RENESAS XEV PRODUCT PORTFOLIO INTRODUCTION

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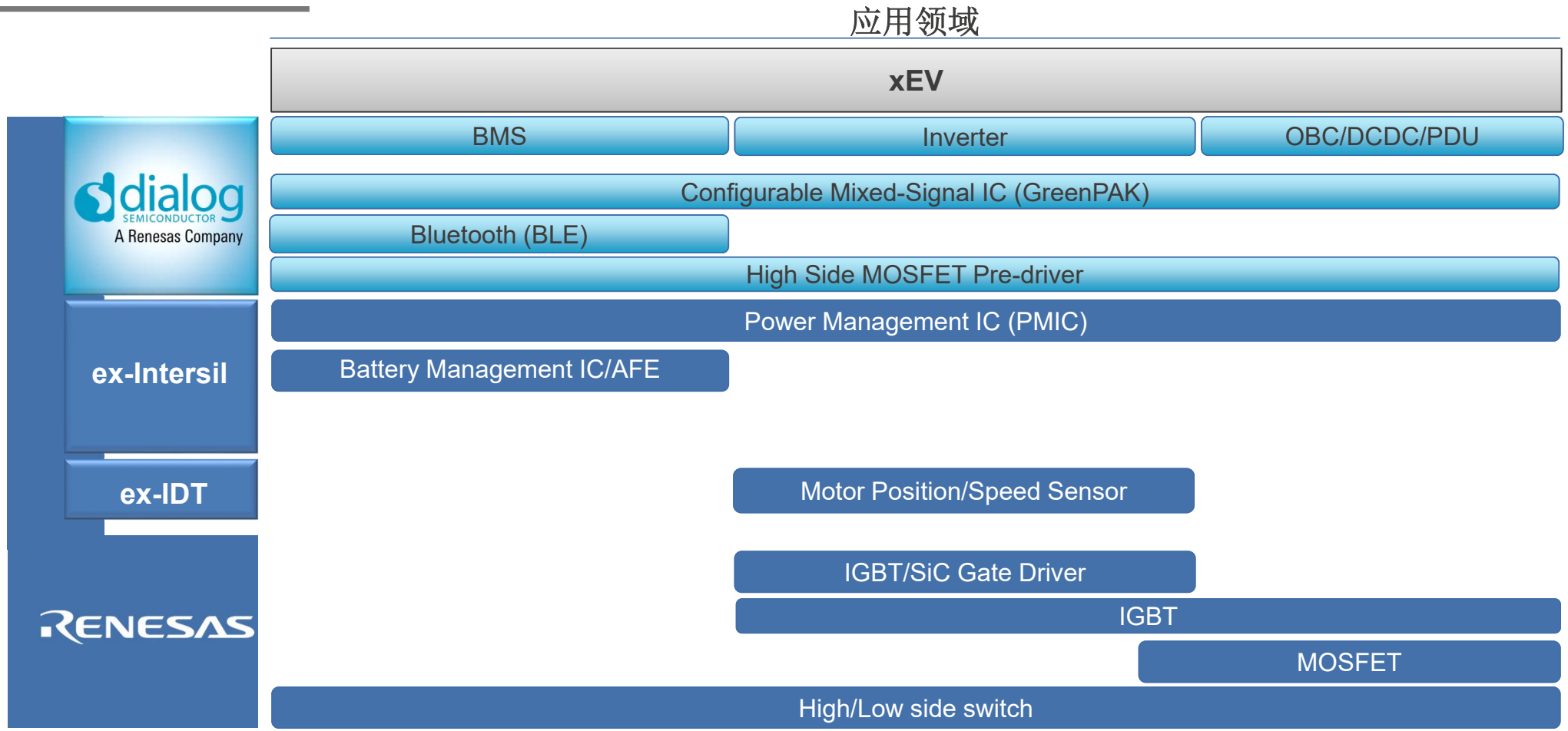
AUTOMOTIVE ANALOG PRODUCT MARKETING DIVISION,
AUTOMOTIVE SOLUTION BUSINESS UNIT
RENESAS ELECTRONICS CORPORATION

不断丰富的模拟和功率产品阵容



BMS REFERENCE DESIGN
INTRODUCTION

LITHIUM BATTERY MARKETS IN AUTOMOTIVE

12V Li-battery

4~6 CELLs
Single AFE

48V Li-battery

12-16 CELLs
Single AFE

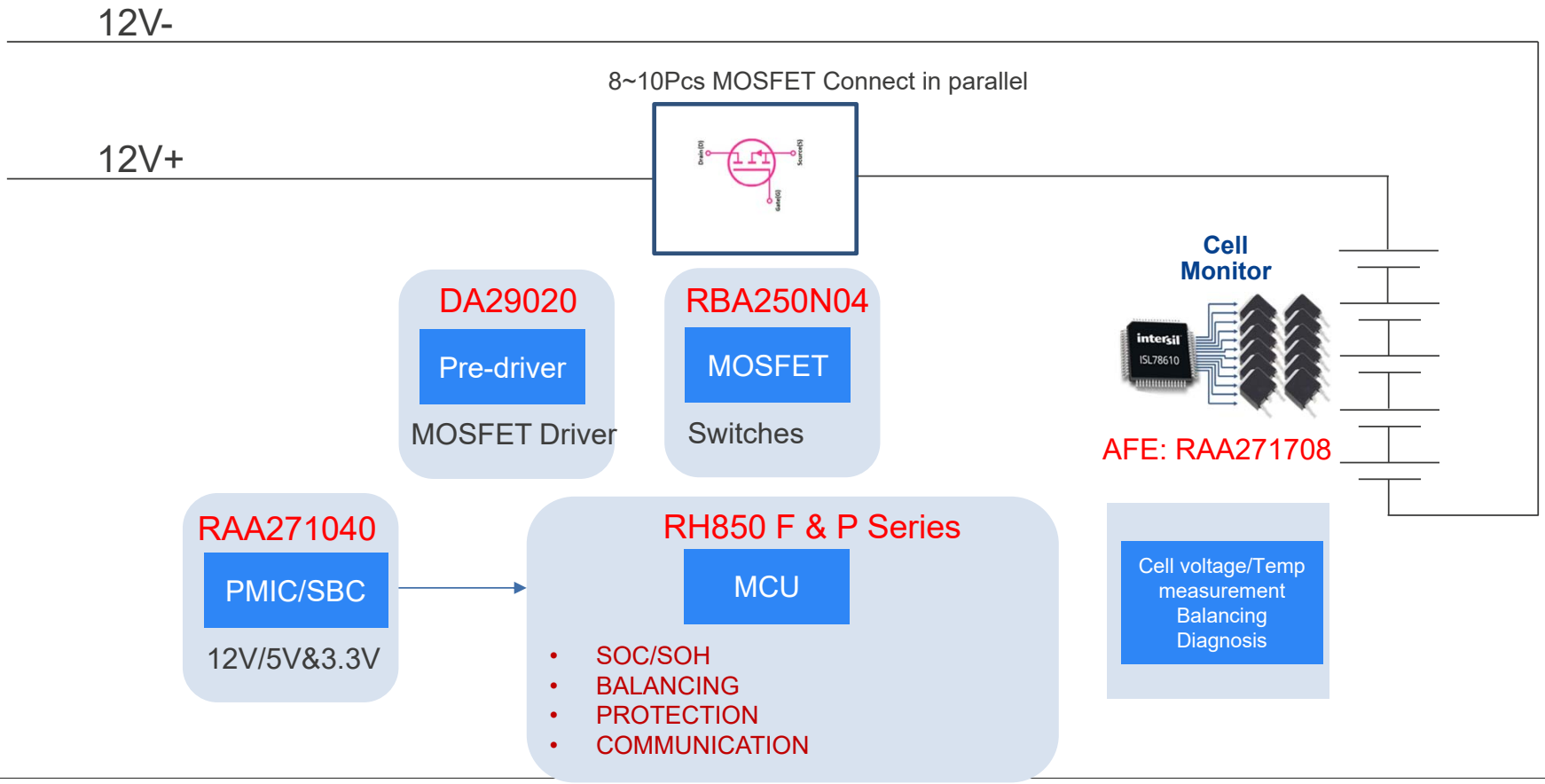
HEV/PHEV/BEV Pack 200V~400V

50~100 CELLs
5~10 Pcs AFEs

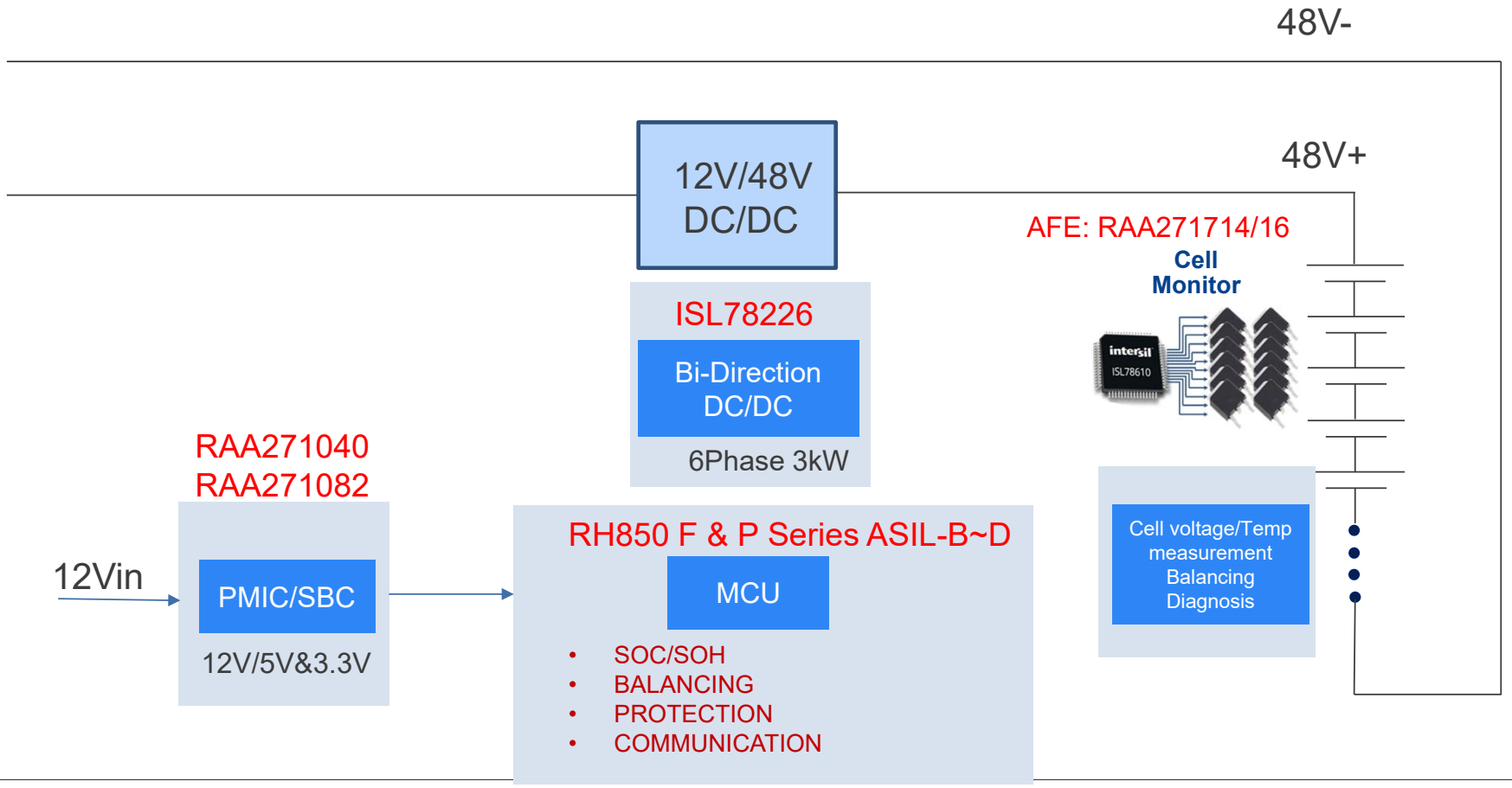
BEV Pack 800V

Above 400 CELLs
16~20 Pcs AFEs

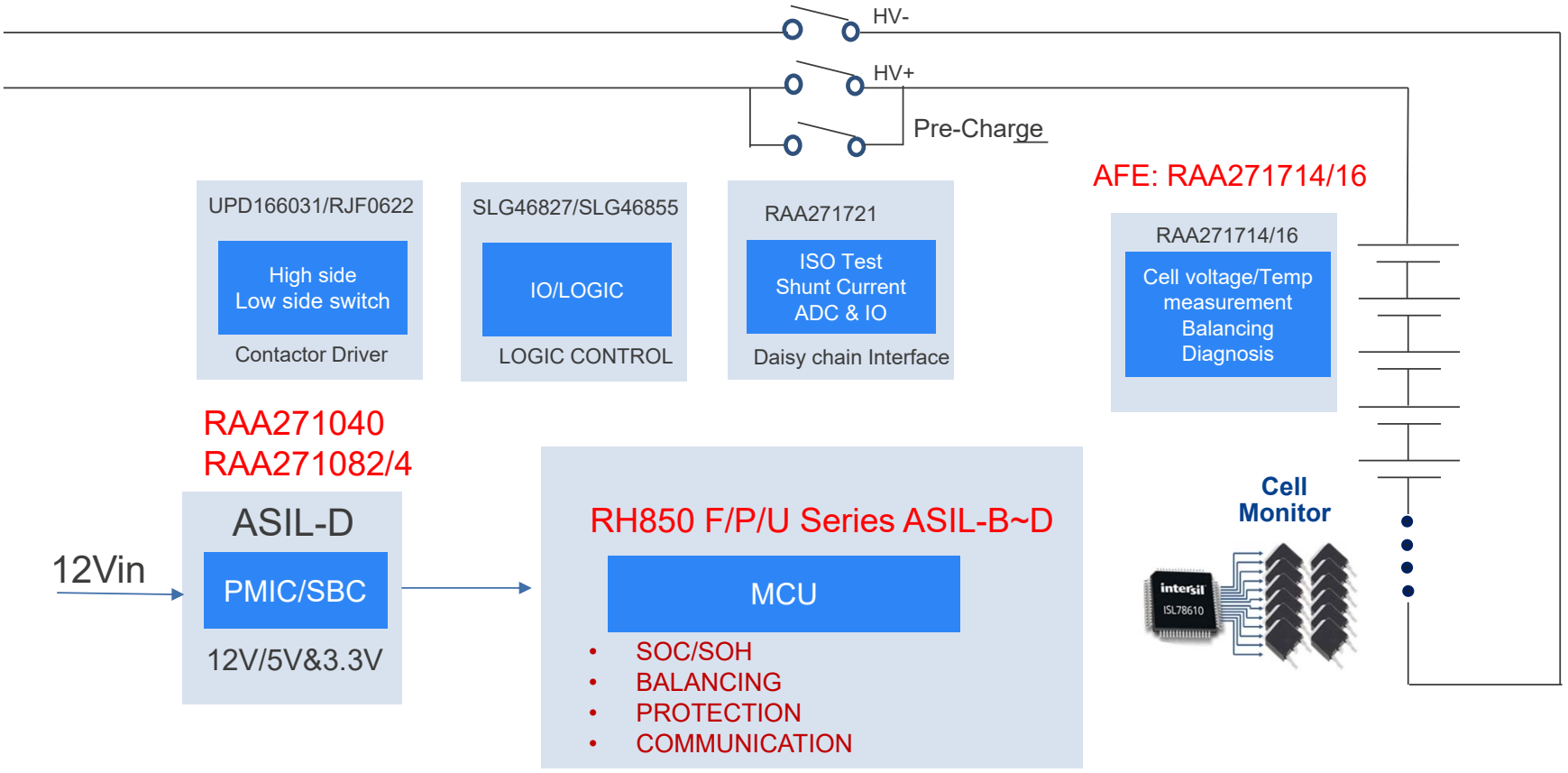
12V LITHIUM BATTERY BMS SOLUTION



48V LITHIUM BATTERY BMS SOLUTION

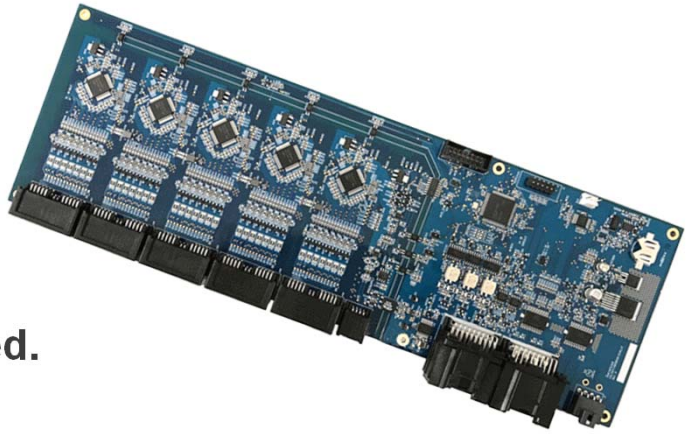


200V~800V LITHIUM BATTERY BMS SOLUTION



CURRENT PRODUCTS: BMS REFERENCE DESIGN

BATTERY MANAGEMENT IC – ISL78714

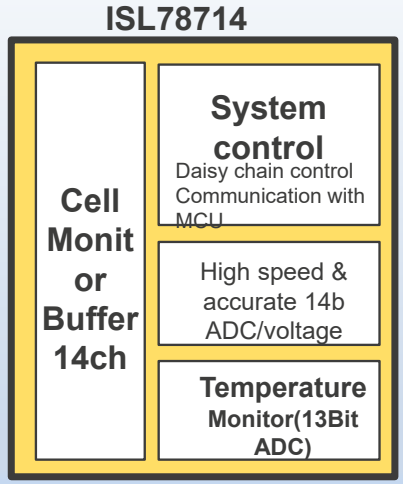


Features:

- ISL78714 supports cell voltage monitoring of 14cells/IC
  - With daisy-chain connection, 30 ICs (420cells) can be connected.
- Board-level accuracy (after soldering)
  - Initial cell voltage accuracy of ±2mV
    - With the wide range of -20~+85°C, 1.65~4.28V
  - Long-term drift of ±6mV @6σ 15years
    - World's top-level performance for long-time use
  - Measurement time of 280us @14cell
    - Contributes to shorten the measurement time interval
  - Certified EMC/ESD (Authorized by IBEE-Zwickau)
- ASIL support (Cell voltage: ASIL-D/Temp.: ASIL-C)
- RH850+ISL78714 reference design ready

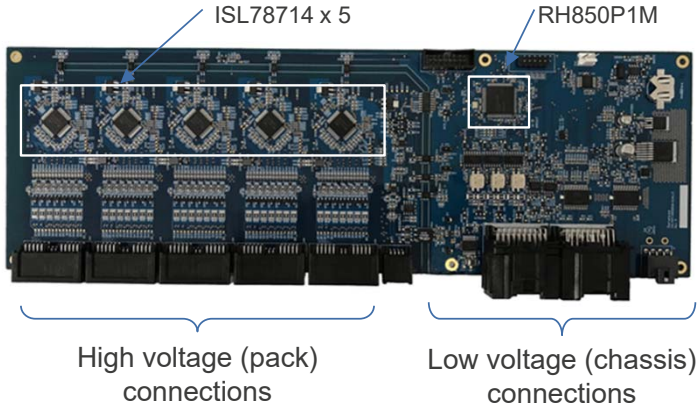
ISL78714 key features

- ✓ Max number of cells: 14cell
- ✓ Monitor voltage range: ±5V
- ✓ Voltage accuracy: ±2mV
- ✓ Measurement time: 280us (14cell)
- ✓ Diagnosis: OV, OT, OC, etc.
- ✓ ASIL-C,AEC-Q100
- ✓ Temp: Ta= -40 ~ +105°C
- ✓ Package 64pin TQFP 10x10㎜

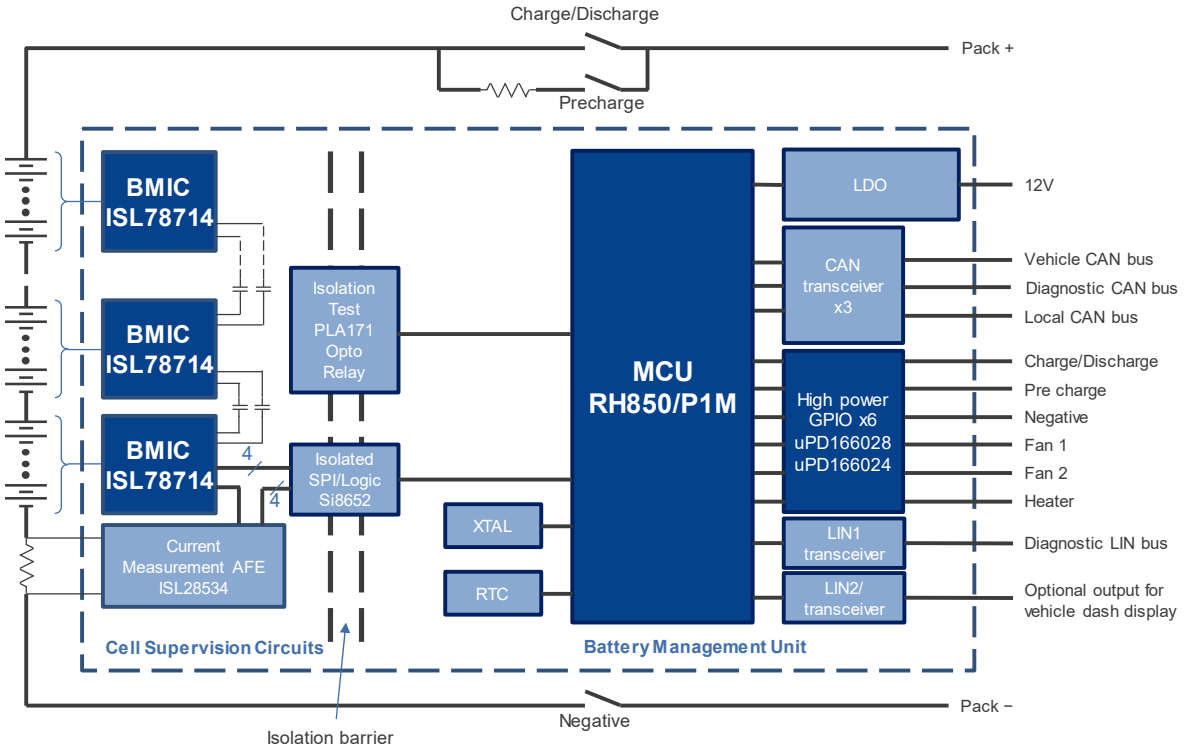


BMS REFERENCE DESIGN – ISL78714 + RH850

- Complete evaluation platform
  - Setup and data logging via CAN and UART
  - Graphical User Interface (GUI)
  - Layout files (Altium)
  - Low level drivers for RH850 peripherals and ISL78714
- Hardware reference manual
- Software reference manual
- Interface manual covers CAN, LIN and GUI



System Block Diagram



NEXT GEN PRODUCTS – RAA2717XX BMS SOLUTIONS

RENESAS NEXT GEN BMS ICS

- Family of pin compatible BMIC devices: 8 to 16 channels
- ISO26262 compliant: ASIL-D
- Loop Daisy Chain
- True simultaneous sampling and filtering functions
- Complete reference designs including software device drivers

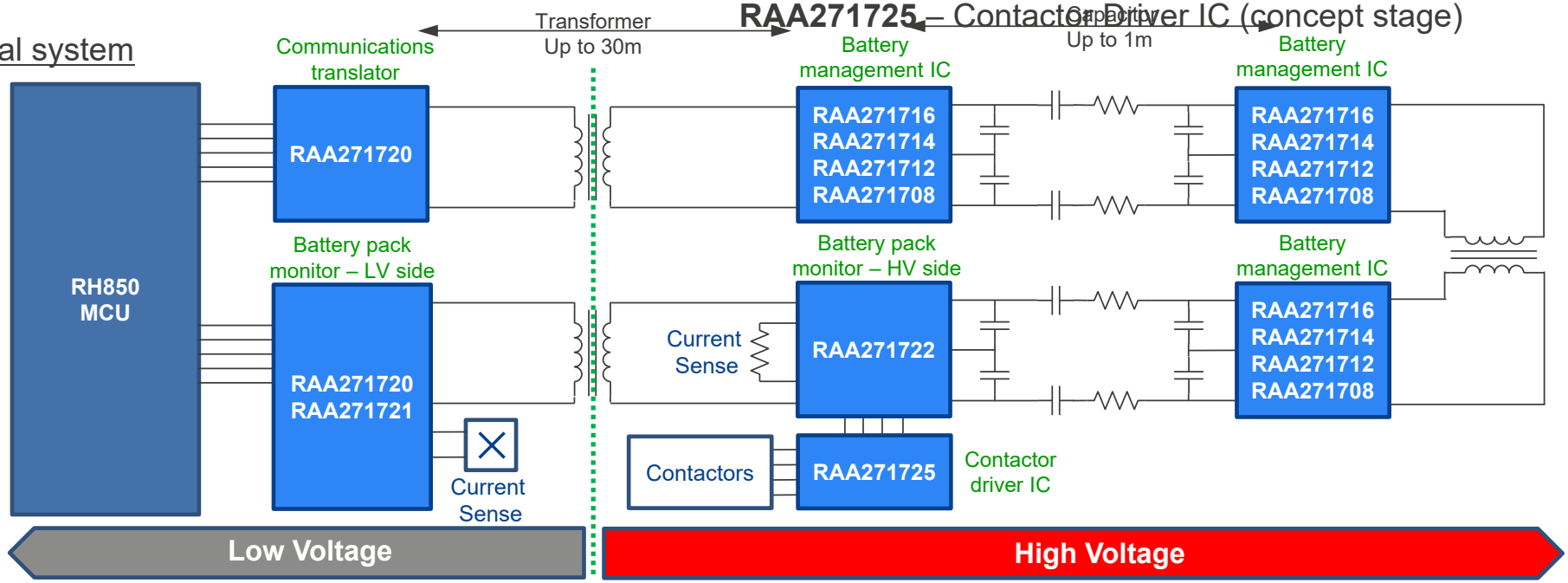
RAA271708 / 12 / 14 / 16 – +/-2mV accuracy, 300mA max internal balancing

Pin Compatible BMIC Family

RAA271720 – +5V Daisy Chain interface
RAA271721 – +5V Daisy Chain I/F + Hall effect I-sense
RAA271722 – Daisy Chain I/F + shunt I-sense + Contactor Control + ISO test

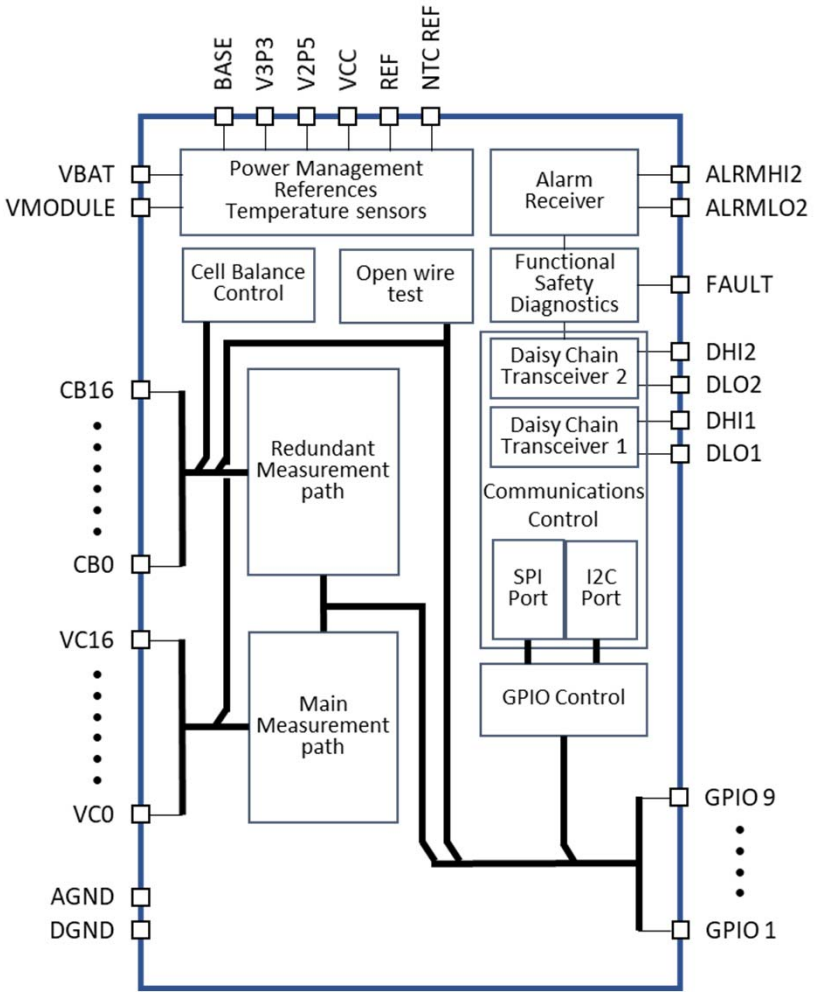
RAA271725 – Contactor Driver IC (concept stage)

Typical system



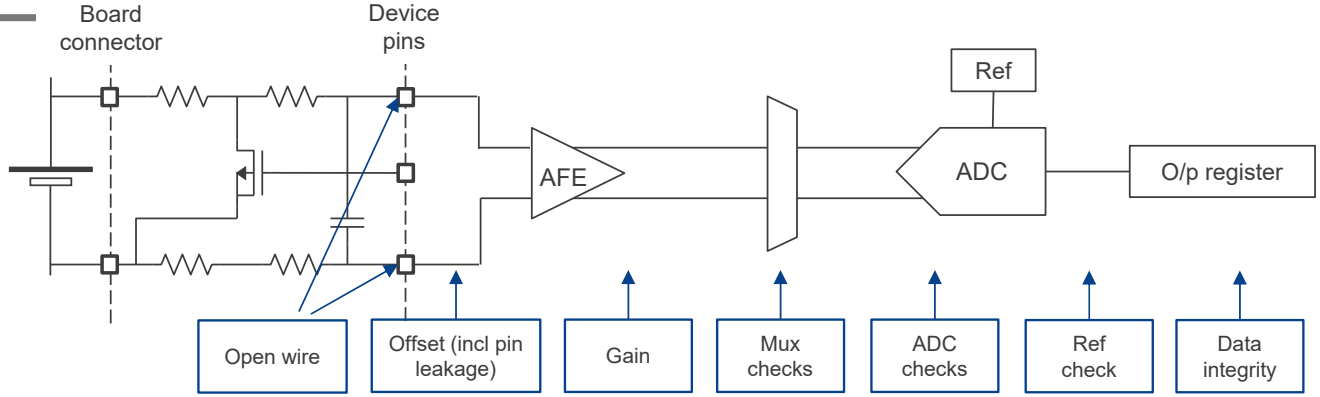
RAA271716 – LI-ION BATTERY MONITOR

- Class leading board level cell measurement accuracy
  - ±2.0mV ±3σ (post Solder – ISL78714 data)
- 16 cell voltage inputs with sample/hold per channel
  - ±5V measurement range (fuel cells/bus bars)
  - Bus bars in any location
- Up to 9 GPIO/voltage/NTC inputs
- Flexible measurement capabilities
  - Digital filtering
  - True Simultaneous Sampling
- 300mA Internal Balancing with <20C temperature rise
- 64 lead Package
- AEC-Q100 and ISO26262 compliant ASIL-D
- Reverse Wake-up



SAFETY CONCEPT – ISL78714 vs RAA2717xx

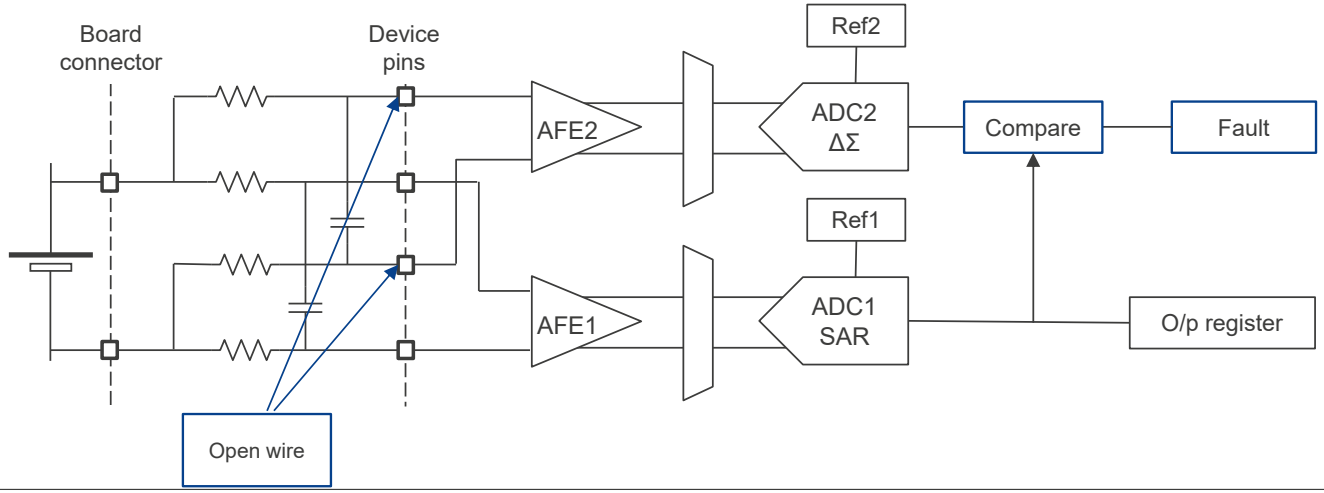
ISL78714 safety concept (single path)



ISL78714/15

Multiple diagnostic functions to ensure measurement integrity

RAA2717xx safety concept (dual path)



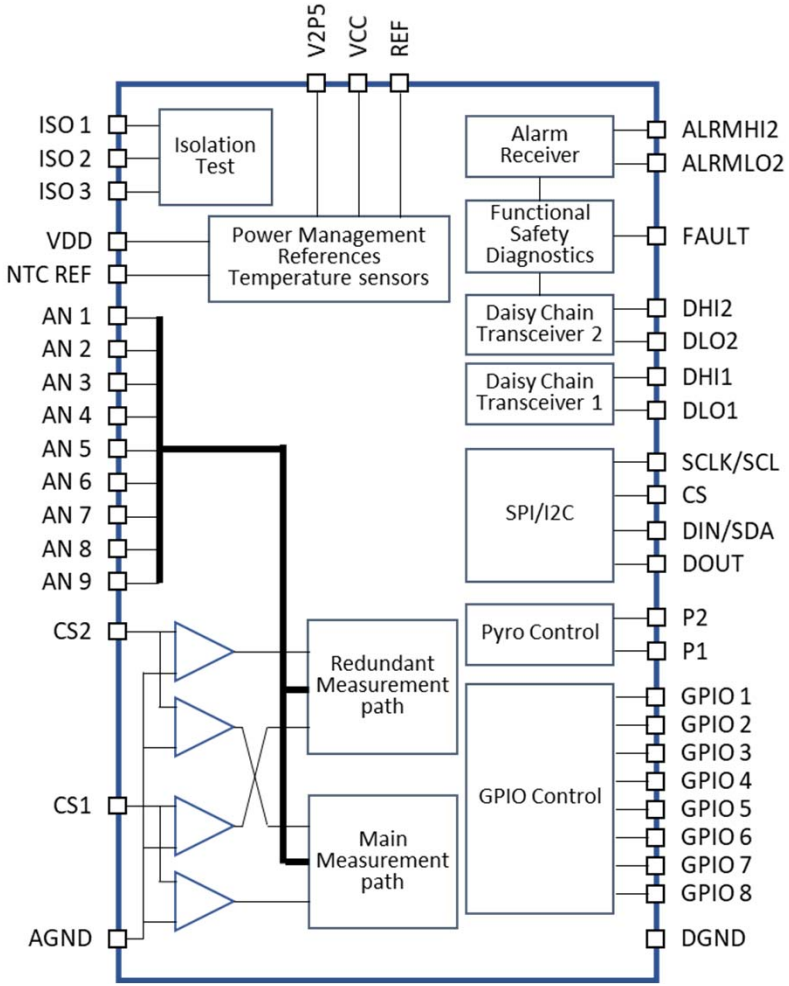
RAA2717xx

Fewer diagnostic functions
~ Faster diagnostics
~ Simpler analysis

Dual ADC sampling checking

RAA271722 – SPI HUB

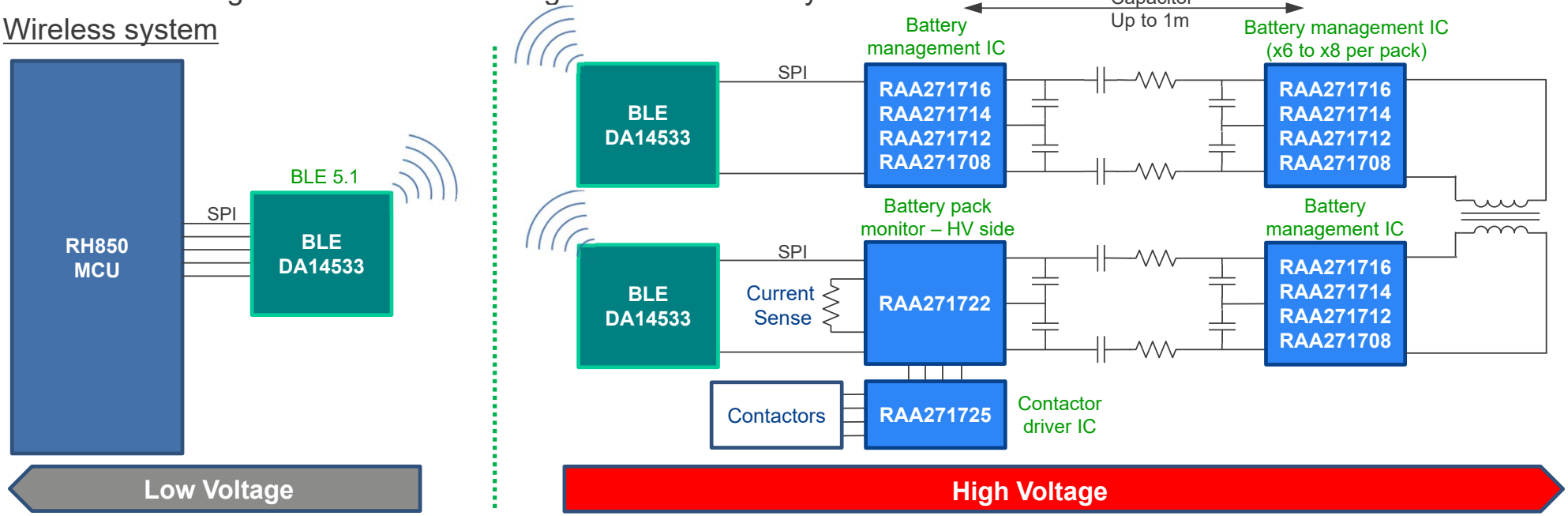
- 2 hall effect current measurement inputs
  - Realizing Coulomb counting
- Built-In Daisy Chain, SPI and I2C interfaces
- SPI/I2C Master
- True simultaneous stack (voltage and current) sampling with RAA271716/14/12/08
- 9 voltage or NTC measurement inputs
- 8 GPIOs
  - Includes 2 PWM outputs
- 2 Pyro trigger outputs
- Isolation test
- Alarm signaling system
- Open wire detection on input pins
- 48 lead Package
- Fully compliant to ISO26262 2nd edition (2018)



Wireless BMS with BLE 5.1

- 1st Feasibility study completed using BLE 4.2 (last year)
- 2nd Feasibility study completed using BLE 5.1 from Dialog
  - DA14531 – World's smallest, lowest power BLE 5.1 SoC
- Continuing system level reference design development throughout CY22
  - Renesas will test both multi-point and single link architectures
  - Planning to have reference designs for customers by the end of CY22

Wireless system



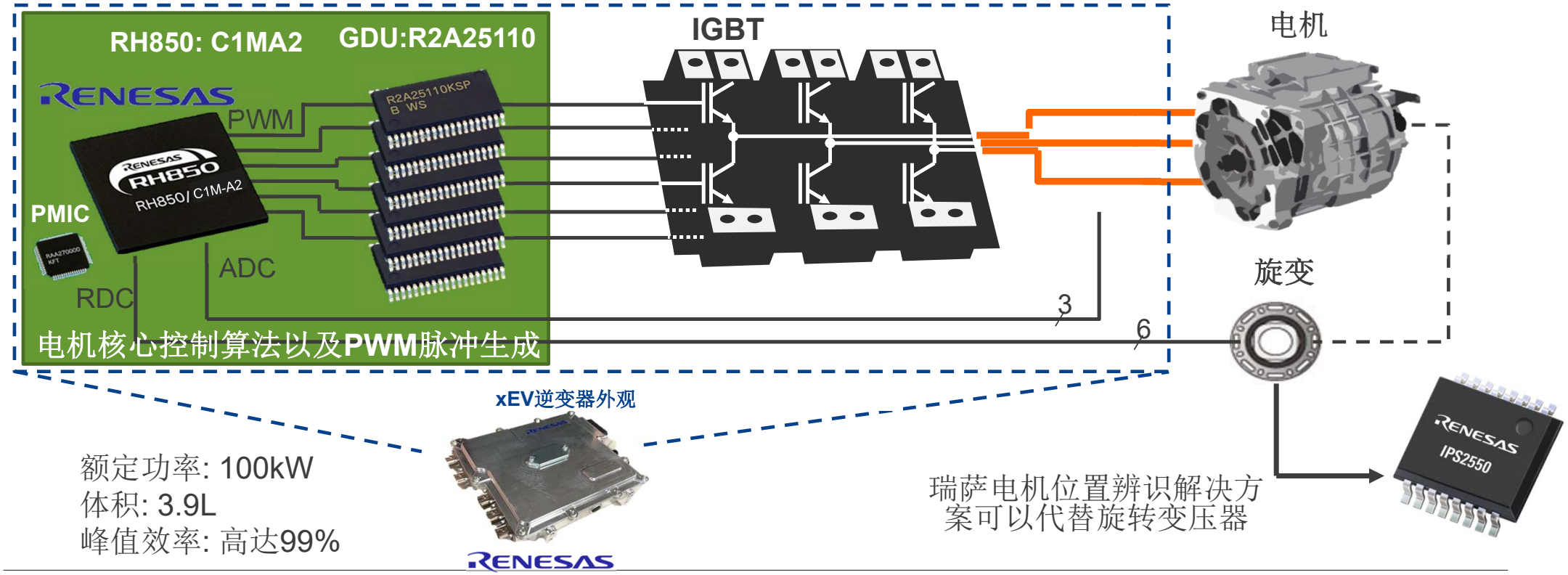
XEV INVERTER REFERENCE DESIGN

XEV 逆变器解决方案

瑞萨电机参考解决方案包含:

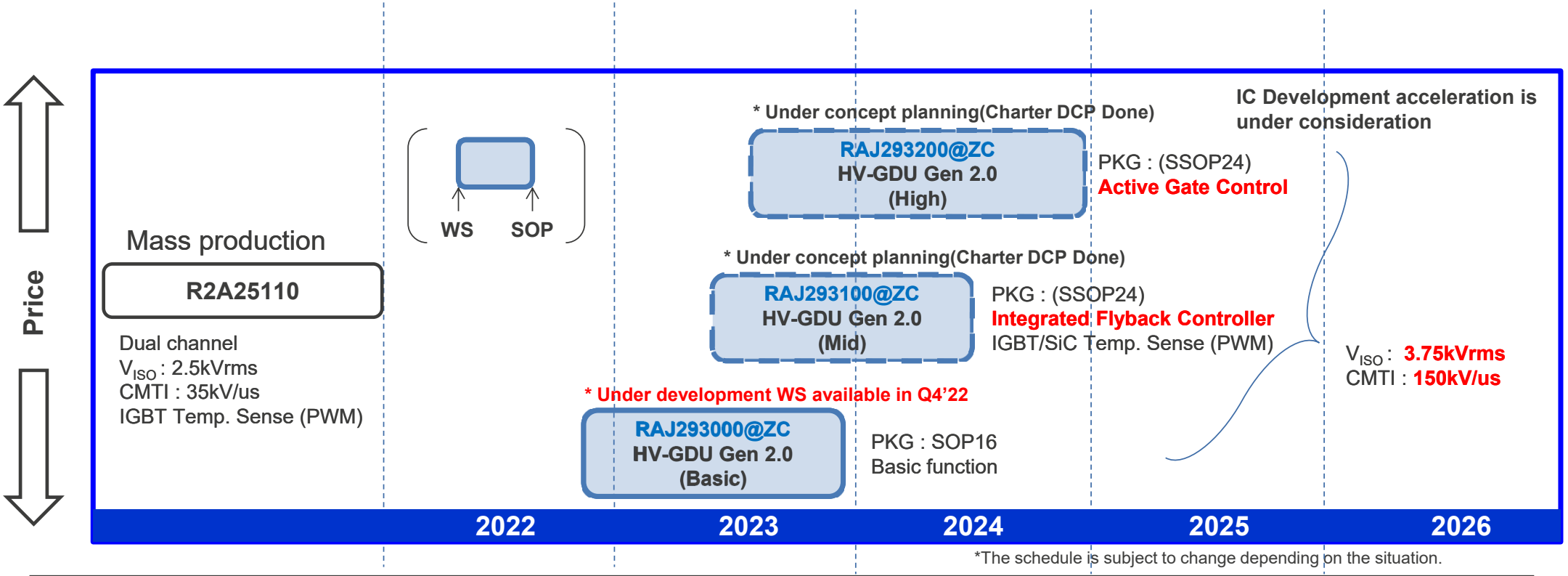
・逆变器硬件平台・电机控制底层代码EV ・硬件参考设计

・电机参数识别与标定



HV-GDU Roadmap

- **Gen2 GDU can support higher isolation voltage and transient noise immunity.**
  (Product Concept : GDU-L / price competitiveness, GDU-M / BOM reduction, GDU-H / Switching loss reduction)



*The schedule is subject to change depending on the situation.

Key Features and Benefits

- **Expanding the lineup of Gate Driver products that match the needs of the xEV Inverter market.**
- **Planning a lineup targeting Improved isolation voltage, SiC compatibility, and Miniaturization.**

※ *Under planning*

Market Needs	IC Technology	R2A25110 (Mass-pro.)	RAJ293000 (Basic)	RAJ293100 (Mid)	RAJ293200 (High)
High efficiency High accuracy	Basic Function※	✓	✓	✓	✓
	Gate control	n.a	n.a	n.a	**Active control**
	IGBT temperature feedback	✓	n.a	✓	✓
High reliability	Insulation voltage	2.5kVrms	3.75kVrms	3.75kVrms	3.75kVrms
	Nose immunity (CMTI※※)	> 35kV/us	150kV/us	150kV/us	150kV/us
	Detailed error output	n.a	n.a	n.a	**SPI**
	Functional safety	—	—	—	ASIL-D
Small size Light weight BOM reduction	Integrated Flyback controller	—	—	✓	—
	Parameter adjustment (e.g. Error detection threshold)	Fixed	Fixed	Fixed	**Programmable**
	Package	SSOP48	SOP16	(SSOP24)	(SSOP24)
SiC support	Negative voltage driving	—	✓	✓	✓

※ Basic Function : Active Miller clamp, Soft shut-down, DESAT

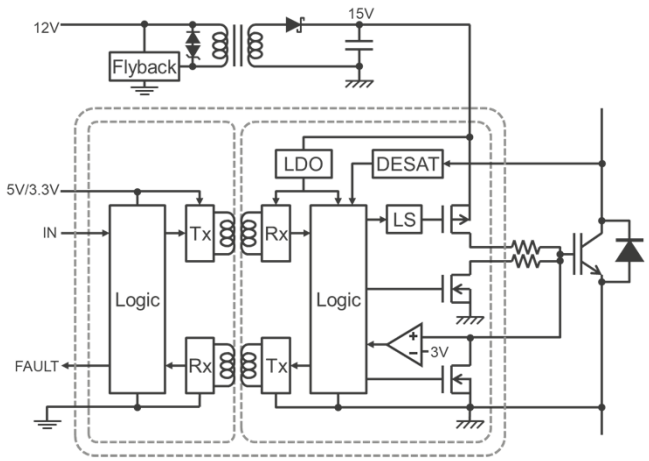
※※ CMTI : Common Mode Transient Immunity

Key Features (Gen 2.0)

- **We plan to develop three HV-GDU products to meet the strong and various demand for xEV inverters**
- **All Gen 2 GDUs can support Isolation voltage of 3.75kVrms and CMTI of 150kV/us.**
  (Current MP product (R2A25110) can support 2.5kVrms and 35kV/us)

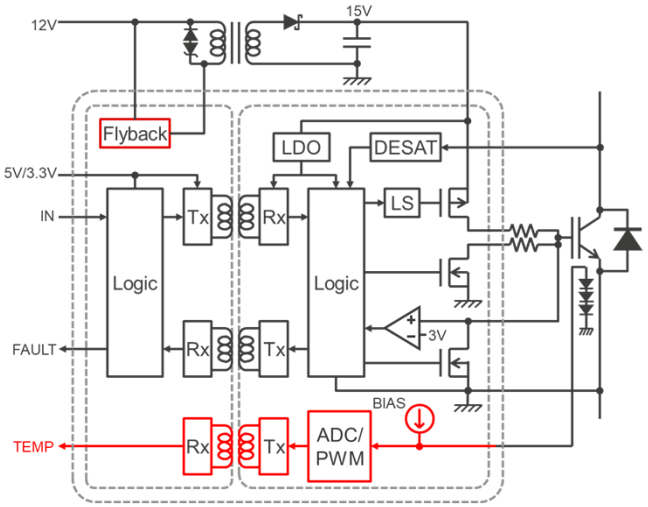
HV-GDU Basic

› **Low price** with basic function
  › Soft turn off
  › Active miller clamp
  › DESAT, UVLO



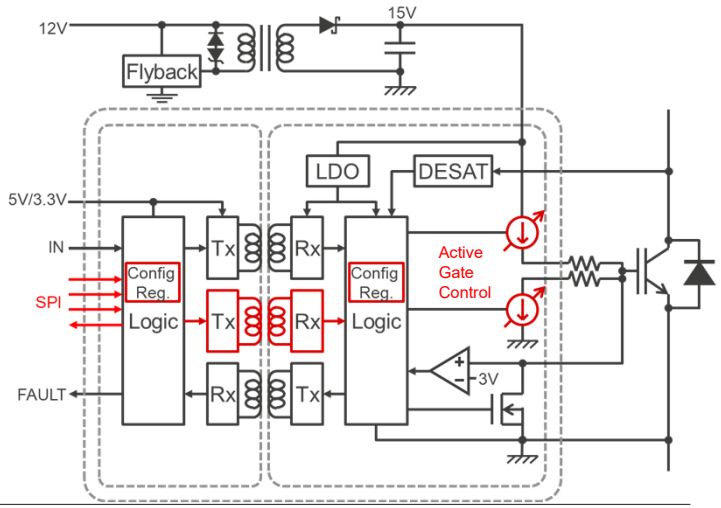
HV-GDU Mid

› **Integrated flyback controller** for DC-DC converter
  › reduced the overall footprint of the inverter design
› **Analog to PWM converter** for temperature / voltage sensing



HV-GDU High

› **Switching loss reduction** by using active gate control

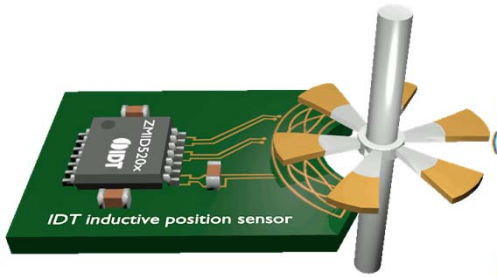


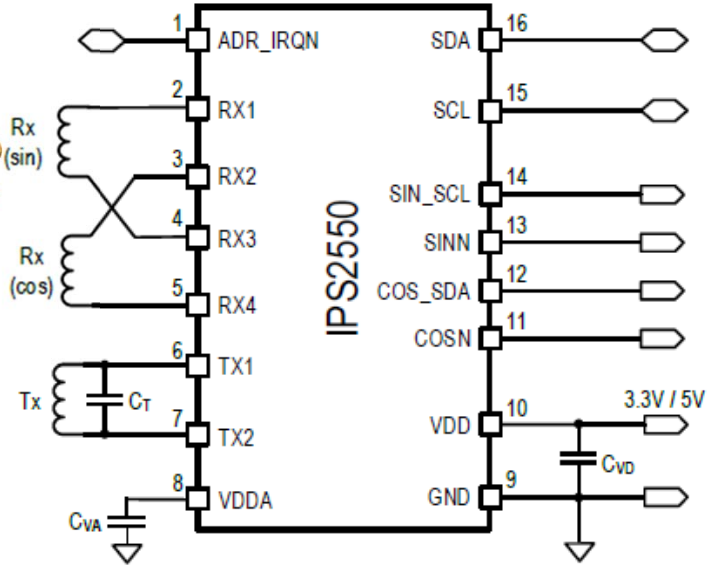
MOTOR POSITION SENSOR

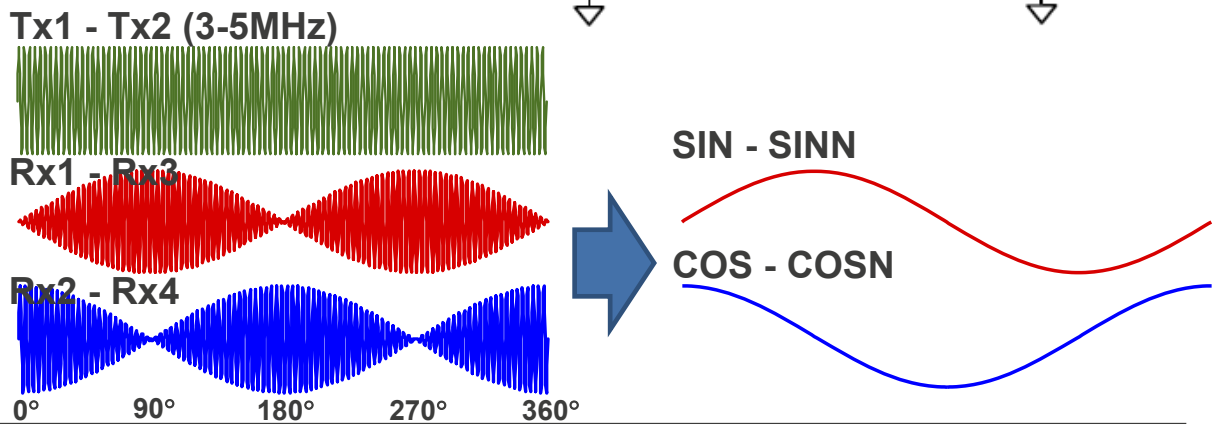
- **BENEFITS**
- **FEATURES**
- **SUCCESSFULL STORY**

IPS2550:INDUCTIVE POSITION SENSOR FOR MOTOR CONTROL

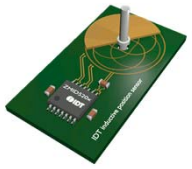
- Ideal for control applications of electric motors (especially BLDC motors)
  - ➢ Sine cosine (differential analog) output
- Automotive AECQ100 Grade-0 Designed & Qualified
- Functional safety: supports ASIL C @ single IC
- Rotational Speed: up to 600,000 (el) rpm
- High accuracy ≤ 0.1% full scale (ideal coil)
- I2C interface for diagnostics and programming
- Diagnostics interrupt to external MCU
- Temperature range: -40℃ to 160℃ ambient
- Package: TSSOP-16 with exposed pad







COMPARISON OF RESOLVER AND IPS

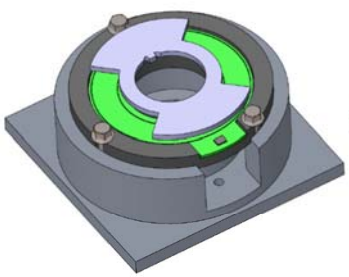
Resolver 	• Sturdy • Excellent linearity	• Large • Expensive • Dedicated equipment required for manufacturing
IPS2550 	• Small, lightweight and thin • Low cost • Easy to production, No special manufacturing equipment required	• Know-how required for board coil design

Support coil design with Renesas

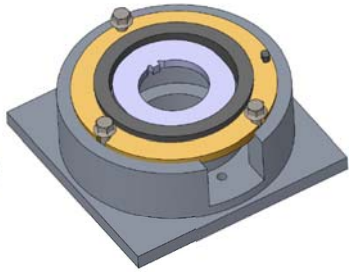
SUCCESS STORIES AND TARGET APPLICATIONS

xEV Traction Motor:

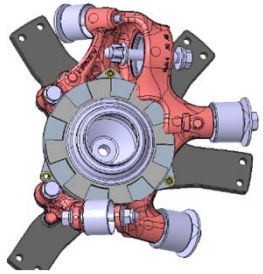
Resolver 4.0
Inductive Solution



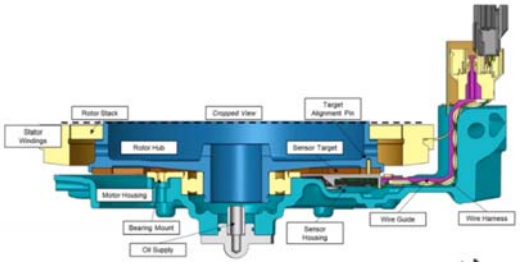
Conventional
Resolver Solution



In-wheel traction Motor



48V Auxiliary Motor



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