SAMSUNG

Electro-Mechanics

January 2021

CONTENTS

Part 1

Introduction

SAMSUNG ELECTRO-MECHANICS

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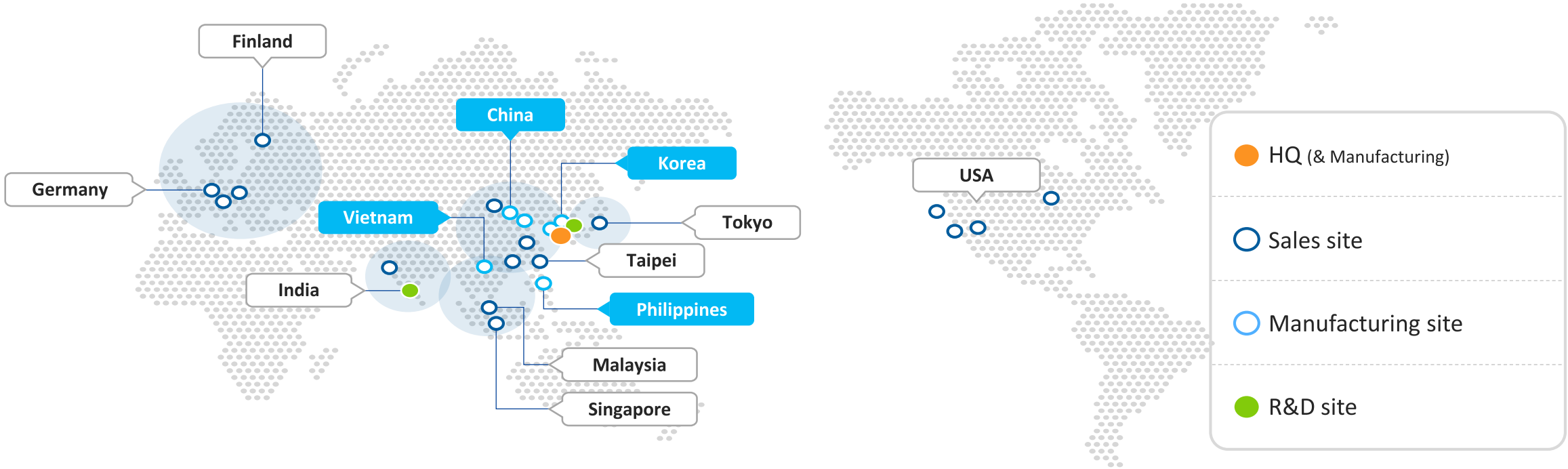
Quality Topics @ Rutronik and AE for S/P and direct customers

SAMSUNG ELECTRO-MECHANICS

Company Overview

SEMCO contributes to the advancement of the electronics industry

Foundation	HQ	Global	Employees	Revenue
1973	Suwon Korea	16 sales sites 7 manufacturing sites	36,000 [2020]	$7.5B [2020]

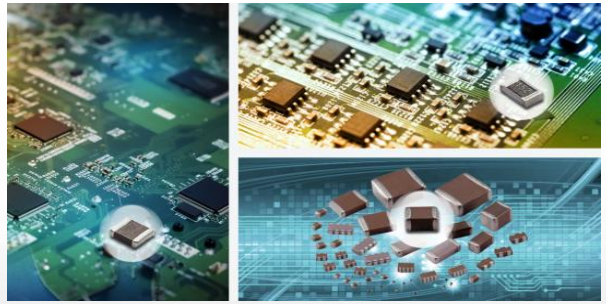


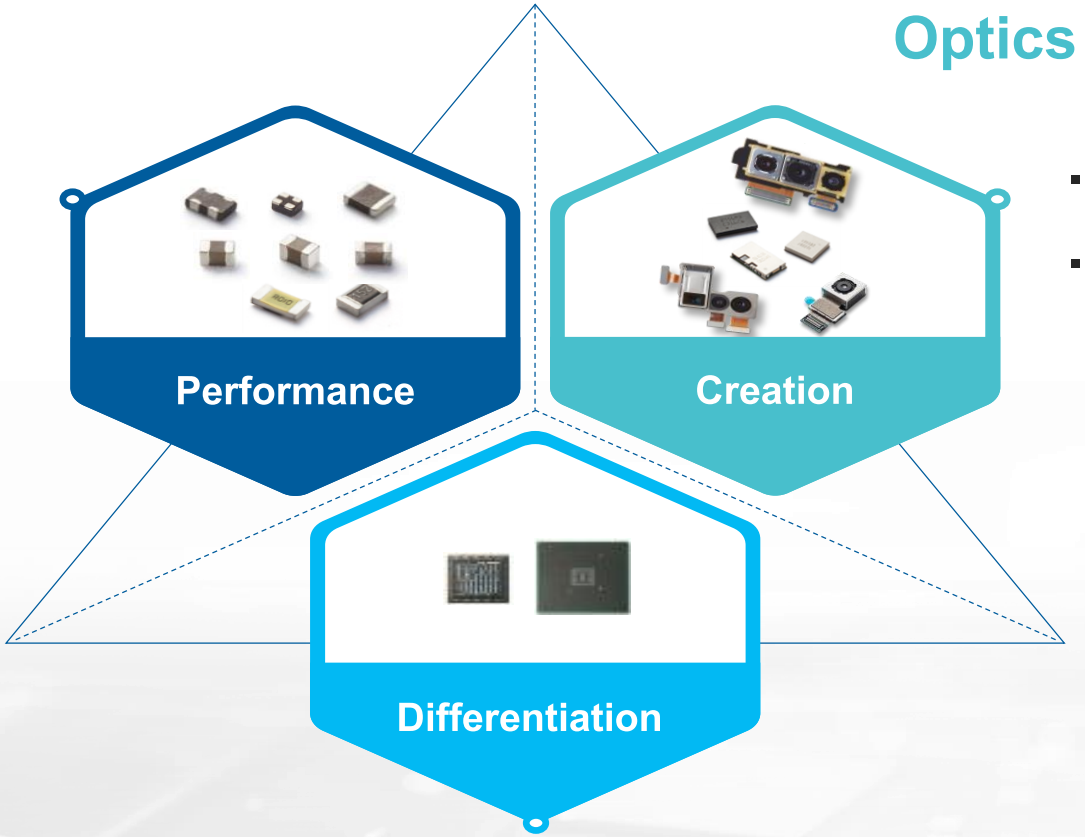
SEMCO Products

[Division]

Component Solution

- MLCC
- Inductor
- Chip Resistor
- Tantalum Capacitor



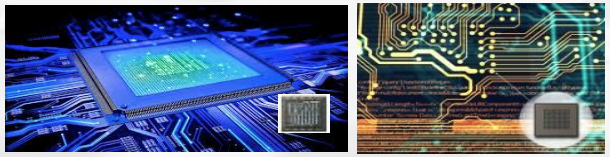


Optics & Communication Solution

- Camera Module
  - Lens/Actuator
- Communication Module
  - Sub-6 FEM/mmW Ant/Keyless

Package Solution

- BGA
- FCBGA



Part 2

Market Trends

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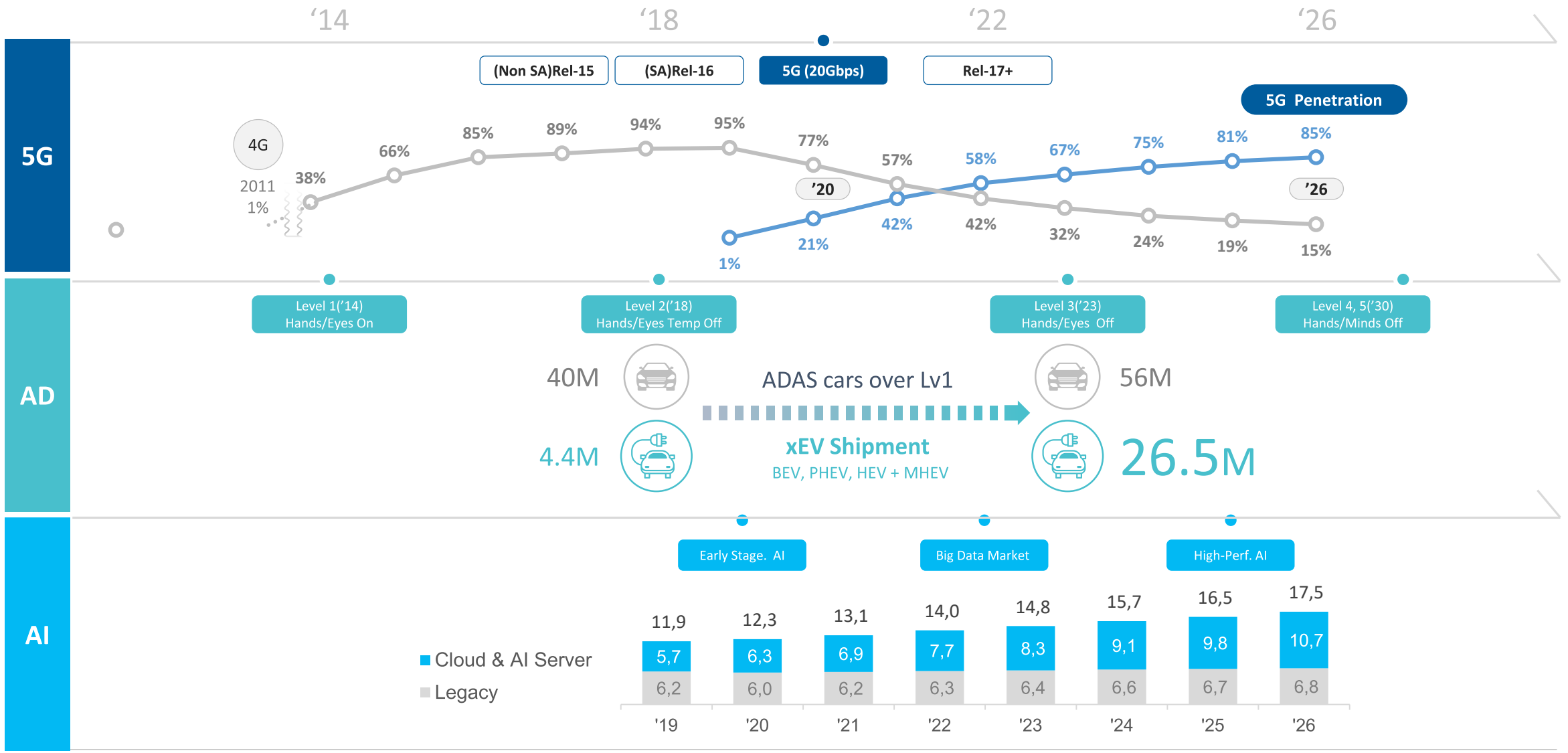
Paradigm Shifting to 4th Industrial Revolution



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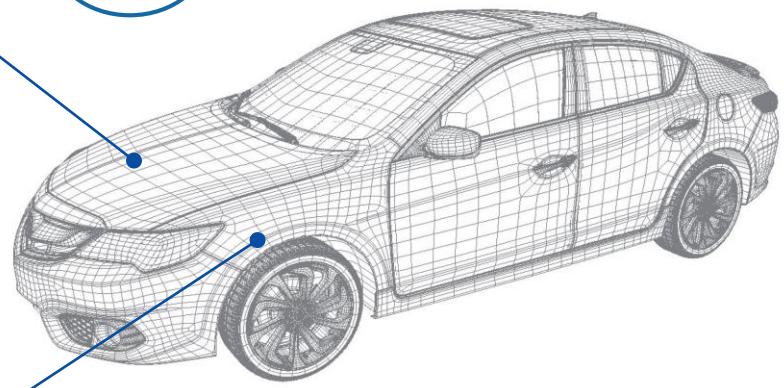
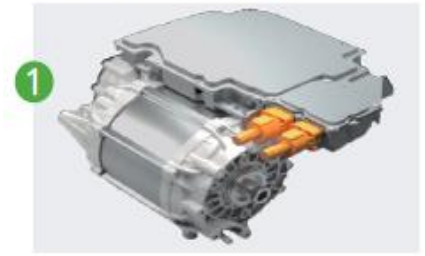
Automotive Snapshot - Megatrends

ACU ADAS
(Autonomous Control Unit)

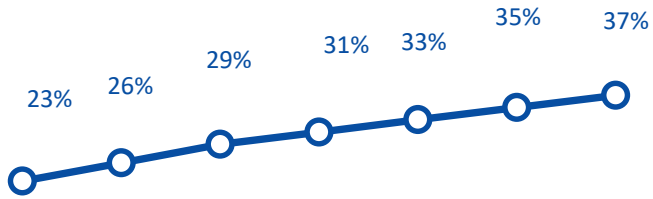
Sensors



Inverter EV
(Main Motor Driver)

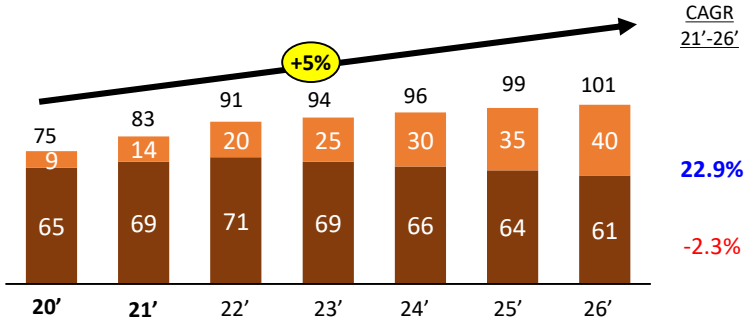


ADAS LV 2~4 penetration ratio



Source : IHS Jul. 2020

Electrification



** EV includes, Battery, Plug in Hybrid, Hybrid and Fuel Cell*

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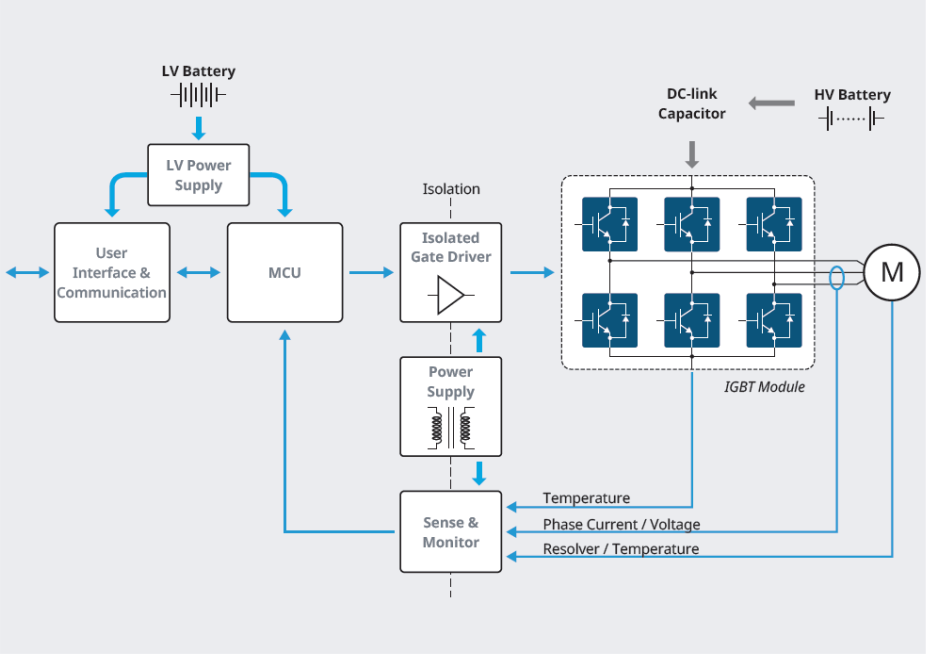
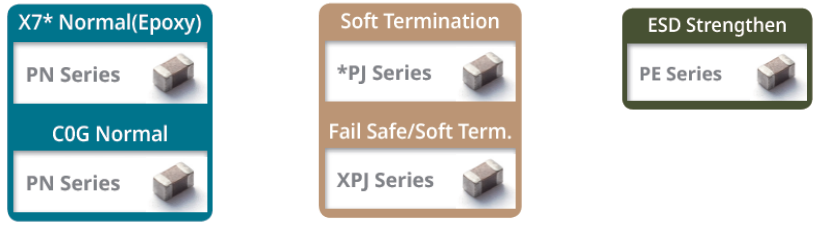
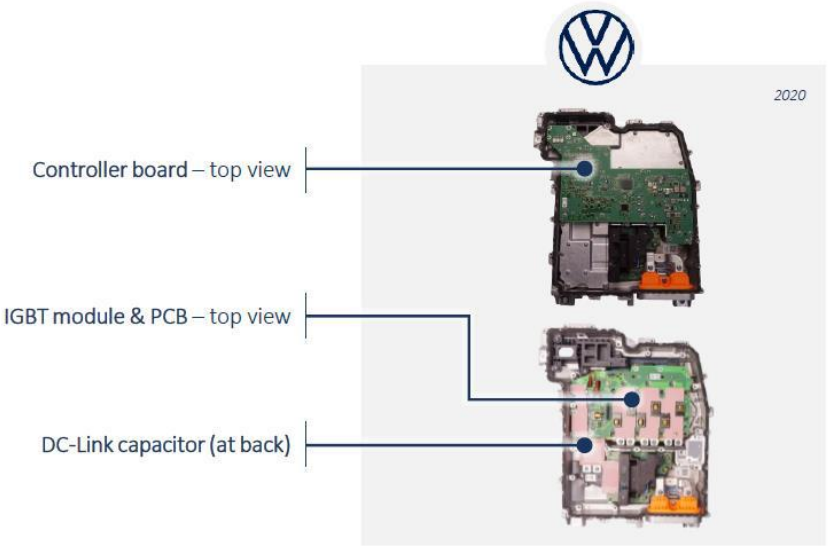
Electrification Snapshot - Main Inverter







Source: UBS VW iD3 teardown

BOM characteristics | New MLCC content per vehicle

- ✓ Up 1000 Automotive grade MLCC required
- ✓ Voltages 16V~100V and higher | Cases sizes 0603~1210i | Capacitance 1pF~22uF

Case Study

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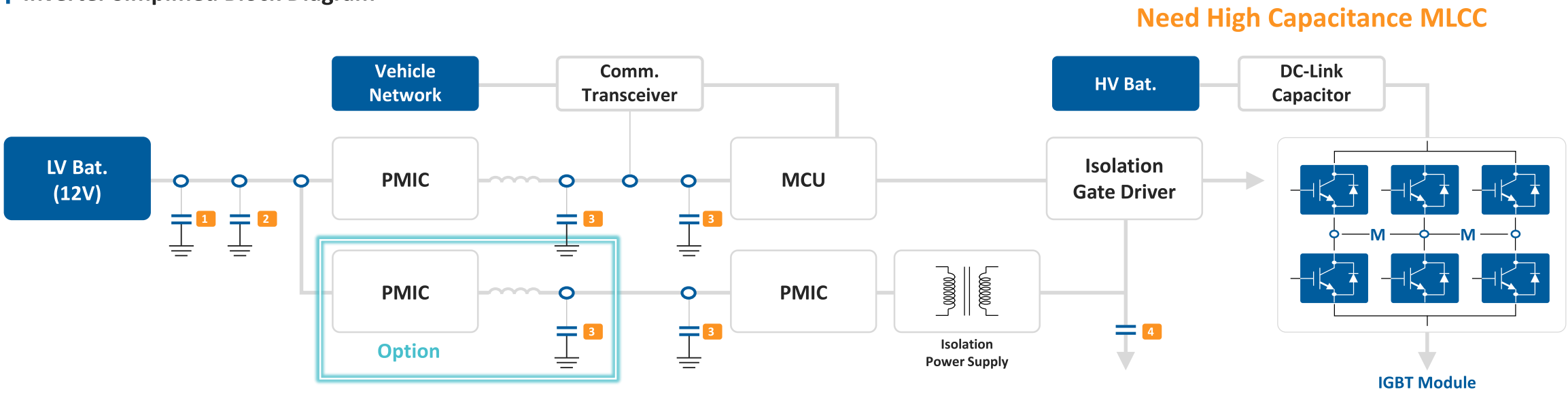
[Motor Inverter]

Stabilize the power line of 12V / PMIC blocks → Total capacitance per set ↑

Inverter Simplified Block Diagram



* Notice : Each company may have different circuit designs

Item	No	VApply [V]	PN		Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	1	12	CL21B104KCFXPJ		X7R	0.1	100	0805	Fail Safe/Soft Term.
	2	12	CL32Y475KCIVPJ	CL31Y225KCHVPJ	X7S	4.7 / 2.2	100 / 100	1210 / 1206	High-C, Soft Term.
			CL31Y106KBKVPJ	CL21Y475KBKVPJ	X7S	10 / 4.7	50 / 50	1206 / 0805	High-C, Soft Term.
	3	≤5	CL32Y476MPVVPN	CL10Y225KP8VPN	X7S	47 / 2.2	10 / 10	1210 / 0603	High-C, Soft Term.
	4	10~15	CL32Y226KAVVPN	CL21Y475KABVPN	X7S	22 / 4.7	25 / 25	1210 / 0805	High-C, Soft Term.
			CL31Y106KBKVPJ	CL21Y475KBKVPJ	X7S	10 / 4.7	50 / 50	1206 / 0805	High-C, Soft Term.

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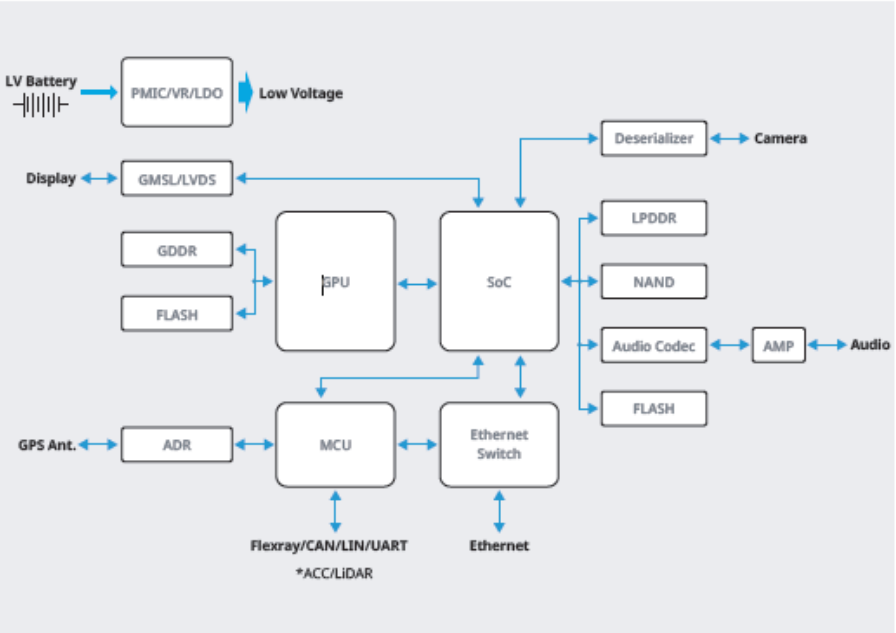
ADAS Snapshot - Autonomous Control Units



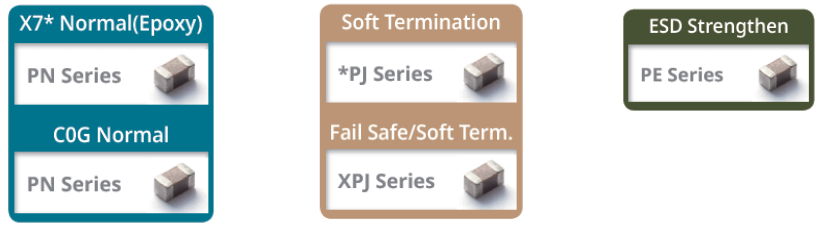
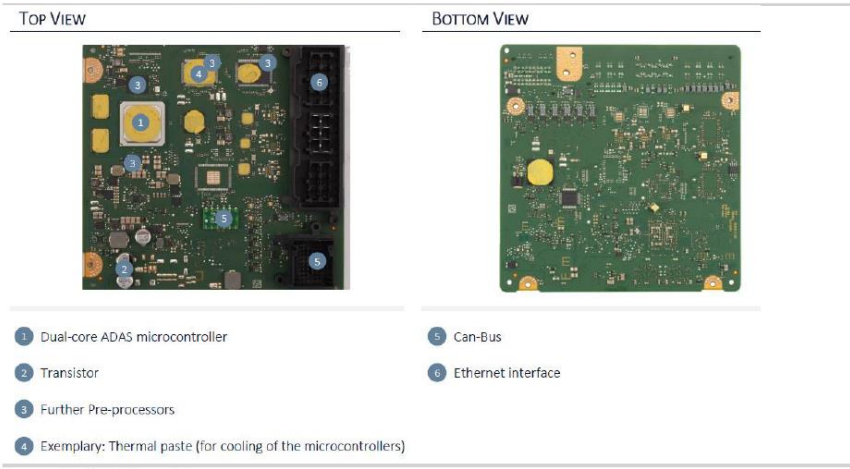


Figure 96: ICAS1 ADAS computer, supplied by Continental



Source: P3, UBS Evidence Lab

BOM characteristics | High computing power

- ✓ **Fail-Safe requirements to address mission critical applications**
- ✓ **Cases sizes 0603~1210i | Higher Capacitance ~47uF | Voltages 4V~50V**

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Product Proposal - EV Charger

[Industrial MLCC]

Smaller size, Higher Cap value with High Temperature for Faster Charging

Communication Block

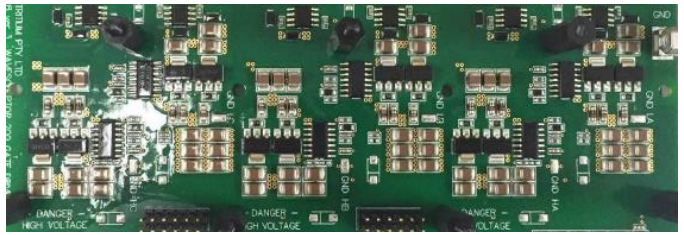
Smaller size for Space Saving

Control Block

Small size with high Cap for Faster processor

Power Block

High Voltage for Power Converter



Size	Rated Volt	100nF	220nF	470nF	1uF
01005	2.5V			X7T (21.Q4)	
0201	6.3V				X7T (21.Q4)
	10V	X7R			
0402	6.3V				X7R
	25V		X7R		

Size	Rated Volt	100nF	1uF	2.2uF	10uF
0805	100V	X7R			
1206	100V			X7R	
	630V	10nF			
1210	630V	47nF			
	1kV	22mF			

Part 3

Product Proposal

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Product Proposal

SEMCO provides higher reliability MLCC for better performance

CL	21	Y	105	K	C	F	V	P	J	E
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

Reliability Test Item	General		Automotive	
	Consumer (NN)	High Level Ⅰ (NW)	AEC-Q200 (PN)	AEC-Q200 + 5mm (PJ)
Application Example *1	Smartphone, TV, PC STB, Game, DSC Consumer Power (Lighting, Adapter) Wireless Modem	Server, Network (Switch, Router) Industrial Power Test Equipment Medical (Class 1~2)	Automotive Heavy Industry Solar PV	Automotive Constant High Power
Biased Humidity	40℃ 95% RH 1Vr, 500hr	65℃ 90% RH 1Vr, 500hr	85℃ 85%RH 1Vr, 1000hr	85℃ 85% RH 1Vr, 1000hr
High temp load test	Max temp, 1.0Vr,1000hr	Max temp, *2 1.5Vr, 1000hr	Max temp, *2 1.5Vr, 1000hr	Max temp, *2 1.5Vr, 1000hr
Board Flex	1mm	*3 1mm	3mm	5mm

*1 Application Guide can be changed by customer test condition or agreement
*2 The part marked 'derating' is less than 150% of rated voltage in the durability and operational life test
*3 Perform 2mm bending outgoing test

Footprint in Automotive MLCC Technology

Size	1 uF	4.7 uF	10 uF	22 uF	47uF	100 uF
0402i (1005m)						
0603i (1608m)	Commodity Products			SEMCO Fine Powder Technology With Vertical Integration		
0805i (2012m)						
1210i (3225m)						

7 Suppliers

4 Suppliers

3 Suppliers

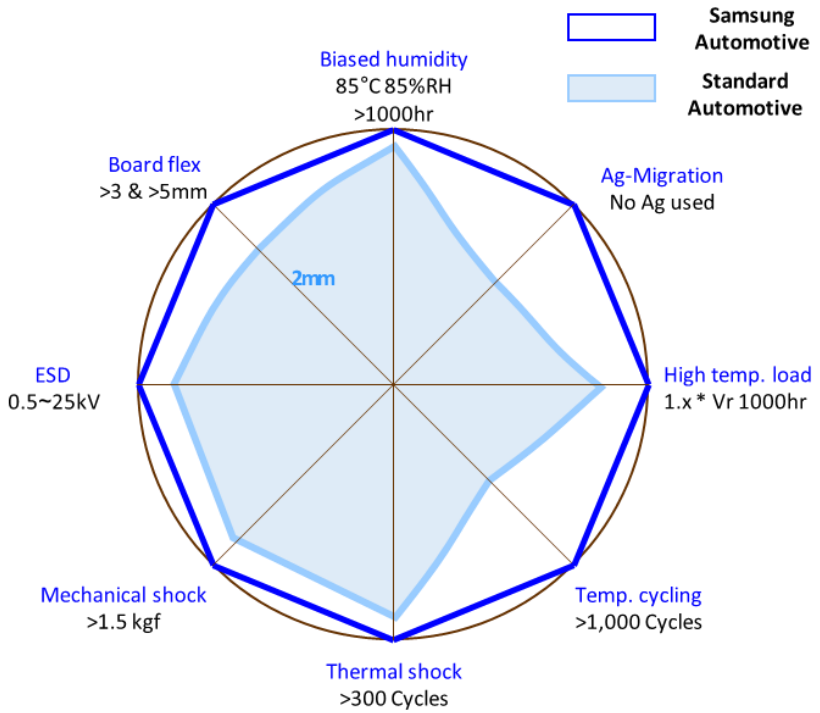
70% of New Designs Industry Wide

☑ High Capacitance and Reliability for leading Technologies

Learn more!

☑ Extension of MLCC Manufacturing Capacity

☑ Investment in Technology and Innovation



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Product Proposal

[Fail-Safety I Open/Series]

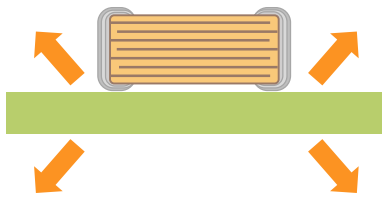
Fail-safe function with Flex Termination, Open & Series Structure design

Needs

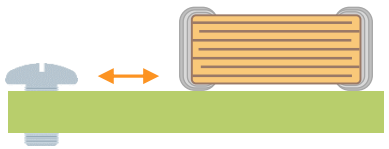
- Design of Circuit Protection against MLCC
  Crack → Need to High Reliability of Automotive

Cause of Damage in MLCC

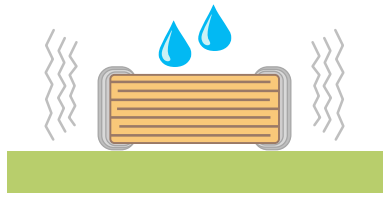
[PCB Thermal Expansion]



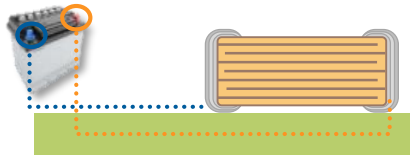
[Screw Around]



[Vibration / Moisture]

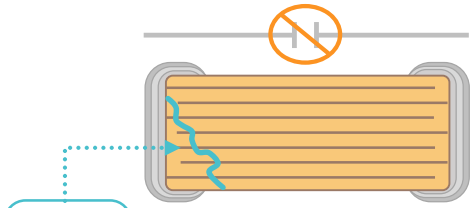


[Battery's Voltage Line]



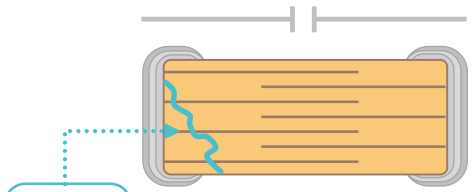
Value

- Fail-safe function with open & series structure

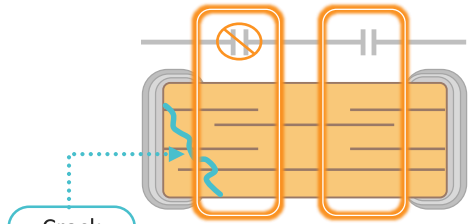


[General]

Conventional MLCCs has Short in Active Area When internal Crack Occurs



[Open Mode]



[Series Structure]

When MLCC Internal Cracks occur,
the Active Area is not short

Securing High Reliability with Short Prevention Design Structure

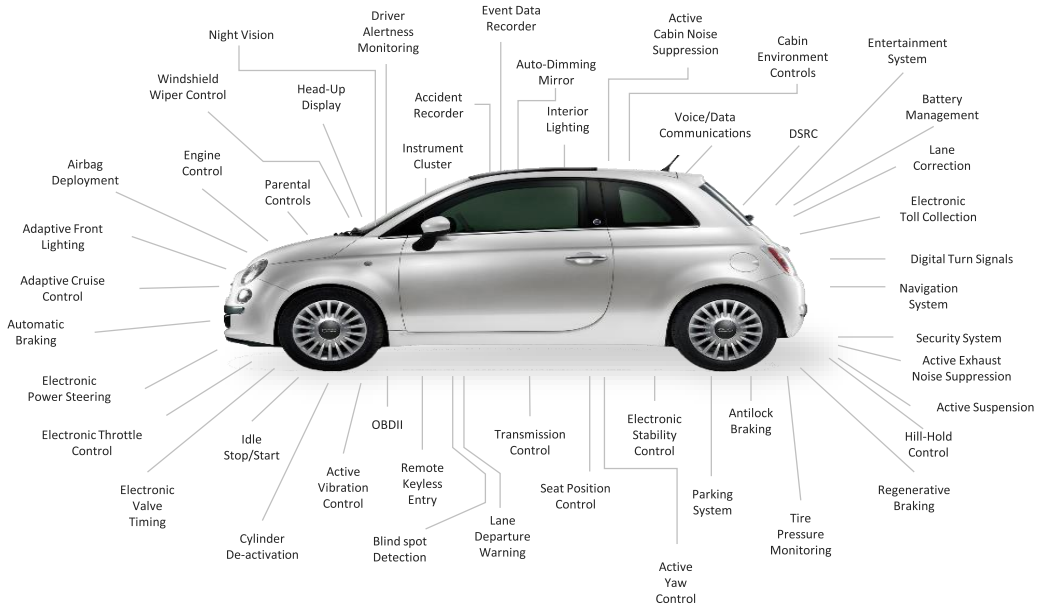
Product Proposal

[ESD Protection MLCC]

Reduce Circuit Damage by applying ESD Protection MLCC

Needs

ESD risk increases Increase of Electronic Part Ratio of Automotive



Need to Improve ESD due to increased ECUs

Value

Reduce Circuit Damage compared to General

Location of Applying ESD Protection MLCC

ESD Protection MLCC Rating

Higher ESD Characteristics than General MLCC by 1.5~2 times

Test Method	Product	Capacitance(nF)		
		2.2	4.7	10
SEMCO Mode1 150pF,330Ω	General	-	10kV	15kV
	ESD Protection MLCC	20kV	20kV	22kV

* Guaranteed IEC 61000-4-2 Standard

SAMSUNG ELECTRO-MECHANICS

SEMCO Automotive MLCC Part Number

CL	31	B	224	K	H	8	W	P	N	C
Series	Size	Diel.	Cap.	Tol.	Volt.	Thick.	Design	Product	Grade	Packaging
	03=0201” 05=0406” 10=0603” 21=0805” 31=1206” 32=1210”	C=C0G B=X7R Y=X7S Z=X7T E=X8L G=X8G	2 significant digits + number of zeros use “R” denotes decimal point	B=±0.1pF **C=±0.25pF** D=±0.5pF F=±1pF or ±1% G=±2% **J=±5%** **K=±10%** M=±20%	R=4V Q=6.3V P=10V O=16V A=25V B=50V C=100V E=250V H=630V I=1KV J=2KV	5=0.5mm 8=0.8mm C=0.85mm P=1.15mm F=1.25mm H=1.6mm I=2.0mm J=2.5mm	***Please see below***			C=Cardboard, Tape, 7”Reel D=Cardboard, Tape, 13”Reel E=Embossed Type, 7” Reel F=Embossed Type, 13”Reel

Design

Internal Design	Outer Termination		
	Cu	Metal-Epoxy	
		Cu	Ag
Normal	**1**	**V**	4
Open		**W**	5
Series		**X**	

Product

P = Automotive Qualified (Based on AEC-Q200)

Grade

N = Normal

J = 5mm bending Strength

E = ESD Protection

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Line-up

Automotive

C0G

- 5% tolerance is standard
- 50V & 100V are most used
- E6 is recommended

1 | 1.5 | 2.2 | 3.3 | 4.7 | 6.8

X7R | X7S | X7T

- 10% tolerance is standard
- 6.3V | 16V | 50V | 100V in focus
- E3 is recommended

1 | 2.2 | 4.7

Size	Voltage	<10p	<100p	100p	220p	470p	1n	2.2n	4.7n	10n	22n	47n	100n	220n	470n	1µ	2.2µ	4.7µ	10µ	22µ	47µ	100µ	220µ	Voltage
1210"	100V																X7R	X7S						100V
	50V																		X7S					50V
	25V																			X7S				25V
	16V																			X7R				16V
	6.3V																				X7R	'22		6.3V
	4V																					X7T	'23	4V
1206"	100V															X7R	X7S	'23						100V
	50V																	X7R	X7S					50V
	25V																		X7R					25V
	16V																		X7R					16V
	10V																			X7R				10V
	6.3V																			X7R	X7T			6.3V
	4V																				X7T			4V
0805"	100V									C0G						X7S	'22							100V
	50V																X7R	X7S	'22					50V
	25V																		X7S					25V
	16V																		X7S					16V
	6.3V																			'22				6.3V
0603"	100V							C0G			X7R													100V
	50V															X7R								50V
	25V																'22							25V
	16V																							16V
	10V																							10V
	6.3V																		'22					6.3V
0402"	100V	C0G			X7R																			100V
	50V	C0G					X7R																	50V
	25V													X7R										25V
	16V															'22								16V
	10V														X7S	X7S								10V
	6.3V															X7S	'22							6.3V
0201"	25V									X7R														25V
	16V																							16V
	6.3V											X7R	X7S											6.3V
Size	Voltage	<10p	47p	100p	220p	470p	1n	2.2n	4.7n	10n	22n	47n	100n	220n	470n	1µ	2.2µ	4.7µ	10µ	22µ	47µ	100µ	220µ	Voltage

R&D

Recommended

Smaller / Higher V available

NRND

* Schedules can be changed according to customer request and subject to change without prior notice.

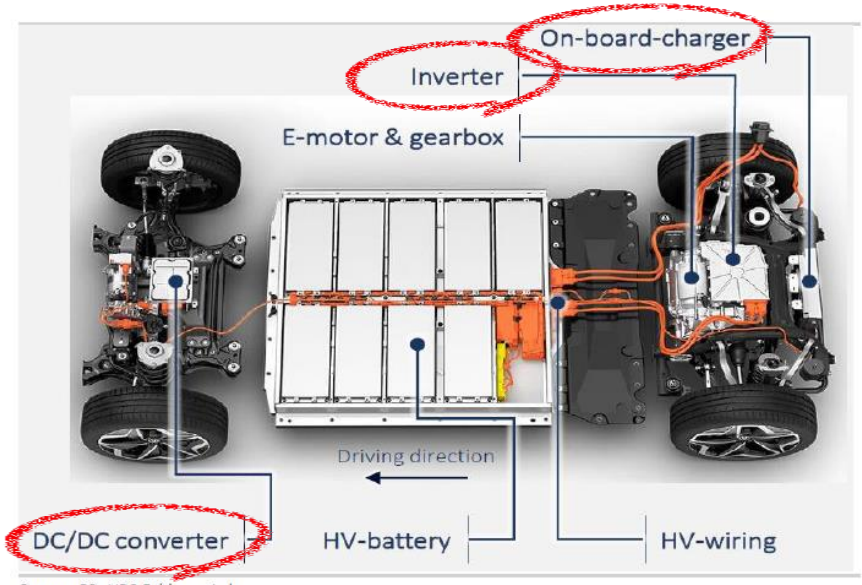
High Voltage Automotive Roadmap 2021.Q4

SAMSUNG ELECTRO-MECHANICS

R&D	
MP Ready	

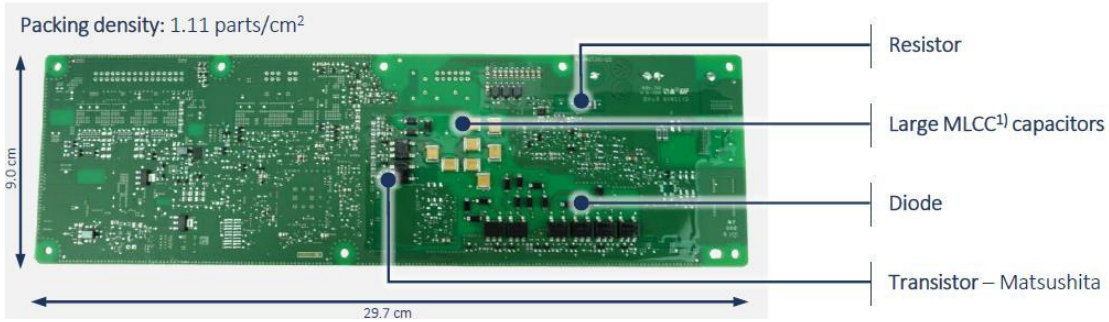
Size / inch	Rated Voltage (V)	Capacitance / nF							
		1	2.2	4.7	10	22	47	100	220
1206"	250								
	630								
	1000								
1210"	630								
	1000								

Targeted Applications



Source: P3, UBS Evidence Lab

Examples



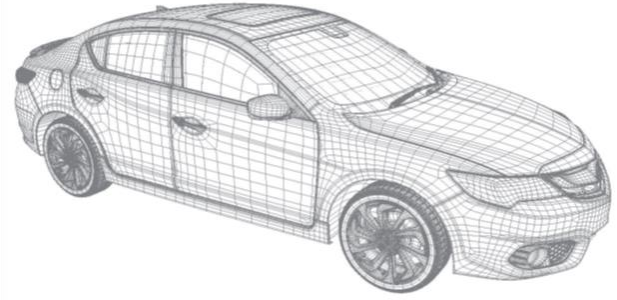
Part 4 Summary & Discussion

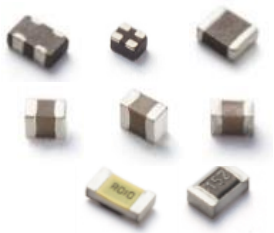
SAMSUNG ELECTRO-MECHANICS

Let us build our future mobility together

Great Components for Superb Driving

Rutronik **SEMCO**





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