



IceMOS Technology

Advanced Power & Isolation Solutions for Charging Infrastructure & Energy Storage Product & Technology Brochure



Next-Generation Power & Isolation Solutions: Driving Efficiency in E-Mobility and Energy Storage

The transition to 400V/800V EV architectures, high-power DC fast charging, and grid-scale battery energy storage demands unprecedented power density, thermal efficiency, and fail-safe isolation.

IceMOS provides an exclusive combination and selection of high-efficiency SuperJunction and Wide-Bandgap SiC MOSFETs designed for heavy-duty power conversion, alongside MEMs SOI Substrate technology for PhotoMOS relays to ensure galvanic isolation as well as ultra-reliable, noiseless signal control.

Technical breakdown of Power switches vs Isolation devices:

- **Silicon SuperJunction (SJ) MOSFETs:** Cost-effective high-voltage performance for standard PFC stages and auxiliary Power supplies.
- **Silicon Carbide (SiC) MOSFETs (650V - 1700V):** Ideal for high-voltage, high-current traction inverters and DC/DC converters. Offers low on-resistance at high temperatures and minimal tail current.
- **Optically Isolated MOSFET Relays (PhotoMOS):** Solid-state signal/insulation switches providing high breakdown voltage (up to 1,500V+), zero contact bounce, and long operational life for Battery Management Systems (BMS).

Device Selection Guide by Power Topology & Application

Technology Class	Typical Voltage Range	Key Applications	Primary Advantage	Typical Package Options
Silicon SJ MOSFET	500V – 900V	EV On-Board Chargers (OBC), Telecom/Server PSUs, Auxiliary Power Supplies, Mid-Range PFC Stages	Cost-to-performance optimization	TO-220, D2PAK
SiC MOSFET	650V – 1700V	EV Traction Inverters, Fast Chargers, BESS Converters	High thermal limits, low RDS(on) at high temp	TO-247, SMD
PhotoMOS Relays	30V – 1500V	BMS Cell Monitoring, Insulation Detection, Pre-charge, Battery Storage systems	Infinite life, high I/O isolation (>5kV), no noise	IceMOS provide TSOI wafers to PhotoMOS manufacturers

Silicon SuperJunction MEMS SJ & K-Series Product Families Advantages

Application-Specific Efficiency: Optimized for high-voltage operation in PFC and industrial inverter applications.

Optimized Cost-Performance: Provides significant performance gains over Si DMOS at a lower price point than SiC alternatives.

Simplified Design-In: Compatible with existing Si MOSFET footprints, reducing engineering overhead and time-to-market.

M-Series Product Family of SiC Performance Benefits

Optimized Performance: Features outstanding thermal stability and high-voltage efficiency for EV and industrial power conversion.

Proven Reliability: Built for longevity and consistent performance under harsh mission-critical conditions.

High-Frequency Capability: Facilitates reduced magnetic footprints, allowing for more compact and lightweight system architectures



Scan to access the High Voltage Power MOSFETs (Blue) Brochure and SJ & SiC Selection Table

IceMOS TSOI Wafers: The Foundation for Ultra Reliable PhotoMOS Relays

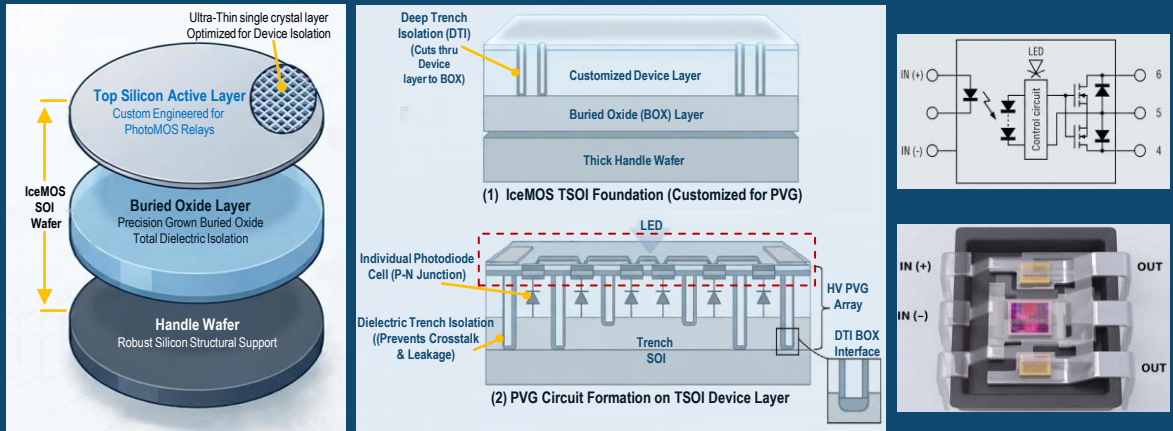
When manufacturing a PhotoMOS solid-state relay (SSR) that integrates optical coupling with signal control and driver circuitry, **Trench Silicon-on-Insulator (TSOI)** technology is utilized for its dielectric isolation, reduced parasitic capacitance, and noiseless signal control.

IceMOS delivers high-performance TSOI wafers, providing the vital foundation required to manufacture these ultra-reliable semiconductor relays.

Leveraging decades of expertise in Wafer Bonding, Deep Trench Reactive Ion Etching alongside electrical isolation with high-quality oxide, IceMOS delivers robust sensing structures built for maximum efficiency. Backed by our advanced defect detection and inspection technologies, every wafer is manufactured to the highest quality standards for reliable, high-yield device performance.

Impact of IceMOS TSOI Technology on PhotoMOS Performance

- **Total Electrical Isolation:** The oxide layer isolates active components completely, effectively eliminating parasitic leakage currents.
- **Ultra-Fast, Noiseless Switching:** Significantly reduces parasitic capacitances to allow PhotoMOS relays to achieve rapid, noiseless signal switching alongside absolute galvanic isolation.
- **Exceptional Reliability & Longevity:** By actively preventing cross-talk and thermal degradation at the silicon level, IceMOS technology ensures stable, bounce-free, high-voltage operation over millions of cycles.



PhotoMOS Applications: Charging Infrastructure & Battery Storage/BMS

Inrush Current Prevention (Pre-Charge) Circuit (Fig 1)

Application: Protecting sensitive DC link capacitors from damaging high-current surges during system startup.

A pre-charge circuit uses a SSR paired with a power resistor. SSRs are preferred for miniaturization and long life.

Upon startup, the relay controlling the pre-charge resistor turns ON first, gently charging the capacitor. Once the voltage stabilizes, the main power relay turns ON, bypassing the pre-charge circuit.

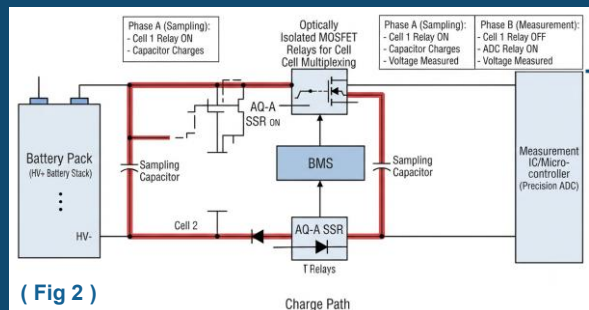
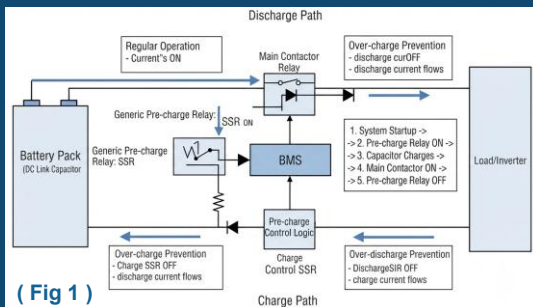
Battery Cell Voltage Monitoring (Fig 2)

Application: This diagram highlights how compact PhotoMOS relays enable high-precision Battery Monitoring Systems (BMS). Individual cells in a stack (Cell 1 to Cell N) float at high voltages, direct connection to a measurement IC is impossible.

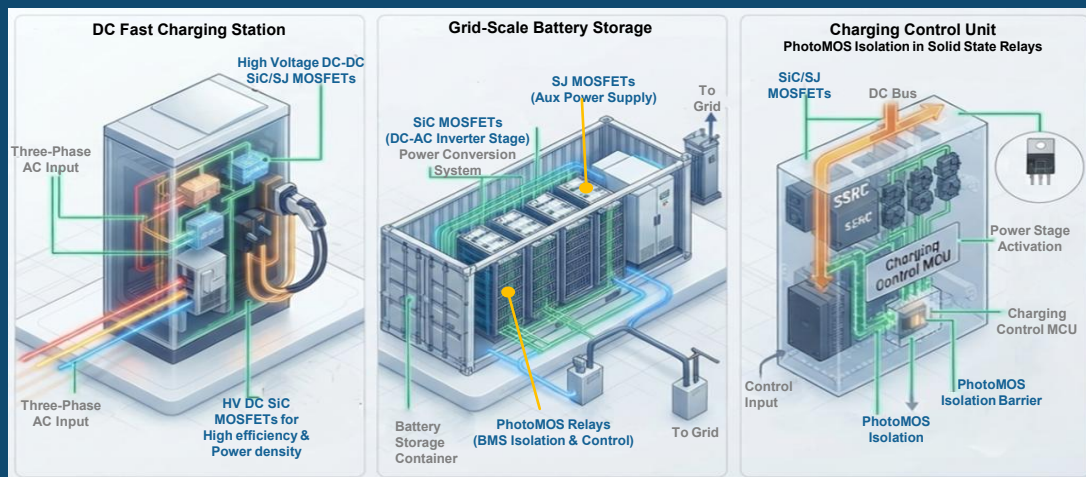
PhotoMOS relays are used in a multiplexing arrangement to safely and accurately measure the individual voltages of stacked battery cells in a module.

SSRs are an ideal solution as they are compact, low-capacitance PhotoMOS relays capable of frequent, high-speed switching to provide necessary channel-to-channel isolation.

During the cell sampling phase (highlighted red) of the circuit, the relays connect individual cells to a common sampling capacitor, charging it to the cell's voltage. During the next measurement phase, the cell relays turn OFF (providing isolation), and the measurement relays turn ON, connecting the capacitor's voltage to the measurement IC/microcontroller.



The Impact of SJ, SiC, and PhotoMOS in Modern Energy Systems



Key Technological Advantages

SJ MOSFETs, SiC and PhotoMOS SSR technologies collectively enhance power density, efficiency, safety, and reliability across modern energy storage and charging systems.

- Super junction (SJ) MOSFETs provide efficient, cost-effective power conversion for mid-range voltage applications within internal auxiliary power supplies. Their low on-resistance and fast switching capabilities also allow for more compact auxiliary power supply designs.
- Silicon carbide (SiC) MOSFETs serve as the primary power conversion components in high-voltage stages, significantly reducing energy loss through lower conduction and switching losses. By supporting much higher switching frequencies, SiC devices enable higher power density and reduce the overall size and weight of charging stations and storage units. In addition, SiC components withstand higher operating temperatures to ensure robust reliability under heavy system loads.
- PhotoMOS solid-state relays provide crucial electrical and galvanic isolation between high-voltage power circuits and low-voltage control systems using optical signals. Because they lack moving parts, PhotoMOS devices offer superior reliability, zero mechanical wear, and a much longer operational life than traditional mechanical relays. Their fast-switching speeds also deliver quicker response times for safety-critical functions like disconnecting battery packs during fault conditions.

IceMOS SJ MOSFETs & Advanced Engineering Substrates

MOSFETs: IceMOS is a global innovator in Power Electronics. We design and manufacture high-voltage Super Junction (SJ) MOSFETs, providing energy-efficient solutions for the industrial, medical, automotive, and telecommunications sectors. We are dedicated to shaping a limitless, sustainable future.

Advanced Engineering Substrates: IceMOS Technology is a global semiconductor leader operating a proprietary fabrication facility in Belfast, Ireland. We deliver advanced Engineering Substrates that drive millions of smart, connected applications, transforming the way people work and live. Our substrates enhance speed, efficiency, and reliability across microelectronics, power devices, MEMS sensors, and photonics.

Patents : IceMOS owns intellectual property with 70+ granted and 15+ pending patents, powering our core technologies and process licenses, based on this IP.

Regulatory Compliance: Our products are RoHS and REACH compliant. We maintain a conflict-free supply chain and do not use minerals sourced from conflict zones.

IceMOS Worldwide Locations

MOSFET Sales:

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