Hardware User Manual

KA49701A Reference Platform
Hardware User Manual

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1. OUTLINE

1.1 Purpose

The purpose of this manual is to explain the hardware configuration of the KA49701A Battery Management System Reference Platform and to assist the user with the setup of the reference platform.

1.2 Reference platform components

The reference platform is made up with 2 boards which consists of the following components:

a) MCU controller board (Main device : MCU M483SGCAE)
b) Analog Front End (AFE) board (Main device : BM IC KA49701A)
c) Board connection Wire (6-pin x1 and 9-pin x1)
d) USB to TTL level serial converter cable (TTL-232R-3V3).
e) Nu-Link Pro Programmer (Optional: For Software Development & Firmware update)

MCU controller board   AFE board

Board Connection Wire   TTL-232R-3V3   Nu-Link Pro Programmer
                                                              (Optional)
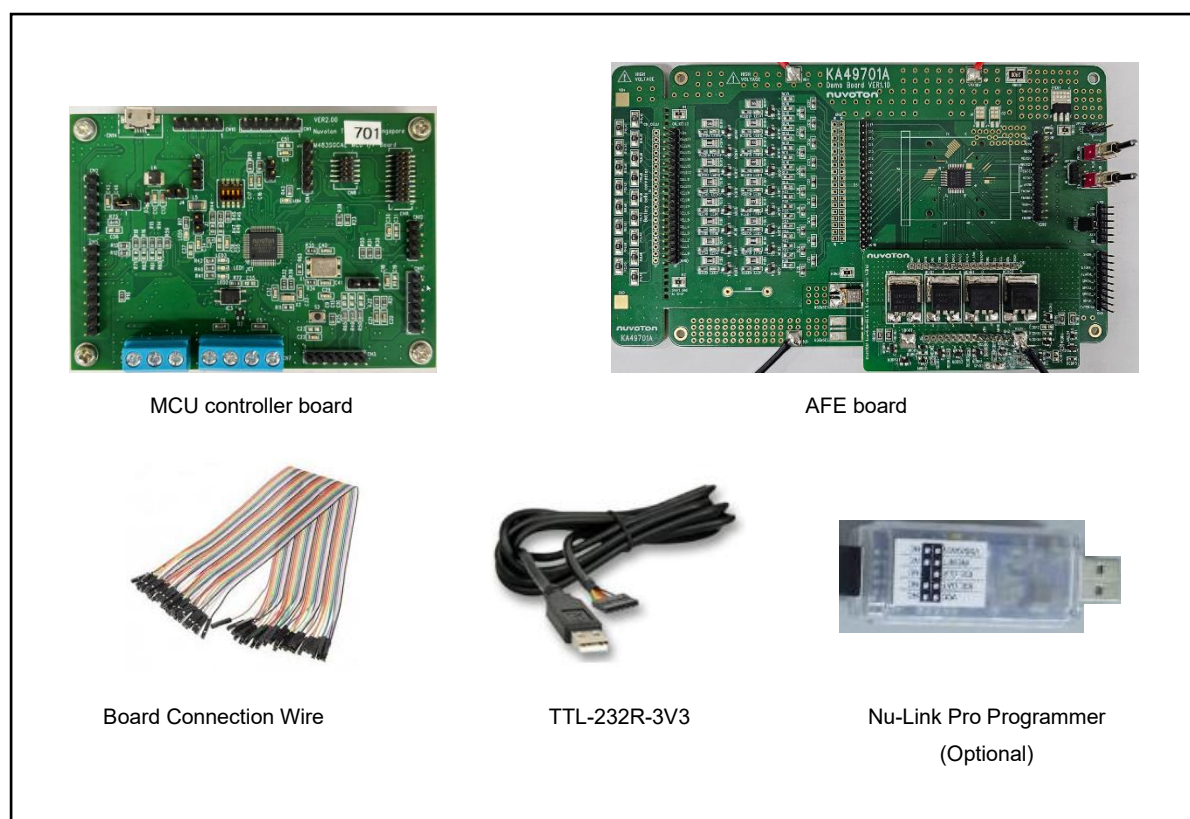
Figure 1.1 Reference Platform components

2. MCU CONTROLLER BOARD

2.1 Introduction

The MCU controller board controls the BM IC with an onboard MCU M483SGCAE. It provides several control circuits and interfaces. Besides controlling the BM IC, the MCU board is also able to interface with a PC GUI. The PC GUI provides flexibility to the user for configuring the BM IC and status display.

The MCU controller board has the following functions:

a) MCU circuitry (including software debugging interface)
b) Power management and MCU reset circuitry
c) BM IC and PC GUI interface circuitry
d) DIP switch for operation option**
e) LED status indication
f) CAN bus interface**
g) Serial Flash**
h) Expansion port** (such as SPI, UART, IIC and FS USB for future expansion)

** not supported by software at this moment.

2.2 MCU controller board components and connector layout

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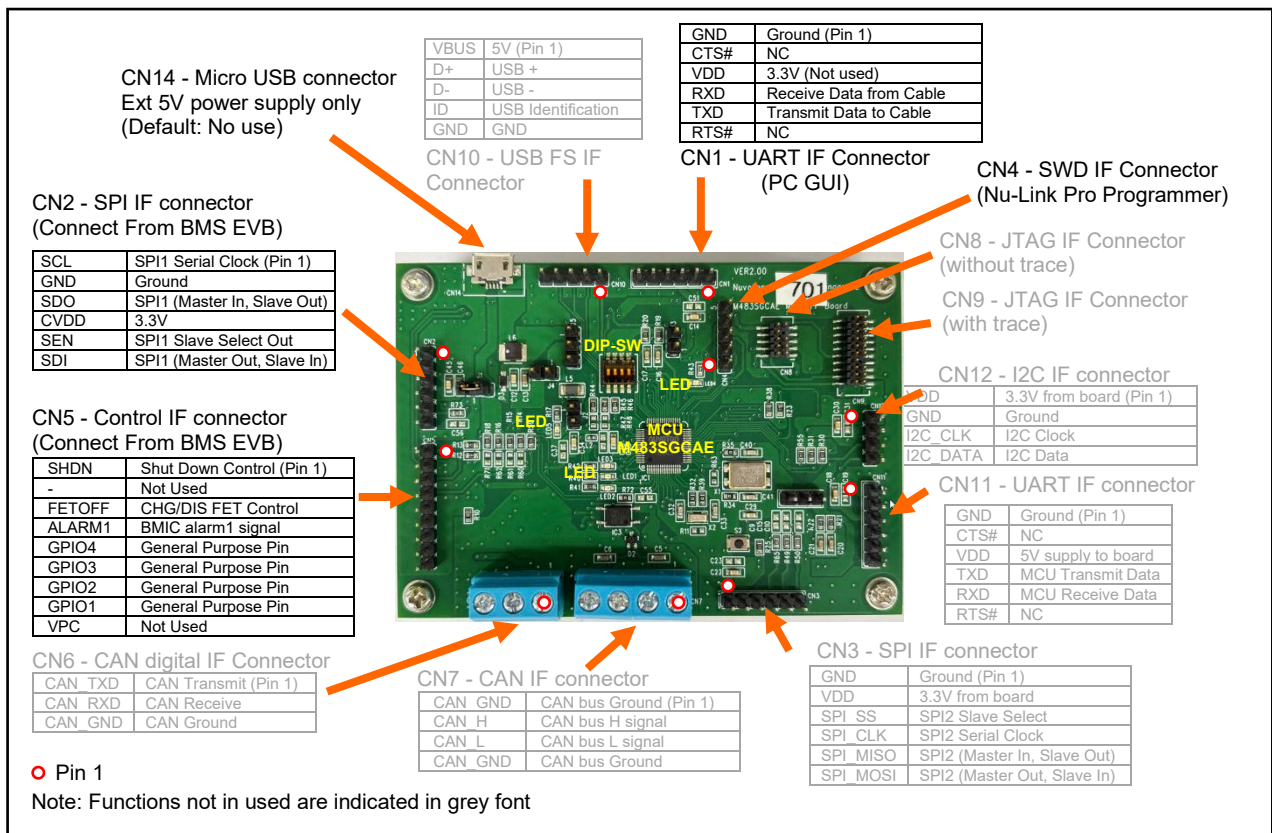

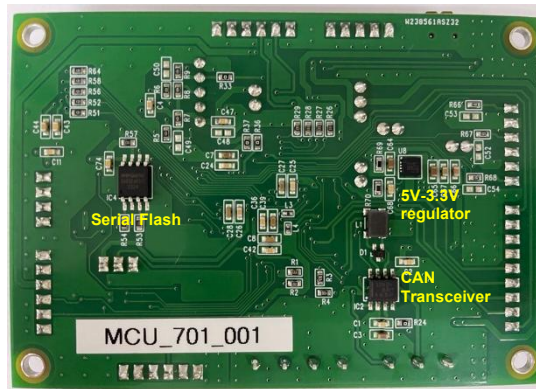Figure 2.1 Top side of the MCU controller board

Figure 2.2 Bottom side of the MCU controller board

2.3 Power Management

Providing flexibility to the user in using the reference platform for their application, the MCU board incorporates several options to supply the required voltage to the reference platform.

a) Power supply from AFE board (max 50mA)
b) External 5V power supply from Micro USB connector (As the MCU is using 3.3V, step down regulator is used)
c) External power supply from UART device (5V and 3.3V is available)
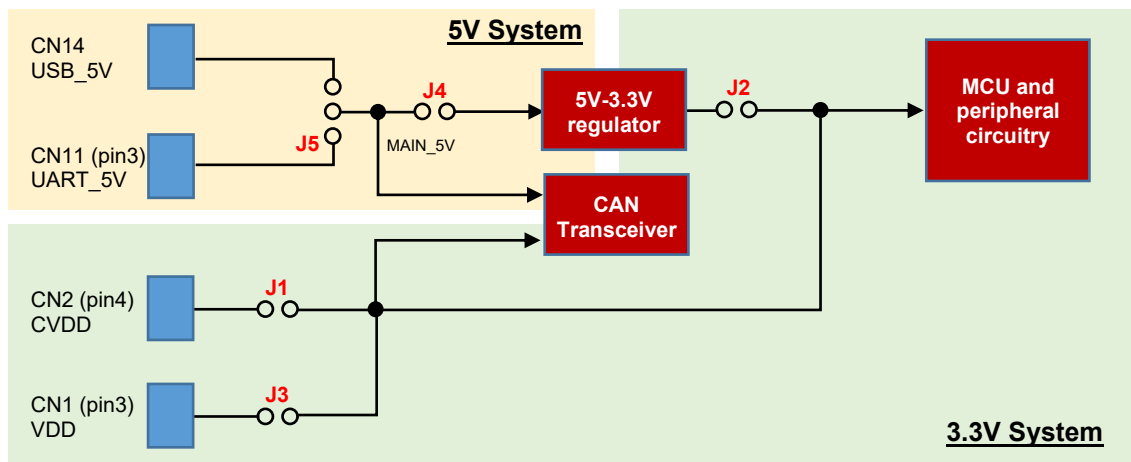
Figure 2.3 Power distribution diagram on MCU controller board

Note :

1. By default, Option (a) is selected (J1 is shorted, others are opened)
2. To use the CAN bus function, 5V must be supplied.

Figure 2.4 Power distribution jumper setting and location.

2.4 MCU Manual Reset

On-board push-button tact switch S2 is used to enable manual reset of the MCU. Press and release the push button to reset the MCU manually.

Figure 2.5 Push button S2 for MCU manual reset

2.5 LED Indicator

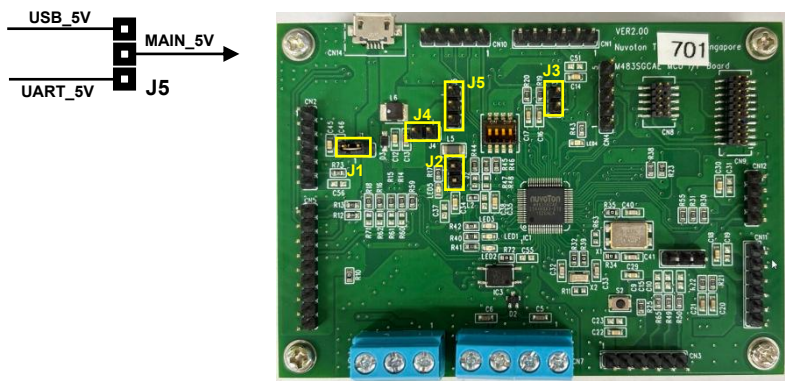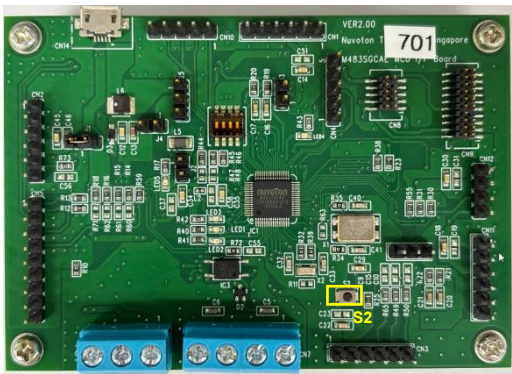For ease of operation status notification, MCU controller board has LED indicator for critical operation and error notification.
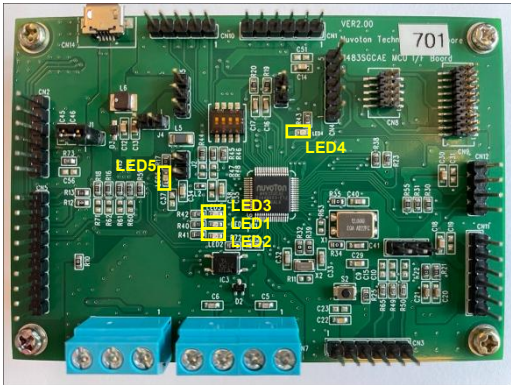

Figure 2.6 LED Indicator

LED	Color	LED status	Notification
LED1	Red	ON	Charging in operation
LED2	Amber	ON	Discharging in operation
LED3	Blue	ON	Cell Balancing in operation
LED4	Green	Flashing	SPI communication with AFE board is working and normal
LED1~4	-	ON	SPI communication error / AFE board wake up error
LED5	Red	ON	Using External 5V power supply

2.6 Software Debugging Using Nu-Link Pro Programmer

To enable software debugging and updating, Serial Wire Debug (SWD) interface is prepared (CN4). Connection to the Nu-Link Pro Programmer is shown as following:

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

○ Pin 1

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)

Figure 2.7 Serial Wire Debug (SWD) Interface connector (CN4)

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USB interface to PC
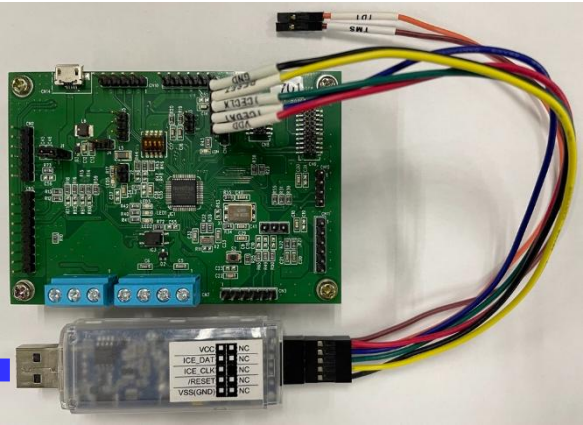
Figure 2.8 Example of Nu-Link Pro Programmer Connection to MCU Board

2.7 Software Debugging Using IAR I-JET

For software debugging and updating, JTAG Debugger interface (CN8/CN9) is also incorporated.
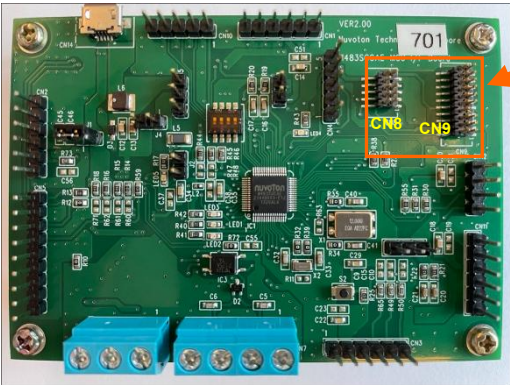
CN8/CN9 – JTAG Debugger interface
(Connection to IAR I-JET)

JTAG Debugger I/F:

CN8 – OBD without Tracer Function (I-Jet)

CN9 – OBD with Tracer Function (I-Jet Trace)

Figure 2.9 JTAG Debugger interface connector CN8 or CN9

3.   ANALOG FRONT END (AFE) BOARD

3.1   Introduction

The Analog Front End (AFE) board uses KA49701A Battery Management IC as main device. The AFE board performs operations such as battery cell voltage measurement, charging and discharging of the battery cell, cell balancing operation, fault detection etc with the control from the MCU board.

CN2 - MCU Communication IF	
SCL	Clock In (Pin 1)
GND	Ground
SDO	Data Out
CVDD	3.3V power supply
SEN	Enable In
SDI	Data In

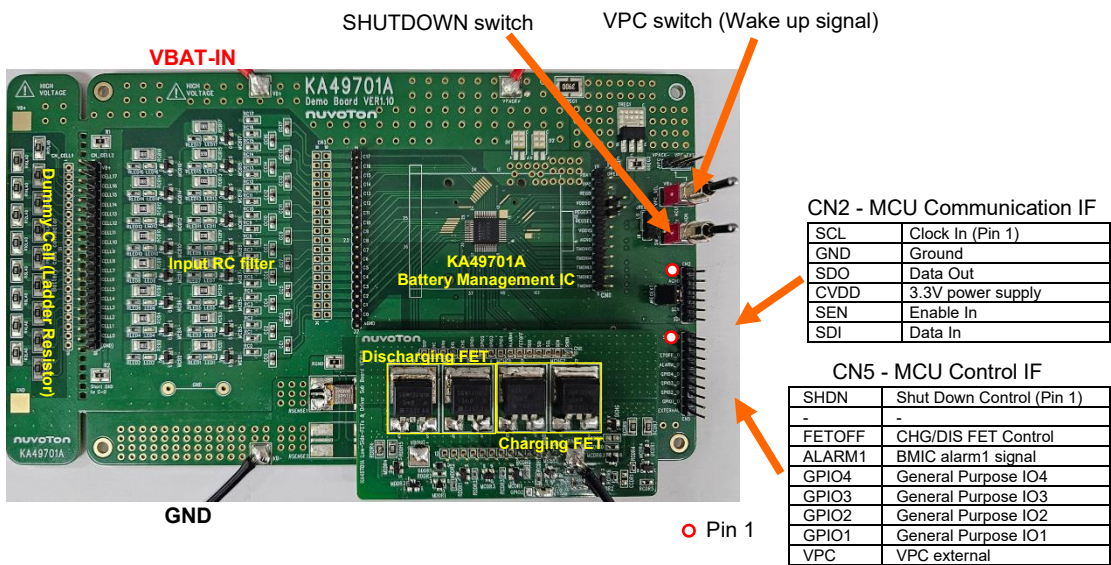| CN5 - MCU Control IF	
SHDN	Shut Down Control (Pin 1)
-	-
FETOFF	CHG/DIS FET Control
ALARM1	BMIC alarm1 signal
GPIO4	General Purpose IO4
GPIO3	General Purpose IO3
GPIO2	General Purpose IO2
GPIO1	General Purpose IO1
VPC	VPC external

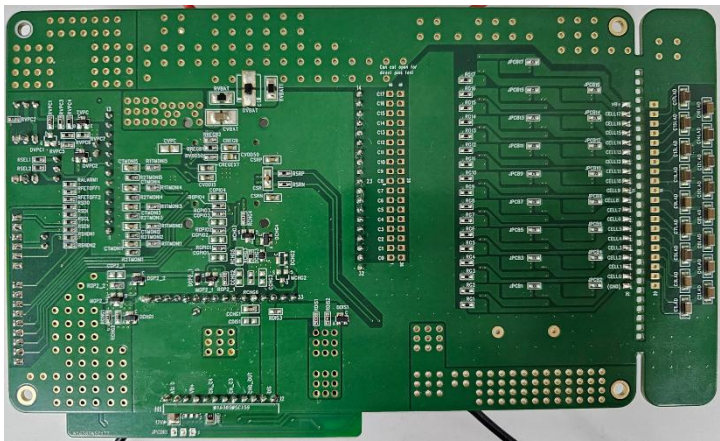Figure 3.1 Top side of the AFE board

Figure 3.2 Bottom side of the AFE board

3.2 MCU controller board power supply

In the reference platform, the REGEXT output is used to provide a 3.3V power supply to the MCU controller board.

To use REGEXT voltage for the MCU, set jumper JREGEXT and ensure that JVDD50 is open. Placing a jumper at JVDD50 will pull REGEXT to 5V, potentially causing damage to the MCU, which operates at 3.3V.

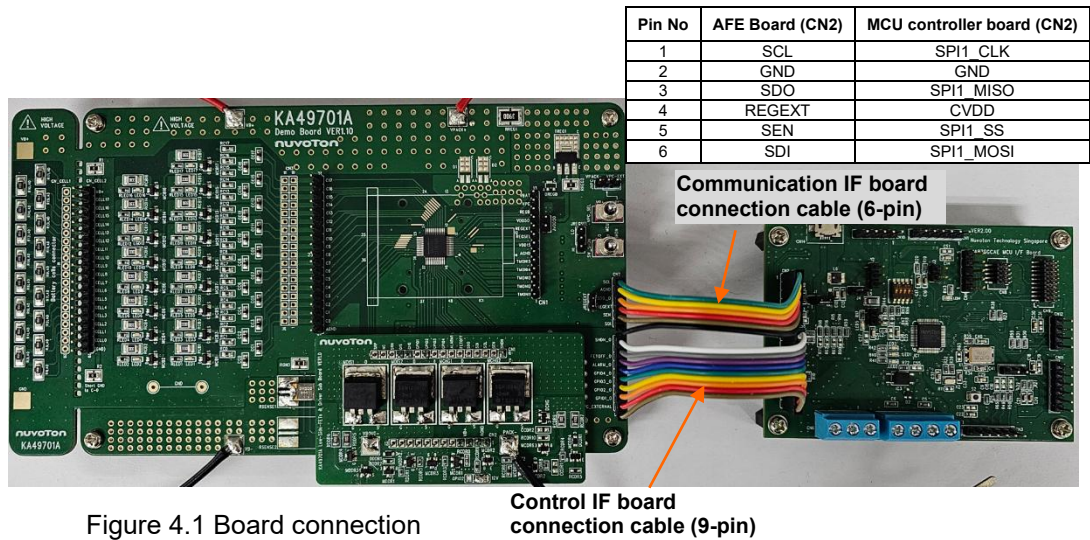JREGEXT set to supply REGEXT voltage to MCU controller board via CN2 (pin4)

Please keep JVDD50 open

Figure 3.3 REGEXT supplies to MCU controller board.

4. REFERENCE PLATFORM HARDWARE SETUP

4.1 Setting up the reference platform

To set up the reference platform, the AFE board is connected to MCU controller board with communication interface board connection cable (6-pin) and control interface board connection cable (9-pin) as following:

Pin No	AFE Board (CN2)	MCU controller board (CN2)
1	SCL	SPI1_CLK
2	GND	GND
3	SDO	SPI1_MISO
4	REGEXT	CVDD
5	SEN	SPI1_SS
6	SDI	SPI1_MOSI

Figure 4.1 Board connection

Pin No	AFE Board (CN5)	MCU controller board (CN5)
1	SHDN	SHDN
2	-	(Not Used)
3	FETOFF	FETOFF
4	ALARM1	ALARM1
5	GPIO4	GPIO4
6	GPIO3	GPIO3
7	GPIO2	GPIO2
8	GPIO1	GPIO1
9	VPC	(Not Used)

4.2 PC GUI Interface Connection

Using USB to TTL level serial converter cable (TTL-232R-3V3), the MCU controller board can be interfaced with PC GUI.

Figure 4.2 PC GUI connection using TTL-232R-3V3 Cable
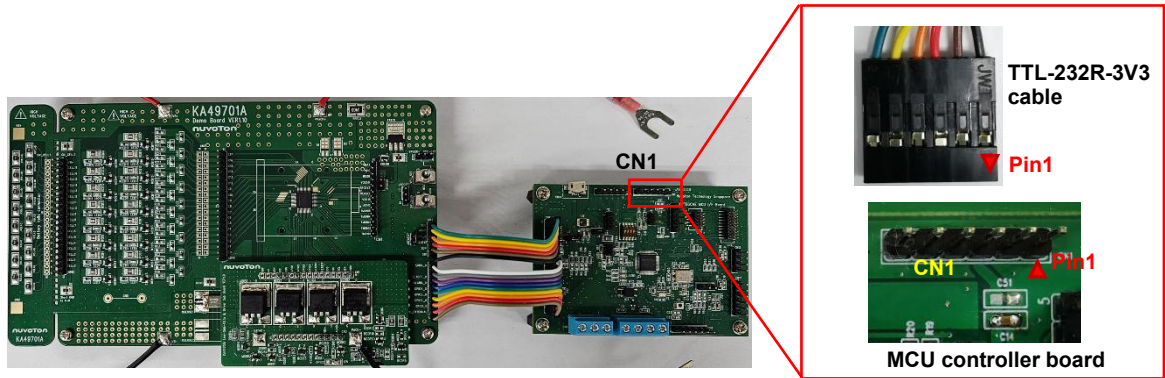
5. REFERENCE PLATFORM OPERATION

5.1 System Start up / Wake up

At the initial stage when VBAT-IN is just supplied but before VPC switch is being toggled, the system is in Shutdown mode.

To start up/wake up the system, VPC switch is toggled between ON-OFF to generate a wake-up pulse signal to BM IC.

Toggles the VPC Switch to the left position and switches back to its original middle position. This will wake up the BMIC Board. Once BM IC is started, internal power on sequence will be executed and provide power supply to MCU board, MCU will start to operate once the internal reset is released from power supply turn on.
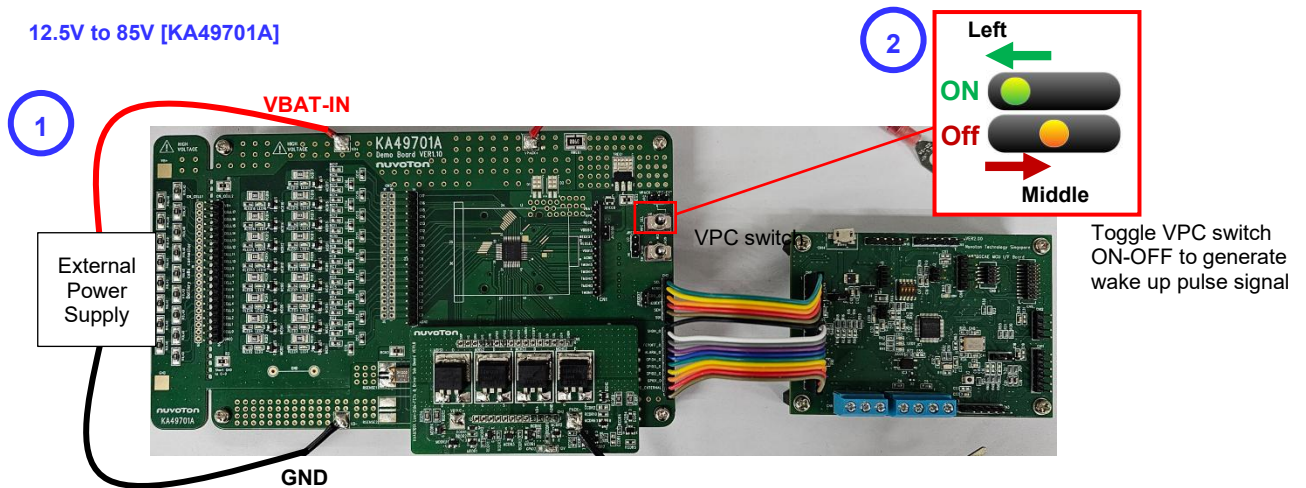
LEDs on MCU Board will indicate the system status.

Figure 5.1 System Start up / Wake up

5.2 Safety Precautions

When using Lithium-Ion Battery for the power up of the Evaluation board, managed by high voltage battery. Kindly take notes of the following safety precautions.

With the presence of high voltage, the hazards involved such as Electric shock, fire due to short circuit.

Always cover the Evaluation board with an acrylic box when doing evaluation. Wear goggles at all times to protect the eye.

6. APPENDIX

	TTL-232-3V3	MCU EVB (CN1)
1	GND (Black)	GND
2	CTS# (Brown)	CTS#
3	VCC (Red)	VDD
4	TXD (Orange)	TXD
5	RXD (Yellow)	RXD
6	RTS# (Green/Blue)	RTS#

Figure 6.0 TTL-232-3V3 Cable Signal Color Indicator Connection to MCU Board UART

TTL-232R-3V3
Cable, USB to TTL Level, Serial Converter, 1.8m

Please refer to "KA49701A Reference Platform PC GUI User Manual"
for the actual operation instruction.

7. REVISION HISTORY

Date	Revision	Description
2024.02.08	1.00	1. initially issued.
2024.10.18	2.00	A Sub board for the charging/discharging FET has been added to the AFE board
		REGSEL pin configuration for REGEXT output voltage has been removed
2025.07.15	2.10	Pg1, "errors or commissions" → "errors or omissions"
		Pg13, "Litium-Ion Battery" → "Lithium-Ion Battery"

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