



# SAMWHA Products for Industrial applications



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## Value Creation Company for Human and Environment



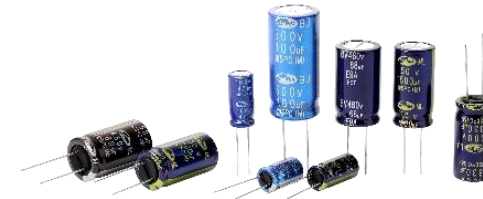
*Multilayer Layer Ceramic Capacitors (MLCC)*



*Chip Inductor*



*Varistors*



*Aluminum Electrolytic Capacitors*



*Electric Double Layer Capacitors*

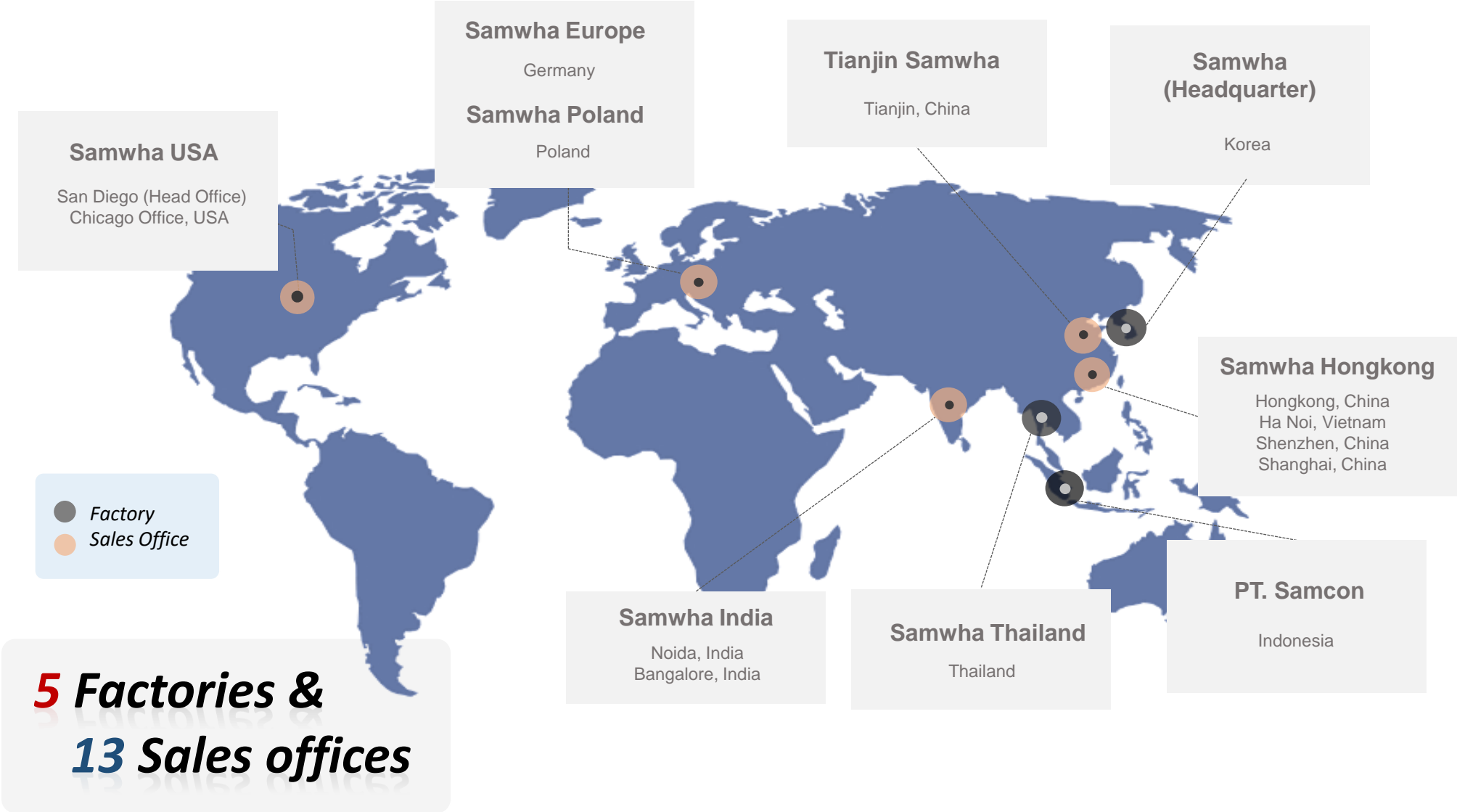


*Polymer Hybrid Capacitor*



*Snubber Capacitors*

# Global Network



# Certifications



## *Quality Management System*

*ISO 9001:2015/KS Q ISO9001:2015*

*IATF 16949:2016*



## *Environmental Management System*

*ISO 14001:2015*

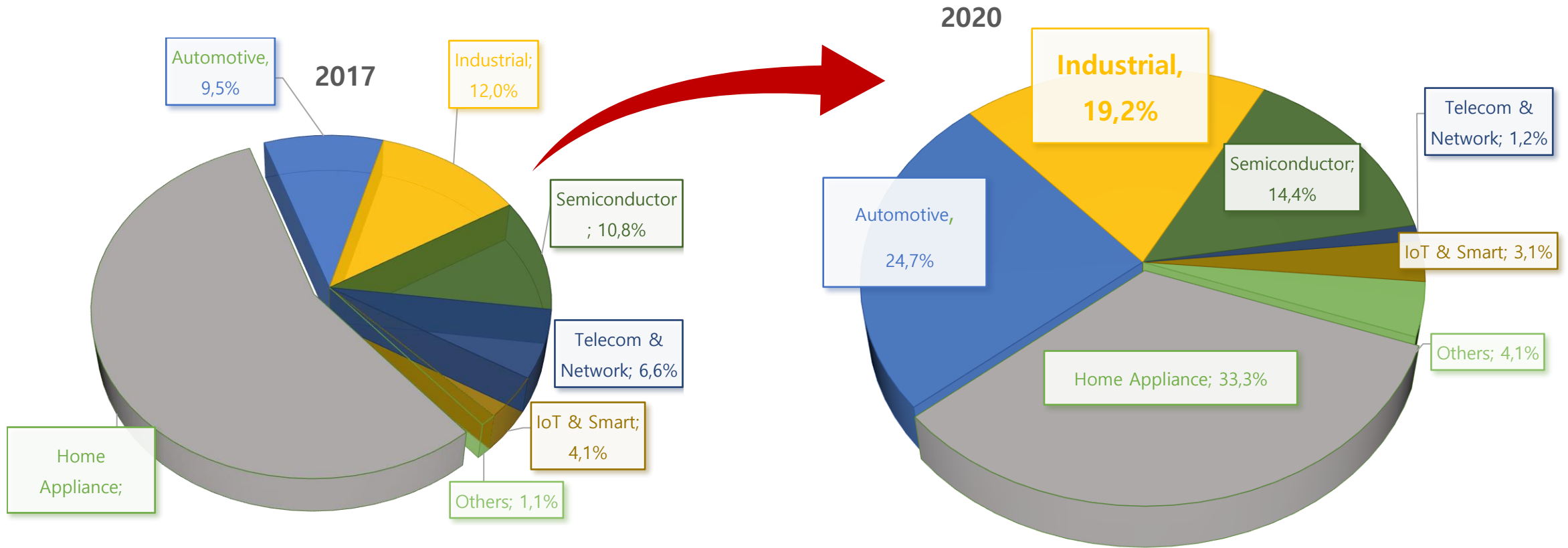


## *Occupational Health and Safety Management System*

*OHSAS 18001:2007/K-OHSMS 18001:2007 & KOSHA 18001*



## Sales Breakdown By Application



***Constant Sales growth in the industrial market***

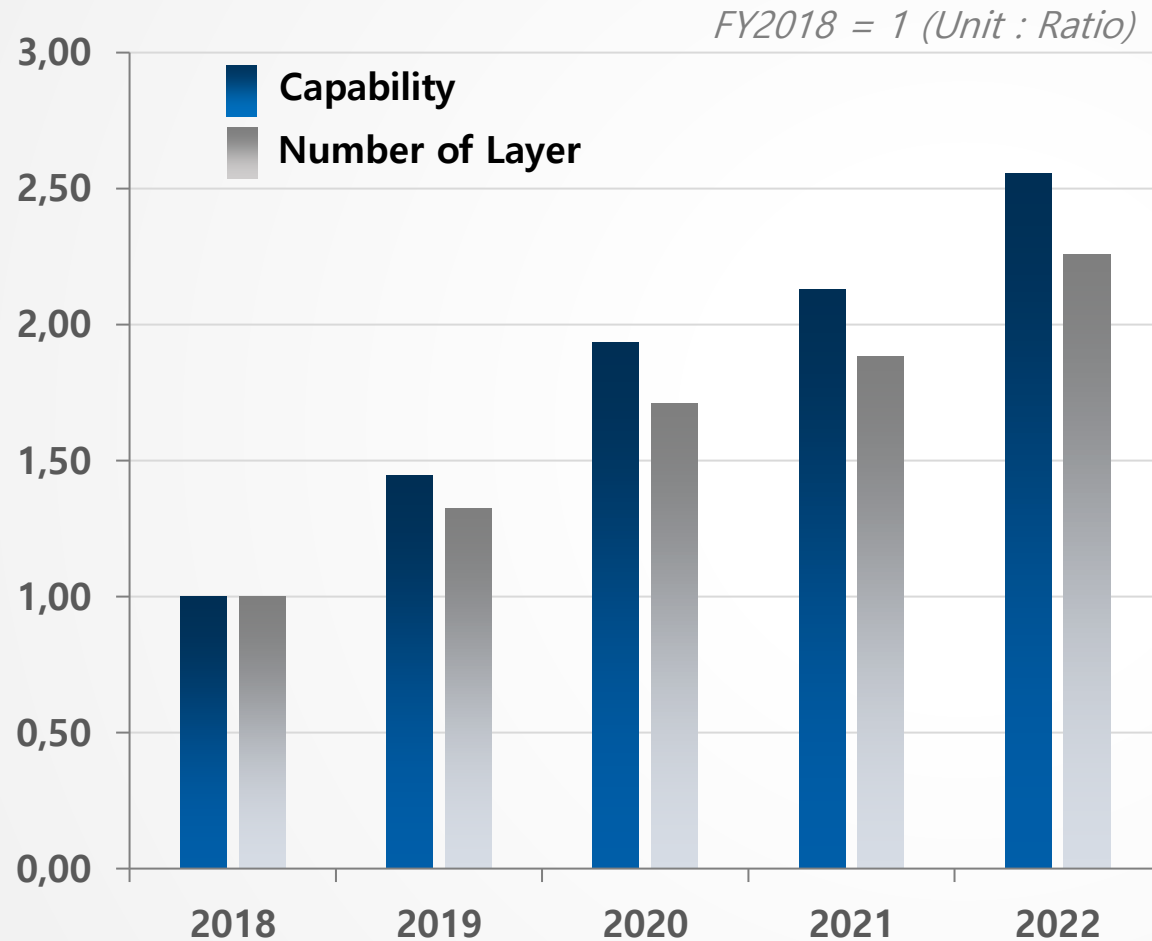
*The scale of the Industrial market has increased up to 19.2% from 12%*

# New Factory and Increase of Production capacity for MLCC

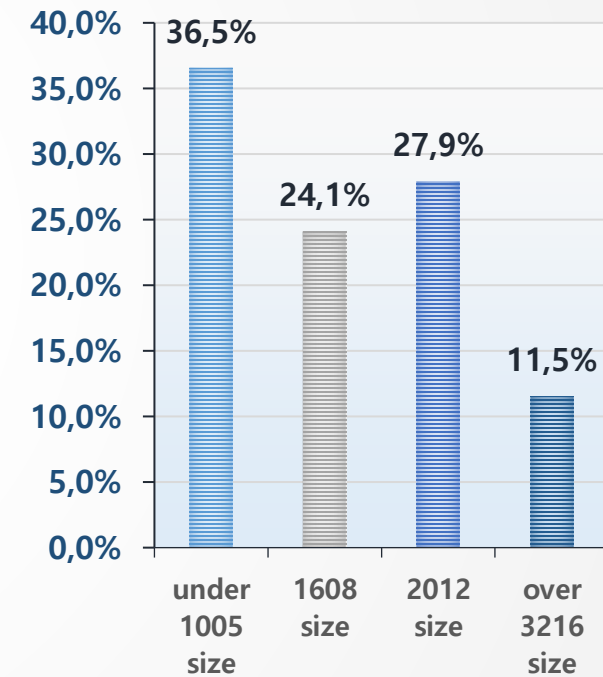


# Capacity build up status of MLCC

## Increasing capability trend by year and forecast



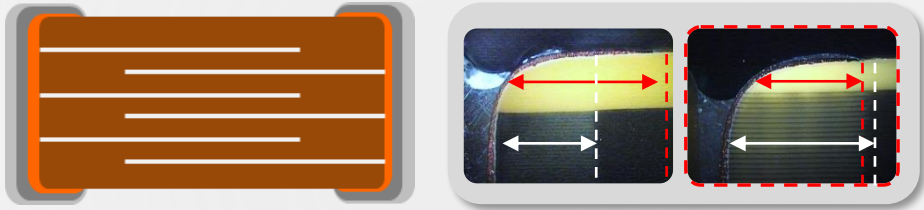
## Manufacturing ratio by size



- Number of stacking layer increase → Change to **High capacitance product**

# Special Designs

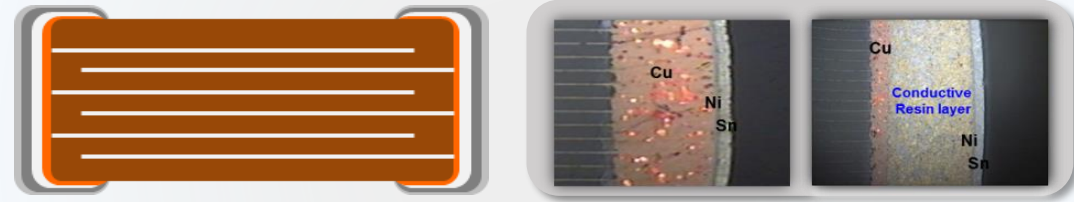
## Open mode



- 0603 ~ 5750mm
- 100pF ~ 10 $\mu$ F
- 6.3V ~ 2kV
- ***Mid Capacitance Spec***

✓ To Prevent risk of short circuit failures

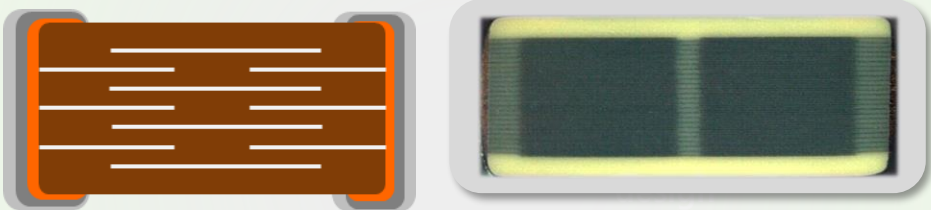
## Soft Termination Type



- 0603 ~ 5750mm
- 1pF ~ 47 $\mu$ F
- 4V ~ 2000V
- ***Mid/High Capacitance Spec***

✓ To Prevent risk of Flex crack

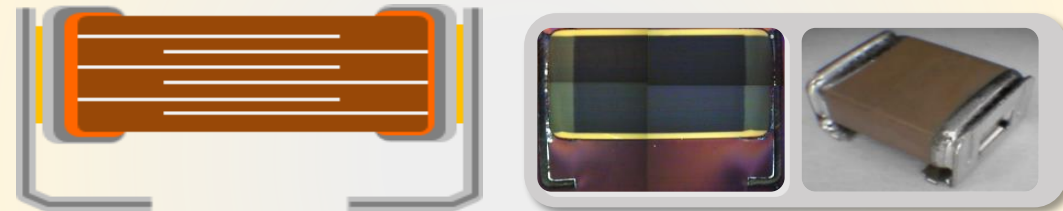
## Floating Type



- 0603 ~ 5750mm
- 1pF ~ 2.2 $\mu$ F
- 10V ~ 3kV
- ***High-Voltage Spec***

✓ Excellent High-voltage properties  
✓ To Prevent risk of short circuit failures

## Metal Frame



- 3216 ~ 5750mm
- 1pF ~ 100 $\mu$ F
- 4V ~ 2000V
- ***Large size Spec***

✓ To Prevent risk of mechanical crack as well as flex crack  
✓ Good for acoustic noise



# Varistors

## ◆ Introduction of Varistors

→ Variable + Resistor, also called MOV (Metal Oxide Varistor) or VDR (Voltage Dependent Resistor)

Varistors are connected in parallel to the parts or circuits to protect, and when the Surge voltage increases, a low resistance circuit is formed to prevent it from rising any further.

## ◆ Main types of Varistors

→ Silicon & Square Types – UL certified

→ VDE Certification

## ◆ Ideal for following markets

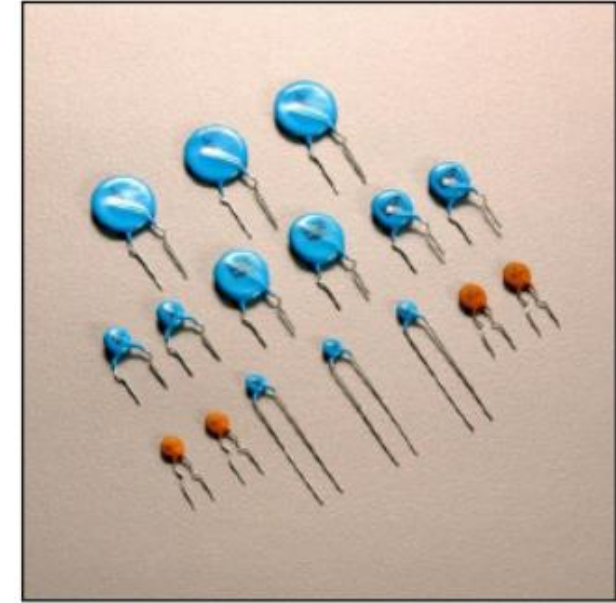
→ Premium Home appliances

→ Industrial (especially Silicon types : Non-flammable)

## ◆ Main Application & Monthly production capacity

→ E-Meter, LCD/LED TV, Home appliance, AV(STB, DVD, ETC), LED-LAMP, Adapter

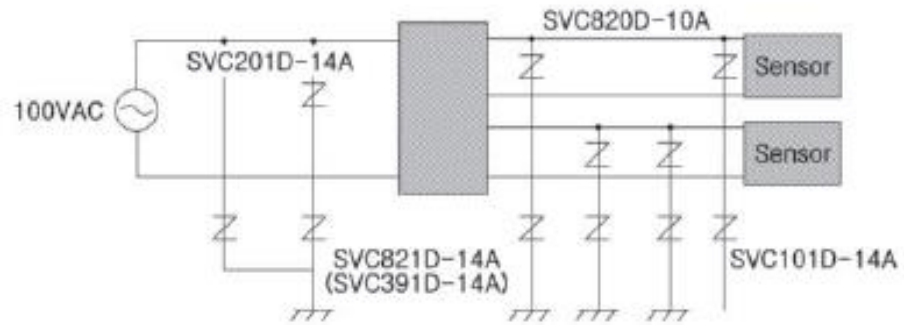
→ MOV (Disc type varistor) : 30Mio.pcs / per month



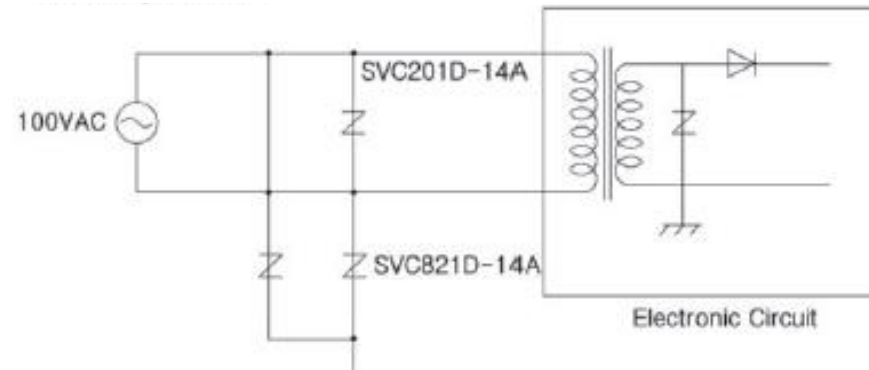
# Varistors

## Application examples

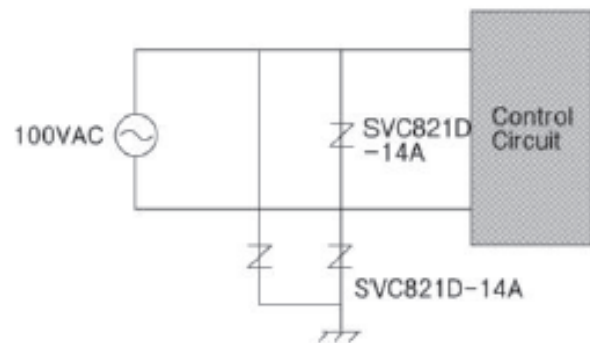
### Fire Alarm System



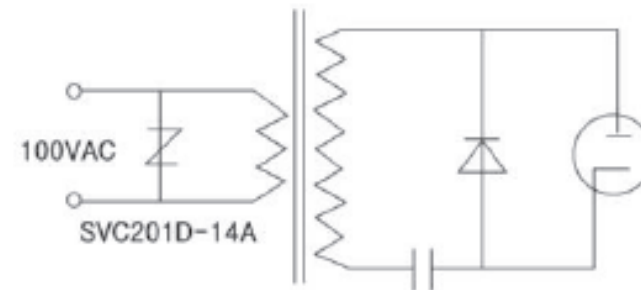
### Stove, Boiler



### Vending Machine



### Microwave Oven



# Electrolytic capacitors for industrial market

## Power supply inverter

<b>GT</b>  <b>85°C</b> <b>2000h</b> For Inverter	<b>GL</b>  <b>85°C</b> <b>20000h</b> For Inverter, Long Life	<b>GR</b>  <b>85°C</b> <b>5000h</b> For Inverter, High Ripple	<b>KG</b>  <b>105°C</b> <b>3000h</b> High Ripple, Wide Temp	<b>JY</b>  <b>105°C</b> <b>10000h</b> Long Life
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**GR** Screw Terminal Type, For Inverter, High Ripple



- Screw terminal in compact case size
- High reliability, Long life
- High Ripple

Product size	Φ51×60L to Φ89×155L
Endurance	5,000 hours at 85°C
Rated Voltage	400 to 450V
Capacitance	2,200 to 12,000μF

Voltage	450V		
Capacitance	Size ΦD×L(mm)	Ripple(mA) 40°C 120Hz	Ripple(mA) 85°C 120Hz
2,700μF	63.5 × 90	22,200	14,800
	76.2 × 75	22,200	14,800
3,300μF	63.5 × 110	25,200	16,800
	76.2 × 85	25,100	16,700
4,700μF	63.5 × 145	31,100	20,700
	76.2 × 110	31,100	20,700
5,600μF	63.5 × 165	34,700	23,100
	76.2 × 130	35,000	23,300
6,800μF	89 × 95	37,700	25,100
	76.2 × 145	38,600	25,700
	89 × 115	44,600	29,700



# Electrolytic capacitors for industrial market

## Transportation

<b>EV</b>  <b>105°C</b> <b>5000h</b> For Inverter, Long Life	<b>GL</b>  <b>85°C</b> <b>20000h</b> For Inverter, Long Life	<b>GR</b>  <b>85°C</b> <b>5000h</b> For Inverter, High Ripple
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**GL** Screw Terminal Type, For Inverter, Long Life and High Ripple



- Screw terminal in compact case size
- High reliability, Long life

Product size	Φ51×110L to Φ89×160L
Endurance	20,000 hours at 85°C
Rated Voltage	350 to 450V
Capacitance	1,500 to 12,000μF





Voltage	450V	
Capacitance	Size ΦD×L(mm)	Ripple(mA)
3,300μF	76.2 × 110	13,500
3,900μF	76.2 × 130	15,300
5,600μF	76.2 × 160	21,800
6,800μF	89 × 150	23,600
8,200μF	89 × 160	26,500



# Electrolytic capacitors for industrial market

## Power Supply for EV Charger and Solar power inverter



<p><b>HY</b></p>  <p><b>105°C</b> <b>7000h</b> 500Vdc, Long Life</p>	<p><b>HL</b></p>  <p><b>105°C</b> <b>5000h</b> 500Vdc, Long Life</p>	<p><b>GL</b></p>  <p><b>85°C</b> <b>20000h</b> For Inverter, Long Life</p>	<p><b>GR</b></p>  <p><b>85°C</b> <b>5000h</b> For Inverter, High Ripple</p>
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### HL Snap-in Terminal Type



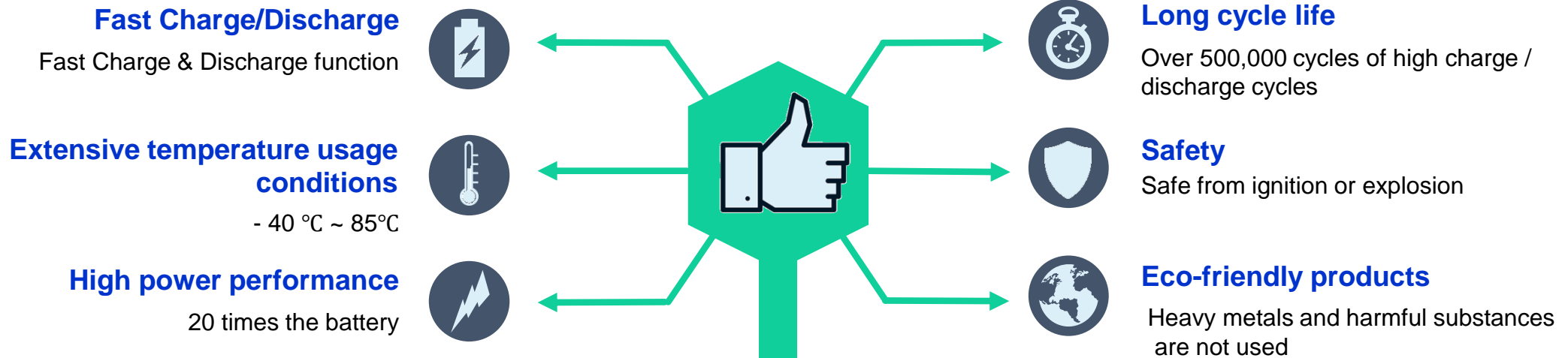
- For high ripple current application
- Load life at 5000 hours at 105°C

Product size	Φ22×20L to Φ35×50L
Endurance	5,000 hours at 105°C
Rated Voltage	10 to 500V
Capacitance	68 to 56,000μF

Voltage	500V	
Capacitance	Size ΦD×L(mm)	Ripple(mA)
150μF	35 × 25	1,180
180μF	30 × 35	1,340
220μF	35 × 30	1,510
270μF	35 × 35	1,620
330μF	35 × 40	1,810



# Green-Cap (EDLC) Major Features



Feature	Green-Cap	Battery
Charge time	Sec. unit	Time unit charge
Temp. Characteristic	<b>- 40 ~ 85 °C</b>	- 20 ~ 60 °C
Energy Density (Wh/kg)	1 ~ 15	20 ~ 100
Power Density (W/kg)	<b>10,000 ~ 20,000</b>	50 ~ 200
Charge/Discharge Cycle Life	<b>500,000 ~ 1,000,000</b>	500 ~ 1,000
Environment	Environmentally friendly	Contains harmful substances

# Green-Cap (EDLC) Series Table



Snap-In type

**New**  
1,500h  
**3.2V**  
65°C

In development

**DA**  
1,500h  
**3.0V**  
65°C

**DB**  
**2,000h**  
2.7V  
65°C

**DK**  
1,500h  
2.5V  
**85°C**



Weldable Type  
Threaded Type

**New**  
1,500h  
**3.2V**  
65°C

In development

**DV**  
1,500h  
**3.0V**  
65°C

**DV**  
1,500h  
2.85V  
65°C

**DH**  
1,500h  
2.7V  
65°C

**DT**  
1,500h  
2.5V  
**85°C**



Radial type

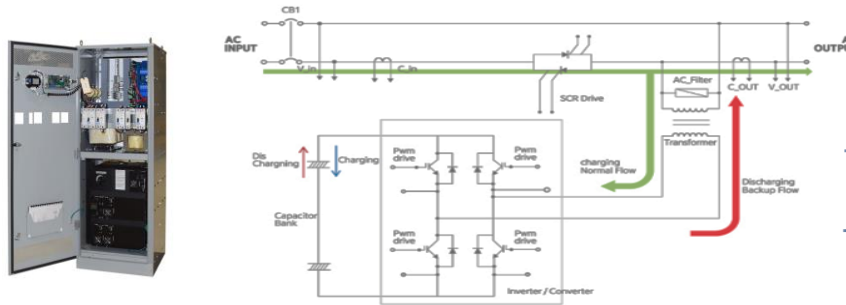
**DS**  
1,000h  
**3.0V**  
65°C

**DS**  
1,000h  
2.5~2.7V  
65°C

**DJ**  
1,000h  
2.5V  
**85°C**


# Green-Cap (EDLC) for UPS / VSP

## ✓ Application



- Energy charged in the Green-Cap supplies for prevention of equipment failures

## ✓ Recommended Product

Product group	Series	Spec.	Advantage
Snap-In 	DB	2.7V 65°C 2000h	Standard
	DK	2.7V 85°C 1500h	Wide Temp.
	DA	3.0V 65°C 1500h	High Volt.
Weldable Threaded 	DH	2.7V 65°C 1500h	Standard
	DT	2.5V 85°C 1500h	Wide Temp.
	DV	2.85V 65°C 1500h	High Volt.
Module 	DM	65~85°C 1500~2000h	Customized Design

## ✓ Characteristic

Parameters	Green-Cap	Battery
Charge/Discharge Cycle Life	> 500,000	500 ~ 1,000
Power Density (W/kg)	10,000 ~ 20,000	50 ~ 200

- Reduces maintenance costs (30 % less than battery)
  - Maximum instantaneous power characteristics (100 times the battery)
- ※ The effect is estimated

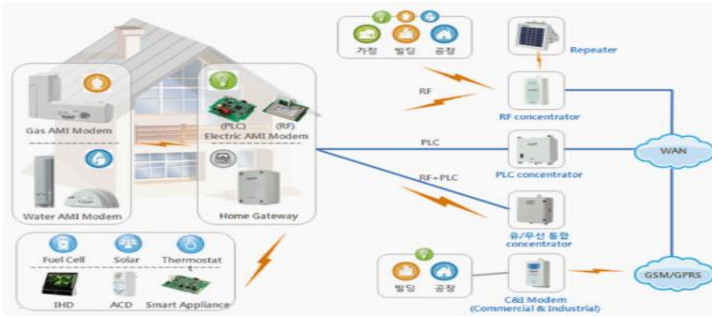
## ✓ Application Examples

Module Spec	Structure
125V 2F	DB 2.7V 100F (Ø22×L45) 50EA Series
125V 7.2F	DB 2.7V 360F (Ø35×L60) 50EA Series
16V 1000F	DH 2.7V 3000F (Ø60×L138) 6EA Series X 2EA Parallel



# Green-Cap (EDLC) for Smart Meter

## ✓ Application



- High power energy supply required when sending and receiving data
- Smart Grid key components of data communication such as Electrical Meter, Water Meter, Gas Meter, etc.

## ✓ Recommended Product

Product group	Series	Spec.	Advantage
Radial 	DS	2.7V 65°C 1000h	Standard
	DS	3.0V 65°C 1000h	High Volt.
	DJ	2.5V 85°C 1000h	Wide Temp.
Module 	DM	65~70°C / 1000h	

## ✓ Characteristic

Parameters	Green-Cap	Battery
Charge/Discharge Cycle Life	> 500,000	500 ~ 1,000
Power Density (W/kg)	10,000 ~ 20,000	50 ~ 200

- Reduced maintenance costs (30 % less than battery)
- Maximum instantaneous power characteristics (100 times the battery)
- Rapid charging characteristics

※ The effect is estimated

## ✓ Application Examples

Module Spec	Structure
5.4V 1.5F	DS 2.7V 3F (Ø8×L20) 2EA Series
5.4V 2.5F	DS 2.7V 5F (Ø10×L20) 2EA Series
5.4V 5F	DS 2.7V 10F (Ø10×L30) 2EA Series

# Green-Cap (EDLC) for Forklift/ Hybrid Excavator

## ✓ Application



- Charge regenerative energy with Green-Cap when lowering lift and turning excavator
- Engine power supply when high power is required

## ✓ Recommended Product

Product group	Series	Spec.	Advantage
Weldable Threaded 	DH	2.7V 65°C 1500h	Standard
	DT	2.5V 85°C 1500h	Wide Temp.
	DV	2.85V 65°C 1500h	High Volt.
Module 	DM	65~85°C / 1500~2000h	Customized Design

## ✓ Characteristic

Parameters	Green-Cap	Battery
Charge/Discharge Cycle Life	> 500,000	500 ~ 1,000
Power Density (W/kg)	10,000 ~ 20,000	50 ~ 200

- Excellent low temperature and high temperature characteristics (-40°C~85°C)
- Reduced maintenance costs (30 % less than battery)
- Maximum instantaneous power characteristics (100 times the battery)

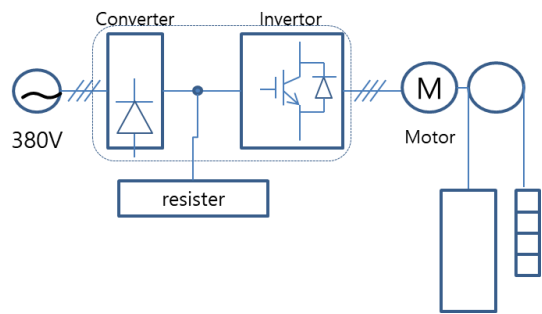
※ The effect is estimated

## ✓ Application Examples

Module Spec	Structure
48.6V 166.6F	DH 2.7V 3000F (Ø60×L138) 18EA Series
129V 62.5F	DH 2.7V 3000F (Ø60×L138) 48EA Series



# Green-Cap (EDLC) for Elevator

## ✓ Application



- Charging regenerative energy with Green-Cap when going down
- Energy saving : Support motor by providing high power energy when going up
- Preventing an accident as emergency power when blackout

## ✓ Recommended Product

Product group	Series	Spec.	Advantage
Weldable Threaded  	DH	2.7V 65°C 1500h	Standard
	DT	2.5V 85°C 1500h	Wide Temp.
	DV	2.85V 65°C 1500h	High Volt.
Module  	DM	65~85°C / 1500~2000h	Customized Design

## ✓ Characteristic

Parameters	Green-Cap	Battery
Charge/Discharge Cycle Life	> 500,000	500 ~ 1,000
Power Density (W/kg)	10,000 ~ 20,000	50 ~ 200

- Reduced maintenance costs (30 % less than battery)
- Maximum instantaneous power characteristics (100 times the battery)

※ The effect is estimated

## ✓ Application Examples

Module Spec.	Structure
92V 100F	DH 2.7V 3000F (Ø60×L138) 36EA Series

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