SAMSUNG SDI

Energy Storage System
Battery Business

Global Network

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www.samsungsdi.com

ESS Batteries by Samsung SDI

Top Safety & Reliability Solutions

SAMSUNG SDI

SAMSUNG SDI

Creative Energy & Materials Solution Leader

Samsung SDI is leading the change of a new era with lithium-ion batteries.

Through our constant innovation towards excellence,
we led with the technological superiority of our innovative IT devices
and expanded into electric cars which have now become reality.
In addition, we are contributing to the expansion of an eco-friendly
environment by the deployment of batteries for energy storage.

We are all dreaming of a better future with BoT (Battery of Things)
in which Samsung SDI will provide solutions for the world.

1970 — Established Samsung SDI

2000 — Began Lithium-ion Battery Business

2008 — Expanded Business into Automotives

2010 — Expanded Business into Energy Storage

Powering Tomorrow, Samsung SDI Battery Solution for Energy Storage

Samsung SDI's technology supplies eco-friendly energy solutions for the present and the future.

We provide safe, reliable and long-lasting performance with our Energy Storage solutions.
ESS projects are deployed using Samsung SDI's battery solutions optimized for a range from residential to utility-scale projects.

Utility & Commercial Battery Platform

Optimized Battery Platforms Based on High-Density Design Technology

Solar & Wind Farm · Grid (Substation) · Building, Factory

UPS Lithium-ion Solution

Proven High-Voltage LIB Solutions Compatible with Premium UPS

Data Center · Factory

Residential & Telecom Battery Pack Solution

Scalable Standard Battery Pack for Customized ESS

PV Home · Telecom

Why Samsung SDI

Samsung SDI optimizes battery systems with advanced cell technology.

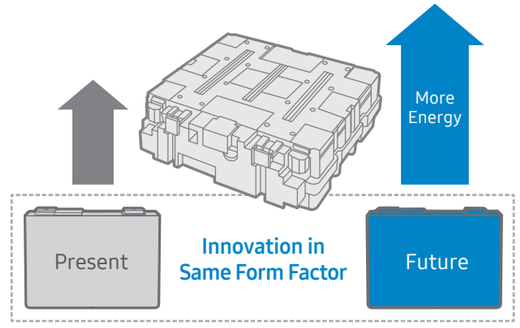
Safety First

Multi-Layered **Protection**

Safety first is Samsung SDI priority. Prismatic cell has multi-layered protection at the cell level resulting in best in class safety. In addition, the aluminum exterior has excellent thermal conductivity and cooling performance, and it releases high temperature safely and efficiently from the inside to the outside.

Sustainable Design

Easy to Upgrade
Capacity without Design Change



We are continuously innovating to increase the energy density while maintaining the same form factor and cell dimensions, thus facilitating future upgrades to higher capacity, higher energy density, ESS with no change to pack design.

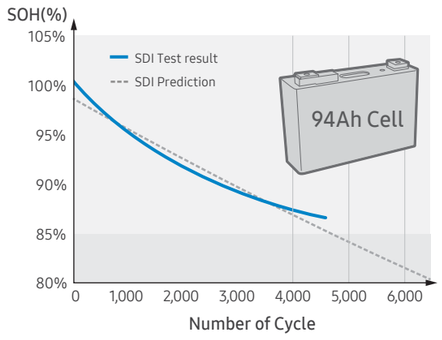
Long Cycle Life

Industry Leading Cycle Life Performance

6,000 Cycles

@ continuous 1C /1C, SOH 80%

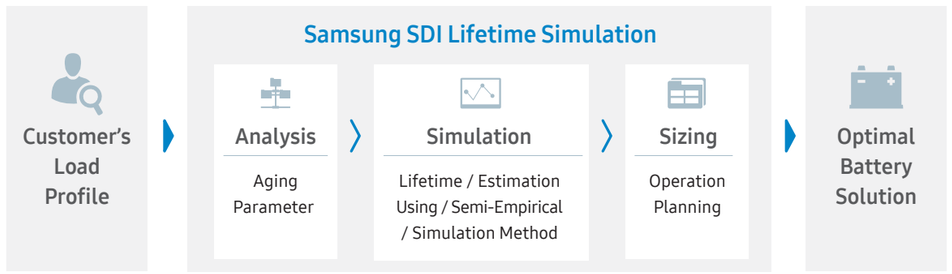
Samsung SDI ESS leverages our manufacturing experience in IT and automotive battery cells resulting in superior and adaptive technology. Samsung SDI ESS is recognized as the industry leader in the market, providing our customers with the safest and long lasting batteries.



(Test Condition at 25℃, 1C/1C, DoD 100%)

*Warranty condition could be different depending on the load profile

Accurate Lifetime Simulation



Samsung SDI offers optimal battery solution with its superior lifetime prediction technology.
We design and propose a battery system with analyzing the various parameter such as purpose, operation period and installation environment.

Battery Platform for

Utility & Commercial ESS

Optimized Battery Platforms Based on High-Density Design Technology

- Solar & Wind Farm
- Grid (Substation)
- Building, Factory

Standard Platform

Energy Platform New

Over 2 hours

- Energy density has increased more than 18% with upgrades to Samsung SDI's new advanced cell
- Higher density enables better footprint and installation cost savings

Item		Module	Rack		
Model		E3-M090	E3-R081	E3-R099	E3-R108
Cell Capacity	Ah	111	111	111	111
Energy	kWh	9.0	81	99	108
Operating Voltage	V	70.4~91.3	634~822	774~1,004	845~1,096
Dimension (W x D x H)	mm	370 x 588 x 160	442 x 702 x 1,792	442 x 702 x 2,124	442 x 702 x 2,290
Weight	kg	53	550	665	724

*2019 Mass Production

Medium Platform

1+hour up to 45 minutes

- Unique Platform in the ESS Industry with Mid-range Capabilities
- Optimized Solution for around One hour of Grid Service
- The Highest Lifetime Performance in a Continuous Charge/Discharge for 1 hour

Item		Module	Rack		
Model		M2-M076	M2-R068	M2-R084	M2-R091
Cell Capacity	Ah	94	94	94	94
Energy	kWh	7.6	68	84	91
Operating Voltage	V	70.4~91.3	634~822	774~1,004	845~1,096
Dimension (W x D x H)	mm	370 x 650 x 160	442 x 702 x 1,792	442 x 702 x 2,124	442 x 702 x 2,290
Weight	kg	54	560	675	734

Power Platform

30 minutes up to 20 minutes

- High Power Platform Optimized for Less than 30 minutes of Use
- Optimized Solution for Power Applications such as F/R, Railway, Ship, etc.

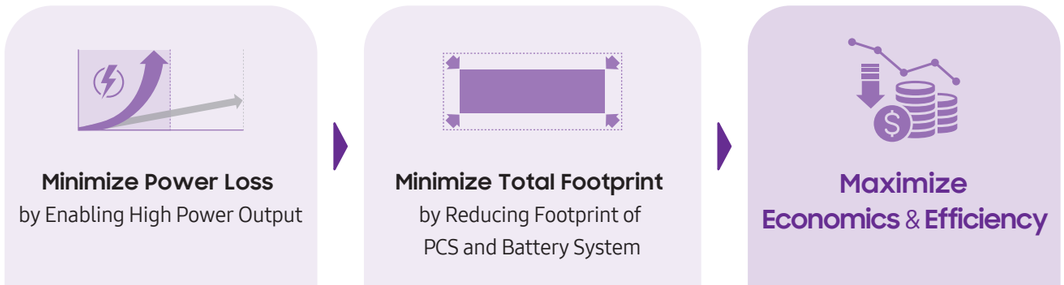
Item		Module	Rack		
Model		P3-M063	P3-R057	P3-R070	P3-R076
Cell Capacity	Ah	78	78	78	78
Energy	kWh	6.3	57	70	76
Operating Voltage	V	68.2~90.2	614~812	750~992	818~1,082
Dimension (W x D x H)	mm	370 x 650 x 160	442 x 702 x 1,792	442 x 702 x 2,124	442 x 702 x 2,290
Weight	kg	54	560	675	734

Battery Platform for
Utility & Commercial ESS

Special Platform

1,500 High Voltage Platform New

- High Efficiency Battery Solution for 1,500V PCS

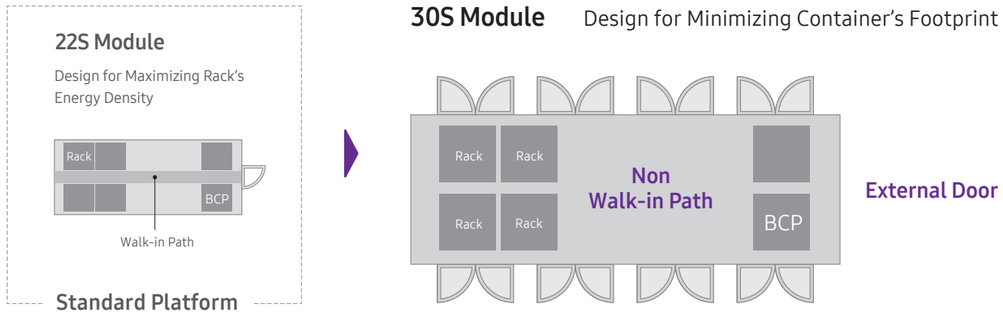


Item		Rack		
Model		E2-R122	M2-R122	P3-R101
Platform		Energy	Medium	Power
Backup Time		2 hours	1 hour	30 minutes
Cell Capacity	Ah	94	94	78
Energy	kWh	122	122	101
Operating Voltage	V	1,126~1,461	1,126~1,461	1,091~1,447
Dimension (W x D x H)	mm	442 x 702 x 3,085	442 x 702 x 3,085	442 x 702 x 3,085
Weight	kg	950	965	965

40FT ISO Container Platform New

- Optimized Solution for 40FT ISO Standard Container

The Highest Capacity
at 40FT Container



Item		Module	Rack
Model		E3-M123	E3-R135
Cell Capacity	Ah	111	111
Energy	kWh	12.3	135
Operating Voltage	V	96~126	1,056~1,386
Dimension (W x D x H)	mm	344 × 1,012 × 160	415 × 1,067 × 2,124
Weight	kg	90	1,170

*2019 Mass Production

Batteries for UPS Uninterruptible Power Supply

Proven High-Voltage LIB Solutions
Compatible with Premium UPS

Data Center

Factory

Benefits of Lithium-ion Batteries

Less Space / Weight

Lead-acid Lithium-ion

[Equal Capacity]

- Less Space for Battery Room
- No Structure Reinforcement Required

Longer Life

3~7 years Lead-acid

15 years Lithium-ion

- Battery Replacement Deferral
- Enhanced Reliability

Fast Charge / Discharge Rate

▲ Charge ▼ Discharge

0.1C 2C Lead-acid

0.5C 6C Lithium-ion

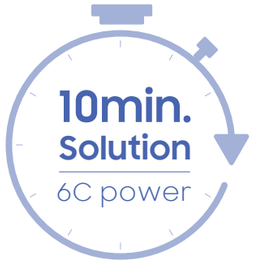
[Back-up 10min]

- No Oversizing Required
- Shorter Charging Time

*This comparison above is based on each material's characteristic. The Battery life time may vary depending on the environmental condition which the device are used in and the customer's usage pattern.

Why Samsung SDI

- Only Samsung SDI can provide a 10 minute backup battery solution
- Compatible with Global UPS Battery Solutions
- Proven Safety & Quality
- Global Reference to IDC, a Factory in Operation for over 5 years



IDC (Internet Data Center)

2012, Shinhan Bank
World's First LIB Solution

Factory

2016, Samsung Display /Semiconductor
World's Largest factory

(Certified by TÜV)

Product Lineup

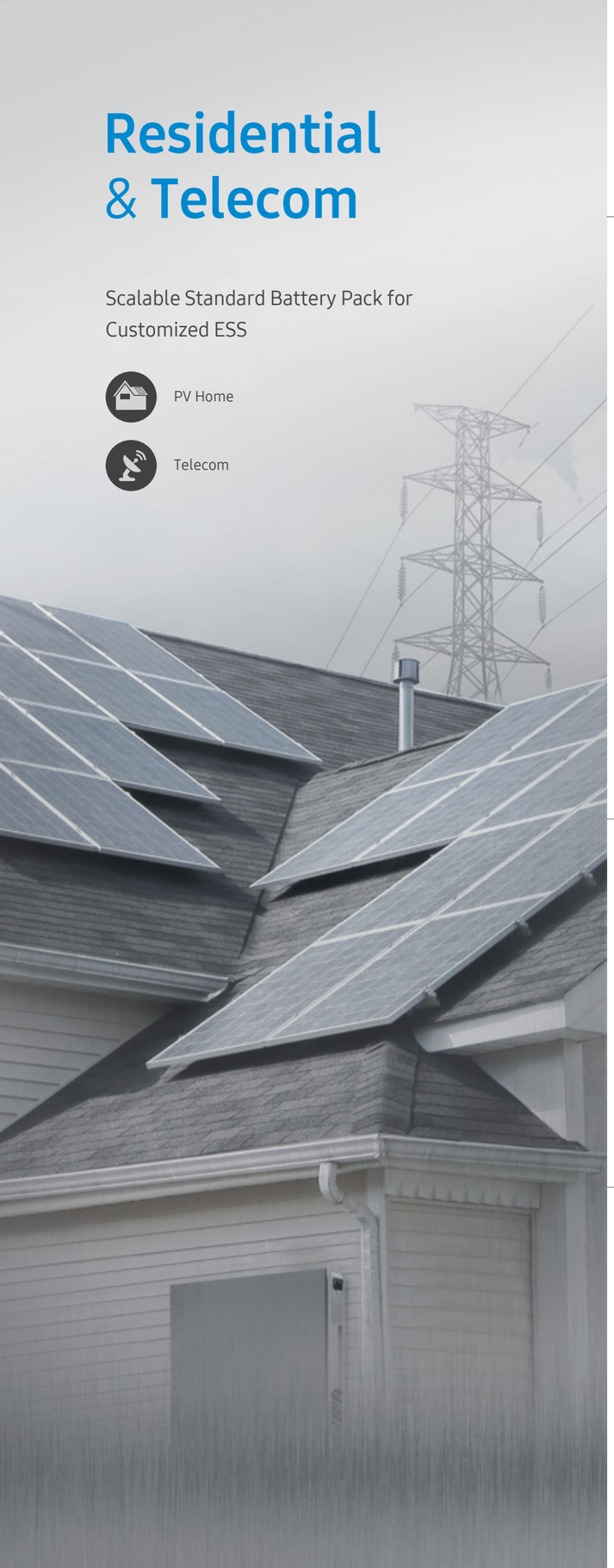
Item		Module	Rack
Model		U6-M020	U6-R035
Cell Capacity	Ah	67	67
Energy	kWh	2.0	35
Operation Voltage	V	24~33.6	408~572
Dimension (W x D x H)	mm	216 x 414 x 163	650 x 600 x 2,055
Weight	kg	17	550

*It is compatible with global UPS solution

Residential & Telecom

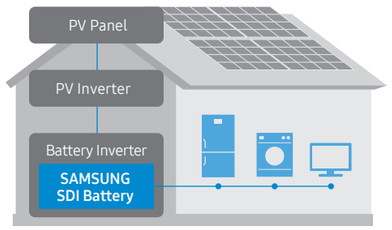
Scalable Standard Battery Pack for Customized ESS

- PV Home
- Telecom

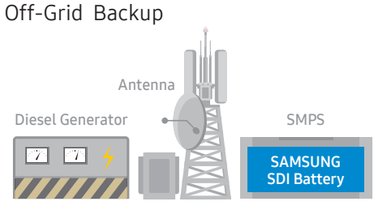


PV Storage / Off-Grid Backup

- PV Storage



- Off-Grid Backup



High Energy Cell
- Advanced High Capacity and Long Lifecycle

Standard Module
- Standard Module for Various Customer Needs

Easy Installation
- Easy Installation by Simple Module Structure

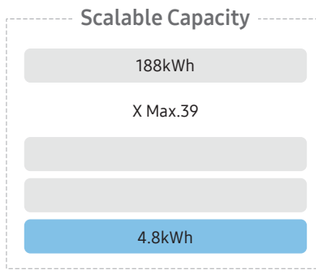
Scalability
- Easy to Expand Capacity

Compatibility
- Compatible with Various Standard Inverters

* Inverter for Residential, SMPS for Telecom

48V Solution

- High Energy 94Ah Prismatic Cell
- High Energy Density & Long Cycle Life
- Available up to 1C-rate
- Fits on 19 inch Standard Rack
- Wide Temperature Range

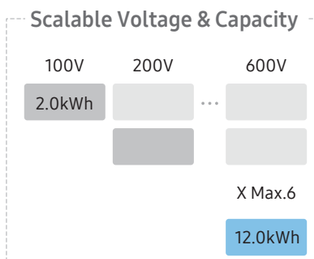


Item		R1-M048
Component		Battery Module, BMS
Nominal Energy	kWh	4.8
Operating Voltage	V	44.8~58.1
Dimension (W x D x H)	mm	446 x 440 x 158
Weight	kg	35
Operating Temperature	℃	-10~50

HVS Solution New

(High Voltage System)

- Advanced 21700 Cylindrical Cell
- High Conversion Efficiency (DC to AC)
- Optimized for High Voltage PCS
- Superior Performance at High Temperature



Item		R3-M020
Component		Battery Module, BMS
Nominal Energy	kWh	2.0
Operating Voltage	V	88.2 ~ 112.5
Dimension (W x D x H)	mm	191 x 433 x 172
Weight	kg	17.5
Operating Temperature	℃	0~60

Global Track Record

Since 2010, Samsung SDI's ESS products have been successfully operating in over 30 countries.

Today, Samsung SDI continues to make history by leading the growing global ESS market, based on best in class battery technology and strong partnerships.

SINCE
'10

COUNTRIES
30+

TOTAL GWh
7.4+

Americas

USA

California 150MWh Deployed 2017~

Austin, TX 36MW / 14MWh
El Cajon/Escondido, CA 37.5MW / 150MWh
Pomona, CA 20MW / 80MWh
Indianapolis, IN 20MW / 20MWh
El Centro, CA 30MW / 20MWh
Tucson, AZ 10MW / 5MWh
Punta Gorda, FL 10MW / 40MWh

Canada

Sault Sainte Marie, Ontario 8MW / 8MWh

Europe

Germany

Schwerin 15MWh Deployed 2014/17~

Schwerin 15MW / 15MWh
Chemnitz 10MW / 10MWh
Hassfurth 10MW / 10MWh

UK

Leighton Buzzard 10MWh Deployed 2014~

Leighton Buzzard 6MW / 10MWh
Barrow in Furness 49MW / 25MWh
Broxburn 20MW / 22MWh
Port of Tyne 36MW / 28MWh
Tynemouth 25MW / 17MWh
Pelham 50MW / 50MWh

Italy

Potenza 2MW / 2MWh

Netherlands

Zeeland 10MW / 10MWh

Spain

Carboneras 20MW / 12MWh

Asia & Oceania

Korea

KEPCO F/R 38MWh Deployed 2015~

KEPCO(5 Sites) 128MW / 38MWh
KOEN(3 Sites) 22MW / 63MWh
PyeongChang 6MW / 18MWh
Ulsan 24MW / 51MWh

China

Tibet 28MWh(2 Sites) Deployed 2016~

Tibet Shuanghu 4MW / 14MWh
Tibet Gaize 4MW / 14MWh

Japan

Hokkaido 25+MWh(3 Sites) Deployed 2017~

Hokkaido Shinhidaka 17MW / 9MWh
Hokkaido Chitose 17MW / 14MWh

Australia

Alice Spring 6MW / 2MWh
Western Australia 4MW / 2MWh
Adelaide 30MW/15MWh

(As of June, 2018 Installation & Award)