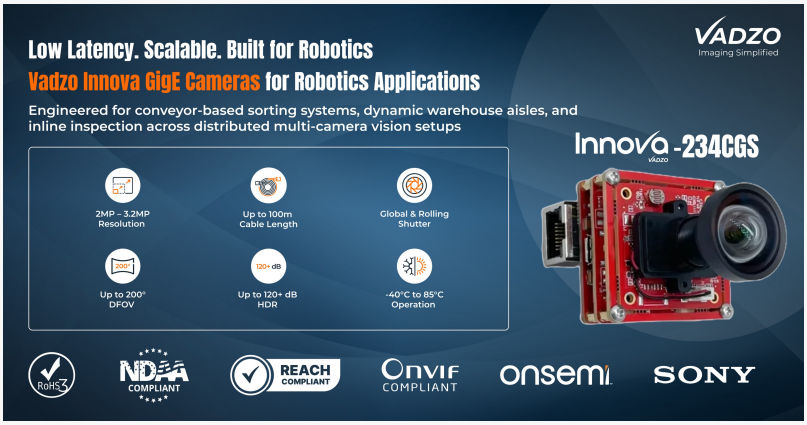
Vadzo Imaging delivers embedded and machine vision cameras for industrial, robotics, healthcare, and smart systems

Bolt-2020MRS delivers 20MP 5K monochrome imaging with AR2020, NIR sensitivity, dynamic ROI, and MIPI CSI-2 for AI and vision systems



Vadzo's Bolt-2020MRS is a high-resolution MIPI camera module

TEL AVIV, ISRAEL, June 15, 2026 /EINPresswire.com/ -- Vadzo Imaging, a provider of embedded vision cameras, today announces the launch of the Bolt-2020MRS, an Onsemi AR2020 20MP Monochrome MIPI CSI-2 Camera Module purpose-built for OEM teams who need the highest spatial resolution available in a compact board-level MIPI form factor. As a 20MP Monochrome MIPI CSI-2 Camera Module, the Bolt-2020MRS delivers 5120 × 3840 monochrome imaging with enhanced dynamic range and near-infrared sensitivity, integrating directly with embedded AI platforms in a 38mm × 38mm form factor without USB or network overhead.

Sensor and Camera Overview

The Bolt-2020MRS is built on the Onsemi HyperLux LP AR2020, a 1/1.8" CMOS sensor with 1.4 µm × 1.4 µm pixel pitch and a maximum resolution of 20MP (5120 × 3840). As an AR2020 Monochrome MIPI CSI-2 Camera Module, the Bolt-2020MRS eliminates the Bayer filter mosaic entirely, maximizing photon capture per pixel and delivering superior sensitivity in both visible and near-infrared spectrums compared to Colour variants of the same sensor. The HyperLux LP designation reflects the sensor's ultra-low power architecture, designed for embedded platforms with constrained power budgets including UAV payloads and battery-operated industrial devices. Enhanced dynamic range (eDR) preserves detail across highlights and shadows in a single frame without multi-exposure merging or host-side tone mapping, making this high-resolution MIPI camera module effective across high-contrast industrial and clinical environments.

As a 20MP Mono MIPI CSI-2 Camera Module, the Bolt-2020MRS connects via 4-lane MIPI CSI-2

directly to the host SoC ISP, supporting video streaming at 4K (3840 × 2160), 1080p, and 720p in addition to full 5K monochrome camera output. Dynamic ROI configuration allows developers to define and stream a specific image area at higher frame rates than full-resolution output, reducing CSI-2 lane bandwidth consumption and ISP processing load for inference pipelines operating at sub-20MP input resolutions. The camera accepts standard S-Mount (M12) optics with a default 74° DFOV lens, operates across −30°C to 70°C, and weighs 18g without lens. Module-level drivers are provided for Raspberry Pi 4, Raspberry Pi 5, Jetson Orin NX, Jetson Orin Nano, Jetson Orin AGX, and NXP i.MX8M Plus.

Key specs: AR2020 20MP Monochrome MIPI CSI-2 Camera Module | 20MP (5120×3840) | Onsemi HyperLux LP AR2020 1/1.8" 1.4 µmBS Pixel | 4-lane MIPI CSI-2 | Dynamic ROI | S-Mount (M12) | 74° DFOV | 38mm × 38mm | −30°C to 70°C | RPI4 · RPI5 · Jetson Orin NX · Orin Nano · Orin AGX · NXP i.MX8M Plus

Key Capabilities of the Bolt-2020MRS: 20MP Monochrome MIPI CSI-2 Camera with Onsemi HyperLux™ AR2020 Sensor

20MP High-Resolution Monochrome Imaging for Precision Detail Capture

As a 20MP Monochrome MIPI CSI-2 Camera Module, the Bolt-2020MRS delivers 5120 × 3840 resolution on a 1/1.8" sensor, the highest resolution available in the Bolt MIPI camera module series. This pixel density enables capture of fine structural and textural detail essential in industrial inspection, digital pathology, and scientific imaging, reducing reliance on multi-camera setups or mechanical zoom systems while preserving edge-level clarity at full resolution. As a 5K Mono MIPI Camera Module, it addresses the class of embedded vision applications where 4K and 8MP sensors provide insufficient spatial resolution for the measurement or detection task, making it a high-resolution mono camera module that delivers 5K monochrome camera output in a board-level form factor integrating directly with embedded AI SoCs. For OEM teams evaluating 20MP monochrome camera options, the Bolt-2020MRS is the only AR2020 20MP Monochrome MIPI CSI-2 Camera Module available in a compact board-level form factor with validated platform drivers.

Enhanced Dynamic Range for High-Contrast Environments

Embedded vision systems routinely operate in environments where illumination varies dramatically within a single frame. As a high-resolution MIPI camera module with sensor-level eDR, the Bolt-2020MRS preserves detail simultaneously across highlights and shadows without post-processing pipelines or auxiliary lighting hardware. For inspection systems where a single Mono MIPI CSI-2 Camera Module must handle both specular reflection from polished surfaces and detail in adjacent low-illumination zones, eDR at the sensor level ensures the input to the inspection algorithm is correctly exposed from the point of capture, improving detection consistency and reducing false positives caused by overexposed or underexposed regions.

NIR Sensitivity and Ultra-Low-Light Performance

The Bolt-2020MRS's monochrome architecture combined with the AR2020 sensor's inherent NIR sensitivity enables reliable imaging in near-infrared and low-light environments where standard visible-light color cameras degrade significantly. The absence of a Bayer color filter means each pixel receives the full photon flux across both visible and NIR spectrums, improving signal-to-noise ratio in low-illumination conditions and enabling effective imaging under 850 nm and 940 nm NIR illumination without auxiliary visible lighting. As an AR2020 Mono MIPI CSI-2 Camera Module, the Bolt-2020MRS is suited for biometric imaging, vein pattern recognition, material sorting under structured NIR illumination, and night-mode surveillance applications where a standard colour Monochrome MIPI CSI-2 Camera Module would fail to deliver usable output. For OEM teams building NIR-based embedded systems, this 20MP Monochrome Camera delivers the combination of resolution and infrared sensitivity that dedicated NIR sensors at lower resolutions cannot match.

Dynamic ROI for Higher Frame Rates and Bandwidth-Efficient Pipelines

Full 20MP output from this 20MP Monochrome MIPI CSI-2 Camera Module at maximum resolution is not always the correct operating mode for embedded AI inference pipelines, many neural network architectures operate on fixed input resolutions significantly smaller than 5K, and streaming full-resolution data wastes bandwidth and compute resources. The Bolt-2020MRS supports dynamic ROI configuration, allowing developers to define a specific image region and stream it at higher frame rates than full 5K Mono MIPI Camera Module output permits. This enables the camera to operate in a resolution-optimized mode matched to the inference engine's input requirements. For multi-mode deployments, this high-resolution mono camera module supports runtime switching between full 20MP capture for imaging tasks and a high-frame-rate windowed ROI stream for real-time inference, from the same AR2020 Monochrome MIPI CSI-2 Camera Module without hardware changes.

4-Lane MIPI CSI-2 for Real-Time Embedded Processing

The Bolt-2020MRS connects via 4-lane MIPI CSI-2 directly to the ISP of the host SoC, delivering image data with deterministic low latency and without the USB enumeration overhead, host driver layer, or network stack that accompany alternative interface architectures. For embedded AI systems where real-time inference, decision-making, and control are non-negotiable, robotic vision pipelines, AGV navigation systems, and UAV imaging platforms, MIPI CSI-2 delivery from this Mono MIPI CSI-2 Camera Module ensures frame timing is consistent and predictable. Module-level drivers for Raspberry Pi 4, Raspberry Pi 5, Jetson Orin NX, Jetson Orin Nano, Jetson Orin AGX, and NXP i.MX8M Plus are provided out of the box, covering the majority of embedded Linux platforms used in production robotics and edge AI deployments. Driver porting support for NXP i.MX, STM, and MediaTek platforms is available on request.

Compact Board-Level Form Factor for Space-Constrained OEM Platforms

The Bolt-2020MRS is designed to fit directly into embedded system PCB layouts without mechanical accommodation or redesign. The 38mm × 38mm board footprint, convertible to 32mm × 32mm for the most space-constrained designs, allows this high-resolution MIPI camera module to be treated as a board-level component during system layout. At 18g without lens, it is compatible with UAV payload constraints and wearable device weight budgets. The standard M12 lens mount accepts the default 74° DFOV optic or 100° DFOV and supports alternative focal lengths and field-of-view configurations without board changes, giving OEM teams full optical flexibility within the same 20MP Monochrome Camera platform.

"What the Bolt-2020MRS gives OEM engineering teams is a combination that hasn't been available in a compact MIPI module before, 20MP resolution, dynamic ROI for higher frame rates, and monochrome NIR sensitivity on a single board. The practical impact is significant: with dynamic ROI, teams can run full 20MP capture for imaging tasks and then switch to a high-frame-rate windowed stream for real-time inference without changing hardware. You get a high-resolution mono camera module that serves both the resolution requirement and the inference pipeline requirement from the same AR2020 20MP Monochrome MIPI CSI-2 Camera Module, which simplifies system design considerably."- Ashu Gupta, Product Manager, Vadzo Imaging

Target Applications

Industrial Inspection and Machine Vision: The combination of 20MP resolution and eDR makes this Onsemi AR2020 20MP Monochrome MIPI CSI-2 Camera Module highly effective for detecting surface defects, micro-level inconsistencies, and structural variations on production lines. Dynamic ROI allows inspection engineers to define the exact image area relevant to the inspection task and stream it at higher frame rates, increasing throughput without reducing spatial resolution in the region of interest.

Digital Pathology and Medical Imaging: High pixel density and monochrome grayscale accuracy are critical in diagnostic and pathology imaging workflows. As a 20MP Monochrome Camera with board-level MIPI integration, the Bolt-2020MRS supports the spatial resolution and tonal precision required in microscopy, slide scanning, and clinical imaging systems, delivering high-resolution mono camera module performance in a compact form factor compatible with portable medical devices and embedded diagnostic platforms.

Biometrics and Identity Verification: NIR sensitivity enables reliable imaging for facial recognition, iris scanning, and fingerprint capture systems. As an AR2020 Mono MIPI CSI-2 Camera Module, the Bolt-2020MRS provides sufficient spatial resolution for high-accuracy biometric capture at distance under 850 nm and 940 nm NIR illumination, reducing the need for close-proximity imaging hardware in access control and identity verification installations..

Robotics, AGVs, and Embedded AI Systems: Low-latency 4-lane MIPI CSI-2 integration with Jetson Orin and Raspberry Pi platforms enables real-time object detection, navigation, and decision-

making for AGVs, robotic arms, and AI-powered embedded systems. Dynamic ROI from this 20MP Mono MIPI CSI-2 Camera Module allows the inference pipeline to receive a bandwidth-efficient stream while full 20MP capture remains available for recording and post-analysis, without hardware changes or system restarts.

UAVs and Aerial Imaging: The Bolt-2020MRS's compact form factor, low weight, and 5K monochrome camera output make it well-suited for UAV payloads requiring precision aerial imaging, mapping, or inspection with minimal size and weight impact. The HyperLux LP sensor's ultra-low power architecture keeps payload power draw within the tight budgets that aerial platforms allocate to imaging subsystems, making this high-resolution MIPI camera module practical for multi-camera UAV configurations.

Smart City and Surveillance Infrastructure: NIR sensitivity and low-light performance enable deployment in outdoor surveillance, traffic monitoring, and smart city systems where consistent image quality must be maintained across varying ambient lighting conditions. This Monochrome MIPI CSI-2 Camera Module provides sufficient resolution for license plate recognition, pedestrian counting, and forensic review from a single camera position. As a 5K Mono MIPI Camera Module, it reduces infrastructure density in large-area deployments where lower-resolution cameras would require multiple units to cover the same spatial area.

Scientific and Research Imaging: Applications requiring precise measurement, repeatability, and high-resolution monochrome output benefit from the camera's low-noise performance and stable operation. As a high-resolution mono camera module optimized for NIR and visible spectrum imaging, the Bolt-2020MRS supports research instrumentation, laboratory imaging systems, and production diagnostics where color information is irrelevant and spatial resolution is the primary requirement.

Frequently Asked Questions

What makes the Bolt-2020MRS different from other Bolt series MIPI camera modules?

The Bolt-2020MRS is the highest-resolution camera in the Bolt MIPI series, an Onsemi AR2020 20MP Monochrome MIPI CSI-2 Camera Module delivering 20MP (5120 × 3840) output compared to the 8.3MP of the Bolt-821CRS. As a 20MP Monochrome Camera with dynamic ROI and NIR sensitivity, it addresses applications requiring maximum spatial resolution and infrared imaging capability, digital pathology, precision inspection, and UAV mapping, where the Bolt-821CRS's 4K HDR colour output is not the right sensor configuration. For OEM teams choosing between the two, the decision maps to resolution and NIR requirements: the Bolt-2020MRS is the high-resolution mono camera module; the Bolt-821CRS is the HDR color camera.

What is enhanced dynamic range (eDR) and how does it differ from standard HDR?

Enhanced dynamic range (eDR) is an in-sensor capability of the Onsemi AR2020 that extends the

usable luminance range of captured images beyond standard linear readout, preserving detail in both highlight and shadow regions within a single frame. Unlike multi-frame HDR approaches that merge separate exposures and can introduce motion artefacts, eDR operates within a single exposure cycle. For a Monochrome MIPI CSI-2 Camera Module operating in high-speed inspection or motion-rich environments, single-exposure eDR means dynamic range is preserved without frame-to-frame ghosting or alignment overhead.

Why is monochrome better than color for NIR imaging applications?

Colour sensors use a Bayer filter mosaic that absorbs approximately two-thirds of incident light, including most NIR wavelengths, to separate color channels. As a Mono MIPI CSI-2 Camera Module with no filter layer, the Bolt-2020MRS receives the full photon flux across the visible and NIR spectrum at every pixel. For NIR-illuminated applications such as vein pattern recognition, iris scanning, and night-mode surveillance, this AR2020 Mono MIPI CSI-2 Camera Module delivers significantly higher sensitivity and signal-to-noise ratio at 850 nm and 940 nm illumination wavelengths than a color sensor of equivalent pixel size.

What SoC platforms does the Bolt-2020MRS Monochrome MIPI Camera support?

Module-level drivers are provided for Raspberry Pi 4, Raspberry Pi 5, NVIDIA Jetson Orin NX, Jetson Orin Nano, Jetson Orin AGX, and NXP i.MX8M Plus, covering the majority of embedded Linux platforms used in production robotics, edge AI, and industrial deployments. Driver porting support for NXP i.MX, STM, and MediaTek platforms is available on request from Vadzo's engineering team.

What is dynamic ROI and how does it benefit embedded AI inference pipelines?

Dynamic ROI allows developers to define a specific image region on this 20MP Monochrome MIPI CSI-2 Camera Module and stream it at higher frame rates than full 5K Mono MIPI Camera Module output permits. For inference pipelines operating at fixed sub-20MP input resolutions, dynamic ROI eliminates the bandwidth and processing overhead of streaming full-resolution data when only a portion of the frame is consumed by the model, increasing effective frame rate for inference, reducing ISP load, and freeing SoC compute resources for application logic without hardware changes.

Can the Bolt-2020MRS be customized for OEM integration?

Yes. Vadzo supports full OEM customization across this high-resolution MIPI camera module including form factor modification, board redesigns, firmware development, NIR and color LED array board integration, lens holder and filter modifications, and IP-rated enclosure design. Driver porting support for additional platforms is available on request. Evaluation kits ship with no minimum order requirement.

Availability and Customization

The Bolt-2020MRS Onsemi AR2020 20MP Monochrome MIPI CSI-2 Camera is available now for evaluation and OEM integration. To request full specifications or an evaluation unit, contact the Vadzo Imaging sales team at support@vadzoimaging.com.

About Vadzo Imaging

Vadzo Imaging develops embedded and machine vision cameras for OEMs and system integrators building production-ready vision systems across industrial automation, robotics, healthcare, and smart infrastructure. The company's portfolio spans MIPI CSI-2, USB 3.x, GigE, Wi-Fi, and SerDes interfaces, supporting a wide range of embedded deployment architectures. Vadzo provides end-to-end imaging support including sensor integration, ISP tuning, firmware development, and SDK frameworks to accelerate system deployment.

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