

# Kokam Battery Solution

Transportation Application



# Electrifying Transport

Kokam Battery System is designed for use in commercial truck, bus, tram, and heavy duty transportation. The system can be integrated in parallel and in series to create very high energy and high voltage systems. Furthermore, the “Variable Bulkhead” allows Kokam to customize the packs’ electrical and cooling interfaces without having to retool the entire systems.

## Superior Lithium Ion Battery

- Exceptionally high power performance
- Extremely safe and wide range of operating temperature

## Compact and High Reliability Battery Packs

- Exceptionally efficient direct liquid cooling
- Ease of installation
- Customizable solution
- IP67 Compliant

## State-of-the-Art Battery Management Systems

- ISO-26262 compatible RTOS
- Highly configurable for any chemistry
- 12V and 24V compatible
- Designed for system voltages up to 1250V

## Complete System Design and Component Selection

- Battery disconnect unit, System controller, Master controller
- Controls up to 300 cells in series; 24 strings in parallel

## Extensive R&D, Engineering, and Test & Validation Resources

# Kokam Modular Pack

For High Performance E-Mobility

## Customizable Design



Single Unit



Scalable Modular Design

## Features

- Variable bulkhead design
- Advanced liquid cooling system
- New Kokam BMS, BDU and MCU
- A function to prevent spreading a fire out of the pack in case of internal fire
- Advanced ultrasonic welding of cell tabs to busbars
- Extremely durable and safe under the toughest conditions
- Available with high energy or high power cells
- All external connections at front panel
- Low and stable impedance



	71P 7.1 kWh	114E 11.4 kWh
Cell Configuration	40NMC-2P24S	65NMC-2P24S
Specific Energy (Wh/kg)	≥92	≥152
Energy Density (Wh/L)	≥116	≥186
Capacity (Ah; Rated at C/2)	80	130
Voltage (Nominal; V)	88.8	87.8
Mass (kg)	77	75
Dimensions (L x W x H)	753mm x 303mm x 282mm	
	Available 1Q 2017	Available 3Q 2017

# Kokam EV Battery System

Certified & Guaranteed

## Advantages

- Easy to customize high voltage, low voltage and cooling interfaces to each application
- All connections at front panel; rear access not needed for installation
- New Kokam BMS permits very large strings and pack combinations (Up to 750V per string, and up to 24 strings in parallel)
- Allows upgrades to connector styles, fuses, VTBs without tooling entire pack
- Robust, highly serviceable BDU with integrated SCU; standalone MCU
- Available with or without internal fuse
- Highly robust tab-to-busbar joint survives the harshest vibration & shock environments while maintaining ultra-low DCIR
- Direct cooling to cell face; 50-75% less mass than competing technology; maximizes volumetric efficiency
- Enhanced cell separator eliminates the need for thermal barriers

## EV Battery Pack Validation

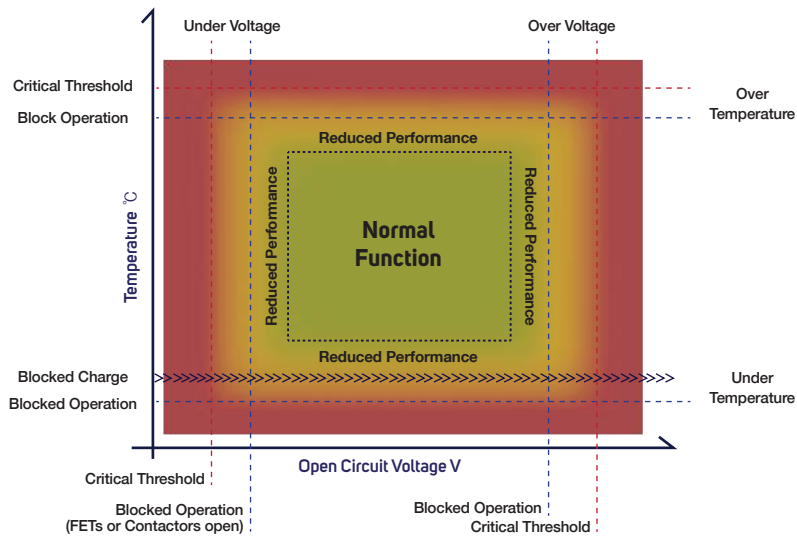
Test	Conditions	Reference
Ingress Protection	Mated: IP67, IPXXD, Unmated	ISO 20653
Isolation		IEC 62133
Shock	50G, 6mS, 3 axis, 10 each	ISO 12405
Vibration	Random, 3 Axis, 21 hr/axis	ISO 12405
Composite Heat & Humidity	RH 93%, 25° - 65°C, 28 day	ISO 16750
Thermal Shock	85°C to -40°C within 30 min	ISO 12405
UNDOT	UN T1, T2, T3, T4, T5	UN 38.3
Housing Load	Knee 150kN/m <sup>2</sup> ; Foot 356kN/m <sup>2</sup>	GMW16390
Corrosion	Salt mist cyclic, test Kb	IEC 60068-2-52 DNV-GL SFC 2.4 sec 3.10
External Fuel Fire	130 sec over fuel fire	ECE R100 8E
Drop Test	1.2m onto cement on corner	IEC 62281
EMC	CISPR25; ISO11452; ISO7637; ISO10605	
Unbalanced Overcharge	1 cell @ 200% forced overcharge	
Forced Internal Coolant Leak	Intentional internal coolant leak	
External Short Circuit, Fused	5mΩ, 100 mΩ	J2929, UN 38.8
External Short Circuit, Unfused	5mΩ, 100 mΩ	J2464



Fully Automated Production Line  
From Manufacturing Cells to Pack Assembly



# Kokam EV Battery System-based Safety



## Kokam Cell 40Ah HP Certified & Guaranteed



Kokam cell incorporates ceramic coated separator and builds upon proven NMC chemistry. Kokam tests cells, modules and systems in its own test labs or in certified regional test agency labs. Development and test of battery systems are done according to the following standards :

## Integrated, multiple layers of protection : Passive and active safety

### Passive safety per many industry standards :

- ECE R100, R17; FMVSS; ISO 6469; UNDOT 38.3 Ellicert / INERIS Safety Tests (French Automotive Consortium), ISO 12405-2 / EN 60068-2 / ISO 20653 / ISO 11452-2

### Active safety follows methods defined in ISO 26262 and IEC 61508 :

- Develop, execute, and maintain, safety plan through the entire product lifecycle
- Strategies, activities, and procedures for achieving product safety
- Utilize tools, methods, and procedures from relevant industry standards, regulations, and best known practices of industry

## Obtained Additional Test & Certifications

UN transport test	ST/SG/AC.10/11/Rev.6
Crush	UN 38.3 T6, QC/T 743, GBT**, SAE J2464**
Nail penetration	SAE J2464, QC/T 743, GBT**
Thermal stability	SAE J2464
Analysis of hazardous substances during cell opening without thermal runaway	USABC (SAND2005-3123)**
Analysis of hazardous substances during cell opening with thermal runaway	USABC (SAND2005-3123)**
FTIR analysis of escaping gases in free space	USABC (SAND2005-3123)**

\*\* testing performed on similar chemistry cells having non ceramic coated separator

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