

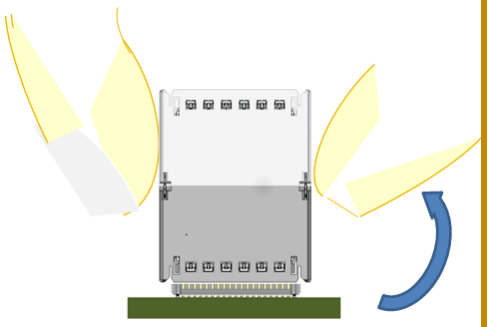


2) Gently rotate one side of the Interposer laterally 3° maximum

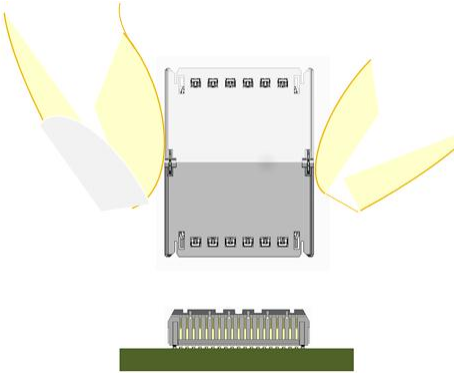


Caution: do not rotate more than 3 degrees

3) While gently rotating, pull up on other side of the Interposer



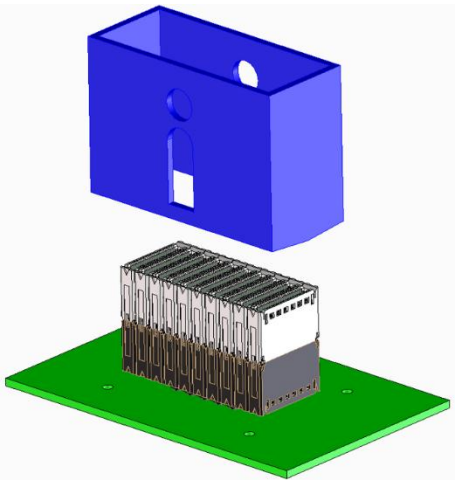
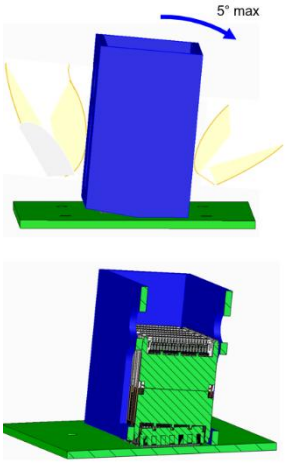
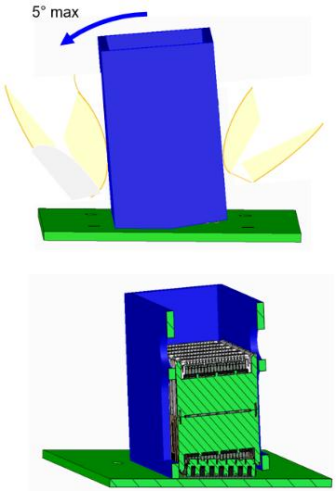
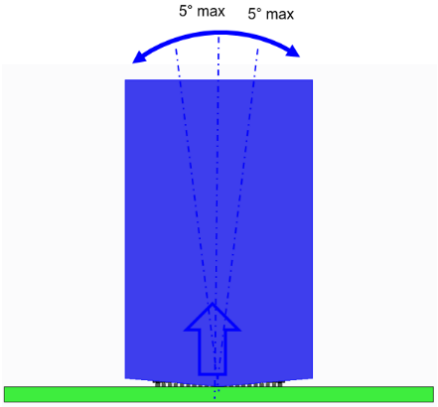
4) The Interposer is removed, and the Mounting Plug is ready to accept another Interposer.



Precaution

Each module composing the interposer should be pulled up and removed at the same timing to minimize distortion or tilting of the interposer during the removal process. Visually inspect the interposer before reinstalling it. Discard if it shows any sign of damage or wear. Do not subject the interposer assembly to more than five removal-reinstallation cycles, even if it appears unaffected.

An Interposer removal tool example is shown below. This tool is not for interposer installation, please do not use it to install an interposer.

Interposer Removal by Tool	
1) Hold the Interposer on the walls. 	2) Gently rotate one side of the Interposer laterally 5° maximum. 
3) While gently rotating, pull up on other side of the Interposer. 	4) Tilt the tool as indicated alternately several times until the Interposer is removed, and the mounting plug is ready to accept another Interposer. 

Precaution: Visually inspect the interposer before reinstalling it. Discard it if it shows any signs of damage or wear. Do not subject the interposer to more than five removal-reinstallation cycles even if it appears to be unaffected. Please note that in case there is not enough spacing between adjacent parts, interference should occur and the removal tool will not be adopted. Hirose will be able to provide electrical data of the tool for 3D modeling, if required.

Section 7 Technical Document Library

Following data and documents are available.

7.1 Technical Data

No	Item	Format	File name (Ex.)
1	Simplified 3D model	STEP (SAT &IGES are also available)	TBD
2	Footprint data	Allegro	TBD
3	Spice models	Spice	TBD
4	Touchstone model	Touchstone	TBD

7.2 Technical Document

No	Item	Format	File name (Ex.) or Document number
1	2D drawing	PDF	TBD
2	Spec sheets	PDF	TBD
3	Contact reliability report	PDF	TBD
4	Lead free thermal cycling test report	PDF	TBD
5	Temperature rise report	PDF	TBD
6	SI report	PDF	TBD
7	Assembly note	PDF	ETAD-F0812
8	Design note	PDF	ETAD-F0768
9	Customer demo board test report	PDF	TBD
10	Characterization board test report	PDF	TBD

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