SUNGHO ELECTRONICS Corp.

Film Capacitor Total Solution Provider

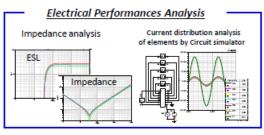


Name	Sungho Electronics Corp
Established	May, 1973 (45 years old)
Capital	12M USD
Employee	1,100 (Global)
Sales	Yr 2018 => 97M USD Yr 2019 (Target) => 123M USD
Capacity	200M pcs/ Month (Top in Korea)
Location	HQ => Seoul, Korea Factory 1 => Zhuhai, Guangdong, China Factory 2 => Weihai, Shandong, China

Raw Material (Weihai, China)



Design/R&D Simulation (Seoul, Korea)



<u>Referenc</u>e VDA6.3 Reliability Test (Zhuhai & Weihai)

> Reference AEC-Q200

Auto Machine (Zhuhai, China)



Mass Production & Inspection

(Zhuhai & Weihai)



 Reference
 Reference

 IATF16949 &
 AEC Q-001

 ISO9001
 AEC Q-002

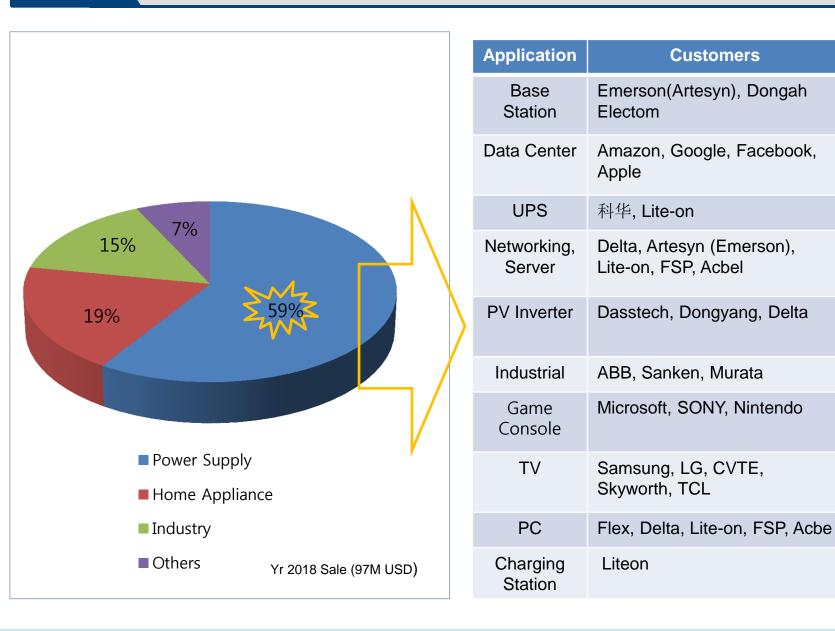
 ISO14001
 JESD 50

 QC080000
 VDA6.3

Global Sales



Application (Power Supply) and Major Customers



SUNGHO ELECTRONICS CORP.

Remark

PS Manufacturers	2015	2016	2017	% of Power Supply Sales
Delta Electronics	4,854	4,877	5,186	17%
Schneider Electric	3,250	3,250	3,400	In process
Emerson(Artesyn)	3,550	3,350	3,075	5%
Eaton Corp	2,050	1,950	1,950	
Liteon Technology	1,620	1,500	1,600	18%
ABB with GE	1,490	1,388	1,240	1%
SMA Solar Technology	1,100	990	1,068	
Mean Well	703	783	926	6%
Chicony Power	875	904	920	5%
Flextronics	875	800	825	6%
Salcomp	638	524	745	
Advanced Energy			671	
TDK	540	530	550	
Acbel	625	570	534	9%
FSP Group			521	6%
	Delta Electronics Schneider Electric Emerson(Artesyn) Eaton Corp Liteon Technology ABB with GE SMA Solar Technology Mean Well Chicony Power Elextronics Salcomp Advanced Energy TDK	Advanced EnergyAdvanced EnergyChick540Comp540Comp540Chick <tr< td=""><td>Advanced EnergyKan and the second second</td><td>AddedKan and the second se</td></tr<>	Advanced EnergyKan and the second	AddedKan and the second se

(USD in Millions)

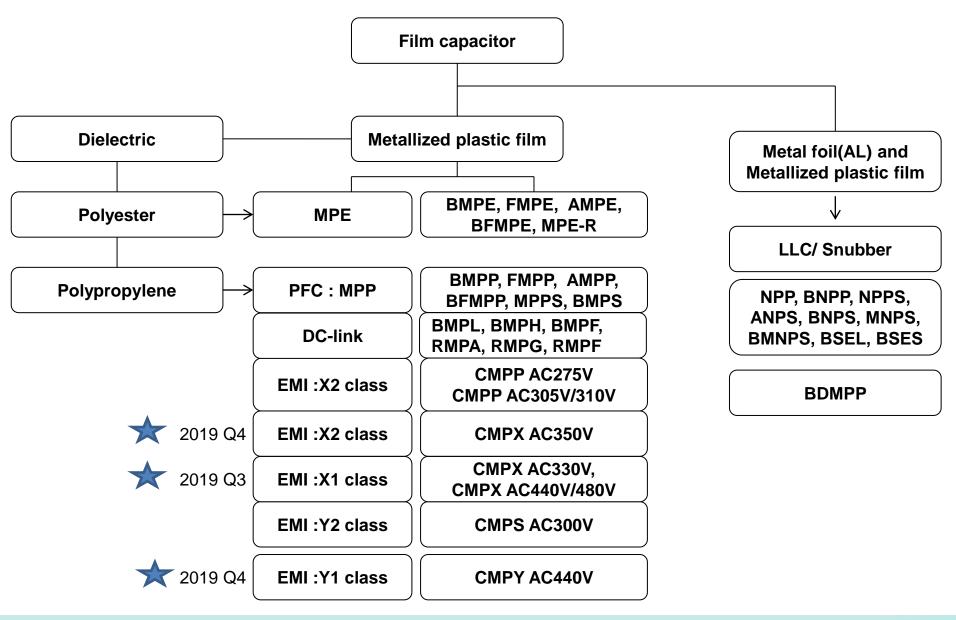
4

SUNGHO ELECTRONICS CORP.

Advantage

Items	Details	Remark
Law Material	Direct production of film	
Law Matchar	Direct production of plastic case	
Facility	70% of direct designing and manufacturing	
	Mass production of 安全膜 from year 2009	Diverse pattern: Diamond, T, Half T, and more
Technology	Mass production of anti-humidification products	85/85, 1000hr, Rated voltage
	Guarantee 125℃	
	World class cutting-edge technology of removing acoustic noise	
World Rank	Top 5 worldwide (TDK, Panasonic, Kemet, Fara)	

6



Product

Functional Applications

- ✓ EMI/RFI Suppressor
 - Across the line
 - X1 class

7-1

- ✓ EMI/RFI Suppressor
 - Across the line
 - X2 class



- 0.0047uf~6.8uf
- 10mm~37.5mm pitch
- -40℃~110℃
- 0.0047uf~10uf
- 7.5mm~37.5mm pitch
- -40 ℃~110 ℃

CMPP275VAC

40 °C/93%RH 275VAC , Pitch10~37.5mm 500hrs: Δ C/C limit: ≦±10%, 1000hrs: ≦±30%

CMPP310VAC-AA

40 °C/93%RH 310VAC , Pitch10~37.5mm 500hrs: Δ C/C limit: \leq ±10%, 1000hrs: \leq ±30%

CMPP275VAC-R / CMPP310VAC-R 85°C/85%RH 275VAC&310VAC 1000hrs △C/C:30%

CMPP310VAC-RR 85°C/85%RH 310VAC 1000hrs ∆C/C:10%

Series Name

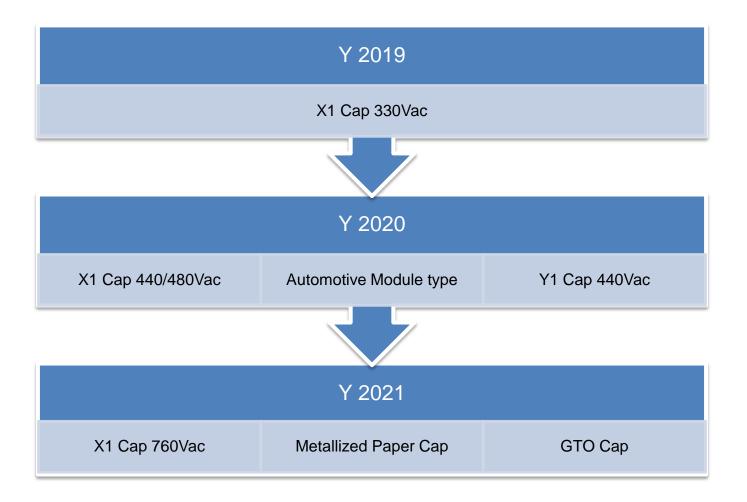
- CMPX 330VAC
- CMPX 440VAC
- CMPX 480VAC
- CMPP 275VAC
- CMPP 305VAC
- CMPP 310VAC
- CMPP 310VAC-AA
- CMPP275VAC-R
- CMPP310VAC-R
- CMPP310VAC-RR

Product

Functional applications	Characteristics	Series name
 ✓ EMI/RFI Suppressor - Line to ground - Y1 Class 	- 470pF~4700pF - 15mm pitch 40℃~115℃	- CMPY 440VAC
 ✓ EMI/RFI Suppressor - Line to ground - Y2 Class 	- 0.001uf~1uf - 10mm~37.5mm pitch 40℃~105℃	- CMPS 300VAC
 ✓ EMI/RFI Suppressor - X2 Class - Spark quenching - CR unit (single resistor included) 	- 0.01uF~1.0uF - 15mm~27.5mm pitch 40℃~85℃	- CMPR 250VAC - CMPR 300VAC
 ✓ AC & Pulse - Resonant - Switching / Snubber 	High currentHigh frequencyHigh Pulse	 NPPS/BNPS/ANPS NPP/BNPP MNPS/BMNPS BDMPP

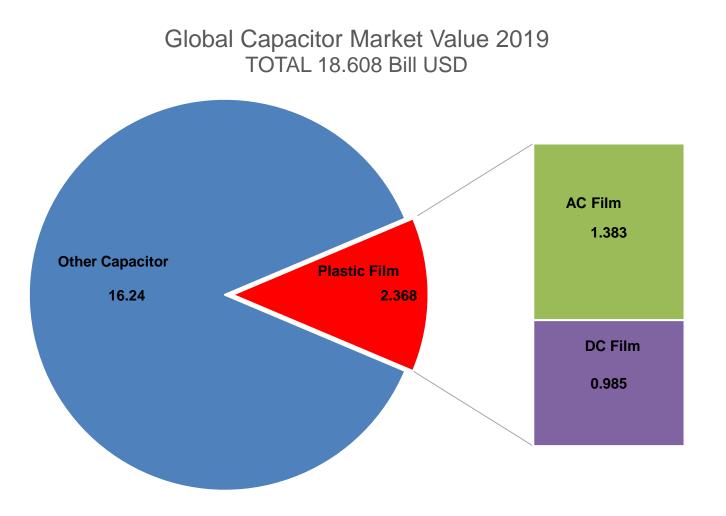
Product

Functional applications	Charact	teristics	Series name
 ✓ PFC Input - Filtering ✓ AC motor running 		 Ultra low noise Capacitance stability Low dissipation factor 	 MPP/MPP(R)/BMPP FMPP/FMPP(R) MPE/BMPE/FMPE
 Power Electronic DC –link / Switching Filtering Snubbing 		- High ripple current - Capacitance stability - Long life - 2pins / 4pins / Lug termin <mark>al</mark>	- BMPL, BMPH, BMPF - BSEL, BSES - AMPP
 ✓ Power Electronic - DC –link 		 High ripple current Capacitance stability Long life Al case 	- RMPA, RMPG, RMPF
 ✓ General Purpose - Blocking / Coupling 		- High insulation resistance - Low inductance	- MPE/FMPE/BMPE - NPP

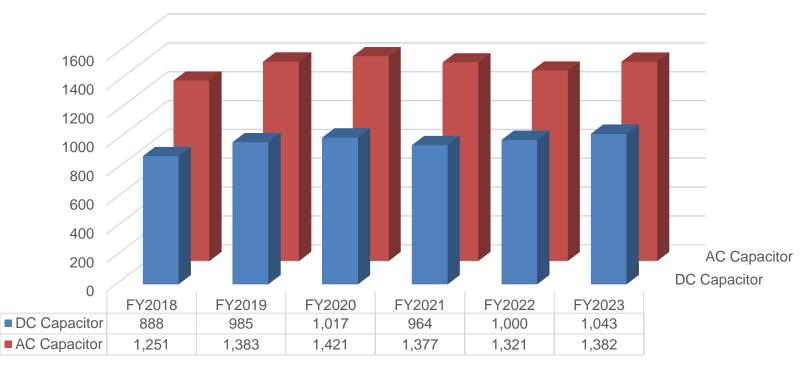


Market Analysis

9-1

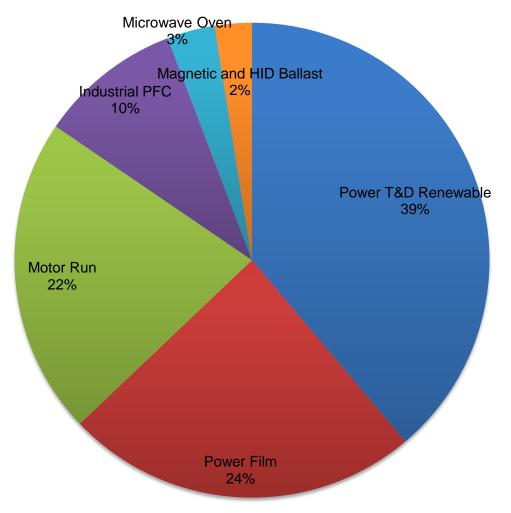


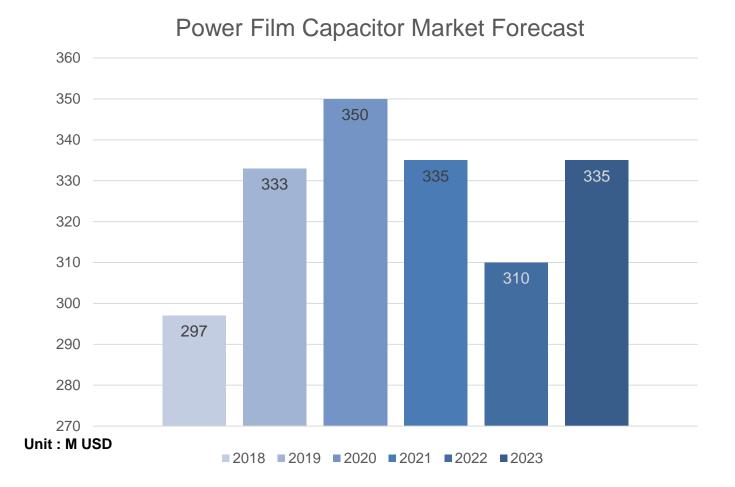
AC and DC Plastic Film Capacitor Market Forecast



Unit: M USD

AC Plastic Film Capacitor Market Trend 2019





Market Analysis-Power Film Application





Renewable Energy Systems

An important part of the energy generation mix is growing globally due to legislation for clean power.



Variable Speed Drives

Demand for energy efficiency proposition, their automation and the increase in productivity as a result of installation.



White Goods Reflects greater energy efficiency as well as growing penetration of variable speed drives into the segment.



Traction

Electric rail, fast and efficient mass transit solutions. Emerging countries represent 30% of revenues for electric rail systems.



Charging Stations

Focus for research and development will be energy efficiency, charging time, and compactness.

Source: Paumanok Publ., Paper & Plastic Capacitor: World Markets, Technologies & Opportunities: 2019-2023

9-5

Market Analysis

2021

CARG2%

2020

43

2022E

9 - 6

45

40

35

B USD

SMPS

2018

Motor

2019

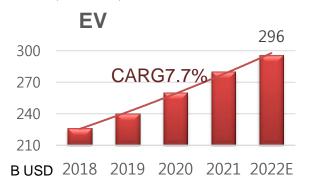
B USD

Home Appliance



BUSD 2018 2019 2020 2021 2022E

Global Home Appliances Market - Growth, Trends and Forecast (2018 - 2023) Research And Markets



Driving into 2025: The Future of Electric Vehicles | J.P. Morgan

Medical



Worldwide Digital Health Market to Hit \$504.4 Billion by 2025: Global Market Insights, Inc.

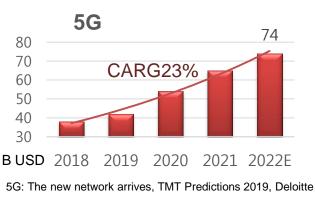




Green Energy



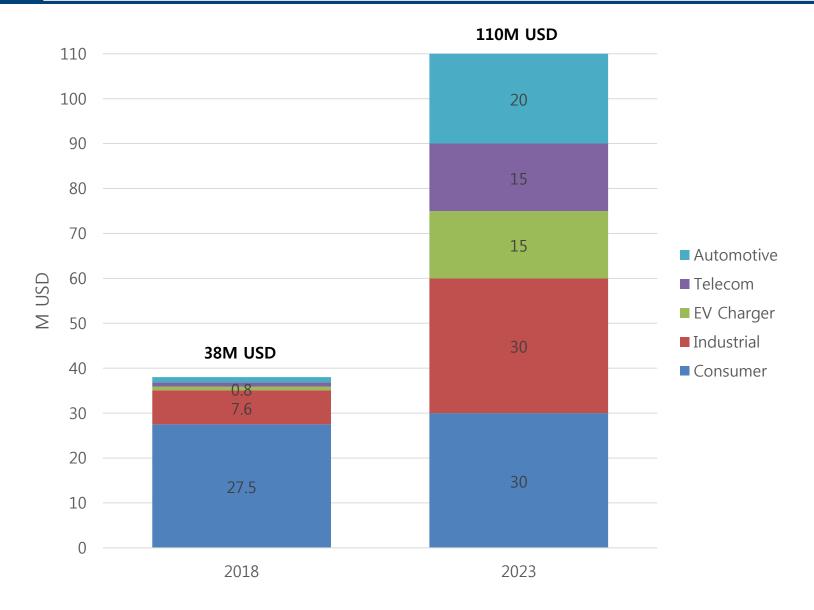
Renewables 2018; Market analysis and forecast from 2018 to 2023, IEA







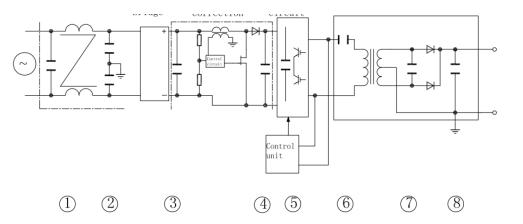
SUNGHO ELECTRONICS CORP.



Application – Networking, Server Power

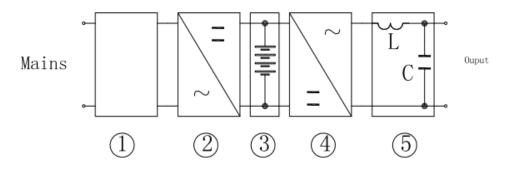


10-1



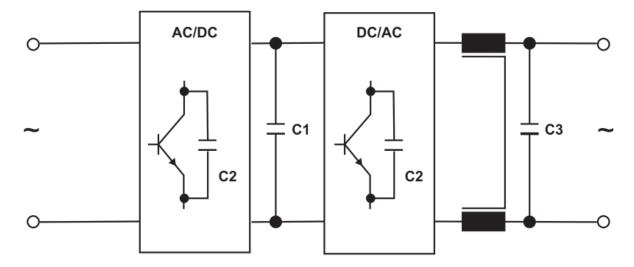
No.	Series Name	Performance	UNIT
1	CMPP 310VAC	RFI	EMI Filter
2	CMPS 300VAC	RFI	EMI Filter / Surge
3	BMPP	PFC	PFC Circuit
4	BMPP/BMPL	DC-LINK	PFC Circuit
5	BNPS/BDMPP	Snubber	Switching Circuit
6	BMPP/BDMPP	Coupling	Output Circuit
7	BMPP/BDMPP	Snubber	Output Circuit
8	BMPE	Filter	Output Circuit



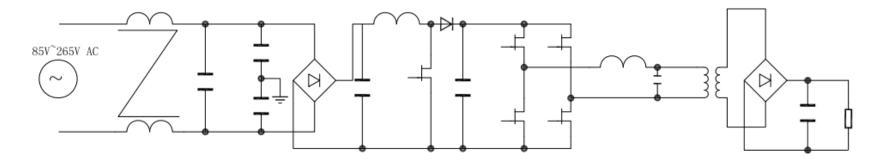


No.	Series Name	Performance	UNIT
1	CMPP CMPX	RFI	EMI
2	BMPL/BMPP/RMPA	DC-LINK	AC-DC Battery Charger
3			Battery Bank
4	BDMPP/BNPS/BSES	Snubber	DC-AC Inverter
5	BMPP	AC-Filter	Output AC-Filter





No.	Series Name	Performance	UNIT
1	RMPA	DC-link	AC/DC DC-Filter
2	BSES/BNPS/BDMPP	Snubber	DC/AC Converter
3	BMPP(AC)	Output AC-Filter	AC-Filter



(4)

 $(1) \quad (2)$





10-4

Charging station

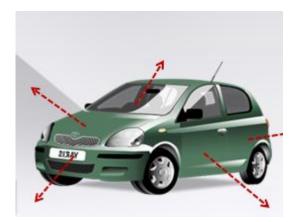


No	Series Name	Performance	UNIT
1	CMPP 310VAC	RFI	EMI Filter
2	CMPS 300VAC	RFI	EMI Filter / Surge
3	BMPP	PFC	PFC Circuit
4	BMPL	DC-link	PFC Circuit
5	BNPS/BDMPP	Resonance	Resonant circuit
6	BMPL/RMPA	DC-Filter	Output DC-Filter

(5)

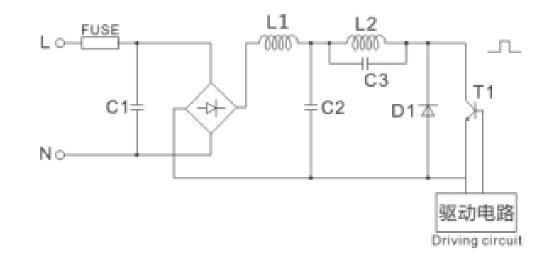
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No.	Series Name	Performance	UNIT
1	MPE/BMPE/MPP/BMPP	Filtering	Wiper, Window, ABS



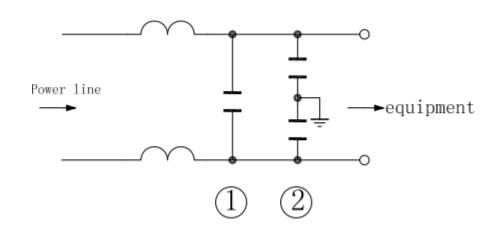


No.	Series Name	Performance	UNIT
1	CMPP	EMI	RFI
2	MPP/BMPP	DC-Filter	PFC/DC-Filter
3	AMPP/AMPS/BDMPP/ BMPP	Resonant	Inductive heating

Application – Home Appliance

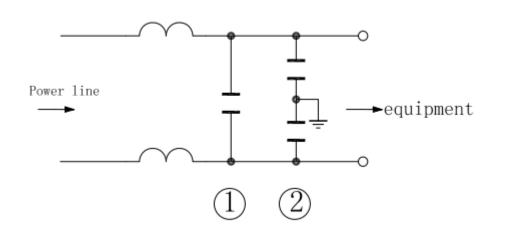


10-7



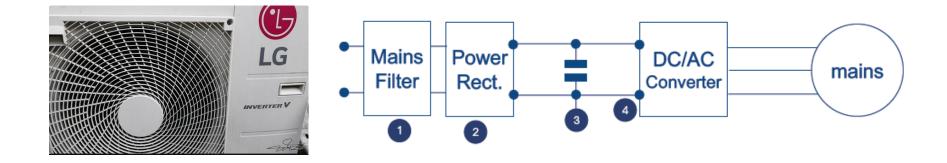
No.	Series Name	Performance	UNIT
1	CMPP	RFI	EMI
2	CMPS	RFI	EMI
4	BMPP/MPP	PFC	Power correction





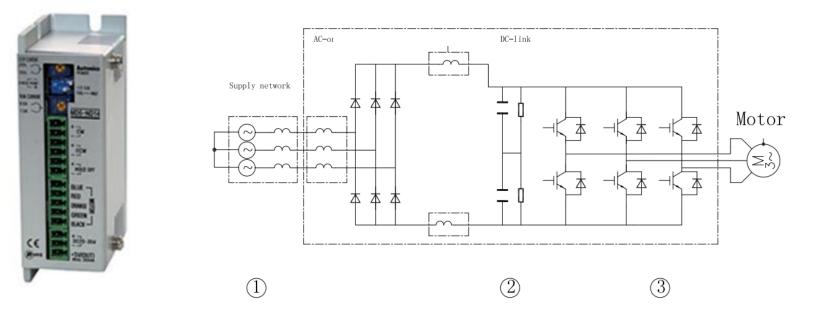
No.	Series Name	Performance	UNIT
1	CMPP	RFI	EMI
2	CMPS	RFI	EMI





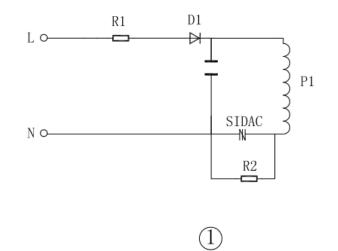
No.	Series Name	Performance	UNIT
1	CMPP/CMPS	RFI	EMI
2	BMPP	PFC	Power Rectifier
3	BMPL	DC-link (Alternative electrolytic capacitor)	DC-Filter
4	BNPS/BDMPP/BSES	Snubber	DC/AC Converter

10–10 Application – Motor Drivers



No.	Series Name	Performance	UNIT
1	CMPP	RFI	EMI
2	BMPL/RMPA/BMPP	DC-link/DC-Filter	AC-DC
3	BNPS/BSES/BDMPP	Snubber	DC/AC





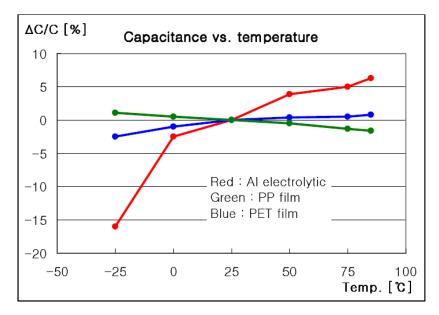
No.	Series Name	Performance	UNIT
1	MPE/BMPE	Charge & Discharge	Ignition Unit

11

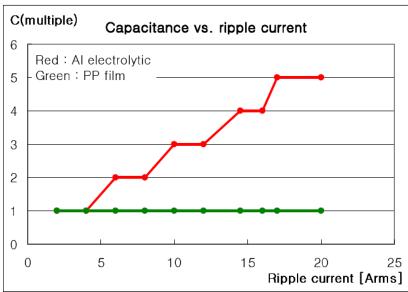
Technical Trend - Replace Al Cap with Film Cap

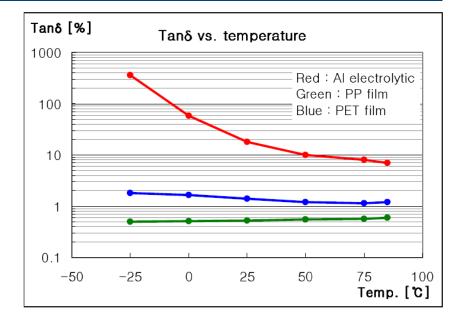
No.	Performance item		Al electrolytic capacitor		Film capacitor	
1	Withstand voltage	Single machine High voltage	~ 750VDC		It corresponds to the high voltage	O
		Resisting voltage dependability	Thickness of a dielectric and electrolyte resisting voltage (It mainly the ESR characteristic and trades off)		Thickness of a film (It mainly capacitance and trades off)	\bigtriangleup
2	Capacitance	Capacity range	Inside capacity ~ large scale	O	Minimum ~ smallness capacity	Х
		Capacity unit price	Cheap	O	Expensive	Х
		Tolerance	±10% ~ ±20%		±3% ~ ±10%	\bigcirc
		Low temperature characteristics	A rate of change is large	Х	A rate of change is small	0
		Frequency characteristics	A rate of change is large	X	A rate of change is small	O
3	Loss (tan δ)		Large	Х	Small	\bigcirc
4	The amount of ripple current		Small	Х	Large	\bigcirc
5	Inductance		Several hundred nH	Х	< 30 nH	\bigcirc
6	Leakage current		Large	Х	Small	\bigcirc
7	Failure mode		Short (Explosion)		Open (self-healing, cap. down)	
8	Structure	Electrolysis liquid	Use		Electrolyte(oil) free	0
		Form flexibility	Cylinder forms are foundations		Form is abundant	0
		Polarity	exist	Х	Nothing	\bigcirc

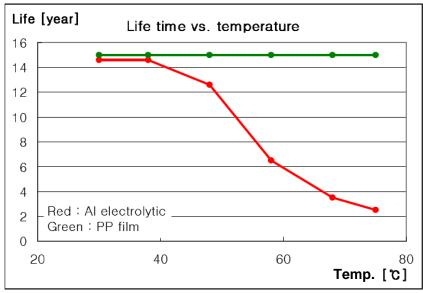
Technical Trend - Replace AI Cap with Film Cap (comparison)



11 - 1







SUNGHO ELECTRONICS CORP.

1. Power Spec

- Output Spec: 200W
- Input Spec: AC 100-240V
- PFC Design

2. Replacement

AI 450V82uF * 2pcs (Before) => Film 630V 10uF * 2pcs (Now)

3. Life Time

No requirement of life time review since it was not AI capacitor

- Stress test like temperature and voltage

4. Surge Test

Very vulnerable due to no Al cap

-Test and Improvement by adding Surge Absorber and changing pattern film

5. Design Difference when no AI cap

Changed of part spec due to AC Ripple came out as it was

- Applied PFC FET 800V (Withstand voltage problem with 600V)
- Used large Trans spec

6. Change of capacitance as ripple during output

Application





12

Solar Energy Market

Location : Zhuhai factory Product : Above 100uF Shape : Can type First line in place : Feb. 2018 Extension of production line : Nov. 2019

Thank you

HILLEAN AND DE MINING THE MERIDIAN