AN49503A Evaluation kit
Users Guide

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1st Business Development Center
Semiconductor Business Unit
Panasonic Semiconductor Solutions Co., Ltd.

1. The outline of EVB kit

1.1 Outline

By using battery management IC (AN49503A), this Evaluation Kit can measure the cell voltage, electric current and the temperature of the lithium ion battery.

1.2 Composition of EVB kit

As the following figure shows, this Evaluation Kit consists of Analog Front End (AFE) board, Micro-computer Unit (MCU) board, USB-I2C converter Module and GUI Application.

AFE board do the measurement by using battery management IC. MCU board is used to control the AFE board and to communicate with GUI Application. The communication between MCU board and GUI Application is made through USB-IC Converter Module. By using the GUI Application, the A/D conversion value such as cell voltage, etc. can be monitored, and all registers of AFE-IC can be written and read.

MCU and AFE are connected by 16-pin connector, MCU board and PC are connected through USB-I2C Converter Module.

Power supply for both AFE and MCU is created by the internal regulator of AFE-IC, with which the voltage of 5V is generated from VBAT and VPACK.

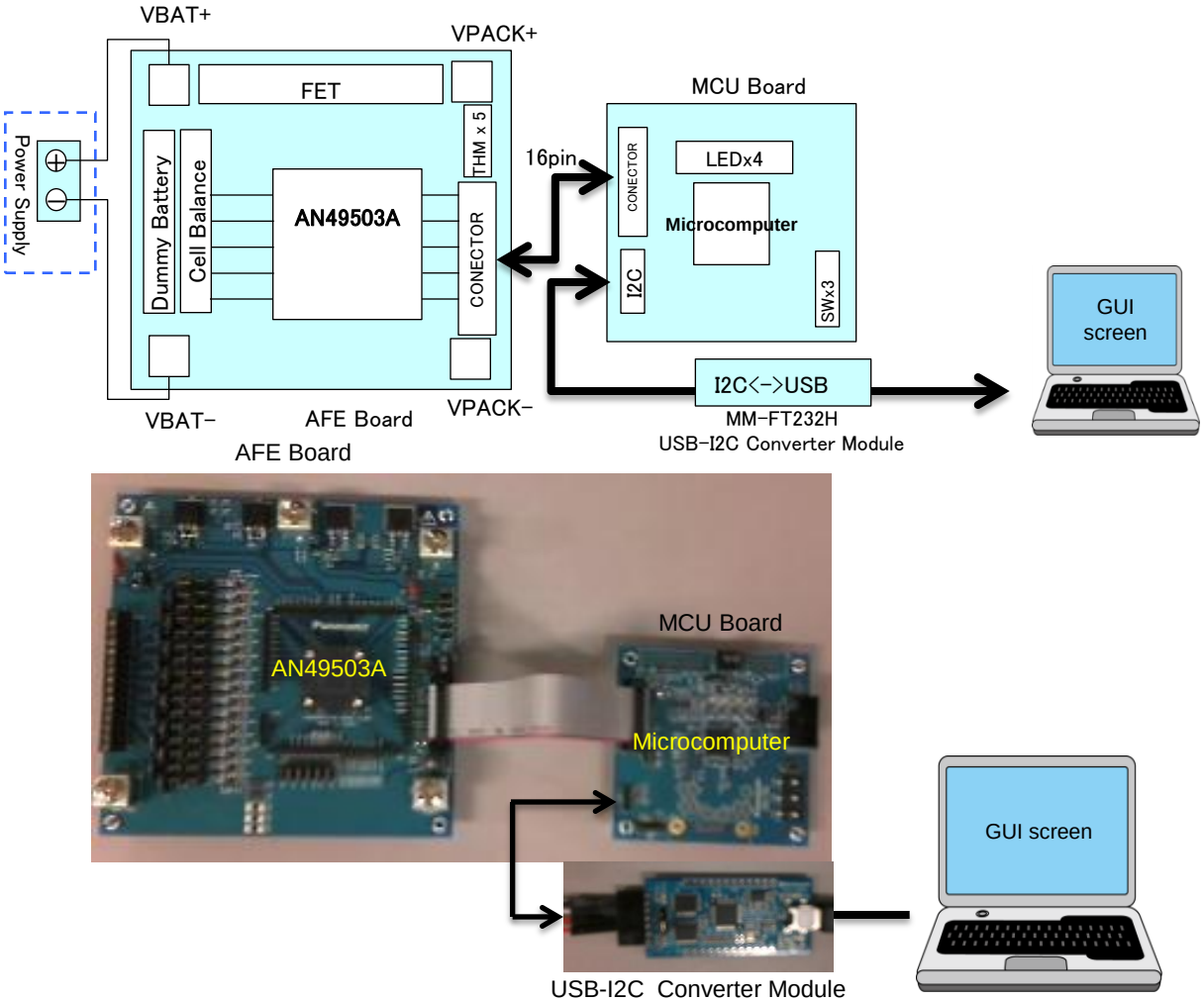


Figure 1.1 AN49503A EVB kit (MCU board, AFE board)

1.3 Supplied items

The following table is the item list for this EVK, please check if there is something in short of.

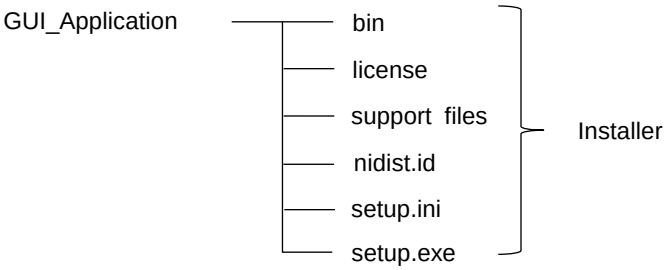
Table 1.1 Supplied items for AN49503A evaluation kit

Name of product	Number of product	Note
AFE Board	AN49503A BMS Eva kit -A	
MCU Board	AN49503A BMS Eva kit -B	
USB-I2C Converter Module	MM-FT232H	Module to connect MCU to PC
Pin-out conversion cable	EX-002	Used to connect USB-I2C Converter Module with MCU board.
16-pin connection cable	MIL16SS-F0010	Used to connect MCU and AFE
USB cable	U2C-M10BK	Used to connect PC with USB-I2C Converter Module.
PC GUI Application *1	GUI Application	Installer

*1: Working on Operating Systems other than Windows7（Japanese ver. 32bit）, Windows8（English ver.64bit）has not been evaluated.

1.4 File structure of PC GUI Application

The following chart shows the file structure of PC GUI Application.



2. Connection method of evaluation kit

2.1 Connection method of an evaluation kit

CN7 on AFE board and CN3 on MCU board should be connected by 16pin connection cable. Operation mode of the evaluation kit is set by SW. Connection between battery and AFE is set by Jumper.

Table 2.1Jumper setting of MCU board

Switch/ Jumper	Description	Default
S1	Reset switch for AN49503A.	-
SW1	Please do not change from Default value.	(1)OFF
SW2	OFF(1) : Status ON (0) : Battery gauge Function: LED display mode selector	(1)OFF
SW3	Please do not change from Default value.	(1)OFF
J10	Jumper Terminal for UART 1 : GND 2 : TXD1 3 : RXD2 4 : CVDD Note: UART is not used by this evaluation kit.	Open
J11	Jumper Terminal MM-FT232H 1 : GND 2 : GND 2 : DATA 3 : CLOCK 3 : DATA 4 : DATA 4 : CLOCK 5 : DATA Function : Connector to I2C-USB Converter Module (MM-FT 232H) *Please take care of the order of connector pin because it is different with I2C-USB Converter Module.	Open
J12	Please do not change Jumper from Default(Short 2,3).	1 Open 2,3 Short
J13	Please do not change Jumper from Default(Short).	Short
J14	Please do not change Jumper from Default(Short).	Short
J15	Please do not change Jumper from Default(Short).	Short

Table 2.2 Set up of AFE board

Jumper	Description	Default
J1	Please do not change Jumper from Default(Short).	Short
J2-J6	Jumper Terminal 1 : TMONI1~5 pins 2 : GND Possible connection: Short : shorted to GND Open : Do not short to GND Note: Connect TMONI1.2 to cell temperature thermistor, and connect TMONI3 to FET temperature thermistor.	Open
J7-J37 (odd number)	J7 – cell 16, J9 – cell 15 and so on … Short : Neither real battery nor dummy battery available. Open: Either real battery or dummy battery is presented. Function : For battery selection. Note:J8~J38 (even number) and J45-J60 should be set correspondingly.	Open
J8-J38 (even number)	J8 – cell 16, J10 – cell 15 and so on … Short : dummy battery Open : real battery Function : For battery selection. Note: J7~J37 (odd number) and J45-J60 should be set correspondingly.	Short
J39-J44	Jumper Terminal 1: GPIO1~6 pins 2: GND Function: selector for using GPIO or not.	Open
J45-J60	Short : use external cell balance. Open :use internal cell balance. Function: external cell balance or internal cell balance selection	Short
J61	Please do not change Jumper from Default(Short).	Short
J62	Please do not change Jumper from Default(Short).	Short
J63	Please do not change Jumper from Default(Short).	Short
J64	Please do not change Jumper from Default(Short).	Short
J65	Short : use Q5,Q6. Open : use Q4,Q1	Open

J45~J60： There are 2 kinds of method for cell balance. The inner cell balance uses the internal circuit of AN49503A, while the outside cell balance uses the external components.

Table 2.3 CN connection of AFE board and MCU board

Connection origin (MCU board)	Connection destination (AFE board)	Description
CN3	CN7	Connect MCU board and AFE board.

Table 2.4 Connection of a MCU board and a USB Converter Module

Connection origin (USB-I2C Converter Module)	Connection destination (MCU board)	Description
Pin 1	-	–
Pin 2	J11_1	GND
Pin 3	J11_4	I2C：SK(CLOCK)
Pin 4	J11_2	I2C：DO(DATA)
Pin 5	J11_3	I2C：DI(DATA)
Pin 6	-	-
Pin 7	-	-

Refer to「Table 2.1Jumper setting of MCU board」for jumper setting
”-” means unused. Please refer to P25(Appendix-1) for the location of SW/Jumper/CN.

2.2 Setting of battery and dummy battery for AFE foundation

Resistance split circuit for dummy battery is implanted on this board. It's possible to choose an dummy battery instead of a battery connection. When battery cells are less than 16 cells, please connect them from both ends and leave the pins in the middle of the connector unconnected. Remember to short the corresponding Jumper for non-connection. Please refer to P5(Table 2.2 Setup of an AFE board) for Jumper setting of Resistance split circuit. VBAT-, CN5, VBAT+ of AFE board are used for real battery connection.

Figure2.1 Battery connection method

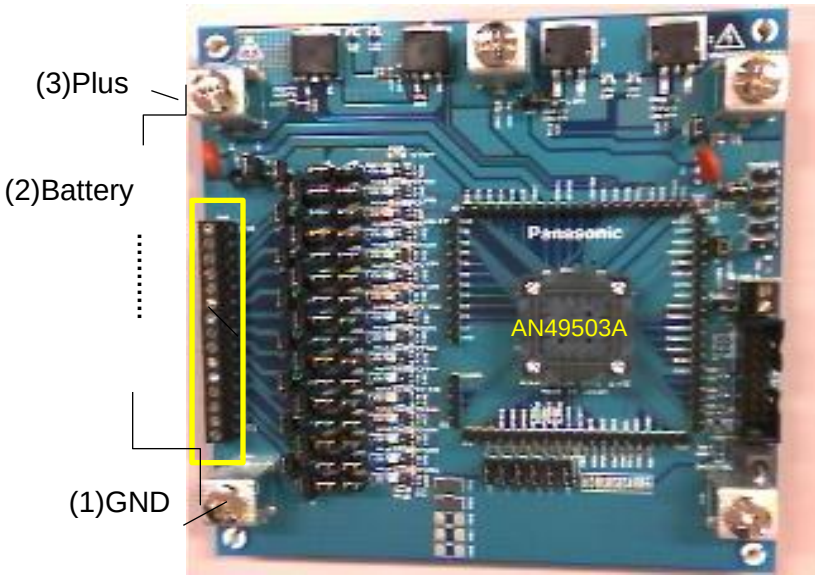
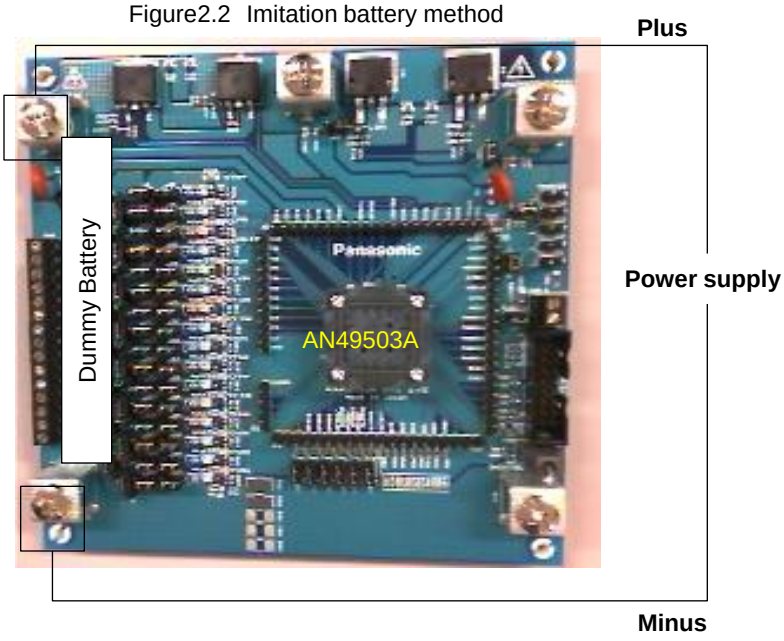


Figure2.2 Imitation battery method



Note1: Pin VPACK is used to connect stabilized power source or loading for Battery Charge or Discharge.
Note2: Connection to battery should be made in the order of GND(VC0) -> VC16 -> from lower cell to higher (VC1 -> VC2 ->..... ->VC15), and in the contrary order when you disconnect them.

2.3 Installation of MM-FT232H driver

if Driver is not installed automatically, please downloaded it from following HP and install it manually.

http://www.ftdichip.com/Drivers/D2XX.htm

Currently Supported D2XX Drivers:

		Processor Architecture							
Operating System	Release Date	x86 (32-bit)	x64 (64-bit)	PPC	ARM	MIPSII	MIPSIV	SH4	Comments
Windows*	2014-09-29	Available as setup executable Contact support1@ftdichip.com if looking to create cusomised drivers		-	-	-	-	-	2.12.00 WHQL Certified Available as setup executable Release Notes
Windows RT	2014-07-04	1.0	-	-	1.0	-	-	-	A guide to support the driver (AN_271) is available here
Linux	2012-06-29	1.1.12	1.1.12	-	1.1.12 Suitable for Raspberry Pi	-	-	-	ReadMe
Mac OS X	2012-10-30	1.2.2	1.2.2	1.2.2	-	-	-	-	Requires Mac OS X 10.4 (Tiger) or later ReadMe
Windows CE 4.2-5.2**	2014-22-04	1.0.1.10	-	-	1.0.1.10	1.0.1.6	1.0.1.6	1.0.1.6	
Windows CE 6.0/7.0	2014-22-04	1.0.1.10 CE 6.0 CAT CE 7.0 CAT	-	-	1.0.1.10 CE 6.0 CAT CE 7.0 CAT	1.0.1.6	1.0.1.6	1.0.1.6	For use of the CAT files supplied for ARM and x86 builds refer to AN_319
Android (Java D2XX)	2013-02-13				Java Driver				Rooting of Android device is not required. Refer to technical note TN_147 TN_147 sample download

*Includes the following version of of the Windows operating system: Windows 7, Windows Server 2008 R2 and Windows 8, 8.1, Windows server 2012 R2. Also, as Windows 8 RT is a closed system not allowing for 3rd party driver installation our Windows 8 driver will not support this variant of the OS. You must use the Windows RT build for this platform.

Figure 2.3 MM-FT232H driver D/L screen

2.5 Installation of GUI Application

Use “setup.exe” (Figure 1) to install the GUI application. When installation ends, shortcut for the GUI Application will be generated on the desktop (AN49503A.exe Figure2) .

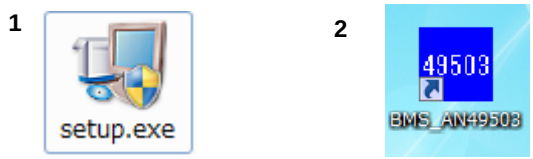


Figure 2.4 Installation of GUI Application

3. How to start evaluation kit

3.1 Preparations of evaluation kit

Start preparations are performed in the following order.

1. Check Jumper/CN Connection of AFE and MCU board. Referring to chapter 2. Connection method of evaluation kit
2. Connect AFE to MCU board, and Connect PC to I2C of MCU board as shown in Figure3.1(1-4)
3. Install driver for MM-FT232H and GUI Application.

Note: GUI Application doesn't work if driver is not installed correctly.

4. Connect battery cell to CN5 of the AFE, 12V DC power supply to the VBAT.
5. After VBAT is applied, Supplying voltage to VPACK+ will make AFE board starting up and generating 5V for MCU board.

*When AN49503A of the AFE board is normally started up, LED of the MCU board blinks at 1Hz.
If not , Please restart the power supply.

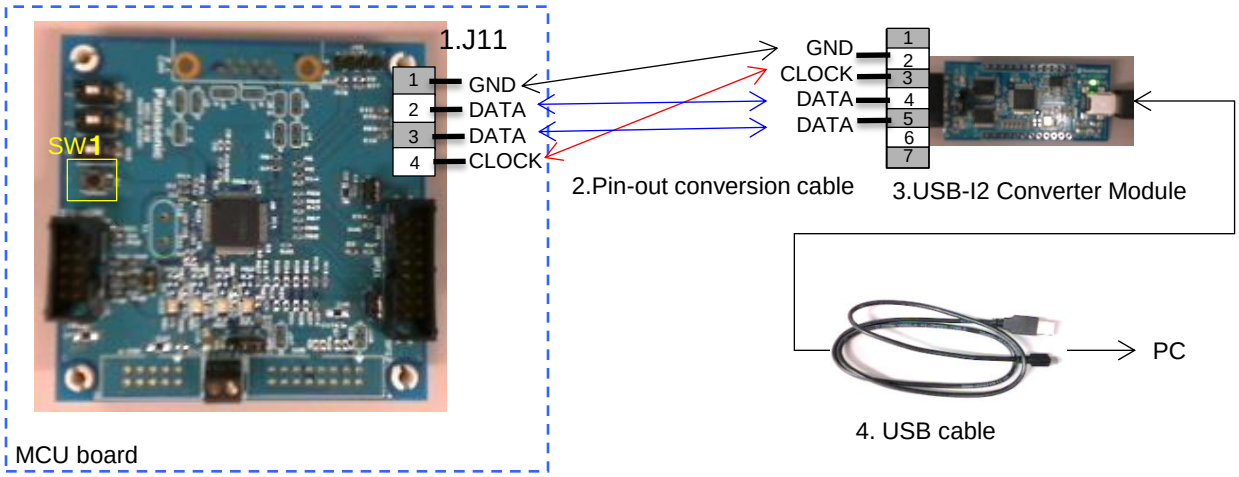


Figure 3.1 Preparations of MCU board

3.2 Start of GUI Application

when Evaluation kit is started up, Click AN49503A.exe to start GUI Application(Figure 3.2).

Figure 3.2 Start of GUI Application

3.3 Operation mode and error factor of Evaluation kit

SW2 is used to select LED mode.
On: Fuel gauge mode
Off: Status mode
X: Off O: On B: Blink(1Hz)

Table 3.1 Fuel gauge, microcomputer operation mode and error factor (LED Indication)

mode		LED status 3 2 1 0	Item	Explanation
Fuel gauge		XXXX	Fuel gauge	0%
		XXXB	Fuel gauge	1%~25%
		XXBB	Fuel gauge	26%~50%
		XBBB	Fuel gauge	51%~75%
		BBBB	Fuel gauge	76%~100%
Status	Error	XXXO	Register write error	SDO is Lo
		XXOX	Register read error	SDO is Lo
		XXOO	Register read error	CRC
		OOOO	Wake Up error	SDO is not HI
	Normal	BXXX	Normal operation	CHG = OFF / DIS = OFF
		BXXO	Normal operation	CHG = ON / DIS = OFF
		BXOX	Normal operation	CHG = OFF / DIS = ON
		BXOO	Normal operation	CHG = ON / DIS = ON
		BBXX	Cell Balance	CHG = OFF / DIS = OFF
		BBXO	Cell Balance	CHG = ON / DIS = OFF
		BBOX	Cell Balance	CHG = OFF / DIS = ON
		BBOO	Cell Balance	CHG = ON / DIS = ON

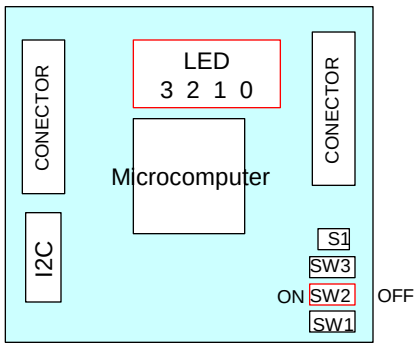


Figure 3.3 LED Indication

4. Control of a GUI Application screen and AFE-IC

4.1 GUI Application window

The start window of GUI Application contain the block as shown in Figure 4.1. When press the setting button the setting tab can be opened.

***Access to a prohibited register is not guaranteed.**

Main window(Start screen)

- Cell Voltage : Cell voltage
- Current : Current
- GPIO1,2 : Voltage of the general-purpose digital terminal (*note1)
- VDD50 : 5V reference voltage
- TMONI1 - TMONI5 : TMONI1.2 for cell temperature,TMONI3 for the FET temperature (*note2)
- FET : The state of FET
- VPACK : The positive pole voltage.
- ShutDown On/Off : Used to control shutdown Pin.
- FET Control On/Off: Used to control FDRV_CHG_FET and FDRV_DIS_FET
- Total : Total voltage of Cell Voltage
- Max : The maximum of the cell voltage
- Min : The minimum value of the cell voltage
- Max - Min : The difference between the maximize and the minimum value
- Setting
  - REGISTER R/W : AFE-IC's register R/W and setting for GPIO and CV/UV
  - Protection : The voltage, current and temperature protection
  - Calibration : Calibration Setting
  - FG : To display the state for charging and discharging
  - Cell Graph : Display cell voltage by chart
  - Current Graph : Display electric current by chart
  - Temp Graph : Display the temperature of the cell and FET
  - VPACK Graph : Display the positive pole voltage of the battery pack
  - Cell Balance : Setting for cell balance

Figure 4.1The structure of the GUI Application screen

Note 1: The function doesn`t work for ES1
Note 2: TMON14,5 doesn't work for ES1

4.2 Stop and End

GUI Application can be exit by pressing *EXIT* button(1). The measurement can be terminated by pressing *STOP* button (2). The AD conversion value for 16 cells is shown on *Cell Voltage area*. The color of graph for Cell Voltage and text for voltage, current and temperature will be changed as graph legend shown in (3), when software or hardware protection setting value is exceeded. The protection setting value can be set by using Protection Setting Window in the Setting area (8), which will be described later.

Abbr.	Name	Color	Abbr.	Name	Color
HOV	Hard Over Voltage	Red	OT	Over Temperature	Red
SOV	Soft Over Voltage	Orange	UT	Under Temperature	Water Blue
SUV	Soft Under Voltage	Water Blue	OC	Over Current	Red
HUV	Hard Under Voltage	Green	UC	Under Current	Blue
SVT	Shut Down Voltage Threshold				

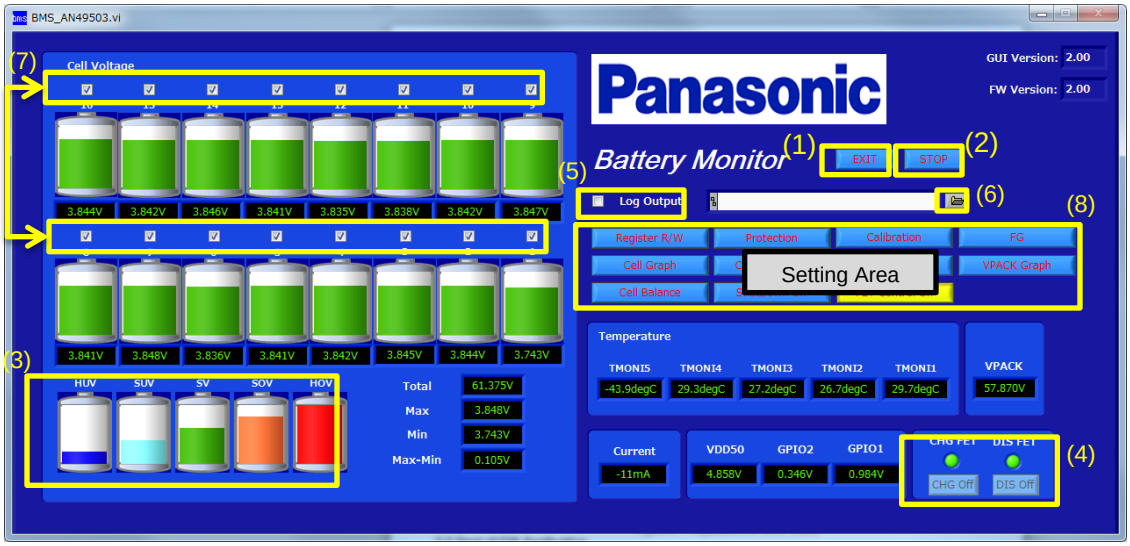


Figure 4.2 Graphic window

4.2.1 FET Indication & Control

LEDs in (Figure 4.2) (4) are used to indicate the state of *FET_CHG* and *FET_DIS*. Since the FET is controlled by software when “FET Control” is set on, Buttons in (Figure 4.2) (4) are invalid. And when “FET Control” is set off, the button*1 can be used to turn on or off *FET_CHG* and *FET_DIS*.

State transition diagram of FET is described in ”4.6.2 FG state transition diagram (status)” . *FET_DIS* is the same as *FET_CHG*.

Note: *1) When the Bit FDRV_CHG_FET or FDRV_DIS_FET of the PWR_CTRL(address 0x01) is accessed by Register R/W, LEDs in (Figure 4.2) (4) will change according to the setting but the button status will not change.

4.2.2 Save the Data

(Figure 4.2) It's possible to save the AD conversion value (the monitor value) by (5). **Chose where to save by button (6) in advance**. And as soon as the checkbox for *Log Output* is checked, the CSV file will be opened for write, and the file will be closed when checkbox is unchecked. Please make sure do not open the CSV file when the application is processing the file.

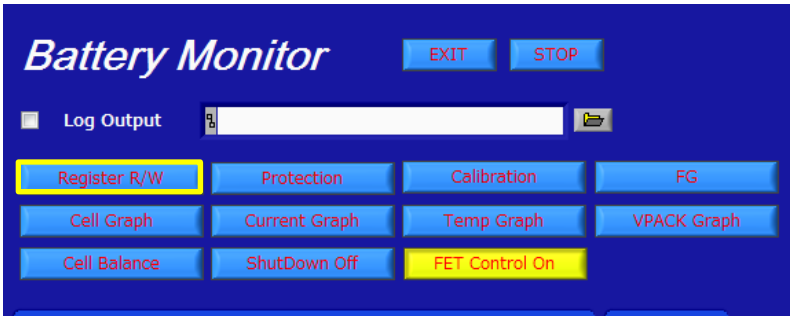
4.2.3 Cell selection

(Figure 4.2) (7) can be used to select battery cell. Please check the checkboxes according to the battery connected, or the measurement won`t work properly.

4.3 Register Read/Write window

By pressing the button *Register R/W*, *Register Read/Write window* will be popped up, and the window can be closed by pressing the button once again. Open/Close method for Other setting windows works the same way.

Registers of AN49503 can be accessed by pressing button *READ or Write* on *Register R/W* window.



When you press the button *Register R/W*, *Register Read/Write window* will be popped up.

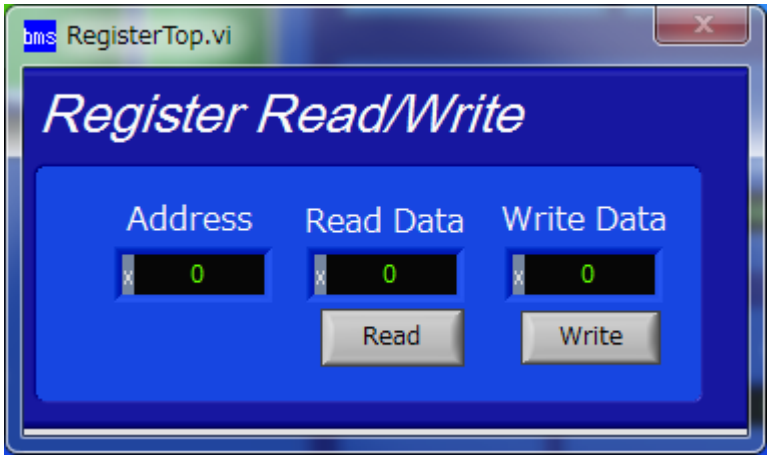


Figure4.3 Register Read/Write window

REGISTER READ/WRITE Function

All data are in hexadecimal format. Register address is set in textbox *Address*. Read value of the register is shown to textbox *READ Data*. WRITE value of the register can be set in textbox *WRITE Data*. when button *Write or Read* is pressed, Write or Read command will be executed.

4.4 Protection setting window

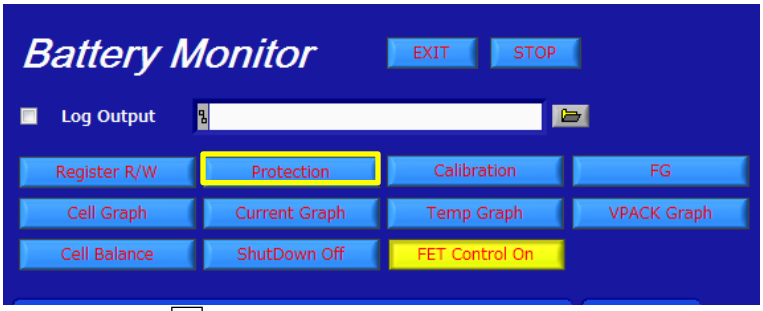
The Protection is realized by using CHG_FET/DIS_FET pin to control external MOSFET. The protection include hardware protection and software protection, which cover voltage, current and temperature. The protection can be enabled or disabled, and the threshold can be set. Over current can be detected by monitors the voltage difference between terminal SRP and SRN. When the difference exceeds the set threshold, Over Current will be acknowledged.

The *Current Sensing Resistor* specifies the impedance of sensing resistor. The value for this EVB is 0.500mohm (two of 1mohm resister in parallel).

You can use the checkbox to enable or disable the corresponding protection.

As for *Hard Over Charge Current Threshold*, *Hard Over Discharge Current Threshold* and *Hard Short Discharge Current*, the setting value should be times of the Initial Value.

Please refer to figure 4.4 for details.



When you press the button *Protection*, *Protection setting window* will be popped up.

Figure4.4 Protection setting window

File Save

The right part of block (2) is the read value. The left part of block (2) is the value will be set by pressing the button *SET*. The read value can be saved by pressing button *Save (1)*. And saved file can be recalled by pressing button *Read*.

4.4.1 Protection

The protection threshold can be changed in *Protection Setting Window*, the default value is given in the following figure. You can change the value in *Protection Setting window* except FCV (Full Charge Voltage) which is in *FG window*. Those figures indicate the relation among Protection and FG and FET. FET will be turn OFF when threshold is exceeded and turn ON when goes back.

when the protection is generated by voltage goes over SOV (Soft Over Voltage Threshold), it will be back to Charging and Discharging state until the voltage goes under SOVRT (Soft Over Voltage Release Threshold).

At the orange block in following figure, FET on or off is also depending on the current of FET.

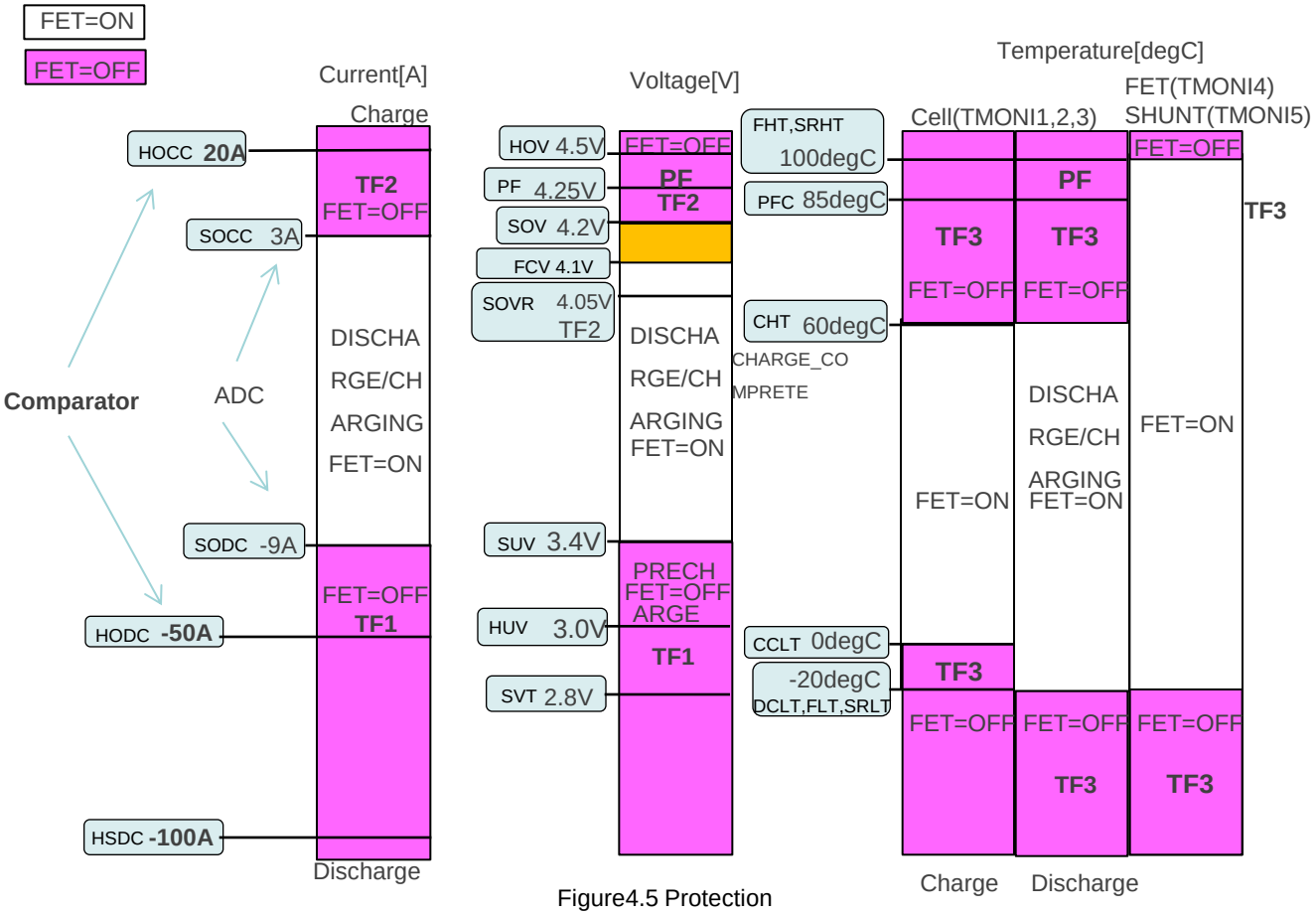


Figure4.5 Protection

HOCC	Hard Over Charge Current Threshold	SOCC	Soft Over Charge Current Threshold
SODC	Soft Over Discharge Current Threshold	HODC	Hard Over Discharge Current Threshold
HSDC	Hard Short Discharge Current Threshold	HOV	Hard Over Voltage Threshold
PF	Permanent Fail Over Voltage Threshold	SOV	Soft Over Voltage Threshold
FCV	Full Charge Voltage	SOVR	Soft Over Voltage Release
SUV	Soft Under Voltage Threshold	HUV	Hard Under Voltage Threshold
SVT	ShutDown Voltage Threshold	FHT	FET High Temp Threshold
SRHT	Shunt Resistor High Temp Threshold	PFC	Permanent Fail Cell High Temp Threshold
CHT	Cell High Temp Threshold	CCLT	Charging Cell Low Temp Threshold
DCLT	Discharge Cell Low Temp Threshold	FLT	FET Low Temp Threshold
SRLT	Shunt Resistor Low Temp Threshold		

4.5 Calibration setting window

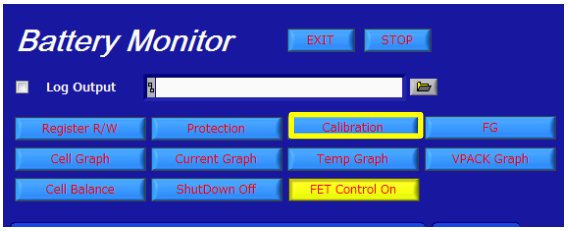
The voltage, current and the temperature can be linearly calibrated by software to eliminate the measurement deviation generated by board.

The calibrated value which is displayed on main window is calculated as the following equation.

Calibration Result = (AD Conversion Value + Offset) * Gain

4.5.1 Offset setting

Offset can be set from -32768 to +32767 (Current:1mA/LSB; Voltage:1mV/LSB, Temp.:0.1degC/LSB).



Press the button *Calibration* to display *Calibration setting window*.

Figure 4.5.1 Offset Setting window

4.5.2 Setting for Gain

Gain can be set from 0x to 2x.

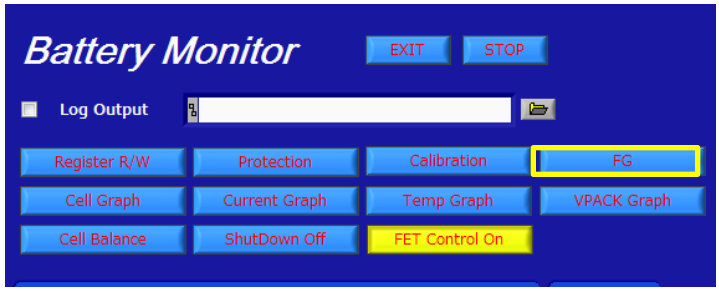
Figure 4.5.2 Gain Setting window

4.6 FG setting window

FG (Fuel Gauge) function is embedded in software. FG function includes the setting for Remain Calculation, Full Charge Detection and Discharge Start Voltage, which will be described later.

Remain calculation uses coulomb counter method.

The system will work as there is no load, if the current is between -(*No Load Current Threshold)* to +*(No Load Current Threshold)*. *MainStatus* is used to display the states. The graph area is used to display *Relative State of Charge*.



Press the button *FG* to display *FG setting window*

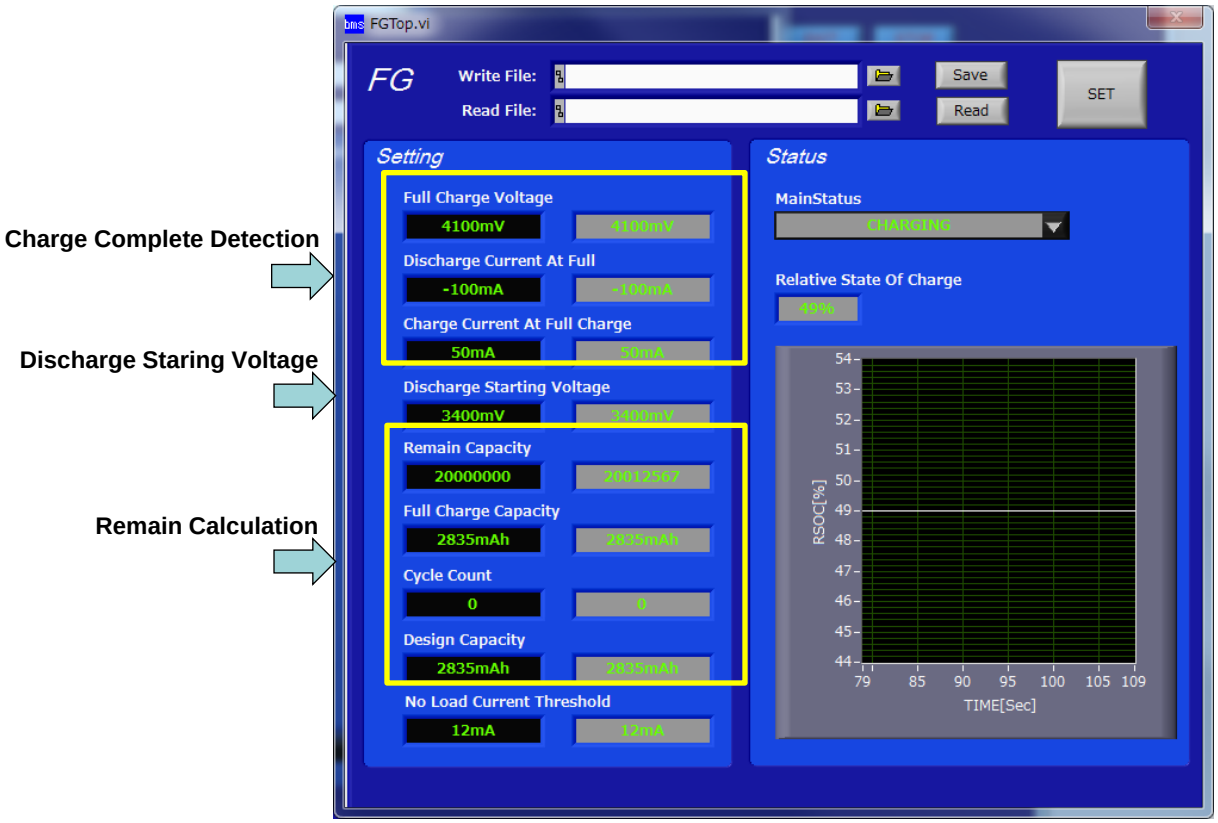


Figure 4.6.1 FG setting window

4.6.1 Charge Complete Detection

Charge Complete will be detected when the voltage goes over *Full Charge Voltage* and the current is between *Discharge Current At Full Charge and Charge Current At Full Charge.* The *MainStatus* will transit into state of *Charge Complete.*

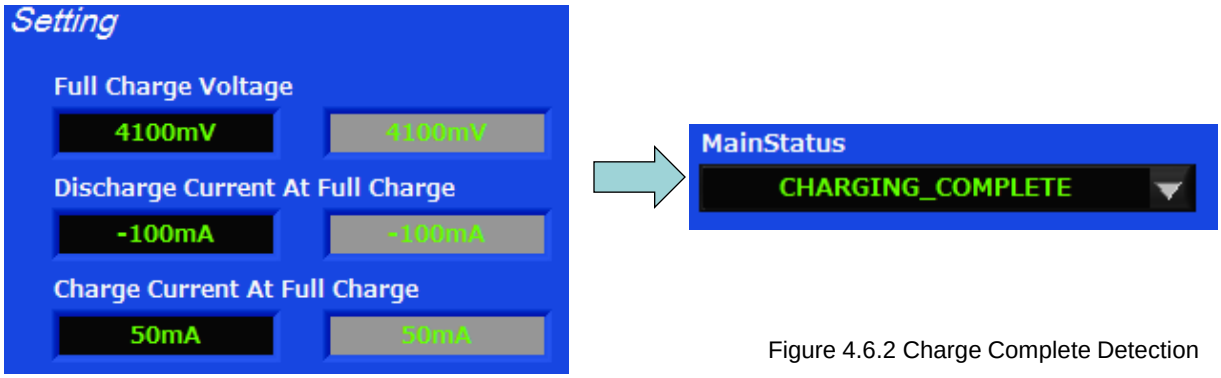


Figure 4.6.2 Charge Complete Detection

4.6.2 Discharge Starting Voltage

When the Minimum Voltage is no longer less than *Discharge Starting Voltage,* Main Status will be able to transit into state of *Discharge.*

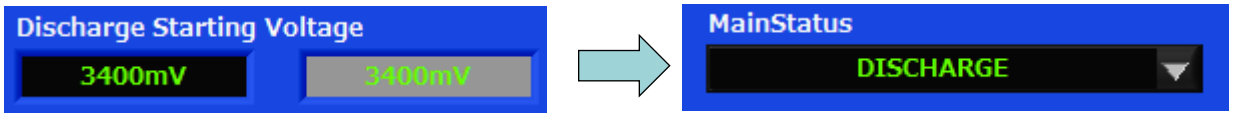


Figure 4.6.3 Discharge Starting Voltage

4.6.3 Remain Capacity

Remain Capacity will be changed with the current flows in or out.

Full Charge Capacity is used to specify the Capacity of the battery, when *Remain Capacity* reaches *Full Charge Capacity* * 14400 (14400=60x60x4), the *Relative State Of Charge* will go to 100%.

As *Cycle Count* counts up when charged coulomb is equal or more than Cycle Count * 14400, *Remain Capacity* will be subtracted with the value calculated according to *Design Capacity*.

Design Capacity is the designed capacity.

The following figure is the example when *Relative State Of Charge* is 50%

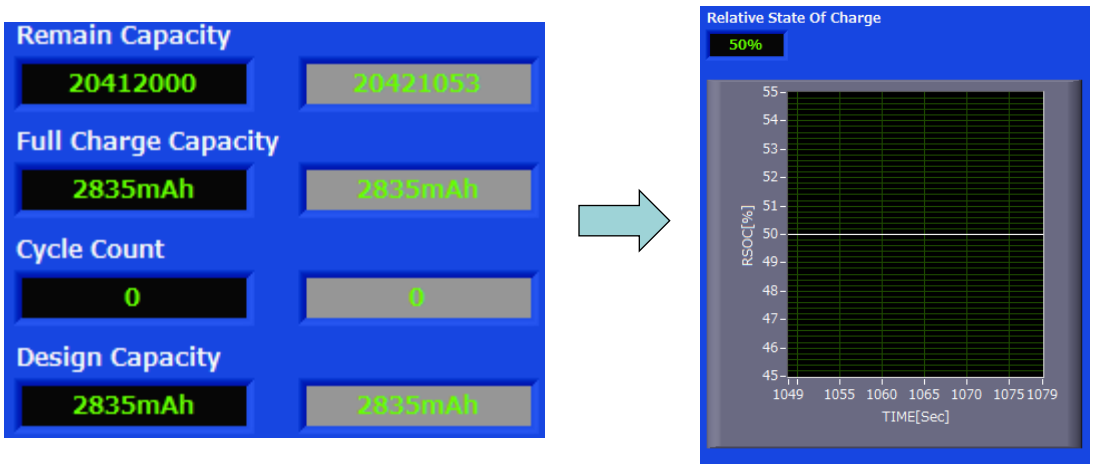


Figure 4.6.4 Remain Capacity

4.6.4 FG state transition diagram (status)

State transition diagram of FG is shown in the following Figure. The value can be set by *Protection Setting window* and FG Setting window. The triggering condition for transition is described in 4.6.1 FG setting window. Please refer to chapter 4.4.1 Protection for detail.

HOV : Hard Over Voltage
SOV : Soft Over Voltage
SUV : Soft Under Voltage
HUV : Hard Under Voltage
SVT : ShutDown Voltage Threshold

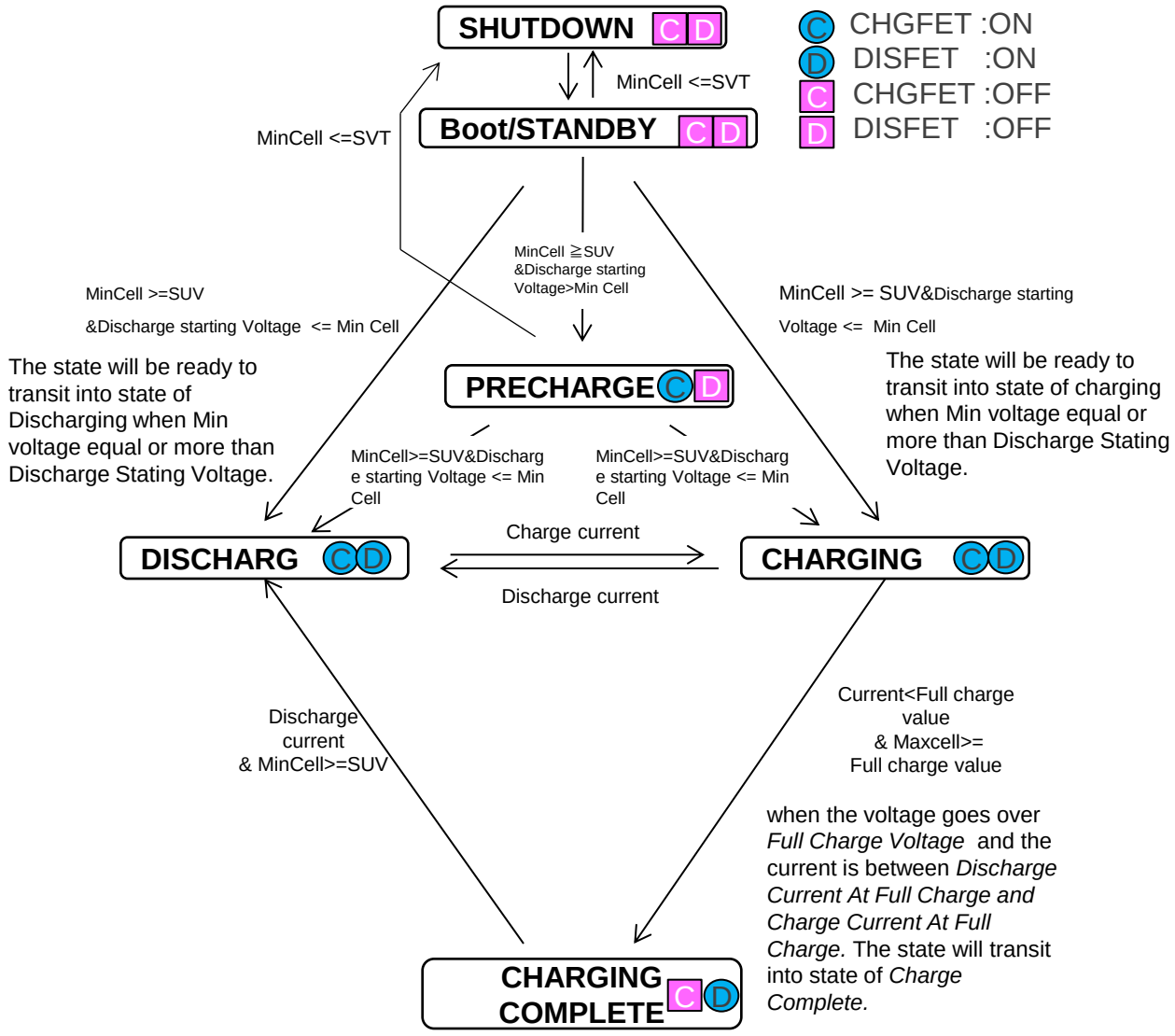
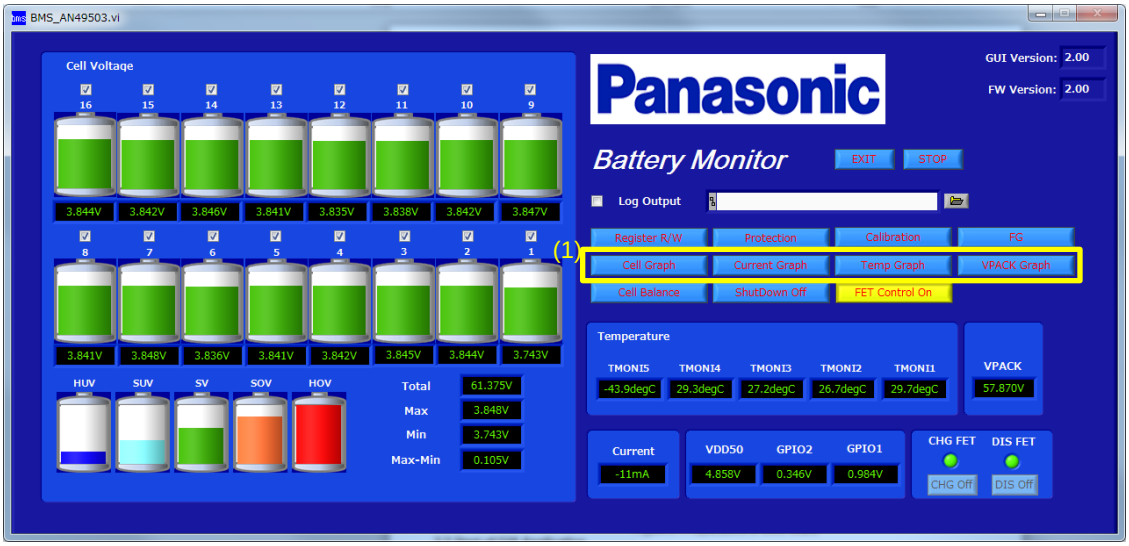


Figure4.6.2 State transition diagram

4.7 Cell Graph window

Cell Graph window can be opened by pressing the button *Cell Graph* in region (1) (Figure4.7.1).
The graph will be plotted if the checkbox for corresponding channel is checked on resign (2).
It can be cleared by *chart clearance* on right-click menu. The range of Time[Sec], maximum of which is 1000, can be changed by changing (3).



When you press the button (1) to display Cell Graph window.

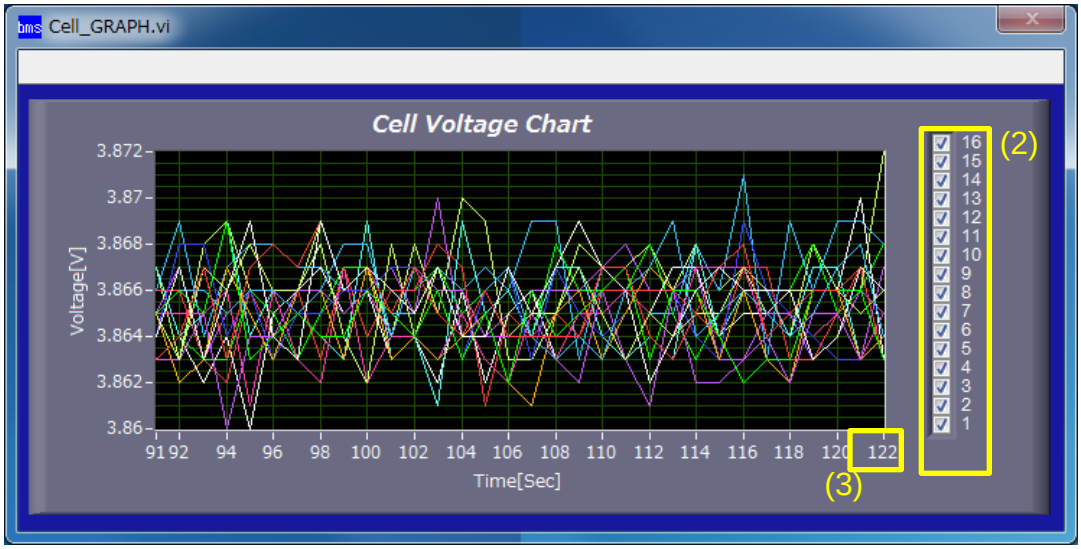


Figure4.7.1 Cell Graph window

4.7.1 Current Graph window

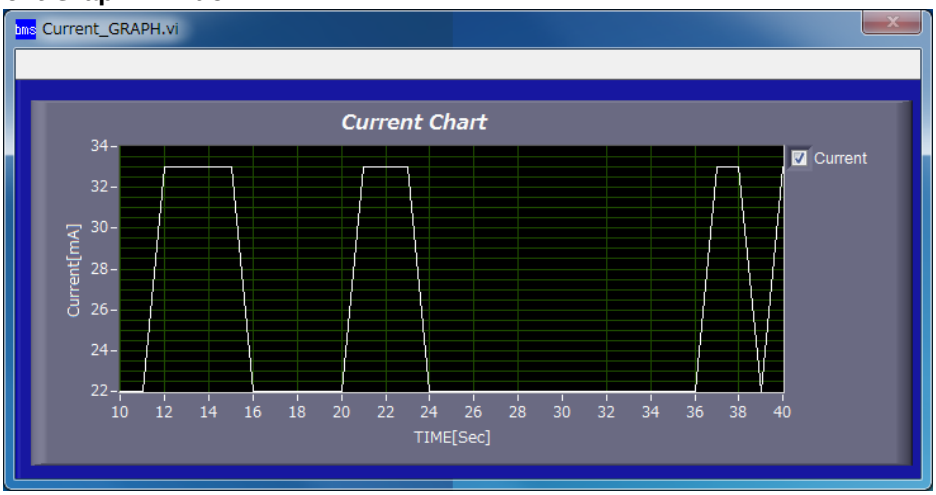


Figure4.7.2 Cell Graph window

4.7.2 Temp Graph window

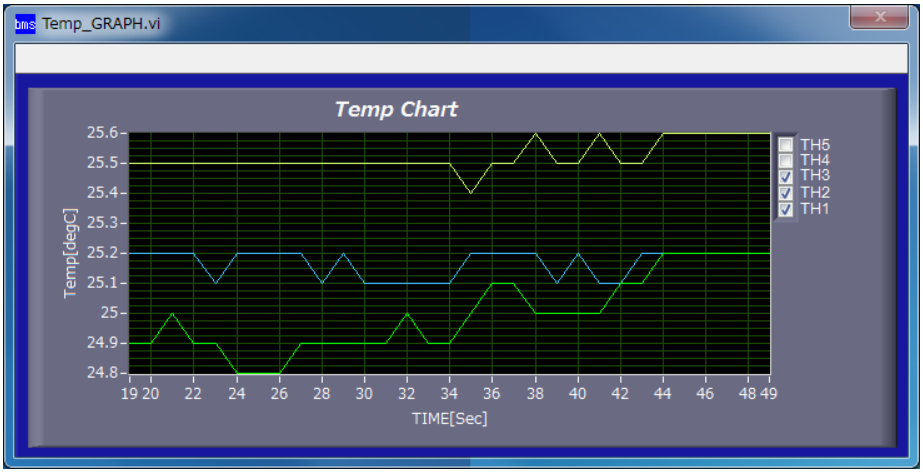


Figure4.7.3 Cell Graph window

4.7.3 VPACK Graph window

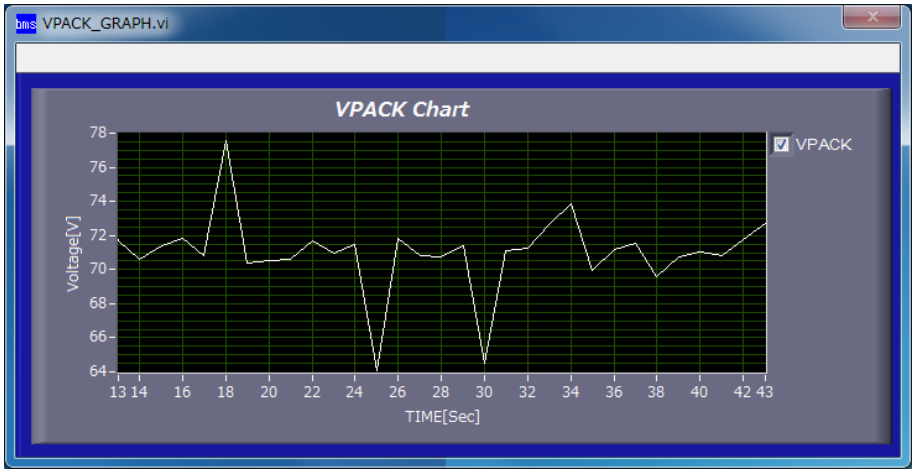


Figure 4.7.4 VPACK Graph window

4.8 Cell Balance setting window

Cell balancing can be performed. Using internal or external circuit can be selected by jumper setting (Table 2.2 Set up of AFE board). Discharging current is decided by resistance value on board.

No more than two cells will be discharging at the same time, and only the cell, check box of which is checked, will be discharged. When the battery cell is less than 16, please connect them from both ends and leave the pin in the middle of the connector unconnected, meanwhile uncheck the check box as shown in the figure 4.8.1.

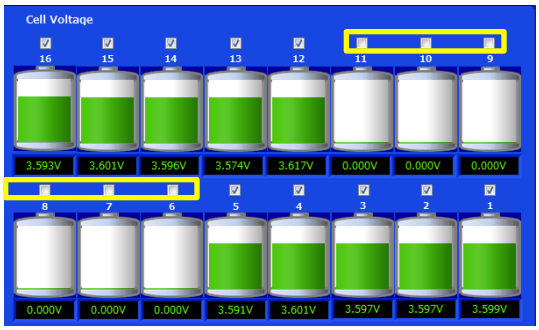


Figure 4.8.1 Cell balance disabled battery cell

4.8.1 Discharging

Cell balance and Protection can not be performed concurrently, since the AD conversion value is unreliable during the cell balancing. During the cell balancing, the voltage value for corresponding cell will be displayed in yellow as shown in the figure 4.8.2. Discharge will be done to the two cells, of which the voltage are highest, and since if they are next to each other, the third or fourth highest one will be chosen instead as shown in figure 4.8.3

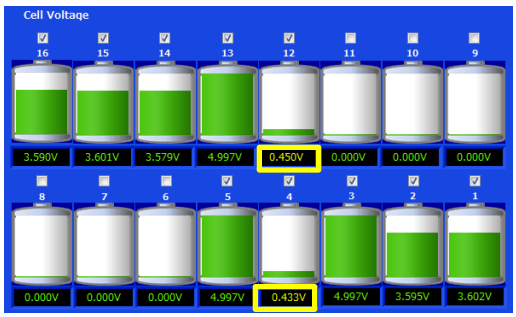


Figure 4.8.2 Discharging

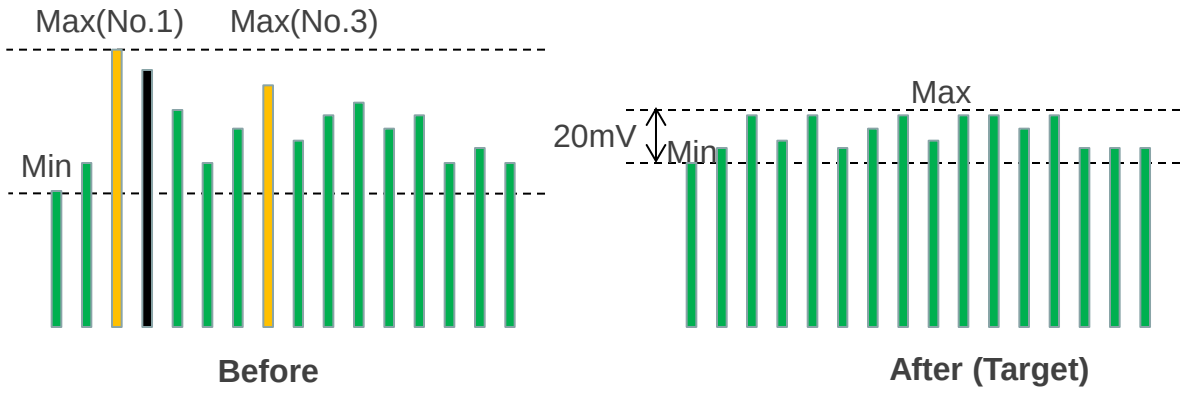


Figure 4.8.3 Adjacent Cell with highest voltage

4.8.2 Cell Balance

The cells, which are enabled by checking the Checkbox *Enable*, will be discharged, as the following conditions are all met.

1. The voltage of min-voltage-cell is equal or bigger than *Min Cell Voltage Threshold*.
2. The voltage difference between min-voltage-cell and max-voltage-cell is equal or bigger than *Max-Min Cell Voltage*.
3. In time slice for Cell Balance (figure 4.8.2).
4. System is working in No Load or Charging states.

Press the button *Cell Balance* to display Cell Balance setting window

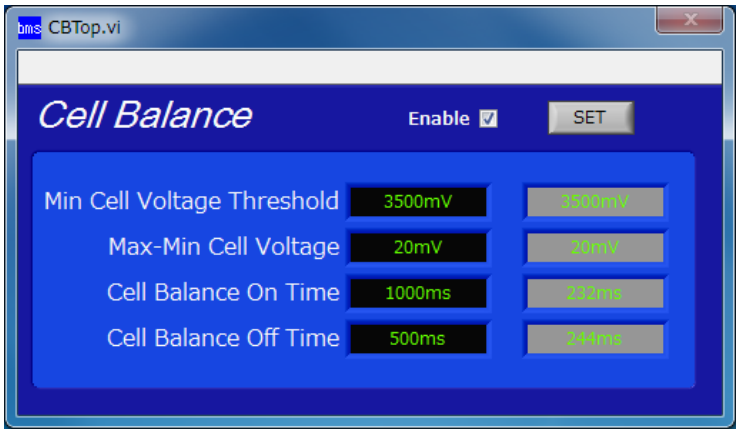


Figure 4.8.1 Cell Balance setting window

Cell balance on time and off time can be set by *Cell Balance On Time* and *Cell Balance Off Time*.
Cell balance will be performed On and Off periodically as set time. While Cell Balance is On, protection function will be Off.

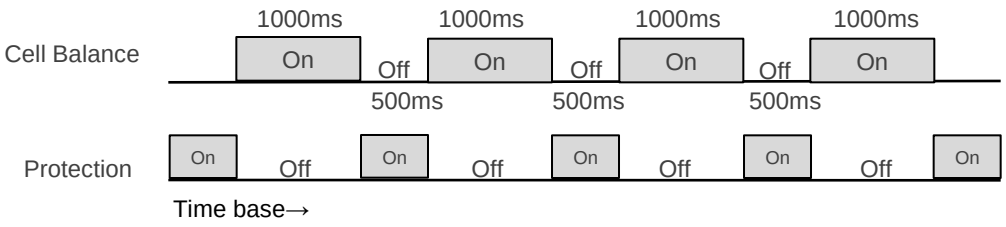
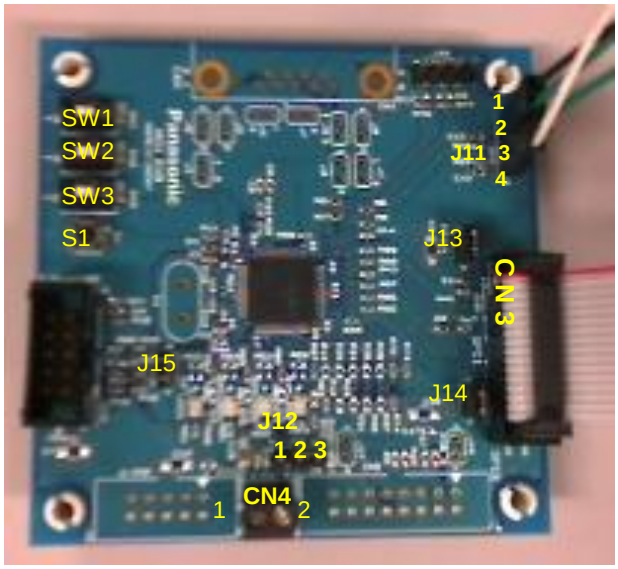


Figure 4.8.2 Cell Balance Timing

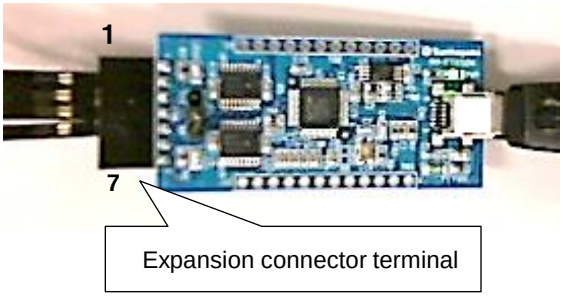
Appendix-1

◆MCU/AFE EVA Board Connector

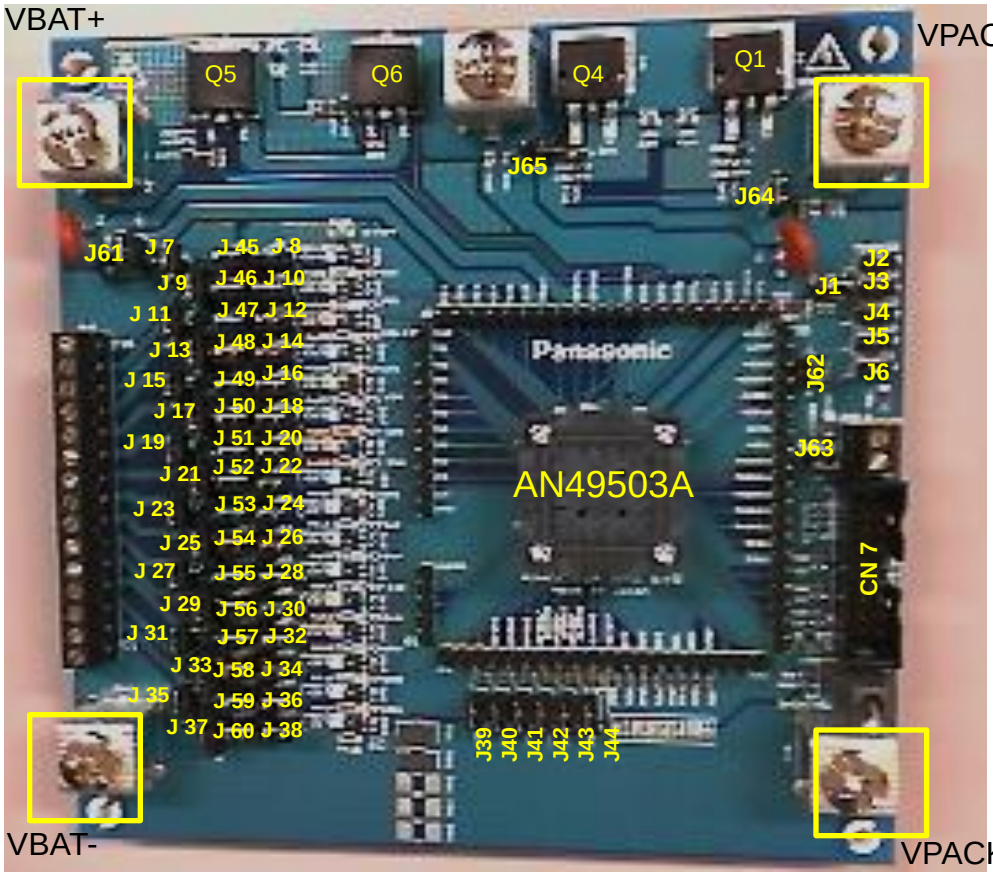
MCU EVA Board



USB-I2C Converter Module



AFE EVA Board



Appendix-2

Calibration setting window

This is an example for Calibration Setting.

If the offset for cell1 is set to 500mV ((1) in following figure), the monitored voltage ((2) in following figure) will increases 500 mV. Other Cell works the same way.

To specify a 500 mV offset for Cell1.

Setting window of Offset value

Appendix-3

MCU EVA Board Connector

CN3 XG4C-1631

pin number	signal name
1	CVDD
2	P_PIN_ALM
3	DGND
4	P_SEN_M
5	DGND
6	P_SDI_M
7	DGND
8	P_SDO_M
9	DGND
10	P_SCLK_M
11	DGND
12	P_POUT_SHDN
13	P_POUT_STB
14	P_POUT_FETOFF
15	NRST
16	DGND

CN5 XG4C-1631

pin number	signal name
1	CVDD
2	P_PIN_ALM
3	DGND
4	P_SEN_M
5	DGND
6	P_SDI_M
7	DGND
8	P_SDO_M
9	DGND
10	P_SCLK_M
11	DGND
12	P_POUT_SHDN
13	P_POUT_STB
14	P_POUT_FETOFF
15	NRST
16	DGND

CN2

pin number	signal name
1	CVDD
2	-
3	-
4	-
5	-
6	-
7	-
8	-
9	-
10	DGND

CN4

pin number	signal name
1	DGND
2	CVDD

Appendix-4

AFE EVA Board Connector

CN7 XG4C-1631

pin number	signal name
1	CVDD
2	P_PIN_ALM
3	DGND
4	P_SEN_M
5	DGND
6	P_SDI_M
7	DGND
8	P_SDO_M
9	DGND
10	P_SCLK_M
11	DGND
12	P_POUT_SHDN
13	P_POUT_STB
14	P_POUT_FETOFF
15	NRST
16	DGND

CN8

pin number	signal name
1	CVDD
2	DGND

CN5

pin number	signal name
1	C1
2	C2
3	C3
4	C4
5	C5
6	C6
7	C7
8	C8
9	C9
10	C10
11	C11
12	C12
13	C13
14	C14
15	C15

IC1 AN49503A

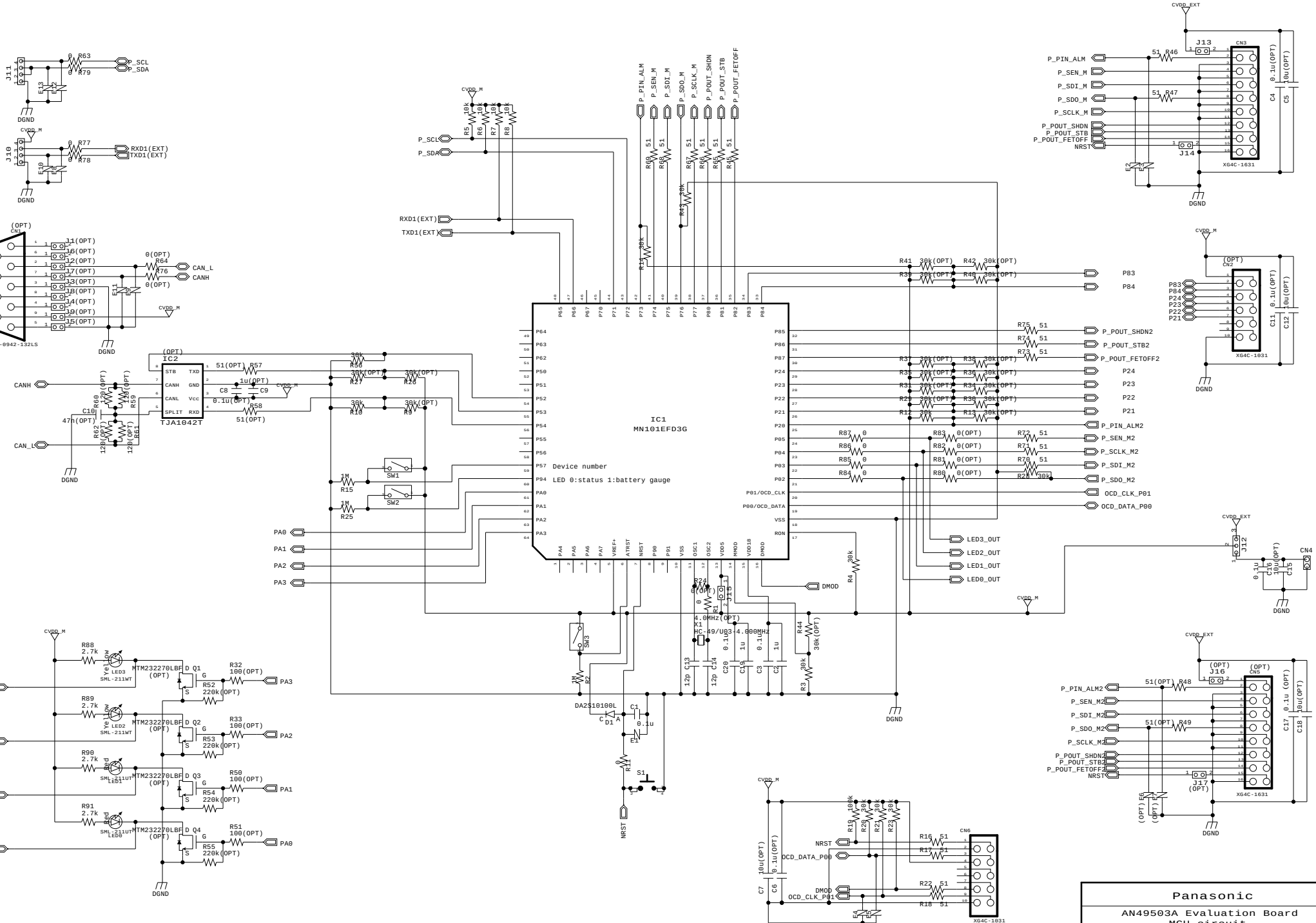
1	NC
2	NC
3	NC
4	NC
5	NC
6	CVDD
7	SHDN
8	TMONI1
9	TMONI2
10	TMONI3
11	TMONI4
12	TMONI5
13	MODE
14	DVSS
15	VDD18
16	AVSS1
17	VDD50R
18	VDD50
19	LDOG
20	AVSS2
21	VPC
22	VPACK
23	D18
24	CP1
25	CN1
26	CN2
27	CP2
28	CHG
29	VBATSW
30	NC
31	GPOH2
32	GPOH1
33	NC
34	VBAT

AFE EVA Board Connector

IC1	AN49503A
35	C16
36	C15
37	C14
38	C13
39	C12
40	C11
41	C10
42	C9
43	C8
44	C7
45	C6
46	C5
47	C4
48	C3
49	C2
50	C1
51	C0
52	GND
53	SRP
54	NC
55	SRN
56	AVSS3
57	NC
58	NC
59	NC
60	NC
61	NC
62	NC
63	NC
64	GPIO1
65	GPIO2
66	GPIO3
67	GPIO4/ADIRQ2
68	GPIO5/ADIRQ1
69	GPIO6/ALARM2
70	ALARM1
71	FETOFF
72	STB
73	SDO
74	SDI
75	SCL
76	SEN
77	NRST
78	NC
79	NC
80	NC

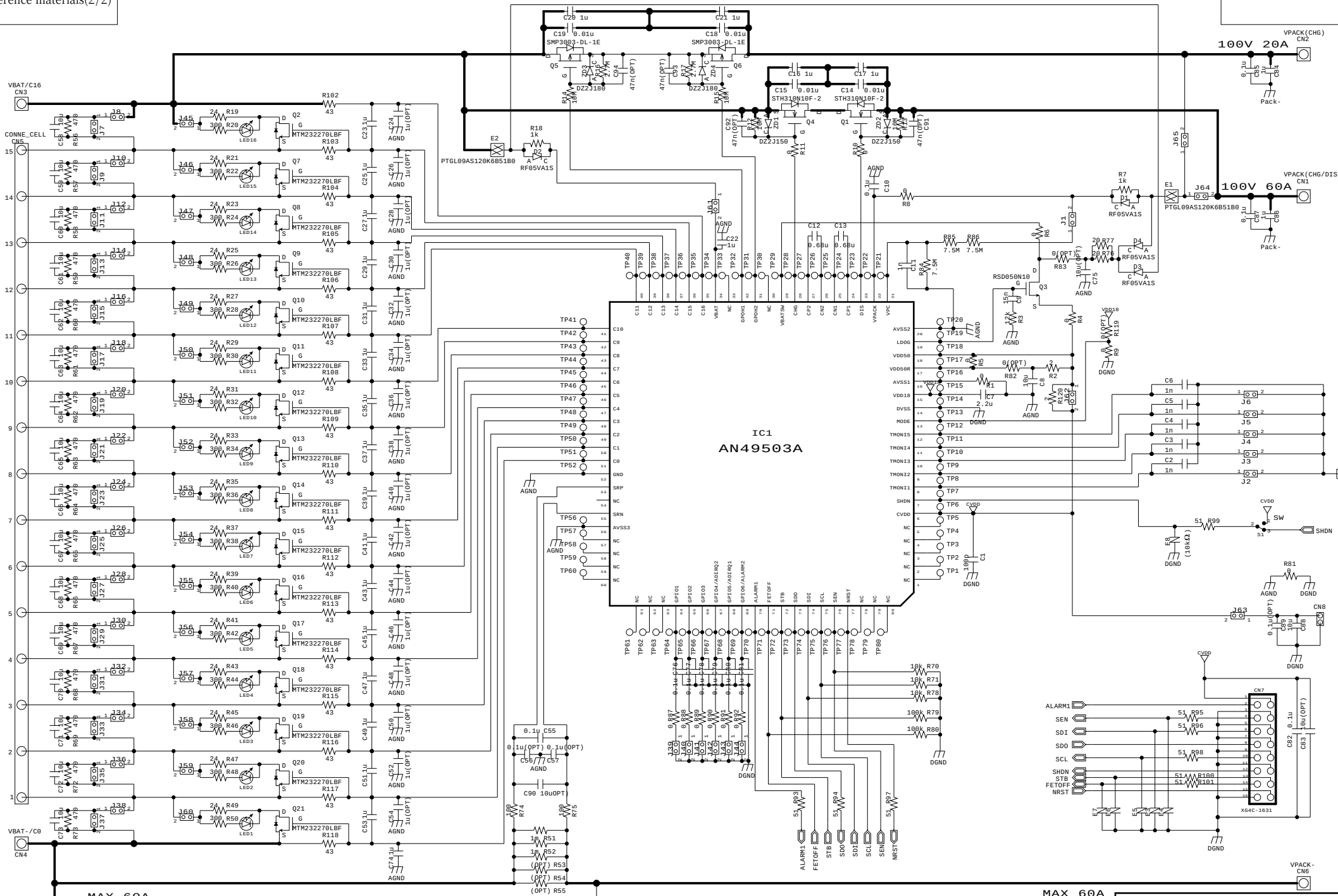
Revision History

Rev No.	Date	Description	approver	Author	Page No.
No.1.00	2014/12/01	First release	Mukoyama	Ikesawa	26
No.1.10	2014/12/19	Add detail for Cell Balance and FG	Mukoyama	Ikesawa	28
No.2.00	2015/01/28	FET control ,Register Read/Write, File Save/Read, TMONI	Mukoyama	RM.Bao	11~16
No.2.01	2015/03/11	Changed the order of battery connection.	Mukoyama	RM.Bao	6



Panasonic		
AN49503A Evaluation Board MCU circuit		
Designer : Hiroyuki Koda Ayumu Mukoyama 2015/01/08 Ver 1.01		2/2

Reference materials(2/2)



Panasonic	
AN49503A Evaluation Board Measurement IC circuit	
Designer : Hiroyuki Koda Ayumu Mukoyama 2015/01/08 Ver 1.02	1/2