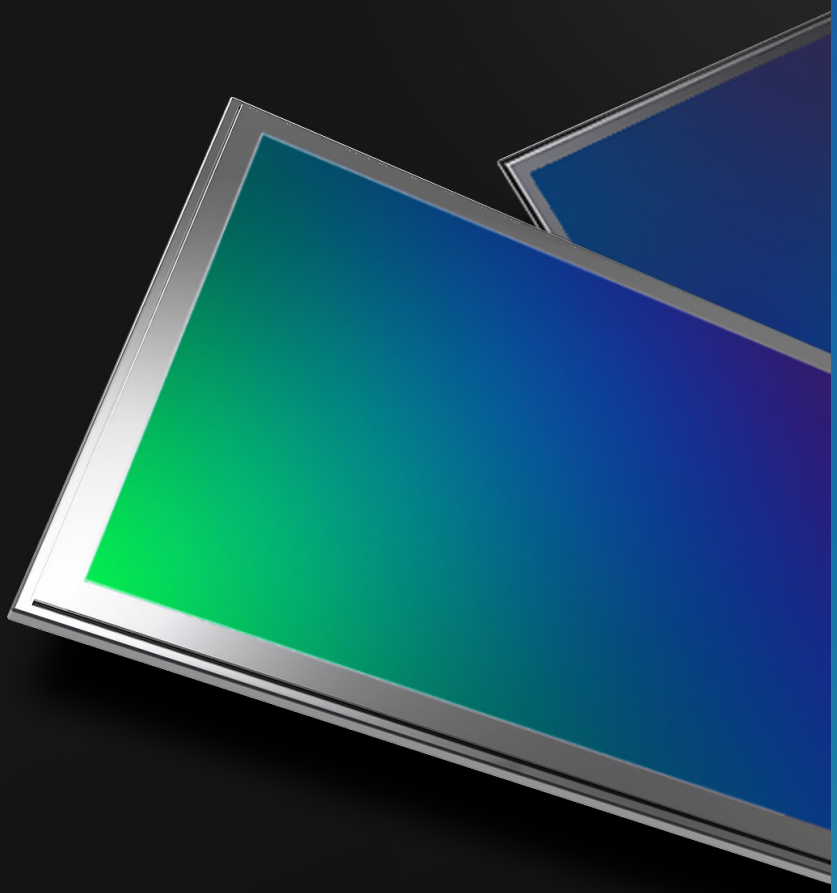


Stabilization Solution for ISOCELL Slim 3P9

Gyro-based stabilization with EIS software for stable video recording without distortion

Brochure

SAMSUNG

Gyro-based solution with EIS software for power efficient and high performing stabilization

Gyroscope's accurate motion information enables more stable video recording

Image stabilization is a feature that corrects images and videos taken with an unwanted shaking due to a hand tremor or unsteady walking. This feature is becoming highly critical as more and more users are using their mobile devices to record clips expecting them to be stable and natural in composition. A conventional stabilization solution compensates motions by analyzing 2-D data, or image and motion information, of each and every frame. However, due to the complexity of 2-D data calculation, this action requires high processing power. The Samsung ISOCELL Slim 3P9 provides synchronized gyro information for much easier calculation thus more power efficient.

The ISOCELL Slim 3P9 with gyro synchronizer for an advanced image stabilization

The ISOCELL Slim 3P9 image sensor features a gyro synchronizer for high performing and power efficient image stabilization. The gyro synchronizer creates a timestamp data that is made up of an exposure time of an image from a sensor and a motion information from a gyroscope. The timestamp data are then sent to a backend processor, such as a mobile application processor, for image stabilization processing. As the data lets the processor know the camera's movement for each frame, the processor simply needs to adjust the frame rather than rigorously analyze each frame for changes in movement. Furthermore, each data can be processed with higher sampling rate of up to 32kHz which means more accurate and faster calculation.

The EIS software solution that compensate for distortion with less power

Samsung offers an advanced and power efficient EIS (Electrical Image Stabilization) software solution. The solution based on gyro-synchronizer utilizes gyro data to compensate for unwanted movements up to approximately 6-degrees of each yaw and pitch axis. In addition, it can correct rolling shutter effect caused by the time differences of each pixel line's exposure.

No more distortion on rolling shutter image sensor:

Rolling shutter method is widely used in mobile camera industry since it has many advantages such as power efficiency and cost-effectiveness. However, this method isn't best when taking pictures while in motion as it creates a rolling shutter effect, also known as a jello effect that makes the objects in the image wobbly. The EIS solution considers both camera's movement and readout timing of rolling shutter to compensate for possible distortion caused by camera motion. As illustrated in figure 1, the left frame captured with the EIS solution shows straight vertical lines while the frame on the right shows distorted lines marked with red triangle.

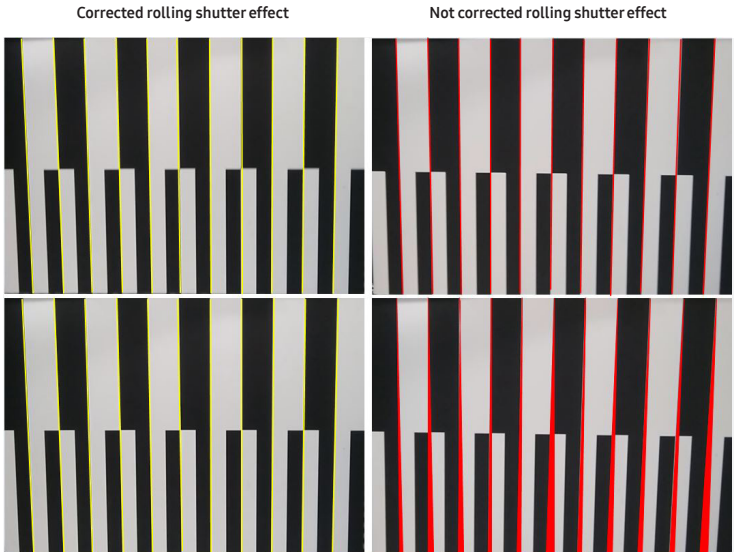


Figure 1. Comparison between corrected image with EIS solution and image showing jello effect

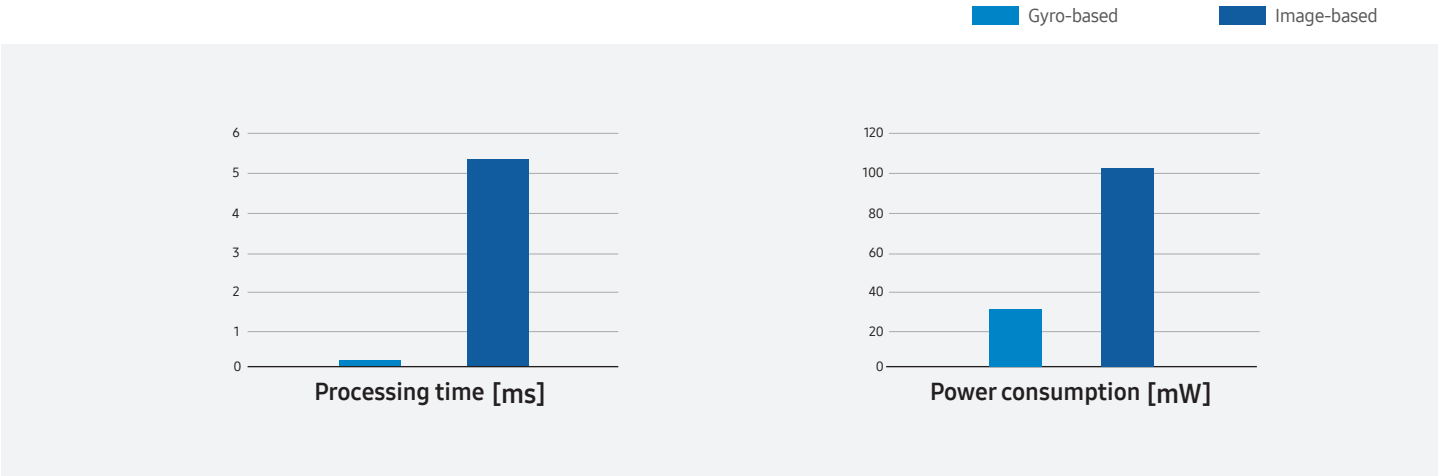
* Internal test results of FHD 30fps video processing with Samsung's algorithms

Gyro-based solution with EIS software for power efficient and high performing stabilization

Precise stabilization with less power

In a conventional image stabilization solution, an application processor acquires gyro and image frame data separately from gyroscope and image sensor. However, this method is unreliable due to random timing and slow, on average 200Hz, sampling rate when delivering the data to the EIS engine. By using the gyroscope, equipped in the ISOCELL 3P9's Plug and Play module, and 3P9's gyro synchronizer the sampling rate is improved to around 32kHz making the data highly reliable. This helps to reduce exceptional cases and make calculation simpler resulting in faster operation with less power consumption.

Motion Estimation	Processing time	Power consumption
Gyro-based	0.17ms	32.4mW
Image-based	5.3ms	102.4mW



* Internal test results of FHD 30fps video processing with Samsung's algorithms

For more information

For more information about the Samsung Semiconductor, please visit **www.samsung.com/semiconductor**

About Samsung Electronics Co., Ltd.

Samsung inspires the world and shapes the future with transformative ideas and technologies. The company is redefining the worlds of TVs, smartphones, wearable devices, tablets, digital appliances, network systems, memory, system LSI, foundry and LED solutions. For the latest news, please visit the Samsung Newsroom at **https://news.samsung.com**

Samsung Electronics Co., Ltd.
129 Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677, Korea **www.samsung.com** 2018-05

SAMSUNG