ON Semiconductor®

Test Procedure for LC709203F Evaluation board

1 Evaluation Kit

1.1 How to select Evaluation board

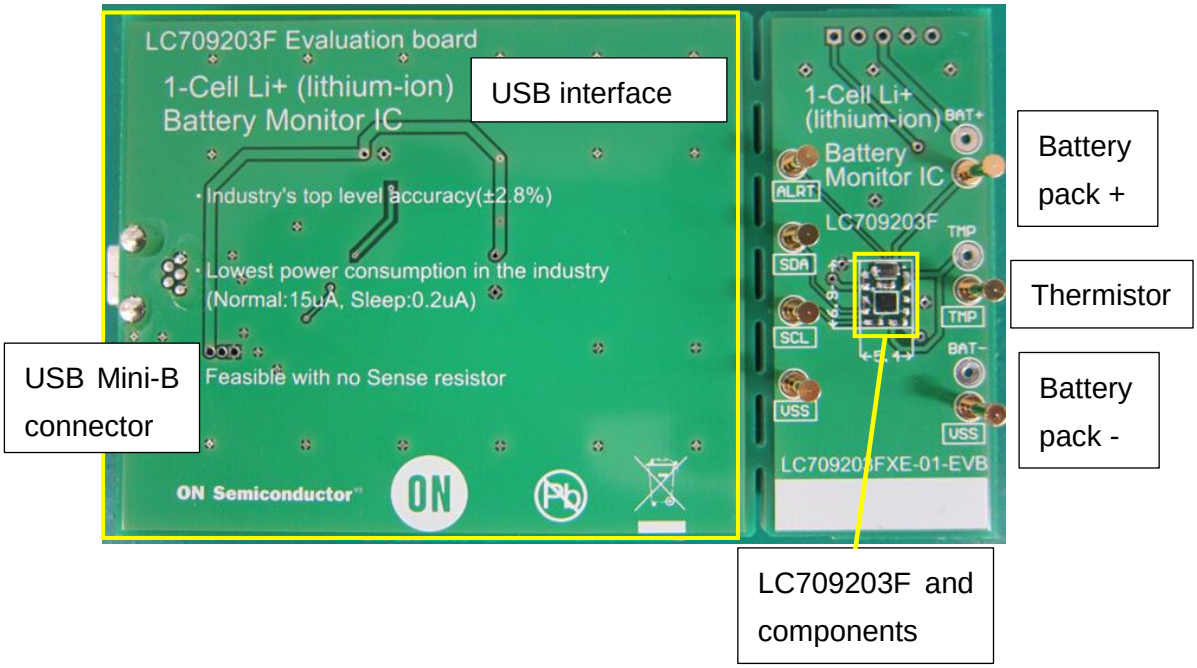
・Select a suitable Evaluation board according to target device and your battery.

Evaluation board	Target device	Battery type	Related documents (Evaluation Board Docs)
LC709203FQH-01-GEVB	LC709203FQH-01	01, 03	*LC709203FQH-01-GEVB Schematic* *LC709203FQH-01-GEVB Gerber Layout Files (Zip Format)* *LC709203FQH-01-GEVB Bill of Materials ROHS Compliant*
LC709203FXE-01-GEVB	LC709203FXE-01	01, 03	*LC709203FXE-01-GEVB Schematic* *LC709203FXE-01-GEVB Gerber Layout Files (Zip Format)* *LC709203FXE-01-GEVB Bill of Materials ROHS Compliant*
LC709203FXE-05-GEVB	LC709203FXE-05	06, 07	*LC709203FXE-01-GEVB Schematic* *LC709203FXE-01-GEVB Gerber Layout Files (Zip Format)* *LC709203FXE-01-GEVB Bill of Materials ROHS Compliant*

Battery profile vs registers

Device	Battery Type	Nominal / Rated Voltage	Charging Voltage	Design Capacity	Number of The Parameter (0x1A)	Change of The Parameter (0x12)
LC709203Fxx-01xx	03	3.8 V	4.35 V	≥ 500 mAh	0x0301	0x0000
	01	3.7 V	4.2 V	–		0x0001
LC709203Fxx-03xx	06	3.8 V	4.35 V	< 500 mAh	0x0601	0x0000
	01	3.7 V	4.2 V	–		0x0001
LC709203Fxx-04xx	05	ICR18650-26H (SAMSUNG)			0x0504	0x0000
	04	UR18650ZY (Panasonic)				0x0001
LC709203Fxx-05xx	07	3.85V	4.4V	–	0x0706	0x0000
	06	3.8V	4.35V	<500 mAh		0x0001

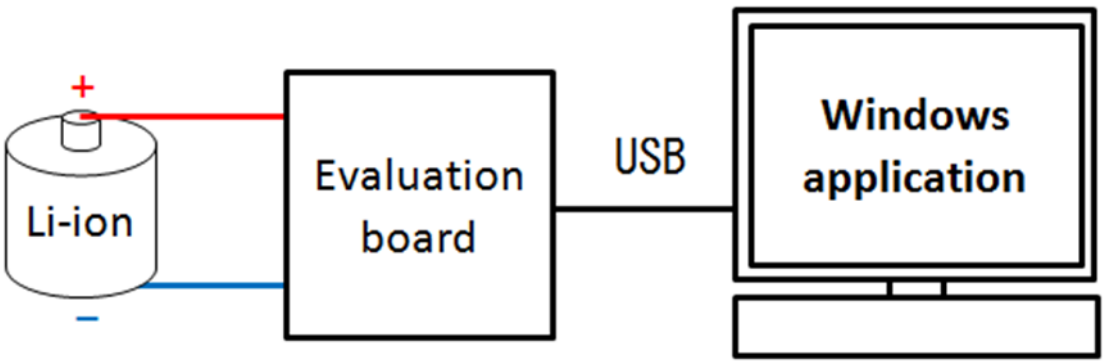
1.2 Evaluation board



1.3 Windows application

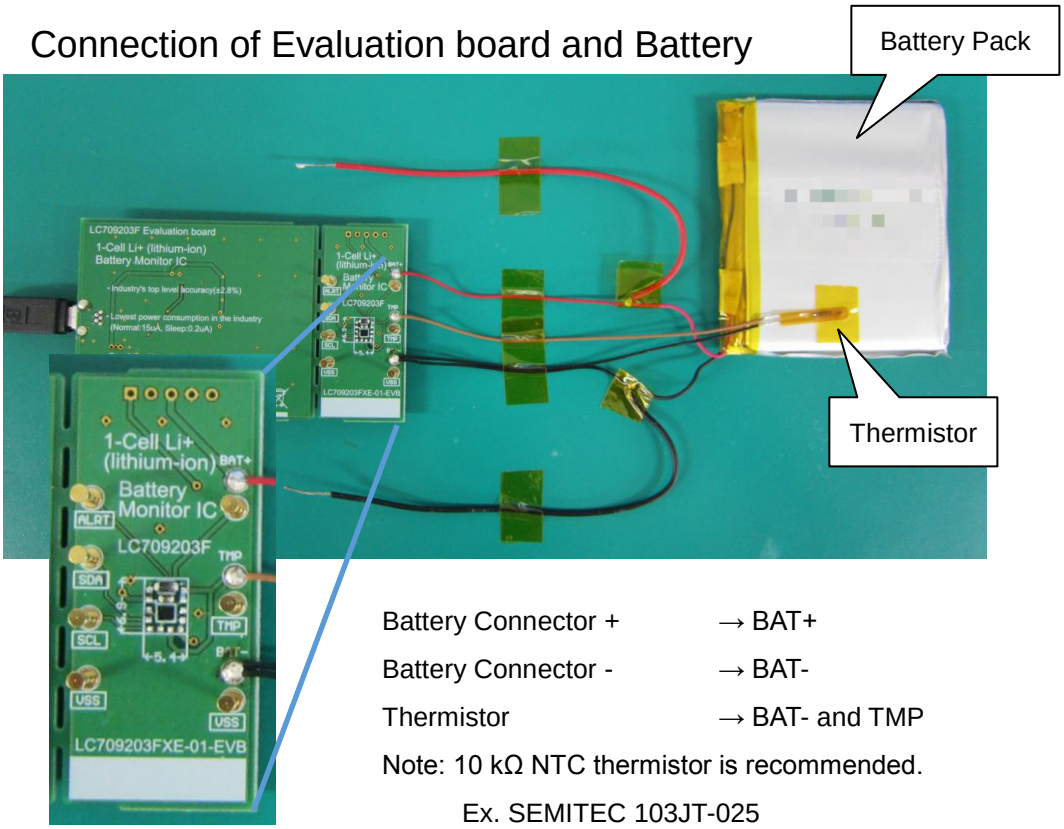
- FGICTool_Verxxx.exe. The software can be downloaded at ON Semiconductor Web site. (Software)

1.4 Evaluation board Block diagram



2 How to connect Evaluation board

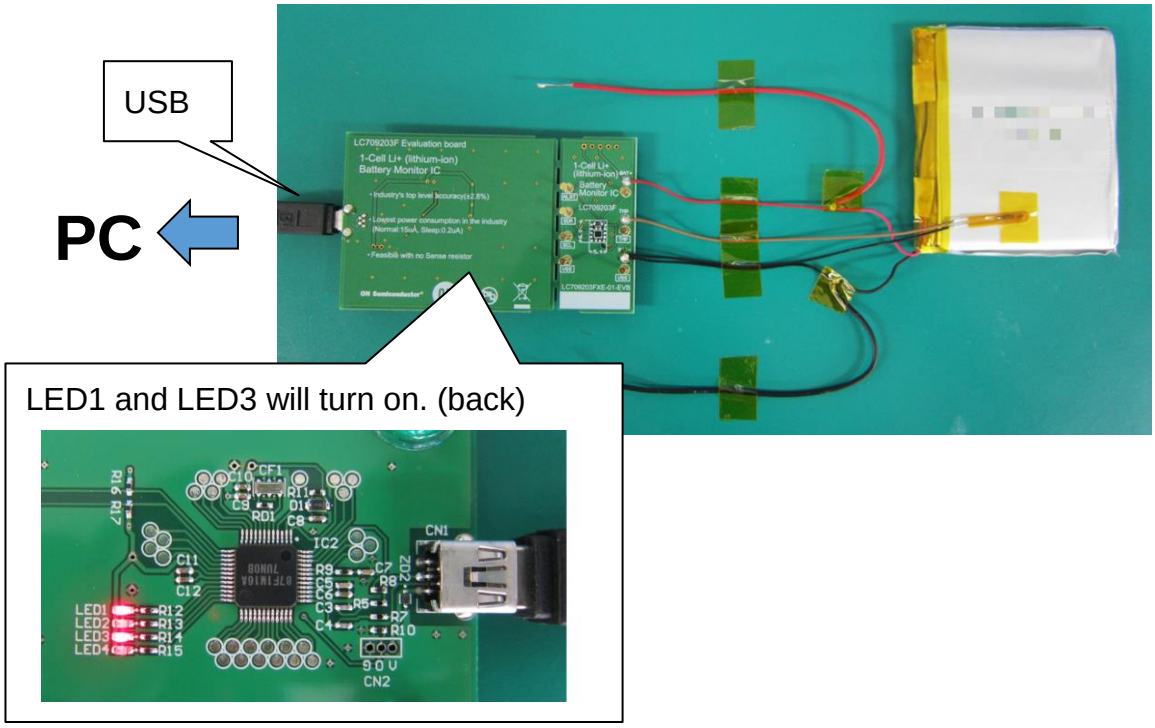
2.1 Connection of Evaluation board and Battery



Battery Connector +	→ BAT+
Battery Connector -	→ BAT-
Thermistor	→ BAT- and TMP

Note: 10 kΩ NTC thermistor is recommended.
Ex. SEMITEC 103JT-025

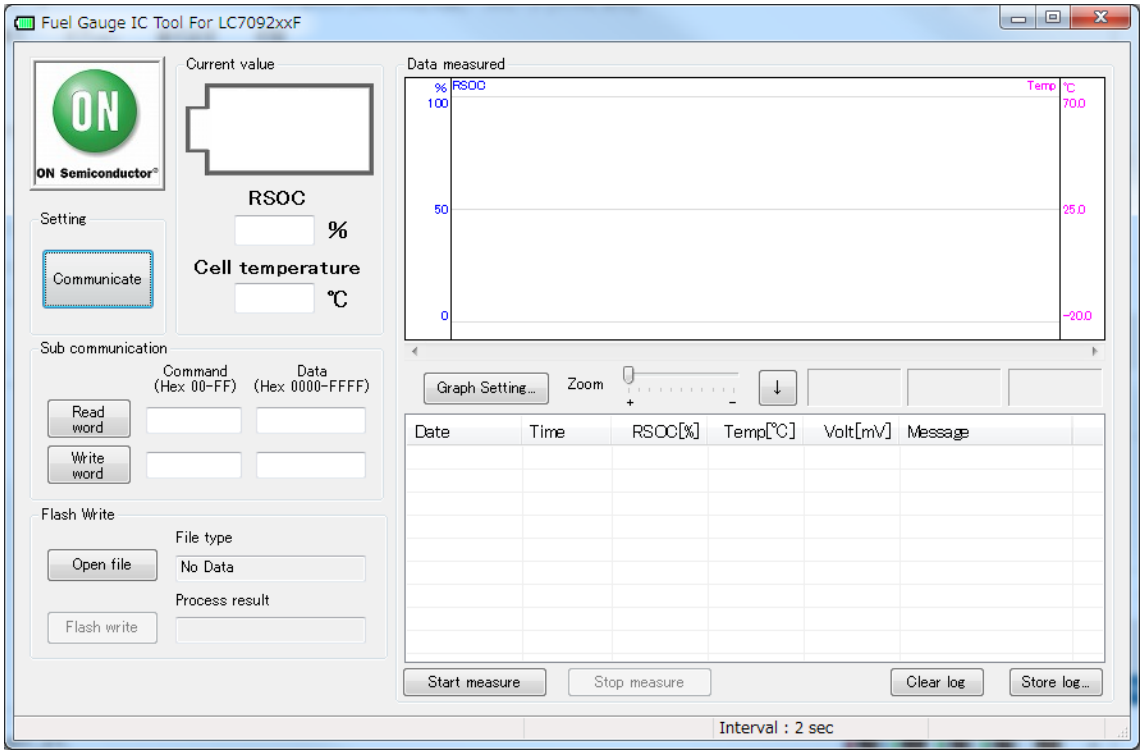
2.2 Connection of PC and EVA board



3 How to start application

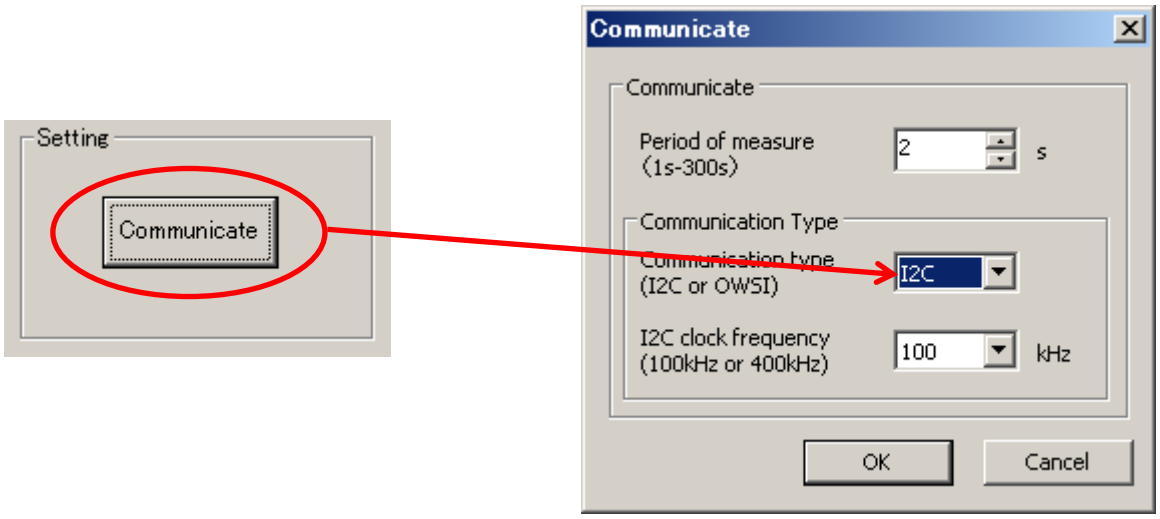
3.1 Start application

・Click “FGICTool_verxxx.exe”

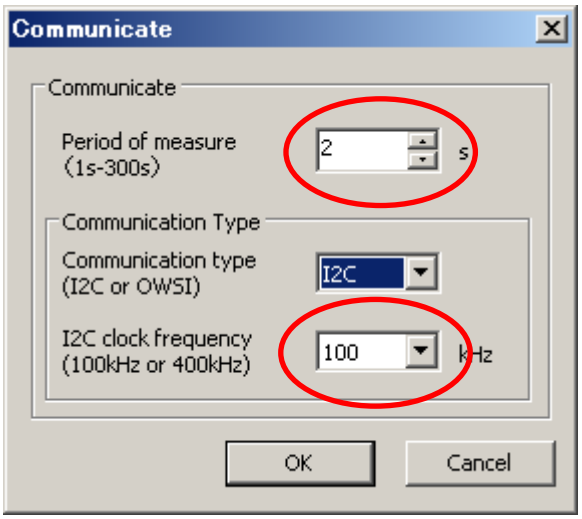


3.2 Select communication type

・Click “Communicate” and select I2C.



・Select time interval of log and I2C clock frequency.



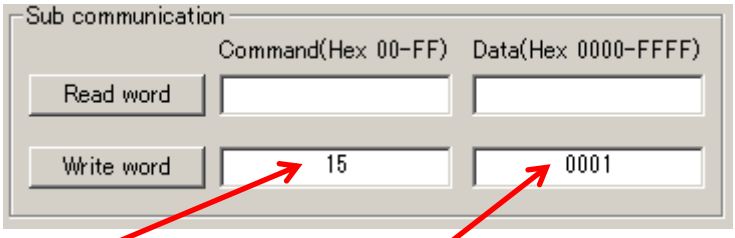
4 Register setting

4.1 Set Operational mode

・Setting registers

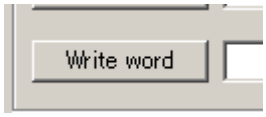
-Input 「15」 in the Command field.

-Input 「0001」 in the Data field.



0x15	IC Power Mode	R/W	0x0001: Operational mode 0x0002: Sleep mode	Selects Power mode	(Note 4)

・Click “Write word”.



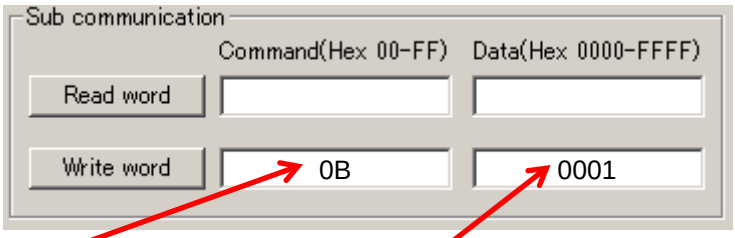
4.2 Set APA

Set APA parameter that is suitable for your battery. Refer datasheet about typical APA. The applied APA value is selected by the design capacity of your battery and Battery type. Select Maximum APA when your design capacity exceeds the listed capacity.

・Setting registers

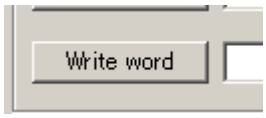
-Input 「0B」 in the Command field.

-Input 「00 to FF (a value suitable for your battery)」 in the Data field.



0x0B	APA (Adjustment Pack Application)	R/W	0x0000 to 0x00FF	1 mΩ	Sets Parasitic impedance	–

・Click “Write word”.



Typical APA

Design Capacity of Battery	APA(0x0B)		
	Type−01, Type−03	Type−06	Type−07
100 mAh	0x08	0x0D	0x07
200 mAh	0x0B	0x15	0x0C
500 mAh	0x10	0x20	0x18
1000 mAh	0x19	−	0x28
2000 mAh	0x2D	−	0x40
3000 mAh	0x36	−	0x4D

Design Capacity of Battery	APA(0x0B)	
	Type−04	Type−05
2600 mAh	0x1A	0x0D

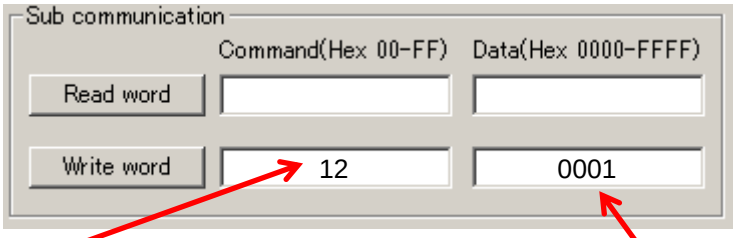
4.3 Select battery profile

Select and set a profile that is suitable for your battery from the datasheet.

・Setting registers

-Input 「12」 in the Command field.

-Input 「0000 or 0001」 in the Data field.



0x12	Change Of The Parameter	R/W	0x0000 or 0x0001	Selects a battery profile	0x0000

・Click “Write word”.

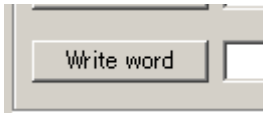


Table 8. BATTERY PROFILE VS. REGISTER

IC Type	Battery Type	Nominal/Rated Voltage	Charging Voltage	Design Capacity	Number of the Parameter (0x1A)	Change of the Parameter (0x12)
LC709203Fxx−01xx	03	3.8 V	4.35 V	≥ 500 mAh	0x0301	0x0000
	01	3.7 V	4.2 V	–		0x0001
LC709203Fxx−03xx	06	3.8 V	4.35 V	< 500 mAh	0x0601	0x0000
	01	3.7 V	4.2 V	–		0x0001
LC709203Fxx−04xx	05	ICR18650−26H (SAMSUNG)			0x0504	0x0000
	04	UR18650ZY (Panasonic)				0x0001
LC709203Fxx−05xx	07	3.85 V	4.4 V	–	0x0706	0x0000
	06	3.8 V	4.35 V	< 500 mAh		0x0001

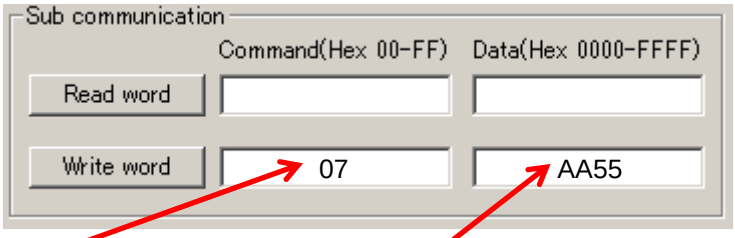
4.4 Initialize RSOC

Execute RSOC initialization.

・Setting registers

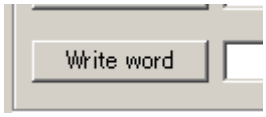
-Input 「07」 in the Command field.

-Input 「AA55」 in the Data field.



0x07	Initial RSOC	W	0xAA55: Initialize RSOC	Executes RSOC initialization when 0xAA55 is set.	–

・Click “Write word”.



Note: The accuracy of the Initialization requires the OCV reading to be taken with minimal load or charge, under 0.025C, on the battery. (i.e. less than 75mA for 3000mAh design capacity battery.)

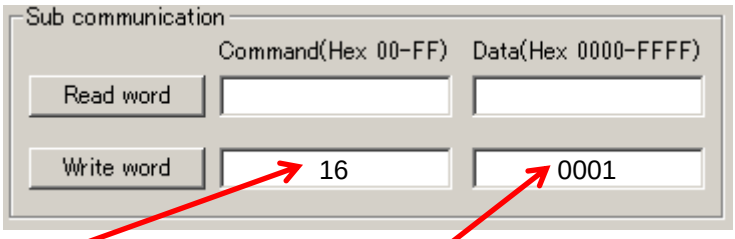
4.5 Set Thermistor mode

Select Thermistor mode.

・Setting registers

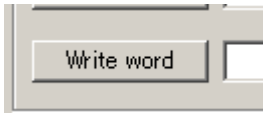
-Input 「16」 in the Command field.

-Input 「0001」 in the Data field.



0x16	Status Bit	R/W	0x0000: I²C mode 0x0001: Thermistor mode	Selects Temperature obtaining method	0x0000

・Click “Write word”.



Note: This setting is unnecessary if this LSI receives Cell temperature from Master device via I2C.

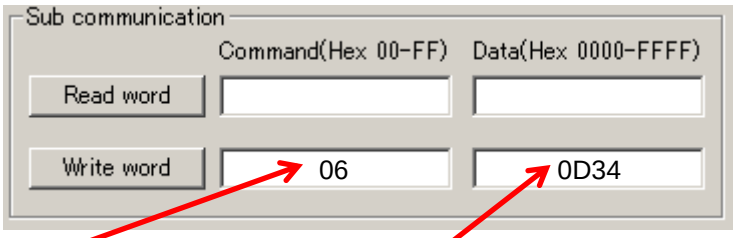
4.6 Set Thermistor B

Set a value that is suitable for your thermistor. Refer to the datasheet of the thermistor for the B constant.

・Setting registers

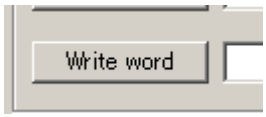
-Input 「06」 in the Command field.

-Input 「B constant」 in the Data field.



0x06	Thermistor B	R/W	0x0000 to 0xFFFF	1K	Sets B-constant of the thermistor to be measured.	0x0D34

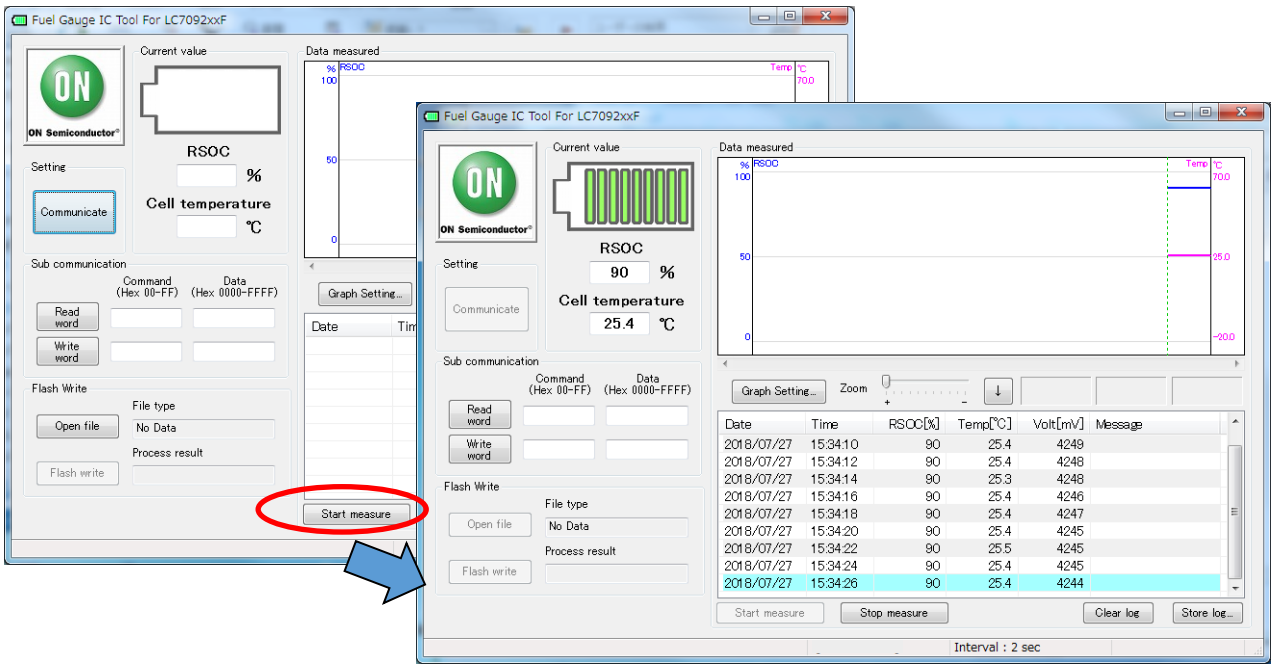
・Click “Write word”.



5 Starting evaluation

5.1 Measurements and Logging

・Click “Start measure”.



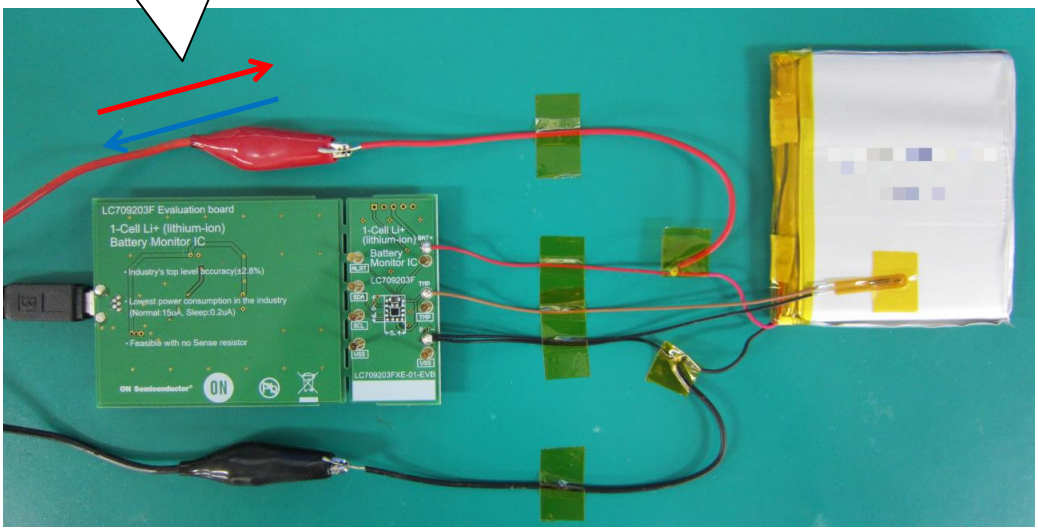
・Application starts measurements and logging.

5.2 Start charging/discharging

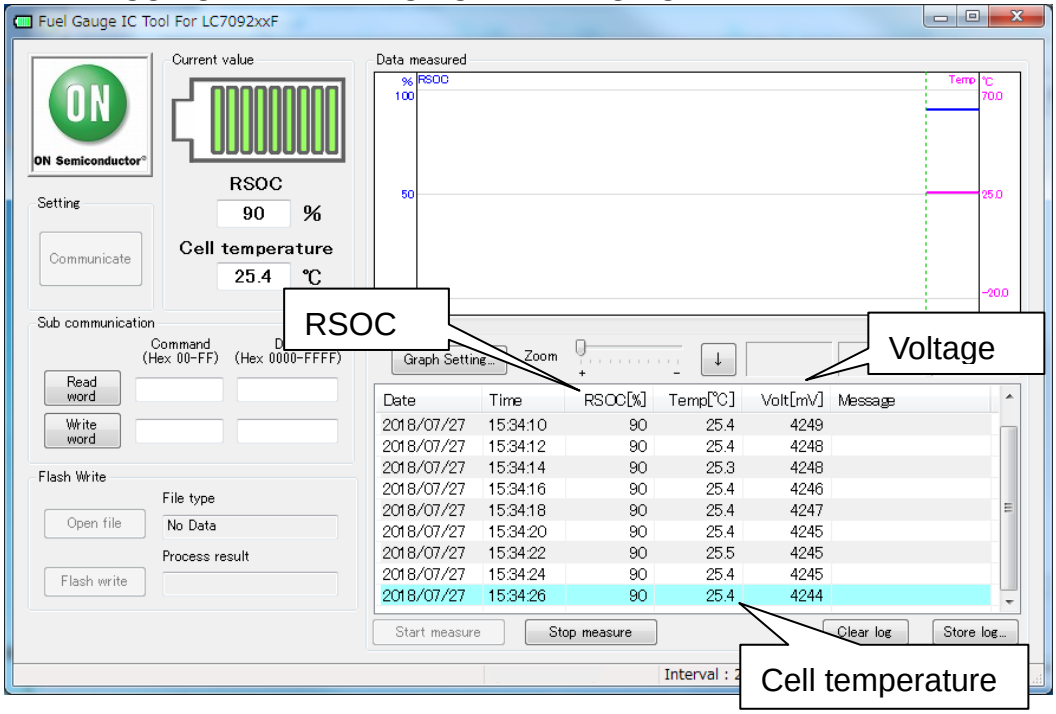
・Connect charger/load to your battery.

Charge or Discharge Example

- Battery charger
- Load equipment
- Various device

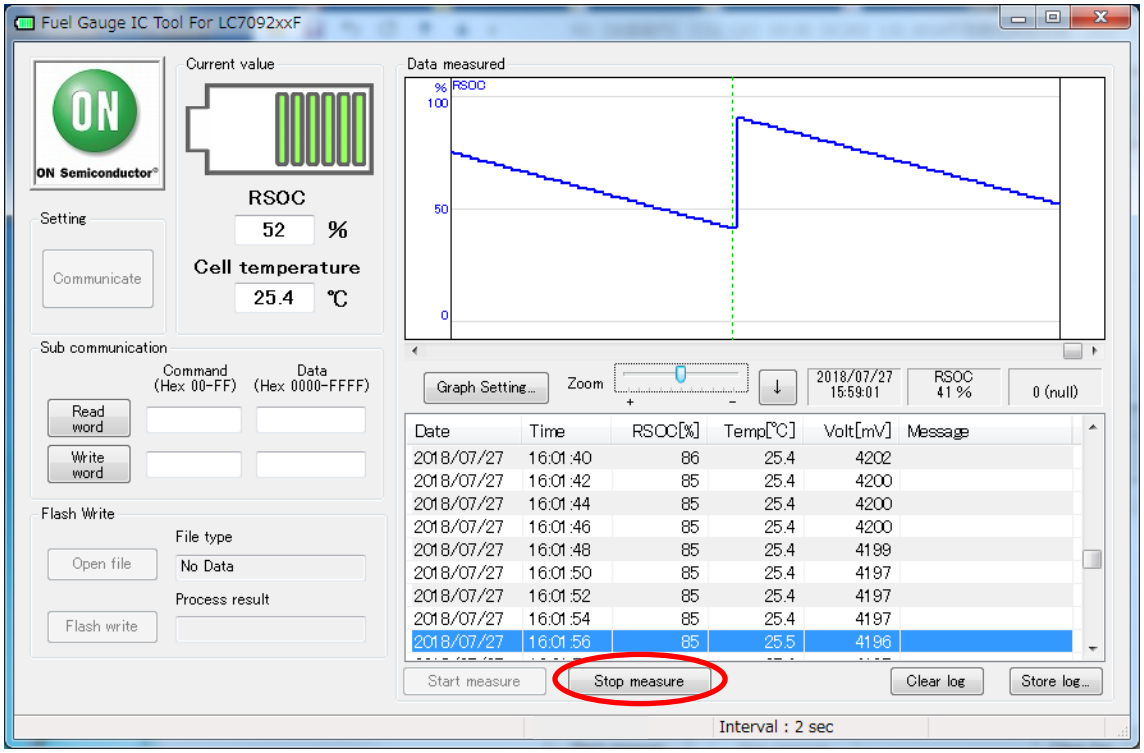


5.3 Logging while Charging/Discharging



5.4 End the measurements

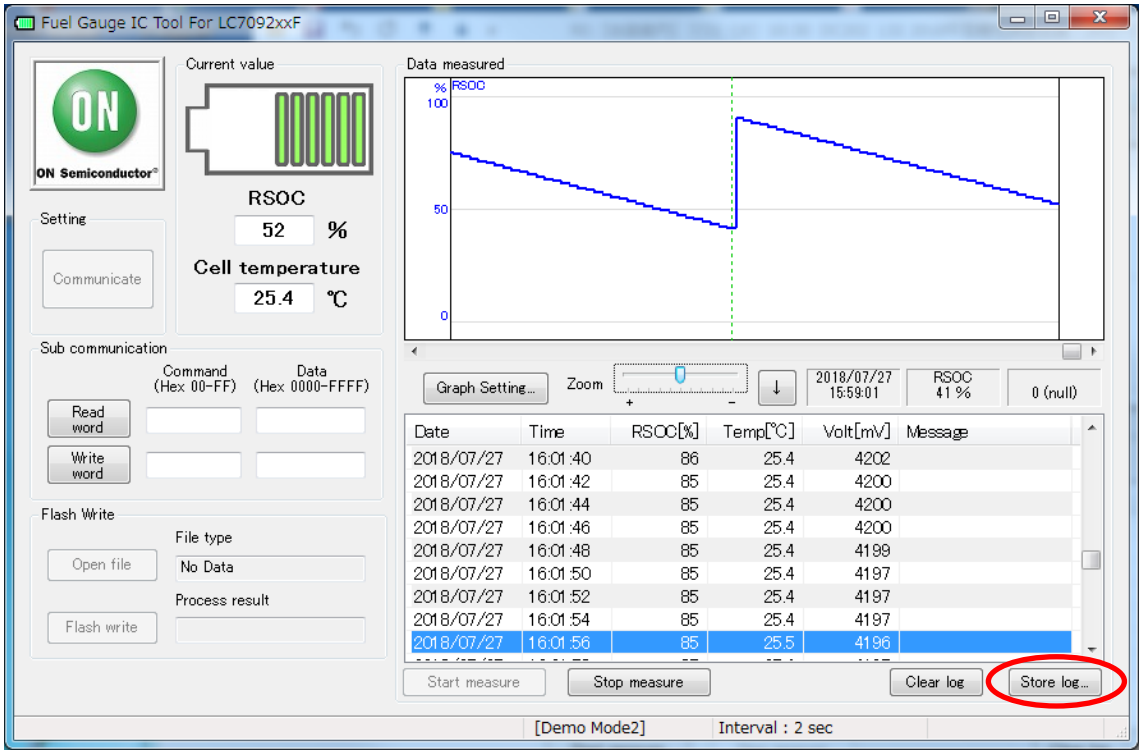
・To end, click “Stop measure”.



5.5 Store log

This application can save all measurement log as a text file.

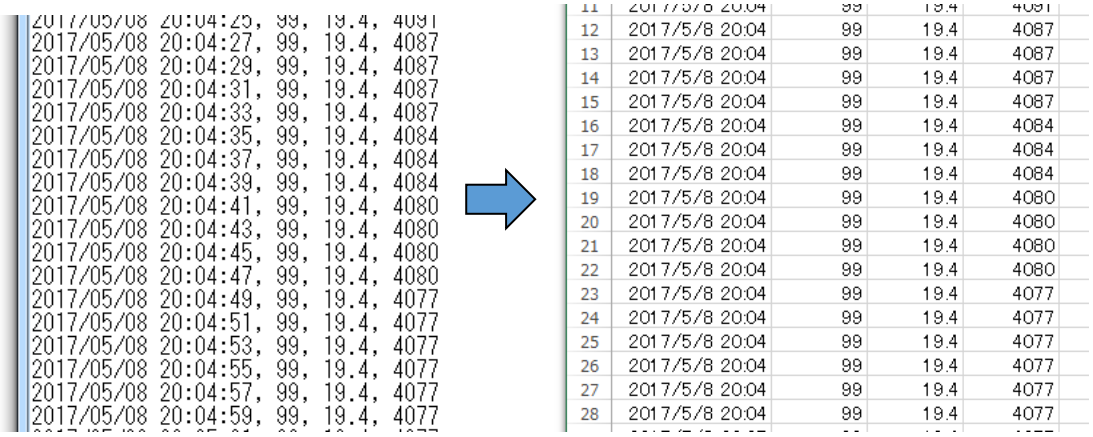
・To save a log, click “Store log”.



5.6 Convert log file format

The output text file can be converted to Excel format csv. The conversion to csv facilitates the analysis of data.

・Change the file format from .txt to .csv. Example) test.txt → test.csv.

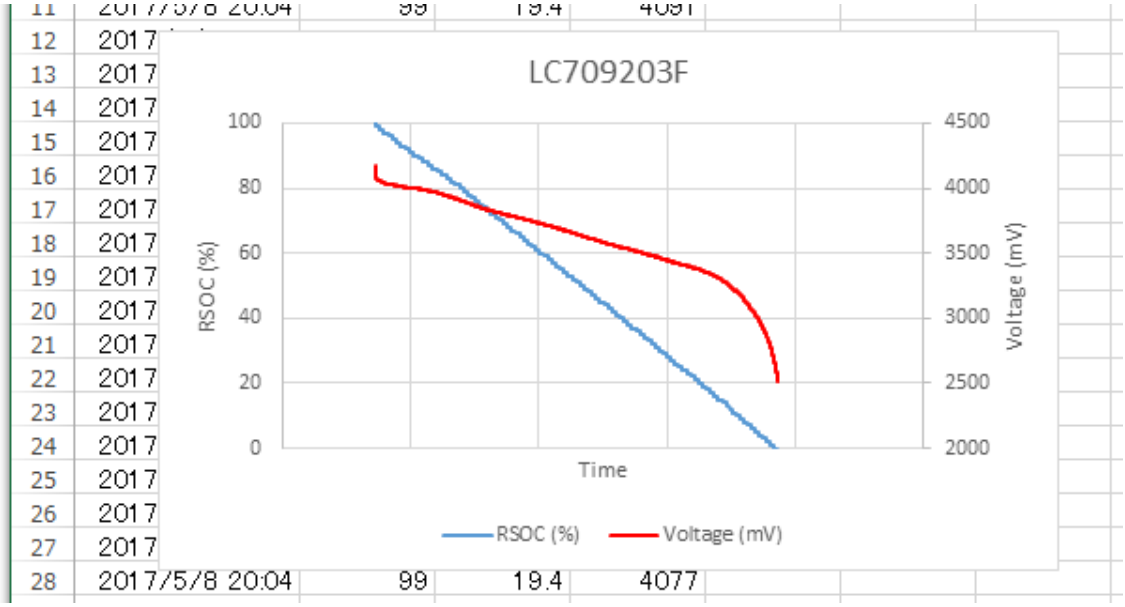


12	2017/5/8 20:04	99	19.4	4087
13	2017/5/8 20:04	99	19.4	4087
14	2017/5/8 20:04	99	19.4	4087
15	2017/5/8 20:04	99	19.4	4087
16	2017/5/8 20:04	99	19.4	4084
17	2017/5/8 20:04	99	19.4	4084
18	2017/5/8 20:04	99	19.4	4084
19	2017/5/8 20:04	99	19.4	4080
20	2017/5/8 20:04	99	19.4	4080
21	2017/5/8 20:04	99	19.4	4080
22	2017/5/8 20:04	99	19.4	4080
23	2017/5/8 20:04	99	19.4	4077
24	2017/5/8 20:04	99	19.4	4077
25	2017/5/8 20:04	99	19.4	4077
26	2017/5/8 20:04	99	19.4	4077
27	2017/5/8 20:04	99	19.4	4077
28	2017/5/8 20:04	99	19.4	4077

5.7 Graph

5.7.1 .csv file

・Graph the .csv file.



This graph shows association between time and cell voltage and RSOC in constant current discharging.

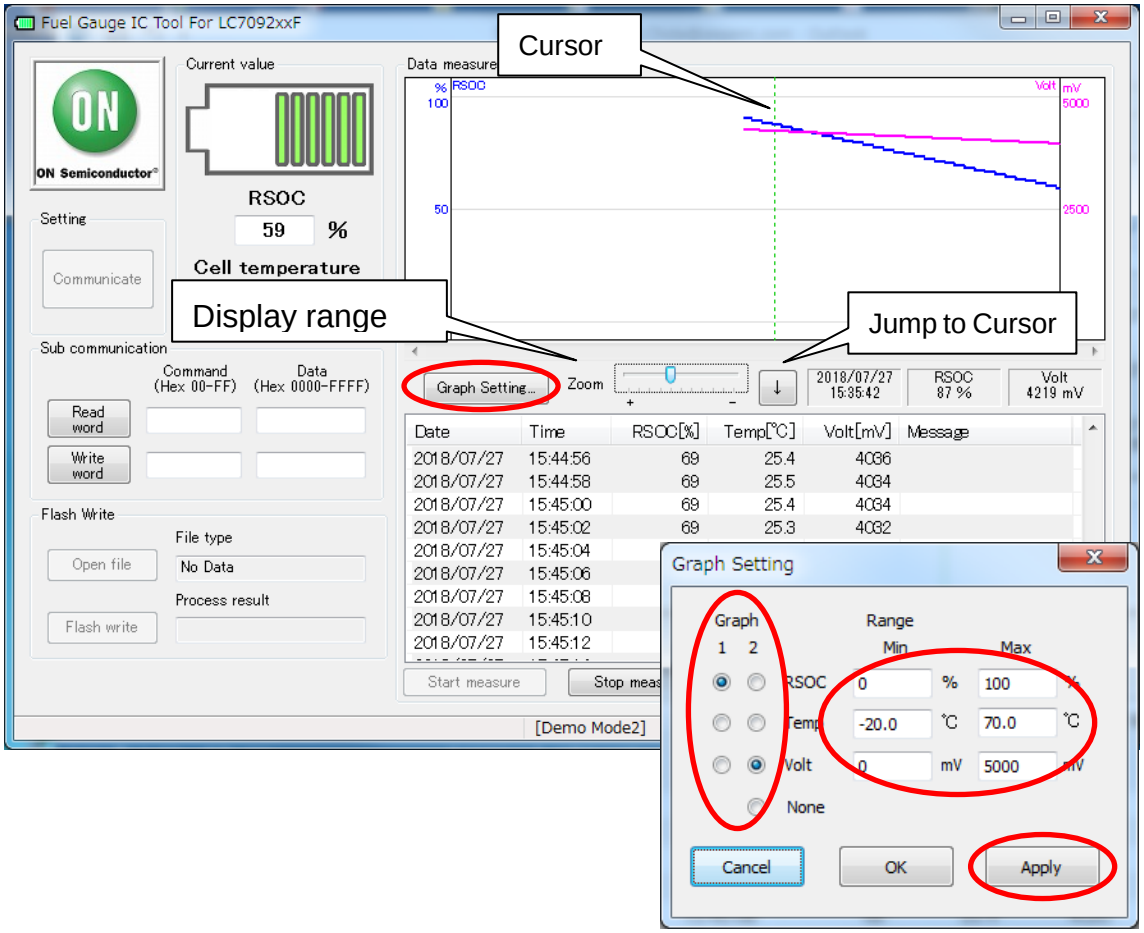
5.7.2 FGI Graph

(1) Click “Graph Setting”

(2) Select “Graph 1 and 2”

(3) Change the value of range for each graph

(4) Apply



6 FAQ's

Q. How do I know what battery profile to use?
A. Battery characteristics are listed on Table 8 of datasheet. If your battery is not listed on the table, please contact ON Semiconductor.

Q. Why does the Fuel Gauge continue to display the same voltage or temperature or RSOC?
A. Please ensure that Fuel gauge is not in Sleep mode. Please set Operational mode if so.

Q. Can I load the other battery profile to the Fuel Gauge?
A. Yes. You can load a new battery profile to the Fuel Gauge using Evaluation board or Master device via I2C. Please contact ON Semiconductor about how to load and new battery profile.

7 Related Documents

Please obtain the latest documents about LC709203F at ON Semiconductor Web site (www.onsemi.com). Search part number: LC709203F.

1) LC709203F, *Smart LiB Gauge Battery Fuel Gauge LSI for 1-Cell Lithium-ion/Polymer (Li+) Data Sheet* (Data Sheet)
2) LC709203F, *Application Note* (App. Note)
3) LC709203F, *Evaluation Board Documents* (Evaluation Board Docs)
4) LC709203F, *Software FGICTool* (Software)

8 Revision history

Version	Date	Details
1.0	08/20/2014	Initial release
2.0	06/07/2018	Add LC709203FXE-05-GEVB and how to select evaluation board.
3.0	02/04/2019	For GUI revision 2.0a