
Cadence LIVE Japan 2022

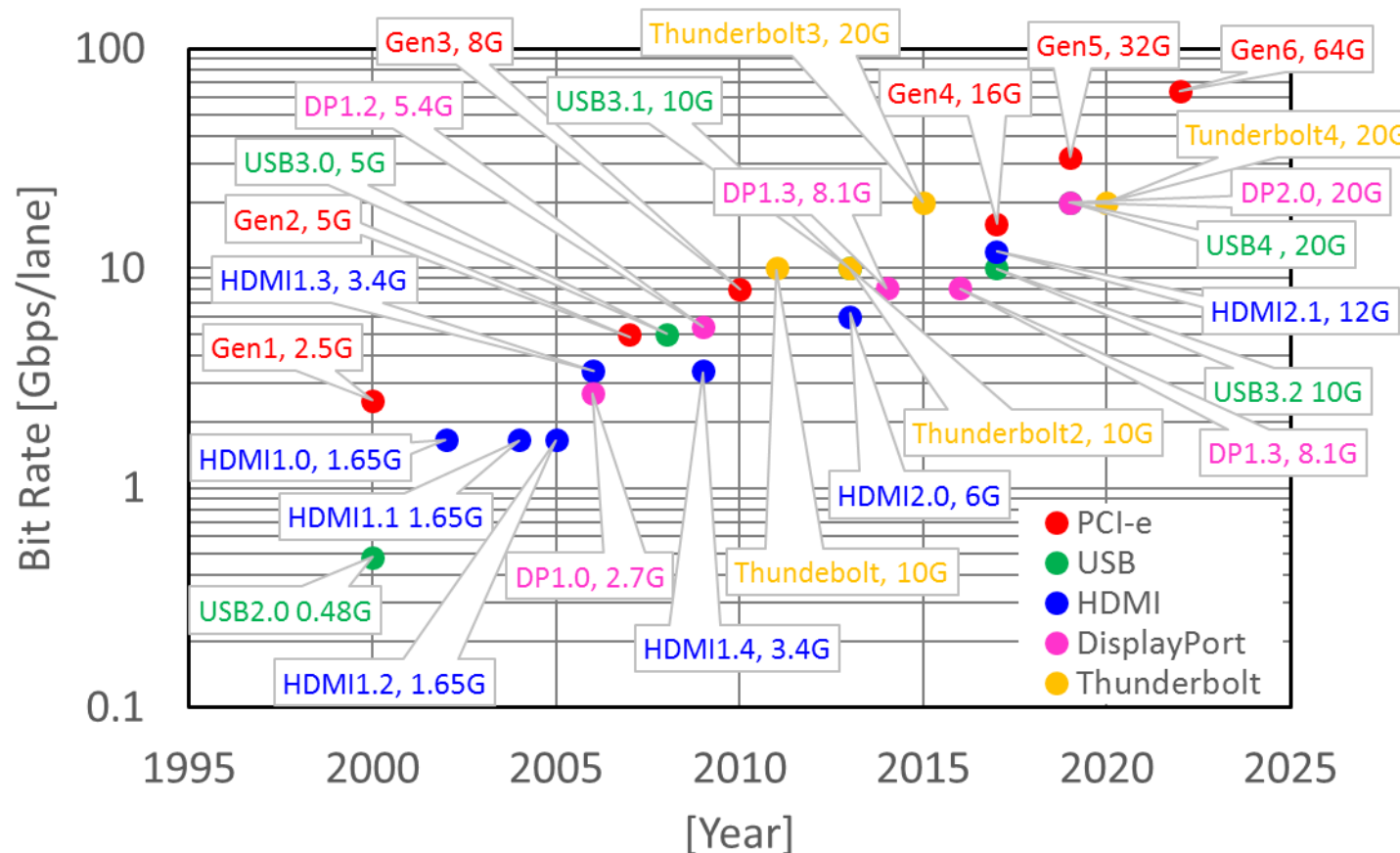
Providing Clarity 3D connector models for the electromagnetic field simulator

07/15/2022 Hiroaki Ikeda

- ✓ Background of creating the encrypted 3D model
- ✓ Lineup of Clarity encrypted 3D models
- ✓ Accuracy benchmark
- ✓ Future Plans
- ✓ Summary

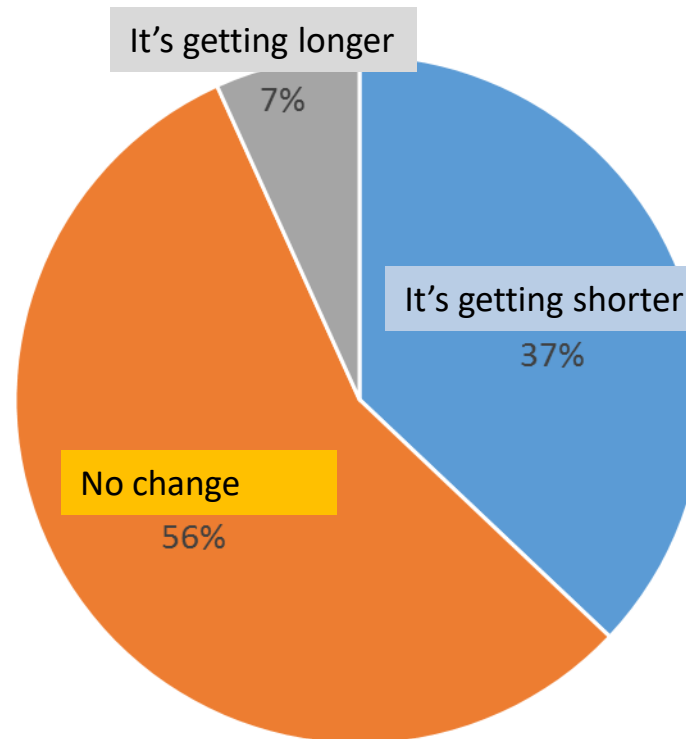
Transition of interface standards and bit rates

- ✓ The performance of electronic devices has improved, and the bit rate of digital signals has increased accordingly.
- ✓ From 2000 to 2010, The data rate is 17 times higher: 480Mbps --> 8Gbps
- ✓ From 2010 to 2020, The data rate is 8 times higher: 8Gbps --> 64Gbps



Product development period

- ✓ Electronic devices become obsolete quickly and the development period is short.
- ✓ 37% of designers say the development period has been shortened.

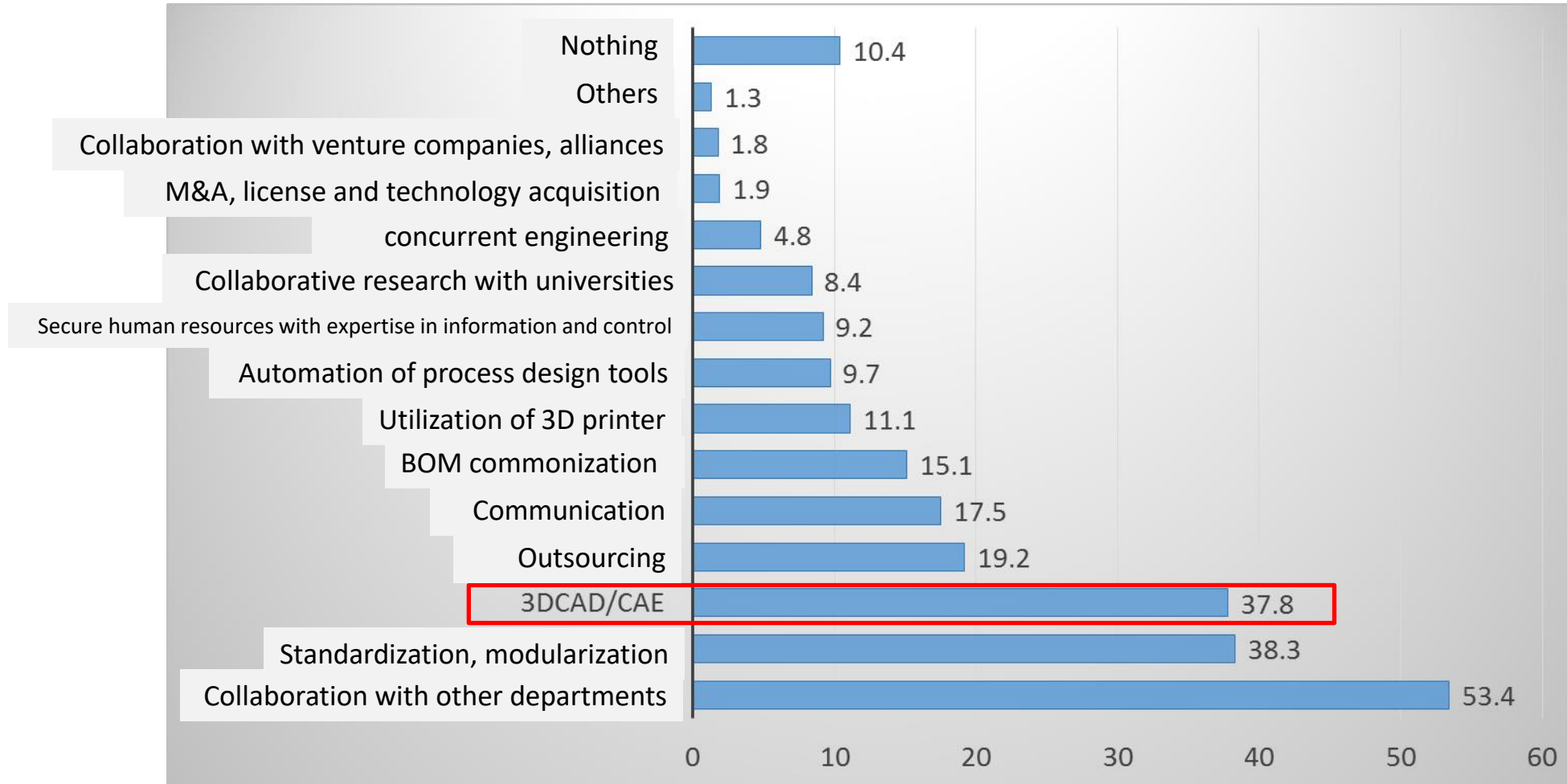


Source: Mitsubishi UFJ Research and Consulting Corporation, "我が国ものづくり産業の課題と対応の方向性に関する調査", 2019

What is important for shortening the product development period



37.8% of designers consider 3DCAD/CAE important.

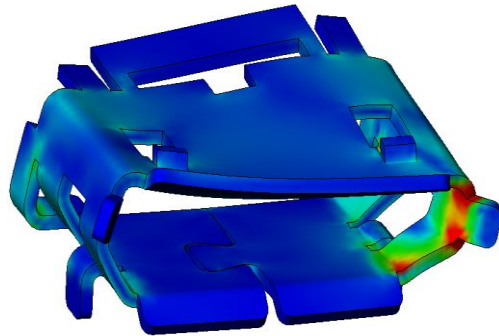


Source: Mitsubishi UFJ Research and Consulting Corporation, "我が国ものづくり産業の課題と対応の方向性に関する調査", 2019

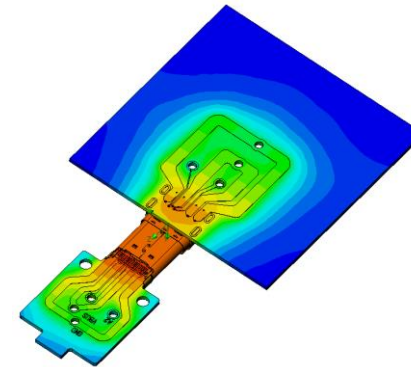
Various numerical simulations

- ✓ Various numerical simulations are used to shorten the development period.

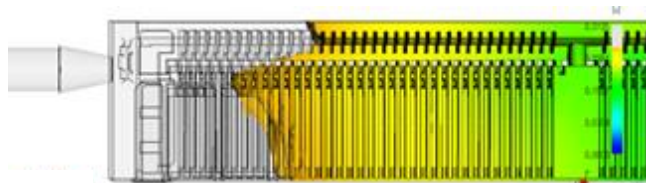
Stress analysis



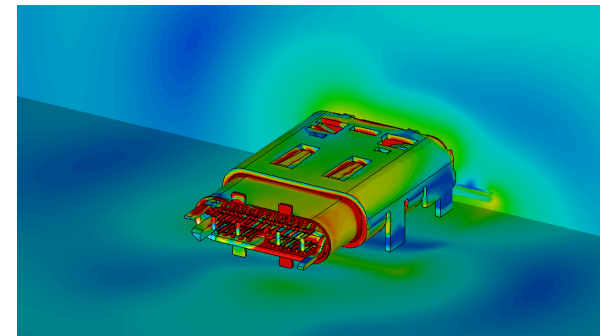
Thermal analysis



Flow analysis



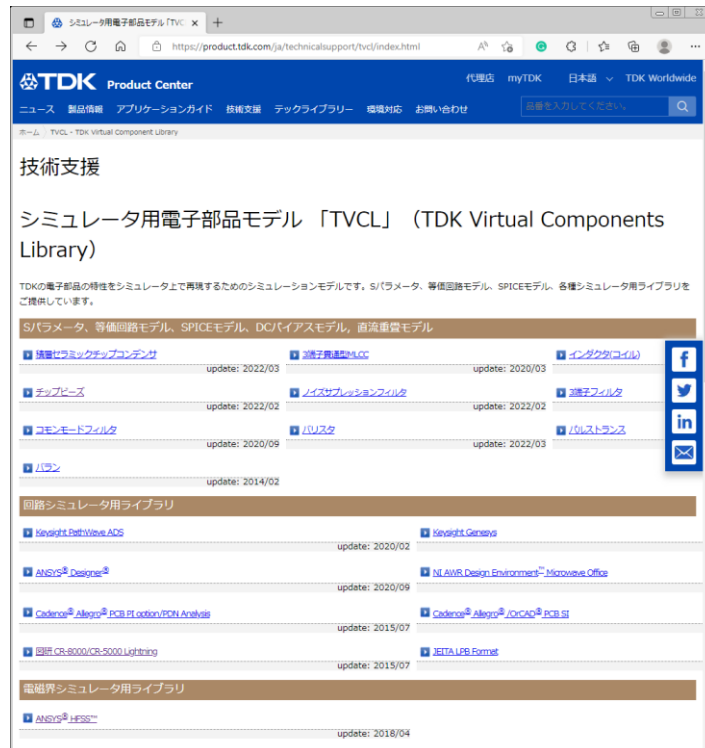
Electromagnetic field analysis



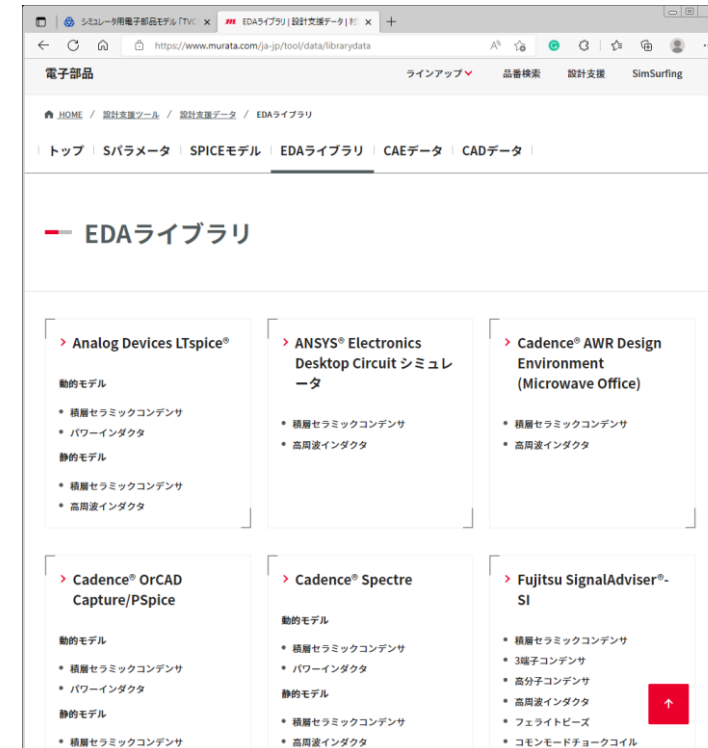
Passive element model

- ✓ For board design only, simulation models of passive elements such as capacitors, coils, resistors and filters as well as active elements such as LSI can be obtained from their manufacturers.

TDK Website



Murata Website



<https://product.tdk.com/ja/technicalsupport/tvcl/index.html>

<https://www.murata.com/ja-jp/tool/data/librarydata>

A model example of passive element (filter)

- ✓ Models of capacitors, coils and filters are provided with equivalent circuit or S-parameter format with their internal structure hidden.

SPICE (equivalent circuit) model

```
.SUBCKT BLE32PN260SN1 port1 port2
R1 port1 1 29.99
L1 port1 1 5.504e-8
C1 port1 2 5.248e-13
R2 1 2 18.82
L2 1 2 6.222e-9
R3 2 3 999.9
L3 2 3 9.924e-10
R4 3 port2 1.100e-3
.ENDS BLE32PN260SN1
```

S-parameter

```
! BLM03AG100SN1
# Hz S RI R 50
!Freq.(Hz) S11(Real) S11(Imag) S21(Real)
1e+06 0.00045893 0.0037198 0.99954
1.0202e+06 0.00046541 0.0037947 0.99953
1.0408e+06 0.00047216 0.0038711 0.99953
1.0619e+06 0.00047918 0.0039491 0.99952
1.0834e+06 0.00048648 0.0040285 0.99951
1.1053e+06 0.00049408 0.0041096 0.99951
1.1276e+06 0.00050199 0.0041923 0.9995
1.1504e+06 0.00051023 0.0042766 0.99949
1.1737e+06 0.00051879 0.0043627 0.99948
```

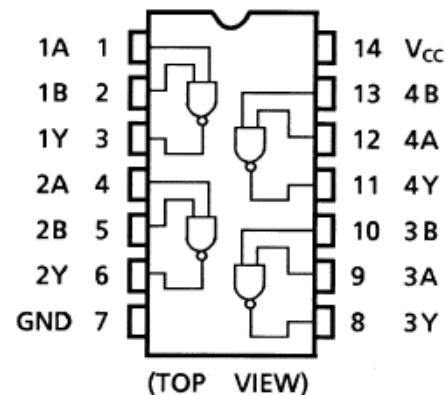

A model example of active element (Logic IC)

Encrypted model

```
.SUBCKT SN74HC00 1A 1B 1Y 2A 2B 2Y
+ CGND 3Y 3A 3B 4Y 4A 4B CVCC
.proot
FREELIB7K1:.=#Kq[=2/63f:bDhe7gd+%XA<SgW%/10'SJ+
q'XU.b[W<C%/$9/U89>!8Y#/6K>2[xJQ7K1:.j#KqU=2/6;f:bD
)e7gd+%XA<SgW%/10'SJ+q:XU.h[W<C//$9/l89>!8Y#/6K>2
[xJQH*/ /7Z w:=>[xJSq%8(L!z![k,'$sj+:w[H$4¥u:m4'$s2
O9>P[s8o!= 2h#3w+Z 2[o¥;:k-a[7C Y38Z57C
C9[897GD+%xa<sGw!=zF8m'u79[877¥c)9[8S7GD+%xa<s
Gw+m6J'[4vRxXz2j#vRxxAa#DW%¥>A$M$2ye2Zv9#/(/z
```

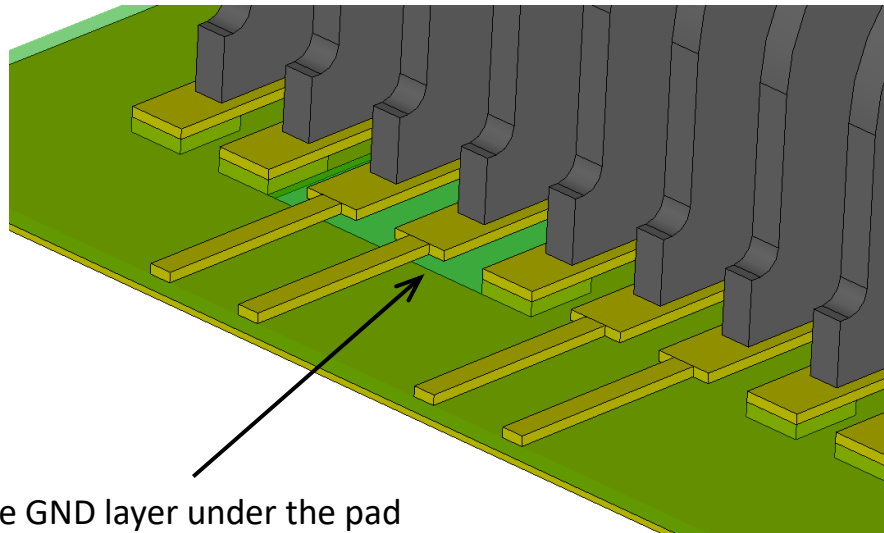
IBIS model

| | | | |
|---------------------|-------------|-------------|-------------|
| [Temperature Range] | 25.0 | 85.0 | -40.0 |
| [Voltage Range] | 5.0V | 4.5V | 5.5V |
| [Pulldown] | | | |
| voltage | I(typ) | I(min) | I(max) |
| | | | |
| -5.0000 | -1.2350E+00 | -1.2270E+00 | -1.2460E+00 |
| -4.6000 | -1.1180E+00 | -1.1110E+00 | -1.1290E+00 |
| -4.2000 | -1.0020E+00 | -9.9550E-01 | -1.0110E+00 |
| -3.8000 | -8.8490E-01 | -8.7930E-01 | -8.9320E-01 |
| -3.4000 | -7.6760E-01 | -7.6320E-01 | -7.7470E-01 |
| -3.0000 | -6.5010E-01 | -6.4700E-01 | -6.5570E-01 |
| -2.6000 | -5.3240E-01 | -5.3100E-01 | -5.3620E-01 |
| -2.2000 | -4.1470E-01 | -4.1530E-01 | -4.1640E-01 |

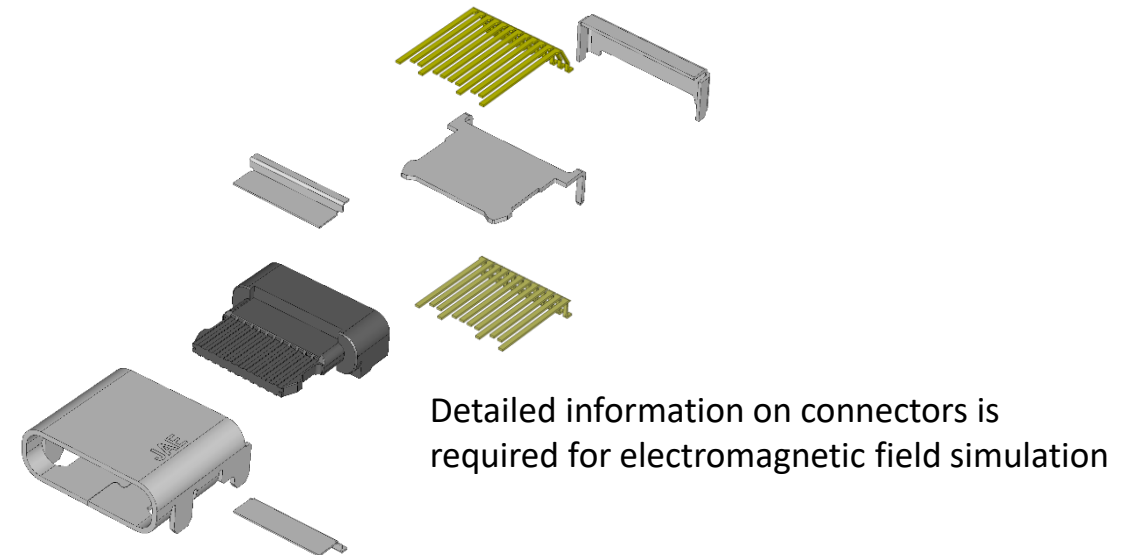


Connector simulation model (present)

- ✓ Regarding the connector model, it is provided by the equivalent circuit or S-parameter, but the characteristics will be slightly different depending on the design of the board side.
- ✓ For connector manufacturers, 3D CAD data for connectors are their design asset and cannot be easily disclosed. (Using the CAD data, we can even design molds.)



Remove GND layer under the pad
to match the characteristic impedance



Source: Nozaki, Hatakeyama, Ikeda, Nagao, Nagano, & Miyazaki. (2019)
USB Type-Cのすべて, CQ Publishing Co.,Ltd,

Cadence and JAE collaborate to develop the encrypted models capable of electromagnetic field simulation while hiding the internal structure of the connector.

■ Advantages

- Signal Integrity Simulation
(The connector is mounted on the PCB)
- Visualization of connector appearance
(The internal structure is invisible)
- No need to set connector physical constants
(Preset inside the encrypted model)

■ Disadvantages

- The simulation time becomes to be long
(The objects of the connector cannot be edited)

Clarity encrypted model lineup – AX01 Series



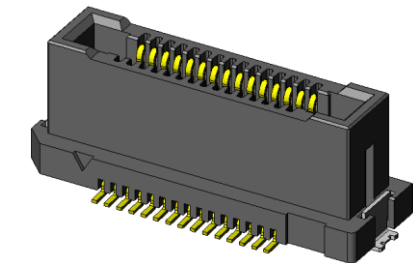
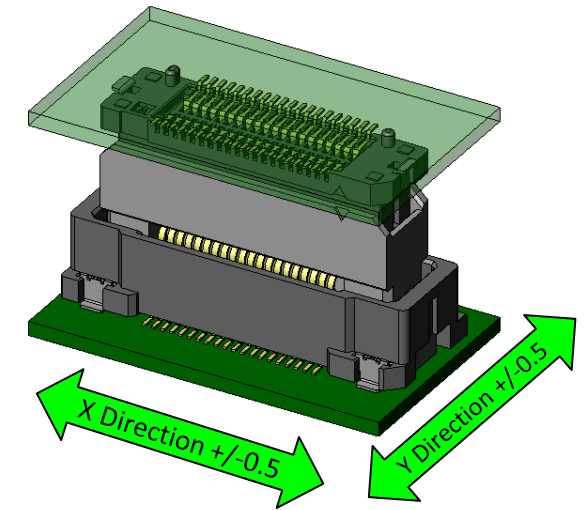
■ Features

1. Floating tolerance: +/-0.5 mm in both X & Y directions
2. Two-point contact structure ensures high contact reliability
3. Low insertion and removal forces achieved by roll surface contact structure
4. 8 Gbps+ high-speed transmission (10GBASE-KR and PCIe Gen3)

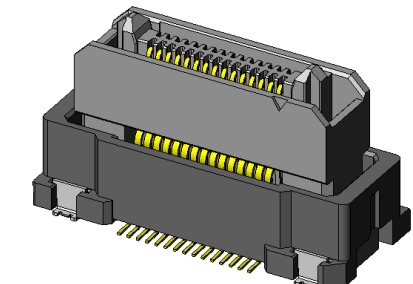
■ General Specifications

| | |
|---------------------------------|--|
| Number of Contacts | 30 to 140 positions |
| Contact Pitch | 0.635mm pitch |
| Stacking Height | 8.0mm to 30.0mm |
| Floating Movable Amount | X direction: +/-0.5mm, Y direction: +/-0.5 mm |
| Operating Temperature Range | -40 deg. C to +105 deg. C (including conduction temperature rise) |
| Rated Current | 0.5A/PIN |
| Rated Voltage | AC50Vr.m.s |
| Contact Resistance | 50mohm max |
| Dielectric Withstanding Voltage | AC 250 Vr.m.s., conduction for 1 minute |
| Insulation Resistance | 100 megohm min. (DC100V) |
| Durability | 100 mating cycles |

<https://www.jae.com/connectors/series/detail/id=89284>

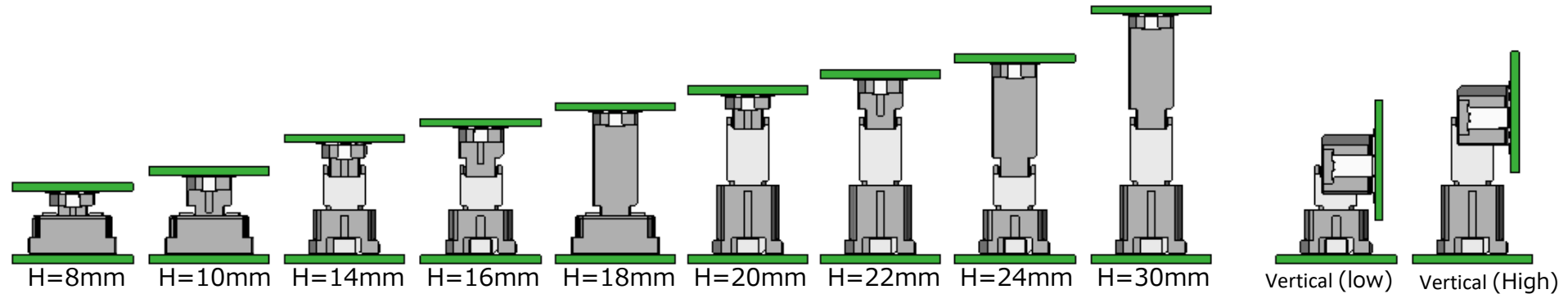


Fixed Side



Floating side

Clarity encrypted model lineup – AX01 Series



| Stacking Height [mm] | Stacking Direction | File Name |
|----------------------|--------------------|--|
| 8 | Horizontal | AX01F030VAAB_AX01R030VABB_H8mm.3dcomp |
| 10 | | AX01F030VAAB_AX01R030VADB_H10mm.3dcomp |
| 14 | | AX01F030VABB_AX01R030VABB_H14mm.3dcomp |
| 16 | | AX01F030VABB_AX01R030VADB_H16mm.3dcomp |
| 18 | | AX01F030VAAB_AX01R030VANB_H18mm.3dcomp |
| 20 | | AX01F030VACB_AX01R030VABB_H20mm.3dcomp |
| 22 | | AX01F030VACB_AX01R030VADB_H22mm.3dcomp |
| 24 | | AX01F030VABB_AX01R030VANB_H24mm.3dcomp |
| 30 | | AX01F030VACB_AX01R030VANB_H30mm.3dcomp |
| 15 | Vertical | AX01F030VABB_AX01R030HAYB_V15mm.3dcomp |
| 20 | | AX01F030VACB_AX01R030HAYB_V_H21mm.3dcomp |

Clarity encrypted model lineup – SM3 Series

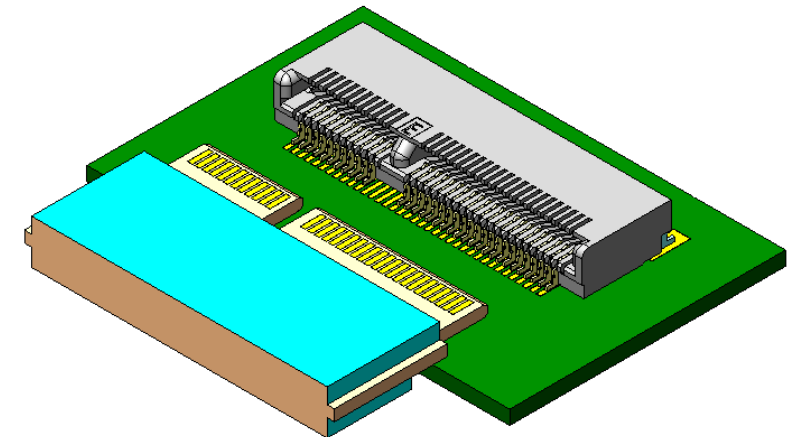


■ Features

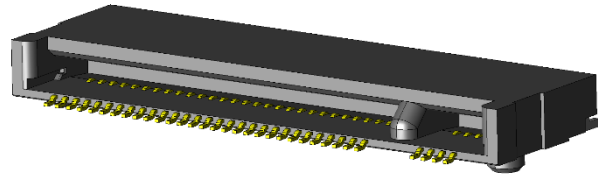
1. Compatible with PCI-SIG PCI Express M.2 Specification, and transmission of high-speed signals such as PCIe, Gen 3, USB 3.0, Displayport, SATA, and more are possible
2. Secures a maximum clearance of 1.2 mm between M.2 module and the board
3. Compatible with 4 types of mating keys
4. 0.5mm pitch (1 row back and front), 69 position, compact card edge connector

■ General specifications

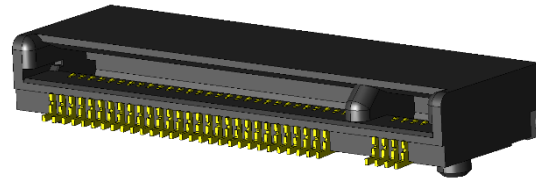
| | |
|---------------------------------|---------------------------|
| Number of Contacts | 69 positions |
| Contact Pitch | 0.5mm |
| Operating Temperature Range | -40 Deg. C to + 80 Deg. C |
| Rated Current | 0.5A/PIN |
| Rated Voltage | AC50Vr.m.s |
| Contact Resistance | 55m ohms max. |
| Dielectric Withstanding Voltage | AC300Vr.m.s (minute) |
| Durability | 60 times |



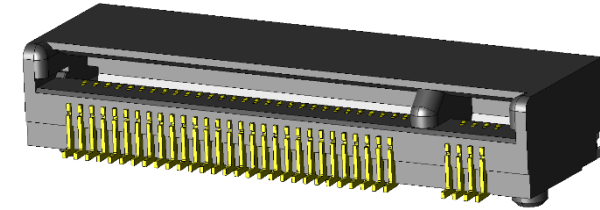
Clarity encrypted model lineup – SM3 Series



SM3ZS067U215



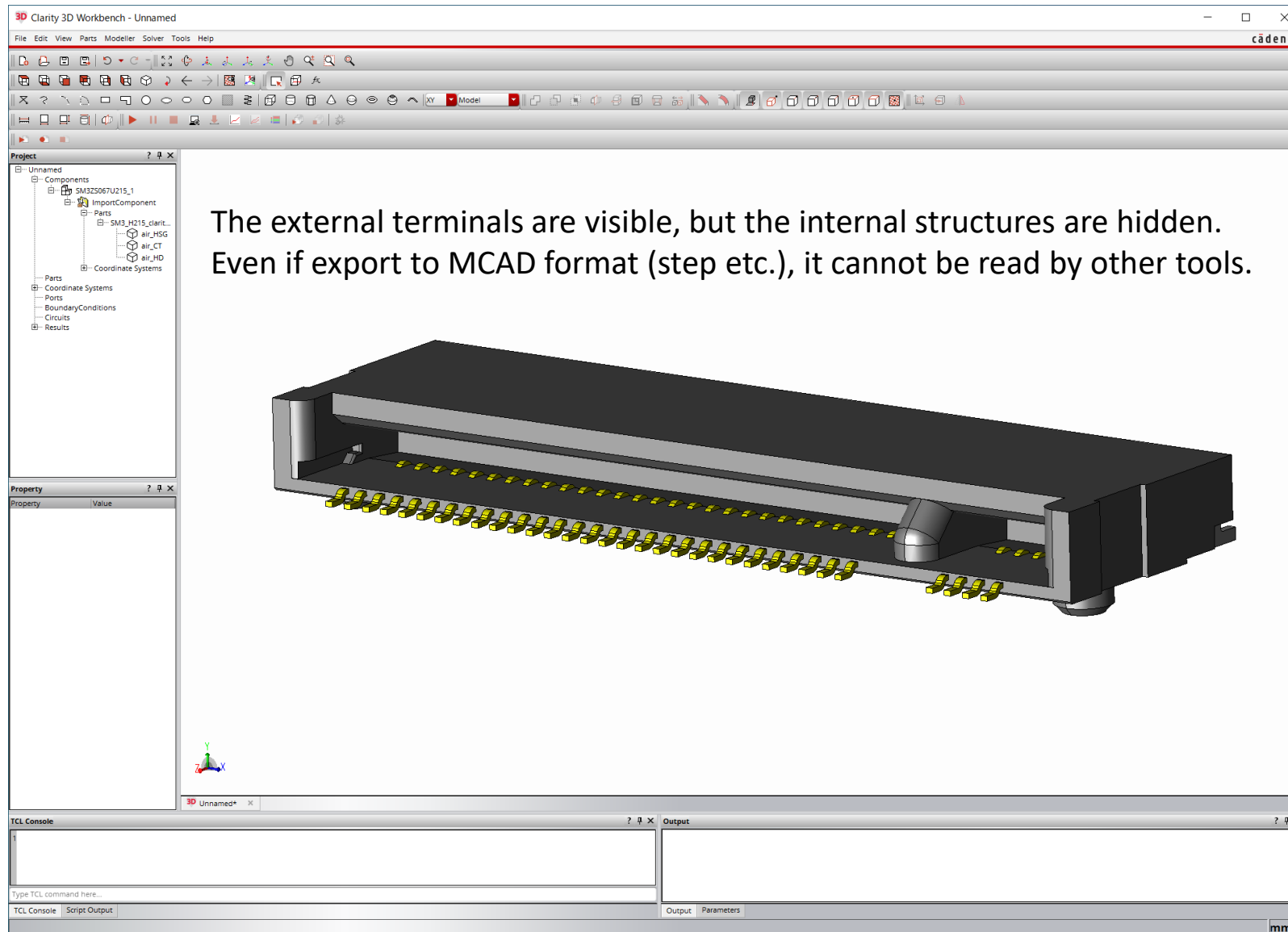
SM3ZS067U310



SM3ZS067U410

| Clearance [mm] | File Name |
|----------------|---------------------|
| 0.3 | SM3ZS067U215.3dcomp |
| 0.2 | SM3ZS067U310.3dcomp |
| 1.2 | SM3ZS067U410.3dcomp |

Import/View the encrypted connector model



Clarity encrypted model lineup – WP26DK Series

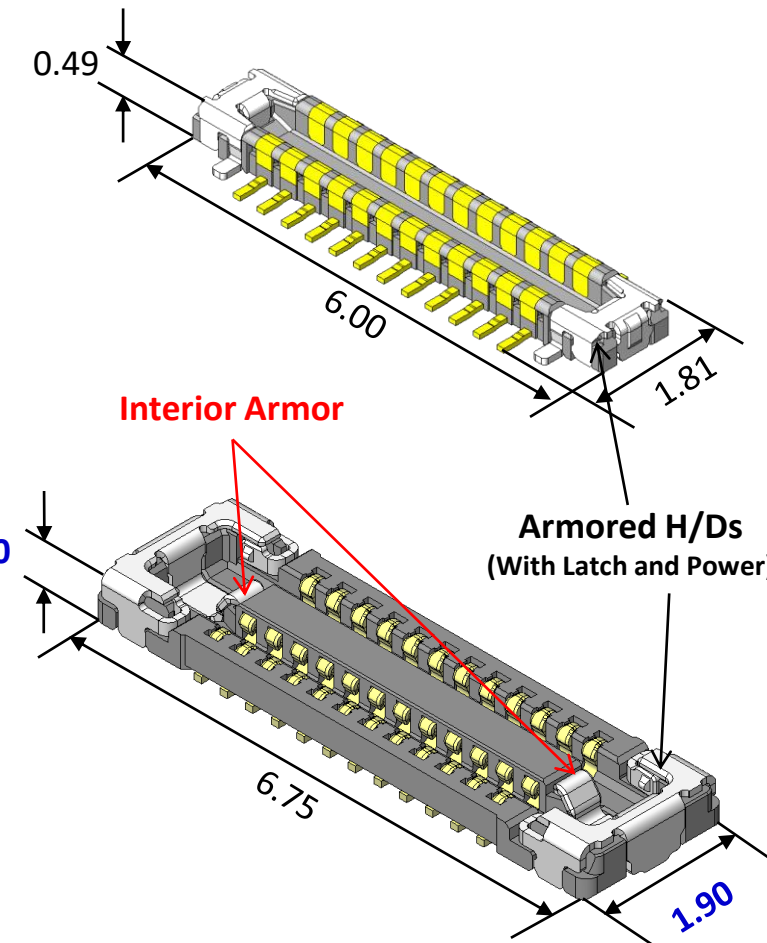


■ Features

1. Supports MIPI, USB3.1 Gen2, and PCIe Gen3 transmission
2. small board-to board connector with 0.35mm pitch and 0.6mm stacking height
3. Two hold-downs for power supply, supporting transmission of 3.0A
4. Nickel barrier on contact prevents solder wicking

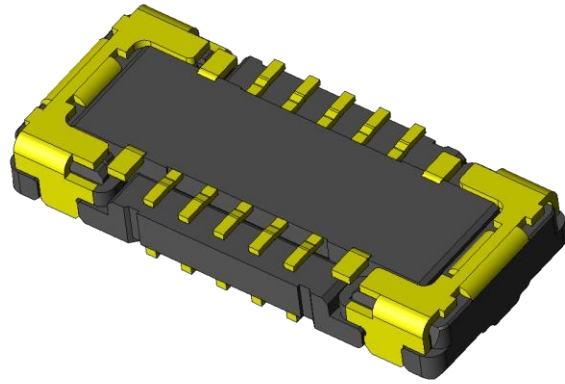
■ General Specifications

| | |
|---------------------------------|--|
| Number of Contacts | 10 to 60 positions |
| Contact Pitch | 0.35mm pitch, 2 rows |
| Rated Current | Signal Terminal: 0.3A/PIN Power Supply Terminal: 3A/PIN |
| Stacking Height | 0.6mm |
| Operating Temperature Range | -40 Deg. C to + 85 Deg. C |
| Rated Voltage | AC,DC 50Vr.m.s |
| Contact Resistance | Signal Terminal: 70mohm max Power Supply Terminal: 20mohm max |
| Dielectric Withstanding Voltage | AC 250 Vr.m.s. 1 minute |
| Insulation Resistance | 100 megohm min. |
| Durability | 30 mating cycles |

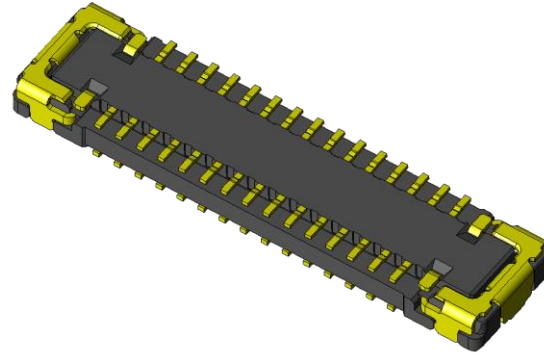


<https://www.jae.com/connectors/series/detail/id=94895>

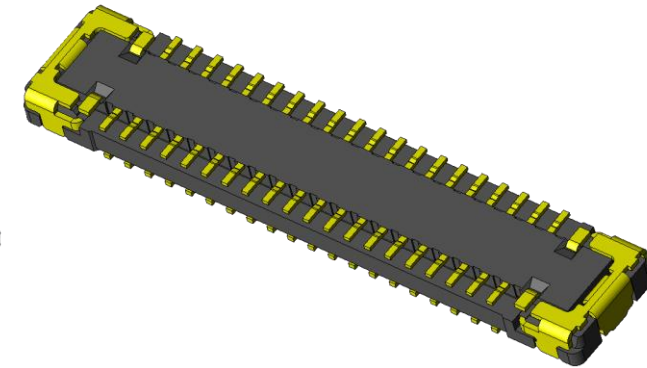
Clarity encrypted model lineup – WP26DK Series



WP26DK P010VA3
&WP26DK-S010VA3.3



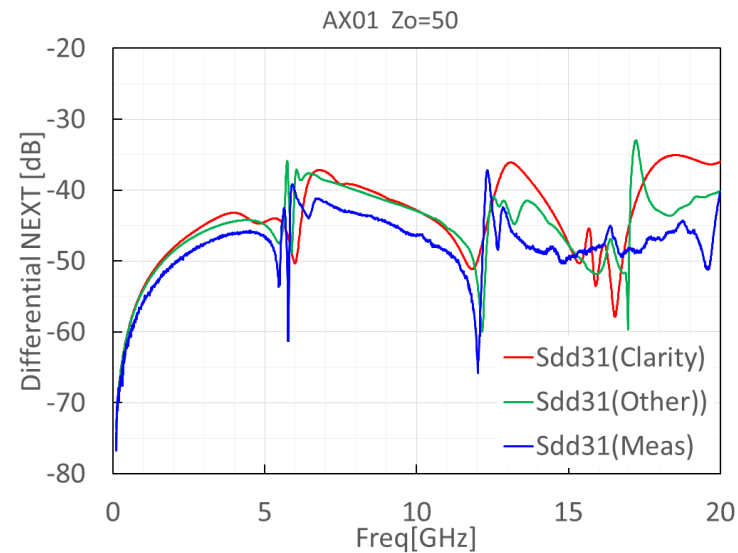
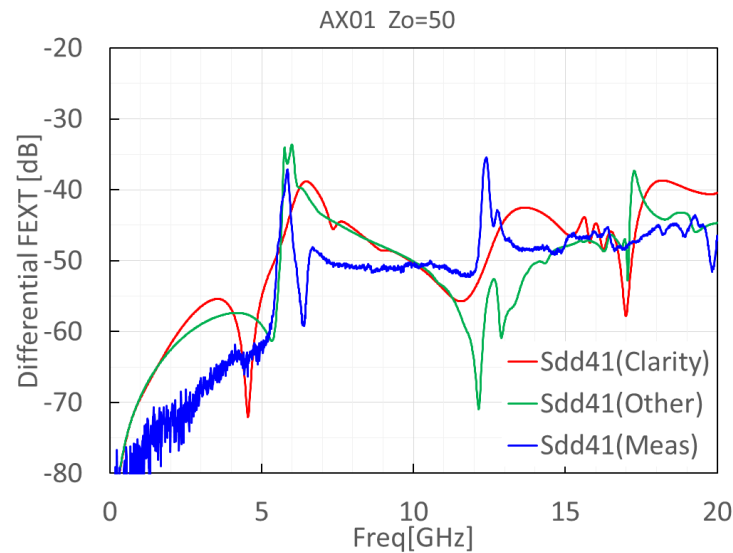
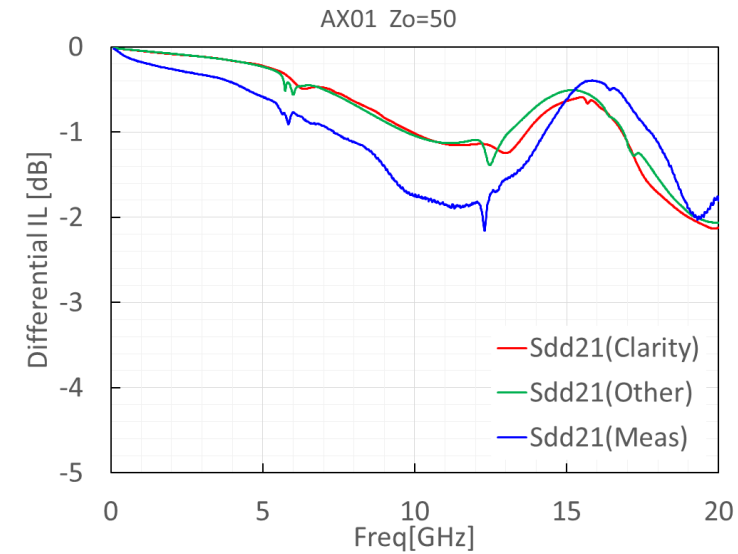
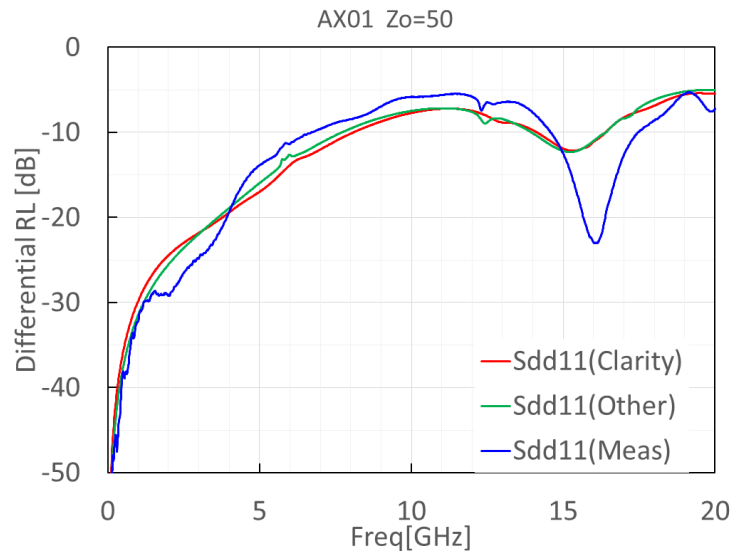
WP26DK P030VA3
&WP26DK-S030VA3.3



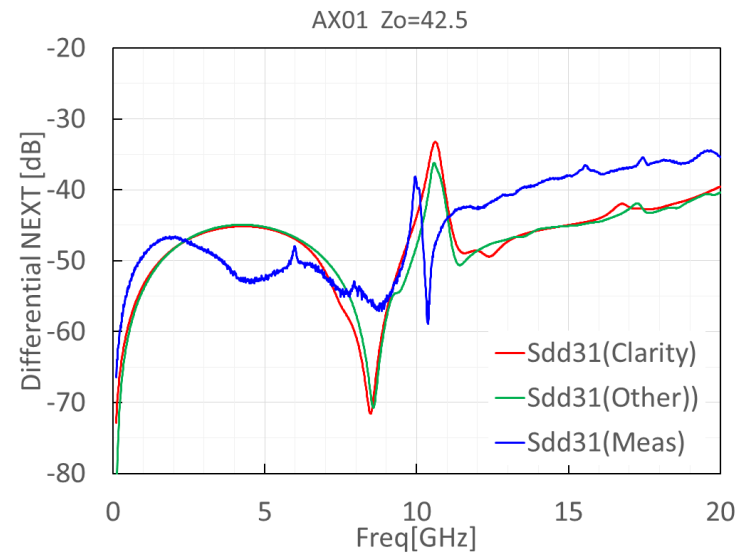
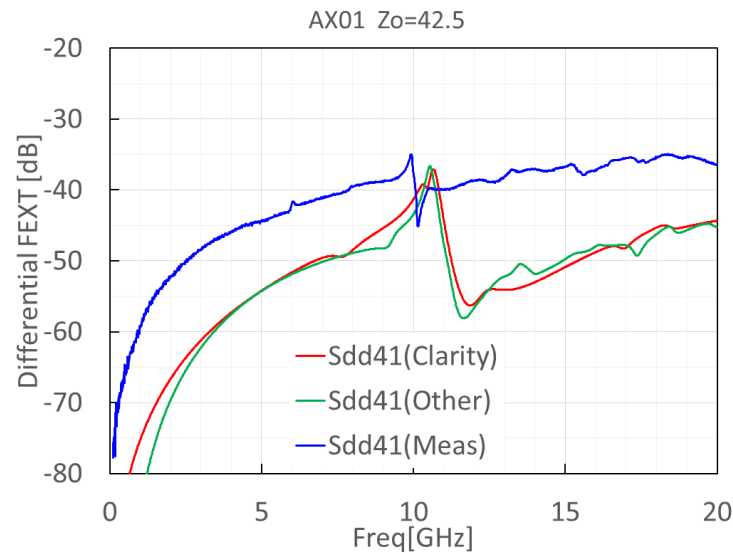
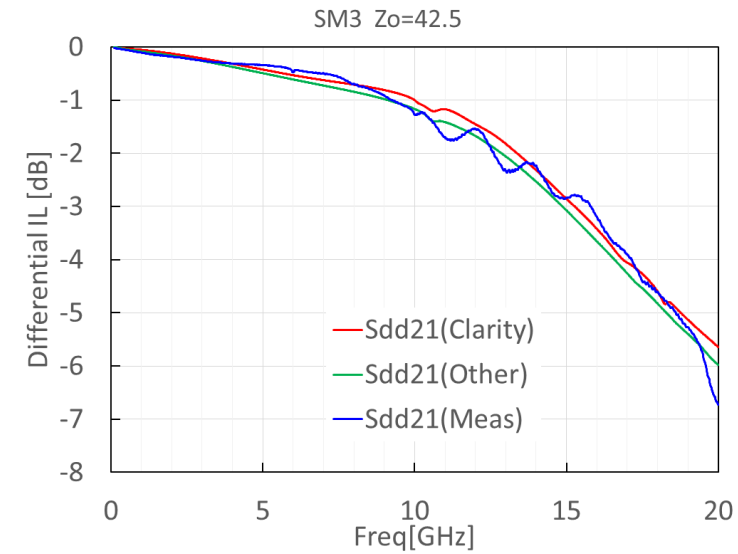
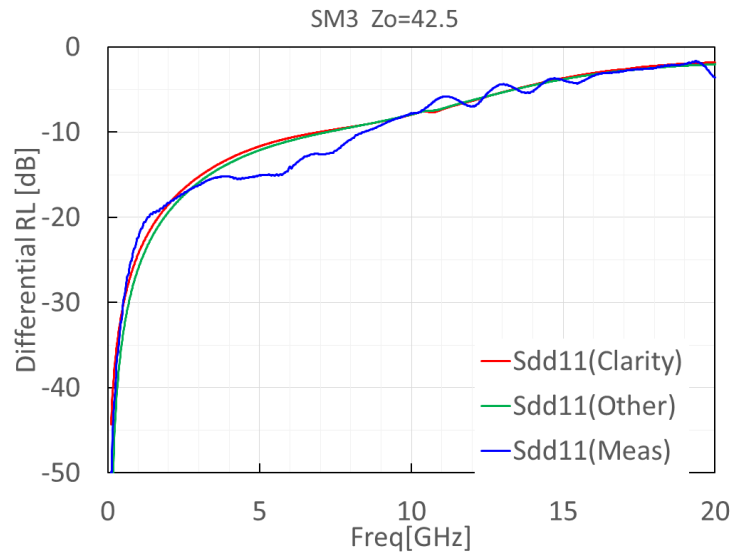
WP26DK P040VA3
&WP26DK-S040VA3.3

| Number of Contacts | File Name |
|--------------------|--------------------------------------|
| 10 | WP26DK_P010VA3_WP26DK-S010VA3.3dcomp |
| 30 | WP26DK-P030VA3_WP26DK-S030VA3.3dcomp |
| 40 | WP26DK-P040VA3_WP26DK-S040VA3.3dcomp |

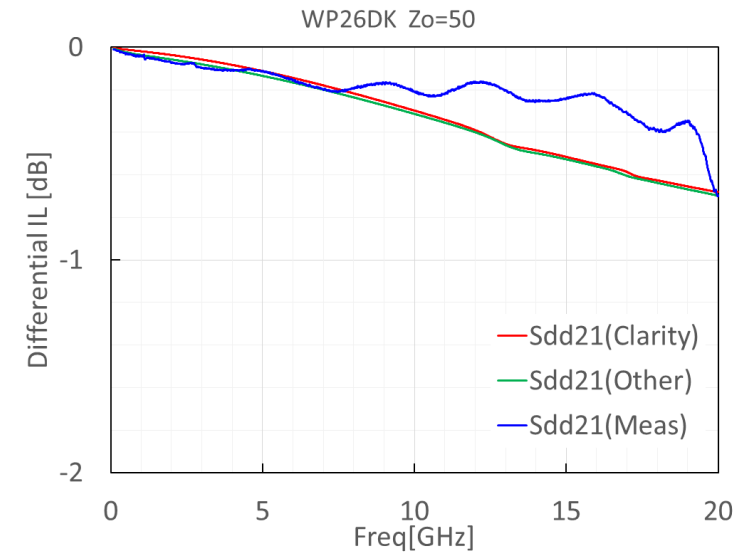
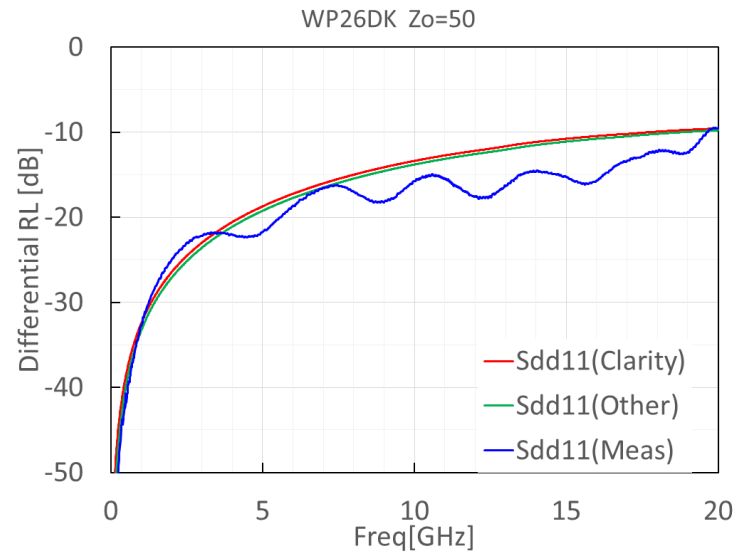
Accuracy Benchmark – AX01



Accuracy Benchmark – SM3



Accuracy Benchmark – WP26DK



Download clarity encrypted 3D models



AX01 (基板対基板コネクタ)
AX01シリーズ高速フローティング基板対基板
2022/03/31
嵌合高さ8mm用~30mm用 30極、0.635mmピッチ 固定側ストレートタイプ、固定側ライトアングルタイプ (11ファイル)
ダウンロード

SM3 (PCI-SIG規格M.2コネクタ)
SM3シリーズ PCI-SIG規格M.2コネクタ
2022/03/31
製品高さ2.15mm用~4.10mm用 67極、0.5mmピッチ (2列) 小型カードエッジコネクタ、(3ファイル)
ダウンロード

WP26DK (0.35mmピッチ堅牢構造)
WP26DKシリーズ 0.35mmピッチ堅牢構造
2022/03/31
スタッキングタイプ 10極用~40極用 スタッキング高さ0.6mm、幅1.9mm 3A通電可能な2つの電源端子 (ホールドダウン兼用)、(3ファイル)
ダウンロード

The following QR Code to download models for use in Clarity3D Workbench

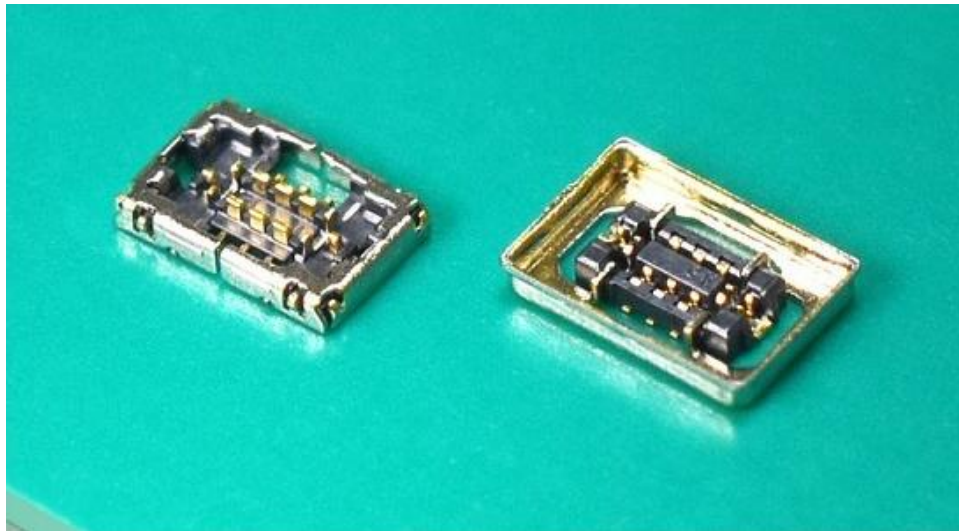


Japanese

WP16RS

Features

1. High shield performance due to the full shield structure
2. New high frequency dedicated for RF terminal developed terminal
3. Supports signal terminal 1A/ contact
4. Robustness and alignment



WP56DK

Features

1. Supports MIPI, USB3.1 Gen2, and PCIe Gen3 transmission
2. 0.3mm pitch, 0.6mm mated height
3. Power supply terminals supporting 3.0A
4. Nickel barrier on contact prevents solder wicking



- ✓ The signal transmission rate of digital devices is increasing year by year, while the product development period is shortening.
- ✓ Numerical simulation is widely used as one of the design tools, but it is necessary to obtain simulation models for each electronic component.
- ✓ Passive component manufacturers provide their models in various formats, but for connector manufacturers, S-parameter and equivalent circuit formats are common.
- ✓ When the signal transmission rate 10 Gbps over, it might be performed the simulation with the connector mounted on the board due to the interaction between the connector and the board.
- ✓ If we want to simulate a self-poisoning problem, we need 3D CAD data of the connector, but it is not possible to provide because of a design asset.
- ✓ In collaboration with Cadence, we are now able to provide 3D CAD data for encrypted connector models, allowing us to simulate signal integrity and self-addiction issues.

QR code for Clarity 3D model download site



Japanese



English



Chinese