

NXP's xEV Energy Management Solutions

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SECURE CONNECTIONS
FOR A SMARTER WORLD

Agenda

- Market forces in xEV market
- xEV architectures
- NXP xEV system solutions





Market Forces

What is driving the shift towards electrification?

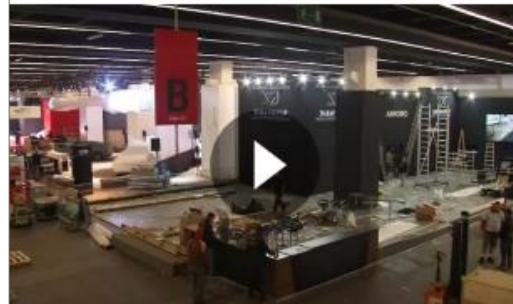
Car Makers' Announcements vs. Legal Action

Daimler announces \$1.8 billion investment to produce Mercedes EQ-branded electric vehicles in China | Electrek

- Feb. 26th 2018 1:08 pm ET



© 12 September 2017 at 1:15 AM MESZ
Volkswagen spends billions more on electric cars in search for mass market



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France set to ban sale of petrol and diesel vehicles by 2040
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Ford plans \$11 billion investment, 40 electrified vehicles by 2022



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Volvo Cars + Add to myFT
Volvo to use electric motors in all cars from 2019

Carmaker calls time on vehicles powered solely by an internal combustion engine



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New diesel and petrol vehicles to be banned from 2040 in UK



German court rules cities can ban diesel cars to tackle pollution | World news | The Guardian

Tue 27 Feb 2018 11.34 EST

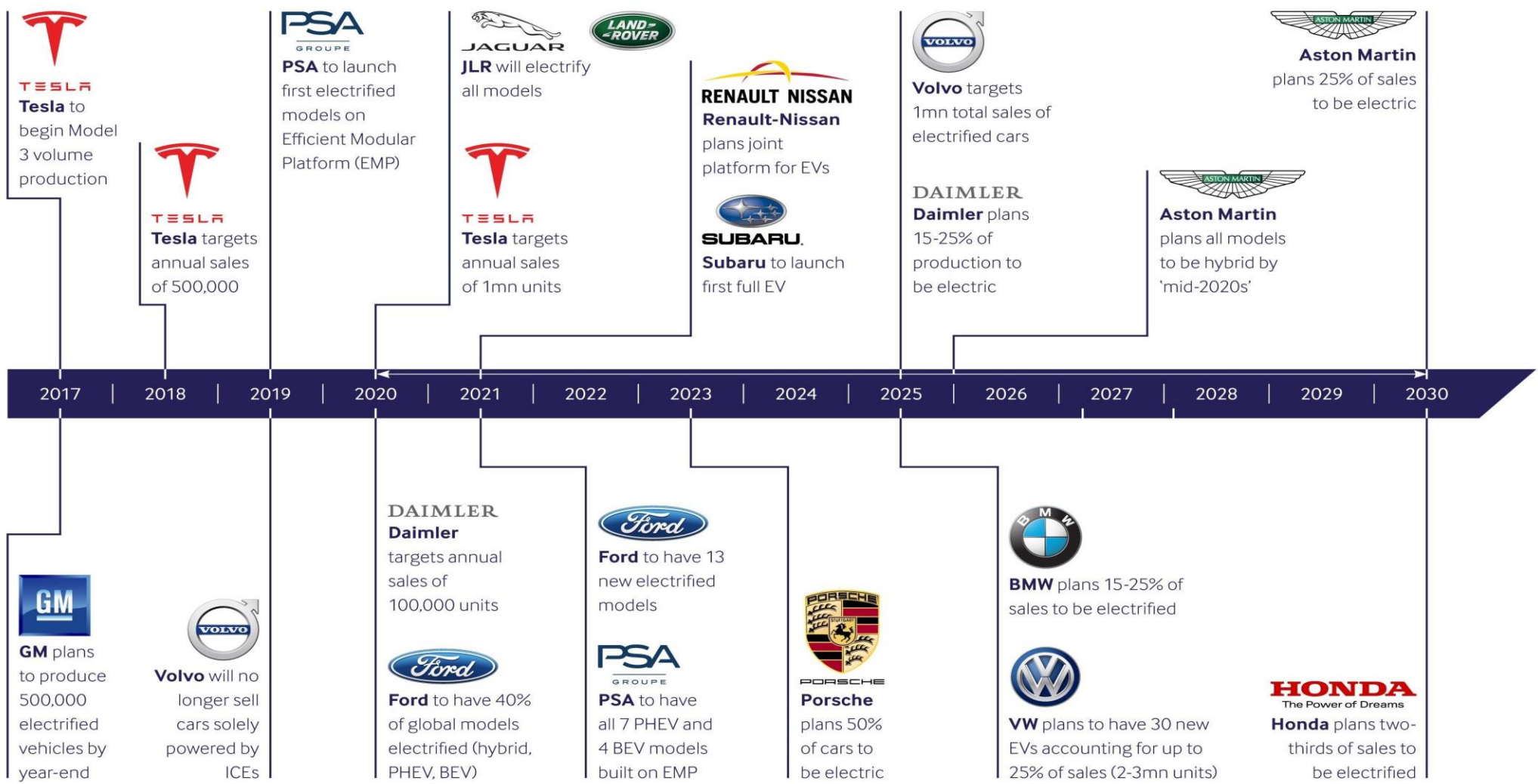


Millions of heavily polluting vehicles could eventually disappear from roads across Germany after its top administrative court ruled that cities have the right to ban diesel motors in an effort to improve deadly air quality levels.

Electric Vehicle Timeline

Electric Vehicle Timeline

BMI Research
A FitchGroup Company



source: <https://www.linkedin.com/pulse/bmi-research-electric-vehicle-timeline-james-damilatis>



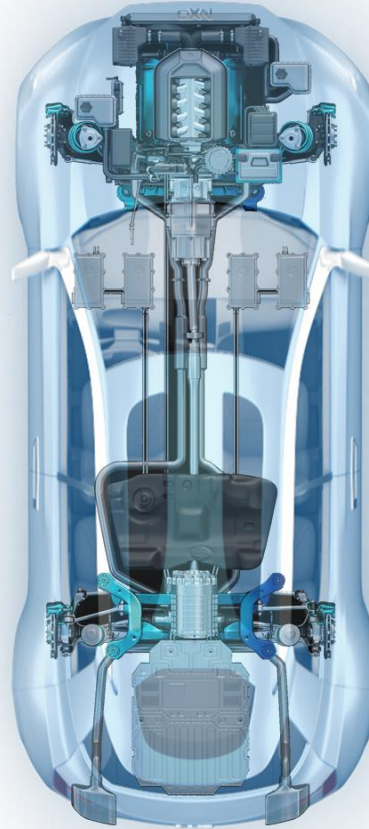
xEV Architectures



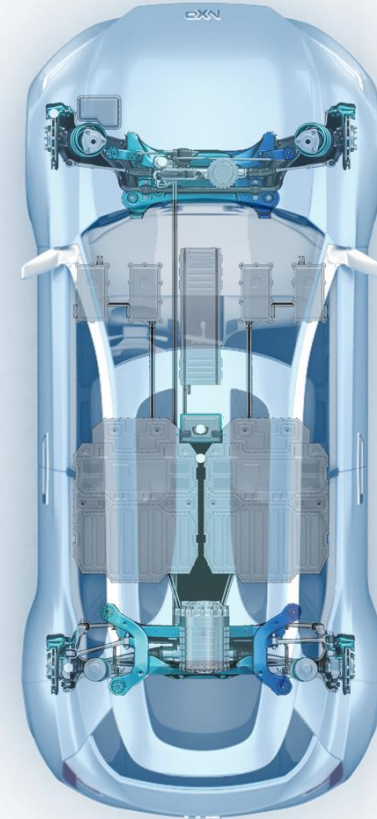
Fundamental Architecture Options



Internal Combustion Engine
Powertrain
(ICE)

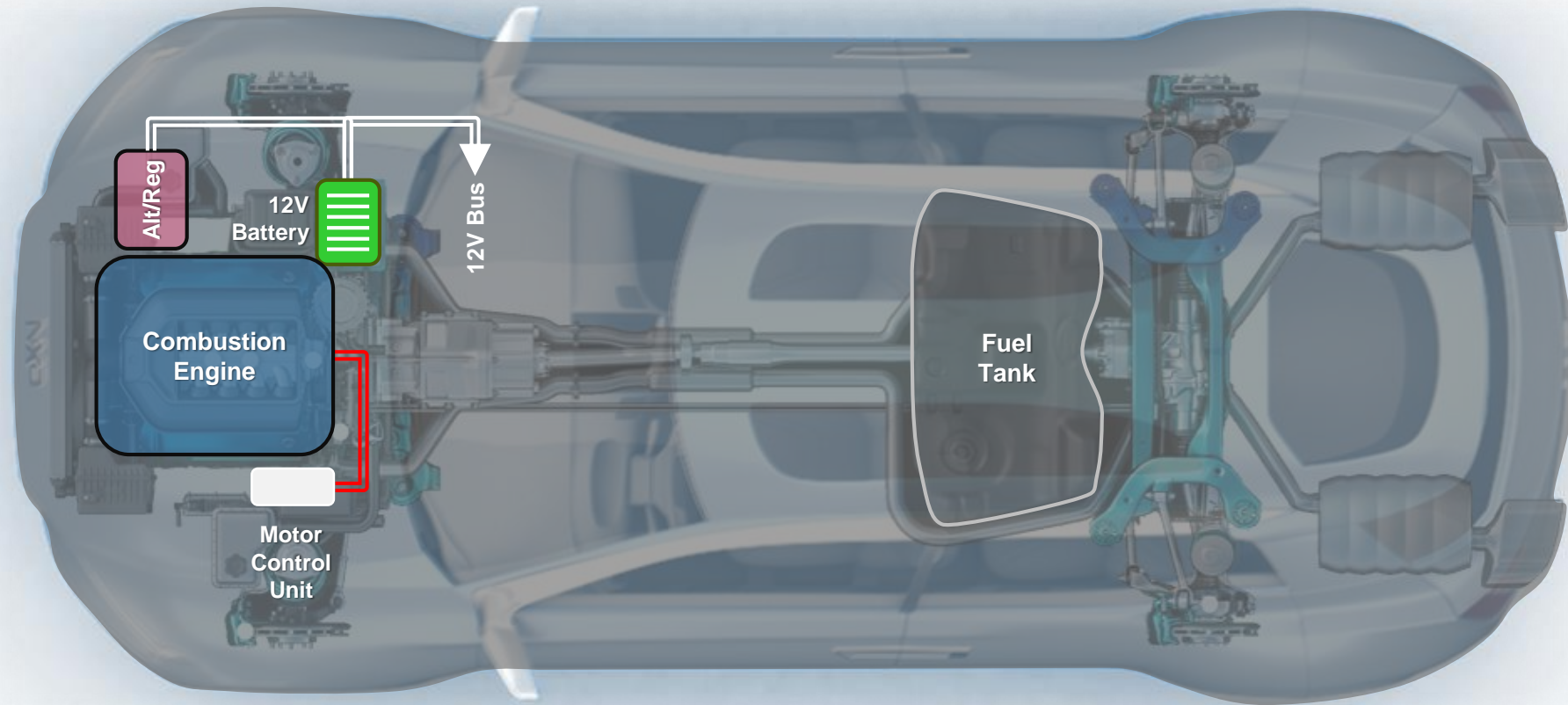


Hybrid
Powertrain
(xHEV)

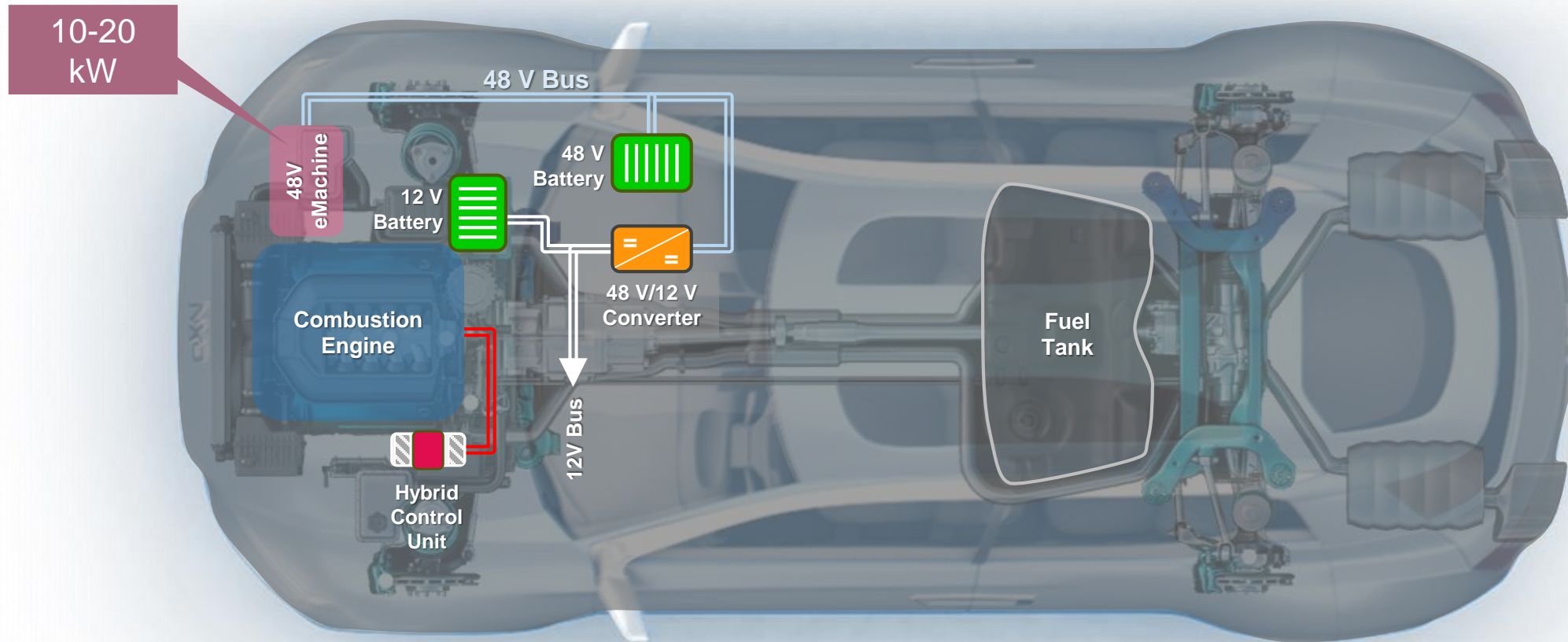


Electric
Powertrain
(BEV)

ICE Vehicle Architecture



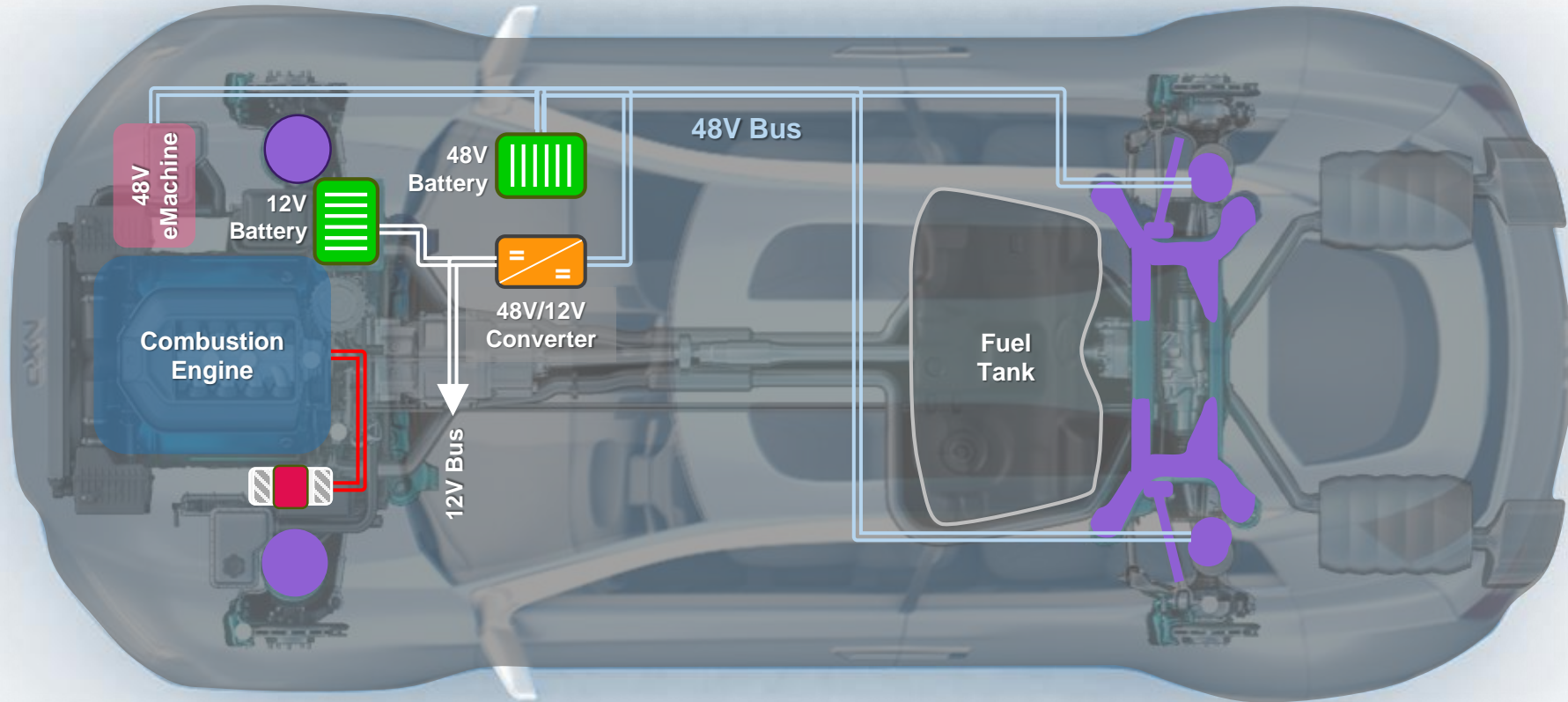
Add 48V to ICE → Mild Hybrid Electric Vehicle (MHEV)



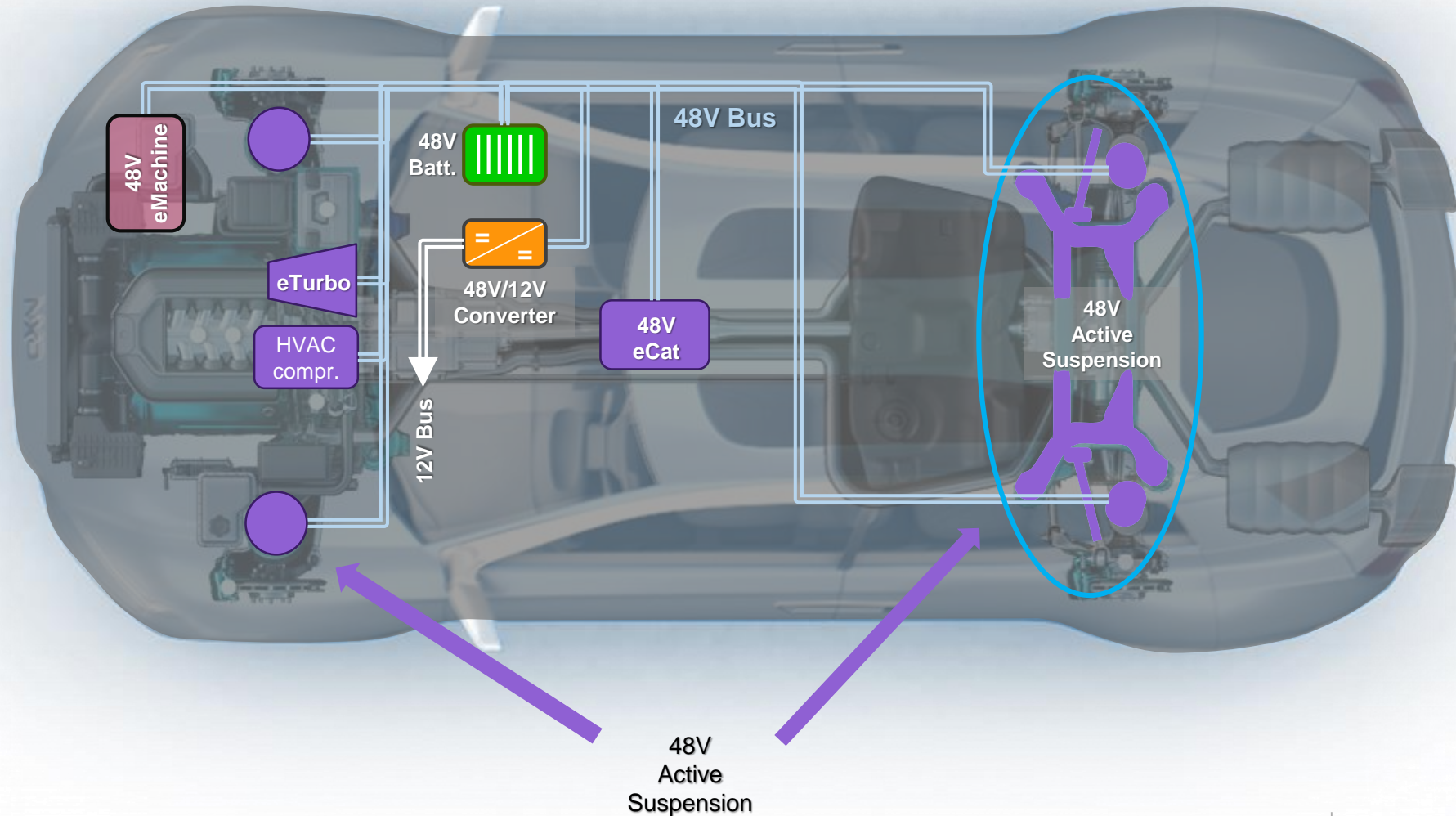
48 V eMachine

- Generates energy (e.g. while braking/loading combustion engine)
- Acts as eMotor to offload ICE during acceleration, coasting and pure eDrive

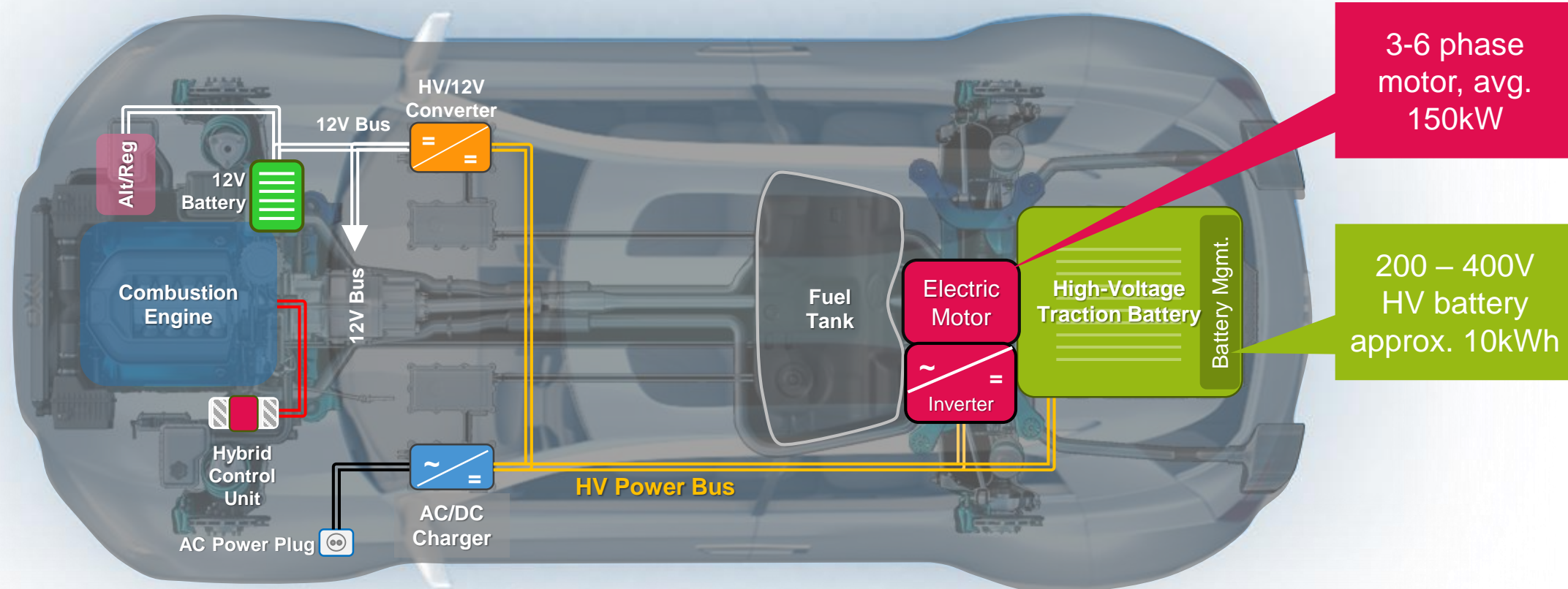
MHEV Architecture Including 48V Applications (I)



MHEV Architecture Including 48V Applications (II)

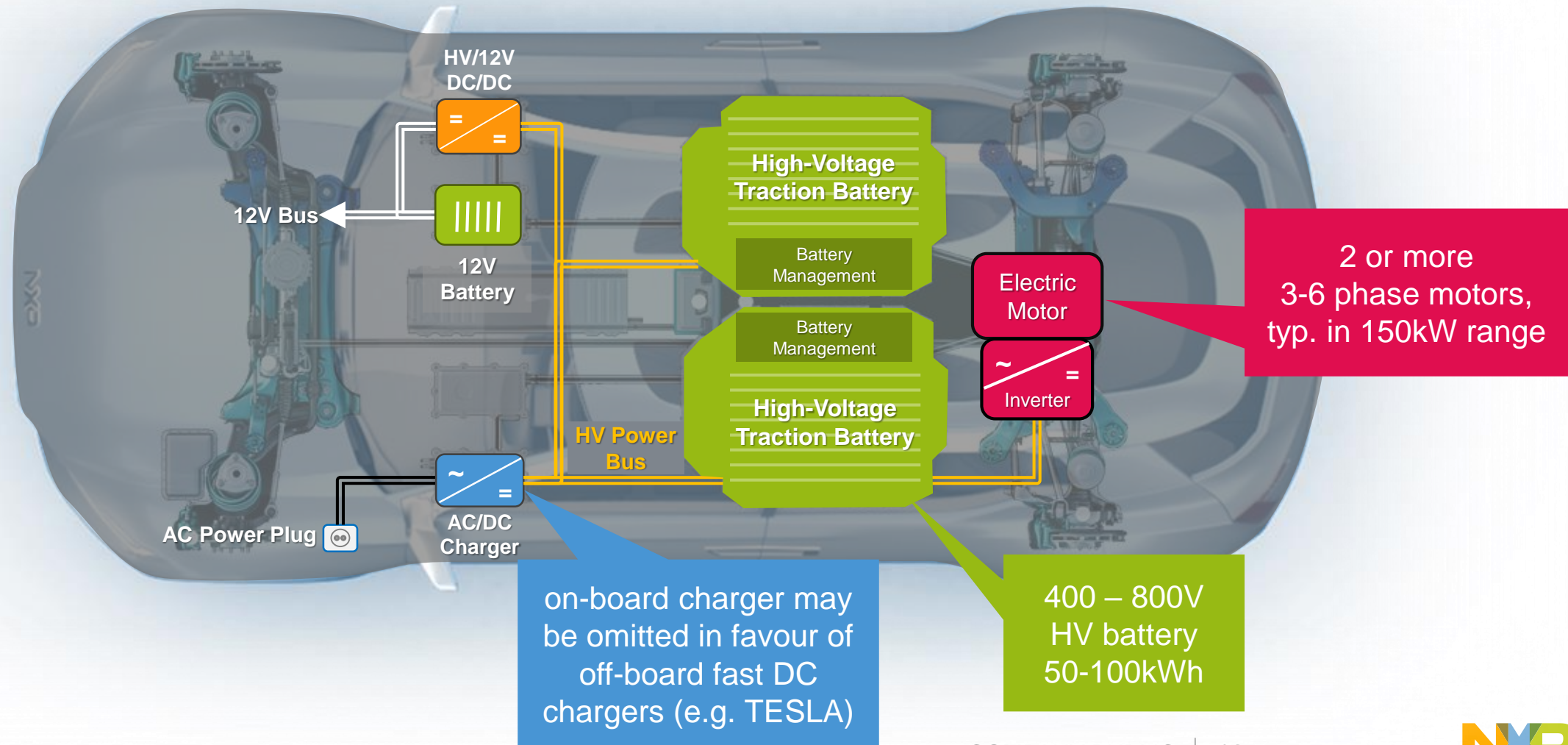


Plug-in Hybrid Electric Vehicle (PHEV) Architecture







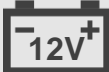











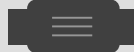



- Combines ICE and 10s of km electric range at cost of volume/weight of battery
- Pure electric range up to 60 (85km) battery charged from AC or while braking
- ICE: usually gasoline, downsized. up to 75% CO₂ reduction

Full Electric Vehicle (BEV) Architecture



Increasing Electrification vs ICE Downsizing or Removal

Electrification Levels	E0	E1	E2	E3	E4	E5
Common Name	Combustion Engine (ICE)	Mild Hybrid (M-HV)	Full Hybrid (F-HV)	Plug-in Hybrid (PHEV)	Range Extended EV (REEV)	Pure Electric Vehicle (BEV)
Example	Ford Mustang 	Honda Insight 	Toyota Prius 	FCA Pacifica 	BMW i3 	Tesla 
Combustion Engine	●●●●	●●●●	●●●	●●●	●●	
Battery System						
Mains Charging	-	-	-			
Electric Traction	-	 10 – 20 kW	 15 – 60 kW	 40 – 100 kW	 40 – 130 kW	 > 80 kW

Electric Vehicles: Base Architecture Components

Major components

Battery management system

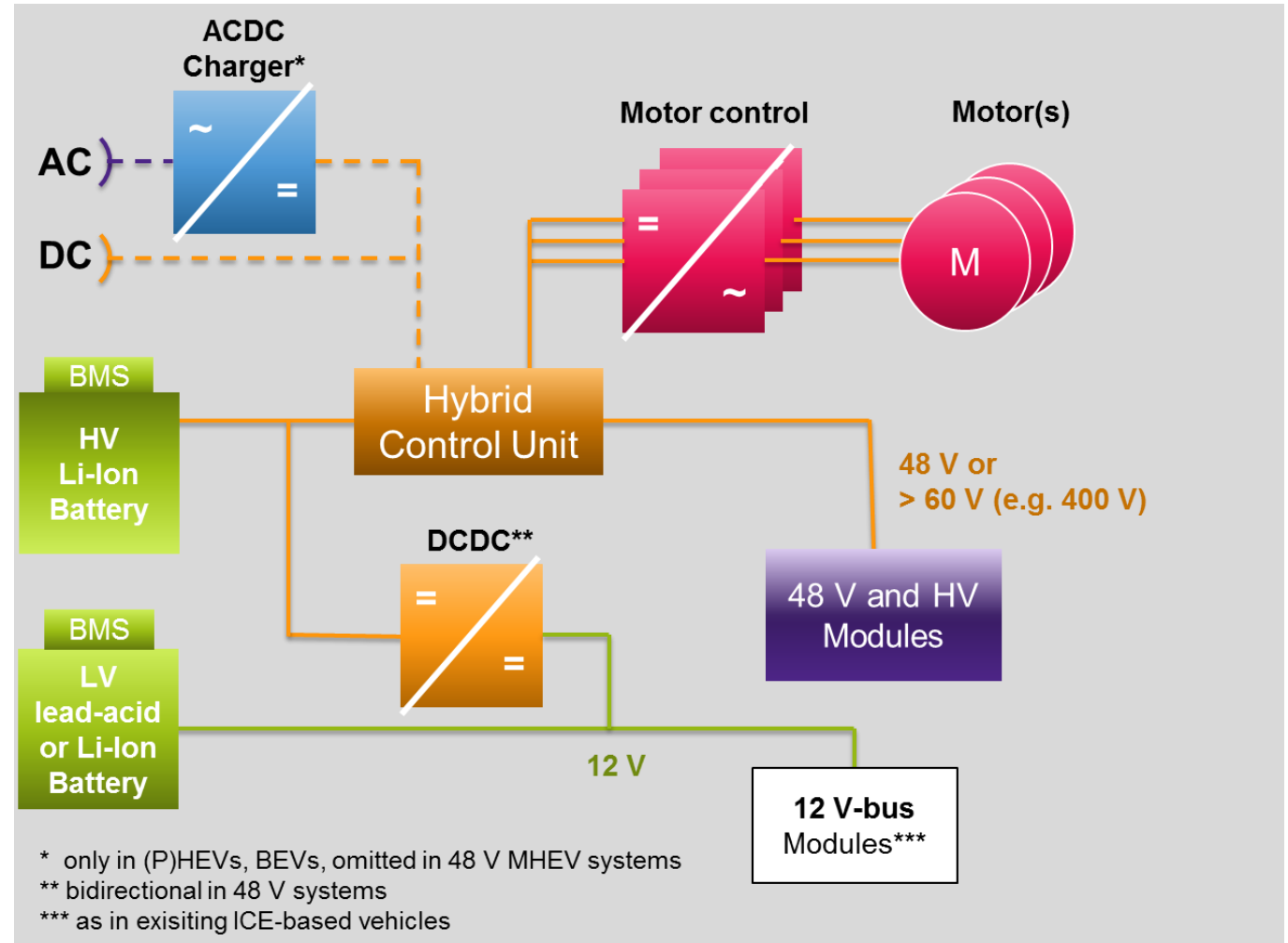
Motor control (HV inverters)

Hybrid Control Unit (Torque/Energy Management & Optimisation)

48 V eMachine (BSG, ISG, HVAC)

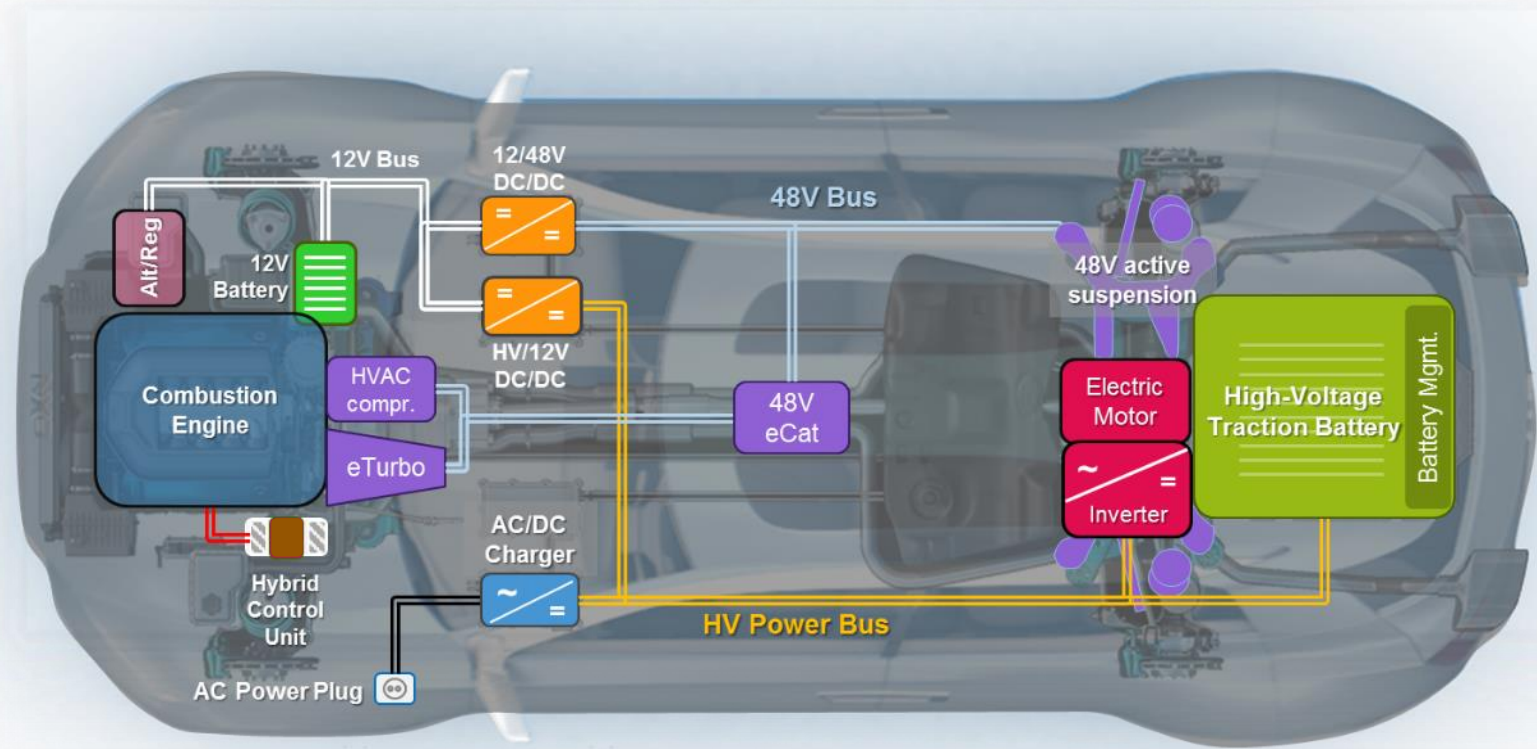
DC/DC voltage domain converter

On-board charger AC/DC converter

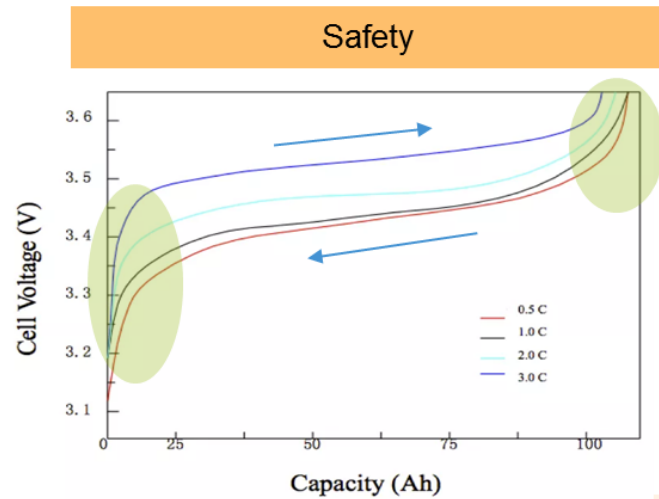


NXP xEV Energy Management: Battery Management Systems

	MCU	SBC	COMM	Driver	AFE
Battery Management Systems	●	●	●		●
eMotor Control (HV inverters)	●	●	●	●	●
Hybrid Control Unit	●	●	●		
48V eMachine (BSG, ISG, HVAC)	●	●	●		
DC/DC Voltage Domain Converter	●	●	●		
On-board Charger AC/DC Converter	●	●	●		

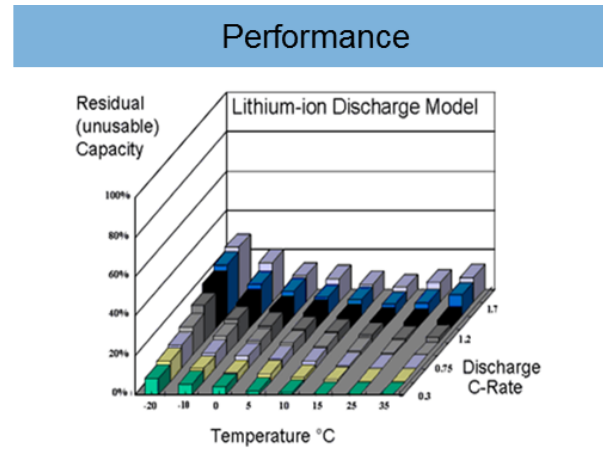


Battery Management: Main Functions and Requirements



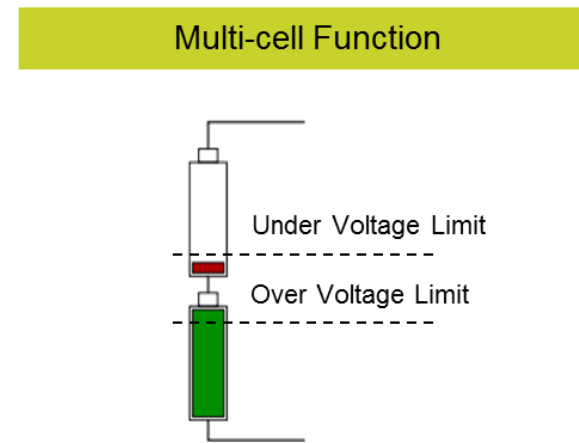
- Danger:**
- Over voltage
 - Extra heat
 - Unstable chemical stage
 - Thermal runaway (fire/explosion)
 - Low temperature

risk mgmt



- Requirements:**
- Safe & fast charging
 - Discharge optimization
 - State of charge (SOC) estimation
 - State of health (SOH) estimation

vehicle range



- Challenges:**
- Up to hundreds of cells
 - Manufacture mismatch
 - Capacity degradation
 - Lifetime degradation

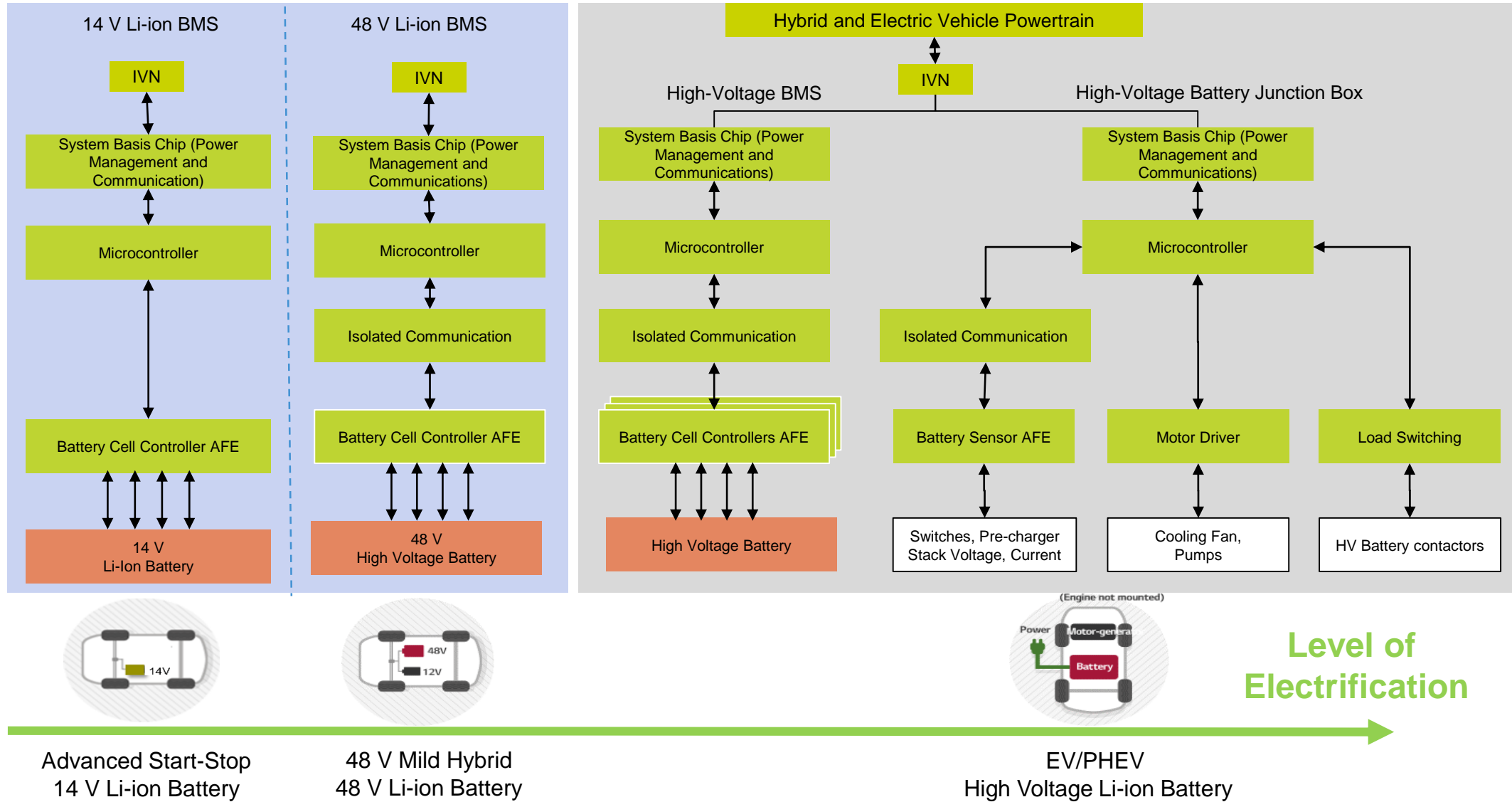
cost

Key BMS Functions

OV/UV Protection

Cell balancing
 Coulomb counting
 Internal resistance estimation

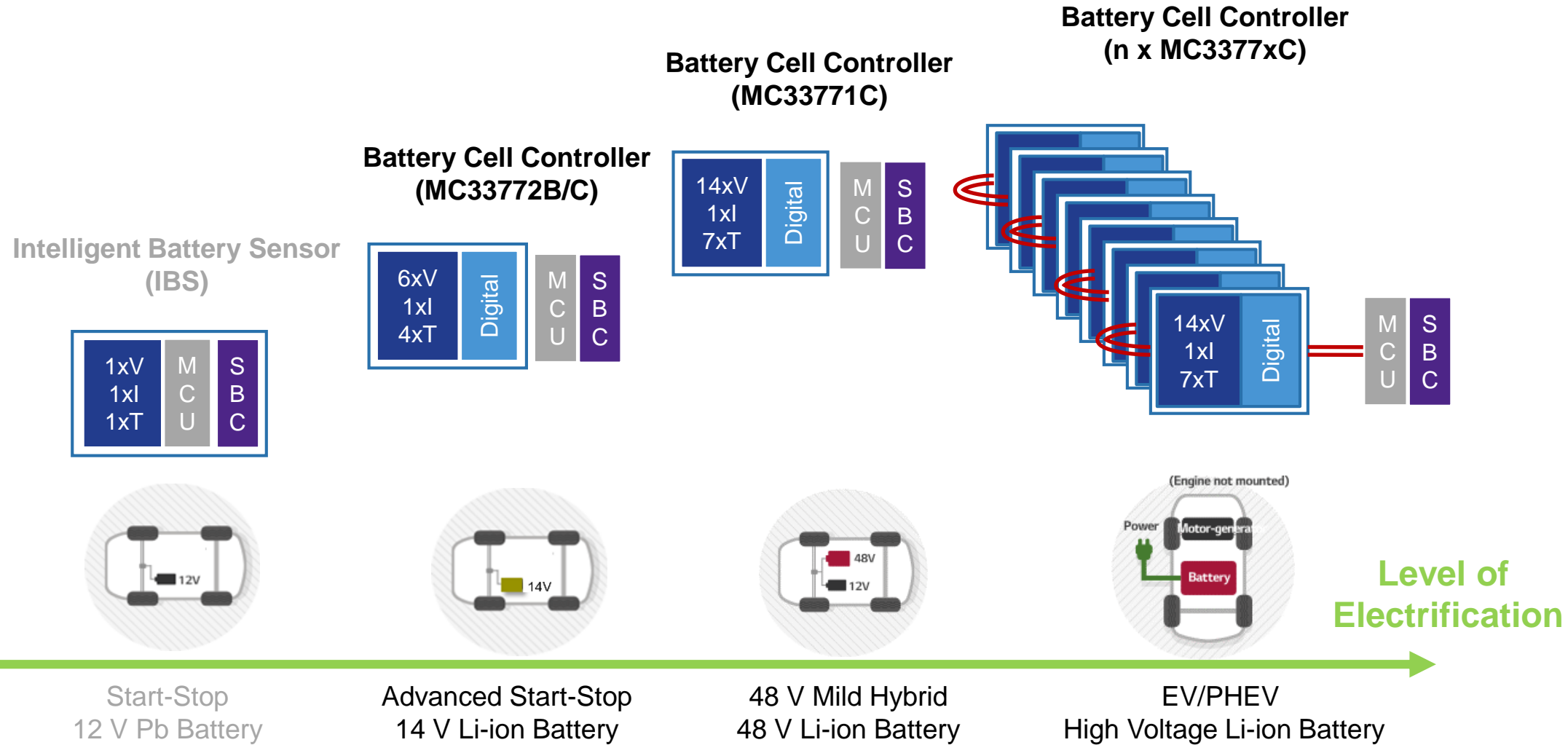
Automotive Li-ion BMS Application Overview



NXP BMS Solution



NXP's Scalable Battery Management Portfolio



What's New with MC33771C

Parameter	MC33772B	MC33771B	MC33771C
Voltage Channels	6	14	14
Supply Vpwr Range (Max Transient)	6V..30V (40V)	9.6V..61.6V (75V)	9.6V..61.6V (75V)
Cell Terminal Input Voltage Range	-0.3V to 5V	-0.3V to 5V	-0.3V to 5V
Typical Measurement Error	± 0.8 mV	± 0.8 mV	± 0.8 mV
Max Total Measurement Error (TME) for Cell Terminal Voltage (After aging: MLS3 & 1000h HTOL)	± 3.9 mV Vpwr=6~30V, Vcell=1.5~4.3V -40~60°C	± 3.9 mV Vpwr=9.6~61.6V, Vcell=1.5~4.3V -40~60°C	± 3.9 mV Vpwr=9.6~61.6V, Vcell=1.5~4.3V -40~60°C
HW Averaging for Cell Terminals	no	no	yes
Functional Safety	Single-chip ASIL C ASIL D Compliance	Single-chip ASIL C ASIL D Compliance	Single-chip ASIL C ASIL D Compliance
Isolated communication Speed	2 Mbps	2 Mbps	2 Mbps
Communication Isolation	Inductive	Inductive	Inductive, Capacitive
Max Nodes per Daisy Chain	15	15	63
CRC Bit	8	8	8
Comms bit	40	40	48
Integrated Balancing	<300 mA	<300 mA	<300 mA
Balancing sleep mode	Yes	Yes	Yes
Deep sleep mode	No	No	No
GPIO / Analog measurement inputs	7	7	7
Current Channels	1	1	1
Coulomb counter	1	1	1
Package	64-pin LQFP-EP	64-pin LQFP-EP	64-pin LQFP-EP

Battery Cell Controllers Reference Design

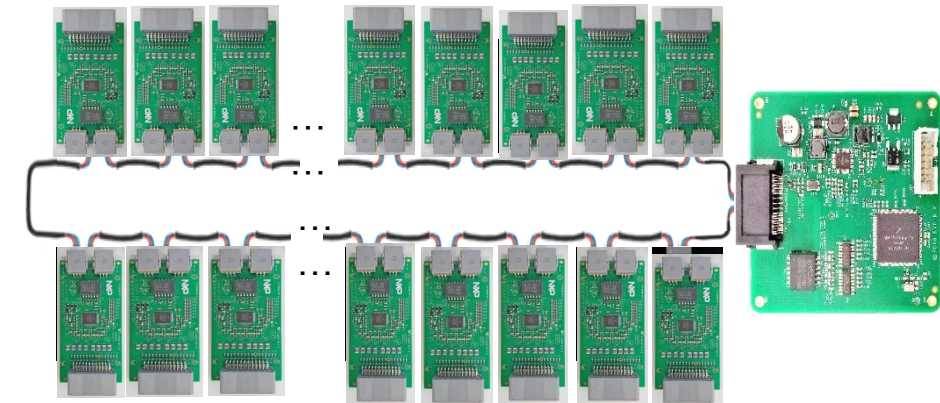
14 V BMS System



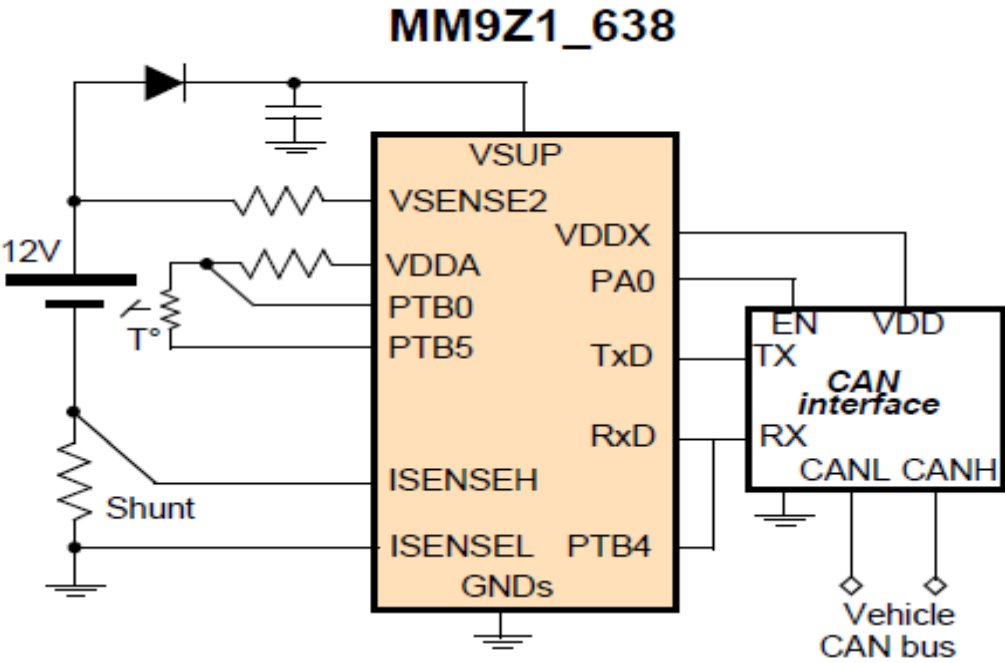
48 V BMS System



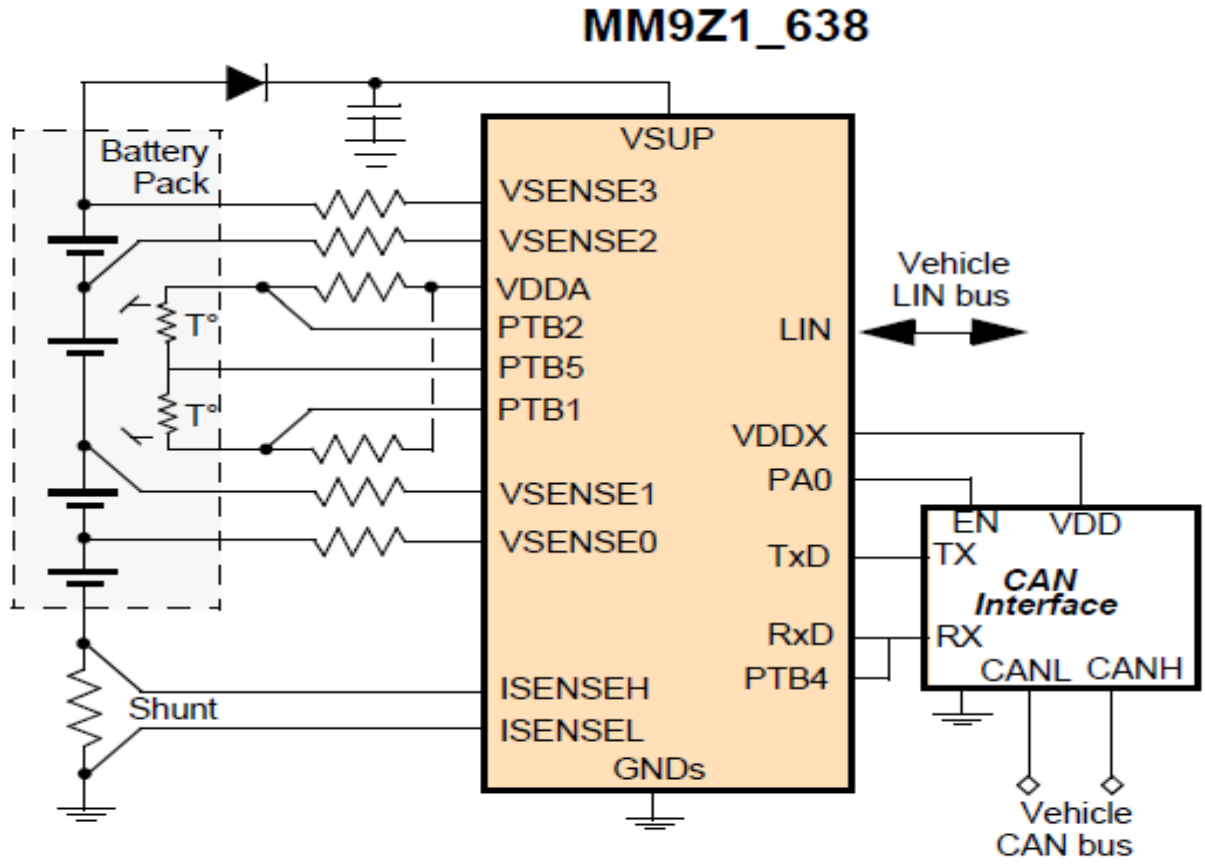
HV BMS System Reference Design



NXP 14V BMS System Solution



12 V Application, CAN Communication



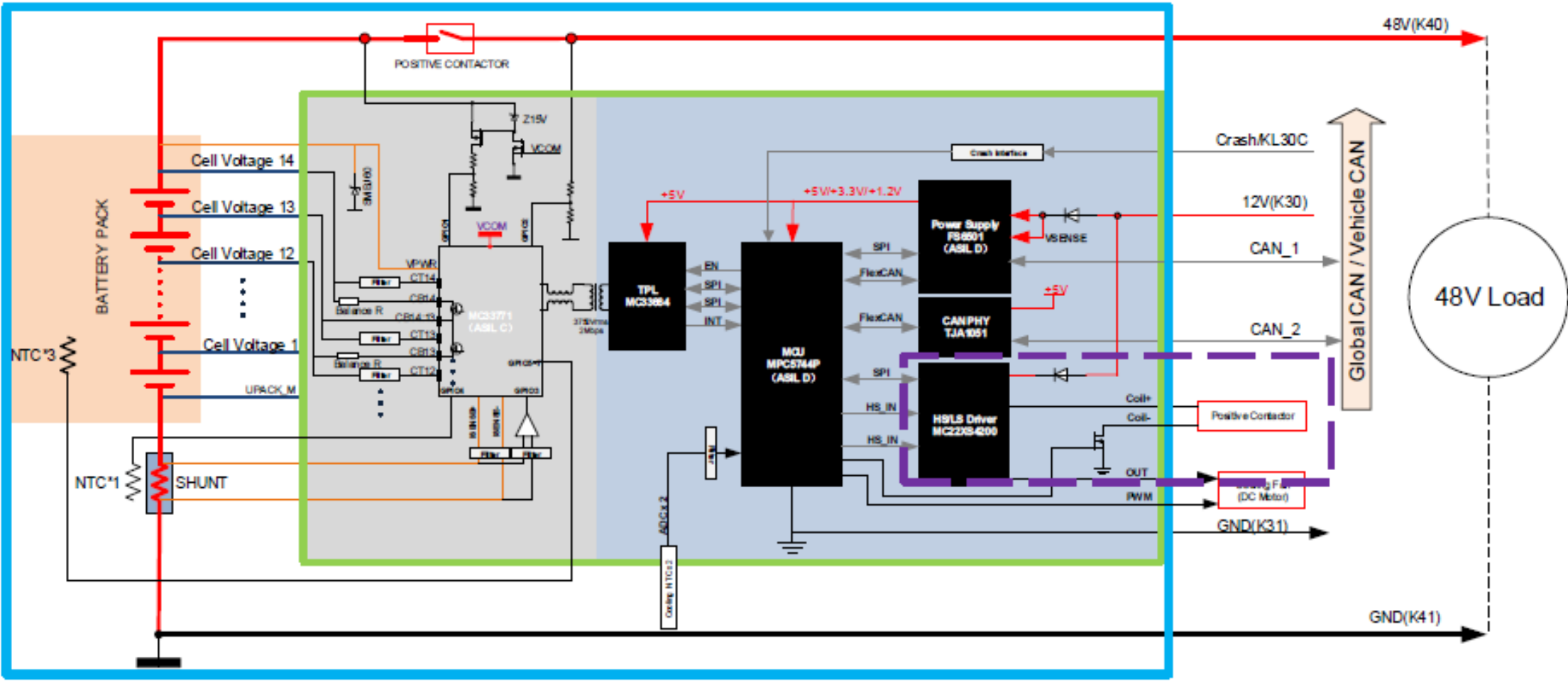
Multiple Cell Monitoring, CAN & LIN Communication,



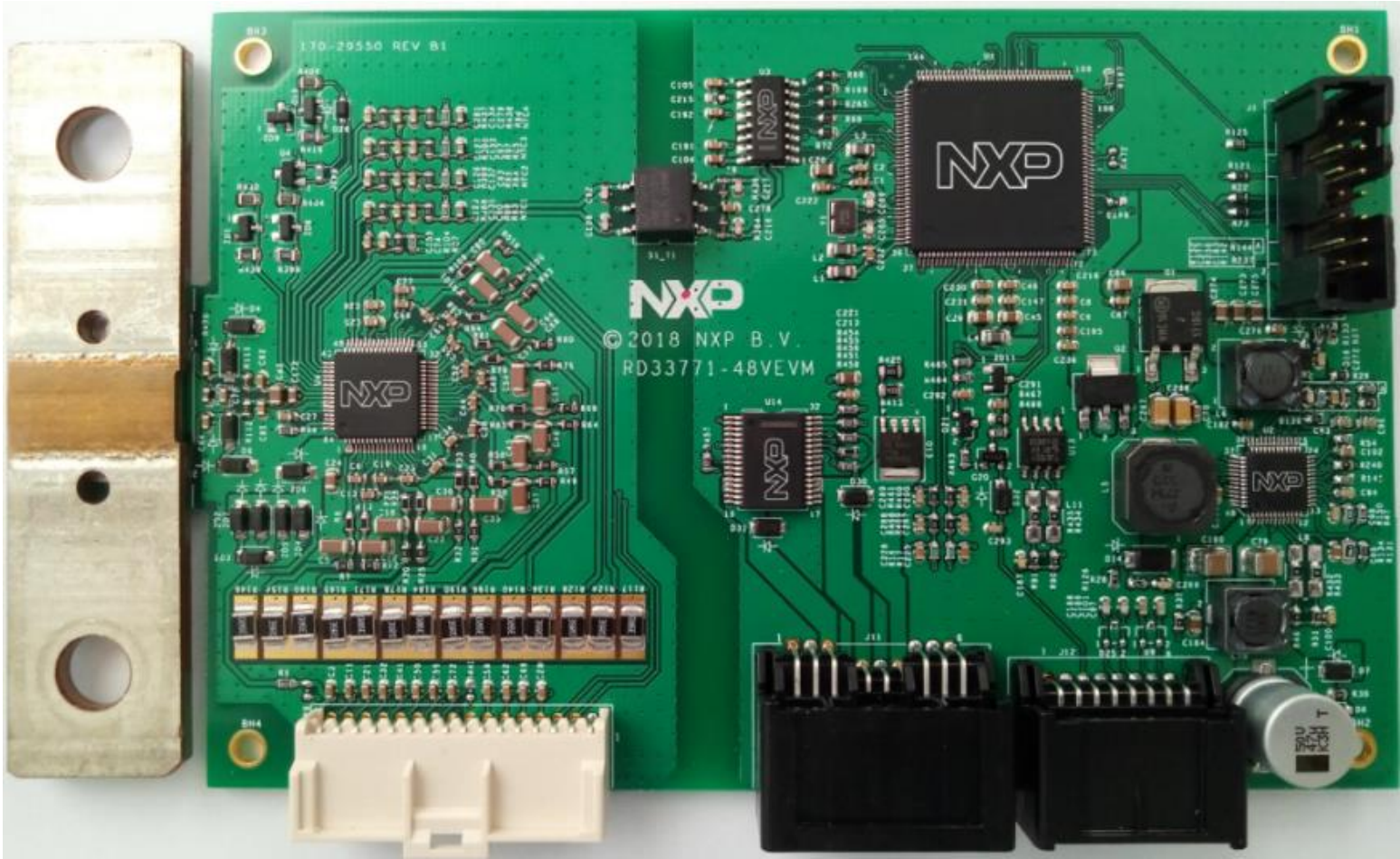
NXP 14V BMS System Solution



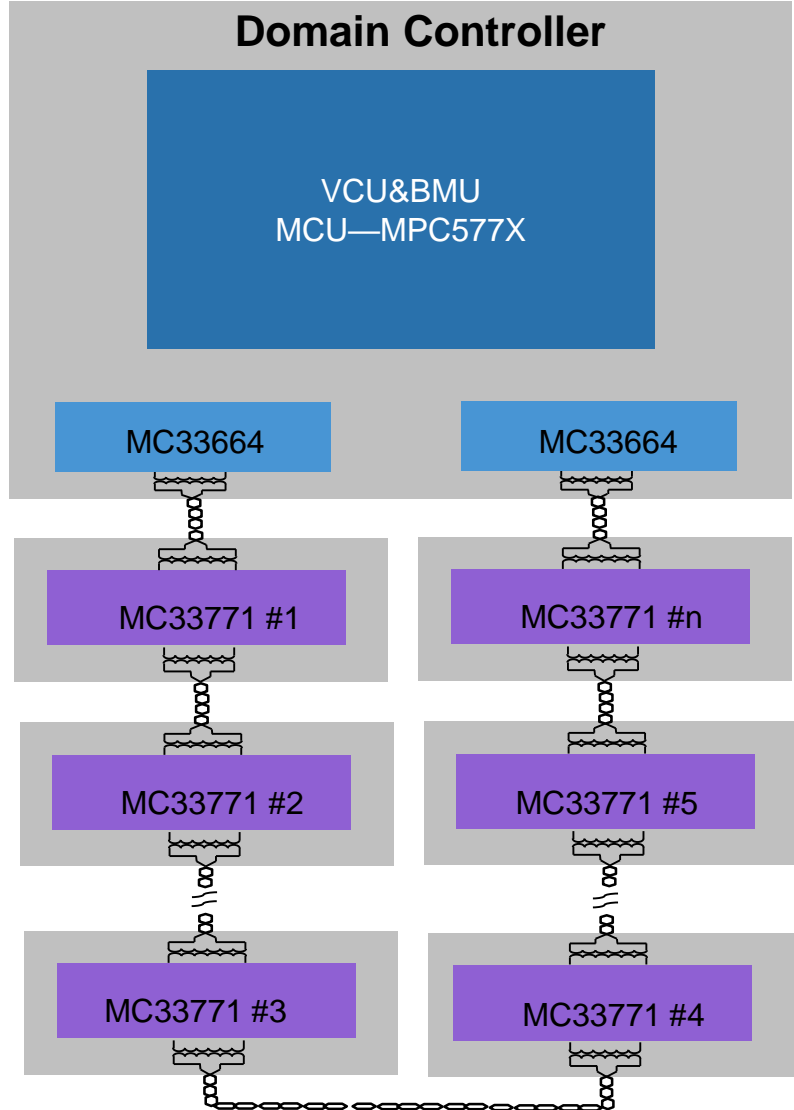
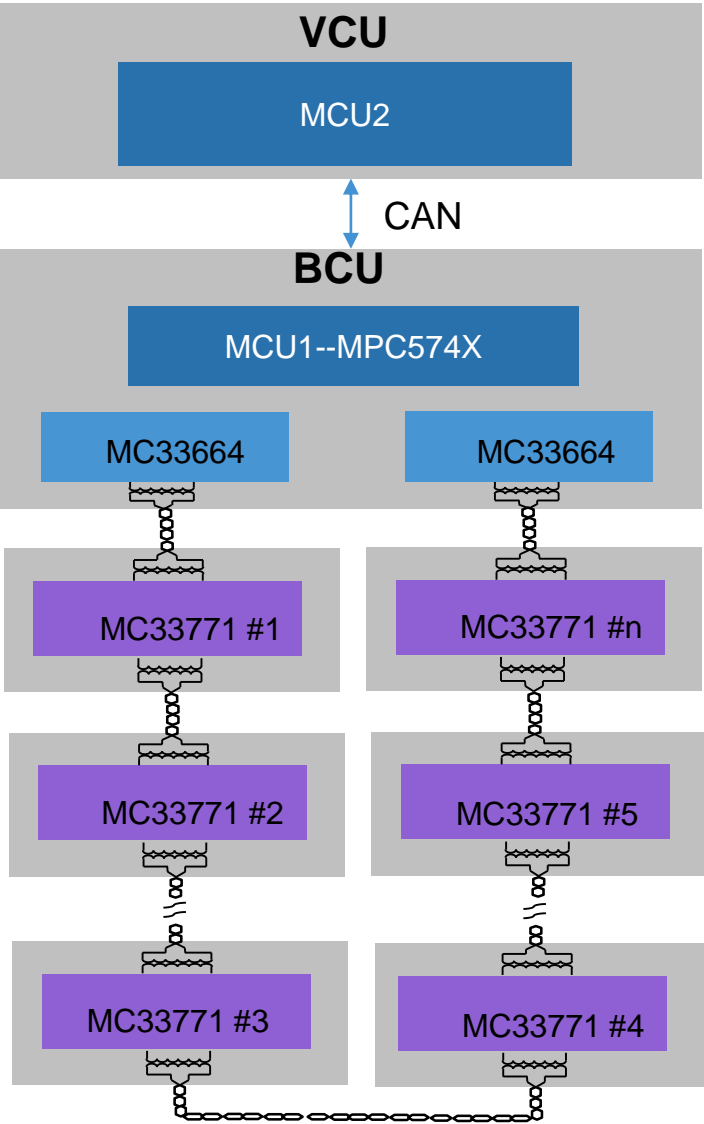
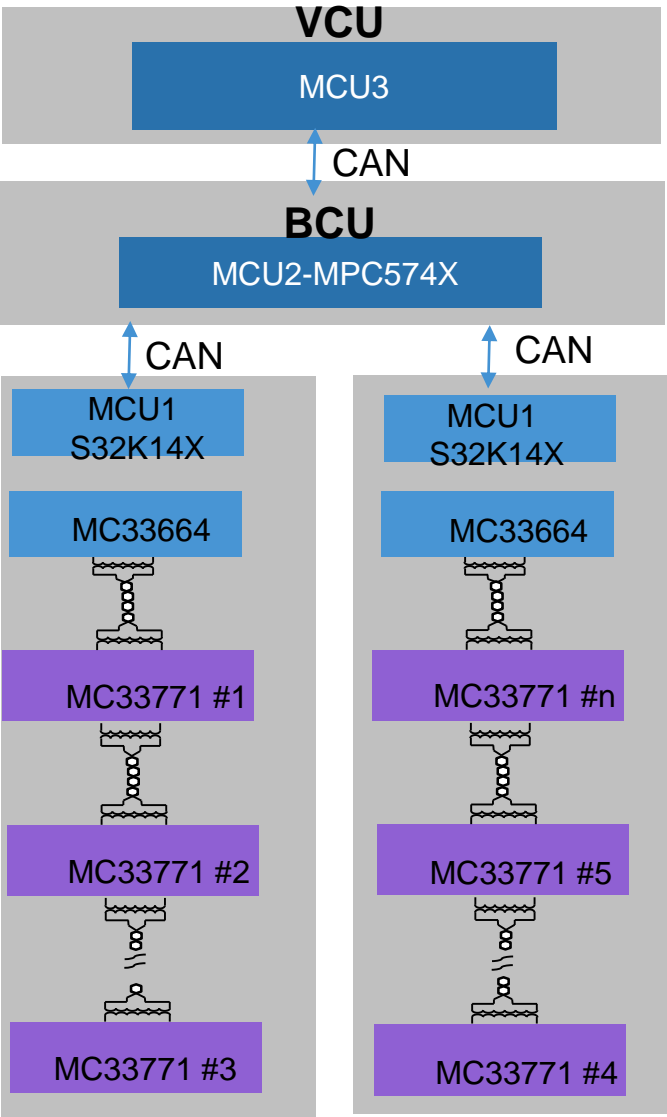
48V BMS System



NXP 14V BMS System Solution



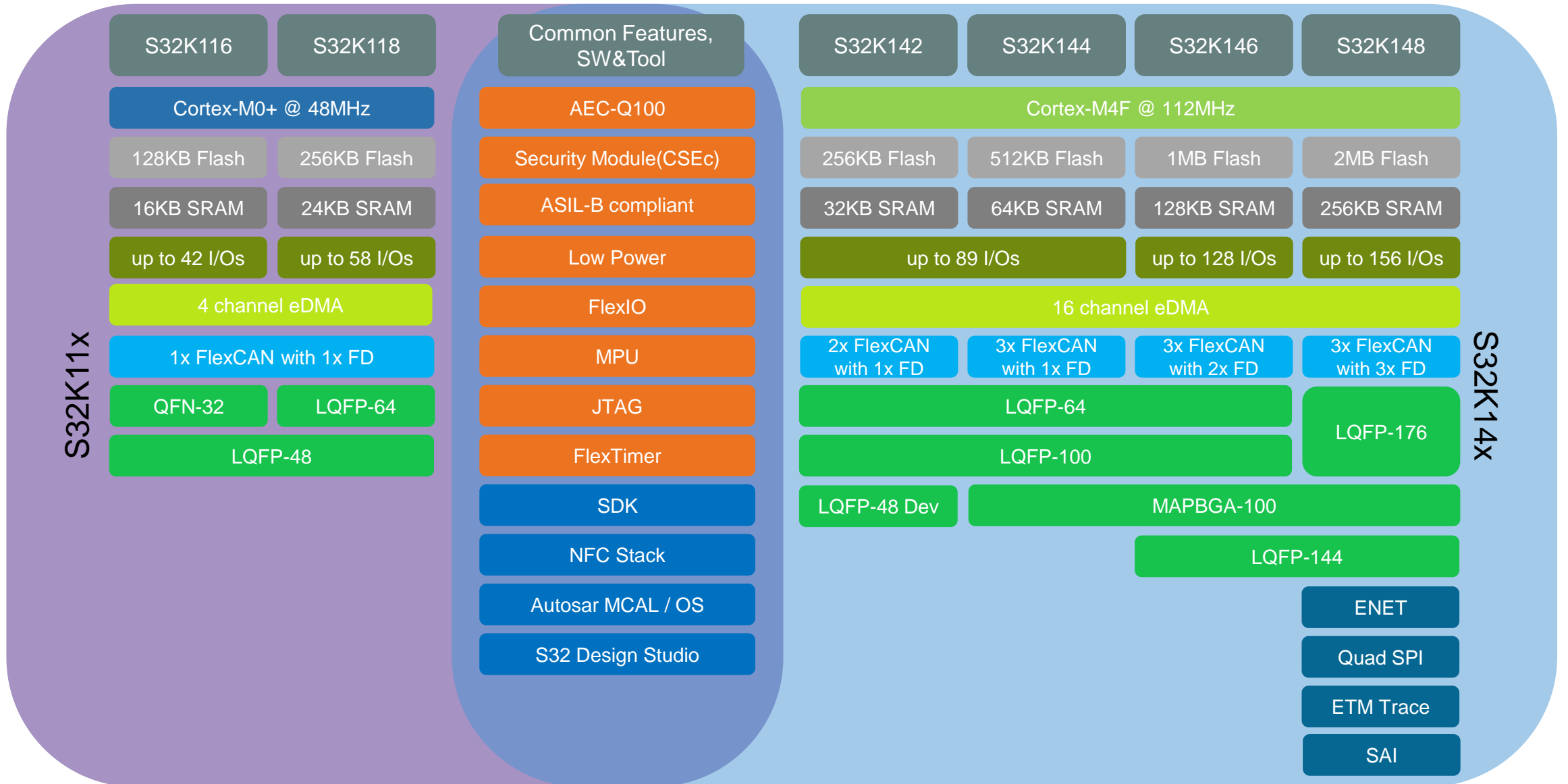
High Voltage BMS System Structure Trend



Feature Set Comparison

Feature	MPC574xP	MPC574xR	MPC5775B	MPC5775E	MPC5777C
Core, Clock	Z4 LS, 200/180/150MHz	Z4 LS+Z4, 200/150MHz	LS z7 + z7 220MHz	LS z7 + z7, 264MHz	LS z7 + z7, 264/300MHz
ASIL	D	D	D	D	D
FPU	Yes	Yes	Yes	Yes	Yes
DMA (ch)	32+ 32	64+ 64	64+ 64	64+ 64	64+ 64
FLASH	1/1.5/2/2.5MB	2/3/4MB	4MB	4MB	8MB
RAM	128/192/256/384KB	128/192/256KB	512KB	512KB	512KB
SPI	4	4 or 5 + 2 MSB	5	5	5
CAN-FD	0	0	2	2	2
Non CAN-FD	3	4	4	4	4
LIN/UART	2	3 or 4 + 2 MSB	5	5	5
Ethernet 100MBit/s	Yes (Only in 257)	Yes	Yes	Yes	Yes
SENT	4	6	12	12	12
Zipwire	1	1	0	0	1
PSI5 channels	0	0	0	0	2
ADC unit x channels	4x SAR12bit. 64 ch total	4x SAR 12bit ADC, 3x SD 16bit ADC	2x eQADC 12bit, 40 ch total	4x eQADC 12bit, 70 ch total, 4x SD, 20 ch total	4x eQADC 12bit, 70 ch total, 4x SD, 20 ch total
Timer (eMIOS) / FlexPWM	2 FlexPWM, 3 eTimer, 18 ch total	2 eMIOS, 32 ch total	2 eMIOS modules, 32ch total	2 eMIOS modules, 32ch total	2 eMIOS modules, 32ch total
eTPU	No	2x 64ch total	None	3x 96 ch total	3x 96 ch total
Security	No	No	CSE	CSE	CSE
Packaging	LQFP 144 or MAPBGA 257	LQFP 144/176 or MAPBGA 252	416 MAPBGA	416 MAPBGA	416/516 MAPBGA
Ambient Temperature	-40°C..125°C	-40°C..125°C	-40°C..125°C	-40°C..125°C	-40°C..125°C

S32K14x and S32K11x Features



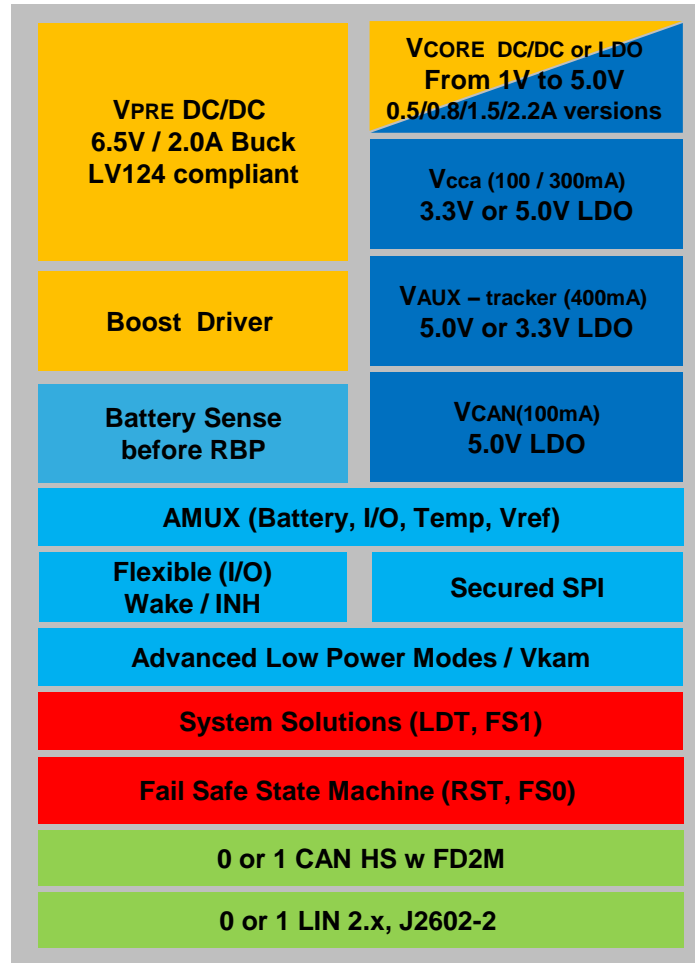
3. Key Part Introduce (FS65XX Safety SBC)

Advanced Power Management

- Buck/Boost Vpre from 2.7 to 36V
- 2.0A / 6.5V Vpre capable
- FS65xx with Vcore 2.4MHz SMPS 0.8/1.5/2.2A
- FS450x with Vcore LDO 0.5A
- Configurable Vcore (external resistor bridge)
- Multiple LDO and Tracker
- Ultra Low Standby Current 30µA

System Solution

- Analog Multiplexer to sense multiple critical signal
- Small package size :49 mm²
- Robust CAN PHY FD 2M
- Configurable I/Os
- Long Duration Timer, Keep Alive memory supply



Independent Safety Monitoring

- **Single Point Failure** : UV/OV Monitoring Unit
- **Latent Failure** : ABIST & LBIST
- **Common Cause Failure** : Independent electrical and physical fail safe circuitry and state machine
- **Reset, Fail Safe** pin to set system in predictive state when system is failing.
- **Configurable Fail Safe State**, while allowing system availability, diagnostic and possible recovery.
- Optional **Fail Silent** operation
- **Second Fail Safe** pin to manage safe delay after failure event
- **Advanced SafeAssure documentation** to fit for safety assessment
- **BOM cost savings** : No need for external MCU challenger
- MCU & external IC **Safety Monitoring**

SCALABLE
Family concept

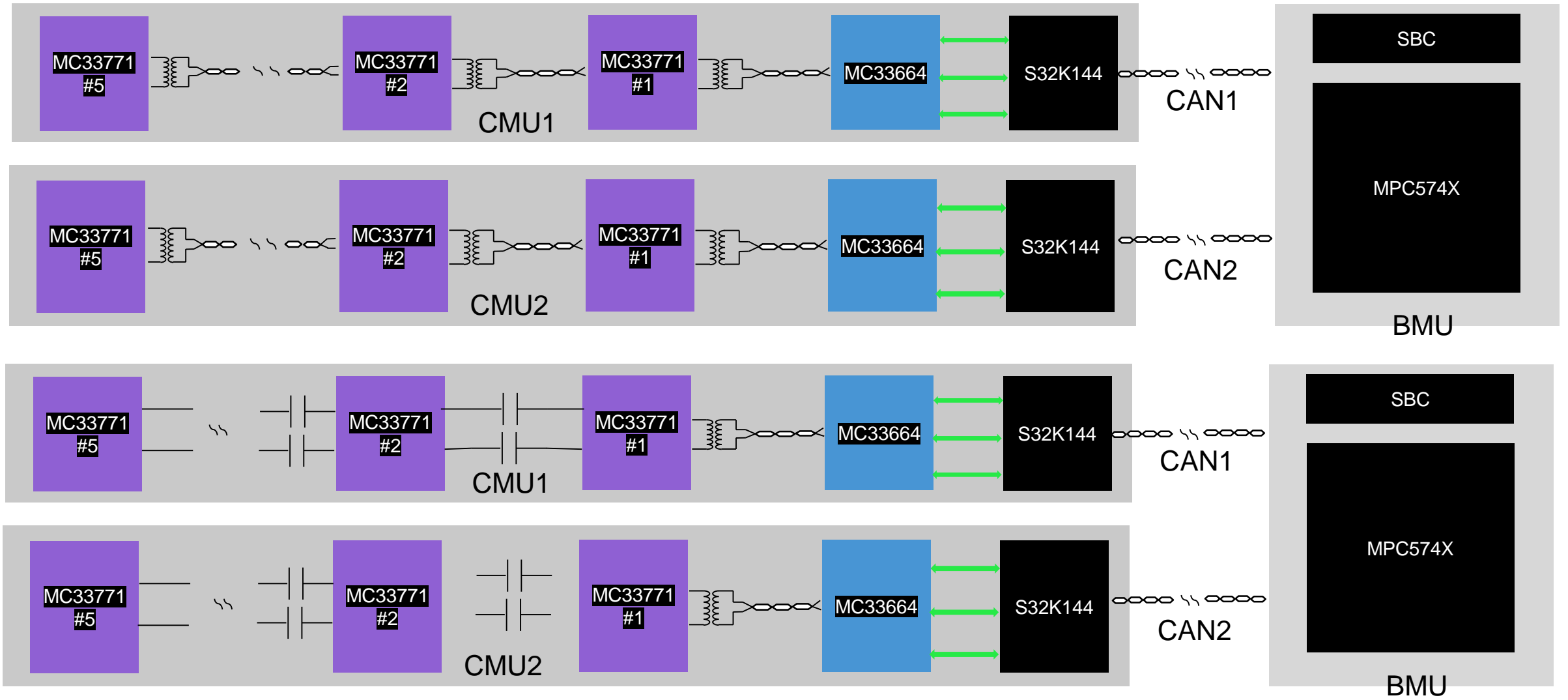
PROVEN
Designed at OEMs

SAFE
Flexible Fail Silent

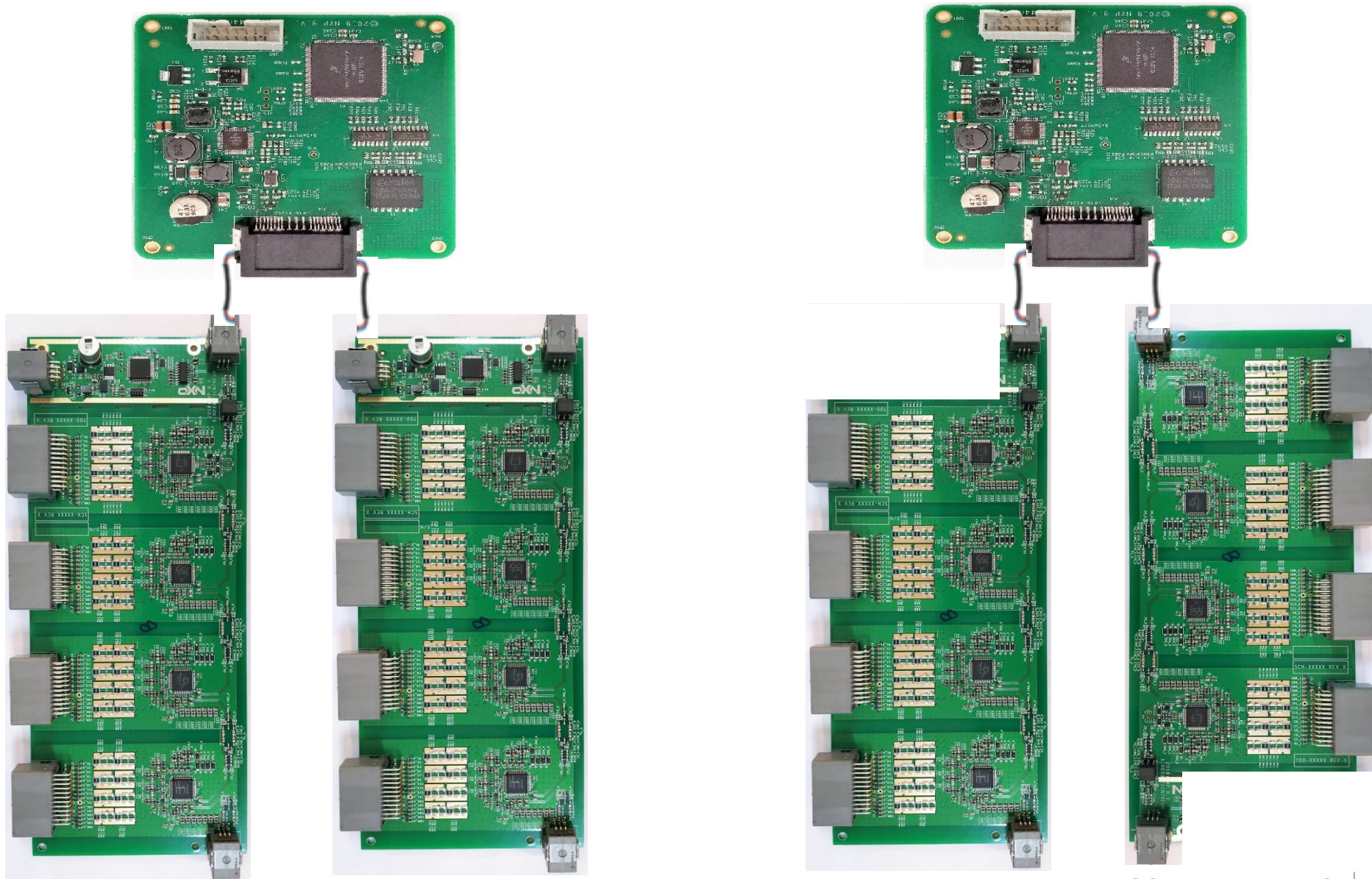
ROBUST
PASS 4200h HTOL

SIMPLIFIED
Tools & Documents

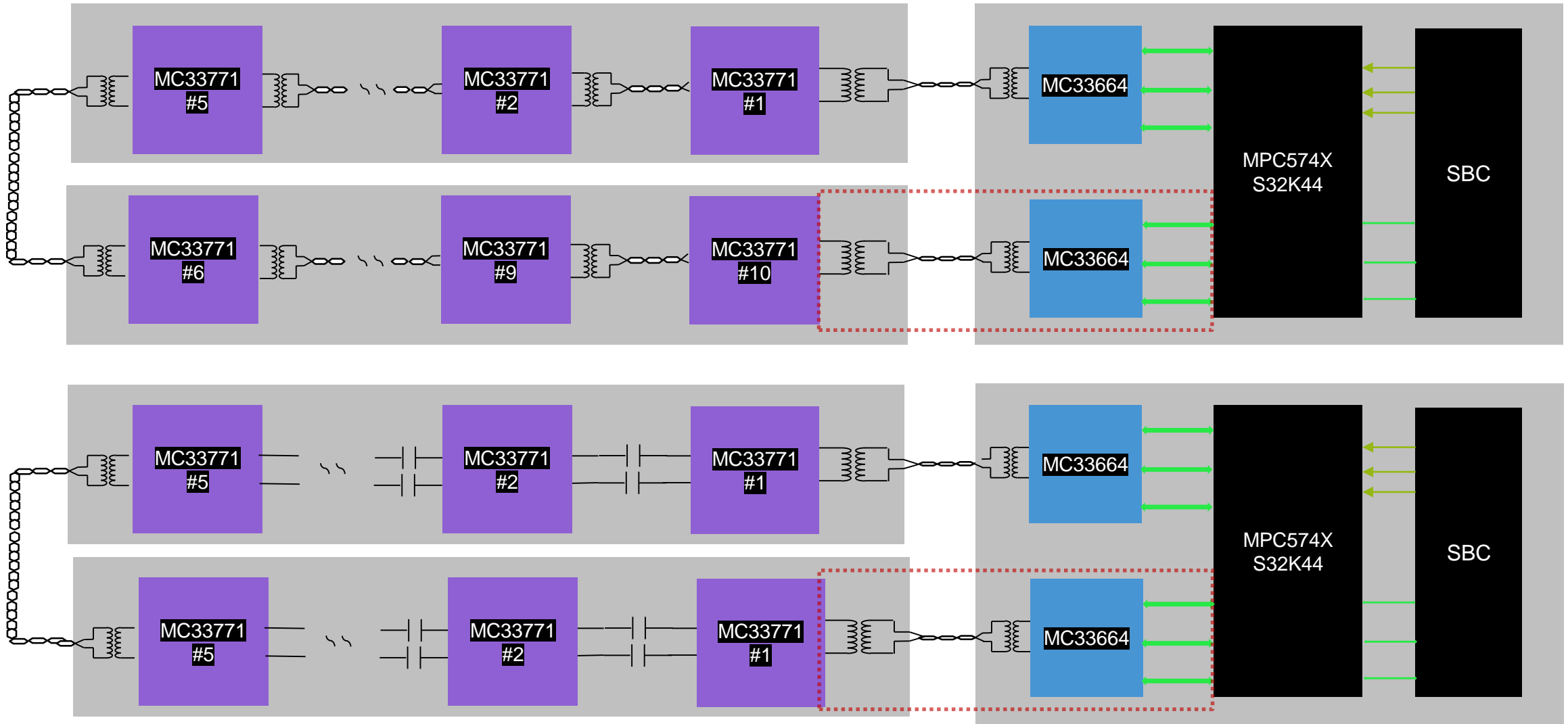
HV BMS System Semi-Distributed Structure--CAN



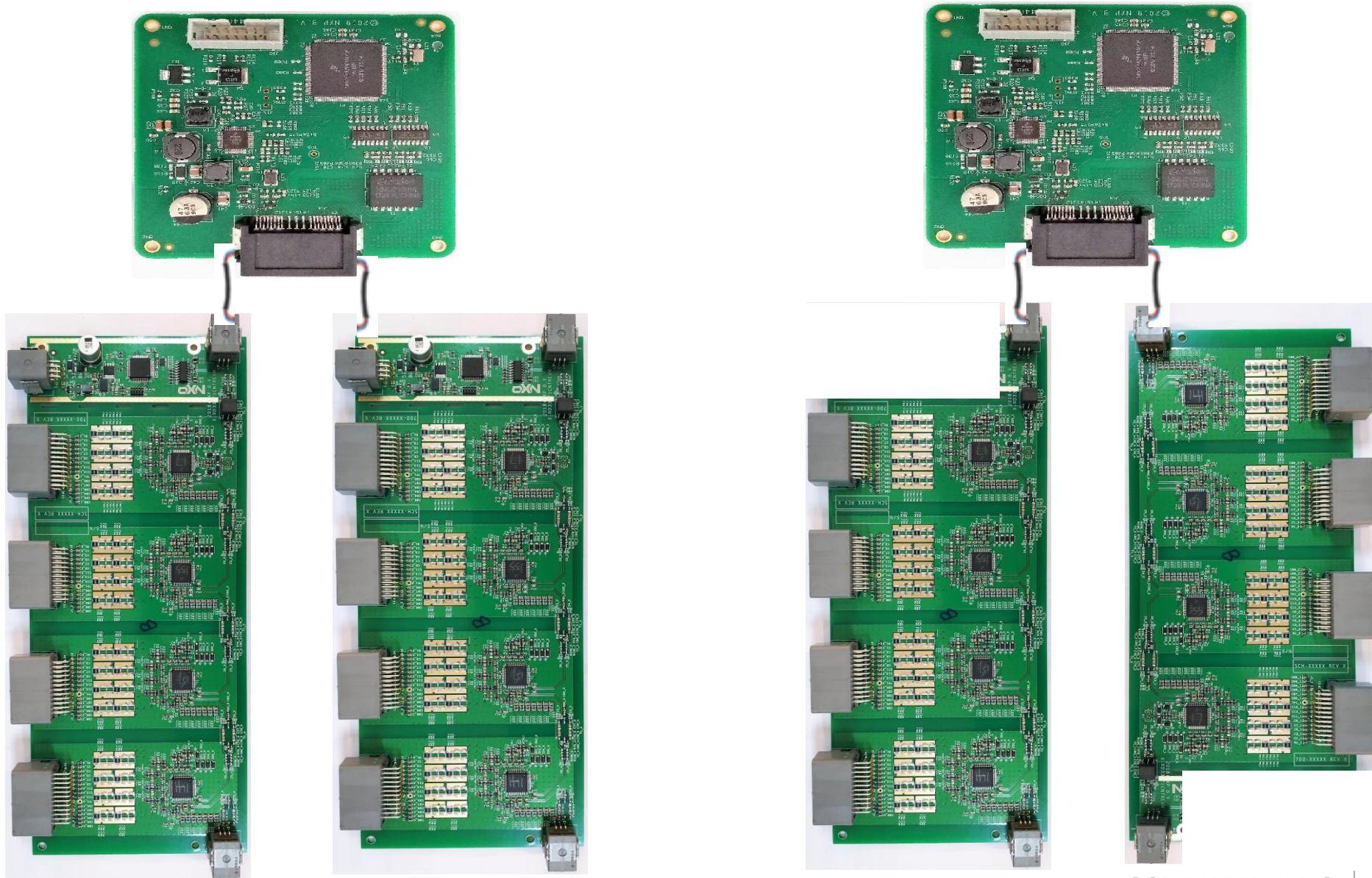
HV BMS System Semi-Distributed Structure



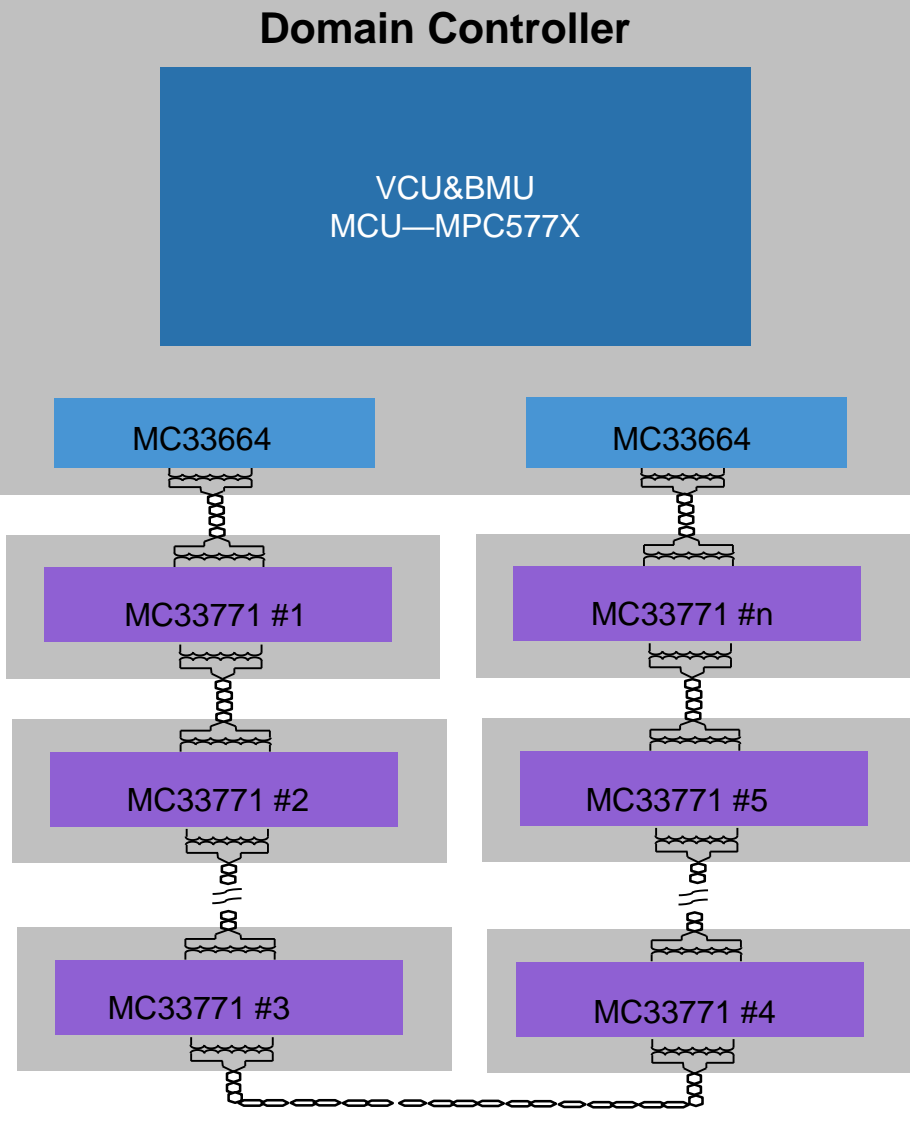
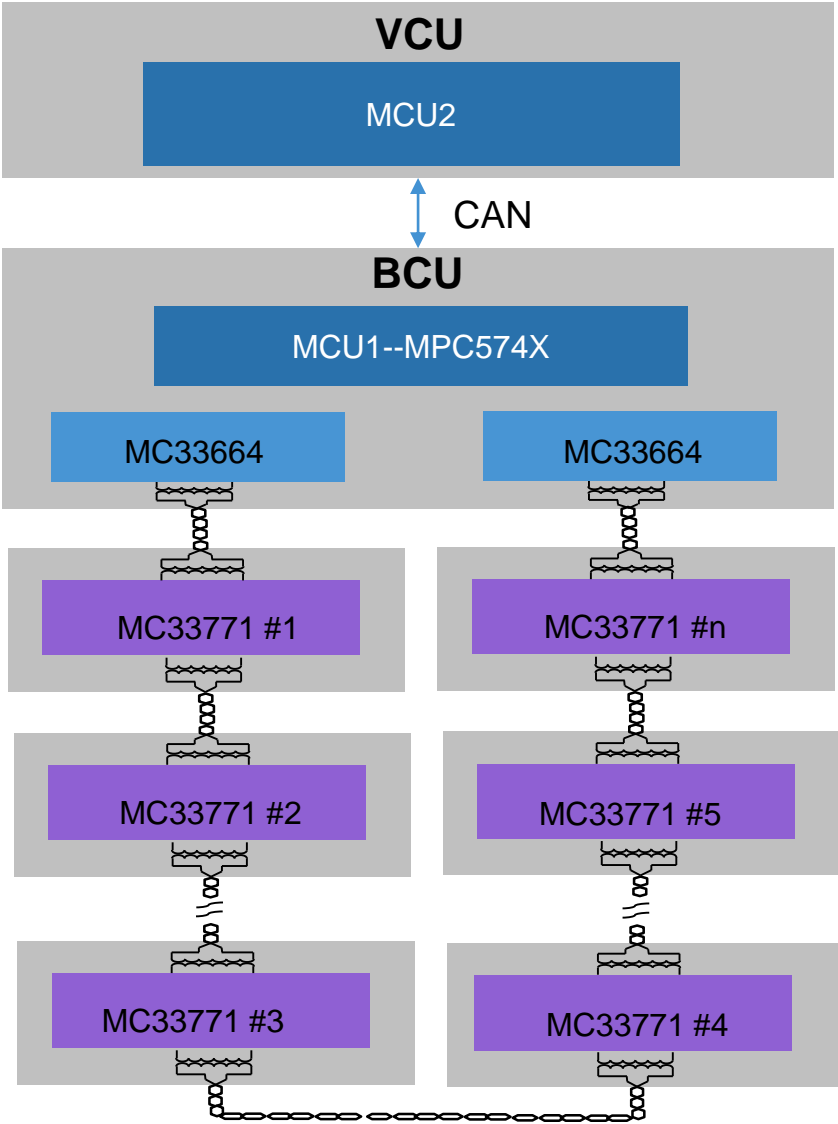
HV BMS System Semi-Distributed Structure--TPL



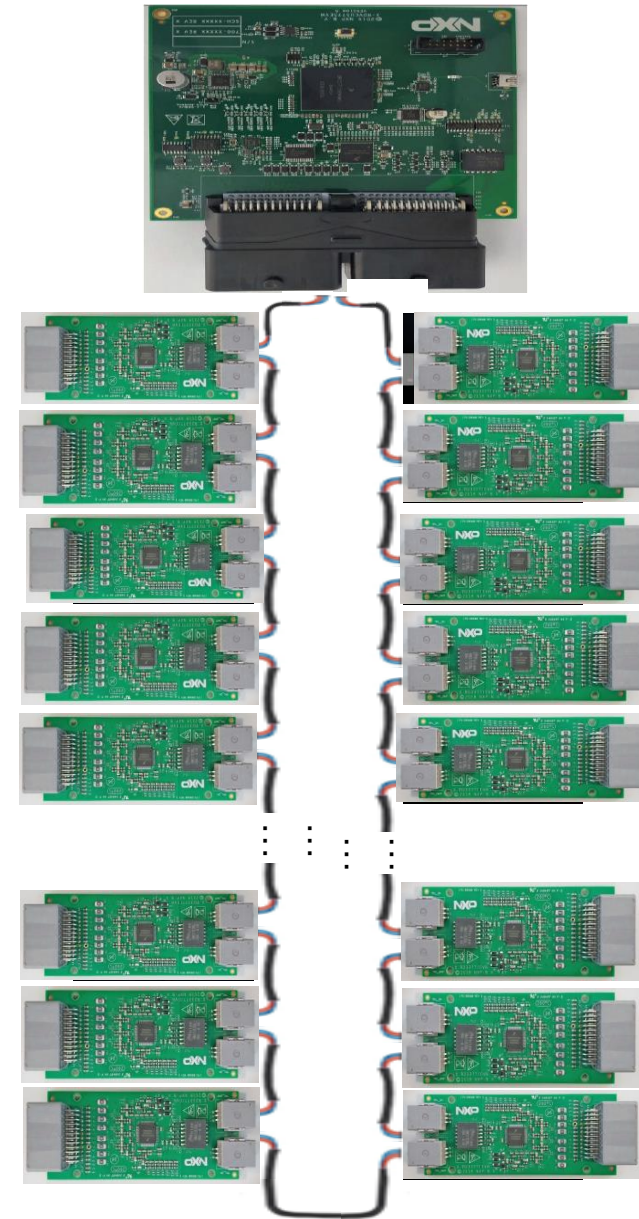
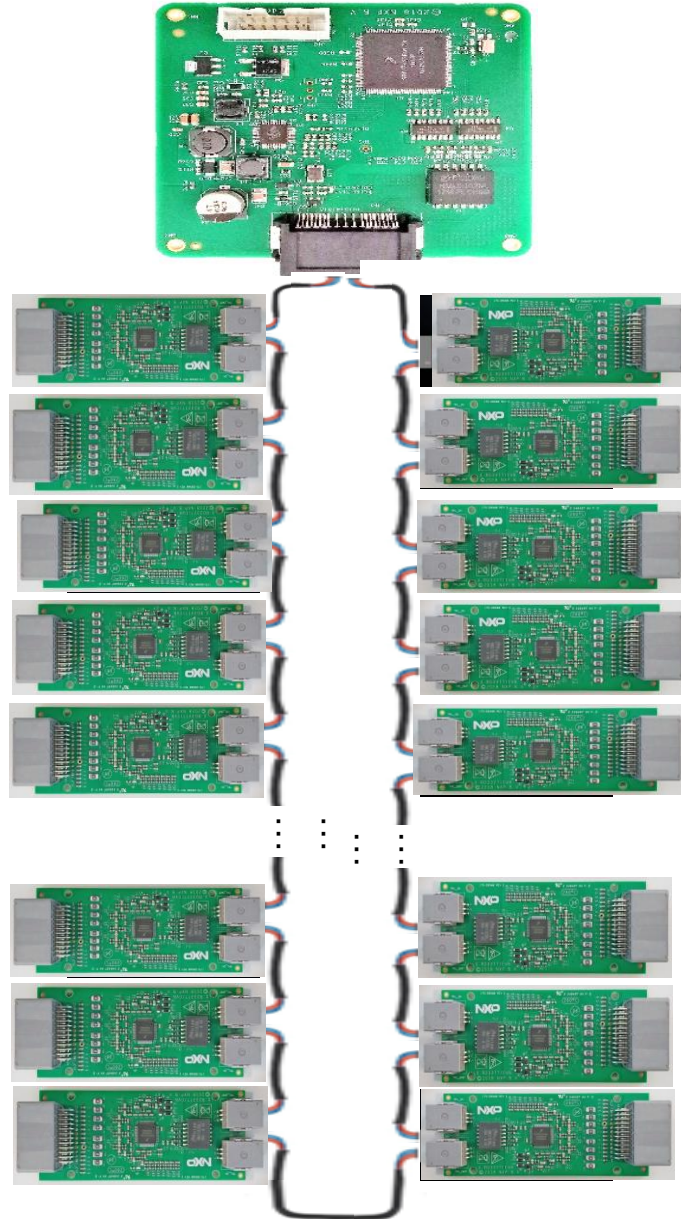
HV BMS System Semi-Distributed Structure



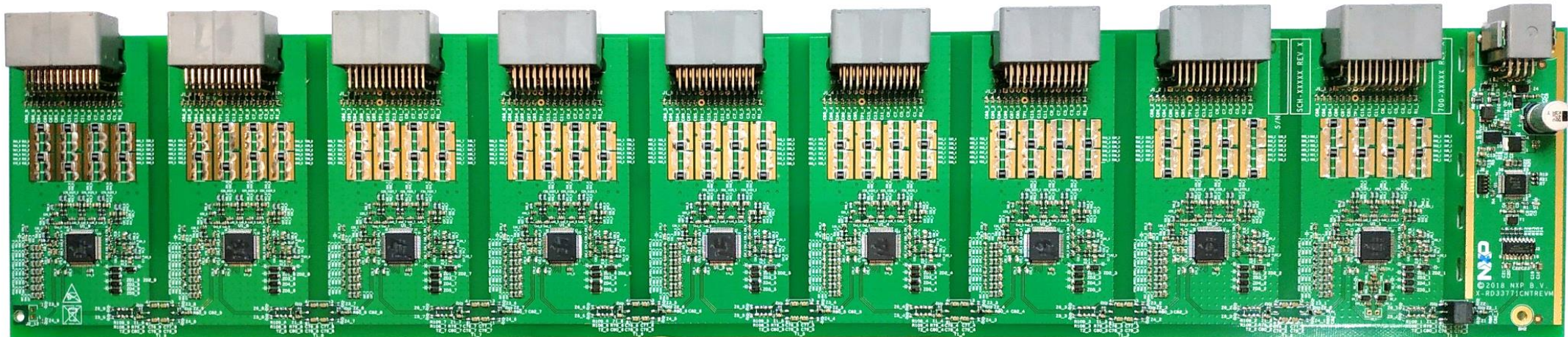
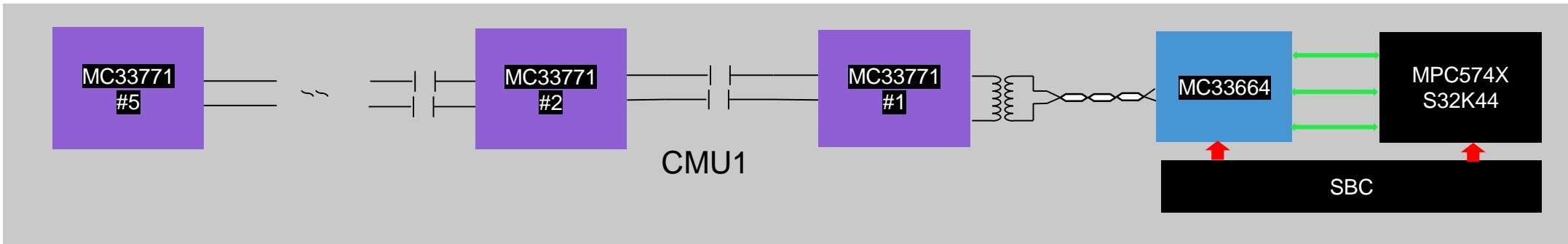
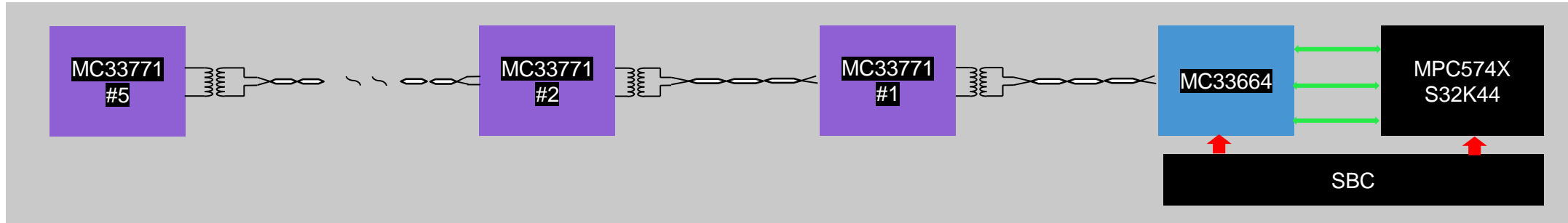
High Voltage BMS System Distributed Structure



HV BMS System Structure

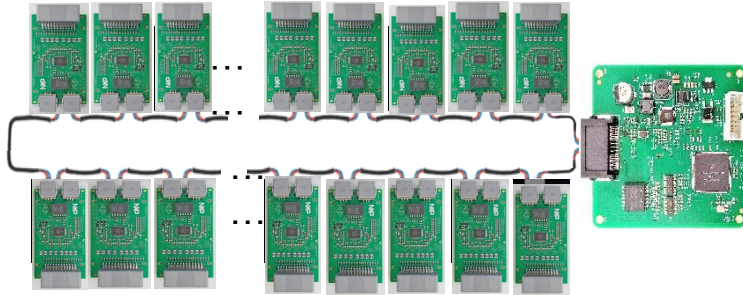


HV BMS System Structure Centralized Structure

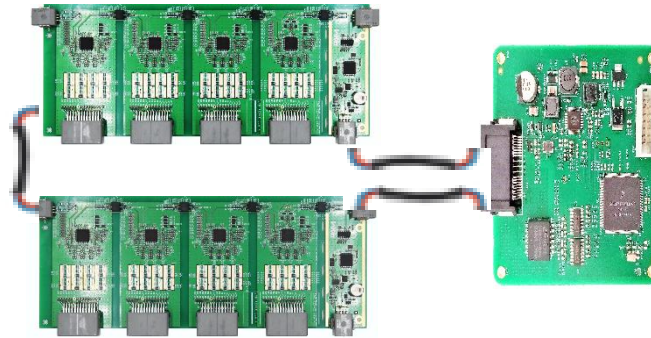


BMS System Architecture

Distributed BMS



Semi-Distributed BMS



Centralized BMS



	Distributed System	Semi-Distributed System	Centralized System
BOM COST	HIGH/MEDIUM	HIGH/MEDIUM	LOW
Wire Cost	LOW	MEDIUM	HIGH
Assembly Cost	LOW	MEDIUM	HIGH
Communication Robust	LOW	MEDIUM	HIGH
Accuracy	HIGH	MEDIUM	LOW
Bus-Bar Issue	NO	Possible	YES

NXP MC33771/2 Battery Cell Controller Solution

Differentiating Points

Battery topology flexibility

- Scalable SW & HW compatible BMS solution supporting **4 to 800+ cells per daisy chain**
- MC33771B/C (7 to 14 cells) MC33772B/C (3 to 6 cells) fully compatible
- Supporting centralized, distributed daisy chain, distributed CAN

High integration level

- Synchronized on-chip current sensor
- Synchronized on-chip coulomb counter
- Integrated passive balancing (300 mA per ch)
- Integrated power regulator

Fast & robust communication

- 4.0 Mbps SPI or isolated 2.0 Mbps differential communication with transformer
- < 546 us conversion time for all measurements
- 3.6 ~ 4.1ms for sending command and read back **96** cell 16-bit voltage data

High lifetime measurement accuracy

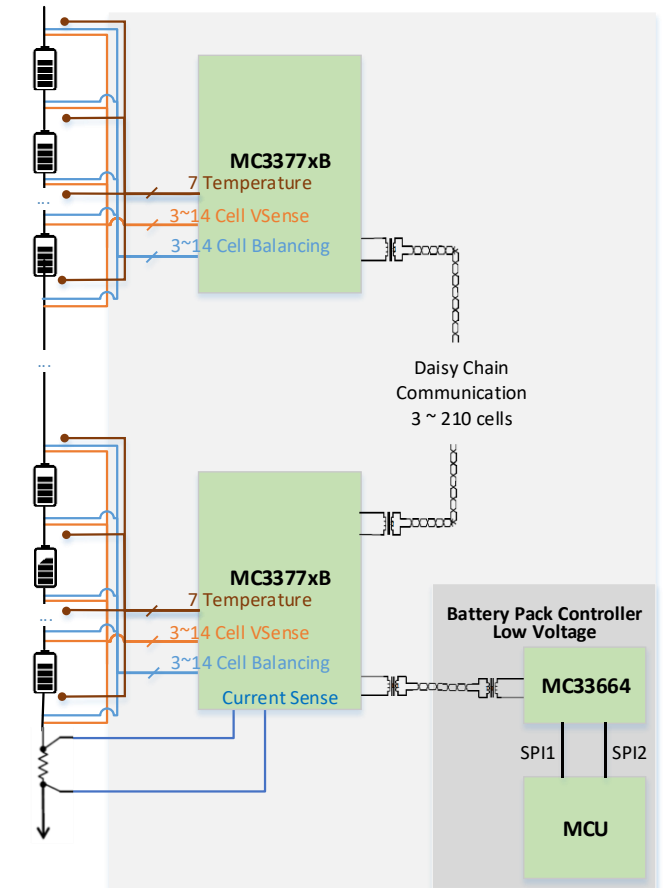
- ± 0.8 mV total voltage measurement error (after soldering & 1000 hrs HTOL aging)
- $\pm 0.5\%$ total stack voltage measurement
- $\pm 0.5\%$ accuracy integrated current sensor

Diagnosis and functional safety supporting ISO 26262 w/ single chip

- Single chip ASIL C capable (easy ASIL D)
- Sleep mode OV/UV and temperature monitor
- **> 40** integrated safety mechanisms detecting internal and external faults

Automotive robustness

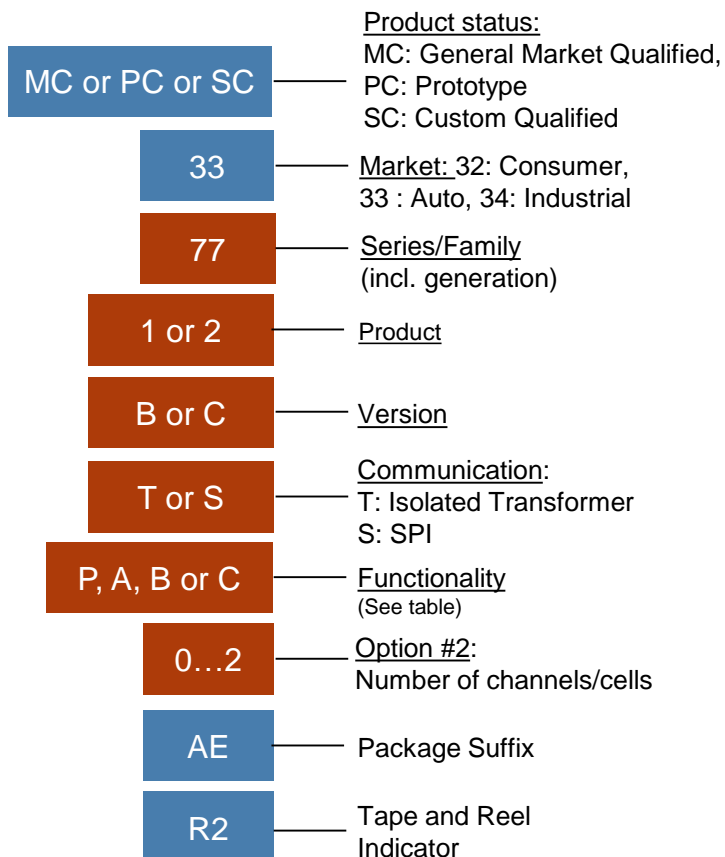
- ESD, EMC; Hot Plug, AEC-Q 100
- Temp range: -40°C to 105°C
- Operational low-power mode



What's New with MC33771C

Parameter	MC33772B	MC33771B	MC33771C
Voltage Channels	6	14	14
Supply Vpwr Range (Max Transient)	6V..30V (40V)	9.6V..61.6V (75V)	9.6V..61.6V (75V)
Cell Terminal Input Voltage Range	-0.3V to 5V	-0.3V to 5V	-0.3V to 5V
Typical Measurement Error	± 0.8 mV	± 0.8 mV	± 0.8 mV
Max Total Measurement Error (TME) for Cell Terminal Voltage (After aging: MLS3 & 1000h HTOL)	± 3.9 mV Vpwr=6~30V, Vcell=1.5~4.3V -40~60°C	± 3.9 mV Vpwr=9.6~61.6V, Vcell=1.5~4.3V -40~60°C	± 3.9 mV Vpwr=9.6~61.6V, Vcell=1.5~4.3V -40~60°C
HW Averaging for Cell Terminals	no	no	yes
Functional Safety	Single-chip ASIL C ASIL D Compliance	Single-chip ASIL C ASIL D Compliance	Single-chip ASIL C ASIL D Compliance
Isolated communication Speed	2 Mbps	2 Mbps	2 Mbps
Communication Isolation	Inductive	Inductive	Inductive, Capacitive
Max Nodes per Daisy Chain	15	15	63
CRC Bit	8	8	8
Comms bit	40	40	48
Integrated Balancing	<300 mA	<300 mA	<300 mA
Balancing sleep mode	Yes	Yes	Yes
Deep sleep mode	No	No	No
GPIO / Analog measurement inputs	7	7	7
Current Channels	1	1	1
Coulomb counter	1	1	1
Package	64-pin LQFP-EP	64-pin LQFP-EP	64-pin LQFP-EP

MC3377x Battery Cell Controller Part Numbering



Functionality & Communication

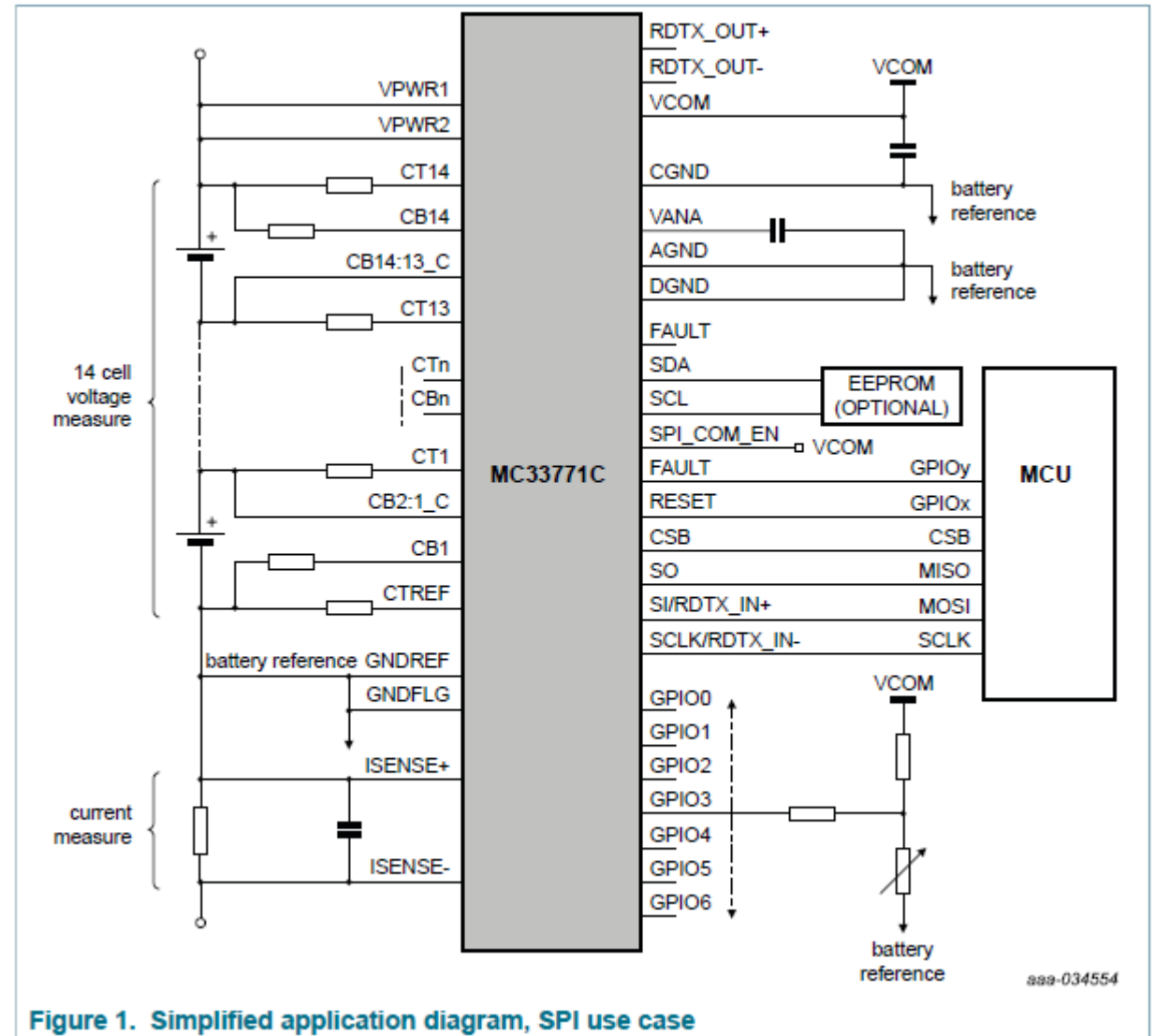
Part Number	Precise differential cell voltage measurement		Temperature		Cell Balancing	Current Channel	Coulomb counter	Communication	
	CTx	Cell OV/UV	Measurement	OT/UT				SPI	Half Duplex Differential
MC3377xBT P y	✓	✓	✓	✓	✓	✓	✓	✓	✓
MC3377xB S Py	✓	✓	✓	✓	✓	✓	✓	✓	NO
MC3377xBT A y	✓	✓	✓	✓	✓	NO	NO	✓	✓
MC3377xB S Ay	✓	✓	✓	✓	✓	NO	NO	✓	NO
MC3377xBT B y	✓	✓	NO	NO	NO	NO	NO	✓	✓
MC3377xB S By	✓	✓	NO	NO	NO	NO	NO	✓	NO
MC33772BT C y	NO	NO	✓	✓	NO	✓	✓	✓	✓

Number of precise differential cell voltage measurement channel

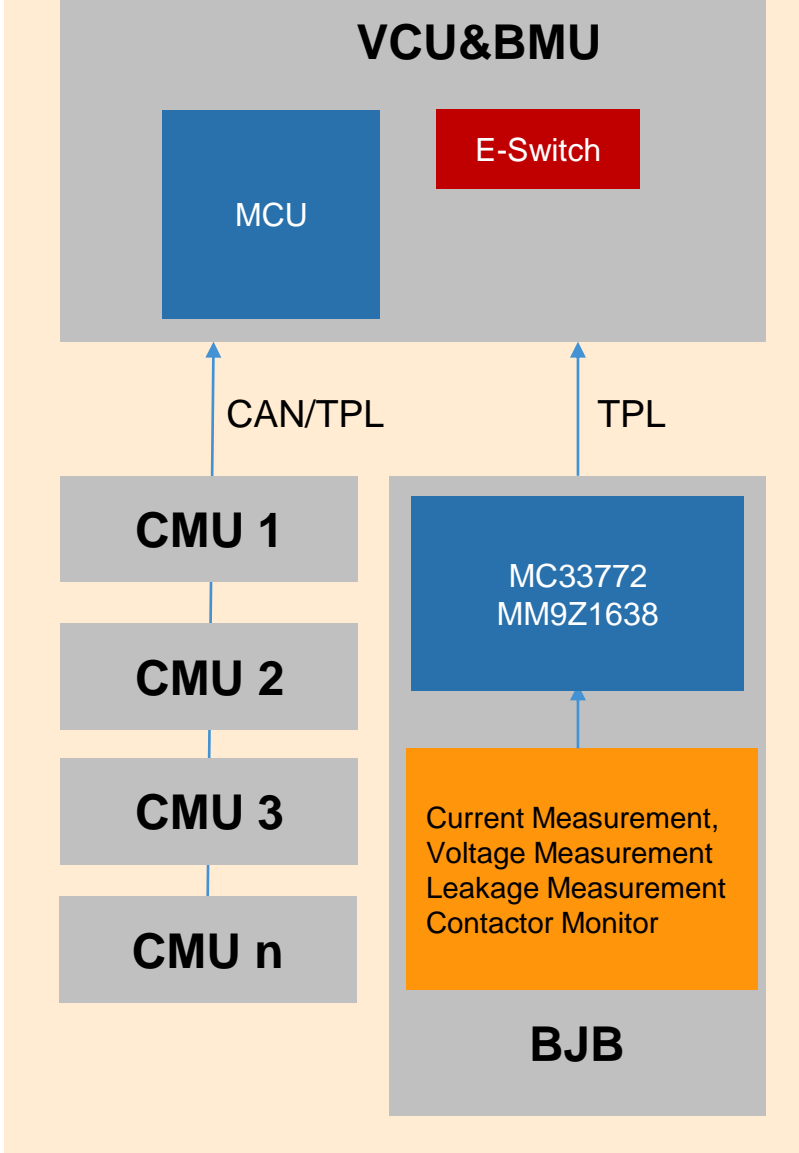
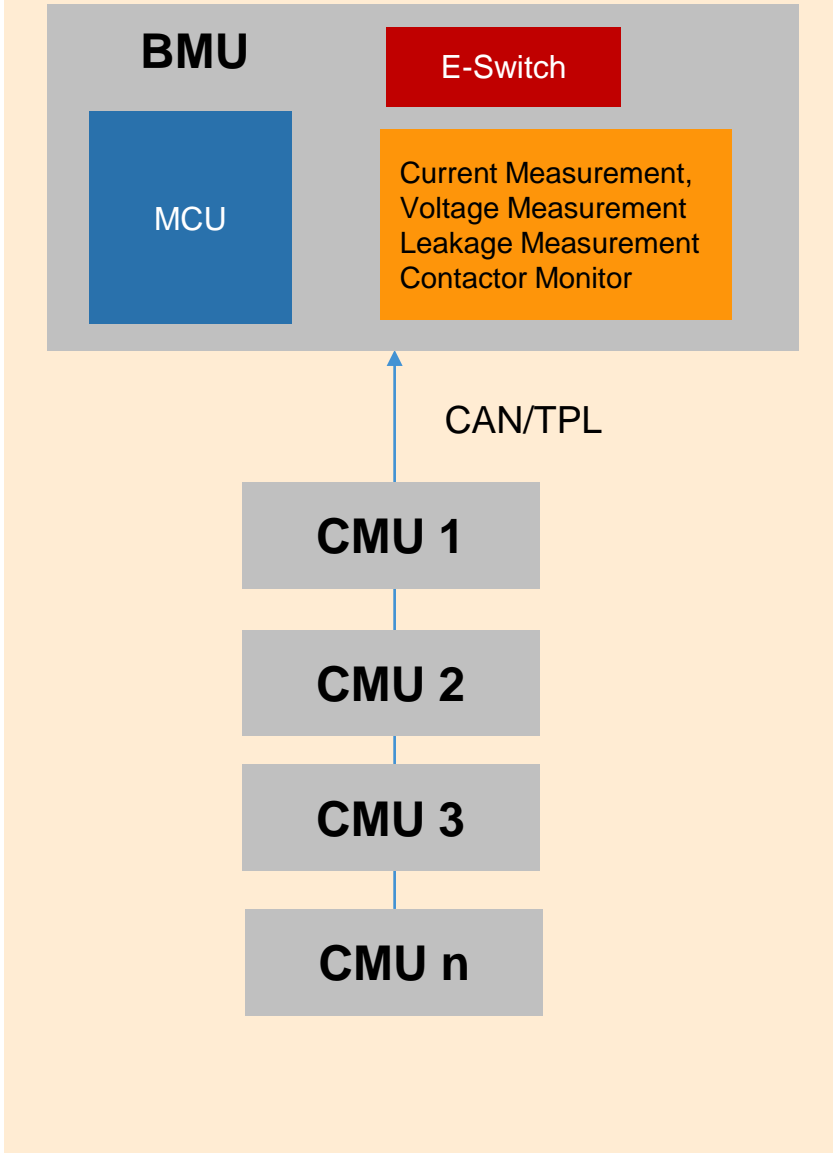
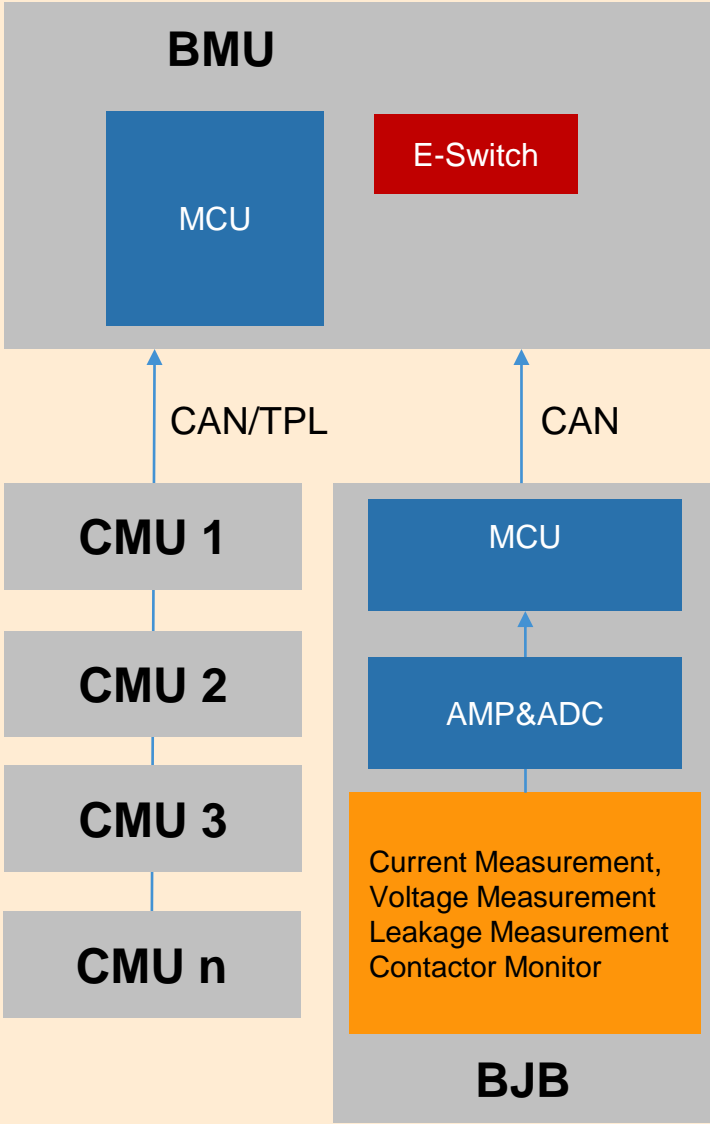
	x = 1	x = 2
y = 0	N/A	0
y = 1	14	6
y = 2	8	4

What's New with MC33771C

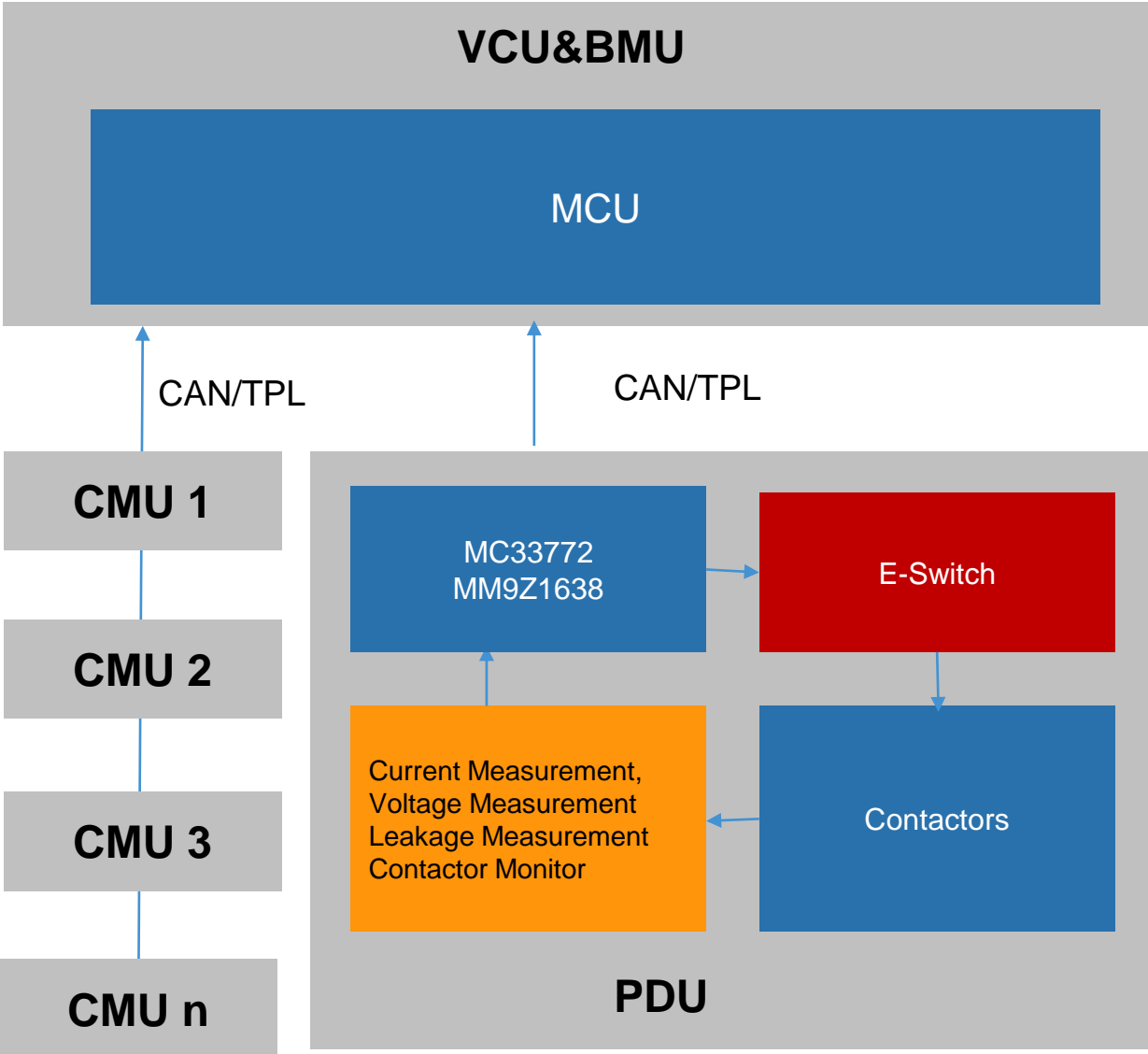
- $9.6\text{ V} \leq V_{PWR} \leq 61.6\text{ V}$ operation, 75 V transient
- 7 to 14 cells management
- **Isolated 2.0 Mbps differential communication or 4.0 Mbps SPI**
- Addressable on initialization
- **Bi-directional transceiver to support up to 63 nodes in daisy chain**
- **0.8 mV maximum total voltage measurement error**
- Synchronized cell voltage/current measurement with coulomb count
- **Averaging of cell voltage measurements**
- Total stack voltage measurement
- Seven GPIO/temperature sensor inputs
- 5.0 V at 5.0 mA reference supply output
- Automatic over/undervoltage and temperature detection routable to fault pin
- **Integrated sleep mode over/undervoltage and temperature monitoring**
- **Onboard 300 mA passive cell balancing with diagnostics**
- Hot plug capable
- Detection of internal and external faults, as open lines, shorts, and leakages
- **Designed to support ISO 26262, up to ASIL D safety system.**
- Qualified in compliance with AECQ-100



BJB (Battery Junction BOX) Solution



BJB Solution



NXP E-Switch Product and Feature

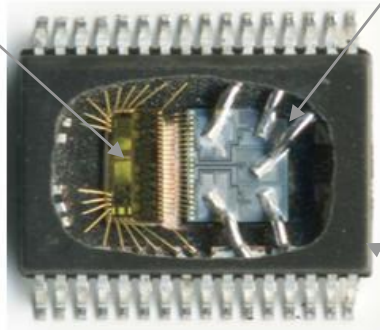
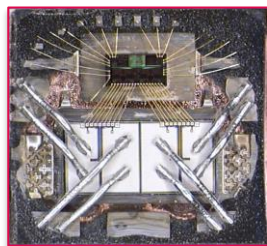
SMARTMOS™

□ 保护和诊断

- 过温 (175°C)
- 过流
- 电源电压过压/欠压
- 短路
- 电源反接
- 掉地和掉电源
- 感性负载能量泄放保护

□ SPI 接口

- 可设置和读取芯片状态
- 菊花链形式
- 可设置过流阈值
- 看门狗
- 内置PWM模块



Vertical Power Stage

□ 最新工艺

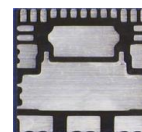
- Planar HDTMOS and TrenchFet LFET
- 45V & 65V BV

□ Protection in the power stage

- 温度检测
- 电流监测
- 电源电压检测(Gen4)

Power Package

□ PQFN low cost power package



- 0.5 mm thick lead frame
- Die soldered attached
- Rthj-c < 0.5°C/W

□ SOICeP32 and 54

- Designed for high power
- Large wire capability
- Pb-free compliancy



NXP E-Switch Product and Feature

Diagnostic type	Event	
SPI diagnostic	✓ Open load On state	Channel level
	✓ Open load Off state	
	✓ Open load LED	
	✓ Over temperature warning	
	✓ Output short to Vpwr	
	✓ I/O status	
	✓ Clock failure	
Analog diagnostic	✓ Supply voltage sense	Device level
	✓ Temperature sense	Channel level
	✓ Output current sense	

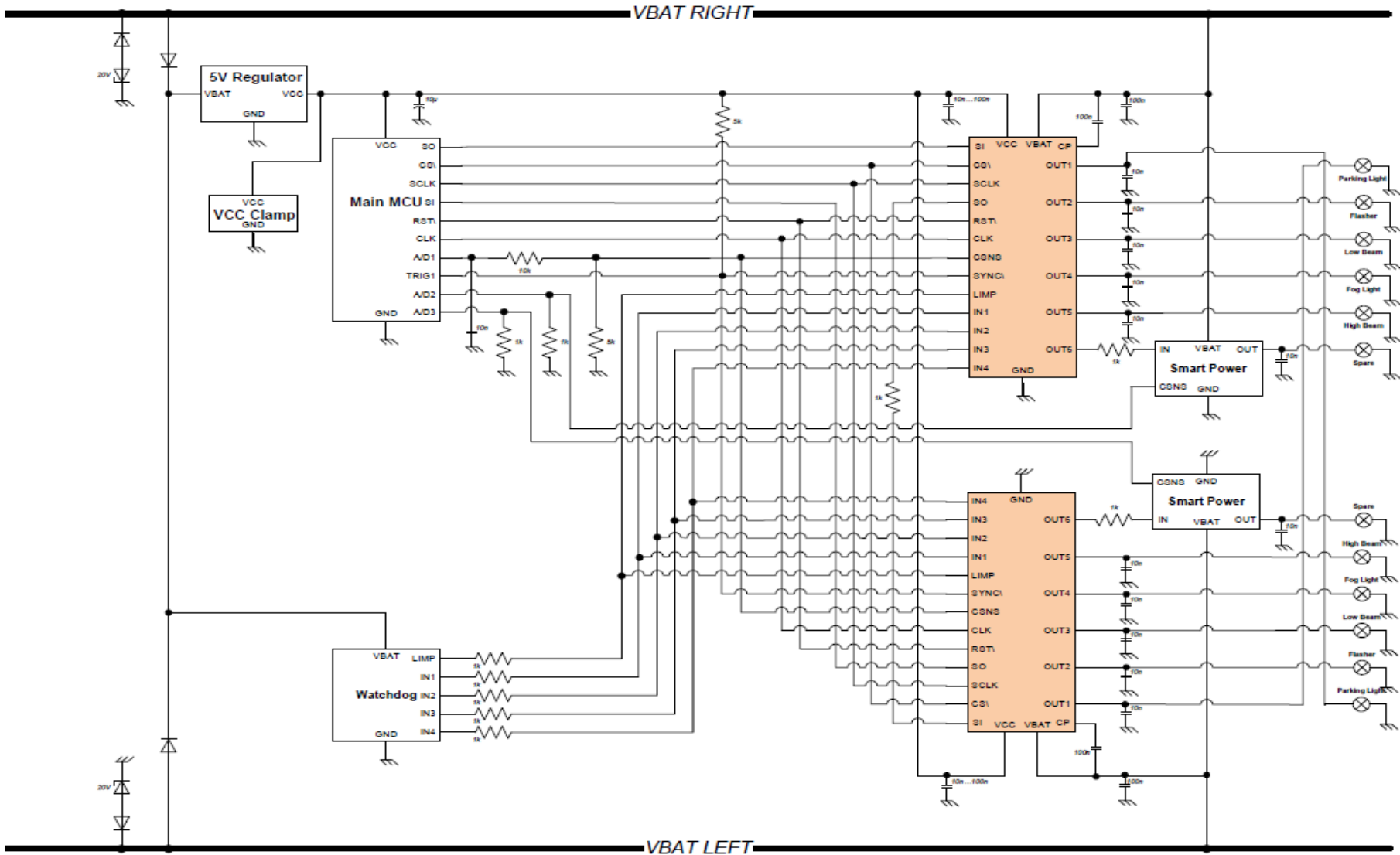


NXP E-Switch Product and Feature

Protection against	Failure type	Protection type	
Device/application failure	✓ Ground loss	Turn off	Device level
	✓ Rev batt	Turn on	
	✓ Overvoltage	Latch off	
	✓ Undervoltage	Latch off	
	✓ Charge pump failure	Latch off	Channel level
	✓ Overcurrent	Latch off / Current limitation	
	✓ Overload	Latch off	
	✓ Severe short circuit	Latch off	
✓ Over temperature	Latch off		
Communication issues	✓ Watchdog timeout	Fail safe mode	Device level
	✓ Watchdog toggle error	Fail safe mode	
	✓ SPI error	Fail safe mode	
	✓ VDD failure	Fail safe mode	



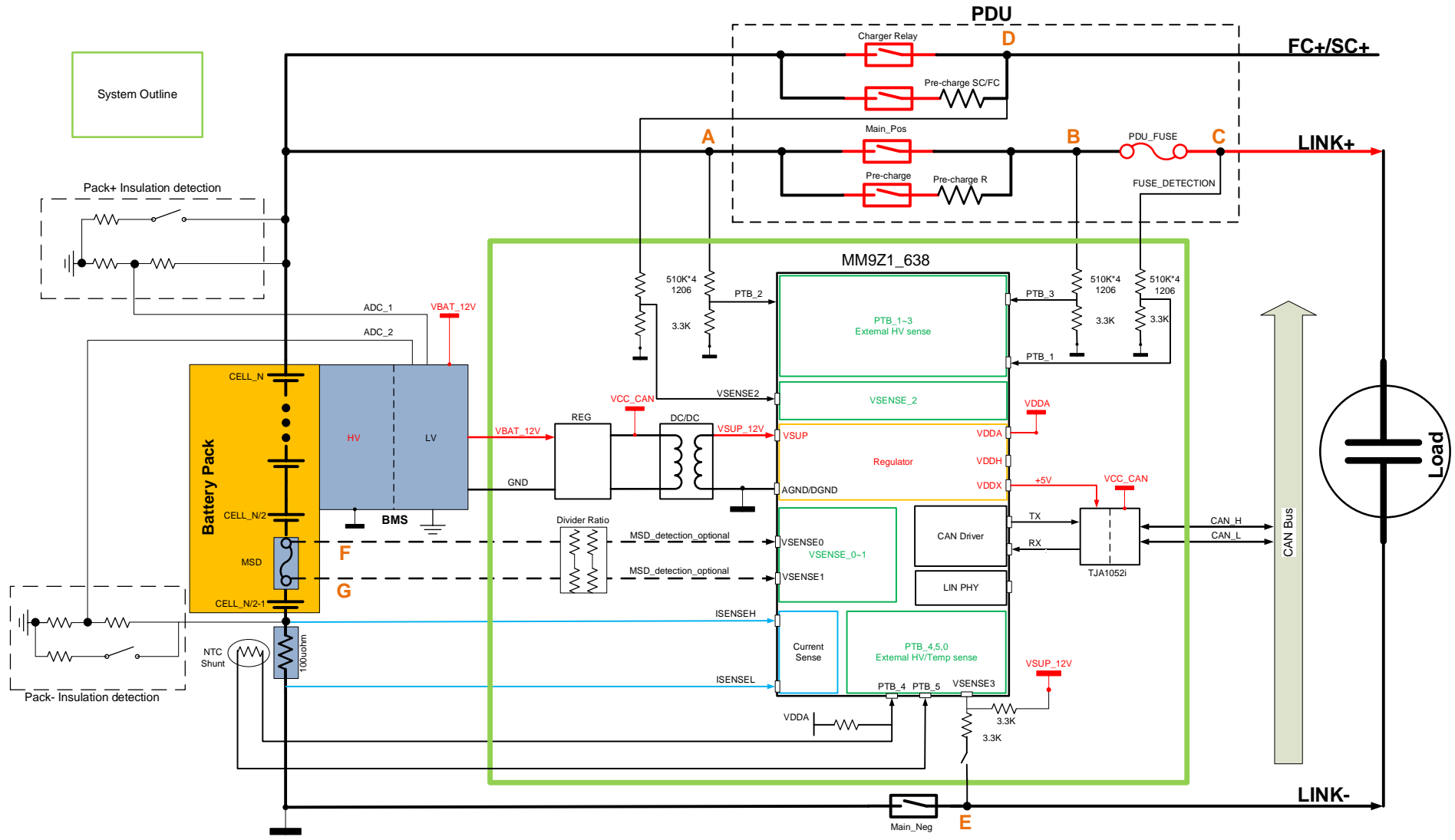
NXP E-Switch Product and Feature



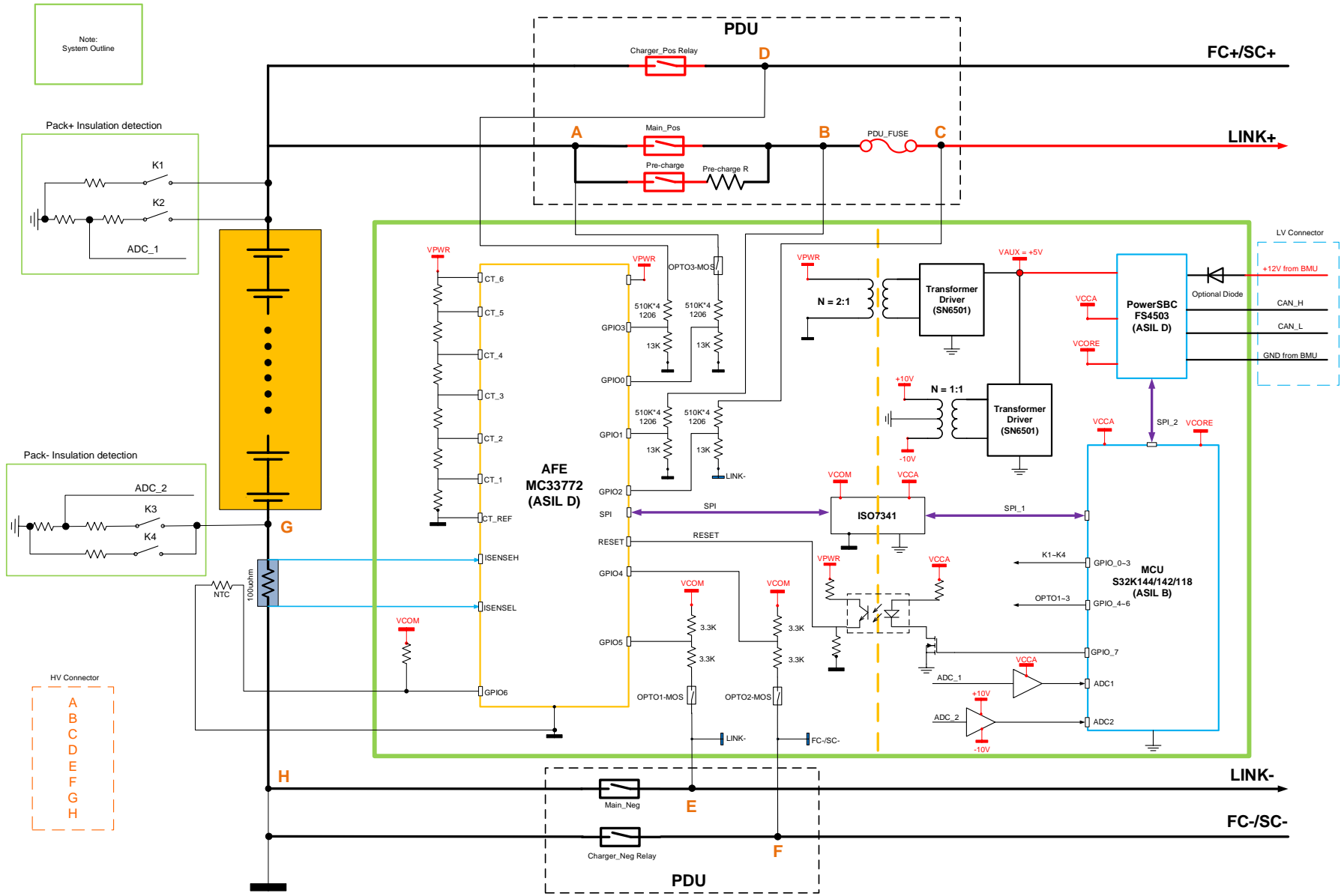
NXP E-Switch Product and Feature

Family	Part Number	Outputs # and Rdson	Total Outputs #	Operating Voltage (V)	Max.continuous current for all output ON (A)	Max continuous current for	Peak current(A)	Max PWM frequency	Package	Pin to Pin Compatibility	SW Compatibility	Application
12V Automotive												
MC12XS2	MC33981ABHFK	1x 4mΩ	1	6-27	40	40	75	60kHz	16-pin PQFN	-	-	燃油泵/水泵
	MC33982CHFVK	1x 2mΩ	1	6-27	60	41	120	1kHz	16-pin PQFN	√	√	保险丝盒
	MC33984CHFVK	2x 4mΩ	2	6-27	30	21	80	1kHz	16-pin PQFN			保险丝盒
	MC33988CHFVK	2x 8mΩ	2	6-27	30	10.5	40	1kHz	16-pin PQFN			保险丝盒
MC12XS3	MC07XS3200EK	2x 7mΩ	2	6-20	6	21	89.9	800Hz	32-pin SOICEP	-	√	BCM
	MC10XS3425EK	2x 10mΩ, 2x 25mΩ	4	6-20	6	19.2 9.2	77.6 38.8	800Hz	32-pin SOICEP	-		BCM
	MC10XS3412DHFK	2x 10mΩ, 2x 12mΩ	4	6-20	6	18.9	78	1kHz	24-pin PQFN	√		BCM
	MC10XS3435DHFK	2x 10mΩ, 2x 35mΩ	4	6-20	6	18.9 9.4	78 39.5	1kHz	24-pin PQFN			BCM
	MC15XS3400DHFK	4x 15mΩ	4	6-20	6	18.9	78	1kHz	24-pin PQFN			BCMBMS
	MC35XS3400DHFK	4x 35mΩ	4	6-20	6	9.4	39.5	1kHz	24-pin PQFN	BCMBMS		
	MC09XS3400AFK	4x 9mΩ	4	6-20	6	21.6	89.4	800Hz	24-pin PQFN	√		BCM
MC12XS3	MC10XS3535HFK	3x 10mΩ, 2x 35mΩ	5	6-20	5.5 2.8	17.6/12.1 5.7	63.2 28	400Hz	24-pin PQFN	√	√	BCM
	MC35XS3500HFK	5x 35mΩ	5	6-20	2.8	5.7	28	400Hz	24-pin PQFN			BCM
	MC06XS3517AFK	3x 6mΩ, 2x 17mΩ	5	6-20	5.5 2.8	17 9	96 48	400Hz	24-pin PQFN			BCM
MC12XS6	MC07XS6517BEK	3x 7mΩ, 2x 17mΩ	5	7-18	11 5.5	17.6 8.8	100 42	400Hz	54-pin SOICEP	√	√	BCM
	MC17XS6500BEK	5x 17mΩ	5	7-18	5.5	8.8	42	400Hz	32-pin SOICEP			BCMBMS
	MC40XS6500EK	5x 40mΩ	5	7-18	3.9	6.4	28	400Hz	32-pin SOICEP			BCMBMS
	MC08XS6421EK	2x 8mΩ, 2x 21mΩ	4	7-18	11 5.5	17.6 8.8	96 40	400Hz	32-pin SOICEP			BCM
	MC17XS6400EK	4x 17mΩ	4	7-18	5.5	8.8	42	400Hz	32-pin SOICEP			BCM
	MC25XS6300EK	3x 25mΩ	3	7-18	4.5	8.3	31	400Hz	32-pin SOICEP			BCM
	MC10XS6325EK	2x 10mΩ, 1x 25mΩ	3	7-18	9 4.5	16 8.3	76 31	400Hz	32-pin SOICEP			BCM
	MC10XS6200EK	2x 10mΩ	2	7-18	9	16	76	400Hz	32-pin SOICEP			BCM
MC10XS6225EK	1x 10mΩ, 1x 25mΩ	2	7-18	9 4.5	16 8.3	76 31	400Hz	32-pin SOICEP	BCM			
24V Automotive												
MC24XS4	MC06XS4200BFK	2x 6mΩ	2	8-36	9	15	90	1kHz	24-pin PQFN	√	√	BCMBMS/Motor
	MC10XS4200BFK	2x 10mΩ	2	8-36	6	9	55	1kHz	24-pin PQFN			BCMBMS/Motor
	MC20XS4200BFK	2x 20mΩ	2	8-36	3	4.5	27.5	1kHz	24-pin PQFN			BCMBMS/Motor
	MC22XS4200BEK	2x 22mΩ	2	8-36	3	4.3	26.4	1kHz	32-pin SOICEP			BCMBMS/Motor
	MC50XS4200BEK	2x 50mΩ	2	8-36	1.2	1.7	10.3	1kHz	32-pin SOICEP			BCMBMS/Motor

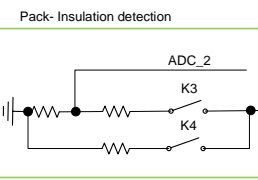
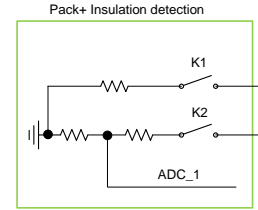
NXP BJB Solution (MM9Z1-638)



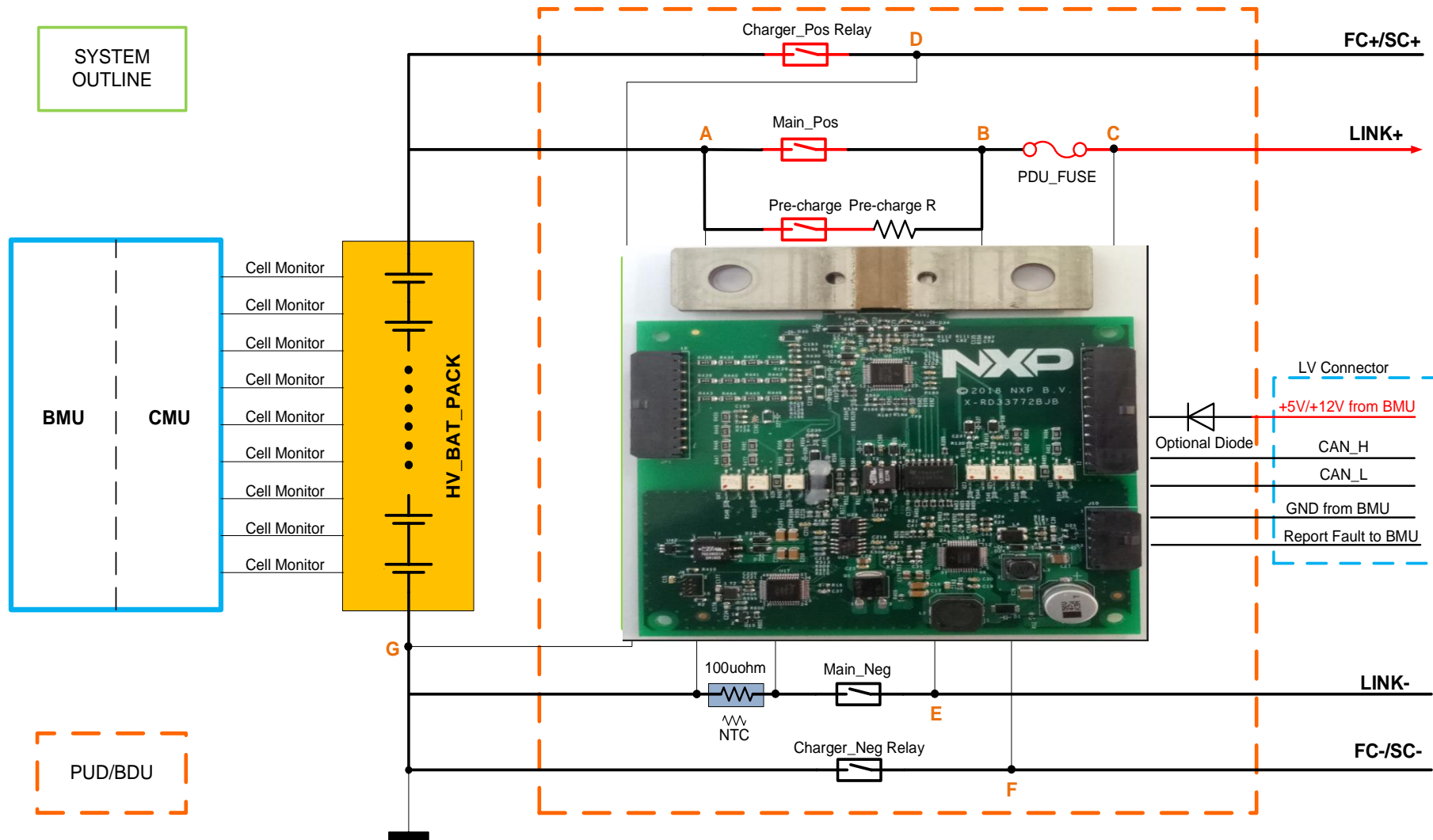
NXP BJB Block(MC33772)



Note:
System Outline



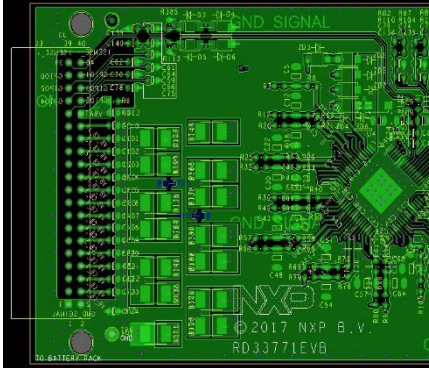
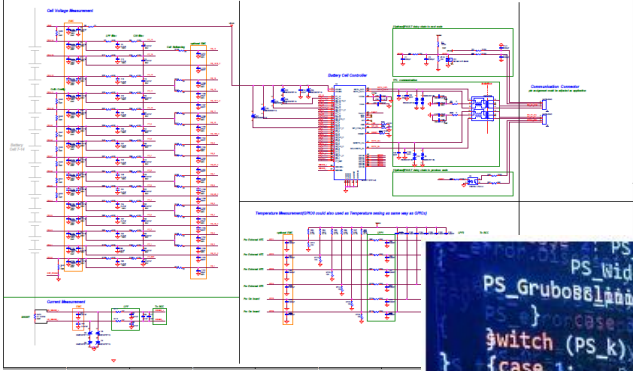
NXP BJB Solution (MC33772)



NXP BMS System Solution Supplier

Solutions	MCU Master/salve	AFE	SBC	Isolated Comm	CAN (isolated)	ESD for CAN	E-switch	RTC	GA & Logic
CAN based – functional safety ASIL-C/D, <= 3xCAN	MPC574xP/ KEA	MC33771/ MC33772	MC33FS6 5xx/ MC3390x	MC33664	TJA1057T/ TJA1052I Low power: TJA1044T, TJA1043T	PESD1CAN	MC15XS3400/ MC35XS3400	PCF8563T	GA: PMEG3020EH PMEG10020ELR PMEG4020EP PMEG6020ETP BZX384-C30 BAS716 PBSS5350Z Logic: 74HC595-Q100 74HC4051-Q100
CAN based – functional safety ASIL-C/D, > 3xCAN	MPC574xR/ KEA	MC33771/ MC33772	MC33FS6 5xx/ MC3390x	MC33664		PESD1CAN		PCF8563T	
CAN based – functional safety <= ASIL-B, <= 3xCAN	S32K144/ KEA	MC33771/ MC33772	MC33FS4 5xx/ MC3390x	MC33664		PESD1CAN		PCF8563T	
CAN based – functional safety <= ASIL-B, > 3xCAN, high end	MPC574xB/C/D/G/ KEA	MC33771/ MC33772	MC33FS4 5xx/ MC3390x	MC33664		PESD1CAN		PCF8563T	
CAN based – functional safety <= ASIL-B, > 3xCAN, low/mid end	MPC560xB/C/ KEA	MC33771/ MC33772	MC33FS4 5xx/ MC3390x	MC33664		PESD1CAN		PCF8563T	

What NXP Can Supply



```

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{
    TFG[1].PS_Wykresl();
    break;
}

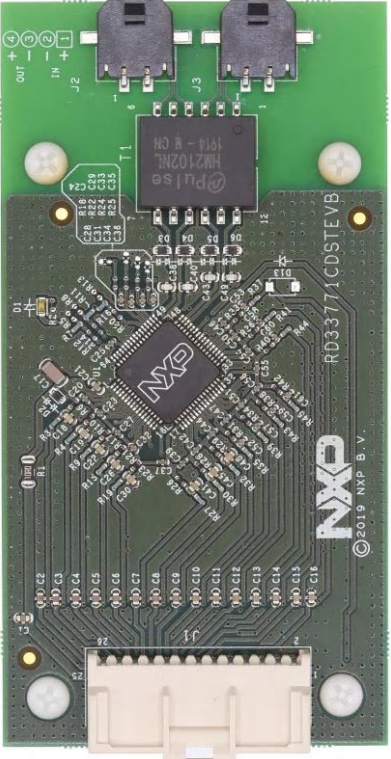
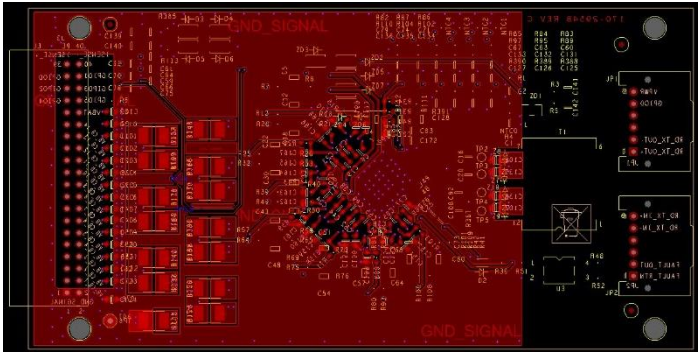
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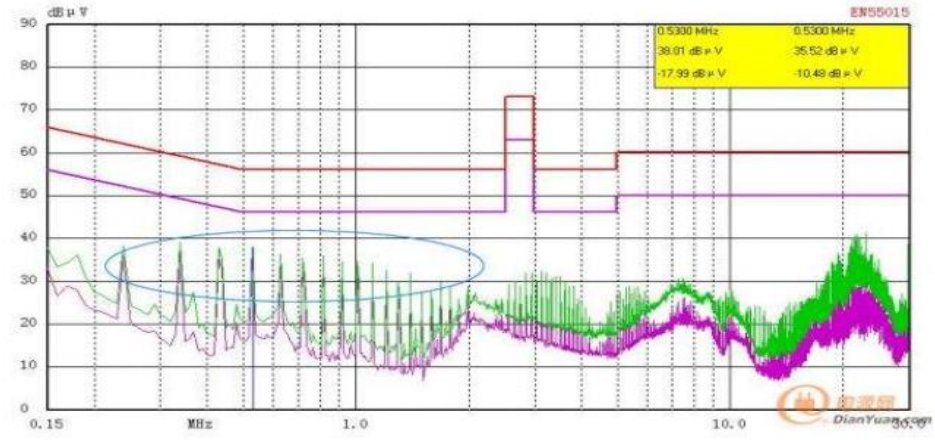
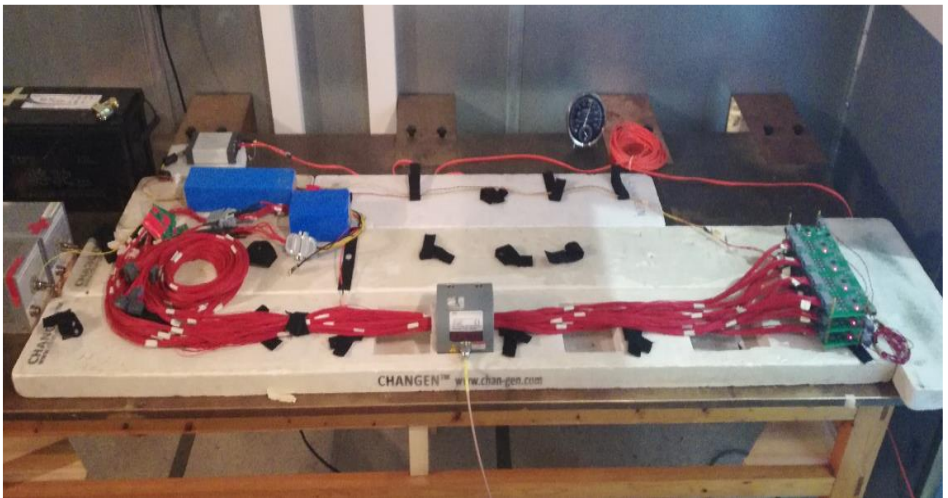
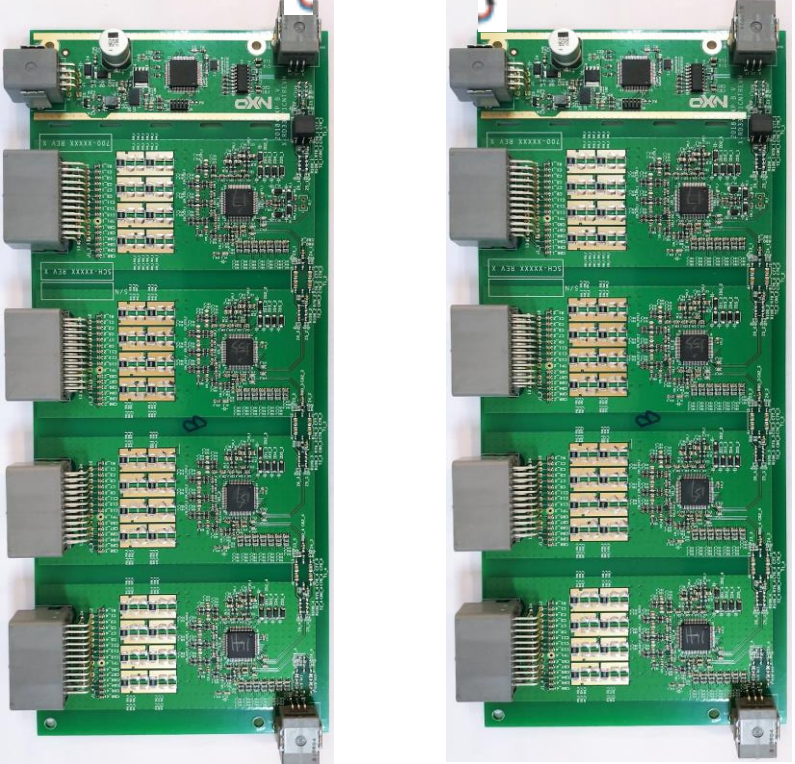
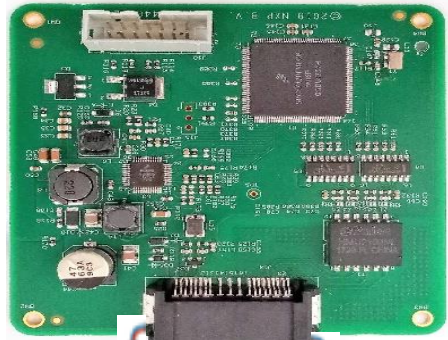
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```



What NXP Can Supply





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