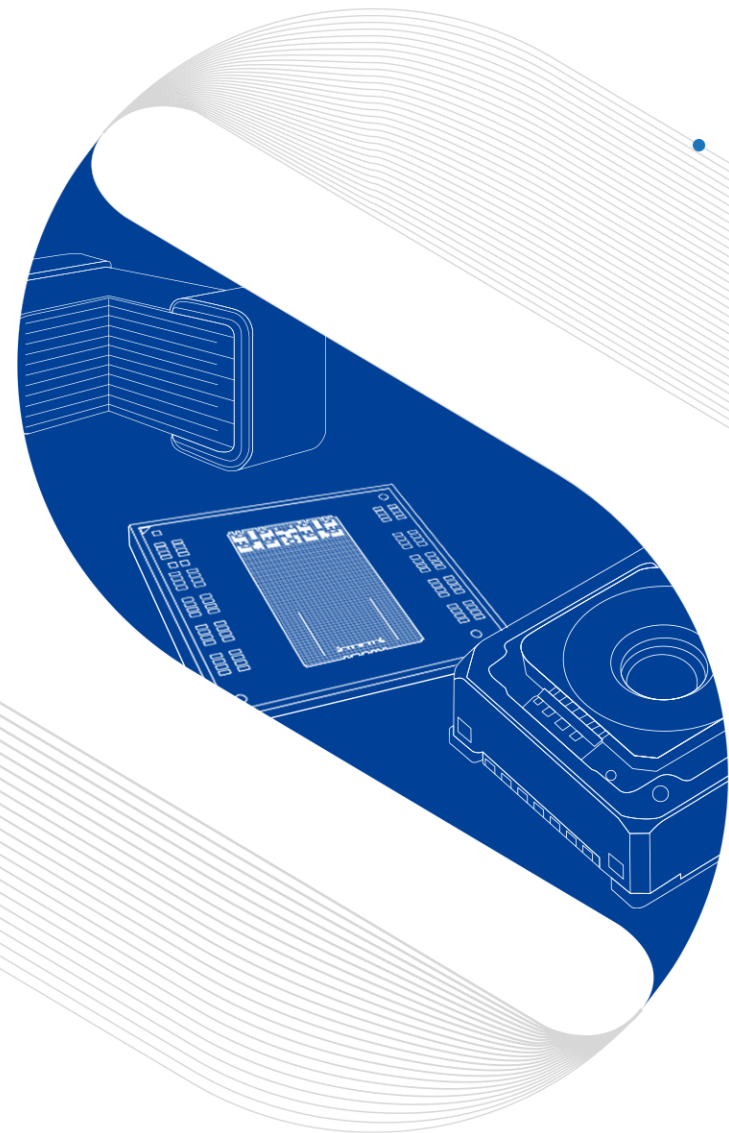


# Automotive Applications for MLCC

## SAMSUNG

### Electro-Mechanics

—  
Nov., 2023



# Product Proposal

[ Automotive MLCC ]

## Automotive MLCC has Higher reliability level than IT MLCC

### Needs

- ✓ Material & structure for high temp. and voltage
- ✓ Robust design for the moisture & vibration resistance
- ✓ Additional customer's requirements

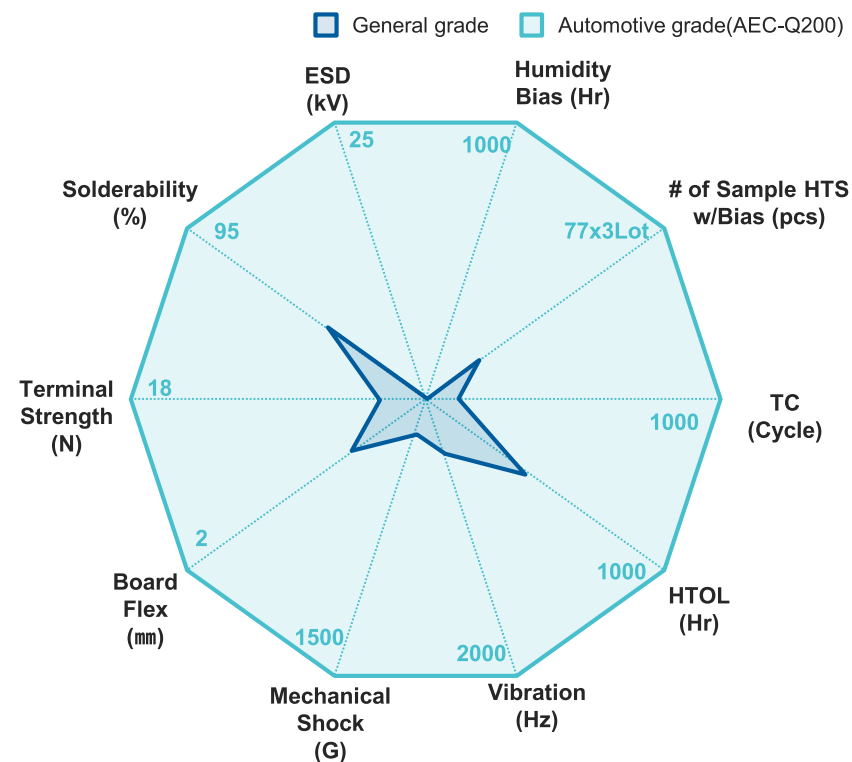
#### [ Consumer (IT) ]

#### [ Automotive grade ]

3 years	Life cycle	More than 15 years
-55 ~ 105°C	Temp.	-55 ~ 150°C
0201~0603i	Size	0201~1210i
1mm	Bending Strength	2~5mm ↑
<b>Compatibility with IT Trend</b>	<b>Design Target</b>	<b>Safety, Reliability</b>

### Solution

- ✓ Higher reliability level than General grade



\* ESD : Electro Static Discharge  
 \* TC : Temperature Cycle  
 \* HTOL : High Temperature Operating Life

# Product Proposal

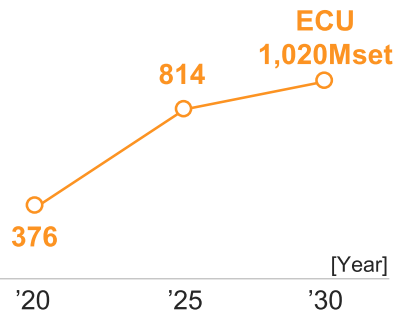
[ High Capacitance MLCC ]

## High Capacitance MLCC for EV & ADAS/AD

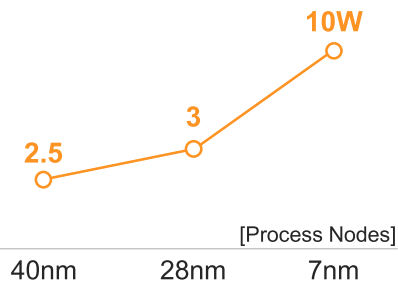
### Needs

- ✓ Electrification Trend → ECU ↑
- ✓ High performance ADAS/AD

#### ECU Shipment (ADAS)



#### Power Consumption (Autonomous Driving)



\* Source : M Company

Need more space

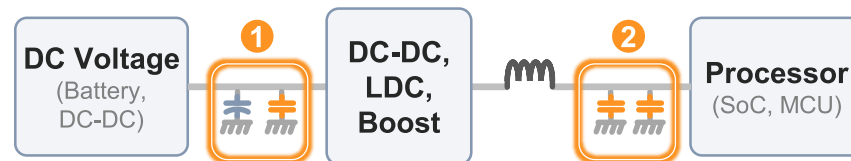
Need Higher Capacitance

Need to Overcome space insufficiency issue

### Solution

- ✓ Space Saving with High Capacitance MLCC

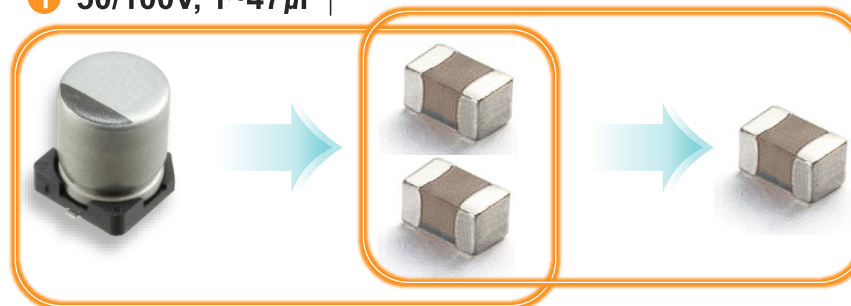
#### ECU Block Diagram



#### Advantage of High Capacitance MLCC

1 50/100V, 1~47μF ↑

2 16V↓, 4.7~100μF↑



Slim & Low ESR

Space Saving

# Product Proposal

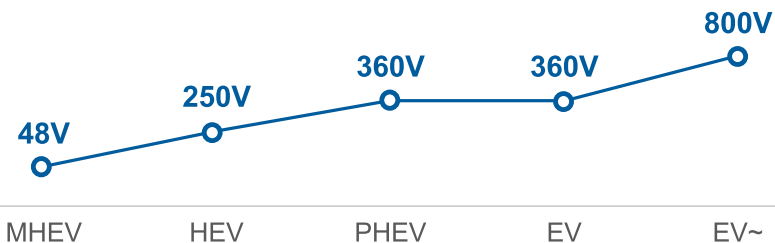
[ High Voltage MLCC ]

## High Voltage MLCC Demand Increases Due to HV System

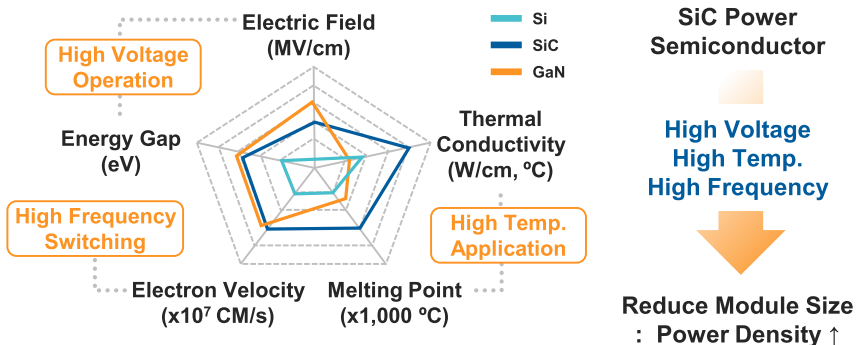
### Needs

- ✓ Increased HV systems in xEV compared to ICE
- ✓ SiC Power Semiconductor Adoption

#### HV System Voltage Change

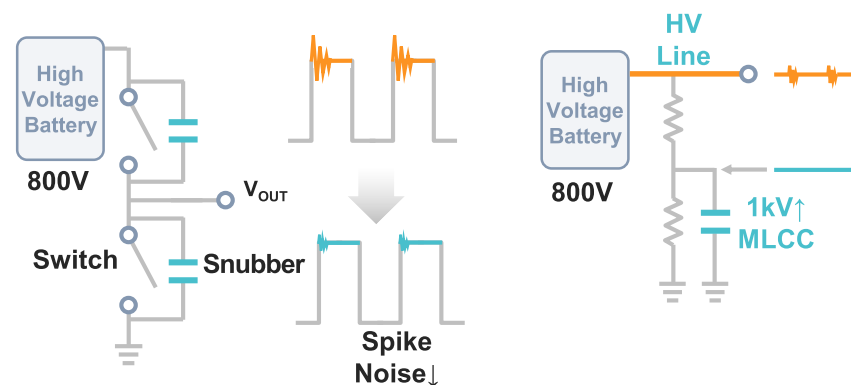


#### SiC Power Semiconductor

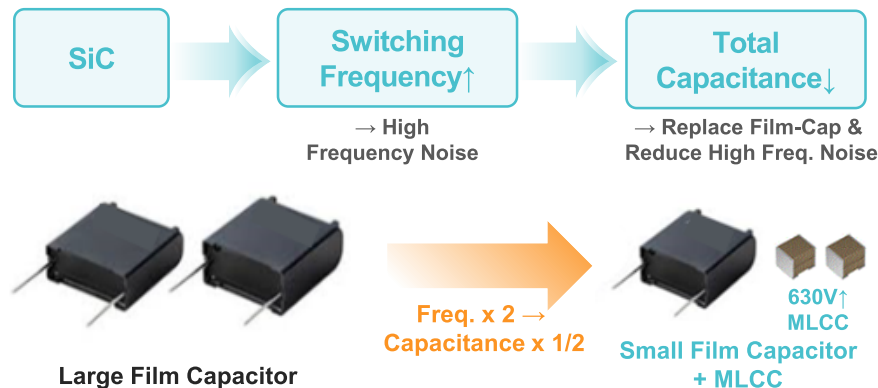


### Value

- ✓ Stress reduction & High Voltage Sensing



- ✓ Space Saving & Reduce High Frequency Noise



# Product Proposal

[ Soft Termination ]

## Soft Termination MLCC to Prevent Bending Crack

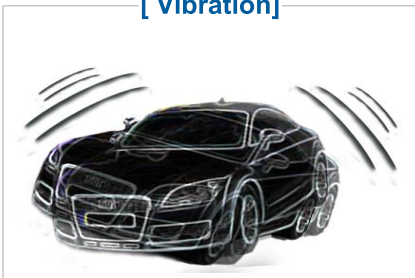
### Needs

- ✓ MLCC Crack Occurred in Various Environment  
→ Need to Solution for Stress-Absorption

### Cause of Bending Crack

Usage Environment

[ Vibration ]



[ External Impact ]



Manufacturing

[ Manufacturing ]



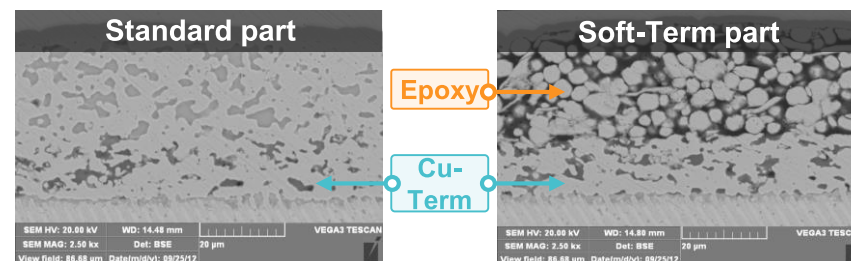
[ SMT ]



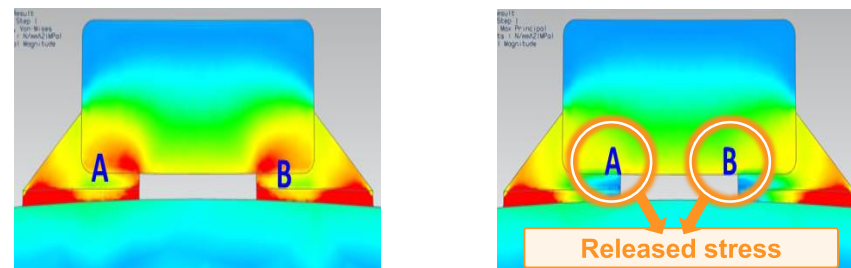
### Value

- ✓ Higher Bending Strength compared to Standard

### Structure of Soft Termination



### Bending Stress Simulation



Higher Bending Strength ( 2mm → 5mm )

# Product Proposal

[ Fail-Safety | Open/Series ]

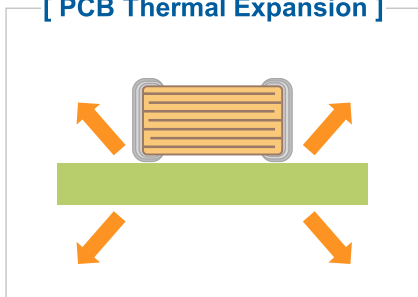
## Fail-safe function with a open and series structure design

### Needs

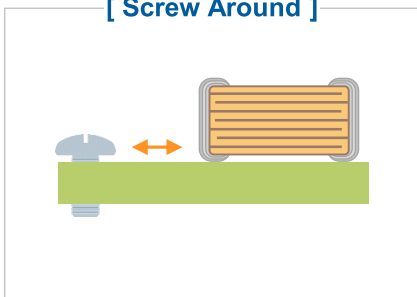
- ✓ Design of Circuit Protection against MLCC Crack → Need to High Reliability of Automotive

### Cause of Damage in MLCC

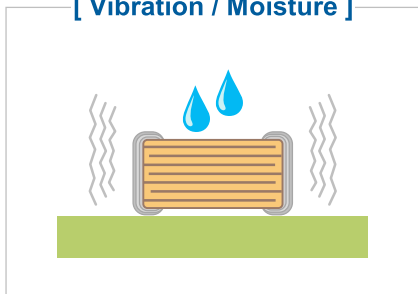
[ PCB Thermal Expansion ]



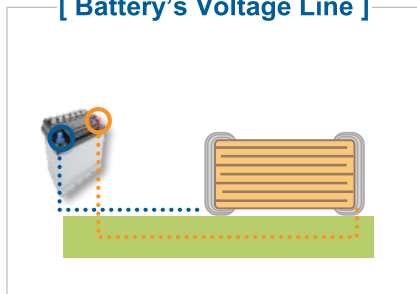
[ Screw Around ]



[ Vibration / Moisture ]

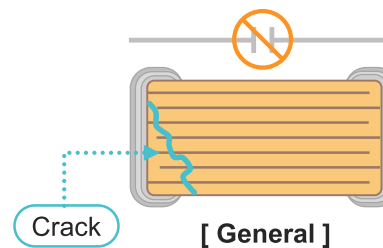


[ Battery's Voltage Line ]

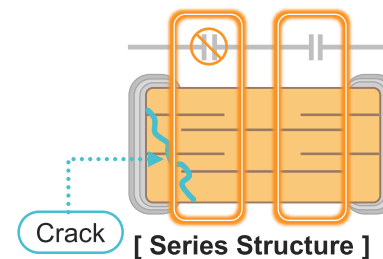
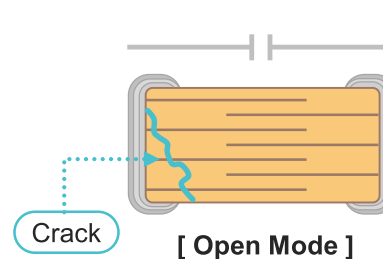


### Value

- ✓ Fail-safe function with open & series structure



Conventional MLCCs has Short in Active Area When internal Crack Occurs



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

Securing High Reliability with Short Prevention Design Structure

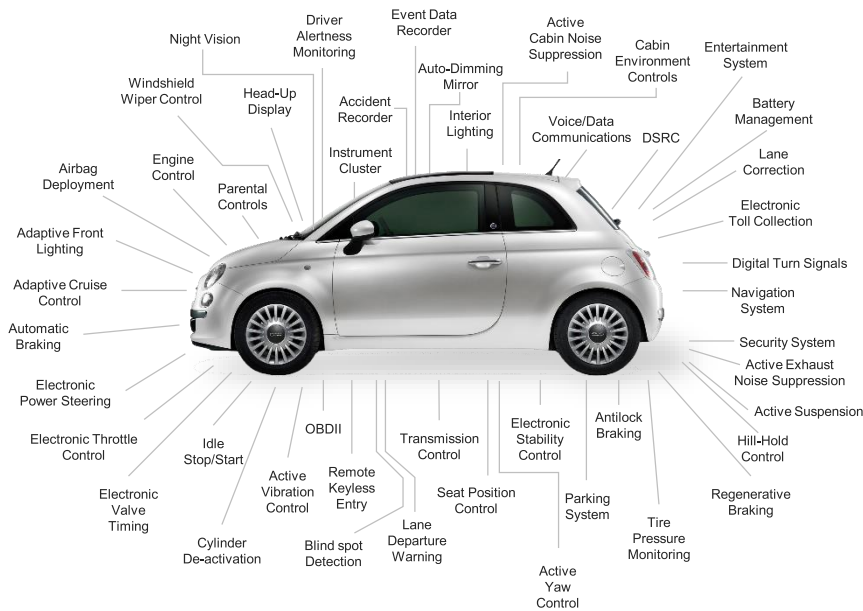
# Product Proposal

[ ESD Protection MLCC ]

## Reduce Circuit Damage by applying ESD Protection MLCC

### Needs

- ESD risk increases Increase of Electronic Part Ratio of Automotive

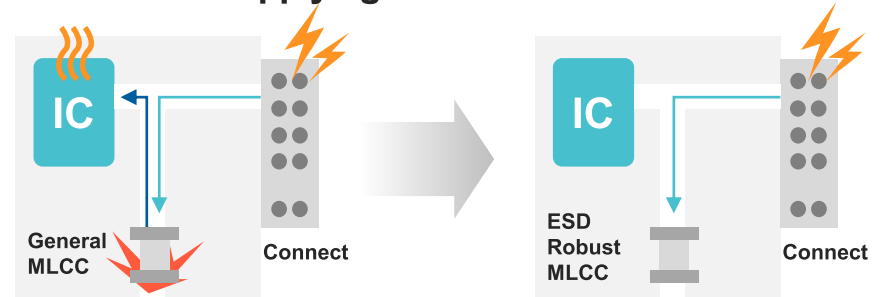


Need to Improve ESD due to increased ECUs

### 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

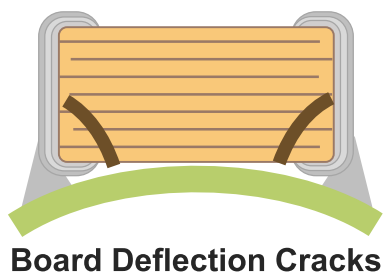
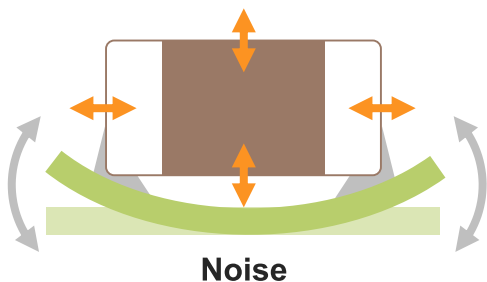
# Product Proposal

[ Molded Frame Capacitor | MFC ]

## Improve Crack and Acoustic Noise by EMC Molding and Improved Metal Terminal

### Needs

- ✓ Issue Mechanical and Thermal Stress
- ✓ Acoustic Noise Issue due to MLCC's Characteristics

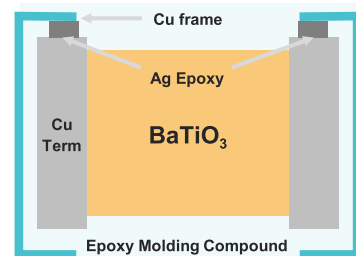


- 1 Cracks from mechanical stress to boards
- 2 Noise from vibration of the capacitors are design issue

### Value

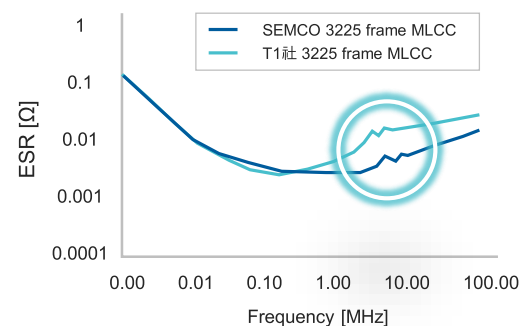
- ✓ Crack, A/Noise better than General MLCC
- ✓ Low ESR compared to Competitors

#### Stress Reduction (Mechanical/Thermal)



- 1 Mechanical Stress absorption by elasticity of Metal Frame
- 2 Thermal Stress absorption by Securing a Gap Between MLCC-Solders

#### Lower ESR (Comparing frame MLCC ESR)



Improved ESR by applying CU-Frame with High Electric Conductivity

- SEMCO : CU-Frame
- Competitor : Ni-Frame

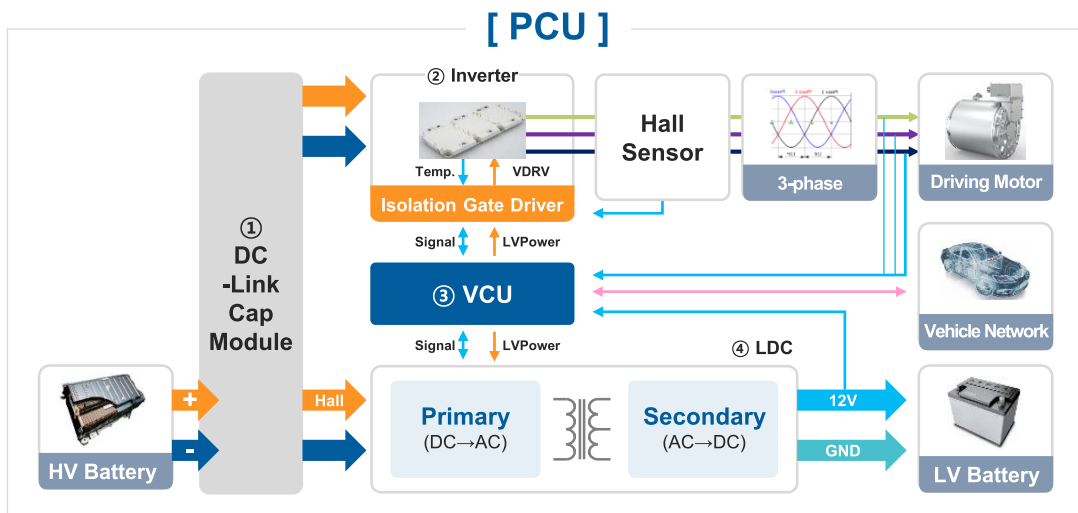


# Case Study

[ Overview | PCU ]

## Power Control Unit

- ✓ Function : Device for supplying energy to the driving motor of a vehicle
- ✓ Trends : High Power, High Efficiency → Application of resonant circuit and WBG power semiconductors



\* Notice : Each company may have different block diagram

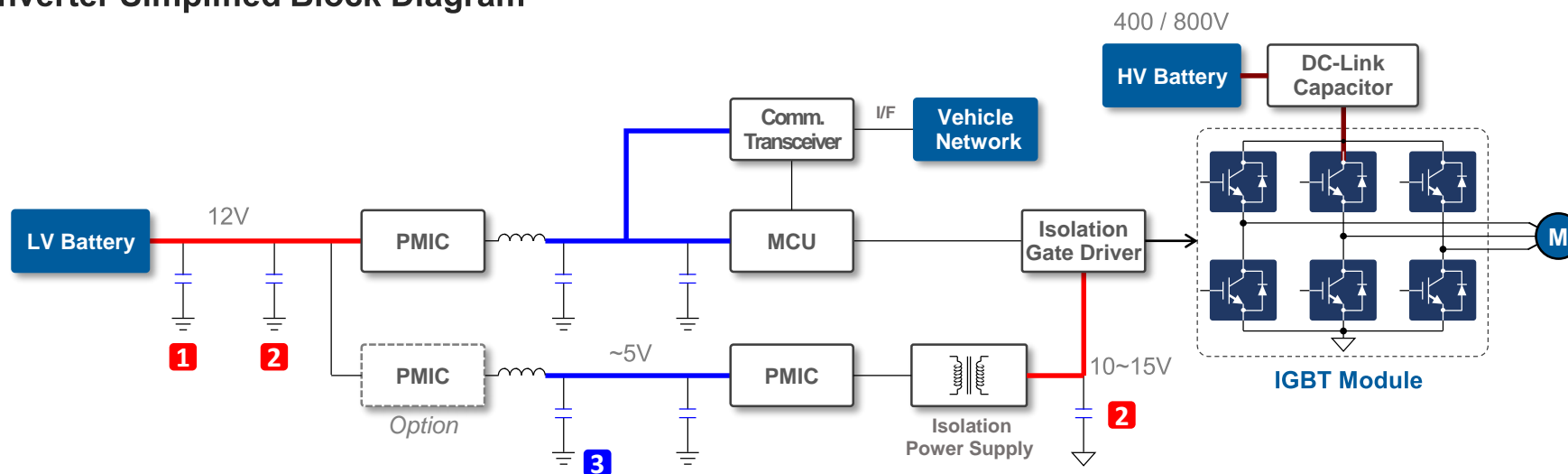
1 DC-Link	2 Inverter (Driver)	3 Control	4 LDC (Low Voltage dc/dc Con)
<ul style="list-style-type: none"> <li>• High-CV (Limited to SiC)</li> </ul>	<ul style="list-style-type: none"> <li>• High-Capacitance</li> <li>• Fail-Safe</li> <li>• Soft-Termination</li> </ul>	<ul style="list-style-type: none"> <li>• High-Capacitance</li> <li>• ESD Strengthen</li> <li>• Soft-Termination</li> </ul>	<ul style="list-style-type: none"> <li>• High-Capacitance</li> <li>• Fail-Safe</li> <li>• Soft-termination</li> <li>• High-Voltage</li> </ul>

# Case Study

[ Motor Inverter ]

## Stabilize the power line of 12V / PMIC blocks → High-Capacitance MLCCs

### Inverter Simplified Block Diagram



\* Notice : Each company may have different circuit designs

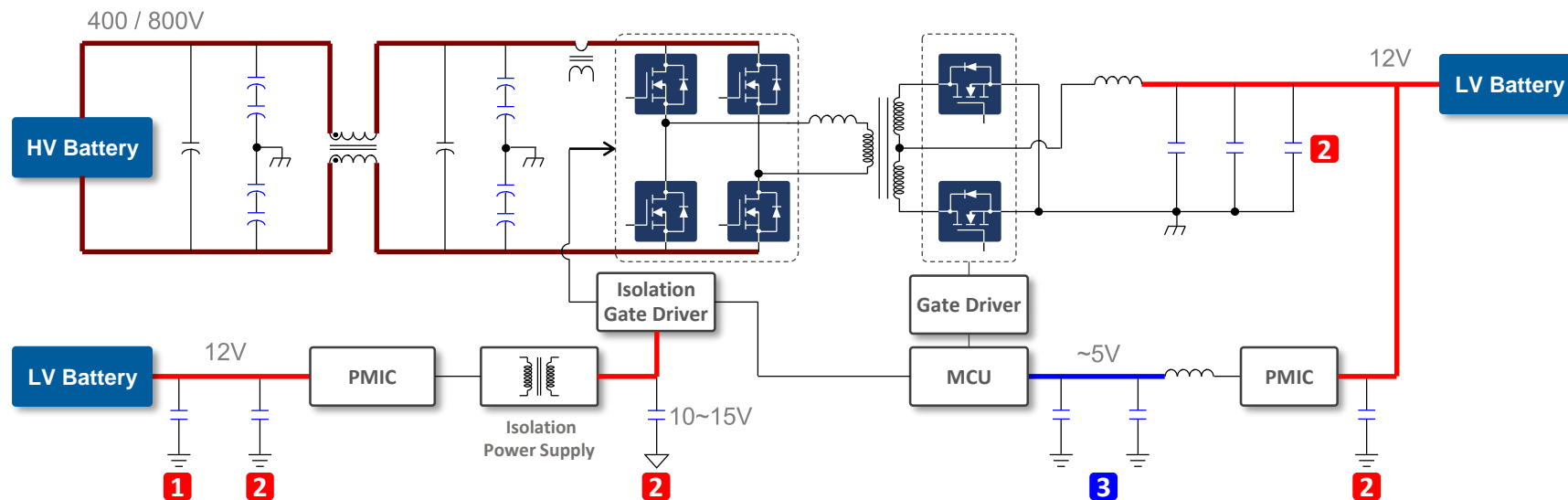
Item	Operating Voltage [V]	PN	Temp	C [uF]	VRating	Size [Inch]	Remark	
MLCC	1	12	21B104KCFXPJ 10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe
	2	12	32Y106KBJVPJ 31Y106KBKVPJ	X7S	10	50	1210/1206	
			32Y106KBJ4PN 31Y106KBKVPN	X7S	10	50	1210/1206	
		10~15	32Y106KBJVPJ 31Y106KBKVPJ	X7S	10	50	1210/1206	
			32Y106KBJ4PN 31Y106KBKVPN	X7S	10	50	1210/1206	
	3	≤5	31B226KPKVPJ	-	X7R	22	10	1206
32Y476MPVVPN 31B226KPKVPN			X7S/X7R	47/22	10	1210/1206		

# Case Study

[ Low Voltage DC/DC Converter ]

## Apply CL31B103KHHVPN to HV Bat. input due to EMI attenuation

### Low Voltage DC/DC Converter Simplified Block Diagram



\* Notice : Each company may have different circuit designs

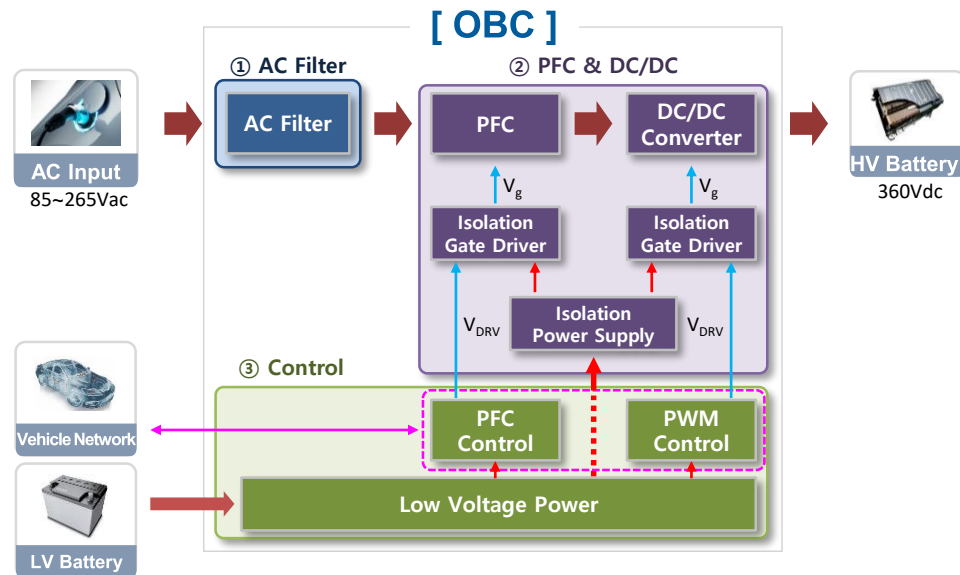
Item	Operating Voltage [V]	PN	Temp	C [uF]	VRating	Size [Inch]	Remark	
MLCC	1	12	21B104KCFXPJ 10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe
	2	12	32Y106KBJVPJ 31Y106KBKVPJ	X7S	10	50	1210/1206	
			32Y106KB4PN 31Y106KBKVPN	X7S	10	50	1210/1206	
		10~15	32Y106KBJVPJ 31Y106KBKVPJ	X7S	10	50	1210/1206	
			32Y106KB4PN 31Y106KBKVPN	X7S	10	50	1210/1206	
	3	≤5	31B226KPKVPJ	-	X7R	22	10	1206
32Y476MPVVPN 31B226KPKVPN			X7S/X7R	47/22	10	1210/1206		

# Case Study

[ Overview | OBC ]

## On Board Charger

- ✓ Function : Built-in system to charge a high voltage battery from AC power outside the car
- ✓ Trends : Reduce charging time (High Power, High Efficiency), Bi-directional charging (Vehicle To Grid)



\* Notice : Each company may have different block diagram

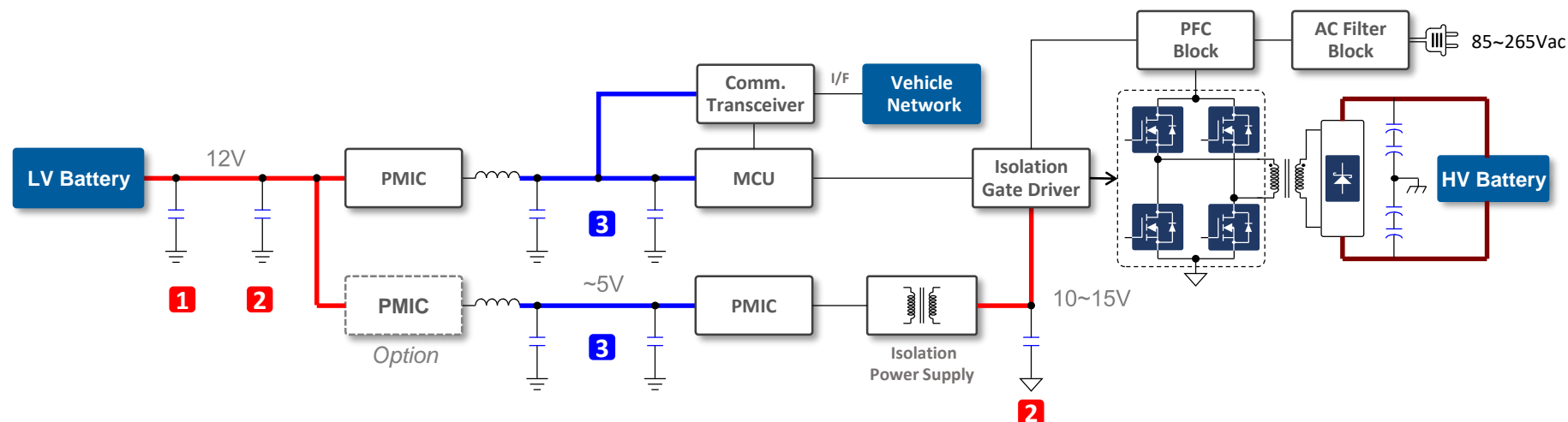
1 AC-Filter	2 PFC & DC/DC	3 Control
<ul style="list-style-type: none"> <li>• High-Voltage</li> <li>• Safety Standard Certification</li> </ul>	<ul style="list-style-type: none"> <li>• High-Capacitance</li> <li>• Fail-Safe</li> <li>• Soft-termination</li> <li>• High-Voltage</li> </ul>	<ul style="list-style-type: none"> <li>• High-Capacitance</li> <li>• ESD Strengthen</li> <li>• Soft-termination</li> </ul>

# Case Study

[ On Board Charger ]

## Stabilize the power line of 12V / PMIC blocks → High-Capacitance MLCCs

### OBC Simplified Block Diagram



\* Notice : Each company may have different circuit designs

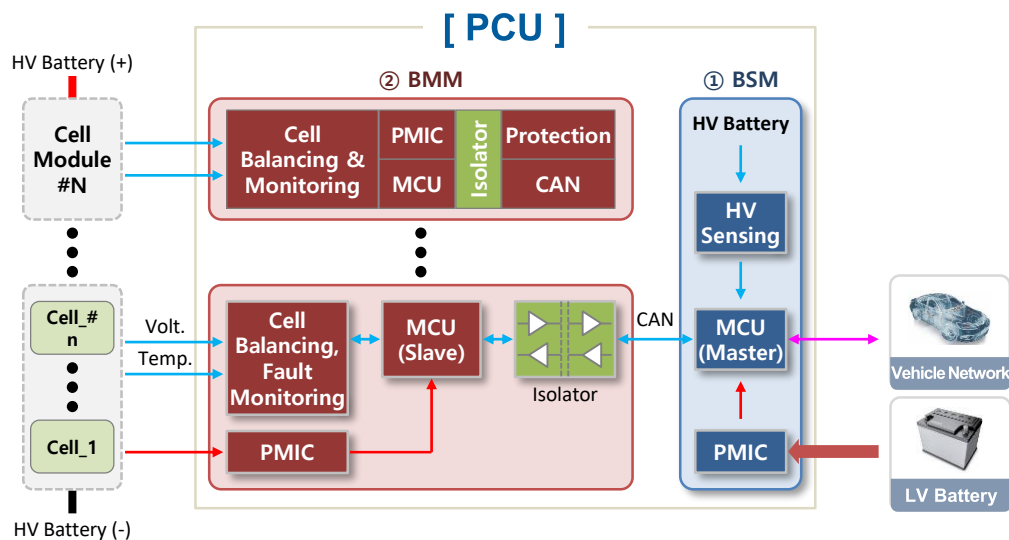
Item	Operating Voltage [V]		PN		Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	1	12	21B104KCFXPJ	10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe
	2	12	32Y106KBJVPJ	31Y106K BKVPJ	X7S	10	50	1210/1206	
			32Y106KBJ4PN	31Y106K BKV PN	X7S	10	50	1210/1206	
	3	≤5	31B226KPKVPJ	-	X7R	22	10	1206	
			32Y476MPVVPN	31B226KPKV PN	X7S/X7R	47/22	10	1210/1206	

# Case Study

## [ Overview | BMS ]

### Battery Management System

- ✓ Function : Monitor and control battery temperature and voltage of each cell
- ✓ Trends : Mileage expansion (High Capacity, High Voltage)



\* Notice : Each company may have different block diagram

#### 1 BSM (Battery System Manager)

- High-Capacitance
- Fail-Safe
- Soft-termination
- High-Voltage

#### 2 BMM (Battery Module Manager)

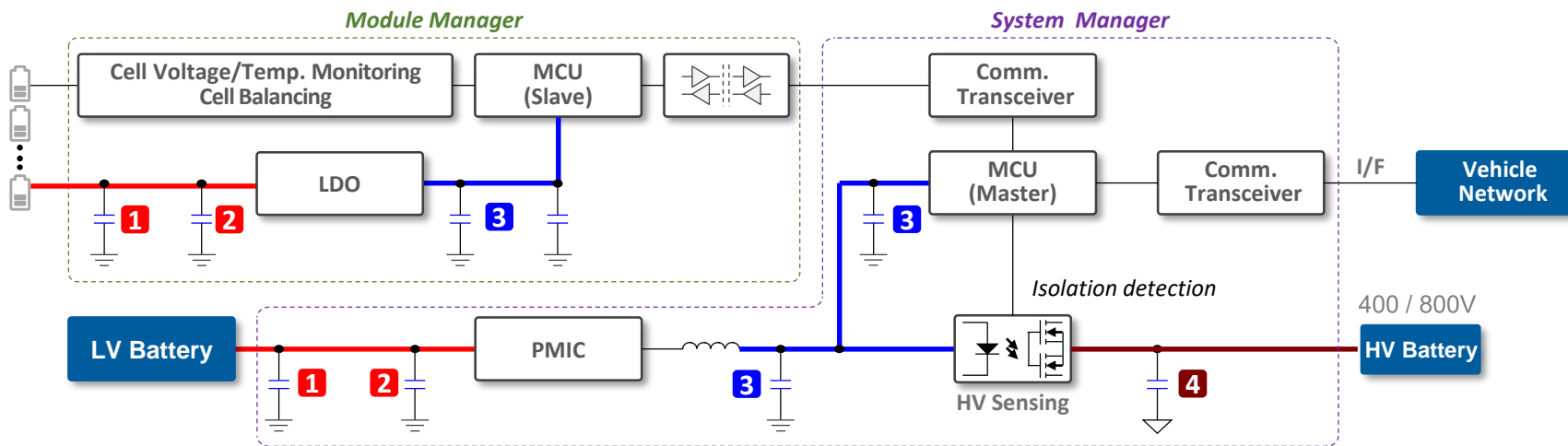
- High-Capacitance
- Fail-Safe
- Soft-termination

# Case Study

## [ Battery Management System ]

### Apply CL31B103KHHVPN to HV Bat. sensing due to EMI attenuation

#### BMS Simplified Block Diagram



\* Notice : Each company may have different circuit designs

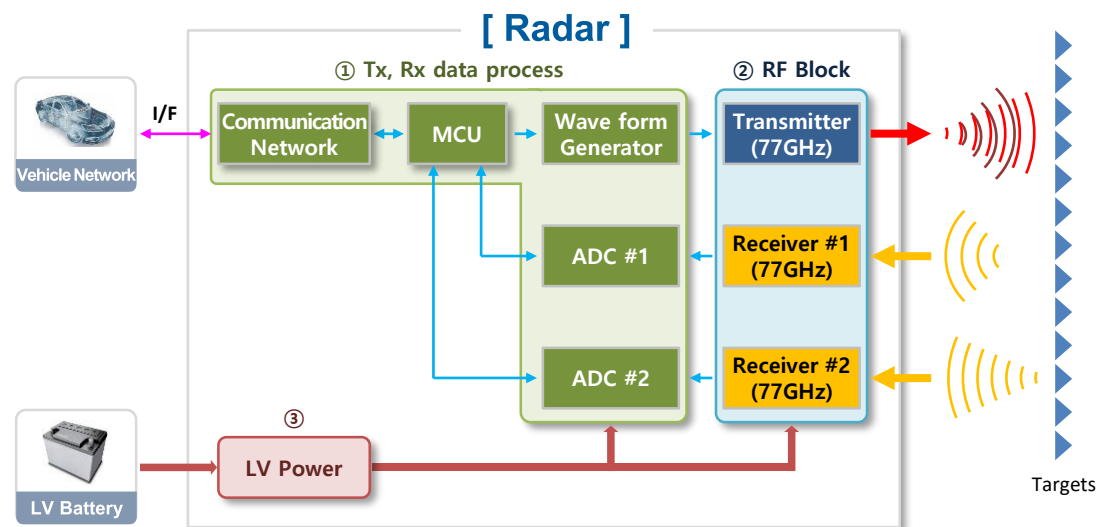
Item	Operating Voltage [V]		PN		Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	<b>1</b>	12	21B104KCFXPJ	10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe
	<b>2</b>	12	32Y106KBJVPJ	31Y106KKBKVPJ	X7S	10	50	1210/1206	
			32Y106KBJ4PN	31Y106KKBKVPN	X7S	10	50	1210/1206	
	<b>3</b>	≤5	31B226KPKVPJ	-	X7R	22	10	1206	
			32Y476MPVVPN	31B226KPKVPN	X7S/X7R	47/22	10	1210/1206	
<b>4</b>	400	31B103KHHVPN	31B332KIHVPN	X7R	0.01/0.0033	630/1000	1206		

# Case Study

[ Overview | SCC(Radar) ]

## Smart Cruise Control (Radar)

- ✓ Function : System to adjust a vehicle speed and to maintain a safe distance from vehicles ahead by radar
- ✓ Trends : 24GHz(Short Range) → 24GHz, 77GHz (Long Range, Antenna size smaller)



\* Notice : Each company may have different block diagram

### 1 Tx, Rx Data Processing

- High-Capacitance
- ESD Strengthen
- Soft-termination

### 2 RF Block

- High-Capacitance
- Soft-termination
- Low-ESL

### 3 Low-Voltage Power

- High-Capacitance
- Fail-Safe
- Soft-termination

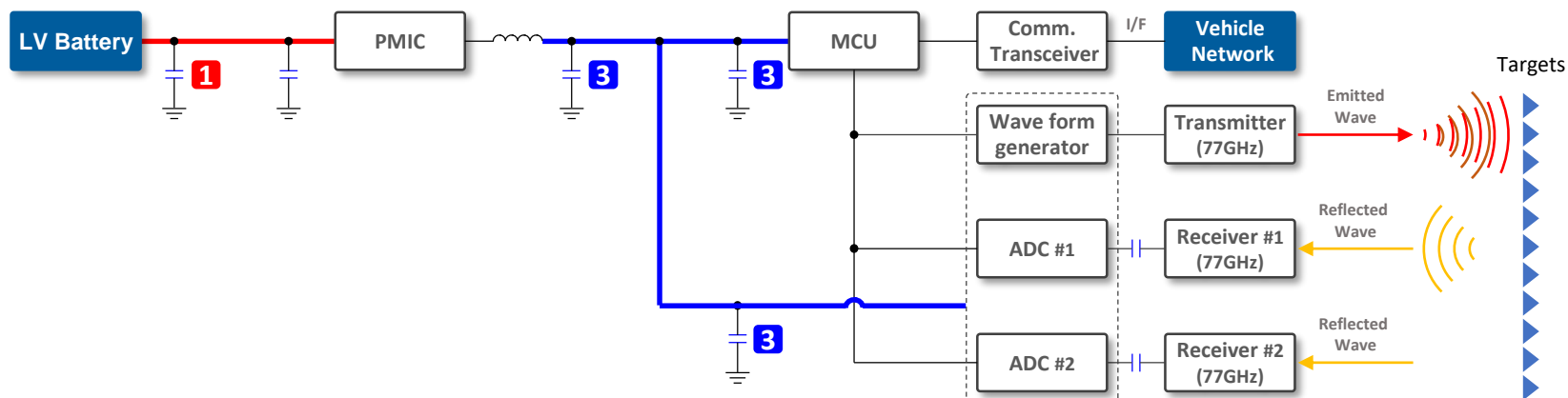


# Case Study

## [ Smart Cruise Control ]

### Stabilize the power line of 12V / PMIC blocks → High-Capacitance MLCCs

#### SCC Simplified Block Diagram



\* Notice : Each company may have different circuit designs

Item	Operating Voltage [V]		PN		Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	1	12	21B104KCFXPJ	10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe
	2	12	32Y106KBJVPJ	31Y106KKBKVPJ	X7S	10	50	1210/1206	
			32Y106KBJ4PN	31Y106KKBKVPN	X7S	10	50	1210/1206	
	3	≤5	31B226KPKVPJ	-	X7R	22	10	1206	
			32Y476MPVVPN	31B226KPKVPN	X7S/X7R	47/22	10	1210/1206	

# Case Study

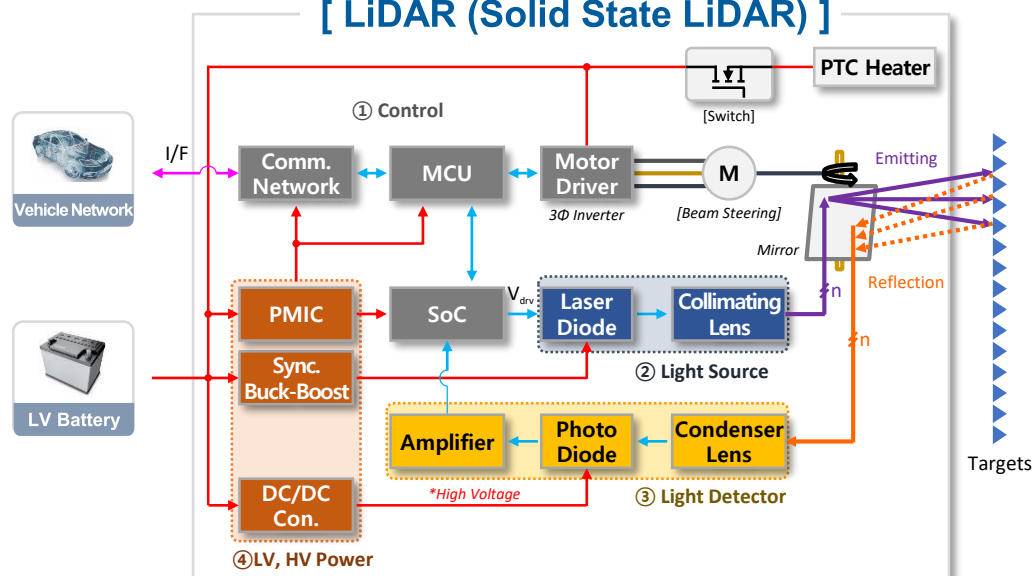
## [ Overview | LiDAR ]

### Light Detection And Ranging

- ✓ Function : Creates 2D&3D images by measuring a distance with laser beam
- ✓ Trends : Low Cost, Size Smaller, Easy to install



[ LiDAR (Solid State LiDAR) ]



\* Notice : Each company may have different block diagram

#### 1 Control

- High-Capacitance
- ESD Strengthen
- Soft-termination

#### 2 Light Source

- High-Capacitance
- Soft-Termination

#### 3 Light Detector

- High-Voltage
- Soft-Termination

#### 4 LV, HV Power

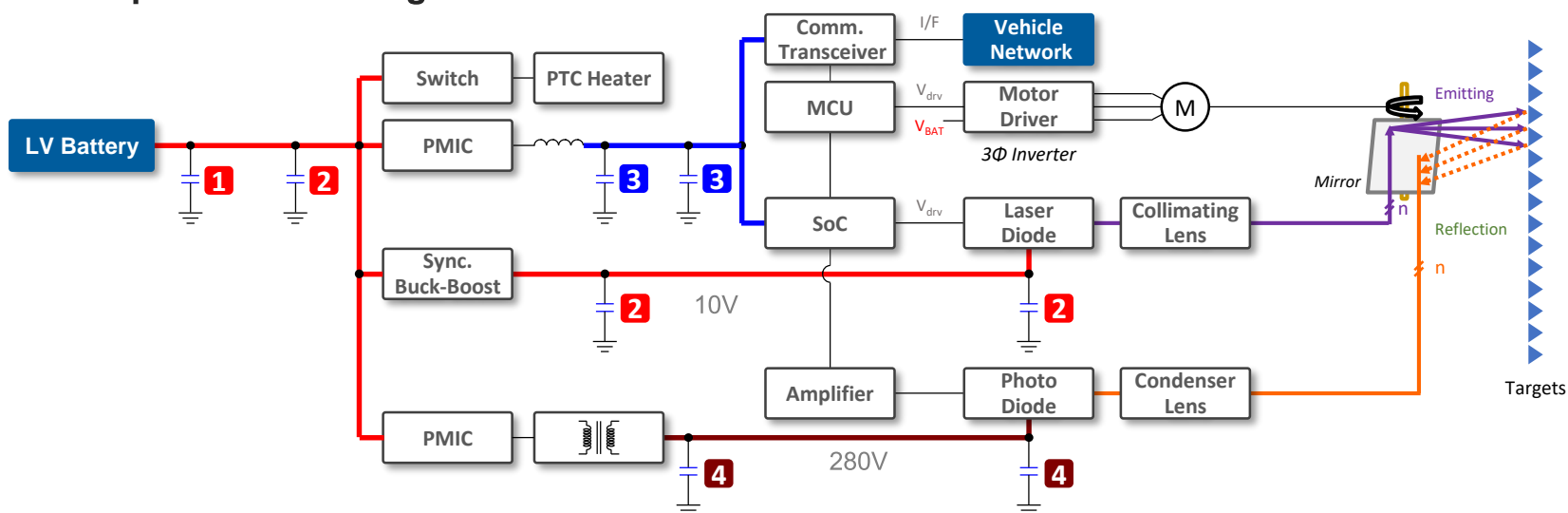
- High-Capacitance
- Fail-Safe
- Soft-termination
- High-Voltage

# Case Study

## [ Light Detection And Ranging ]

### Stabilize the power line of 12V / PMIC blocks → High-Capacitance MLCCs

#### LiDAR Simplified Block Diagram



\* Notice : Each company may have different circuit designs

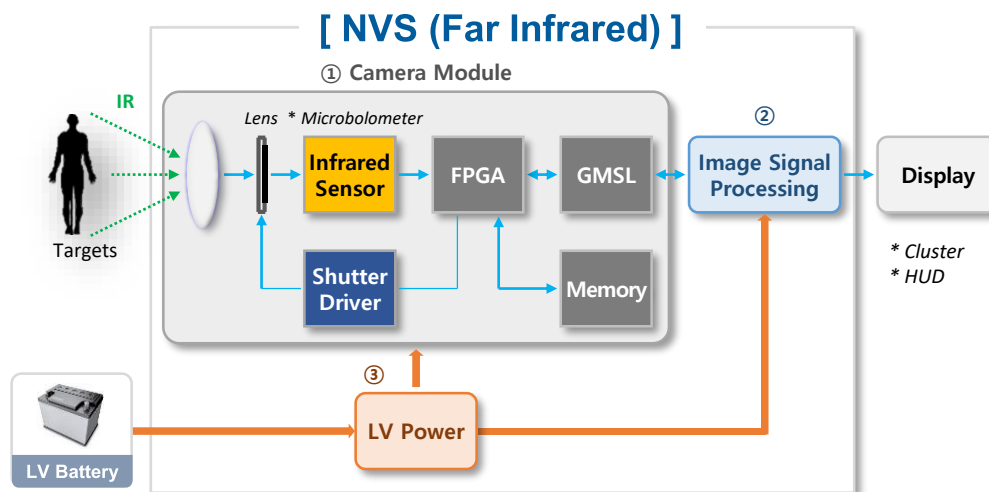
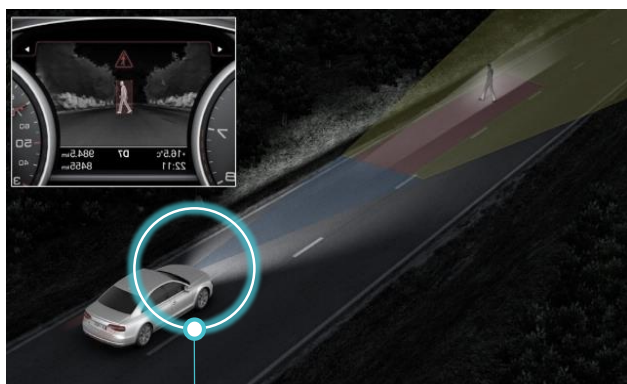
Item	Operating Voltage [V]	PN	Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	1	21B104KCFXPJ 10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe
	2	32Y106KBJVPJ 31Y106KKBKVPJ	X7S	10	50	1210/1206	
		32Y106KBJ4PN 31Y106KKBKVPN	X7S	10	50	1210/1206	
	3	32Y226KAVVVPN 21Y475KABVPN	X7S	22 / 4.7	25 / 25	1210 / 0805	
		31B226KPKVPJ -	X7R	22	10	1206	
4	32Y476MPVVPN 31B226KPKVPN	X7S/X7R	47/22	10	1210/1206		
	280	31B103KHHVPN -	X7R	0.01	630	1206	

# Case Study

[ Overview | NVS ]

## Night Vision System

- ✓ Function : To take greater care of driver's view at night by proving reliable visual information by infrared
- ✓ Trends : Low Cost, High Resolution



\* Notice : Each company may have different block diagram

### 1 Camera Module

- High-Capacitance
- ESD Strengthen
- Soft-termination

### 2 Image Signal Processing

- High-Capacitance
- Soft-termination
- Soft-termination

### 3 Low-Voltage Power

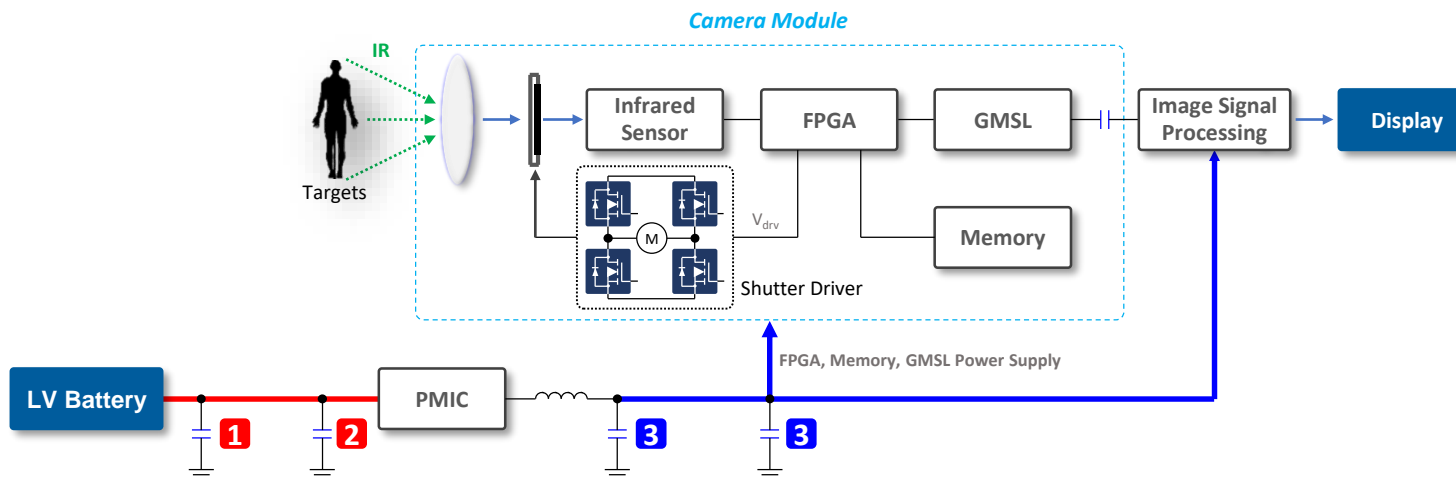
- High-Capacitance
- Fail-Safe
- Soft-termination

# Case Study

## [ Night Vision System ]

### Stabilize the power line of 12V / PMIC blocks → High-Capacitance MLCCs

#### | NVS Simplified Block Diagram



\* Notice : Each company may have different circuit designs

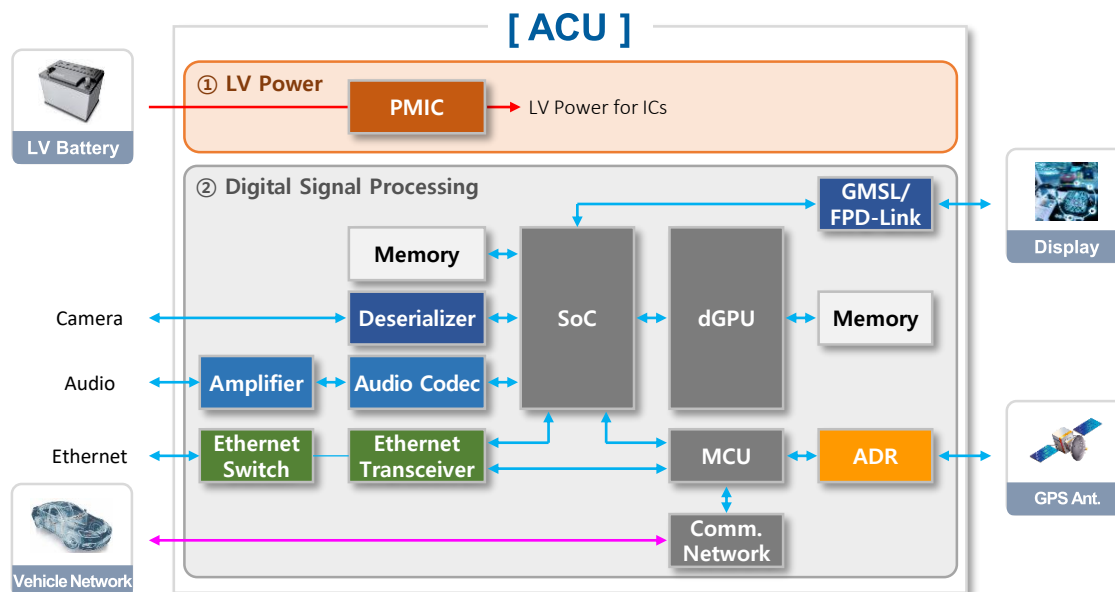
Item	Operating Voltage [V]	PN	Temp	C [uF]	VRating	Size [Inch]	Remark	
MLCC	1	12	21B104KCFXPJ 10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe
	2	12	32Y106KBJVPJ 31Y106KKBKVPJ	X7S	10	50	1210/1206	
			32Y106KBJ4PN 31Y106KKBKVPN	X7S	10	50	1210/1206	
	3	≤5	31B226KPKVPJ -	X7R	22	10	1206	
			32Y476MPVVPN 31B226KPKVPN	X7S/X7R	47/22	10	1210/1206	

# Case Study

[ Overview | ACU ]

## Automated-driving Control Unit

- ✓ Function : Analyze a big data on sensors, Autonomously performs route navigation, control and driving
- ✓ Trends : Increasing of sensors and High-performance ICs (High frequency, High power)



\* Notice : Each company may have different block diagram

### 1 Low-Voltage Power

- High-Capacitance
- Fail-Safe
- Soft-termination

### 2 Digital Signal Processing

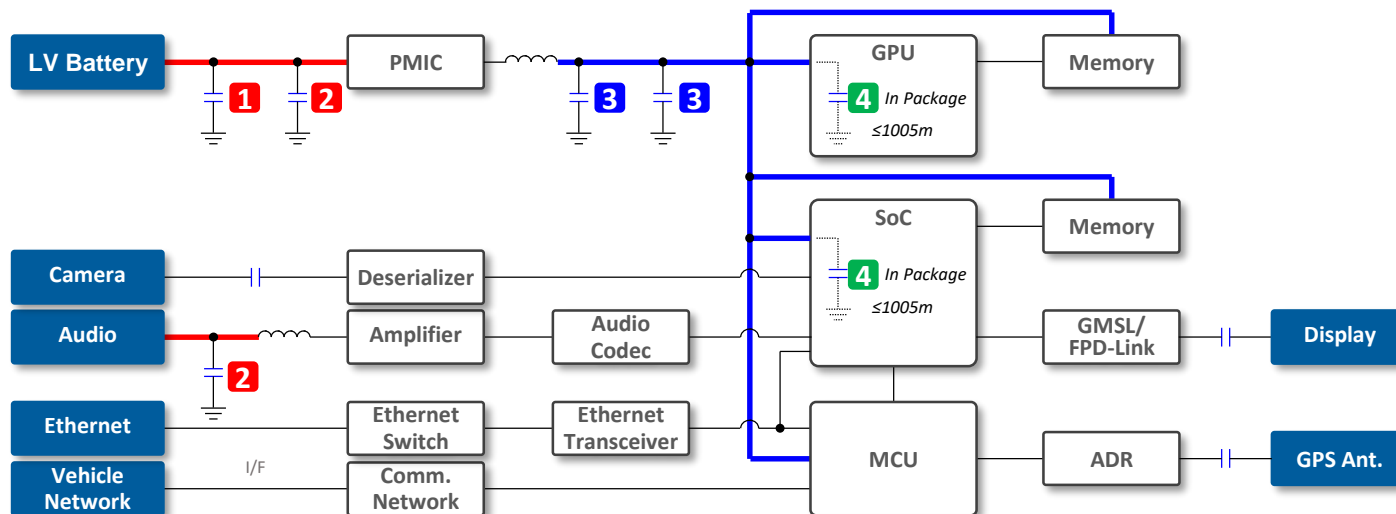
- High-Capacitance
- ESD Strengthen
- Soft-termination

# Case Study

## [ Automated-driving Control Unit ]

CL05Y105KP6VPN is recommended due to power supply stabilization of GPU & SoC

### | ACU Simplified Block Diagram



\* Notice : Each company may have different circuit designs

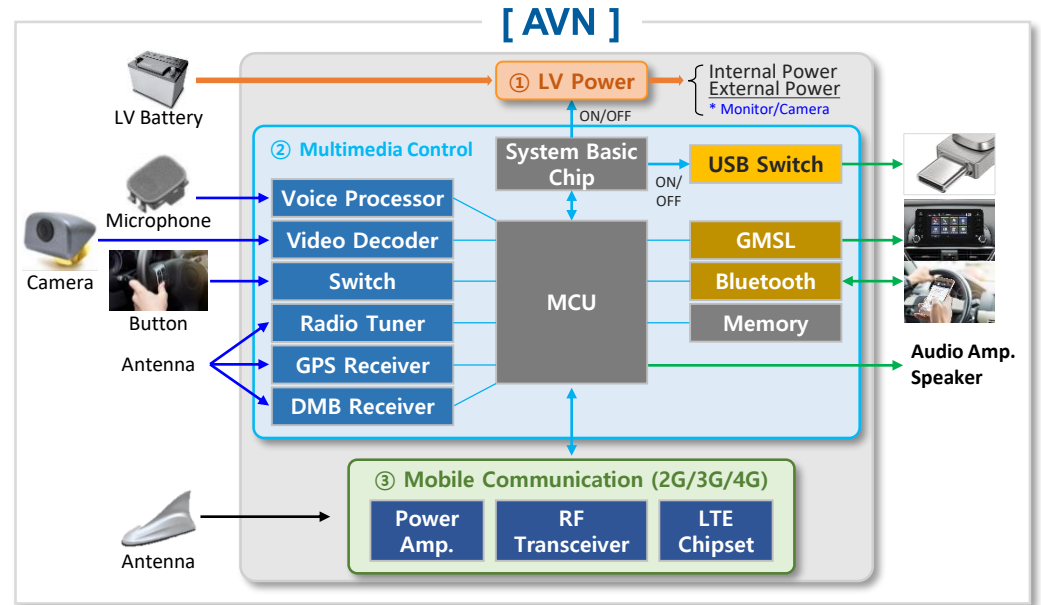
Item	Operating Voltage [V]	PN	Temp	C [uF]	VRating	Size [Inch]	Remark		
MLCC	1	12	21B104KCFXPJ 10B104KC8VPJ	X7R	0.1	100	0805/0603	Fail-Safe	
	2	12	32Y106KBJVPJ 31Y106KKBKVPJ	X7S	10	50	1210/1206		
			32Y106KBJ4PN 31Y106KKBKVPN	X7S	10	50	1210/1206		
	3	≤5	31B226KPKVPJ	-	X7R	22	10	1206	
			32Y476MPVVPN 31B226KPKVPN	X7S/X7R	47/22	10	1210/1206		
	4	≤5	05Y105KP6VPN	-	X7S	100	10	0402	
05B104KP5VPN			-	X7R	0.1	10	0402		

# Case Study

## [ Overview | Head Unit (AVN) ]

### Head Unit (for AVN, Audio-Video-Navigation)

- ✓ **Function** : Main control system of AVN to interface with peripheral devices according to user commands
- ✓ **Trends** : Multifunctional and Communication, High performance, Increased convenience (Touch)



#### 1 LV Power

- High-Capacitance
- Fail Safe
- Soft-termination

#### 2 Multimedia Control

- High-Capacitance
- ESD Strengthen
- Soft-termination

#### 3 Mobil Communication

- High-Capacitance
- ESD Strengthen
- Soft-termination

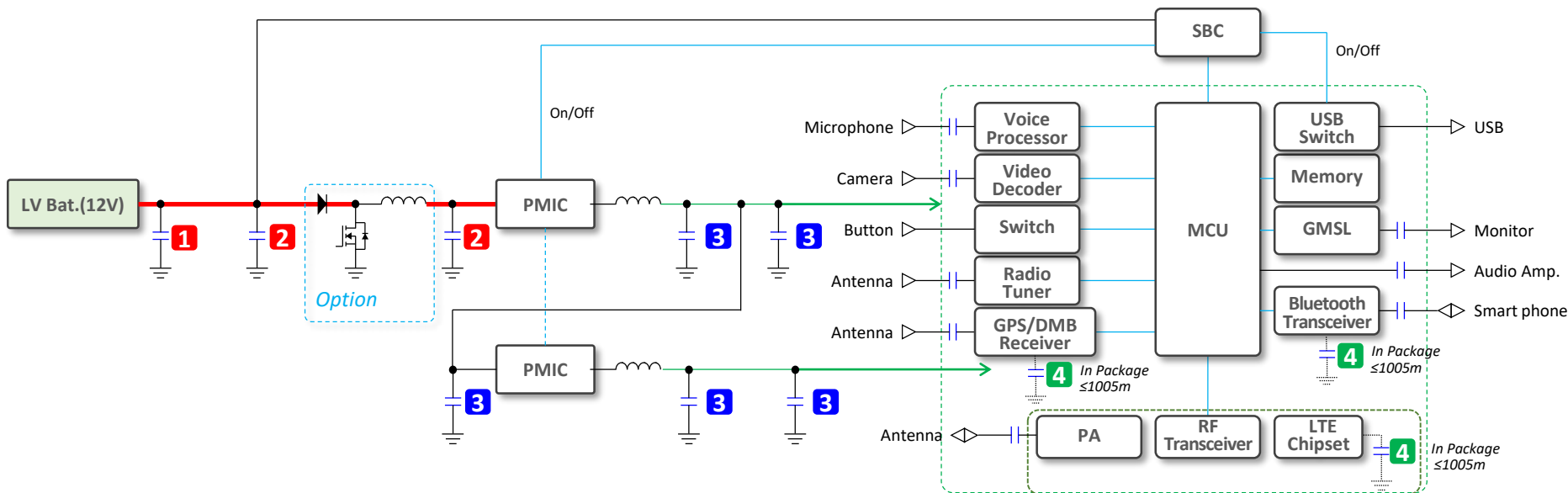


# Case Study

[ Head Unit (AVN) ]

X6S MLCC is recommended to be used for LTE Module, GPS/DMB Receiver module

## AVN Simplified Block Diagram



\* Notice : Each company may have different circuit designs

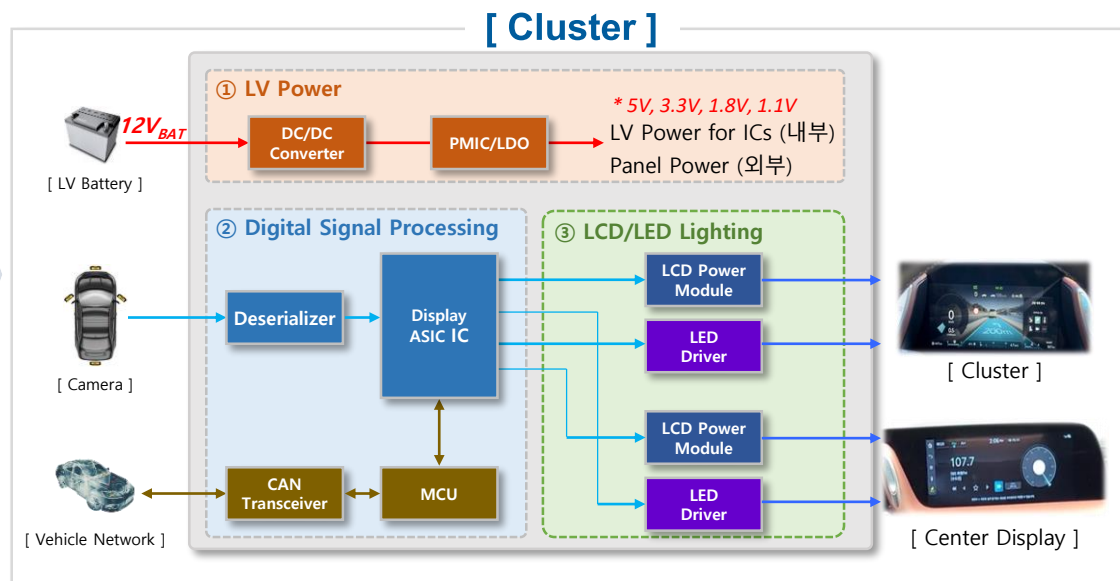
Item	Operating Voltage [V]	PN	Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	1	21B104KKCFWPJ 10B104KC8VPJ	X7R	0.1	100	0805/0603	Open-Mode
	2	32B106KBVVPL 32B106KBVVPO	X7R	10	50	1210	
		32Y106KCJ6PJ 31Y106KBKVPJ	X7S	10	50	1210/1206	
	3	31B226MQKVPN 21Z226MQYVPN	X7R/X7T	22	6.3	1206/0805	
		21B106KQY6PJ 10Z106MQ9VPJ	X7R/X7T	10	6.3	0805/0603	
	4	10Z106MQ9VPN 10X106MQ91IN	X7T/X6S	10	4/6.3	0603	
	≤5	10Y475KQ96PN 05X475MQQ1IN	X7S/X6S	4.7	6.3	0603/0402	

# Case Study

[ Overview | Cluster ]

## Cluster

- ✓ Function: Display information such as Car condition, Driving Assist, Navigation, Camera, Etc.
- ✓ Trends : Digitization, Integration(Cluster + Center Monitor), Wide Screen



### 1 LV Power

- High-Capacitance
- Fail Safe
- Soft-termination

### 2 Digital Signal Processing

- High-Capacitance
- ESD Strengthen
- Soft-termination

### 3 LCD/LED Lighting

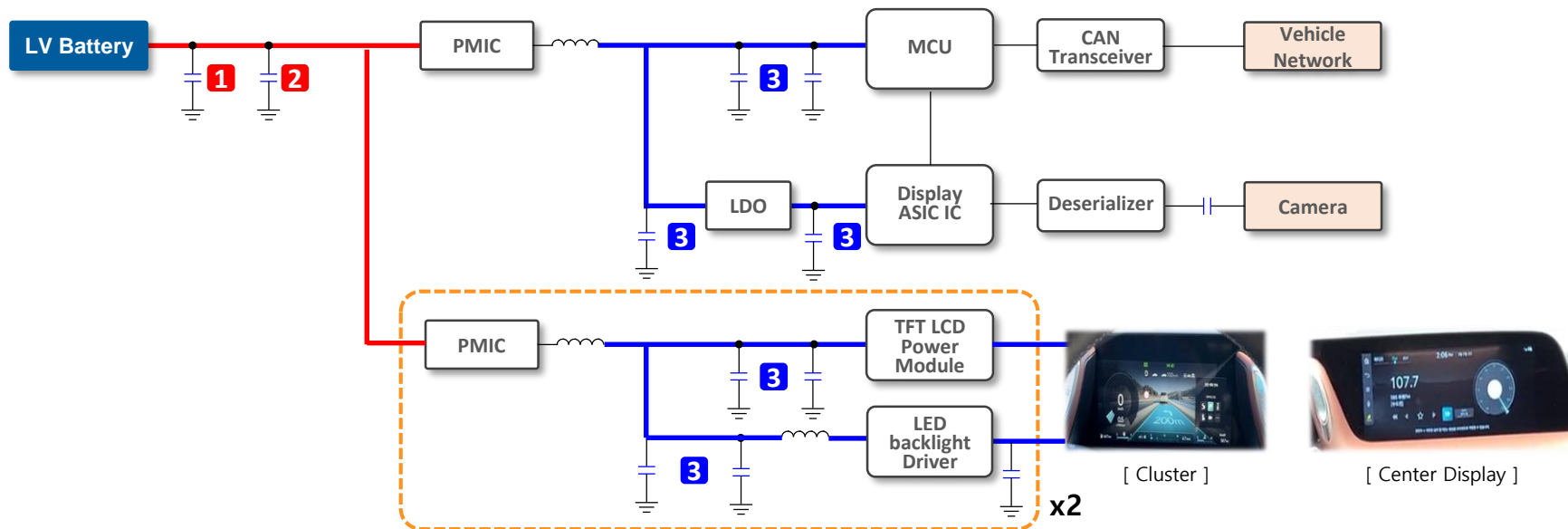
- High-Capacitance
- ESD Strengthen
- Soft-termination

# Case Study

## [ Connected Car Integrated Cockpit ]

### Stabilize the power line of 12V / PMIC blocks → High-Capacitance MLCCs

#### CCIC(Cluster + Center Display) Simplified Block Diagram



\* Notice : Each company may have different circuit designs

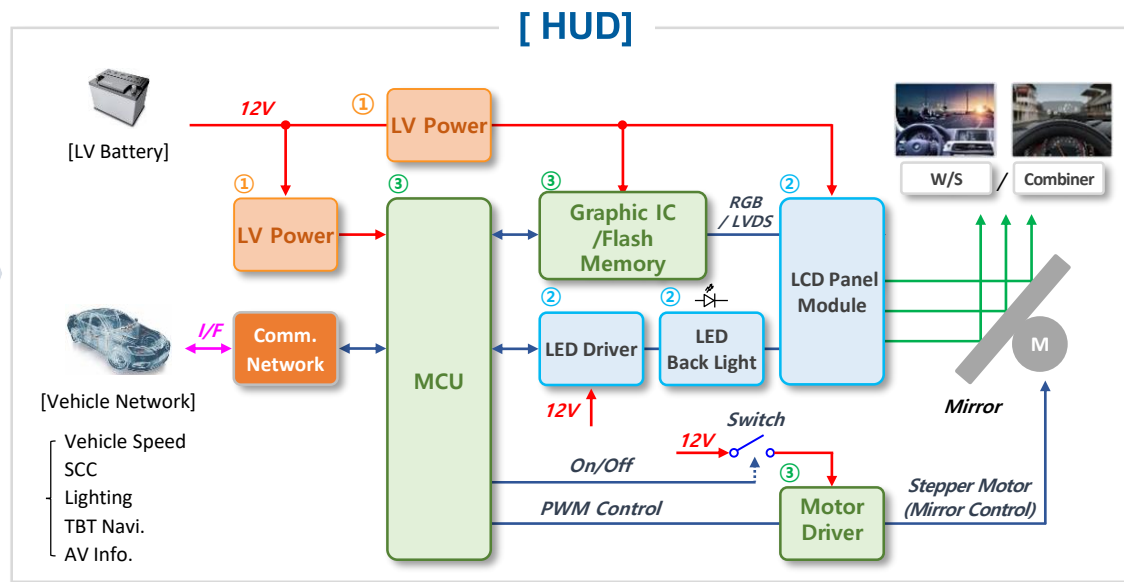
Item	Operating Voltage [V]		PN		Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	1	12	21B104KKCFWPJ	10B104KC8VPJ	X7R	0.1	100	0805/0603	Open-Mode
	2	12	32B106KBVVPL	32B106KBVVPO	X7R	10	50	1210	
			32Y106KCJ6PJ	31Y106KBKVPJ	X7S	10	50	1210/1206	
	3	≤5	31B226MQKVPN	21Z226MQYVPN	X7R/X7T	22	6.3	1206/0805	
			21B106KQY6PJ	10Z106MQ9VPJ	X7R/X7T	10	6.3	0805/0603	

# Case Study

## [ Overview | HUD ]

### HUD (Head Up Display)

- ✓ **Function** : A device that displays information necessary for driving the vehicle in front of the driver
- ✓ **Trends** : Expansion of the Premium → Economy vehicles, Tech. advancement to AR HUD



#### 1 LV Power

- High-Capacitance
- Fail Safe
- Soft-termination

#### 2 LCD Display Block

- High-Capacitance
- ESD Strengthen
- Soft-termination

#### 3 HUD Control Block

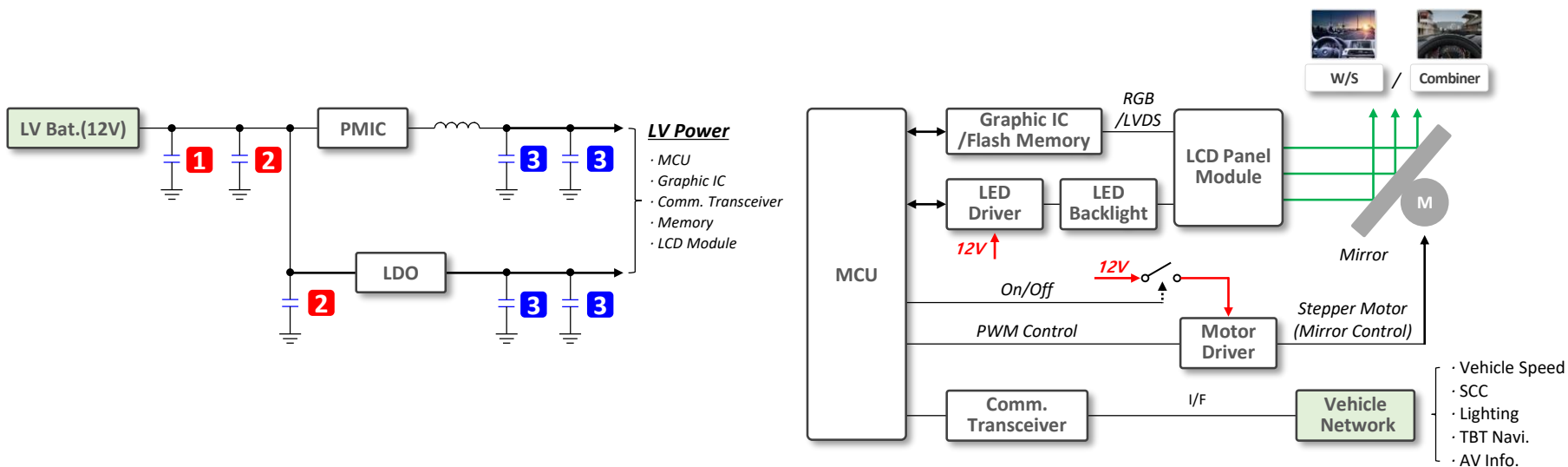
- High-Capacitance
- ESD Strengthen
- Soft-termination

# Case Study

[ Head Up Display ]

## Stabilize the power line of 12V / PMIC blocks → High-Capacitance MLCCs

### HUD Simplified Block Diagram



\* Notice : Each company may have different circuit designs

Item	Operating Voltage [V]		PN		Temp	C [uF]	VRating	Size [Inch]	Remark
MLCC	1	12	21B104KKCFWPJ	10B104KC8VPJ	X7R	0.1	100	0805/0603	Open-Mode
	2	12	32B106KBVVPL	32B106KBVVPO	X7R	10	50	1210	
			32Y106KCJ6PJ	31Y106KBKVPJ	X7S	10	50	1210/1206	
	3	≤5	31B226MQKVPN	21Z226MQYVPN	X7R/X7T	22	6.3	1206/0805	
			21B106KQY6PJ	10Z106MQ9VPJ	X7R/X7T	10	6.3	0805/0603	

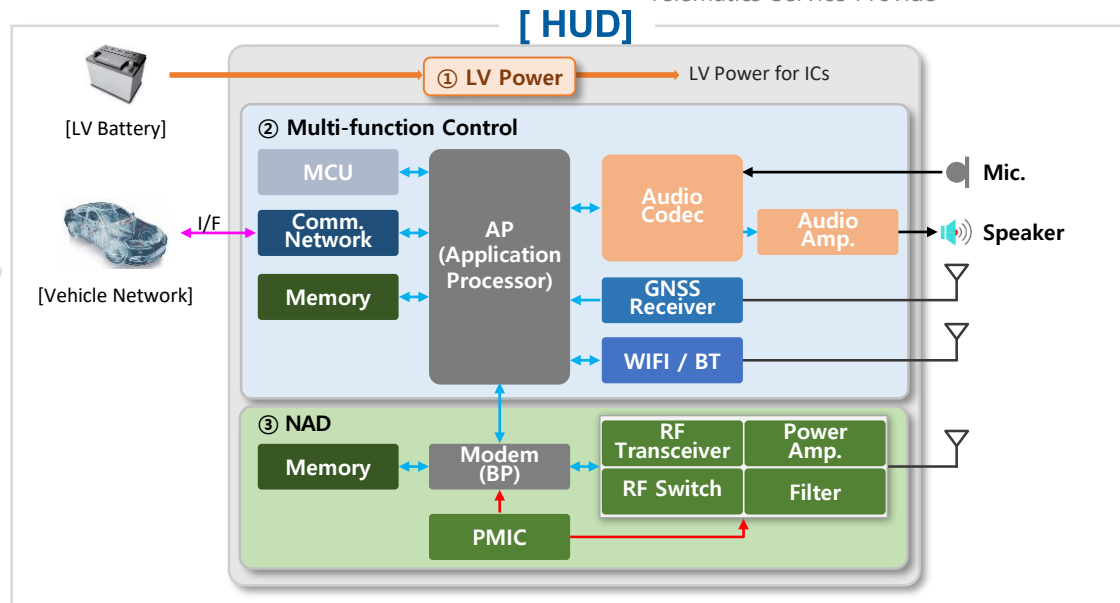
# Case Study

[ Overview | TCU ]

## TCU (Telematics Control Unit)

- ✓ **Function** : Provides wireless data services combining Telecommunication and Informatics
- ✓ **Trends** : Increasing proportion of car manufacturers (Before Market), Various TSP service contents

\* Telematics Service Provide



### 1 LV Power

- High-Capacitance
- Fail Safe
- Soft-termination

### 2 Multi-function Control

- High-Capacitance
- ESD Strengthen
- Soft-termination

### 3 NAD

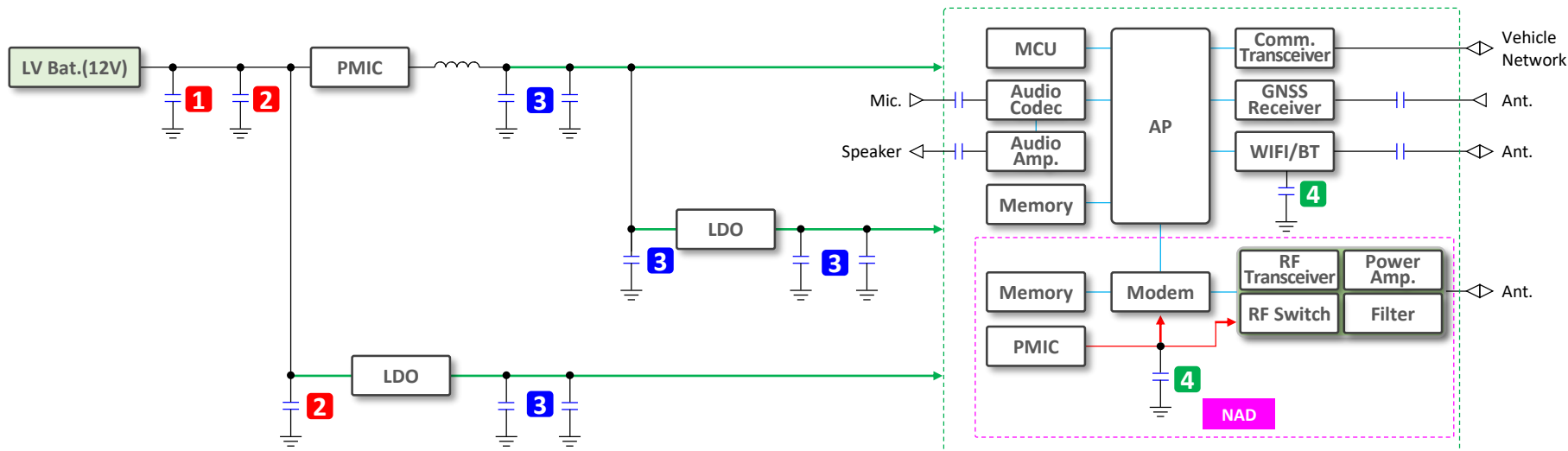
- High-Capacitance
- ESD Strengthen
- Soft-termination

# Case Study

[ Telematics Control Unit ]

## X6S MLCC is recommended to be used for NAD, GNSS, WIFI/BT Receiver module

### TCU Simplified Block Diagram



\* Notice : Each company may have different circuit designs

Item	Operating Voltage [V]	PN	Temp	C [uF]	VRating	Size [Inch]	Remark	
MLCC	1	12	21B104KKCFWPJ 10B104KC8VPJ	X7R	0.1	100	0805/0603	Open-Mode
	2	12	32B106KBVVPL 32B106KBVVPO	X7R	10	50	1210	
			32Y106KCJ6PJ 31Y106KBKVPJ	X7S	10	50	1210/1206	
	3	≤5	31B226MQKVPN 21Z226MQYVPN	X7R/X7T	22	6.3	1206/0805	
			21B106KQY6PJ 10Z106MQ9VPJ	X7R/X7T	10	6.3	0805/0603	
	4	≤5	10Z106MQ9VPN 10X106MQ91IN	X7T/X6S	10	4/6.3	0603	
10Y475KQ96PN 05X475MQQ1IN			X7S/X6S	4.7	6.3	0603/0402		

# Case Study

[ Application of X7S 100V MLCC ]

## X7S 100V-Rated Voltage Lineup & Development Plan

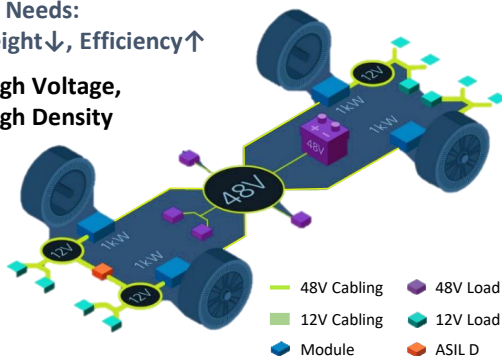
Size	RV	Capacitance						Remark
		220nF	470nF	1uF	2.2uF	4.7uF	10uF	
1608	100V	'24.06						<div style="background-color: #00AEEF; color: white; padding: 5px; text-align: center;">Mass Production</div> <div style="background-color: #D9D9D9; color: black; padding: 5px; text-align: center;">Under Development</div>
2012	100V							
3216	100V					'24.03		
3225	100V							

## 48V E/E Architecture

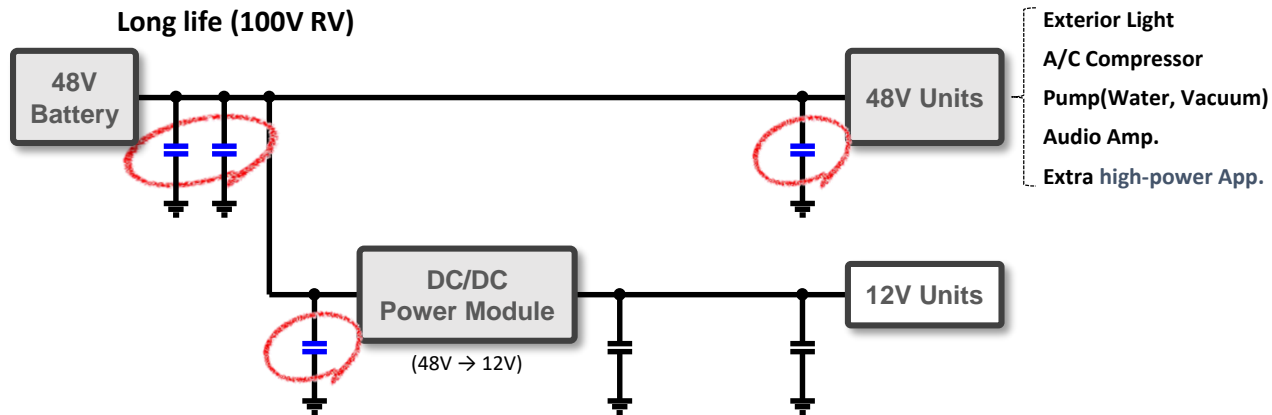
Electric and electronic

Set Needs:  
Weight↓, Efficiency↑

High Voltage,  
High Density



- ✓ Set benefits : Miniaturization (Qty Used↓),  
Strong against PCB banding (Soft Termination),  
Long life (100V RV)





# Case Study

Low Voltage DC-DC Converter

## 48V MHEV LDC

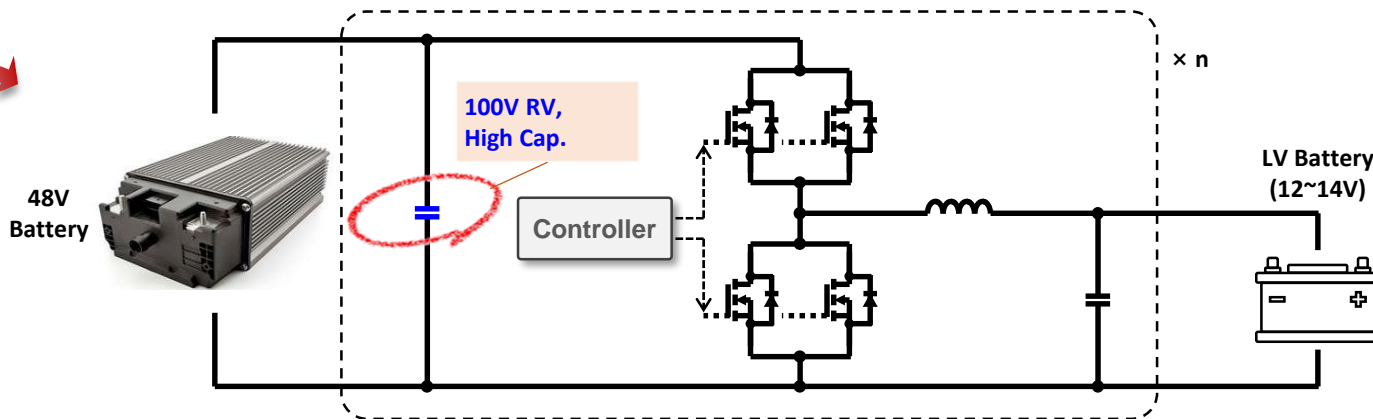
Mild hybrid Electric Vehicle

✔ Set benefits : Miniaturization, Long life

48V DC/DC Converter



Set Needs: Size↓, Efficiency↑  
High Frequency,  
High Density



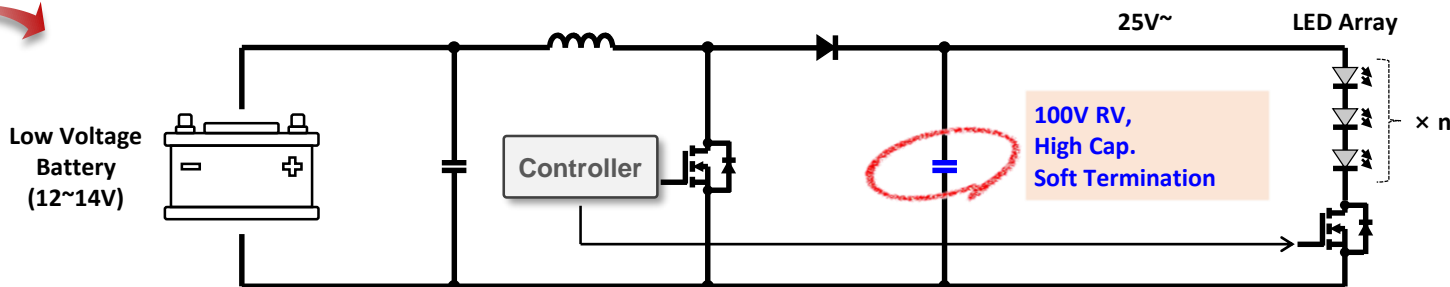
## LED Lighting

Head Lamp [High/Low Beam]



Set Needs: Size↓, Reliability↑  
High Density, Anti-Crack,  
High Temperature,

✔ Set benefits : Miniaturization, Long life, Strong against PCB banding



# THANK YOU

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