

KA49701A BM-IC AFE Reference Platform

Introduction To KA49701A Reference Platform

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Overview of KA49701A Reference Platform

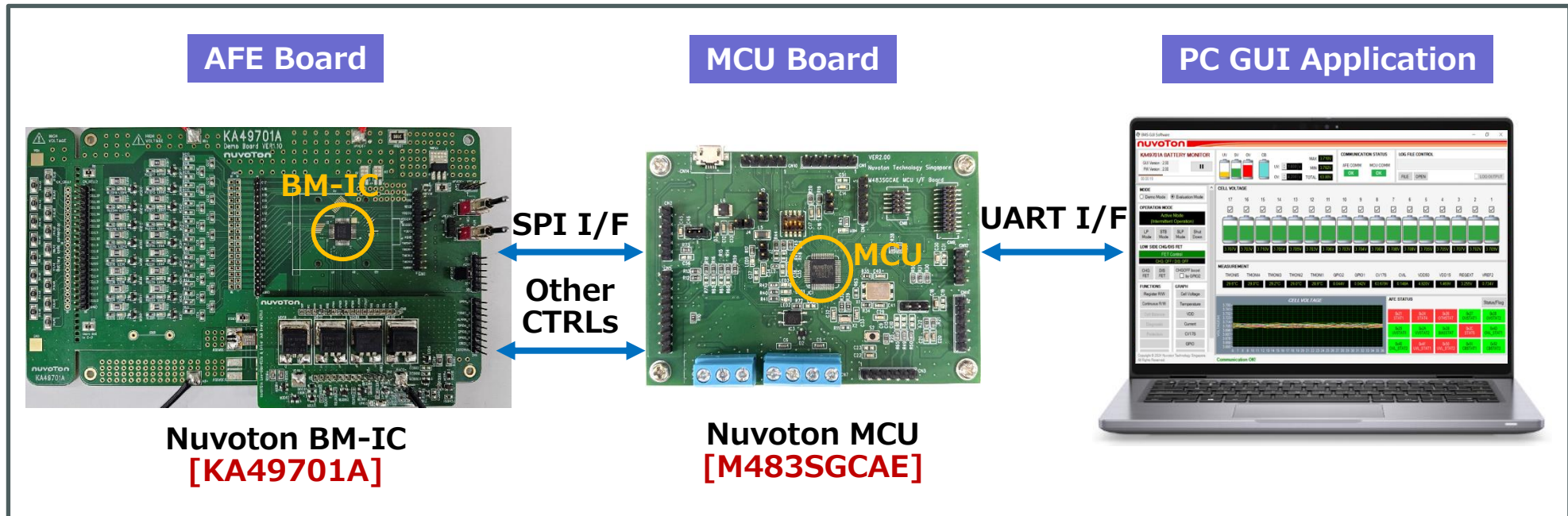
❑ Features

❑ Consists of 3 main components:

- **PC GUI Application:** High-level User Interface to access and control AFE (BM-IC).
- **MCU Board:** Contain System Controller (or CMU) Software Framework with BM-IC Device Driver & Middleware to control BM-IC.
- **BM-IC Board(AFE Board):** Contain reference design of BM-IC to perform operations such as cell voltage measurement, charging/discharging, cell balancing operation, fault detection etc. with control from MCU Board.

❑ Hardware & Software reference designs are provided with detailed documentation to facilitate new design-in or adoption in Target System.

❑ Can be used as a Starter Kit for Application Software Development or Proof-of-Concept (POC) in new Design without fabricating new hardware.



Target Users & Benefits of Reference Platform

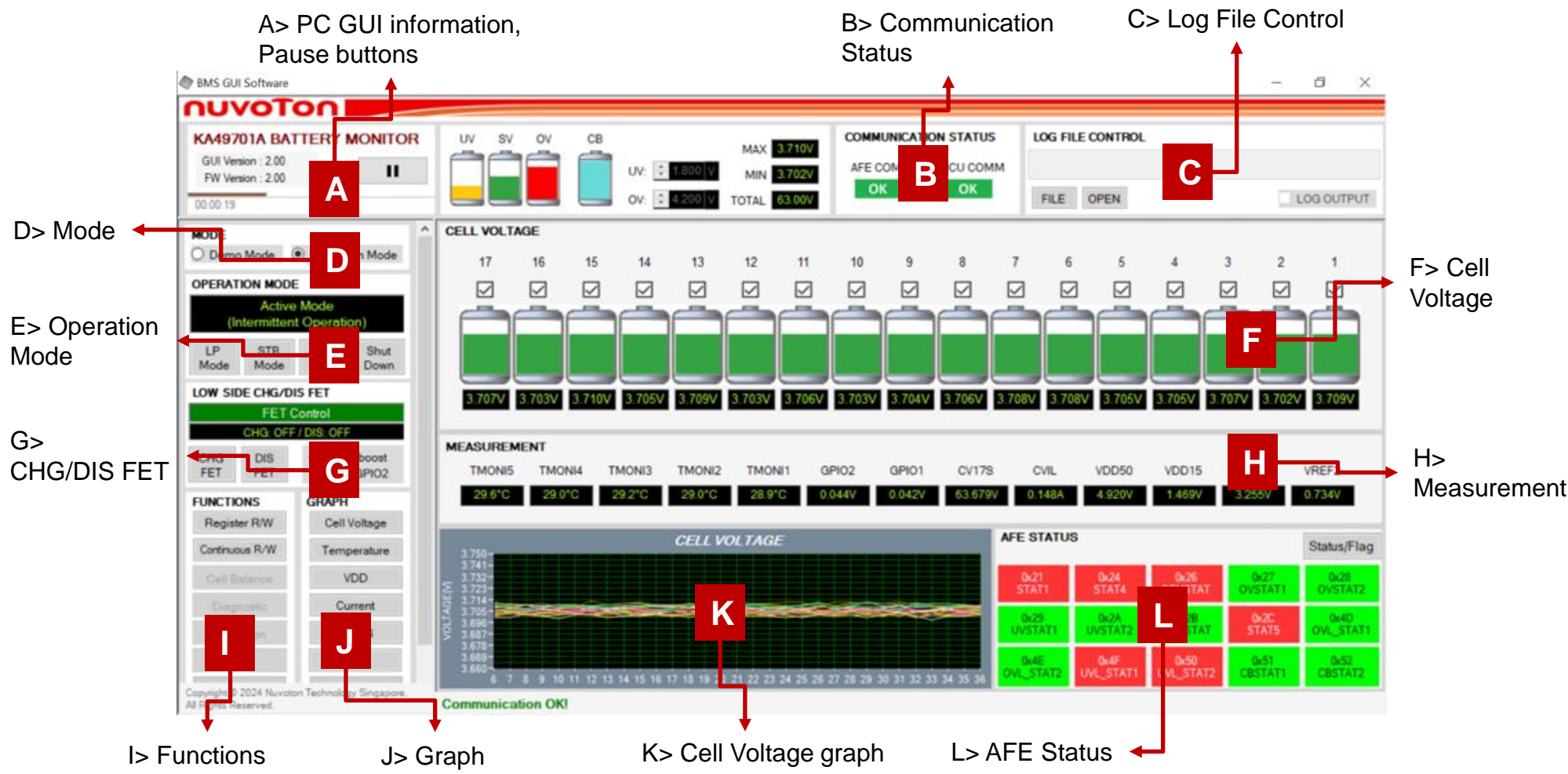
❑ Reference Platform can be used by each user with the corresponding applications:

User	Application / Use Case
Sales	For promotion & easy demonstration of BM-IC features such as: <ol style="list-style-type: none">1. Immediately see the converted value of cell voltages, other voltage, temperature, current etc on the PC GUI.2. Simple control of the BM-IC (e.g. cell select & FET control) & viewing of BM-IC Registers & Status at graphical format.
Customer	<ol style="list-style-type: none">1. Early evaluation of BM-IC, Device Driver & Middleware from PC GUI without the hassle of complex low- level setup.
Developer / Development	<ol style="list-style-type: none">1. Minimise Hardware Development Time with reference schematic, PCB Layout, BOM & Application Notes.2. Minimize Software Development Time with reference AFE Device Driver & Middleware.3. Immediate Application development environment ready using reference software framework with Nuvoton M483 MCU.4. Rapid prototyping (when target system is not ready) by re-using the highly configurable AFE-MCU setup.5. Using the PC GUI to verify developer understanding of the BM-IC specifications, behaviours & verify control sequence etc <i>without writing software Test Stub Program.</i>

Functional Operation from PC GUI

Overview of PC GUI Functional Features

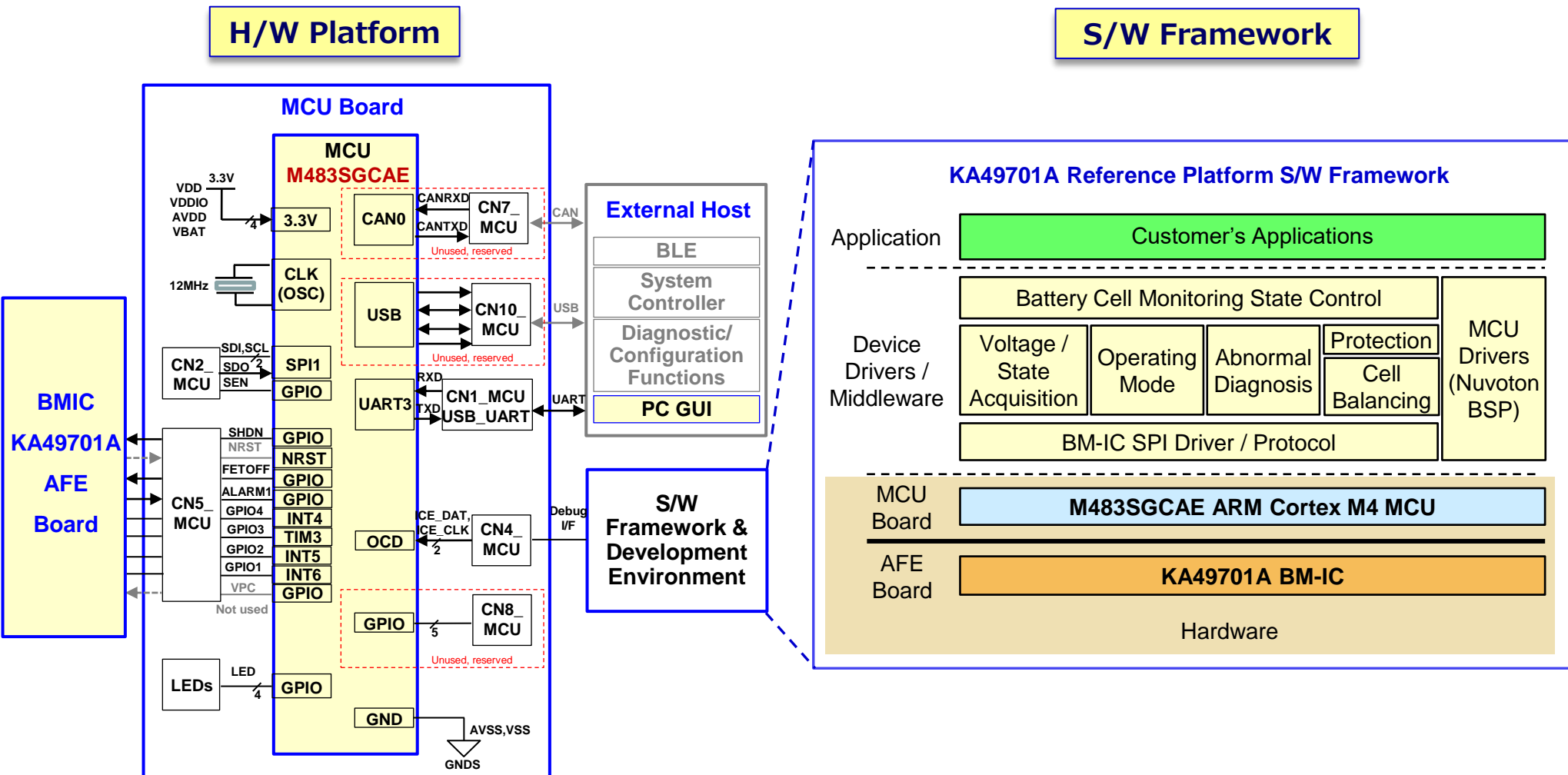
The PC GUI facilitates the transmission and reception of data to and from the BMIC through the MCU. Following data retrieval, the PC GUI software undertakes data conversion and presents it in both graphical and text formats.



Reference Platform: Hardware + Software System Overview

Starter Kit For S/W Development & Rapid Prototyping

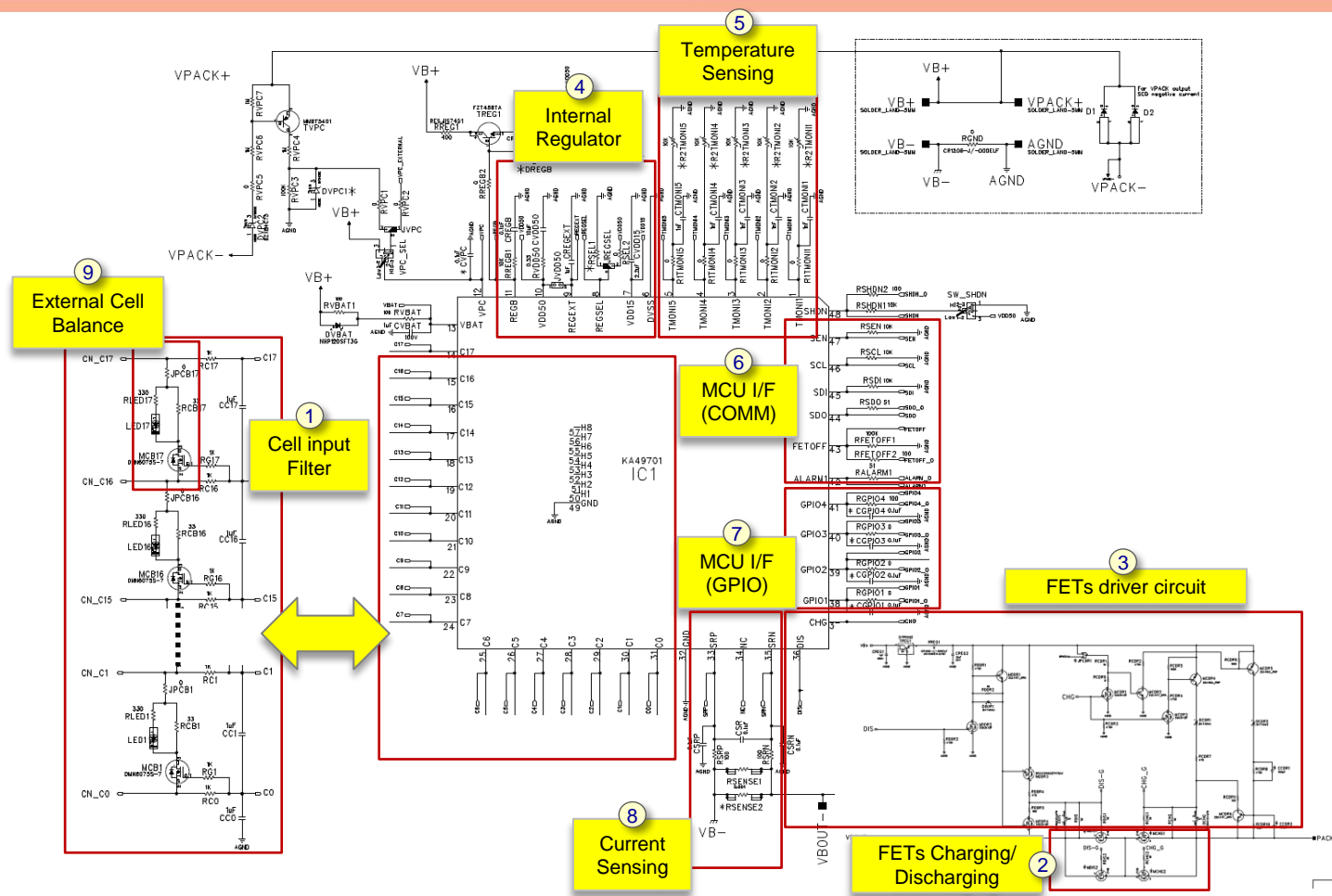
- H/W & S/W platforms readily available customer to start prototyping & S/W Development.
- H/W: Reference Board & Design for CMU to interface to AFE BM-IC.
- S/W: Provides Device Driver & framework for CMU S/W Development.
- Customer can verify design and start S/W Development before target platform is ready.



AFE System Reference Design With KA49701A

AFE Reference Design

- Provide reference schematic design on I/F & Drivers for easy adoption.
- Provided recommended passive component value (RC) & parts number for optimum operation.
- Minimizing adoption time for customer and supporting effort to customer.



S/N Hardware Reference Items Provided			
1	Cell Input Filter Circuit	2	FETs of Charging (CHG) & Discharging (DIS)
3	FETs driver circuit for CHG & DIS pins	4	Internal Regulator Circuit
5	Temperature Sensing Circuit	6	MCU Interface (COMM): SPI, Alarm, FETOFF Circuit
7	MCU Interface (GPIO): GPIO Circuit	8	Current Sensing Circuit
9	External Cell Balancing Circuit	10	Components: Transistor part number & RC value are provided.

KA49701A AFE Board

❑ AFE Board is designed with the flexibility to interface with customer own System Controller / CMU

- Customer can hook up AFE Board to own target system for evaluation / development.
- Dummy cell sub-PCB can be break-off to connect to actual battery cell.

KA49701A Demo Board VER1.10

VBAT+

VPACK +

VPC switch
(Wake up signal)

SHUTDOWN switch

CN2_MCU Communication Interface

SCL	SPI1 Serial Clock (Pin 1)
GND	Ground
SDO	SPI1 (Master In, Slave Out)
CVDD	3.3V
SEN	SPI1 Slave Select Out
SDI	SPI1 (Master Out, Slave In)

CN5_MCU Control Interface

SHDN	Shut Down Control (Pin 1)
-	-
FETOFF	CHG/DIS FET Control
ALARM1	BMIC alarm1 signal
GPIO4	General Purpose Pin
GPIO3	General Purpose Pin
GPIO2	General Purpose Pin
GPIO1	General Purpose Pin
VPC	Wake Up – Not Used

Input RC filter

KA49701A
Battery Management IC

Discharging FET

Charging FET

Dummy Cell
(Resistor Ladder)

BAT -

VPACK -

VBAT -

VPACK -

Please keep JVDD50 open

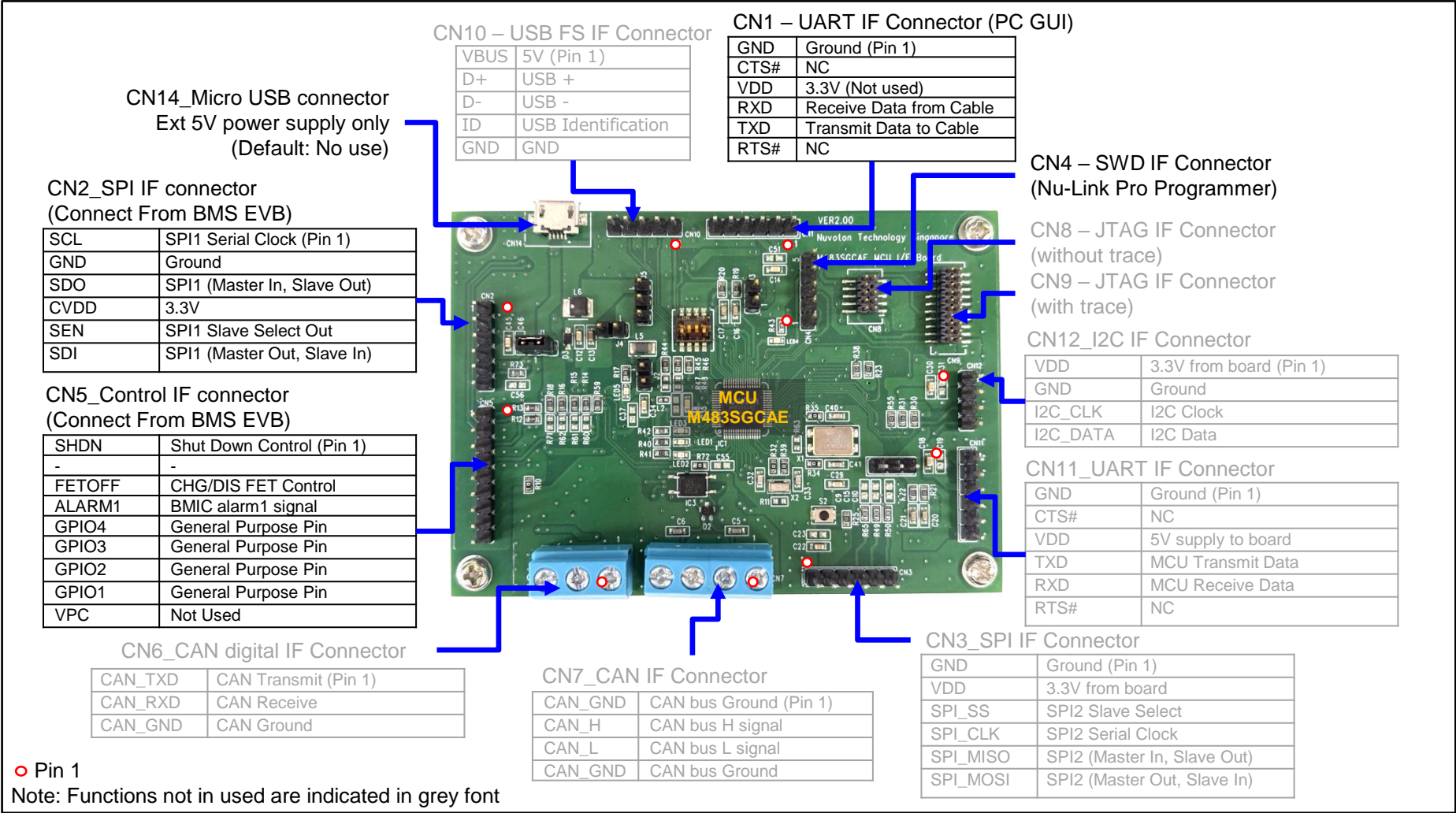
JREGEXT set to supply REGEXT voltage to MCU controller board via CN2 (pin4)

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M483SGCAE MCU Board – Flexibility For Rapid Hardware Prototyping

- MCU Board is designed with Expansion connectors, offers flexibility to connect to other system device in Rapid Hardware Prototyping.

The following shows the connector Layout and component placement of the MCU controller board



M483SGCAE MCU Board – Supporting Debugger Connection

❑ Software Development / F/W Update with Nu-Link Pro Programmer OR IAR I-JET

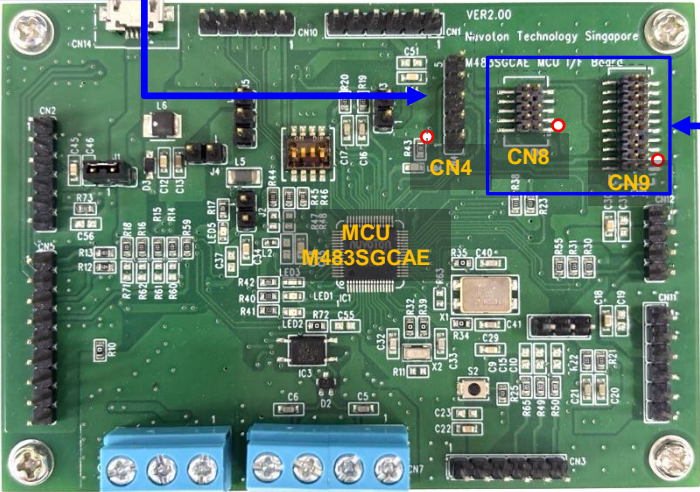
To enable M483 MCU Software Development / updating, use of either Serial Wire Debug (SWD) interface CN4 OR JTAG Debugger interface (CN8/CN9) is incorporated.

Connection to either the Nu-Link Pro OR IAR I-JET is as shown below:


CN4 – SWD IF Connector
(Connection to Nu-Link Pro Programmer)

MCU Board (CN4)		Nu-Link Pro Programmer
Pin No	Description	
1	VCC	VCC (Red)
2	SWDIO	ICE_DAT (Blue)
3	SWCLK	ICE_CLK (Green)
4	RESET	/RESET (Yellow)
5	GND	VSS (Black)

○ Pin 1

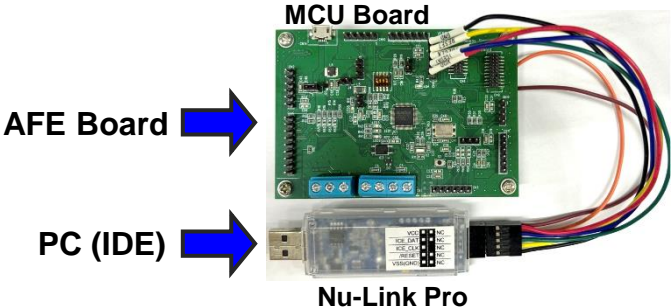


CN8/CN9 – JTAG Debugger Interface
(Connection to IAR I-JET)



JTAG Debugger I/F:
CN8 – OBD without Tracer Fn (I-Jet)
CN9 – OBD with Tracer Fn (I-Jet Trace)

MCU Board



AFE Board →

PC (IDE) →

Nu-Link Pro

Reference Platform Package Inventory List

❑ The KA49701A Reference Platform Package consists of the following parts:

Part	Description
Hardware Board	1. KA49701A AFE Board
	2. M483SGCAE MCU Board
Accessories	1. USB to TTL level serial converter cable (TTL-232R-3V3)
	2. Board connection Wire (6pin x1 and 9pin x1)
	3. Nu-Link Pro Programmer (Optional)
Software	1. PC GUI Application (for Windows 10) and Industrial BMS Firmware Update Tools
	2. MCU Software Framework with AFE Device Drivers & Middleware (source code available upon request)
Documentation	1. Hardware User Manual
	2. MCU Software User Manual
	3. KA49701A Device Driver API List
	4. PC GUI User Manual and Firmware Update Tools User Manual
	5. Schematic, PCB Layout, BOM for MCU and AFE Boards
	6. Application note

REVISION HISTORY

Ver.	Date	Revised Contents
V1.00	8 th Feb 2024	1. Initially issued.
V2.00	27 th Sep 2024 18 Oct 2024	<ul style="list-style-type: none">• Update the version no. and the changes relating to the AFE board from KA49701(ES) to KA49701A• A sub-board for the charging/discharging FET has been added to the AFE board• Reference Platform Release package to include Application note, PC GUI Industrial BMS Firmware Update Tools and its User Manual

Joy of innovation
nuvoTon

Thank You

Danke

Merci

ありがとう

Gracias

Kiitos

감사합니다

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