

## TOUGH CONTACT CONNECTORS

2019 FEBRUARY 1.0 VERSION

WHITE PAPER

TOUGH AGAINST EXPOSURE TO FOREIGN  
PARTICLES AND SOLDER FLUX

TOUGH AGAINST  
CORROSIVE GASES

TOUGH AGAINST  
SHOCK IMPACT

TOUGH AGAINST  
SOLDER RISE



CONNECTORS FOR YOUR MINIATURIZATION DESIGN – HIGH RELIABILITY CONTACT  
THAT CAN STAND UP TO VARIOUS ENVIRONMENTAL CONDITIONS

**PANASONIC INDUSTRY'S TOUGH CONTACT CONNECTORS  
OPTIMIZING YOUR MINIATURIZED DESIGN**

INTRODUCTION.....3

BELLOWS CONTACT.....4-5

BACKLOCK CONSTRUCTION FOR FPC/FFC TYPES.....6

Y5BW & Y3BW AND B01 SERIES.....7

APPLICATION: WEARABLES.....8-9

APPLICATION: SMART METERING.....10

PRODUCT INFO.....11-12

## TOUGH CONTACT CONNECTORS

### PANASONIC INDUSTRY'S TOUGH CONTACT CONNECTORS OPTIMIZING YOUR MINIATURIZED DESIGN

#### INTRODUCTION

The global connector market is expected to reach an estimated \$80.4 billion by 2023 with a CAGR of 4.9% from 2018 to 2023, states a 2018 market report by Lucintel. This surely is big news for such a small and let's be honest – relatively little-considered component. The primary growth drivers for this market are 3C applications (Computers, Communications, and Consumer Electronics), and demand for products with advanced features, convenience, and connectivity. However, the main drivers behind the growing relevance of connectors are the entrenched design goals of miniaturization and functionality.

The electronics in consumer applications such as cell phones, tablet computers, smart watches and multiple handhelds as well as in the medical field with blood glucose monitors, and hearing aids are becoming more tightly packed, leaving little room for connectors. Therefore it is essential to use miniature size electronic components instead of conventional bulky ones to achieve compact mobile devices with high functionality. However, the lack of internal space makes it challenging to find electrical components that will not only fit but also perform reliably. This difficulty can be particularly noticeable when it comes to board connectors. As demand for smaller connectors grows, design engineers face a new set of challenges. They can no longer defer their connection designs to the waning days of the project. Micro-miniature connectors require forethought. They demand that designers consider packaging, durability, current-carrying ability, ease of replacement, and other factors early in their designs.

It is now possible to source high-density connectors with terminal pitches as tight as 0.2mm and widths down to 1.7mm on the socket side. Just a couple of years ago, connectors with a similar terminal pitch would have been at least 33 percent larger. The increased design requirements also translate into a far more diversified product range. The Panasonic Industry Narrow Pitch Connector Series currently includes more than 3,000 parts which specifically address a number of electrical and mechanical miniaturization issues for both board-to-board and board-to-flexible printed circuit connectors. Design and know-how are based on more than 30 years' expertise and reliable connection to the Asian market where Panasonic Industry currently holds 22% of the narrow pitch segment and has been very successfully involved in the miniaturization of devices for the Asian telecommunication market.

**“The main drivers behind the relevance of connectors are the entrenched design goals of miniaturization and functionality”**

The following are a few design recommendations from Panasonic Industry. They are based not only on our expertise as a connector designer but also on our long time experience with application designers and their daily challenges. Fortunately, it is possible to work around the engineering constraints related to miniaturization by paying attention to connector design features. Here's what you need to know.

## TOUGH CONTACT CONNECTORS

### TOUGH CONTACT FOR B-TO-B CONSTRUCTION – BELLOWS CONTACT IN COMPARISON TO CONVENTIONAL TURNING FORK CONTACTS

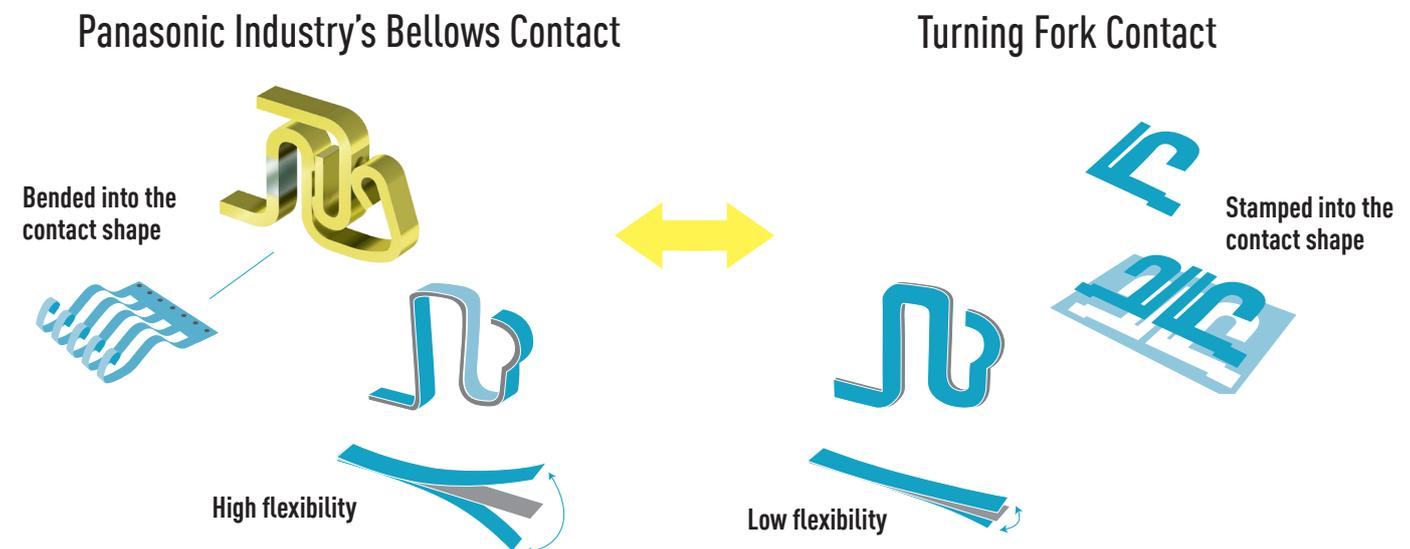
#### BELLOWS CONTACT

Panasonic Industry narrow-pitch B-to-B connectors feature a rugged contact geometry called “Bellows”. They use advanced materials and contact shape to maximize reliability. Main markets are medical products and wearables due to their miniature size, long life cycle and corrosion resistance against fluids. The robust B-to-B connectors are built around a metal bellows whose spring forces strike a balance between easy insertion and resistance to shock loads (compare Figure 1).

The most important feature of the bellows-type contact structure is that it improves the resistance of the design to drop impacts and twisting forces. Compared to standard turning fork type contacts, Panasonic Industry’s connectors are not stamped into shape with a die out of a metal sheet. The disadvantage of stamping is, it is impossible to make the plate width smaller than the plate thickness.

That’s why the contact flexibility reduces, making the contacts more susceptible to a drop impact and causing solder cracks. Also, the plated surfaces are quickly worn out because the cut ends rub against each other. Panasonic Industry’s bellows type contacts are made, on the contrary, by stamping a thin plate at the terminal pitch and then bending it into the contact shape (compare Figure 1). The bellows-type contacts have excellent contact reliability and resistance to solder joints removal because the plate width can be optimized according to the terminal pitch. This provides sufficient flexibility to absorb drop-impacts providing the ultra-miniature body with high strength and the high-level reliability required for mobile equipment. The smooth and rolled contact surfaces prevent the gold-plated surfaces from wearing out, providing high resistance to corrosion due to ambient environmental conditions. The simple lock structure gives tactile feedback that ensures reliable insertion/removal operations.

Figure 1



## TOUGH CONTACT CONNECTORS

### TOUGH CONTACT FOR B-TO-B CONSTRUCTION – BELLOWS CONTACT IN COMPARISON TO CONVENTIONAL TURNING FORK CONTACTS

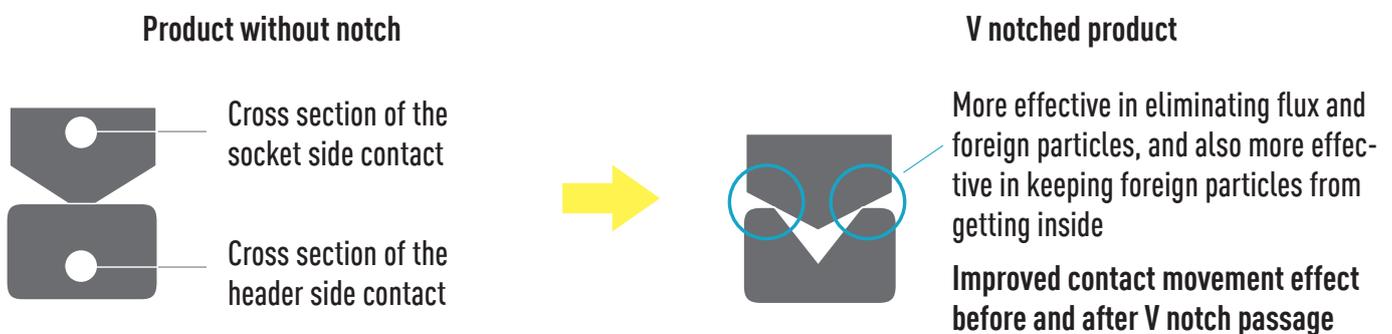
#### TOUGH CONTACT

The Tough Contact design also features a notched cross-section to ensure a high-force, edge-to-edge contact between connector halves. This V-shaped notch has the side benefit of sealing out contamination from flux or other particulates as well as an integrated nickel solder barrier and a proprietary anti-corrosive treatment.

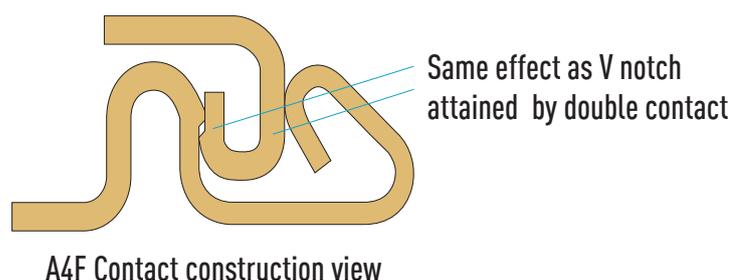
Further benefits of the v-notch structure are increased contact pressure and that it ensures the mating of the contact and contact points.

Figure 2

#### Panasonic Industry's improved with 2-point contacting and edge



#### Improved with use of double contact



## TOUGH CONTACT CONNECTORS

### BACK LOCK CONSTRUCTION FOR FPC/FFC TYPES HIGHER CONTACT RELIABILITY AND SIMPLIFIED ASSEMBLY

#### BACK LOCK CONSTRUCTION

FPC, Flexible Printed Circuit” and FFC, an abbreviation for “Flat, Flexible Connectors” are both a variety of electrical cable that is both flat and flexible. Panasonic Industry FPC and FFC Connectors have double top and bottom contacts which guarantee higher contact reliability. The four walls surrounding the FPC inlet prevent displacement of the FPC allowing smooth FPC insertion (compare Figure 3). Since the lever is located on the opposite side of the FPC inlet, tilting will not affect the lever, enhancing reliability. Assembly man-hours can be significantly reduced, as Panasonic Industry connectors are provided with the bars open what translates into only two steps. A significant advantage in comparison to traditional front lock types requiring as assembly steps lever opening, FPC insertion, and lever locking.

The second big advantage for your design is the high holding force provided by Panasonic Industry’s front lock FPC/FFC types. With a guaranteed holding force of 0.45N/Pin, they deliver more than twice as much force than traditional front lock types. The question regarding holding force is especially crucial for your design if you are dealing with low-pin-count connectors in the range of less or equal to six pins – design specification as it is common for wearables.

Figure 3

	Front lock	Back lock
Contact	Bottom contact	Top/buttom (Y3B, Y5V) Top (Y3BL)
Work flow	<b>3 steps</b> (Level Open > Insert FPC > Lever Close)	<b>2 steps</b> ( Insert FPC > Lever Close)
FPC Holding force	<b>Low</b> (No tab version) High (Tab version: FPC insertion low efficiency)	<b>High</b>
Against FPC peel off	<b>Weak</b> (FPC insert window quite open)	<b>Strong</b> (FPC insert window square box)
FPC easy insertion	FPC insert window quite open > risk of incorrect slant insert	FPC insert window square box > Proper FPC insert
Mounting space	<b>Small</b>	<b>Small</b> (in Comparison to Competitive Products)

## TOUGH CONTACT CONNECTORS

### PANASONIC INDUSTRY'S Y5BW & Y3BW AND B01 SERIES

#### LOCK HOLDER

The Y5BW and Y3BW-Series feature a lock holder which is ideal for applications requiring high reliability and retention force. The FPC holding contacts located on both ends of the connector enhance holding power further. These connectors are compatible with FPCs that have nudes. The click-feel confirms the FPC insertion. Panasonic Industry's unique lock holding structure temporarily holds the FPC until the lever is closed. As soon as the bar is closed, the holding contacts lock the FPC nudes enhancing the FPC retention strength.

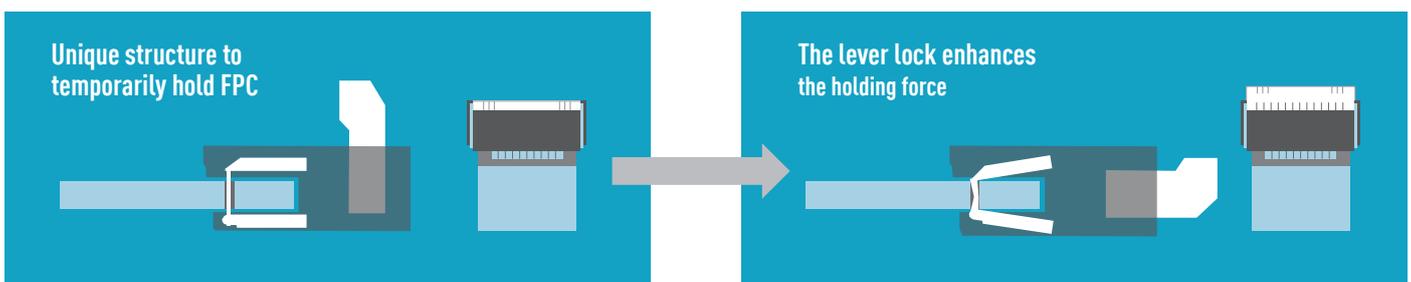
Panasonic Industry's B01 provides a low profile design alternative. They are available with profiles as small as 0.6mm stacking height which allows the miniaturization of electronic devices and equipment. A stacking height of 0.8mm is also available allowing design flexibility if required.

Panasonic Industry B01 connectors feature a high current rating of 6A. There are a total of 4 power pins in each connector and each power terminal can handle 3A. Therefore a connection of two power terminals can handle up to 6A. Batteries have positive and negative terminals. Each power pin can be connected to positive and negative terminals. Therefore there are two power terminals for positive and two power terminals for negative. Each signal terminal can handle 0.3A. There are two signal terminals in each connector. Generally, these terminals are used for sensing applications, for example a thermistor that monitors the battery temperature and battery ID.

High retention force is another feature of the B01 connector series. The actual retention force measured exceeds 10N even after several mating cycles. Supporting test data is available to substantiate exact retention force measurements.

B01 Series connectors provide insertion guides. The four corners of the flinch have insertion guides. These guides help with smooth positioning even if the connector is misaligned.

Figure 4



**Advanced functionality model:** Higher reliability for  
**Y5BW | Y3BW** assembly work

## TOUGH CONTACT CONNECTORS

### WHICH APPLICATIONS QUALIFY?

#### APPLICATIONS

In a nutshell: Panasonic Industry's connectors are the right go-to choice if you are thinking about miniaturizing of your product but also on combining functionality. Miniaturization has had a far-reaching influence on many different industries, but one of the biggest benefactors in Europe is the field of medical measurements and wearable followed by industrial metering, smart home metering devices but also security cameras, POS terminals and so on. For especially the field of wearables and smart metering we want to have a closer look at design margins and challenges.

#### WEARABLES

The pace of innovation in the headphone sector continues unabated. The audio market for wireless Bluetooth headsets is growing rapidly and is becoming more and more ubiquitous. Looking back at 2016, the outcry about Apple's decision to remove the headphone jack from the iPhone and to focus on wireless earphones no longer seems relevant. At least in the US, wireless headphones outsell "classical" headphones according to the NPD Group's retail tracking service.

Today, there are a large number of wireless headphone options that use Bluetooth to connect to mobile devices and these are arguably more convenient than traditional wired headphones. However, this is not where the story ends – in fact, earphones today have to fulfill increasing demands for functionality: from in-ear monitors to over-ear headphones with Bluetooth 5, consumers continue to want next-generation devices that deliver the best possible audio experience, while reducing outside noise and "cutting edge" new features. Moreover, all of this needs to be presented in a robust, ultra-small elec-

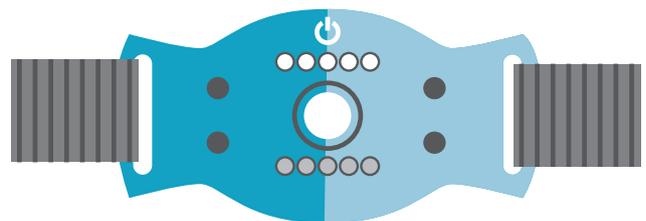
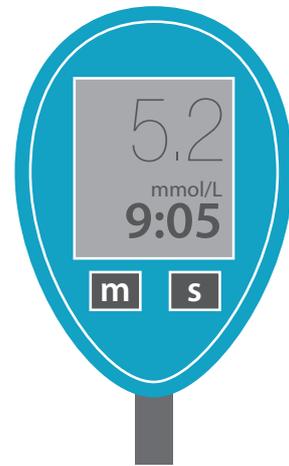
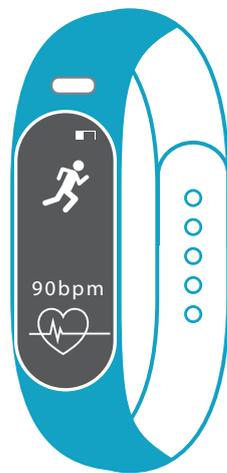
tronic design to meet stringent mechanical design requirements for enhanced durability, wearability and comfort. In other words: earphones becoming more and more a design engineering nightmare. More functionality equals more PCBs while the design margin dictates less space and less weight. This is where it becomes useful to talk about connectors.

Board-to-Board Connectors are used to connect printed circuit boards. Each terminal connects to a separate PCB while connecting the different PCBs without the use of wires. One part, which typically has pins, attaches to one PCB while the part with receptacles is mounted to another PCB. The circuit boards are then connected by mating to two parts of the connector. The advantages are vibration resistance and the prevention of minor misalignments. A further significant benefit in comparison to both labor-intensive and inconsistent hand-soldered connections is that Panasonic Industry's low-profile, narrow pitch B-to-B connectors are not susceptible to damage from solder rise. And they are available even in a product-range of 4 – 6 pins. Using B-to-B connectors delivers tremendous design advantages in new small and smart mobile device designs – they can be used in applications ranging from hearing aids, through fitness trackers to earphones and save you save manual assembly time, save space by eliminating PCB fixing clips and also make products more reliable and robust.

**"Using B-to-B connectors delivers tremendous design advantages in new small and smart mobile device designs"**

TOUGH CONTACT CONNECTORS

WEARABLES



## TOUGH CONTACT CONNECTORS

### WHICH APPLICATIONS QUALIFY?

### SMART METERING

By today's technological standards, the common electro-mechanical energy meter is a relic of the past – incapable of anything but flat-rate pricing and infrequent meter readings. Smart meters are connected meters which are designed to replace the electricity which you've currently got sitting in your cabinets. Public awareness of smart grid technology has expanded in Europe mainly as a result of the adoption by the European Union of the Third European Energy Liberalization Package. The primary goal of this agreement is the installation of "intelligent metering systems" in 80 percent of households by 2020. They do the same jobs as the ones you've got at the moment, but they send meter readings direct to your energy suppliers without anyone having to come round and look at them. The actual data is transmitted to a little in-home display (IHD) which you have sitting around on the sideboard somewhere. That's designed to give householders meaningful representations of their energy consumption. Miniaturization and discretion are here again the predominant design margins – which confronted the industry, which relied on for years on building bulky meters, now on providing sleek and elegant control devices with often several screens.

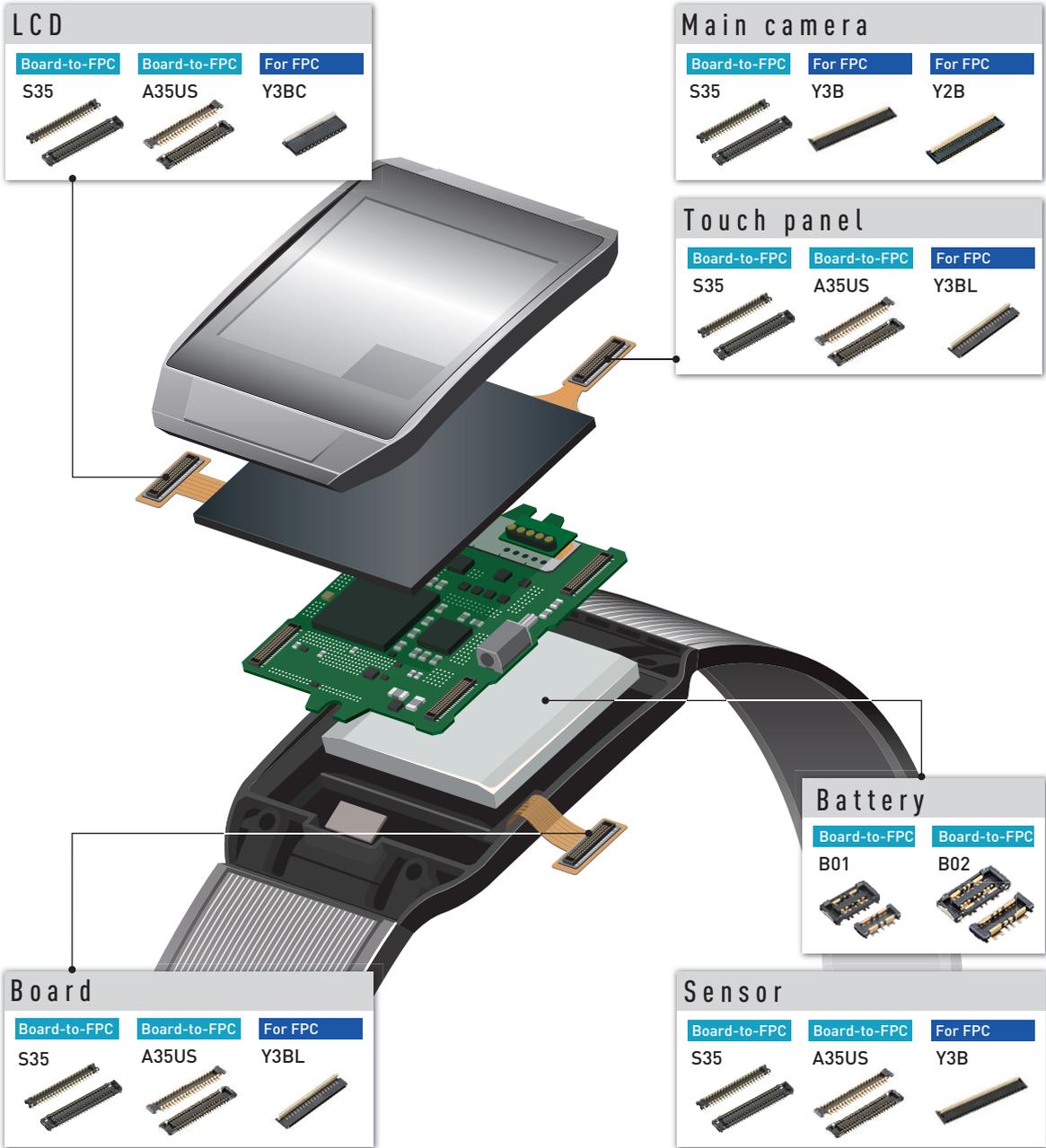
**"The FPC & FFC connector can efficiently use existing space, i.e., space above the PCB and inside the enclosure"**

Panasonic Industry's FPC connectors are small in size, lightweight and easy to install. As mentioned before key arguments for implementing Panasonic Industry cable solutions are that with the back lock function you can save tremendously on working hours and with its strong holding force it secures you – even for low pin number connectors – a higher strength against FPC peel off. FPC and FFC are both primarily used in the connection of LCD screens and driving circuit (PCB). With the significant increase in display driven applications for smart metering electronics, both of them are becoming more and more a vital electromechanical component. Panasonic Industry's interconnects are ideal when small centerline spacing makes larger wire-to-board interconnects impractical. The FPC & FFC connector can efficiently use existing space, i.e., space above the PCB and inside the enclosure. In addition to saving space, they can achieve a design with high wiring density which is widely popular with many electronic devices in the market.



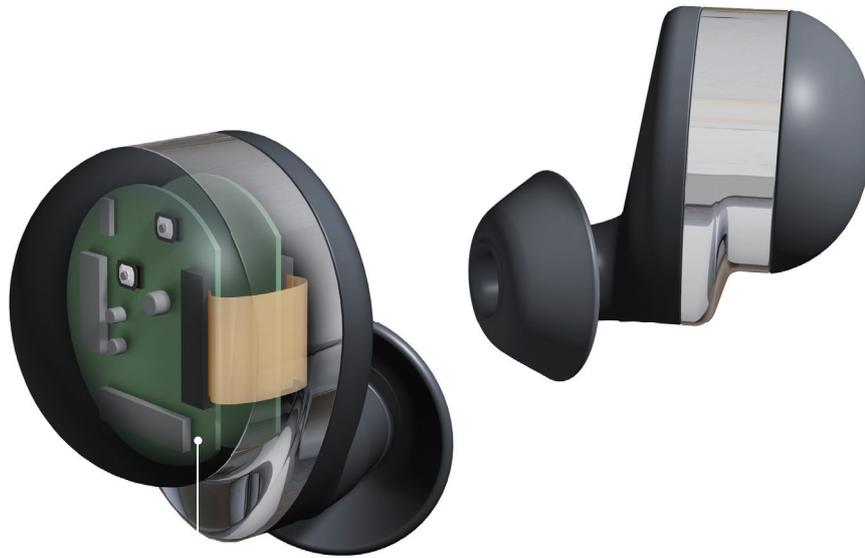
## TOUGH CONTACT CONNECTORS

### WEARABLE WATCH



TOUGH CONTACT CONNECTORS

HEARABLE DEVICES



Board			
Board-to-FPC	For FPC	For FPC	For FPC
S35	Y3BL	Y3B	Y2B
			