Application note

L9963E Evaluation Board with on board MCU with preloaded firmware (GUI)

Introduction

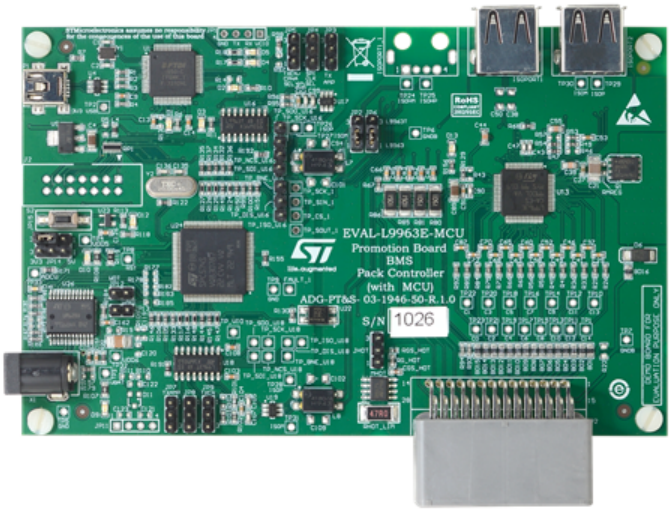
The EVAL-L9963E-MCU is a hardware tool for evaluation and development and is ideal for rapid prototyping of a 48 V battery management system (BMS) or as lower stage of a distributed BMS. This board can be used to evaluate the features of the L9963E device and L9963T.

1 Preparation

1.1 Overview

The EVAL-L9963E allows the user to connect up to 14 channels for cell voltage sensing, one channel for current sensing, and up to 4 channels for temperature sensing (plus an additional on-board NTC to sense PCB temperature). The board provides an onboard microcontroller with preloaded firmware intended to be used with STSW-L9963E GUI (graphical user interface).

Figure 1. EVAL-L9963E-MCU board



1.2 Components list

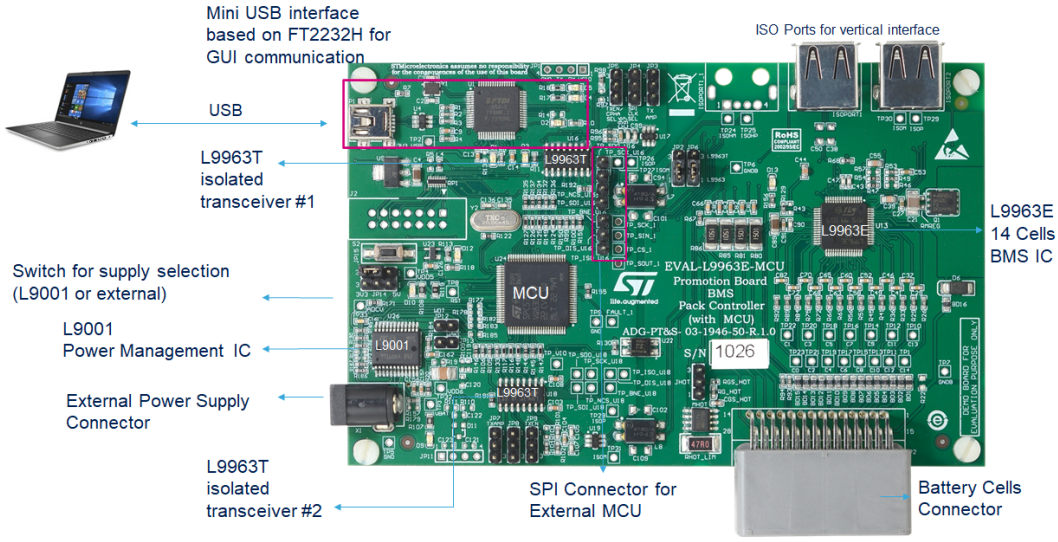
Included in the kit:

- EVAL-L9963E-MCU
- L9963E evaluation GUI STSW-L9963E

Not included:

- Mini USB to USB type A cable
- Power supply (at least 3 output 0 – 30 V, if possible 60 V):
  - 1 output to power L9963E (0:60 V)
  - 1 output to simulate cells common mode voltage (0:60 V)
  - 1 output to simulate cell voltage (0:5 V)
  - 12 V power supply with 2.1 mm jack output, internal pin +

Figure 2. Main components and connectors



2 Setup

2.1 HW connection and configuration

Figure 3. **Jumper settings**

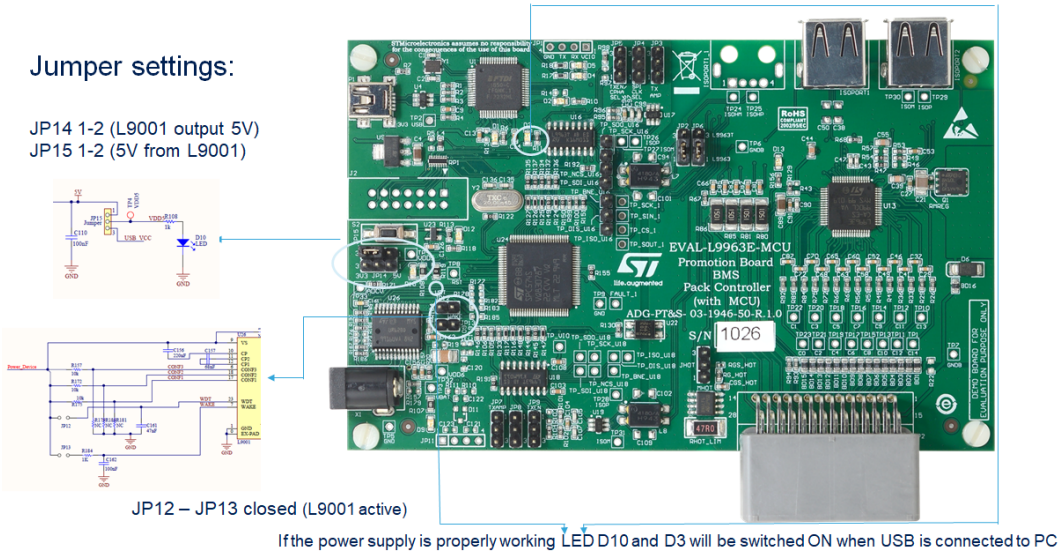


Figure 4. **Power supply connection**

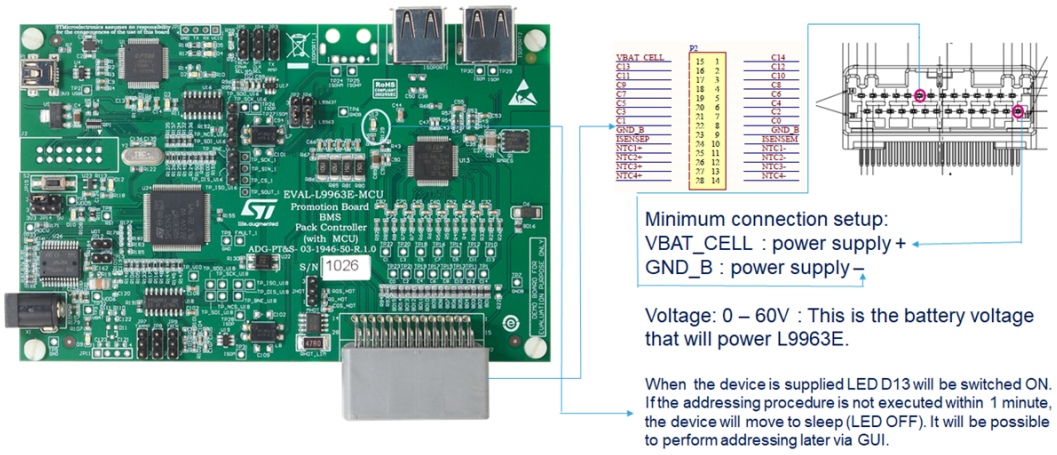
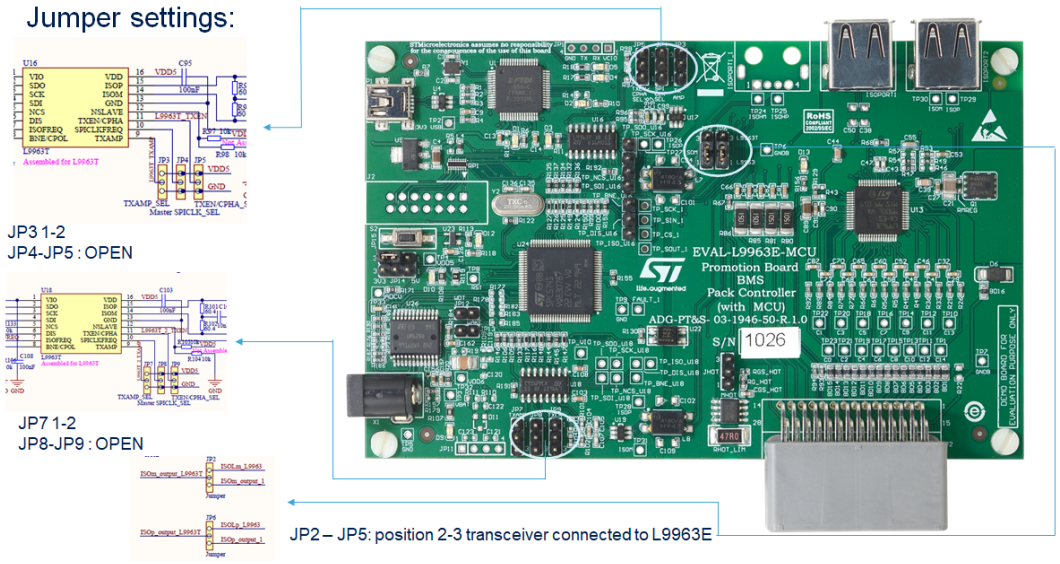


Figure 5. **Transceiver settings**



2.2 HW jumper

Table 1. HW jumper

Name	Description	Type
X1	External power supply connector	Jack
P1	USB connector for PC communication	Mini USB connector
ISOPORT 1	Isolated serial communication port: 1. VBAT 2. ISOH- (From L9963) 3. ISOH+ (From L9963) 4. FaultH	USB Type A connector
ISOPORT 2	Isolated serial communication port: 1. N.C. 2. ISO- (from L9963T) 3. ISO+ (from L9963T) 4. N.C.	USB Type A connector
P2	Battery connector: 1. Cell 14 2. Cell 12 3. Cell 10 4. Cell 8 5. Cell 6 6. Cell 4 7. Cell 2 8. Cell 0 9. Ground 10. Current sensor resistor negative pin 11. NTC 1- 12. NTC 2- 13. NTC3 - 14. NTC4 – 15. VBAT 16. Cell 13 17. Cell 11 18. Cell 9 19. Cell 7 20. Cell 5 21. Cell 3 22. Cell 1 23. Ground 24. Current sensor resistor positive pin 25. NTC 1+ 26. NTC 2+ 27. NTC3 + 28. NTC4 +	Multi pin connector
JP2	L9963T (U16) ISO- output selection	1-2: ISO- redirected to ISOPORT 1_1 2-3: ISO- redirected to L9963
JP3	L9963T (U16) TX amplitude selection	1-2: high amplitude/high threshold(1) 2-3: low amplitude/low threshold(1) Unconnected : highamplitude/high threshold

Name	Description	Type
JP4	L9963T (U16) SPI Master Clock selection	1-2: minimum frequency(1) 2-3: Maximum frequency(1) Unconnected: minimum frequency
JP5	L9963T (U16) Transmitter enable signal	1-2: enable the TX activity(1) 2-3: disable the TX activity(1) Unconnected : controlled by uc (PD9)
JP6	L9963T (U16) ISO+ output selection	1-2: ISO- redirected to ISOPORT 1_1 2-3: ISO- redirected to L9963
JP7	L9963T (U18) TX amplitude selection	1-2: high amplitude/high threshold(1) 2-3: low amplitude/low threshold(1) Unconnected: high amplitude/high threshold
JP8	L9963T (U18) SPI Master Clock selection	1-2: minimum frequency(1) 2-3: Maximum frequency(1) Unconnected: minimum frequency
JP9	L9963T (U18) Transmitter enable signal	1-2: enable the TX activity(1) 2-3: disable the TX activity(1) Unconnected: controlled by uc (PD8)
JP12	L9001 (U26) watchdog disableRefer to DS12089(2)	Connected: watchdog disabled Unconnected: watchdog enabled
JP13	L9001 (U26) wake signal	Connected: L9001 enabled Unconnected :L9001 disabled
JP15	5 V selector	1-2: 5 V from L9001 2-3: 5 V from USB
JHot	Hot plug voltage selector	1-2: VTREF 2-3: Vreg

1. *Refer to DS13590 (see Table 2).*
2. *Refer to DS12089 (see Table 2).*

2.3 Power up procedure

- Low voltage power supply:

  the 12 V power supply must be connected to X1 connector in order to properly supply the low voltage portion of the EVAL-L9963E-MCU board.
- Switch on the High voltage side power supply:

  the LED D13 will be switched on because VTREG is ON. If the addressing procedure is not executed within 30 s, L9963E will go in standby mode and VTREG and consequently the LED D13 will be switched OFF.

2.4 SW/FW installation on evaluation kit

Install following SW on your PC:

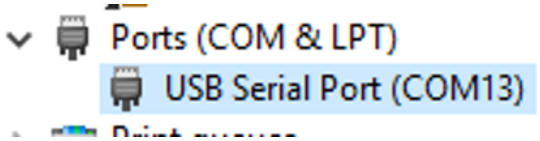
- NI Labview-runtime 2014
- NI VISA-RUNTIME
- FTDI driver

When all is installed reboot your PC and open: *STSW-L9963E.exe*.

2.5 Verification/Debugging

If FTDI Virtual COM PORT (VCP D2XX) driver has been correctly installed, you will find in Windows Device Manager a USB serial port under Ports (COM&LPT). Take note of the COM port number (i.e. COM13).

Figure 6. Windows Device Manger COM port number



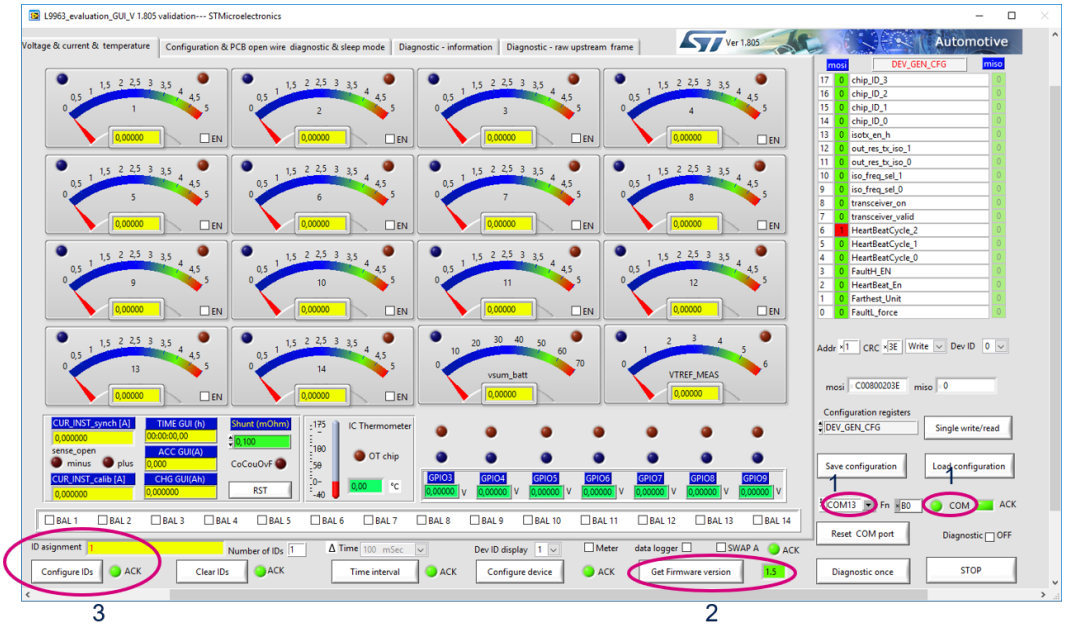
3 GUI usage and setup

3.1 Connection

Steps:

1. Select COM port according to your device manager. The COM led will become green;
2. Press on “get firmware version” button to check the communication with uC and the firmware version. The version should be 1.6;
3. In the “ID assignment” text box write 1 because you are using 1 L9963 then press “Configure IDs Button”, ACK LED will become green. If D13 LED on the board was switched OFF it will be switched ON and will not switch OFF anymore.

Figure 7. GUI connection

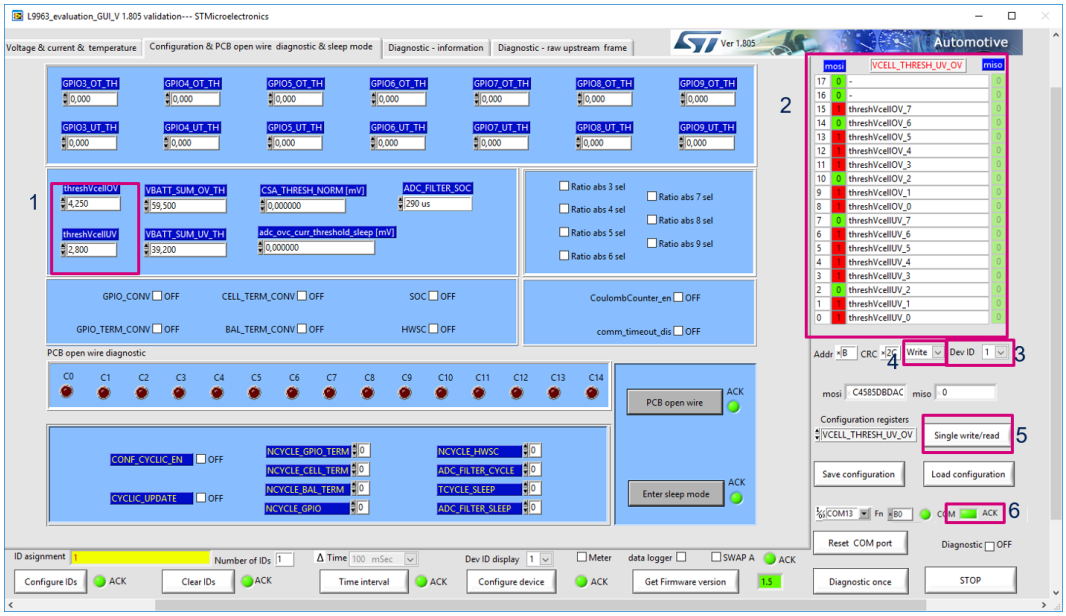


3.2 Threshold configuration

Steps:

1. Select Cell overvoltage and undervoltage. i.e. UV 2.8 V and OV 4.250 V;
2. The VCELL_THRESH_UV_OV register will be automatically updated;
3. Select Dev ID 1;
4. Select Write;
5. Press on “Single write/read” button;
6. If communication with L9963 is ok the ACK LED will become green.

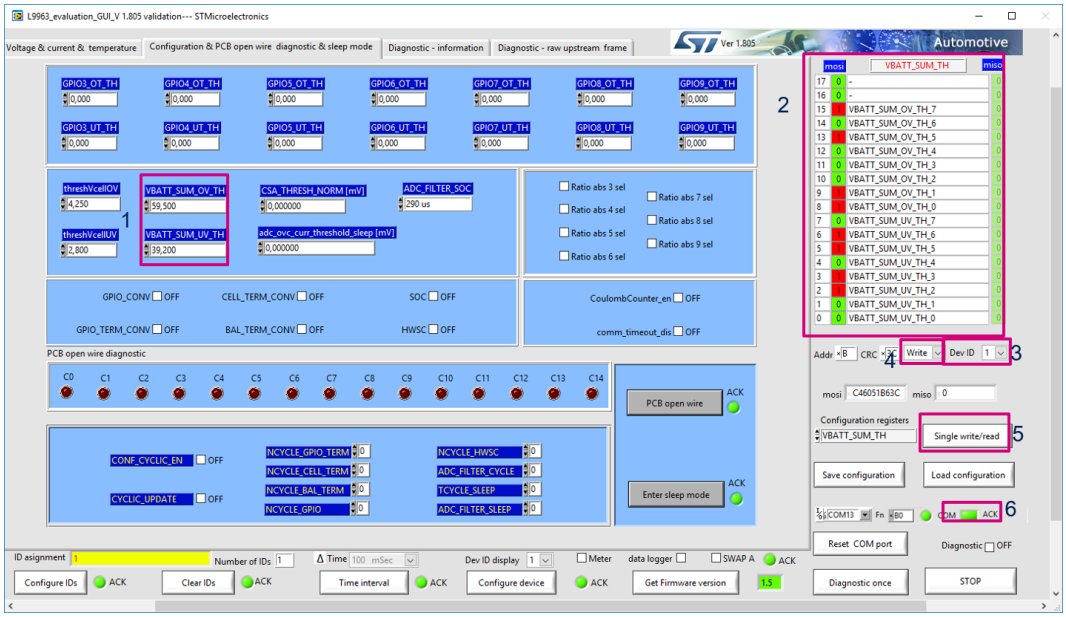
Figure 8. Threshold configuration 1



Steps:

1. Select Battery overvoltage and undervoltage. i.e. UV 39.2 V and OV 59.5 V;
2. The VBAT_SUM_TH register will be automatically updated;
3. Select Dev ID 1;
4. Select Write;
5. Press on “Single write/read” button;
6. If communication with L9963 is ok the ACK LED will become green.

Figure 9. Threshold configuration 2



3.3 Measure enabling

Steps:

1. Select cell voltage gauge with the EN check box. At least Cells 1, 2, 13, 14 must be selected;
2. The VCELLS_EN register will be automatically updated;
3. Select Dev ID 1;
4. Select Write;
5. Press on “Single write/read” button;
6. If communication with L9963 it’s ok the ACK LED will become green.

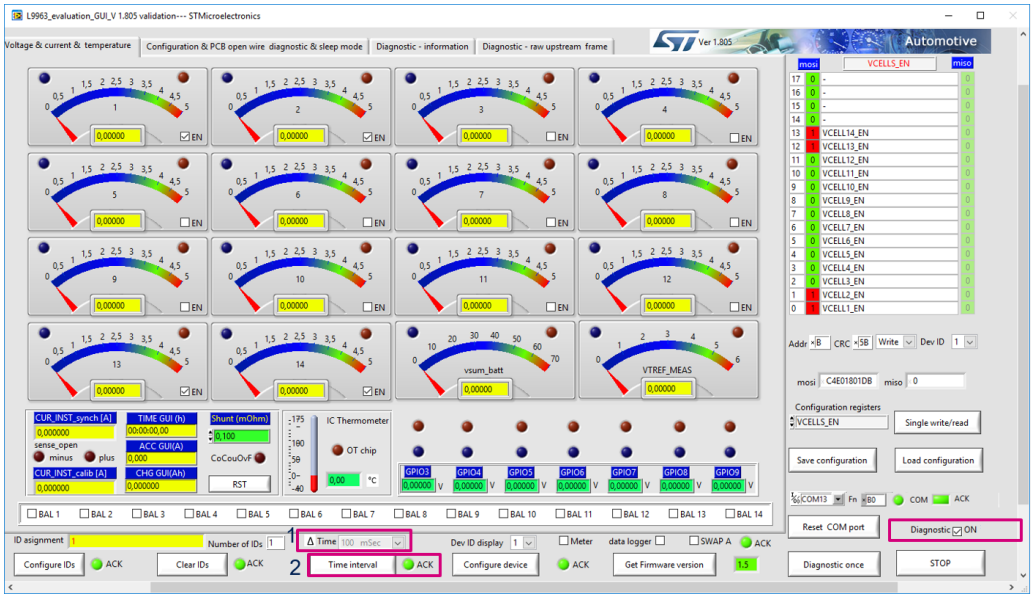
Figure 10. Measure enabling

3.4 Measure starting

Steps:

1. Select time interval. i.e. 100 ms. This is the refresh rate of GUI measurement;
2. Press on “Time interval” button to apply setting. ACK LED will become green;
3. Check Diagnostic checkbox to start measurement.

Figure 11. Measure starting



3.5 Measurements example

Figure 12. **Setup**

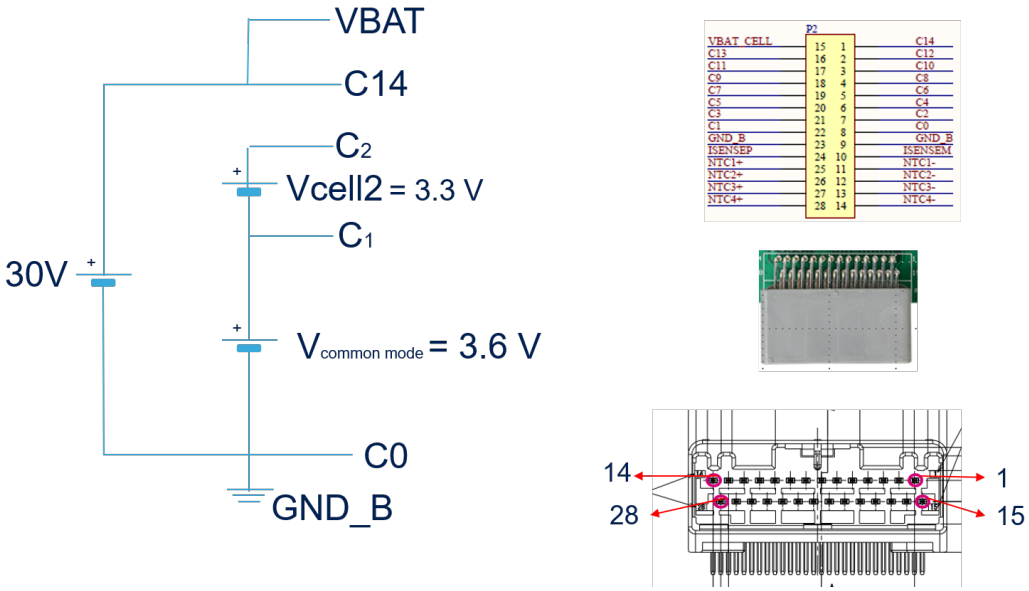
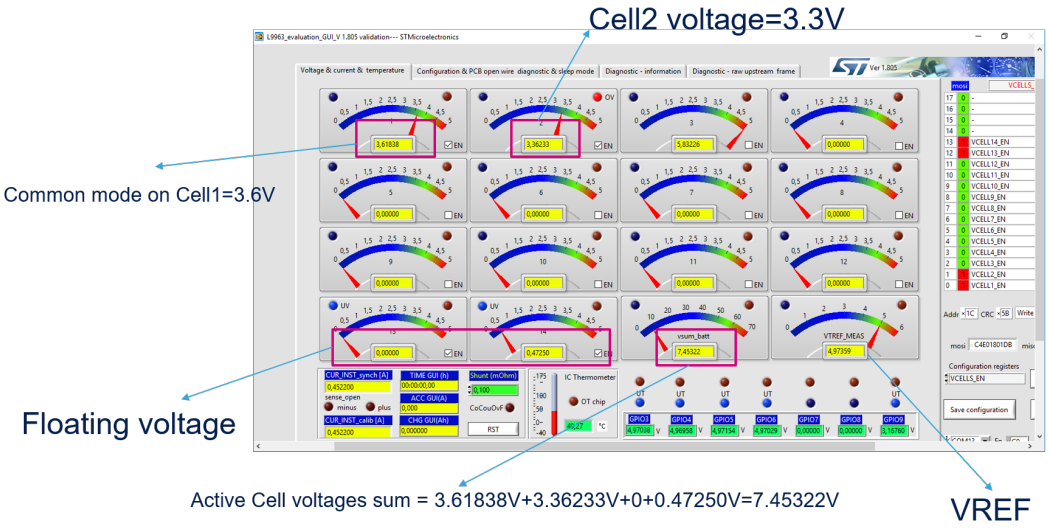


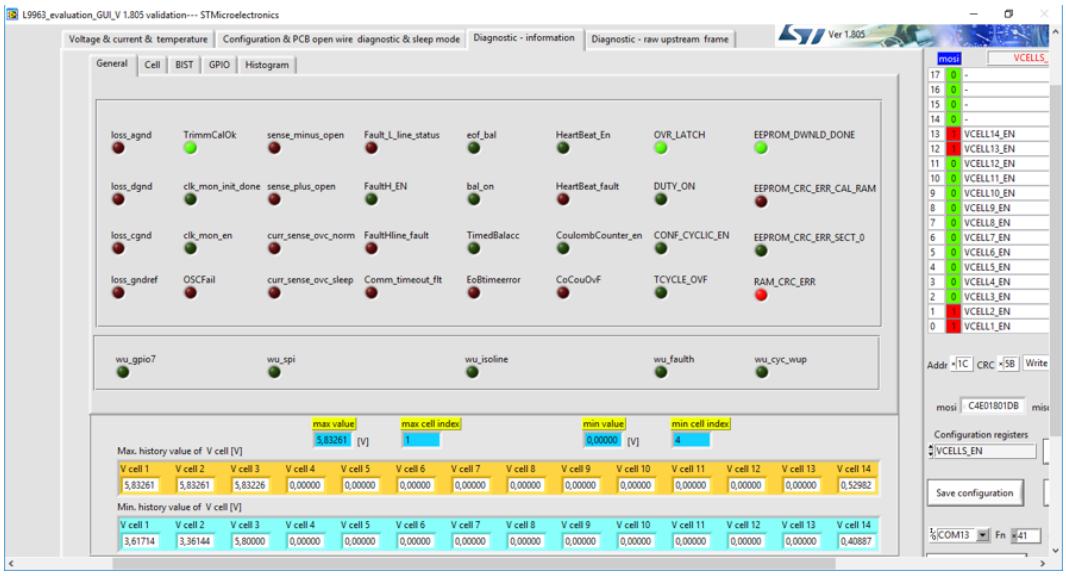
Figure 13. **Results**



3.6 Diagnostic

All the diagnostics are available in the Diagnostic-Information tab. They are updated at the same rate as measurement.

Figure 14. Diagnostic



Appendix A Reference documents

Table 2. Reference documents

Doc Name	ID	Title
DS13590	034961	Automotive general purpose SPI to isolated SPI transceiver
DS12089	030494	Automotive power supply IC with multiple voltage regulators

Revision history

Table 3. **Document revision history**

Date	Version	Changes
20-Jul-2021	1	Initial release.

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