

TechTalk

Education Inspiration Exchange



SAMSUNG
ELECTRO-MECHANICS

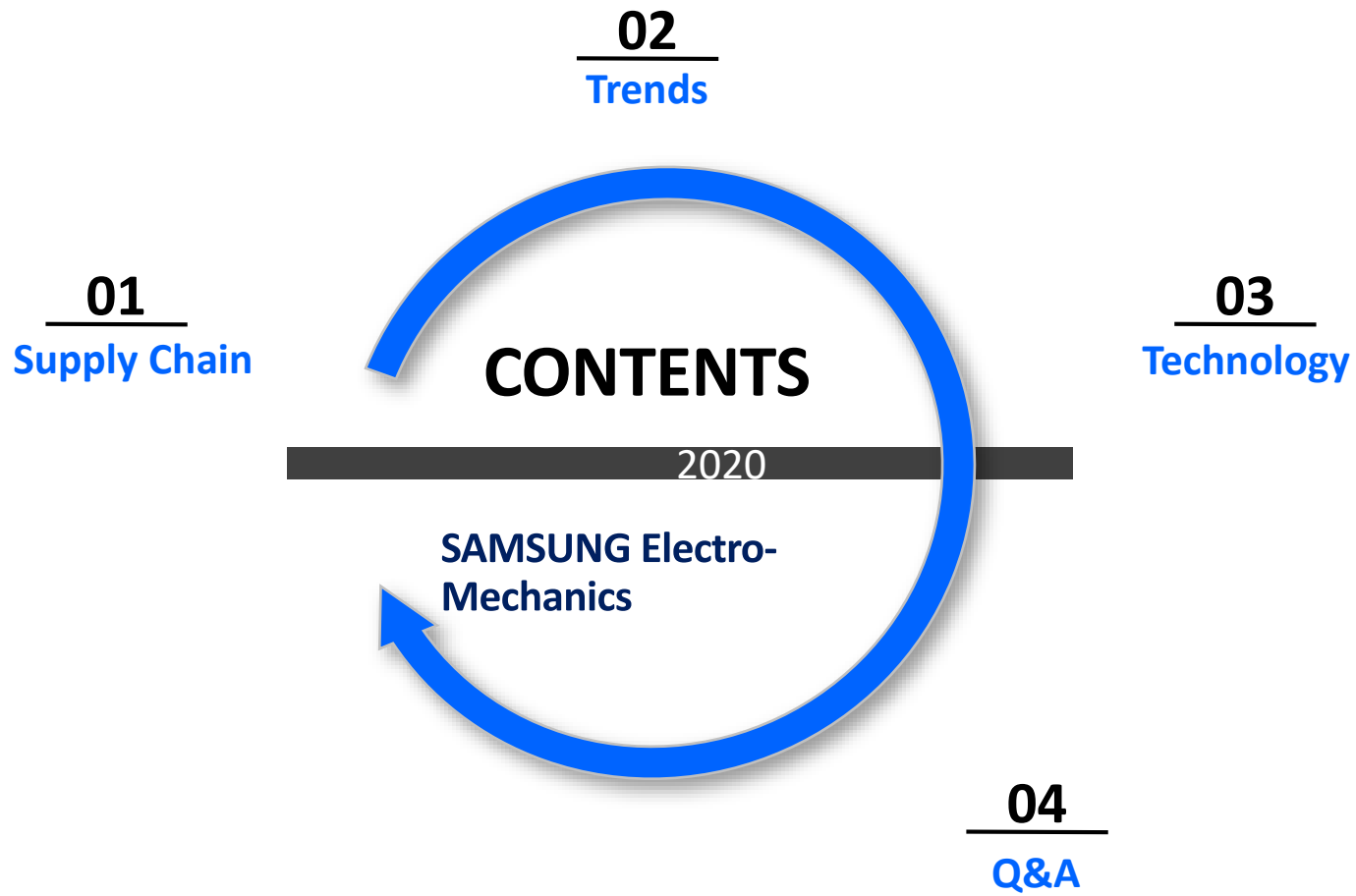
Samsung Electro-Mechanics

Automotive Innovations and their Impact on Ceramic Capacitors

Wasilios Pitharas (Application Engineer)

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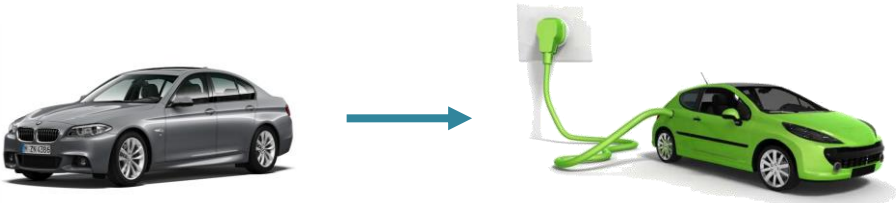
Supply Chain

1. Supply Chain

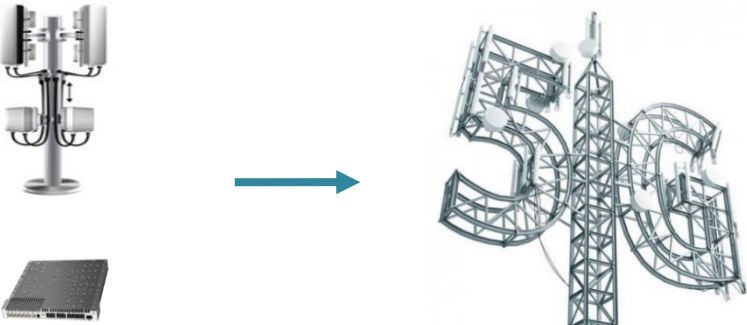
Smart Phone



Automotive



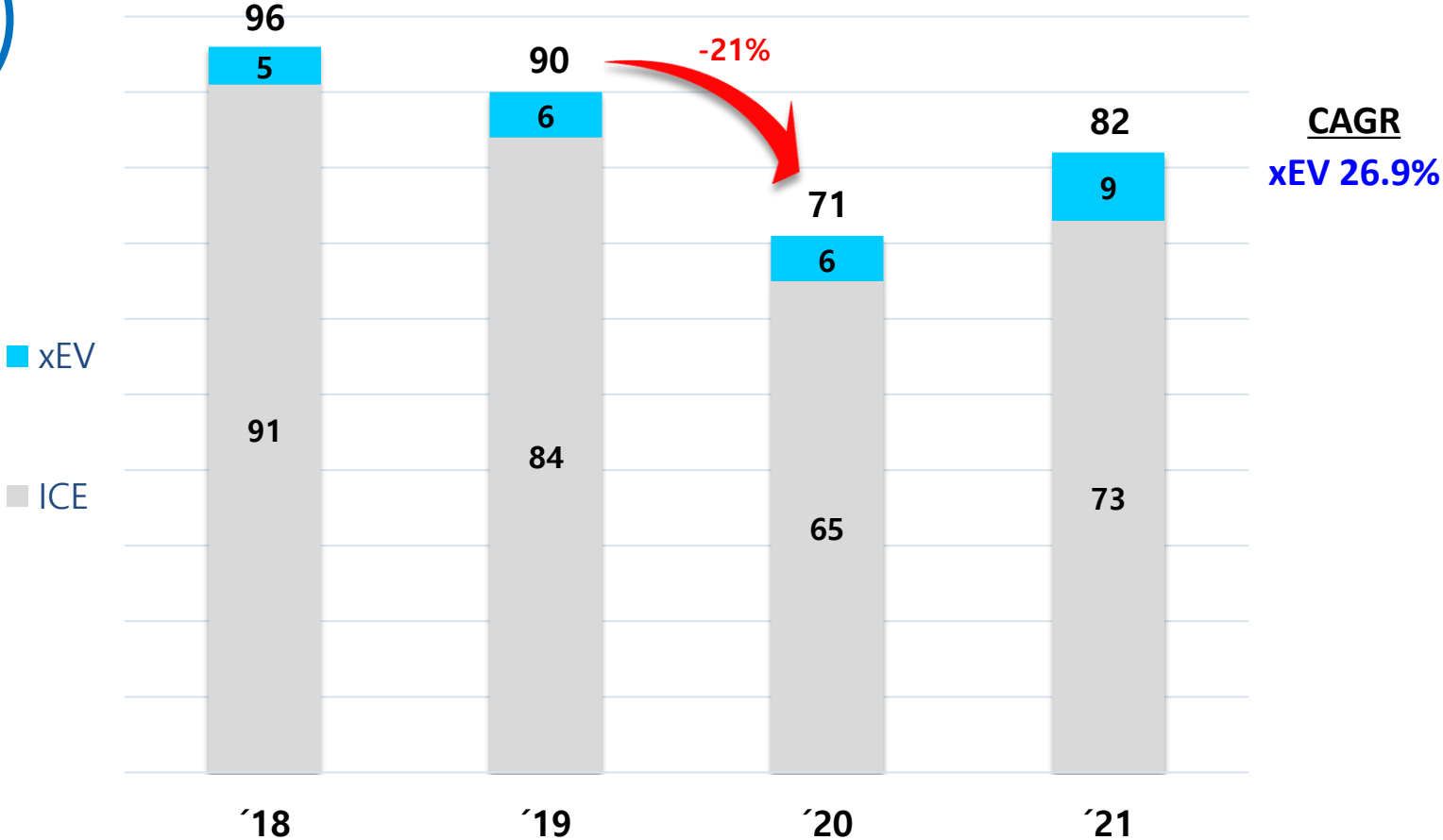
Network



Server



1. Supply Chain



*xEV includes Battery, Plug-In Hybrid, Hybrid and Fuel Cell

1. Supply Chain

TSEM (Tianjin Binhai Factory)



Production : MLCC (1994 ~)

SEMHQ (Suwon & Busan Factory)



Production : MLCC (1986 ~)

China
(Tianjin)

Korea
(Suwon, Busan)

Philippines
(Calamba)

Expanding the capacity for Automotive MLCC

R&D

Production

SEMPHIL (Philippines Factory)



Production : MLCC, PI, Tantal, Chip Resistor (1997~)



Trends

Electrification / Autonomous Driving / Connected Car

Market Mega Trend

① xEV



- Electrification(BMS, VCU, MCU, etc.) ↑
- Increase of Inverter, Converter

② Autonomous Driving



- Driver Assist System Level ↑
- Head lamp, Sensor, Camera, Radar, SPAS
LKAS, ACC, AEB, ILS ESC, EPS ↑

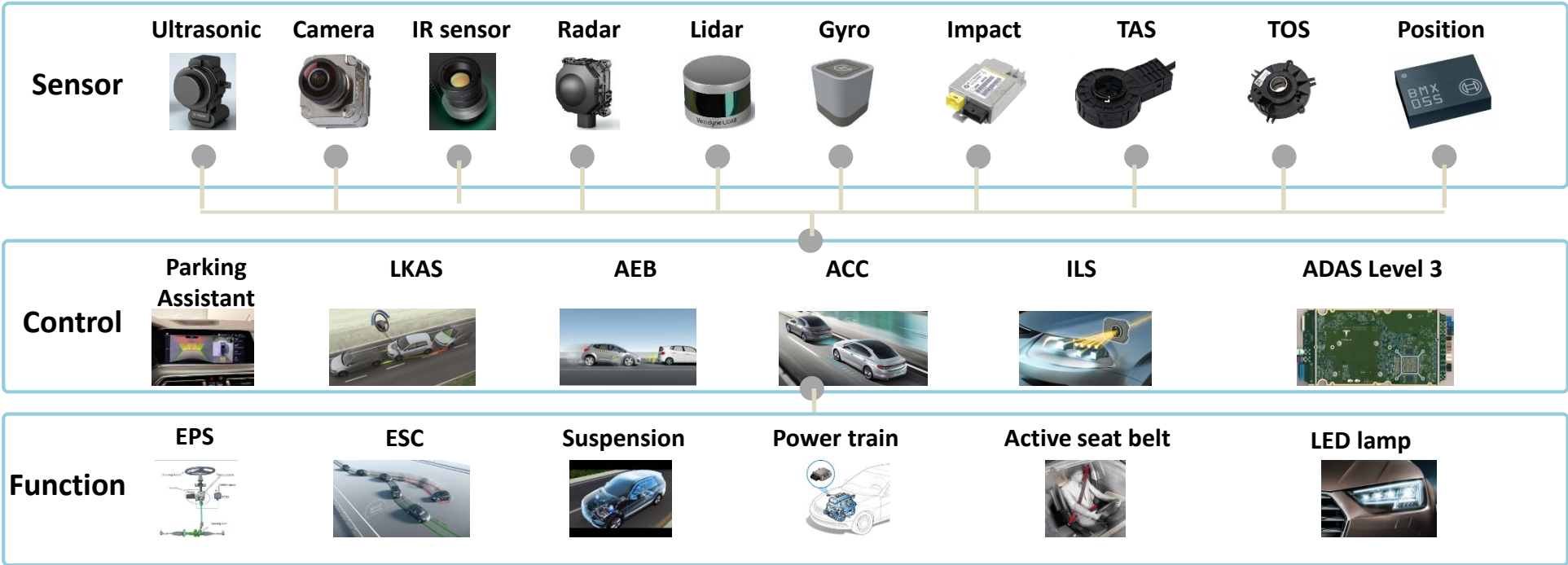
③ Connected Car



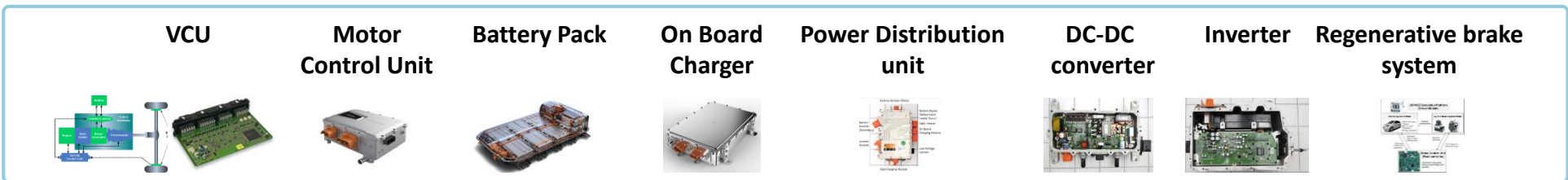
- Electrification (HMI, S/W, H/W, Network) ↑
- Display, V2X, HMI, Radio & Car Control Unit ↑



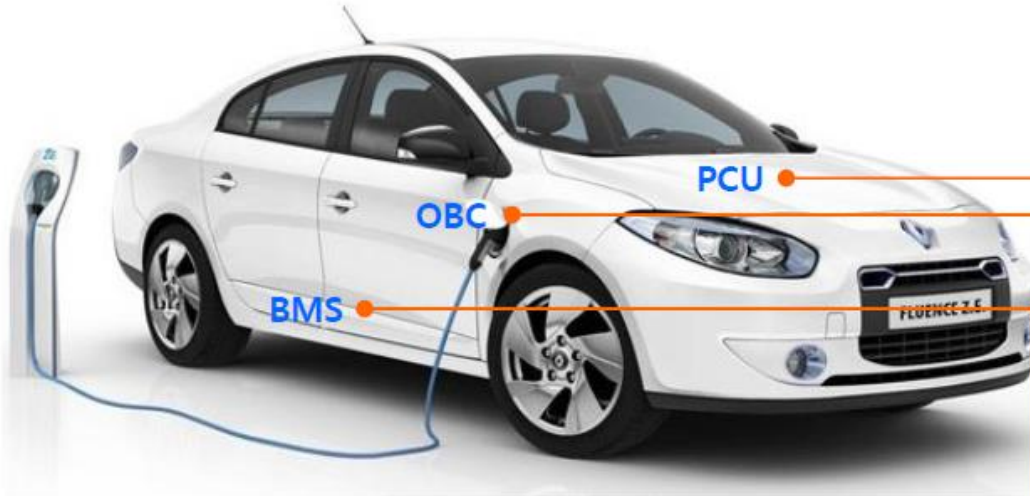
- Autonomous(or Advanced) Driving






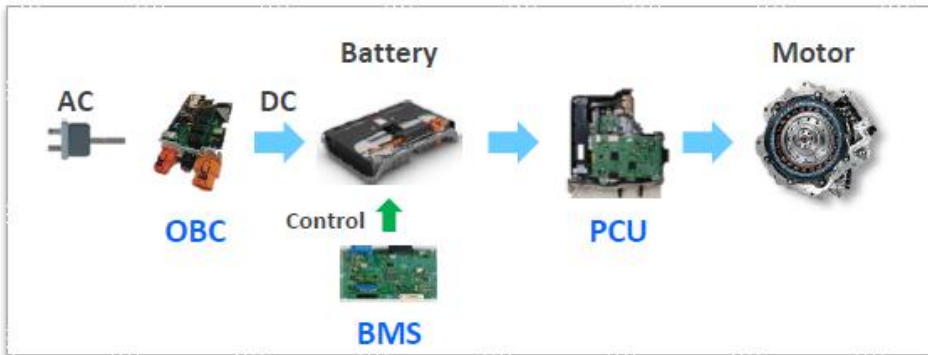
- xEV



2. Trends



<p>PCU</p> 	<ul style="list-style-type: none"> ▪ Power Control Unit of the vehicle · Motor Driving Unit · Consist of control, inverter and LDC(12V) block · Smaller ECU Size
<p>OBC</p> 	<ul style="list-style-type: none"> ▪ High voltage battery charging using AC Power · Target car : PHEV, BEV · Bidirectional Charge, Fast Charge
<p>BMS</p> 	<ul style="list-style-type: none"> ▪ Battery life and stability management · Battery's cell temperature and Voltage · Efficiency ↑ (800V_{BUS}, '25~)

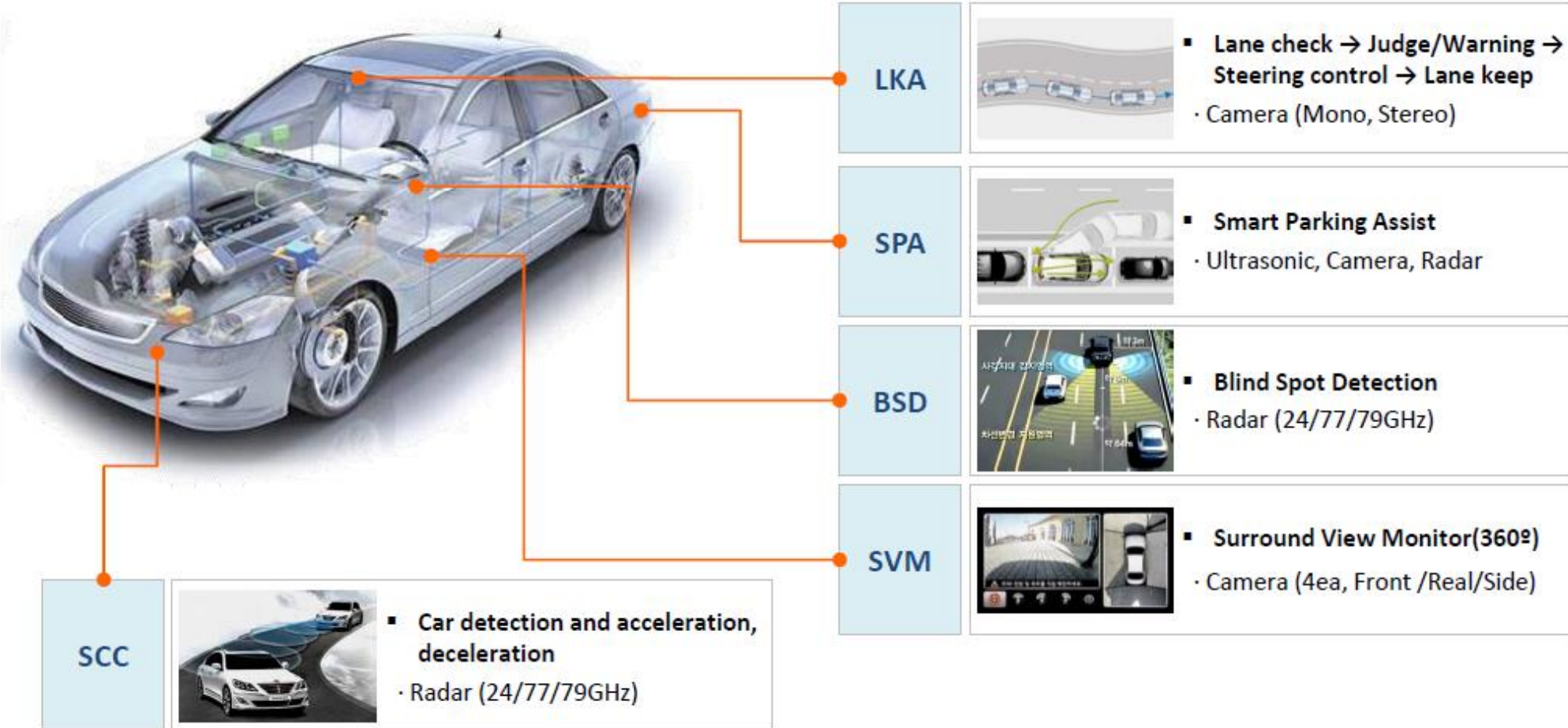


※ PCU: Power Control Unit, BMS: Battery Management System, OBC: On Board Charger, LDWS: Lane Departure Warning System, BCM: Body Control Module

2. Trends

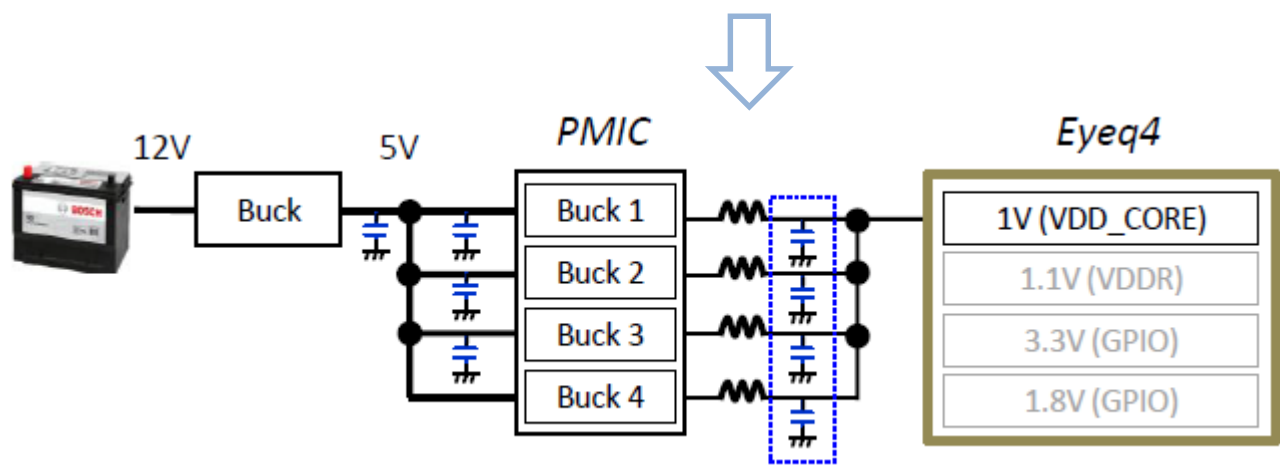
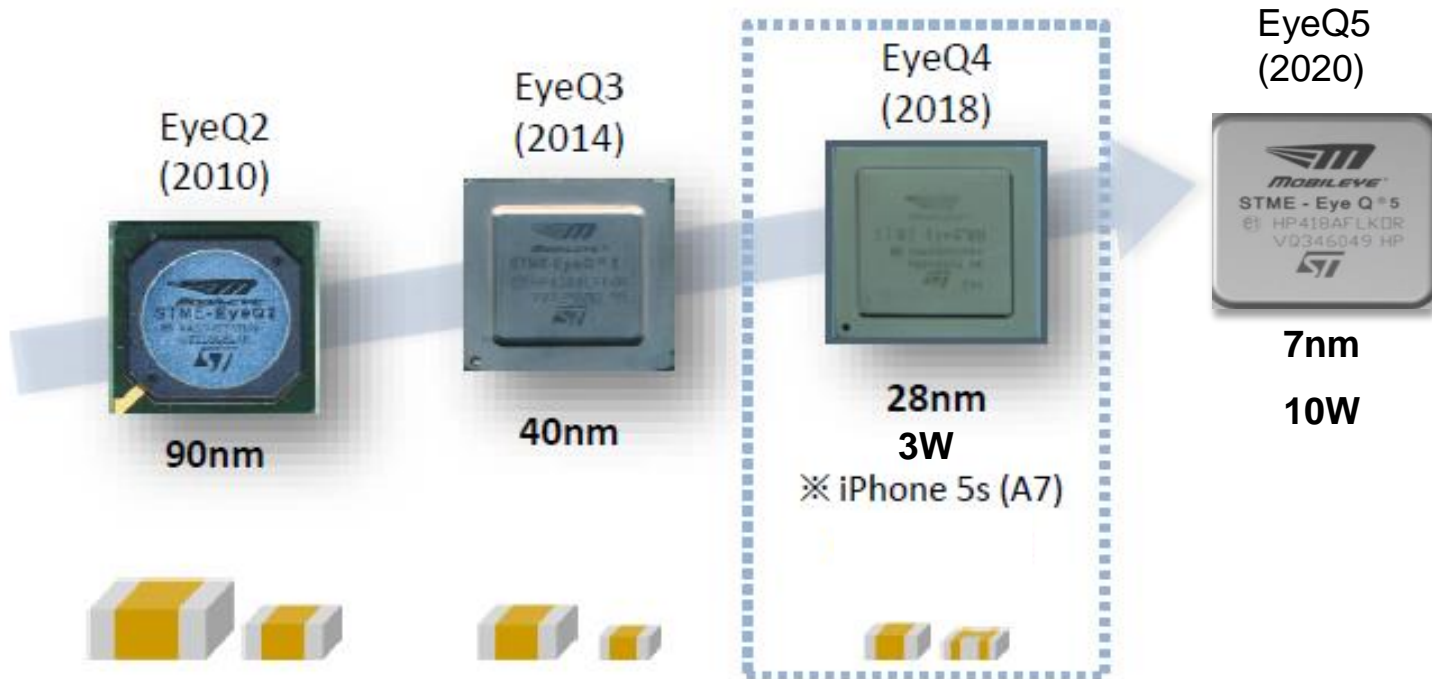
Item	1) ICE	HEV	BEV
Driving force (Engine)	<p>[Engine] ECU → [Engine] (large)</p>	<p>[Engine] ECU → [Engine] (medium)</p>	Unused
Driving force (Electric)	Unused	<p>*Power Control Unit PCU → Motor (small) ↔ BMS → Battery (small) *Battery Management System</p>	<p>PCU → Motor (large) ↔ BMS → Battery (large) ← OBC *On Board Charger</p>
MLCC (ea)	500~700	1,300~1,700	1,900~2,300
Advantage	High Power	High fuel efficiency	CO ₂ and hazardous gas is none Simple System
Limit	CO ₂ /Hazardous gas big	Complex system	Long battery charging time
Social/ Environmental	Enhance Envir. regulation, Fossil fuels exhaust		Dependence of battery-tech. growth and rare-earth element

2. Trends



※ Reference document : IHS, Automotive ECU market database (2019.3), Hyundai MOBIS homepage

2. Trends





Technology

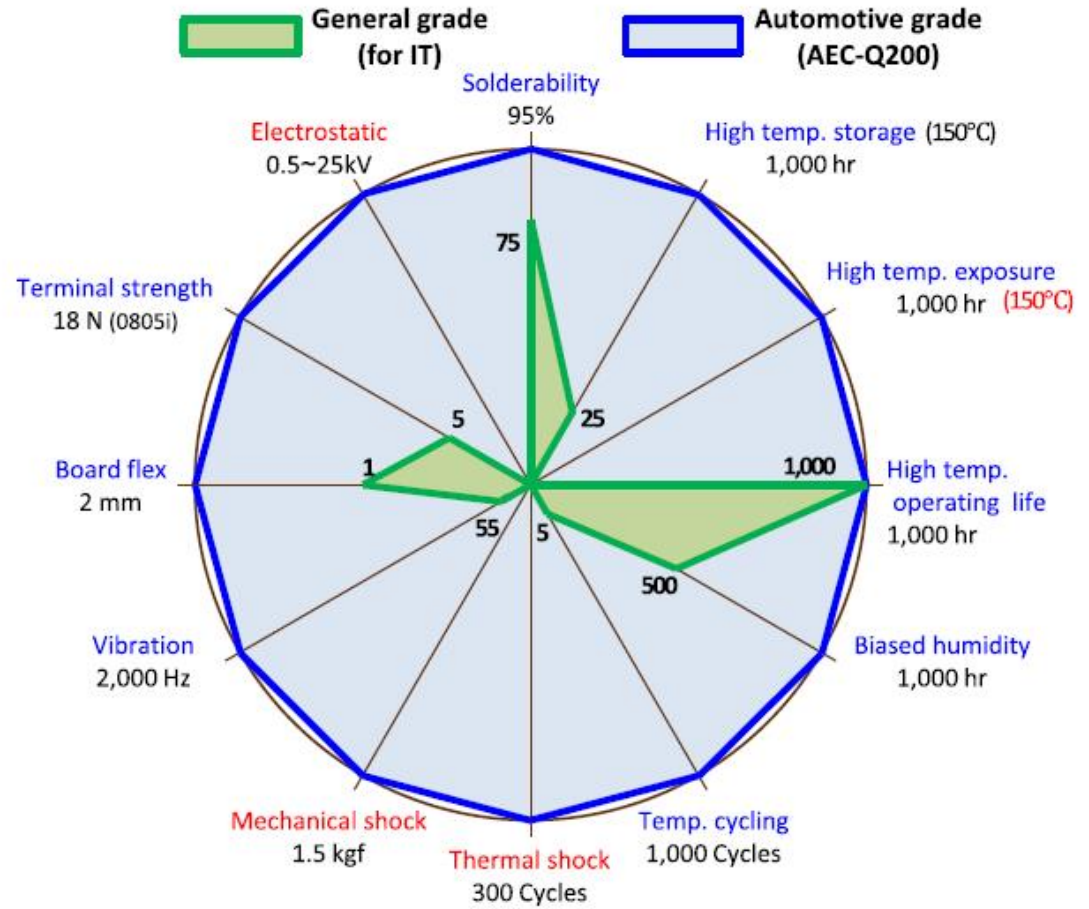
3. Technology

Reliability Requirements

【 Mobile - Environment 】



【 Automotive - Environment 】



【 IT vs Automotive 】

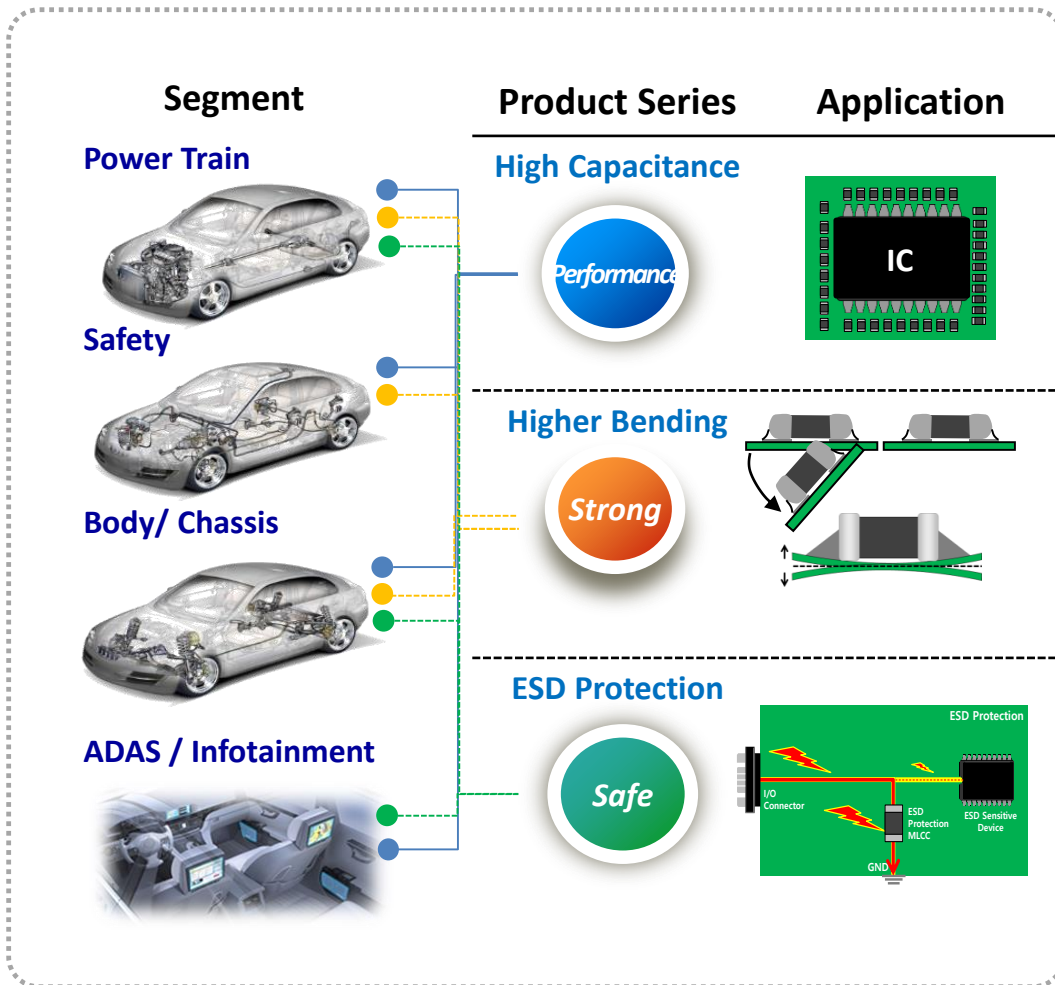
3. Technology

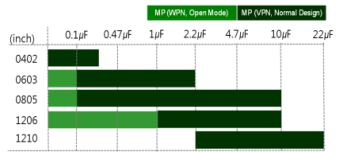
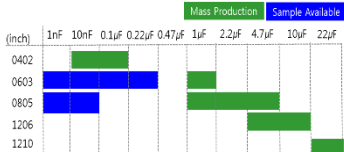
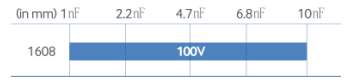
Part Number Explanation

Series

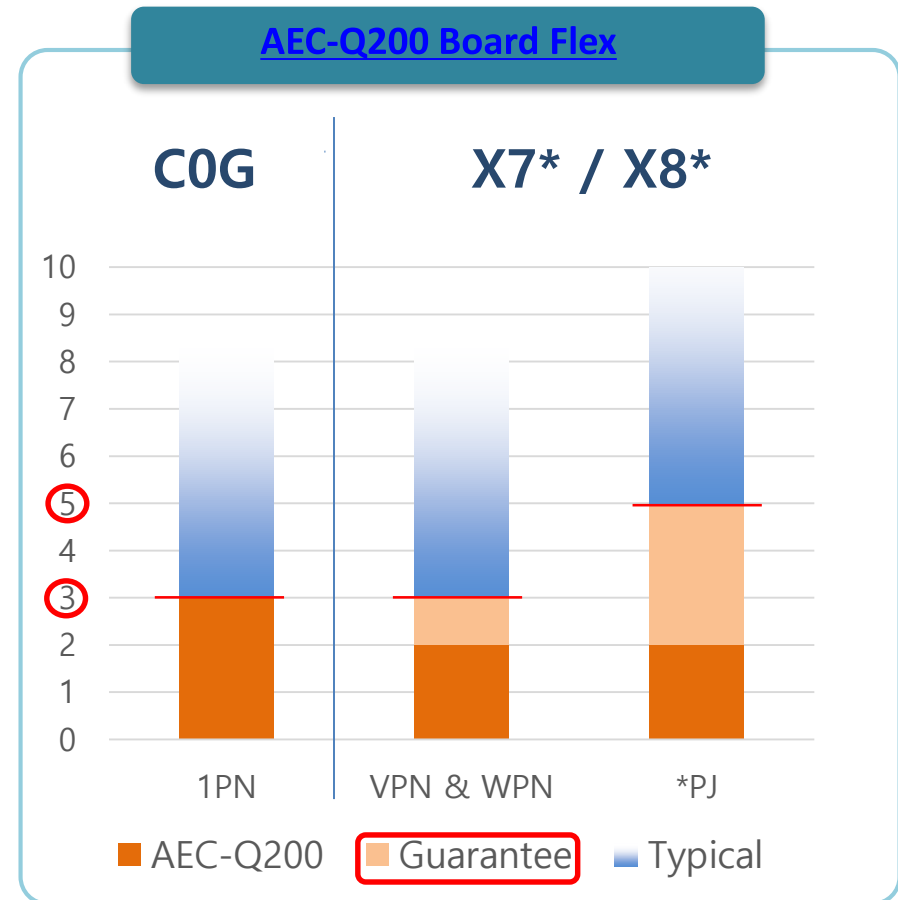
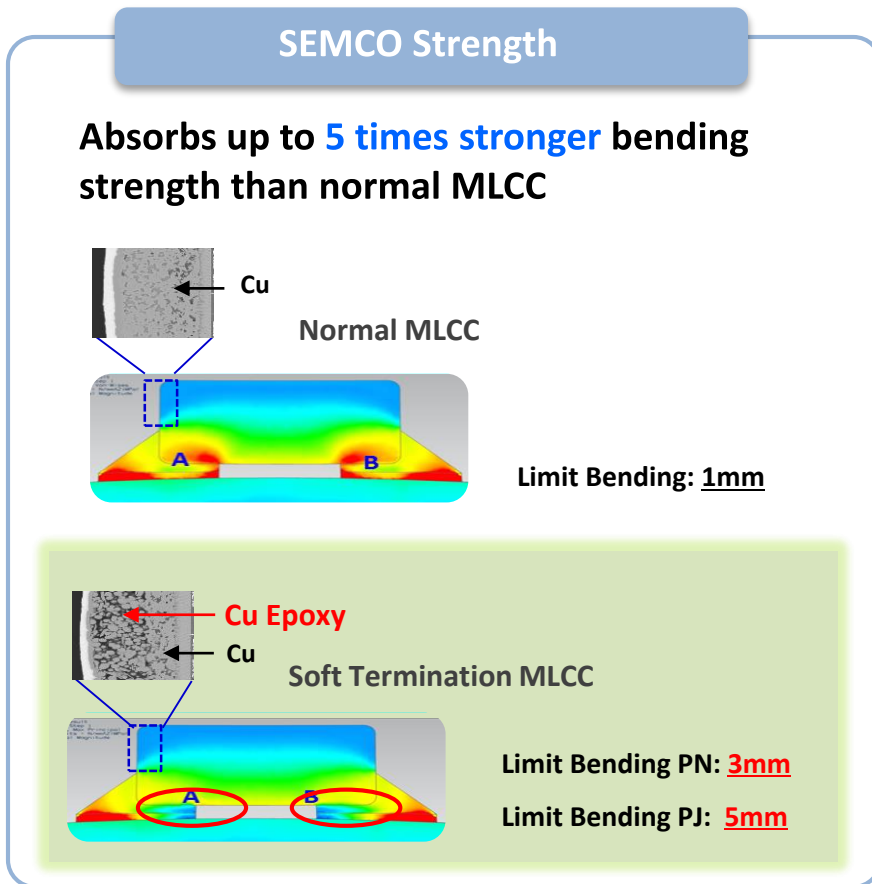
<u>CL</u> MLCC	<u>10</u> Size	<u>B</u> Dielectric	<u>104</u> Cap.	<u>K</u> Tolerance	<u>B</u> Voltage	<u>8</u> Thickness	<u>N</u> Design	<u>N</u> Termination	<u>N</u> Control	<u>C</u> Packaging
02=01005 "	A= X5R	2	B= ±0.1pF	R= 4V	5= 0.50mm	N =Standard	NN= Standard	Cardboard Tape		
03= 0201"	B= X7R	significant	C= ±0.25pF	Q= 6.3V	6= 0.60mm	S= Soft Term	NW= Industrial	C= 7" Reel		
05= 0402"	C= C0G	digits	D= ±0.5pF	P= 10V	8= 0.80mm	V= AEC-Q200	W6=Industrial soft	(standard for t<1mm)		
10= 0603"	X= X6S	+	F= ±1pF	O= 16V	C= 0.85mm	W=AEC-Q200& Open mode	PN=Automotive	D/L= 13" Reel		
21= 0805"	Y= X7S	number	or ±1%	A= 25V	P= 1.15mm	4 & 5 = NRND	PJ= Automotive	Embossed Plastic		
31= 1206"	Z= X7T	of zeros	G= ±2%	B= 50V	F= 1.25mm		5mm board Flex	E= 7" Reel		
32= 1210"	G= X8G	use "R"	J= ±5%	C= 100V	H= 1.60mm		PE=Automotive	(standard for t>1mm)		
	E= X8L	denotes	K= ±10%	D= 200V	I= 2.00mm		ESD Protection	F= 13" Reel		
		decimal	M= ±20%	E= 250V	J= 2.50mm			Other		
		point		H= 630V				B=Bulk		
				I= 1000V						

Higher Capacitance, Fail-safe and Miniaturization



Competitiveness	Line-up
PN <ul style="list-style-type: none"> Fine powder technology Strong thermo-mechanical properties 	0402~1210 size ~47uF 
PJ <ul style="list-style-type: none"> Higher bending strength guarantee (~5mm) VW 80808 compliant 	0402~1210 size ~47uF 
PE <ul style="list-style-type: none"> IEC 61000-4-2 STD compliant Higher ESD voltage 	0603 100V 1nF~10nF << New Product >> 

- Solution for stress-absorption – Metal Epoxy Termination – VW80808-2 Compliant



3. Technology

Size (mm)	RV (V)	Capacitance (nF)									Capacitance (μF)					
		1	2.2	4.7	10	22	47	100	220	470	1	2.2	4.7	10	22	47
0402 (1005)	100															
	50															
	25								1							
	16															
	10															
	6.3															
0603 (1608)	100							1								
	50															
	25															
	16															
	10															
	6.3															
0805 (2012)	100										1					
	50											1	1			
	25												1	2		
	16															
	10															
	6.3															
1206 (3216)	100										1	1				
	50													1		
	25															
	16															
	10															
	6.3														2	
1210 (3225)	100											1	1			
	50													1		
	25														1	
	16															
	10															
	6.3															

*1 : New Product *2 : SPL available. Please contact us.



Q&A

Thank you

Appendix

Appendix

Web-site supports

SEMCO Web-site supports for Customer Engineers

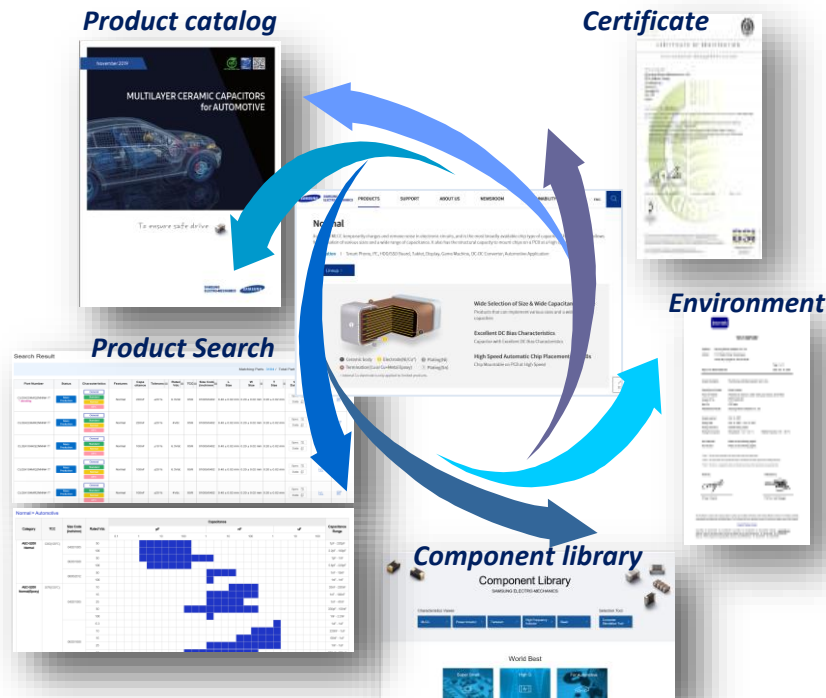
Homepage main : <http://www.samsungsem.com/>

Component library : <http://weplib.samsungsem.com>

Product Search : <http://product.samsungsem.com>



SEMCO Web site (Component biz.)



Component Library

- S-parameter and Spice Model of MLCC/Inductor
- Characteristics of MLCC according to Temperature and DC bias
- Temperature rise and Inductance of Power Inductor according to DC Current
- Converter Simulation tool

