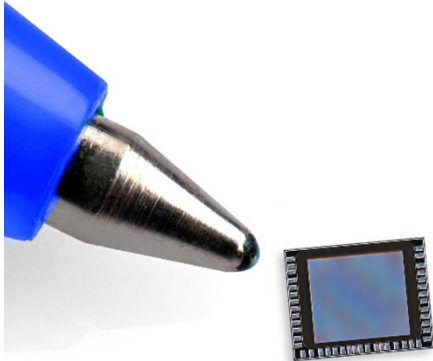


## Tiny, clever, low power, 0.56-megapixel, global shutter image sensor



Order code	Description
VD55G4CCC0/RW	Monochrome, die as reconstructed wafer
VD65G4CCC0/RW	RGB, die as reconstructed wafer

### Features

- **Resolution:** 0.56 MP (804 x 704)
- **Chroma:**
  - VD55G4: Monochrome (visible to NIR)
  - VD65G4: RGB Bayer
- **Pixel array diagonal:** 2.3 mm
- **Die size:** 2.73 mm x 2.16 mm
- **Pixel technology:**
  - Pixel pitch: 2.16  $\mu$ m
  - Shutter type: global shutter
  - Technologies: BSI, CDTI, 3D stacking
- **Embedded features:**
  - Image enhancement: autoexposure, noise reduction, defect correction, multi-exposure, and more.
  - Low-power operation:  $\leq$  35 mW at 60 fps.
  - Ultralow power solution with:
    - Smart auto wake-up feature, with ultralow power sleepy mode (<2 mW), and smart wake up when an event is detected
    - Power consumption scaling with features, frame rate, and software standby
  - Optimized for computer vision application:
    - 4x4 frame statistics output
    - Event-like frame output
    - Background subtraction mode
    - Others: context management, crop, GPIOs x4, and more.
- **Frame rate:** up to 184 fps, full resolution
- **Output:**
  - Pattern: VD55G4 Clear / VD65G4 RGB Bayer
  - Format: RAW8, RAW10
- **Interfaces:**
  - Data output interface: MIPI CSI-2 1 lane / SPI 1 lane / I3C
  - Control interface: I<sup>2</sup>C/ I3C
- **Deliverable types:** Bare die in reconstructed wafer

### Application

- XR headsets, AI smart glasses, and wearables
- PC and personal electronics
- Robotics and drones
- Computer vision and machine vision
- Barcode scanning
- Security and biometrics
- Smart building
- Medical imaging

## Description

The VDx5G4 is a unique ultracompact and low-power image sensor in the ST BrightSense portfolio. It has been developed to enable the next generation of smart and power-efficient systems. Two versions are available: monochrome and RGB Bayer. Leveraging the world's first 2.16  $\mu\text{m}$  global shutter pixel, the sensor highlights maximum compactness. It has a tiny 2.73 x 2.16 mm<sup>2</sup> footprint that fits into the most size-constrained devices such as smart glasses, XR and wearables, personal electronics, or laptops.

VDx5G4 is optimized for low power consumption across a wide frame-rate range, ideal for battery-operated AI systems. A dedicated low frame-rate autoexposure and auto-white-balance mode precompute exposure and color parameters directly on-sensor before each frame. By offloading these iterative calculations from the host, it accelerates convergence, cuts end-to-end latency, and reduces host CPU or NPU activity. This architecture significantly lowers overall system power, while maintaining robust image quality even in challenging or dynamic lighting conditions.

An embedded auto wake-up function further enables ultralow-power “sleepy” monitoring, instantly switching to full streaming when an event is detected. In addition to this low operating power, the sensor embeds an auto wake-up feature. This enables the sensor to operate in an ultralow power sleepy mode when no change or event is detected. As soon as an event is detected, the sensor automatically sends a trigger to its host processor to switch into full streaming mode to capture the corresponding event. Thanks to this clever feature, vision system makers can finally get rid of the power-hungry, ineffective 24/7 operation of systems such as security cameras, auto-ID, or in-line product inspection.

Beyond power optimization, the VDx5G4 embeds a complete toolbox of on-chip features for optimizing image quality, adjusting frame rate, or improving data efficiency. Autoexposure, noise reduction, and various image corrections help to get stunning images directly from the sensor. This sensor is tailored for computer vision applications with dedicated features. The frame statistics can be output, allowing fast and low computer vision application. This sensor can capture event frames in an event-like mode, enabling synchronous output of event information. A background subtraction mode can also be activated to seamlessly differentiate the foreground.

Combining a small form factor, power efficiency, and a full range of clever features, the VDx5G4 is the ideal vision extension for the next generation of smart embedded systems. Its single-lane MIPI CSI-2 output and I<sup>2</sup>C or I<sup>3</sup>C control interface makes it natively compatible with the broadest range of processing units. The VDx5G4 also includes a single-lane SPI interface and the capability to stream data over I<sup>3</sup>C, offering enhanced flexibility for diverse applications. To facilitate further integration, the sensor is provided along with development kits, camera modules, and drivers. All can be found on [st.com](https://www.st.com).

# 1 Product characteristics

**Table 1. Key characteristics**

Category	Parameter	VDx5G4 characteristics
Resolution	Pixel array [H x V]	804 x 704 (0.56 MP)
	Aspect ratio	Close to 1:1 pixel
Pixel	Shutter type	Global shutter
	Sensor technology	Back Side Illuminated (BSI)
	Pixel size	2.16 µm x 2.16 µm
Optical characteristics	Pixel array size [H x V]	1.74 mm x 1.52 mm
	Pixel array diagonal	2.3 mm
	CRA	30° linear
Die	Die footprint [H x V]	2.73 mm x 2.16 mm
	Die pinout	43 pins
	Package	Bare die
Electronic characteristics	Sensor data interface	MIPI CSI-2, 1 lane   I3C   SPI
	Sensor control interface	I <sup>2</sup> C, up to 1 MHz   I3C, up to 12.5 MHz
	Output format	RAW8, RAW10
	Supply voltages	V <sub>CORE</sub> 1.1 V   V <sub>DDIO</sub> 1.2 V or 1.8 V   V <sub>ANA</sub> 2.8 V
	External clock frequency	6 to 27 MHz and 27 to 42 MHz

**Table 2. Key features**

Category	Embedded features
Image quality optimization	<ul style="list-style-type: none"> <li>• Autoexposure</li> <li>• Automatic dark calibration</li> <li>• Noise reduction   Defective pixel correction</li> <li>• Gamma correction</li> <li>• Analog gains: 1x to 8x</li> <li>• Digital gains: 1x to 32x</li> </ul>
Computer vision, power and data optimization	<ul style="list-style-type: none"> <li>• Auto wake-up</li> <li>• Event-like mode</li> <li>• Cropping   Binning   Subsampling</li> <li>• Context management with up to 4 contexts</li> <li>• 4x4 programmable frame statistics</li> </ul>
Other	<ul style="list-style-type: none"> <li>• Mirror   Flip</li> <li>• Test pattern generation</li> <li>• Temperature sensor</li> <li>• GPIOs x4</li> </ul>

**Table 3. Typical product performances**

Parameter		VD55G4	VD65G4
Color pattern		Monochrome (Clear)	RGB Bayer (RGGB)
Dynamic range		68 dB	
Operating temperature range		-30 to 85°C	
Power consumption	60 fps typical	35 mW	
	Auto wake-up	1-2 mW	
	Standby	0.8 mW	
Maximum frame rates	Full resolution	184 fps	
	VGA resolution	271 fps	
	QVGA resolution	480 fps	

## Revision history

**Table 4. Document revision history**

Date	Version	Changes
10-Apr-2026	1	Initial release

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