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Towards advanced BMS development for NEV
ST’s BMS solution

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BMS Offer

In production

L9963

14-cell Analog Front End
BCD9sL
TQFP64EP

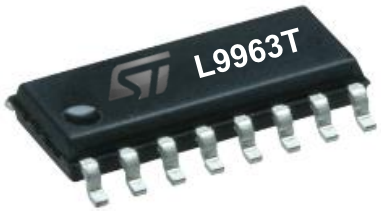
Q3 2020 qualified

L9963E

14-cell Analog Front End
BCD9sL
TQFP64EP

In production

L9963T



BMS Transceiver
BCD9sL
SO16N

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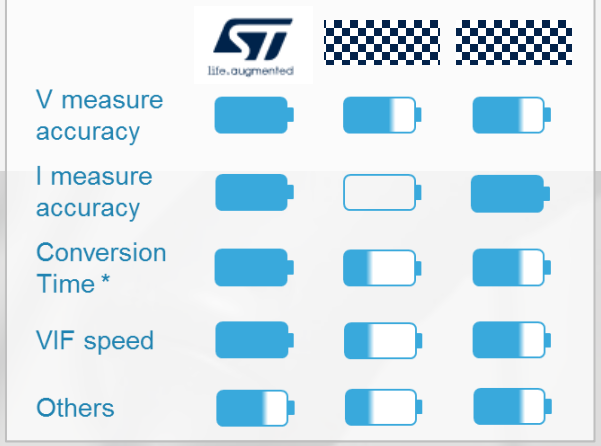
L9963

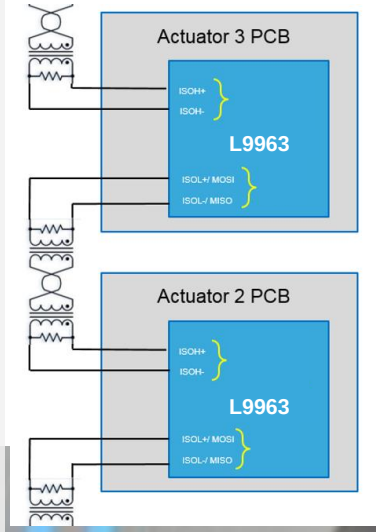
- Up to 14 cells monitoring and balancing
- 16-bit Σ-Δ ADC for cell voltage monitoring
- 18-bit Σ-Δ ADC for battery current monitoring
- Internal balancing FET up to 200mA
- Configurable for external FET balancing
- Vertical interface up to 3 Mbps

- ISO 26262 Ready for ASIL D systems
- Cell total conversion error 2 mV
- Current sense error 0.5%
- Real simultaneous conversion of 14 cells: total conversion is done in 300 µs.

Outperforming Competition



ISO 26262

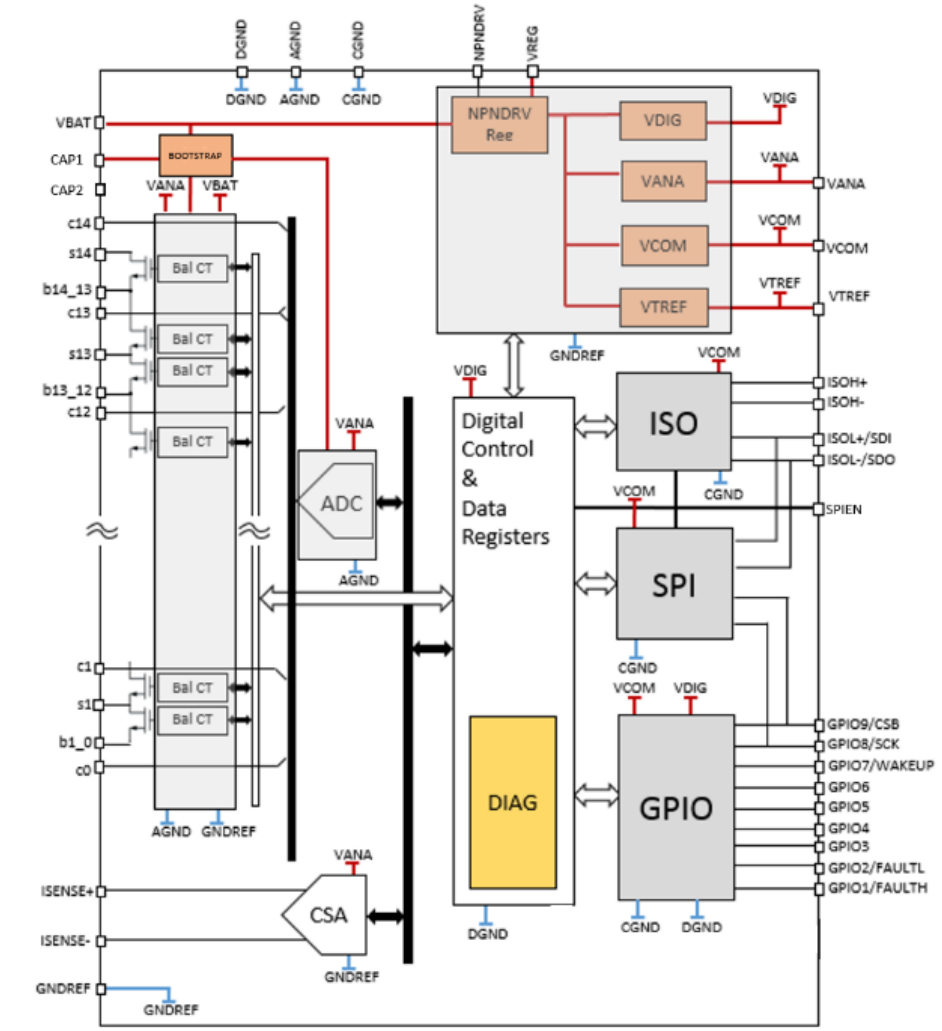


L9963
Battery Management IC for EV/HEV

Key Highlight

- 14-cell monitoring and balancing, 100V ST BCD9sL tech
- 16-bit Σ-Δ ADC → Cell total conversion error 2mV
- 18-bit Σ-Δ ADC → Current sense error 0.5%
- Internal and external balancing configurability
- Full ISO26262 compliant, ASIL-D systems ready

Block Diagram



Technical information

- Measures 4 to 14 cells in series
- Synchronized High-precision cell voltage and current measurement within ±1500A range with Coulomb counter included
- 8 programmable filtering options for cell&battery stack Vconversion
- 16-bit voltage measurement with maximum error of ±2mV in whole operating temperature range
- 2.66mbps isolated serial communication and 6Mbps SPI are integrated for daisy-chained connection
- Supports both mono and bi-directional daisy chain configuration
- Maximum 200 mA passive internal balance for single cell in both normal and sleep-balancing mode. If balance is enabled on more cells, the maximum current of each single cell is reduced according to power dissipation
- Two balancing modes: Manual and Timed mode
- Supports both internal and external balancing
- Single or multiple channel cell balancing simultaneously
- -40/200° C temp. measure. range with support for NTC monitoring
- 9 General purpose I/O (7 out of 9 can be used for NTC)
- Robust hot-plug performance
- Passes 200 mA Bulk Current Injection (BCI) test

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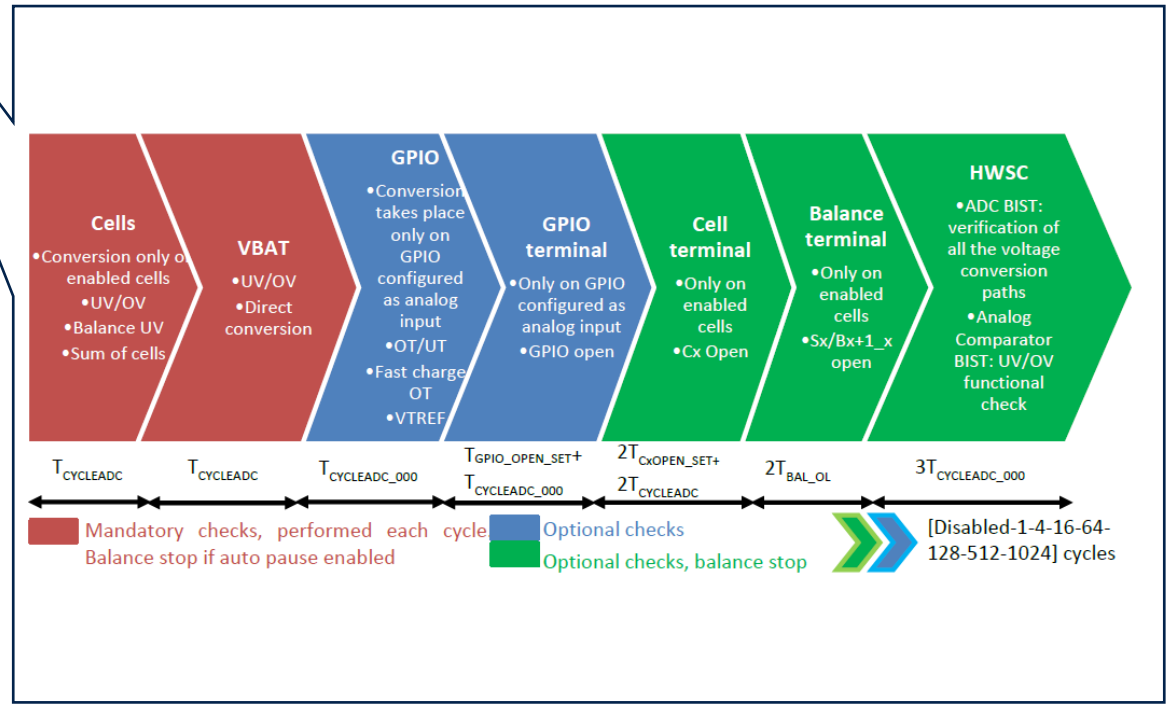
L9963 vs Competition

		Competitor 1	Competitor 2
# of cells	14	18	14
Vertical interface	2.66 Mbps	1 Mbps	2 Mbps
Cell voltage accuracy	1.7 V ≤ V_{CELL} ≤ 4.7 V -40 °C < T_J < 125 °C 2mV	2 V ≤ V_{CELL} ≤ 4.2V -40 °C < T_J < 125 °C 4.2mV	1.5 V ≤ V_{CELL} ≤ 4.5 V -40 °C < T_J < 125 °C 4.5mV
ADC resolution	16 bit	16 bit	16 bit
Conversion time	300 µs	1.2 ms	360 µs
Current sense	Coloumb counter	No	Coloumb counter
Temperature sensor	7	9	7
Balancing	Internal & external	Internal	Internal & external
Package	64 pin	64 pin	64 pin

L9963 Advanced Features

1. Measures 4 to 14 cells in series, supporting also busbar connection without altering cell results.

2. Intelligent diagnostic routine providing automatic failure validation. Redundant fault notification through both SPI Global Status Word (GSW) and dedicated FAULT line.

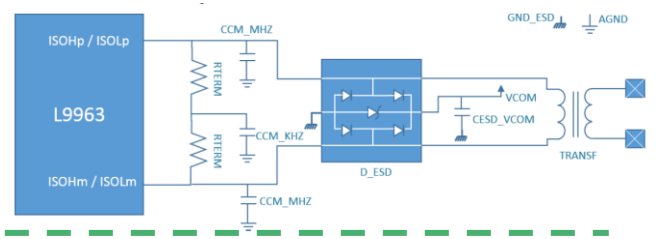


3. 2.66 Mbps isolated serial communication with regenerative buffer, supporting long cables and dual access ring.

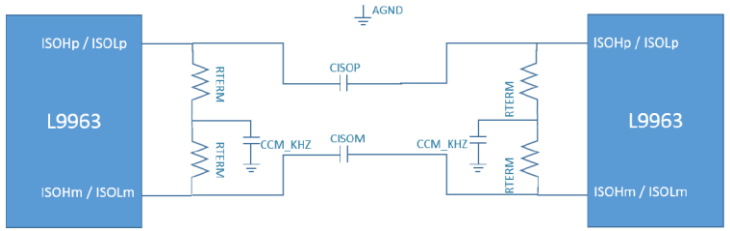
4. Robust hot-plug performance. No Zeners needed in parallel to the cells.

Fast cells conversion & acquisition
15 x L9963 = <u>210 cells → < 10ms</u>

Distributed BMS



Centralized BMS



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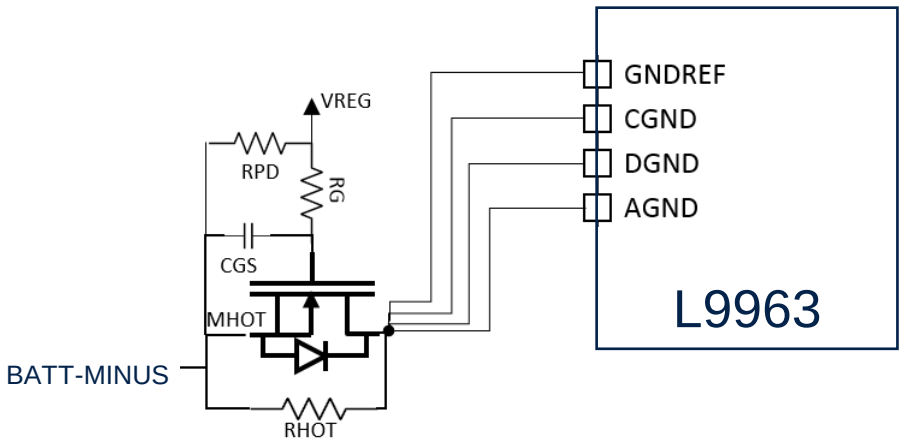
Hot Plug Protection

4

- Hot plug is a critical condition for AFE
- The majority of the AFE devices requires a large number of external components to withstand hot plug.
- L9963 has an intrinsic robustness to hot plug and only in some very critical cases few limited external components are needed



L9963 can safely handle hot plug if:

- The recommended components and configurations for cell voltage sensing and balancing are used
- AMR is not violated

In case the above conditions are not met, a few additional external components must be mounted.

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L9963 - Tools
Battery Management IC for EV/HEV

Evaluation board

EVAL-L9963-MCU

Complete BMS board with embedded SPC574S MCU (1st stage of BMS pipeline)

EVAL-L9963-NDS

CMU board, it's a node in a distributed system (from the 2nd stage up to 15th)

Support material

- Datasheet
- Application notes
- FMEDA
- Safety manual
- Evaluation board
- User GUI
- EMC report

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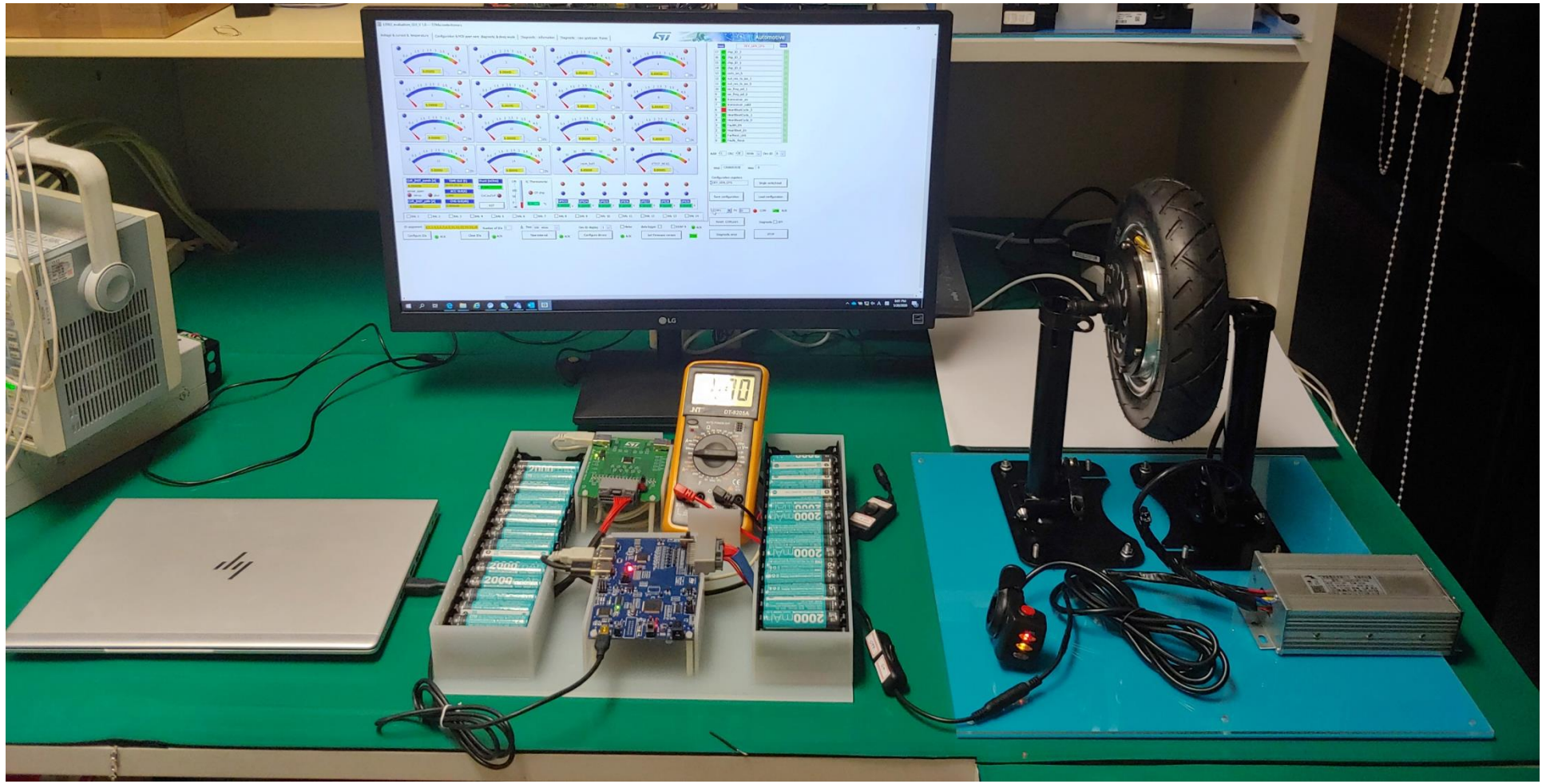
Appendix : L9963 EVB



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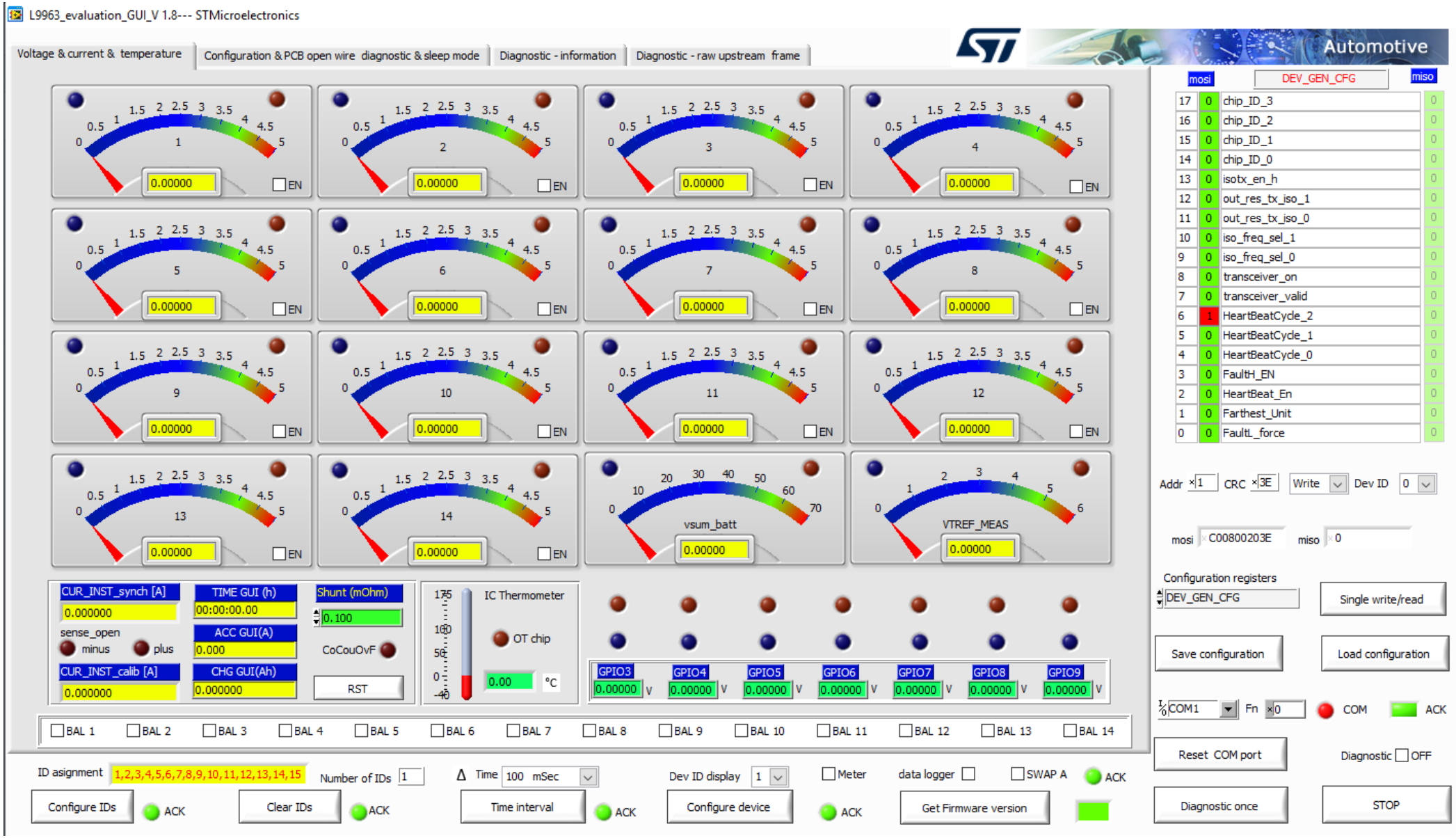
Appendix : L9963 EVB



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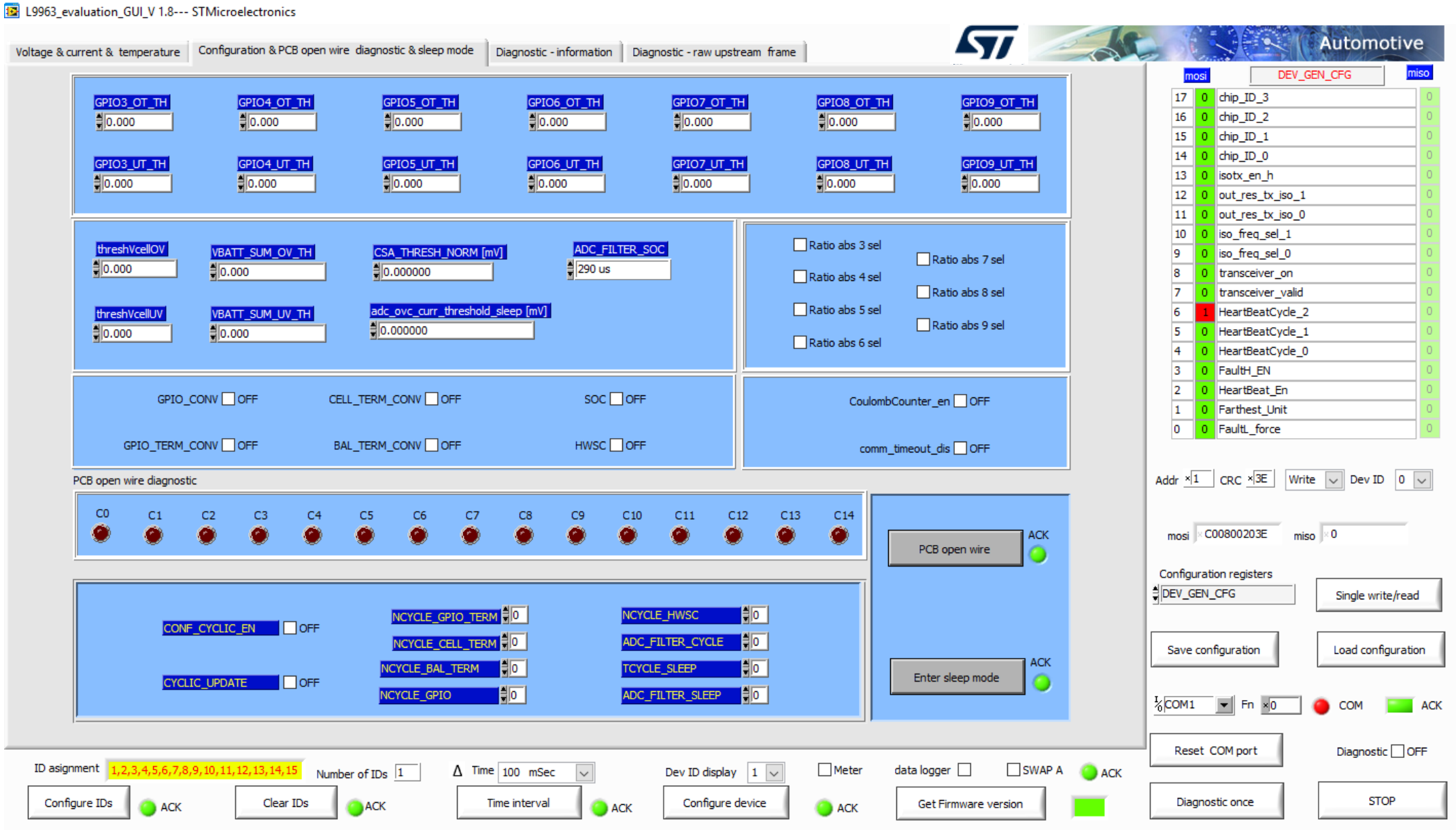

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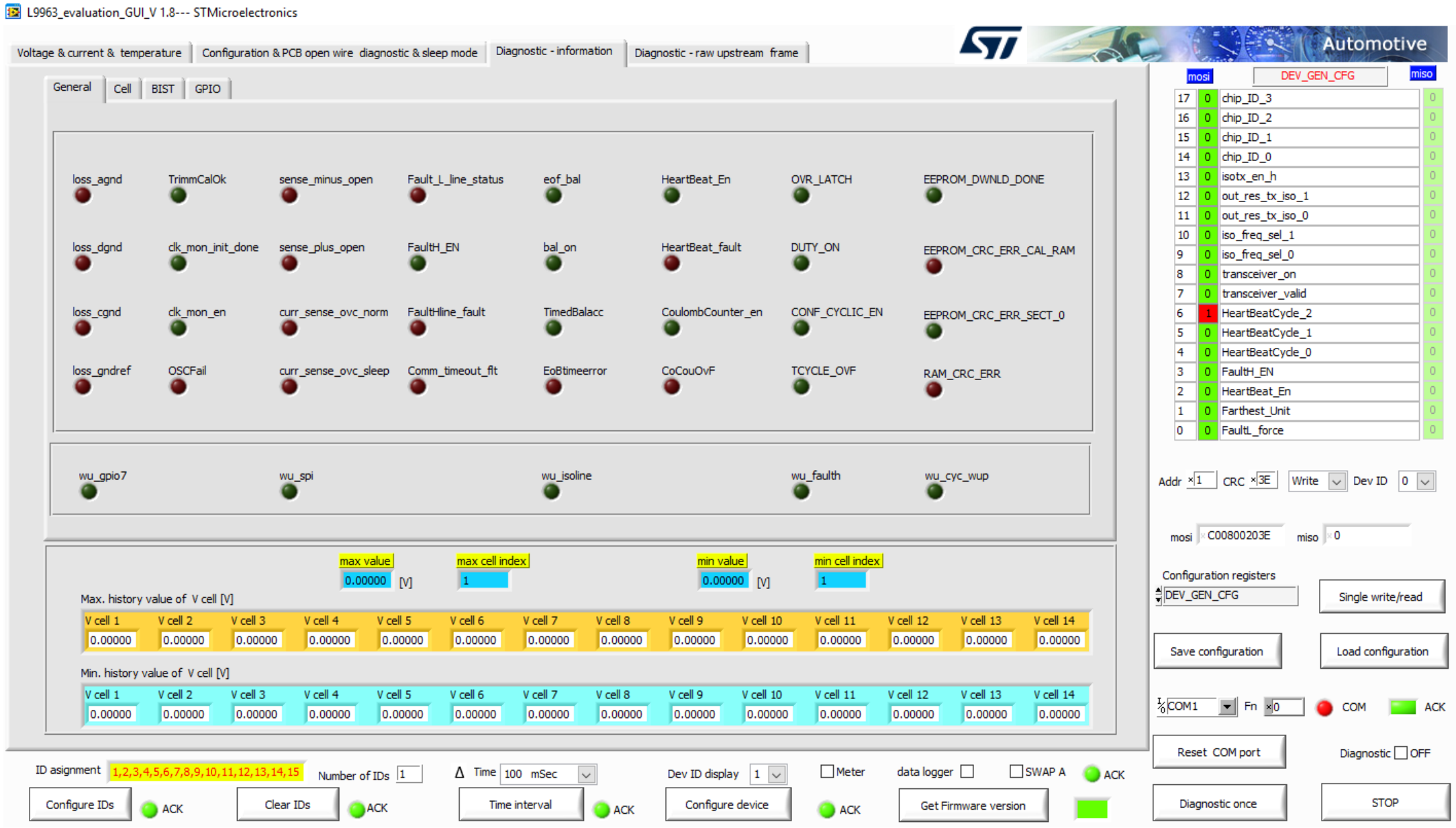

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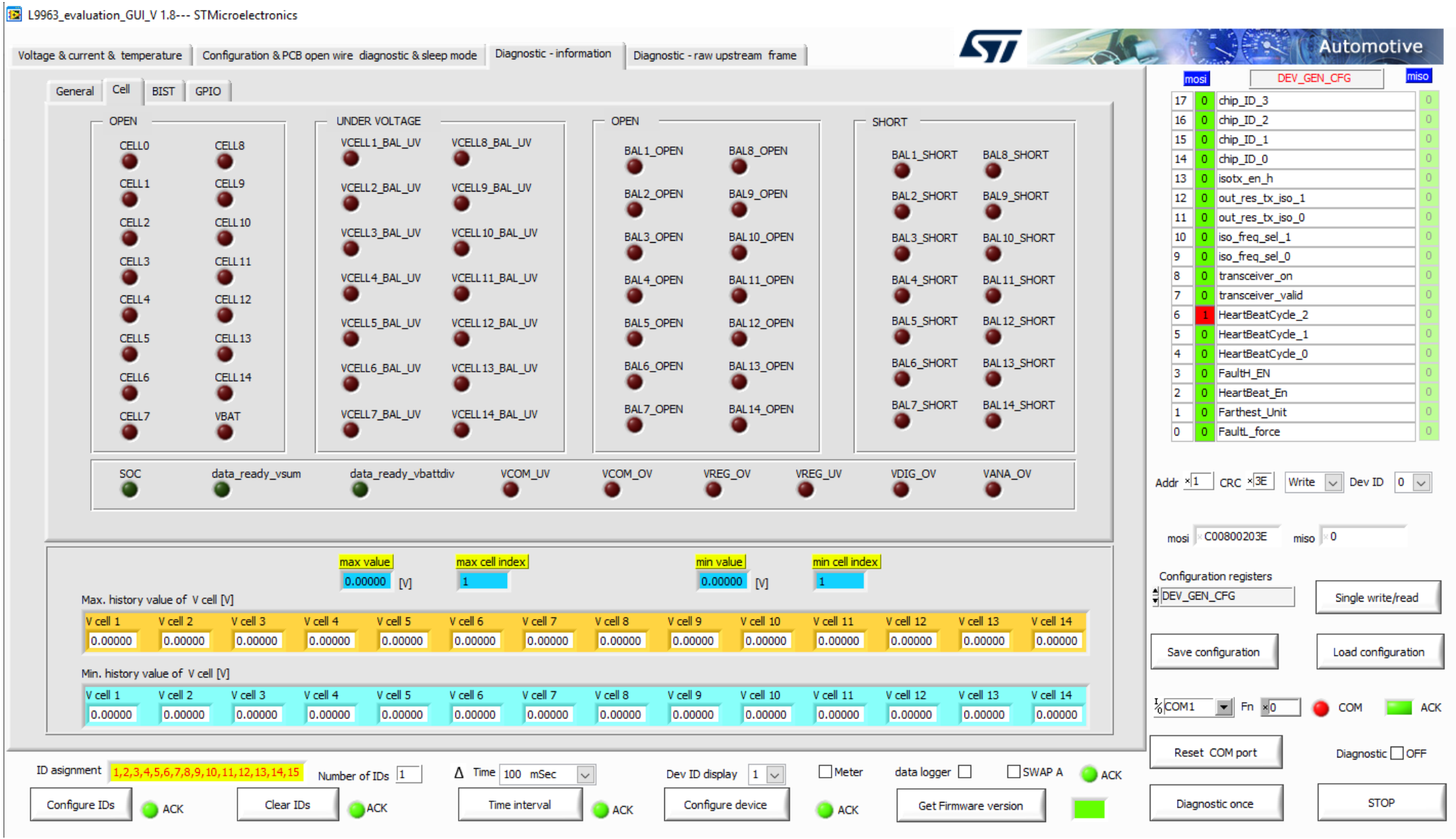
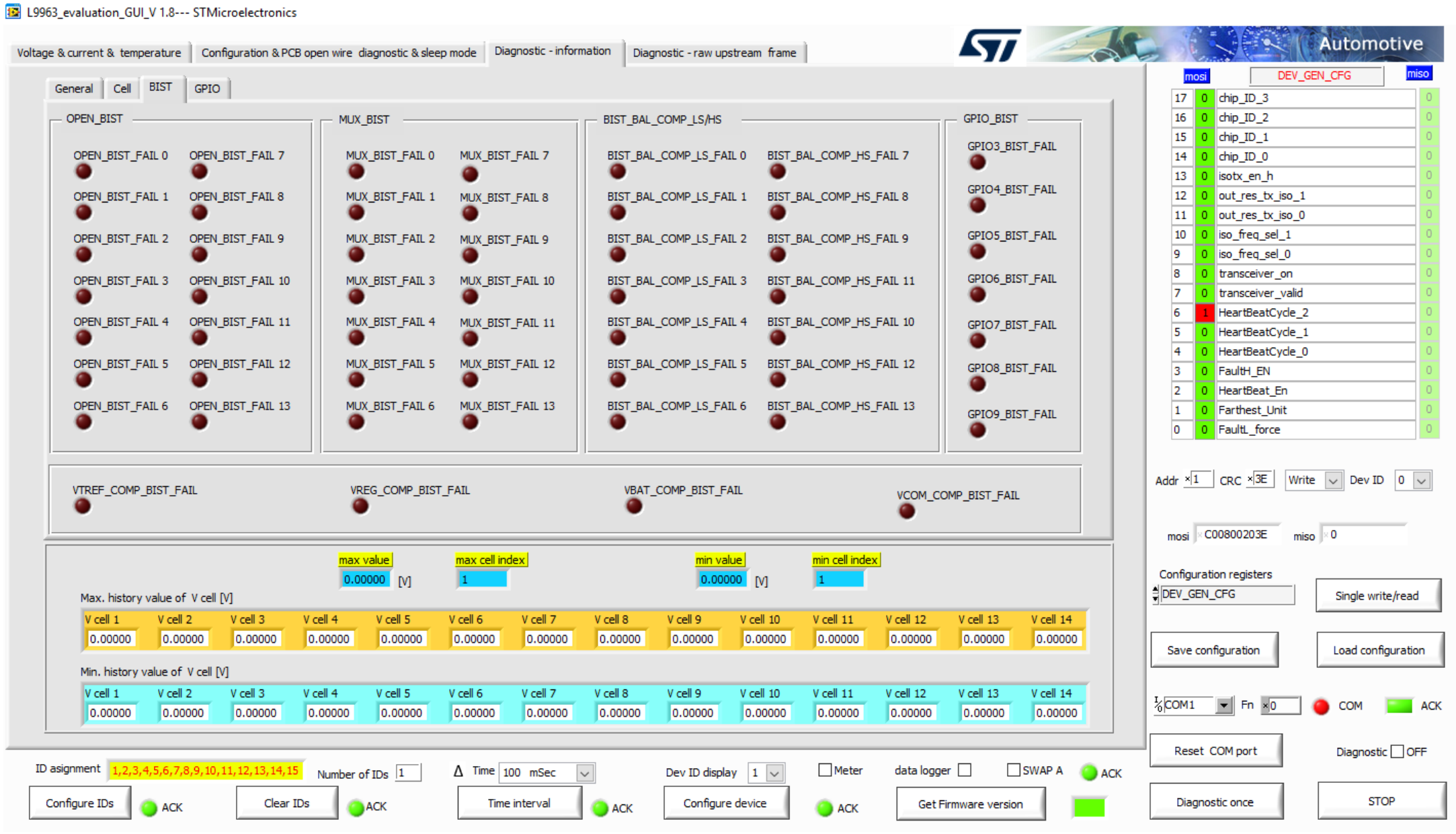


Appendix : L9963 EVB



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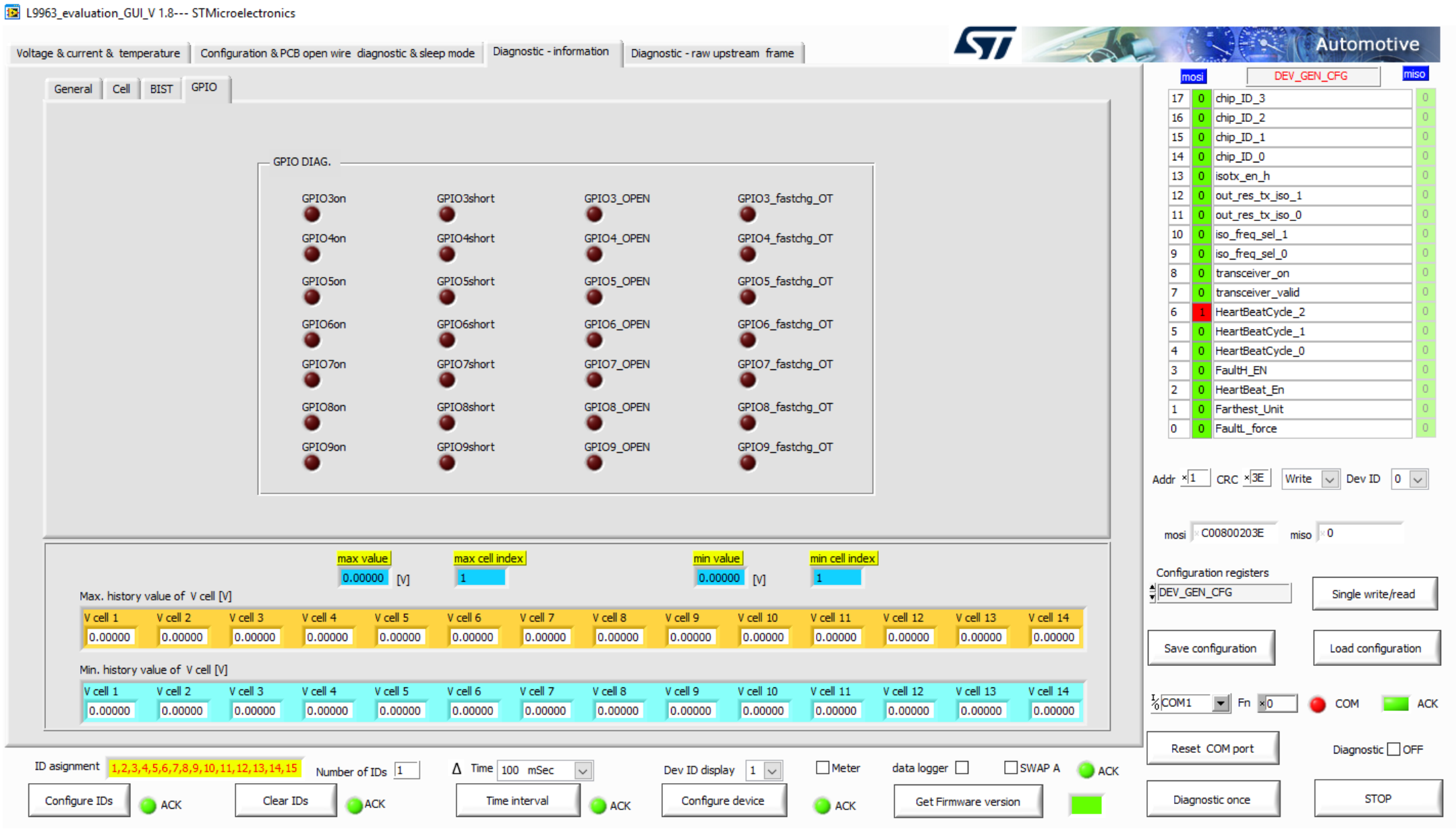
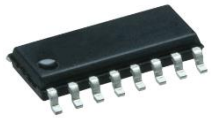


SO16



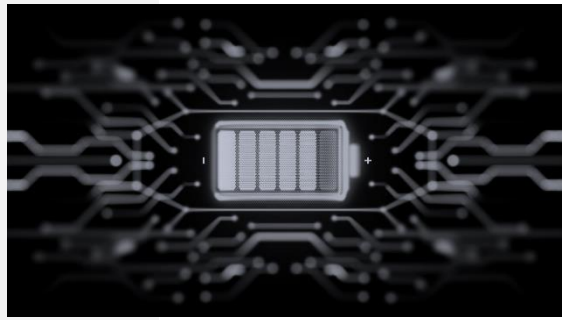
L9963T Isolated Transceiver for BMS

Transformer isolated communication interface

Up to 2.66 Mbps

3.3V and 5V compatible logic threshold

- Isolated SPI interface
- L9963 companion transceiver for BMS application
- Automotive EV application
- Robust conducted and radiated immunity performance
- ISO26262, ready for ASIL D system



Sample : Available
SOP : Q3. 2020

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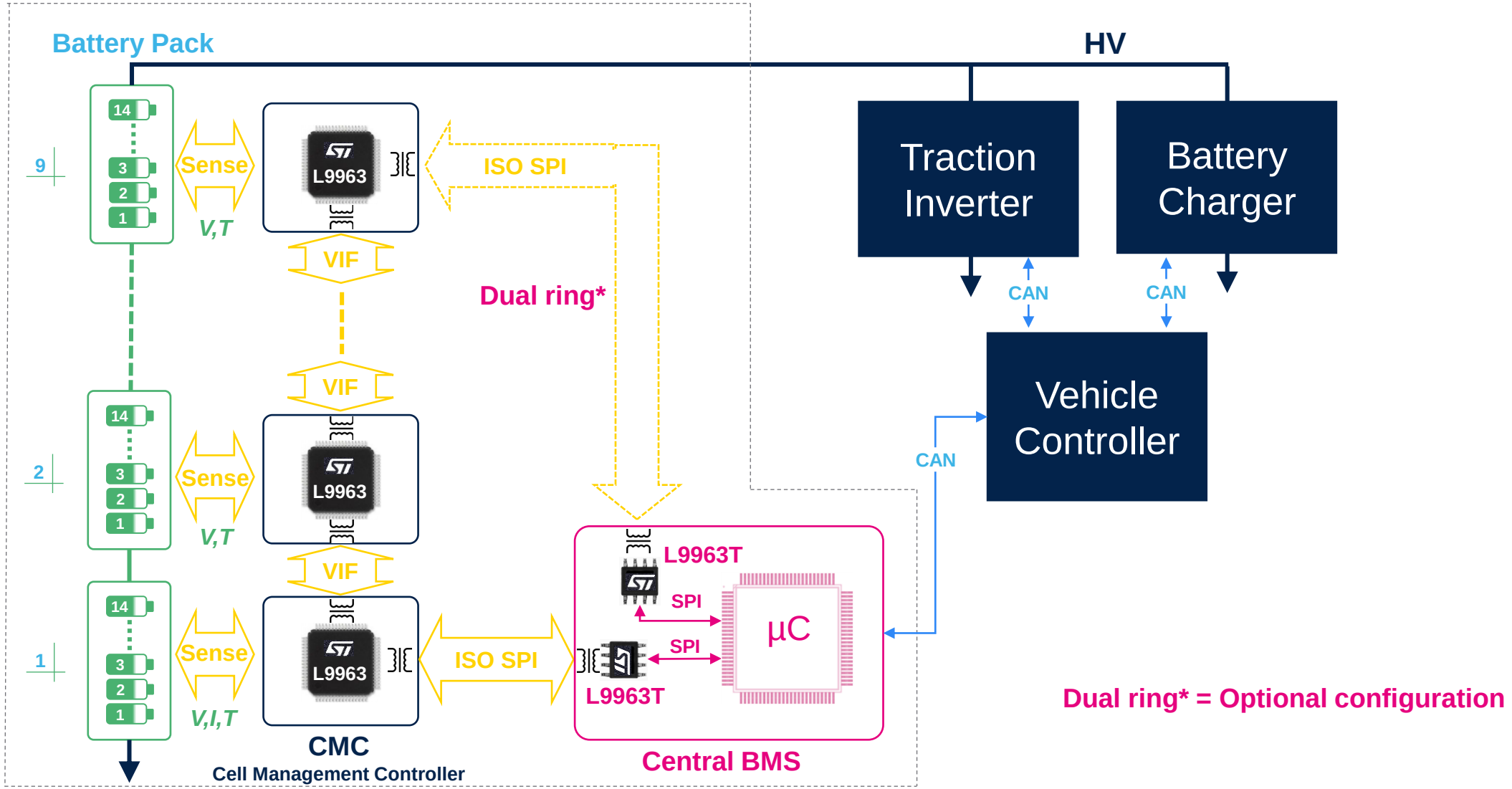
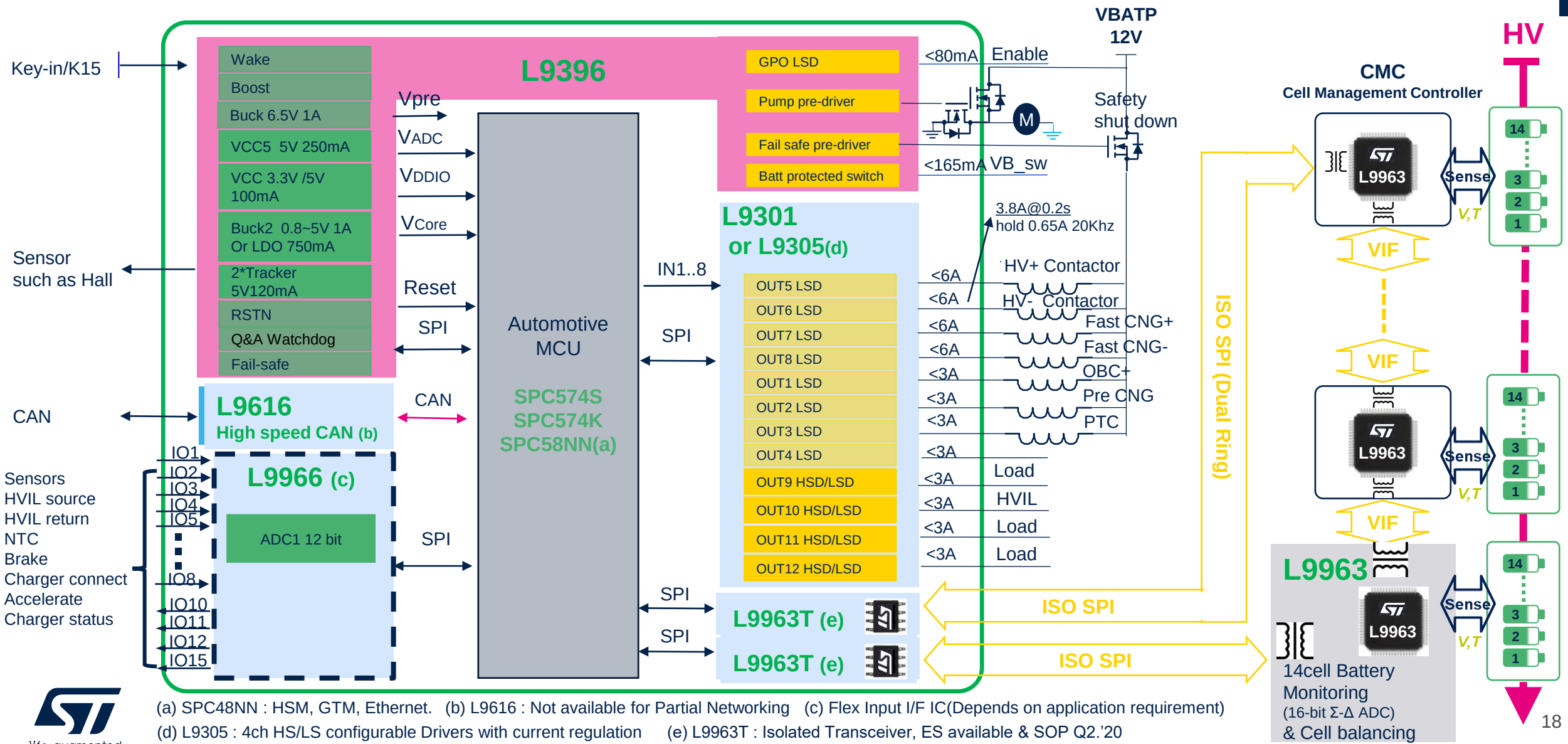
L9963 & L9963T System Overview



V,I,T = Voltage, Current and Temperature sense

ST BMS Solution for BEV/HEV



(a) SPC48NN : HSM, GTM, Ethernet. (b) L9616 : Not available for Partial Networking (c) Flex Input I/F IC(Depends on application requirement)
(d) L9305 : 4ch HS/LS configurable Drivers with current regulation (e) L9963T : Isolated Transceiver, ES available & SOP Q2.'20

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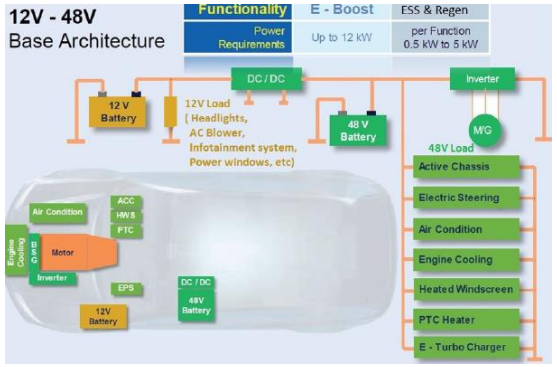
ST's BMS Solution for 48V Mild-Hybrid



48V Load

Pre-charging

PTC

Back to Back MOSFET

48V Bi-Directional DC/DC converter 12V

12V Battery

12V Load

Powertrain Control Unit

MHSG

(Mild Hybrid Starter and Generator)

VB HS1 HS2 HS3
IS1+
IS1-
VCC SPI/EN/PWM
L9907 or L9908

A7987
3A Buck (61V Vin)

L9616 High speed CAN (b)
- ISO11898(1M baud)

External CAN transceiver
- Partial Networking
- Available to combine wit L9396

L9396 PMIC (Option)
1. 5V/500mA (or 1A)
2. 5V/200mA
3. 3.3V/200mA

MCU
SPC574S or SPC574K or SPC58NN(a)

L9963
14cell Battery Monitoring
(16-bit Σ-Δ ADC)
With cell balancing

Current Sense Amplifier
18-bit Σ-Δ ADC

48V Battery
14Cell

14
13
1

(a) SPC48NN : HSM, GTM, Ethernet.

(b) L9616 : Not available for Partial Networking

48V Battery Pack
Switch Board
Connector
Main Board

Power Line
I/O or Interface

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Thank you

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