

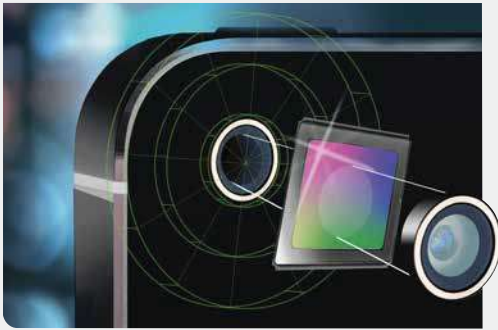
# Pixel-Level 3D Integration for Advanced Stacked CMOS Image Sensors

Revolutionizing the image sensor industry by enabling improved sensitivity, high dynamic range (HDR) & lower cost

Low Temperature Wafer Bonding

Scalable to <math><1\mu\text{m}</math> Pitch

Up to 15x Higher Bonding Throughput



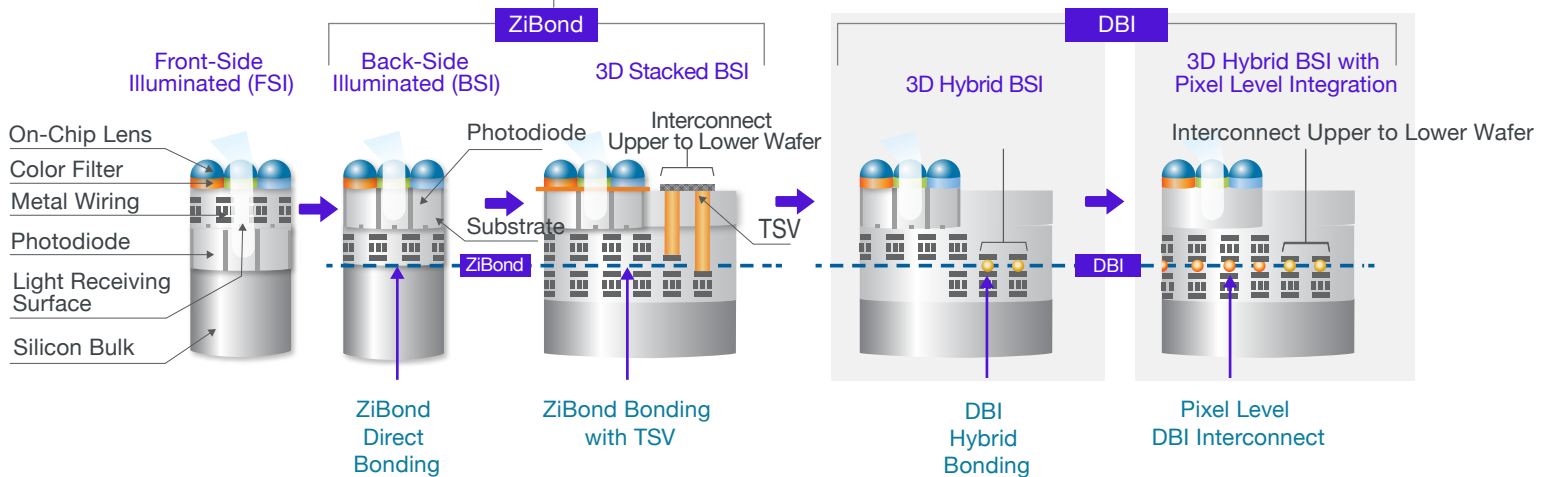
## Key Benefits

- Allows 3D Integration with each Pixel Connected to an Individual ADC
- Eliminates need for Thru Silicon Vias (TSVs)
- Improves Signal to Noise Ratio
- Enhances High Dynamic Range
- Enables Global Shutter
- Provides Smaller Footprint
- Drives Higher Manufacturing Throughput

➔ Wafer Bonding is a key enabler of back-side illuminated (BSI) image sensors. ZiBond® direct bonding technology enabled 1st generation BSI and 2nd generation 3D stacked BSI image sensors.

➔ DBI® 3D interconnect technology eliminates the need for TSVs, reduces die area penalty and enables high performing 3D hybrid BSI image sensors.

➔ Very fine pitch DBI allows pixel level interconnect between each pixel and an associated A/D converter, providing the functionality and performance needed for next generation CMOS image sensors.



## ZiBond® Technology

ZiBond technology is a low temperature homogeneous direct bonding solution that forms a strong bond between wafers or die with the same or different coefficients of thermal expansion (CTE). ZiBond technology is in high volume production today.

### Features

|                          |                                                                                    |                    |              |
|--------------------------|------------------------------------------------------------------------------------|--------------------|--------------|
| Bond Interface Materials | SiO (TEOS, Thermal, Silane)                                                        | SiN (CVD or PECVD) | SiON (PECVD) |
| Substrates               | Si, Glass, InP, GaAs, GaN, SiC, LiTaO <sub>3</sub> , LiNbO <sub>3</sub> , Sapphire |                    |              |
| Bonding Temperature      | Room Temperature                                                                   |                    |              |
| Anneal Temperature       | 75-300°C (application dependent)                                                   |                    |              |
| Equipment                | Industry standard wafer alignment and bonding equipment                            |                    |              |

## DBI® Technology

Direct Bond Interconnect (DBI) technology is a low temperature hybrid direct bonding solution that allows wafers or die to be bonded with exceptionally fine pitch 3D electrical interconnect. DBI can also minimize the need for Thru Silicon Vias (TSVs). DBI technology is in high volume production today.

### Features

|                          |                                                                               |
|--------------------------|-------------------------------------------------------------------------------|
| 3D Interconnect Metals   | Cu, Ni                                                                        |
| 3D Interconnect Pitch    | Scalable to <1µm pitch<br>1.6µm demonstrated<br>6µm in high volume production |
| Bond Interface Materials | Same dielectrics as ZiBond with integrated metal interconnect                 |
| Substrates               | Same as ZiBond                                                                |
| Bonding Temperature      | Room Temperature                                                              |
| Anneal Temperature       | 150-300°C (application dependent)                                             |
| Equipment                | Industry standard wafer alignment and bonding equipment                       |

