

## CES 2023 PREVIEW

# Discovering the Future of Technology with LG Innotek

**LG INNOTEK,  
WHERE  
INNOVATION  
STARTS**Meet  
LG Innotek  
at CES 2023



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LG Innotek will be an exhibitor at CES 2023, the world's largest consumer electronics event, to be held in Las Vegas, USA from January 5 to 8, 2023 (booth location: West Hall #381).

CES 2023 is the first such event to be held at full-scale since the COVID-19 pandemic. According to the Consumer Technology Association (CTA) which hosts the event, the number of participating companies will increase to 2,500 exhibitors – a 40% increase compared to 2022 – and 100,000 visitors are expected to visit the event.

### CES – The Premier Event for the 'Next' Paradigm

CES began as a consumer electronics showroom event, and since 2015 has been reborn as a venue for comprehensive digital innovation that encompasses a wide range of technology domains. Over the years, the annual CES event has become a bellwether of future technology and market directions. CES keynotes, conferences, and exhibition halls are arenas where big tech companies, global home appliance titans, manufacturers, service providers, and medical companies compete in good faith. In addition, CES hosts a large number of startups vying to become the next unicorns driving new technologies such as artificial intelligence, virtual reality, augmented reality, and NFTs and blockchain transactions, suggesting the direction of technological innovation.

### Tech Topics at CES 2023

The main themes of CES 2023 will be automotive, digital healthcare, metaverse, and sustainability – with automotive topics and technologies expected to capture the spotlight at this year's event.

By utilizing digital and eco-friendly technologies, future means of transportation are being transformed into another living space beyond simple point-to-point movement.

Future transportation trends have risen to prominence at recent CES events, and CES is the ideal venue for announcing new automotive technologies and exploring exciting innovations in more detail than at any other event. In fact, major automakers such as Mercedes, Audi, BMW, Ford, and Toyota have preferred to announce new technologies at CES than at global motor shows in recent years. The scale of exhibits related to future transportation is increasing every year, and at CES 2023, the West Hall – where the bulk of mobility companies are concentrated – boasts 25% more exhibition space compared to the previous year. In total, over 300 exhibitors will showcase automotive technologies including autonomous driving, electric vehicles, and future mobility. LG Innotek, the leader in sophisticated automotive components for autonomous driving systems and electric vehicles, is mobilizing its technological capabilities as a ‘total solutions provider’ for the next generation of transportation innovations such as electric vehicles and autonomous cars.

## LG Innotek Innovation Topic Areas at CES

LG Innotek has grown into a leading global material and component company by intensely fostering world-class products through continuous technological development and process innovations.

LG Innotek's state-of-the-art global product offerings include smartphone-camera modules, semiconductor substrates for communication, and photomasks for display. In addition, there are also connectivity, motor, power, and lighting technologies for EV. LG Innotek is expanding its technological capabilities to new businesses such as metaverse, autonomous driving, and sustainability. Next-generation innovations based on these technological capabilities will be exhibited at LG Innotek's booth at CES 2023 under the concept of LG Innotek, Where Innovation Starts.

In addition to four main zones, including Camera Solutions & Metaverse, Automotive Solutions, Substrates, and Power Solutions for Sustainable Energy, there will also be a Partner Zone that focuses on collaboration with global strategic partners under the theme of innovation together.

## **Zone 1: Camera Solutions & Metaverse**

LG Innotek's optical solutions division applies cutting-edge camera modules and 3D sensing technology to the spaces in which we spend our daily lives, such as cities, buildings, means of transportation, homes, and offices, as well as mobile devices that we carry with us every day.

The world seen by the device is realized as the metaverse – a digital world – and the camera module and 3D sensing technology become our digital eyes in the metaverse. Smart glasses that allow us to experience VR, AR, and XR are new eyes through which we see the world, and advanced camera modules and 3D sensing technology serve as eyes for autonomous cars to recognize real-world driving situations.

As the global number one camera and 3D solutions provider, LG Innotek is expanding its business beyond its origins in mobile technology into new markets such as metaverse and autonomous driving based on its precision materials capabilities and partner ecosystem. LG Innotek's metaverse innovations derived from its high-performance optical component technology – such as the 3D sensing module and display assembly, which are essential for the implementation of XR – are of particular interest.

Exhibition Highlights		Key Features
<b>Camera Solutions</b>	Optical Zoom Camera	<ul style="list-style-type: none"> <li>Small, high-performance optical zoom move with high-level optical design and precision drive system</li> </ul>
	Wide Camera	<ul style="list-style-type: none"> <li>Securing high definition and high reliability based on precision manufacturing (AA) and quality control (traceability) capabilities</li> </ul>
	Ultra-Wide Camera	<ul style="list-style-type: none"> <li>Realization of high-temperature resolution and heating solution by applying a solution to enhance environmental resistance</li> </ul>
	Front Camera	
	Home IoT Camera	
	Industrial Camera	
	Automotive Camera	
<b>Metaverse Camera</b>	Viewing Camera	<ul style="list-style-type: none"> <li>Light and convenient AR glasses that are comfortable to use outdoors for long durations</li> </ul>
	Sensing Camera	<ul style="list-style-type: none"> <li>Ultra-small light source design and high-precision AA application</li> </ul>
	Projector	<ul style="list-style-type: none"> <li>Realization of outdoor visibility and low power consumption by applying high-brightness, high-efficiency parts</li> </ul>
	Display Assembly	<ul style="list-style-type: none"> <li>Ultra-small and low-power camera module</li> </ul>

CES 2023  
Innovation Award

## LG Innotek Optical Zoom Camera



LG Innotek's technology is unique in the field of Optical zoom camera. In addition to introducing the world's best-performing products and remaining one step ahead of its industry competitors, LG Innotek recently won the CES Innovation Award 2023 for Optical zoom camera – the product of nearly 20 years of innovation and accumulated expertise.

LG Innotek's Optical zoom camera – making its global debut at CES 2023 – is a micro-component that integrates telephoto camera functions commonly used in DSLRs and mirrorless cameras into a form factor for smartphones. When installed in the rear smartphone camera, it allows users to take photos and videos without image quality degradation even when zooming from long distance.

Unlike the digital zoom, which magnifies the size of the displayed image and causes serious quality degradation, optical zoom camera has the advantage of maintaining high image quality because it moves the lens directly to zoom the subject. The main advantage of this product is that optical zoom filming is possible in all magnifications freely in the sections of 4~9 times with one module.

LG Innotek has developed the zoom actuator (component that moves the lens to change the focal distance or to set to the clean focus) to realize clear and clean image quality in all sections between the 4~9 times magnification. The zoom actuator boasts high accuracy, high moving speed and durability, and less battery consumption compared to competing products. LG Innotek has applied control technology that can move the zoom actuator with micrometer ( $\mu\text{m}$ , 1 millionth of a meter) unit.

Additionally, a newly designed Optical Image Stabilizer (OIS) reduces blur caused by shaking and increases definition. OIS is a key feature because camera shake is especially apparent in hand-held zoom cameras.

A typical optical zoom module has a longer focal distance and thicker form factor as magnification increases. To solve this problem, LG Innotek has newly innovated the lens design and module structure. By minimizing the thickness of the module, camera protrusion from the smartphone body has been eliminated.

LG Innotek's plan is to solidify the global No. 1 position in the smartphone camera module market through the 'Optical Zoom Camera'

In particular, LG Innotek and Qualcomm Technologies are working closely to optimize software for optical continuous zoom that will be applied to the new premium Snapdragon 8 Gen 2 Mobile Platform. It will enhance the image tuning custom for the optics, which includes Auto-Focus, Auto-Exposure, Auto-White

Balance, lens shading correction and much more. Users will be able to focus quickly. And the photos and videos will have stunning image quality.

Starting with the release of products at CES 2023, which will be held next month, LG Innotek and Qual-

comm Technologies plan to speed up joint promotions for global smartphone manufacturers.

<Snapdragon is a trademark or registered trademark of Qualcomm Incorporated. Snapdragon is a product of Qualcomm Technologies, Inc. and/or its subsidiaries.>

### Zone 2: Automotive Solutions

Competition in the automotive industry for the future of the automobile market is getting fiercer by the day. Autonomous driving and hyper-connectivity are the core of next-generation automobiles – one of the innovations that unlock the future. In the case of autonomous driving, as of 2022 autonomous driving has been implemented to level 2, which is partial automation where the system assists humans, and level 3, which operates autonomously without driver intervention under certain conditions. Automakers are accelerating technology development, test driving, and data collection with the ultimate goal of achieving level 5, which enables driving without a driver, beyond the concept of driving assistance. Through hyper-connection, future cars are being reborn as new spaces that encompass both your offline and online daily life rather than just a means of transportation. In order to meet these technical characteristics, the automotive industry is accelerating the innovation of autonomous driving and communication-related module technologies.

LG Innotek provides a complete suite of solutions, including cutting-edge camera modules used by autonomous cars to recognize driving conditions, sensors such as LiDAR and Radar, short- and long-distance communication modules required to connect cars to networks, and front and rear lighting solutions for smart lamp designs.

The camera module, which is the eye of an autonomous vehicle, collects and analyzes video and images to process information around the vehicle while driving. The LiDAR module performs a 3D scan of the environment around the vehicle with 360-degree omnidirectional sensing. High-frequency 77 GHz radar determines the direction, speed, and distance of objects outside the vehicle, while newly-developed Sensor Fu-

sion combines camera modules and radar technology. LG Innotek also boasts a deep line-up of long- and short-distance communication modules needed to connect vehicles, people, and infrastructure. Among them is the world's first long-distance LTE/5G modifier, while short-distance also continues the tradition of innovation in areas such as Bluetooth, Wi-Fi 6, and 6E modules. LG Innotek has also been the subject of keen attention within automobile industry for its UWB digital key, which supports precise positioning within 10 cm.

At the Automotive Solution Zone of LG Innotek's exhibition booth, visitors can experience first-hand the future of the Level 4 and Level 5 autonomous driving sought by automakers and consumers. Ultra-precise sensors represent the essential foundation of Level 4 and Level 5 autonomous driving. LG Innotek's Sensor Fusion supports object sensing beyond LiDAR, radar, and cameras. Sensor Fusion can improve sensing performance and driving stability in various adverse conditions including snow, rain, fog, nighttime, direct sunlight, and harsh backlight. In addition, visitors can experience Nexlide, a module for automotive lamps that implements a uniform luminous image by applying a high-efficiency optical structure and optical pattern design technology.

	Exhibition Highlights	Key Features
Autonomous Driving Solutions	ADAS Camera	Improves autonomous driving stability by providing clear images regardless of the environment
	Sensor Fusion	Improves sensing performance and driving stability in various environments through 4D radar and camera data fusion
	Mechanical LiDAR	Increases the object recognition rate and improves the stability of autonomous driving systems
	Solid State LiDAR	
	In-Cabin Camera	<ul style="list-style-type: none"><li>DMS: Accurate driver recognition at all times by applying AF function</li><li>OMS: Improved interior convenience and autonomy through miniaturization</li></ul>
	In-Cabin Radar	Provides high resolution and detection accuracy to enhance passenger safety
Connectivity Solutions	5G+V2X Module	Optimized for automotive TCU systems with 5G and V2X modules that can respond globally
	BT / Wi-Fi6, 6E	Communication module for quick connection between vehicle and smartphone
	UWB Digital Key	Digital key solution with enhanced location recognition accuracy, security, and convenience
Nexlide (Next Lighting Device)	Front/Rear Lamp Mock-Up	High-quality, low-power lighting module applicable to a range of smart lamp designs

### Zone 3: Substrate & Material

As the paradigm changes to a hyper-connected society with the advent of 5G mobile communication (5G), artificial intelligence (AI), autonomous driving, and cloud, many products have become 'smart,' requiring them to store and process data according to high specifications. Consequently, demand for high-performance semiconductors is soaring.

Along with the development of microprocesses for the realization of high-performance semiconductors, the added value brought by technological innovation in the packaging process – the post-process for enhancing semiconductor performance – is also the subject of much attention. In particular, the importance of semiconductor substrates is being emphasized. Semiconductor substrates are circuit components that electrically connect semiconductors and main boards and mechanically support them. As the packaging process develops, sophistication of semiconductor substrate technology must keep pace.

For the past 37 years, LG Innotek has been producing ultra-precision, high-density, and ultra-fine substrates used in high-resolution display panels, semiconductor packages such as communication chips, and application processors used in mobile and IoT devices. LG Innotek leads the global market in layer-to-layer (layers of substrates are stacked accurately and evenly) bonding technology, coreless technology, and roll-to-roll thin film material processing technology.

At CES 2023, LG Innotek will unveil innovative products in three areas: FC-BGA substrate, Package Substrate, and Tape Substrate. FC-BGA substrate is a high-end substrate mainly used for CPU, GPU in PC, server, and communication chipsets. In anticipation of the increased market demand driven by artificial intelligence (AI), clouds and 5G, LG Innotek invested KRW 413 billion in FC-BGA facilities and equipment in 2022, and is intensively fostering the continued development of the FC-BGA substrate business. In particular, various DX technologies such as AI and simulation were applied to the FC-BGA development process to minimize warpage, which is fatal to product performance. LG Innotek has the manufacturing capacity and depth of knowledge to respond to each customer's needs, and can manufacture substrates of

various thicknesses including Coreless, which removes the core layer of semiconductor substrates.

In the Package Substrate field, LG Innotek will introduce RF-SiP substrate for global market-leading mobile wireless communication front-end modules, AiP substrate for 5G mmWave antenna modules, FC-CSP substrate for application processors, and CSP substrates used for memory and more.

In the Tape Substrate field, Chip on Film (COF), which leads the global market based on its extraordinary ultra-fine construction, 2metal Chip On Film (2Metal COF), and Chip On Board (COB), will be exhibited. COF and 2Metal COF connect display panels such as smartphones and TVs to the main board, and COB is used for credit cards and passports.

Visitors to LG Innotek's booth at CES 2023 will get an opportunity to learn about sophisticated substrate technology and LG Innotek's unmatched manufacturing capabilities through product mock-ups, FC-BGA substrate assembly exhibits, and multimedia experiences.

Exhibition Highlights		Key Features
Package Substrate	FC-BGA	Capable of producing substrates with various core thicknesses (coreless, thin, and thick core), and large-area/high-multilayer substrates through warpage simulation and control technology
	RF-SiP	Provides ultra-thin substrate with low signal loss through the development of low-dielectric/low-loss material
	AiP	Provides total solutions based on antenna design and substrate production capabilities
	FC-CSP	High-density/ultra-slim package solution
Tape Substrate	CSP	
	2Metal COF	
	COF	High Resolution Display and Zero Bezel Implementation
	COB	Stable supply of highly reliable substrates

#### **Zone 4: Power Solutions for Sustainable Energy**

Increasing the use of sustainable energy to protect the environment is a top concern of major governments and corporations around the world. In fact, as one of the main goals of building smart cities, governments around the world are showing interest in supplying zero-energy houses that are highly energy efficient and can directly produce and store sustainable energy. LG Innotek is similarly focused on the household as the starting point for its sustainability innovations.

The expansion of electric vehicles and the increasing number of data centers are present notable challenges. As the supply of electric vehicles increases, the problem of insufficient charging infrastructure has surfaced, and governments around the world are actively seeking to secure charging infrastructure by revamping their systems. In addition, the rapid increase in demand for data centers due to the accelerated digital transformation taking place across society, economy, and culture is also emerging as an environmental issue. Since data centers require a huge amount of electricity, LG Innotek is working with regulatory agencies to prepare systems related to energy efficiency.

Using its decades of accumulated expertise in the vehicle power and electronic components sectors, LG Innotek is developing technological solutions that will lead the fields of renewable energy and electric vehicles. LG Innotek not only develops and supplies renewable energy-related technologies and solutions, but also actively participates in environmental protection by increasing the use of renewable energy while increasing energy efficiency related to product production.

In the case of new and sustainable energy generation, LG Innotek has developed Module Level Power Electronics (MLPE) that maximize the power generation efficiency of solar panels, AC inverters for homes, and DC-DC converters that are mounted on ESS (Energy Storage System) to store generated energy. On the energy consumption front, the company mass-produces DC-DC converters that supply electricity to in-vehicle devices, and BMS and EVCCs that are communication and control modules. CES attendees can take a closer look at LG Innotek's solutions by visiting the Eco-friendly Power Solution for Sustainable Energy Zone at LG Innotek's booth. In addition,

a wealth of information is presented about magnetic components and materials, mechanical design, simulation, and various software capabilities, which are the technical basis of LG Innotek's power product line-up.

Exhibition Highlights		Key Features
<b>Renewable</b>	Hybrid Inverter	Industry-leading power density and efficiency, increased installation convenience through compatibility with ESS/DC Optimizer, OTA and controllable communication technology, global SCM implementation and production response
	MLPE (DC Optimizer)	Convenient installation through impedance matching with panels, improvement of power generation efficiency in shaded situations, individual monitoring and control of solar panels
	DC-DC Converter for ESS	High market share of DC-DC equipped ESS, improved battery stability by applying DC-DC
<b>EV</b>	Power module for EV charger	Improved installation convenience, system miniaturization driven by high-density design, enhanced vehicle reliability performance and evaluation/management capabilities
	DC-DC converter for EV	<ul style="list-style-type: none"> <li>Increased mileage and reduced weight/cost by applying high-efficiency, lightweight, compact, and wireless power parts</li> <li>Integrated modules tailored to various electric vehicle platform configurations</li> </ul>
	Wireless BMS	
	EVCC	
	Battery Electric Module	
<b>Display &amp; Server</b>	Slim PSU for TV	Increased freedom in set design with high-capacity/high-efficiency/slim PSUs in line with the large-screen/high-definition/slim trends of OLED TVs
	Slim PSU for LED Monitors	Improved set design by providing a slim PSU capable of high definition
	PSU for Data Centers	Server Power Supply with maximum design flexibility, Titanium Plus efficiency class, high-density PSU, redundant operation

### Ready for CES 2023:

### Don't Miss LG Innotek's Virtual CES Experience!

In line with the opening of CES 2023, LG Innotek will launch a CES online exhibition hall on its website ([www.lginnotek.com](http://www.lginnotek.com)). A wealth of information will be presented, including detailed descriptions of the exhibited products and sketches of the exhibition site, giving visitors to the online exhibition hall a rich and vivid experience – just as though they were visiting LG Innotek's actual booth in person at CES 2023.