

# Test Procedure for LC709204FXE-N01-GEVB







## 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
LC709204FXE-N01-GEVB	LC709204FXE-01TBG	EC01	LC709204FXE-01-GEVB_SCHEMATIC.pdf
		EC02	LC709204FXE-01-GEVB_GERBER.zip
		EC03	LC709204FXE-01-GEVB_BOM.pdf
		EC04	

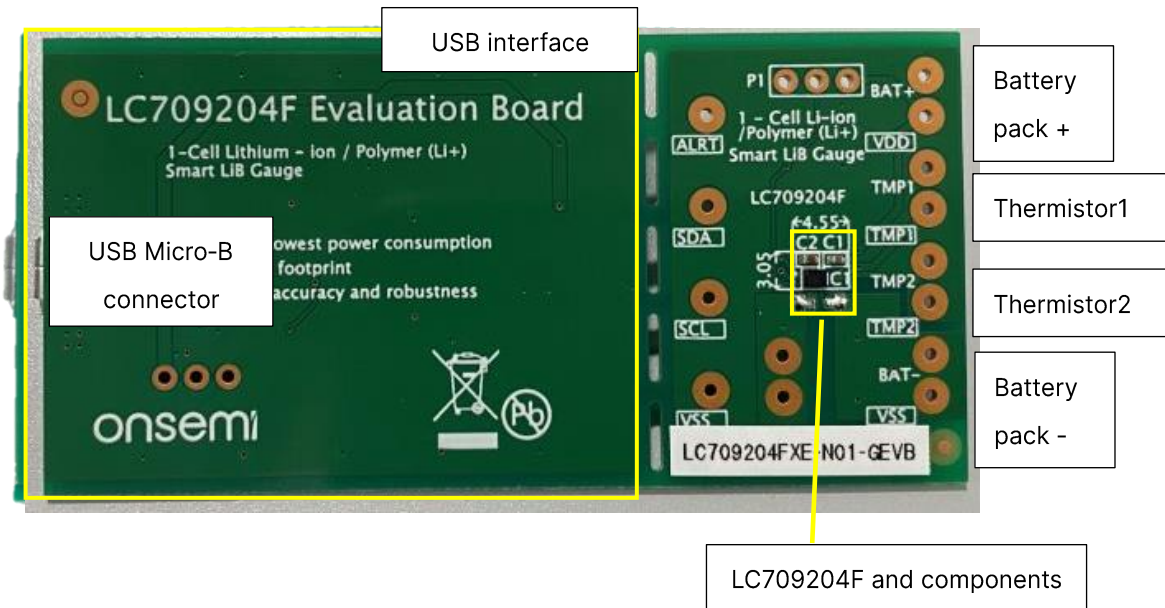
### Battery profile vs registers

IC Type	Battery Information				Registers			
	Type	Product Code	Charging Voltage	Photo	Number of The Parameter (0x1A)	Change of The Parameter (0x12)	APA (0x0B)	
			Nominal Capacity					
LC709204FXE -01TBG (Note 1)	EC01	EC382704P-T	4.2V		0x1011	0x0000	0x0000	
			24mAh					
		EC382504P-P	4.2V					
			20mAh					
	EC02	EC382704P-C	4.2V					
			24mAh					
		EC382204P-C	4.2V					
			18mAh					
	EC302304P-C	4.2V						
		14mAh						
	EC04	EC382704P-H		4.2V				
				20mAh				

1. The LC709204FXE-01TBG in mass production is shipped with a different battery profile built in than this board. If the battery profile of this board is used in mass production, it is necessary to download it is battery profile (LC709204FXE-N01-DATA.zip) from web site and update the profile of LC709204FXE-01TBG by yourself.

\*EnerCera(EC382704P-T,EC382504P-P,EC382704P-C,EC382204P-C,EC302304P-C,EC382704P-H) are products of NGK Insulators, Ltd.

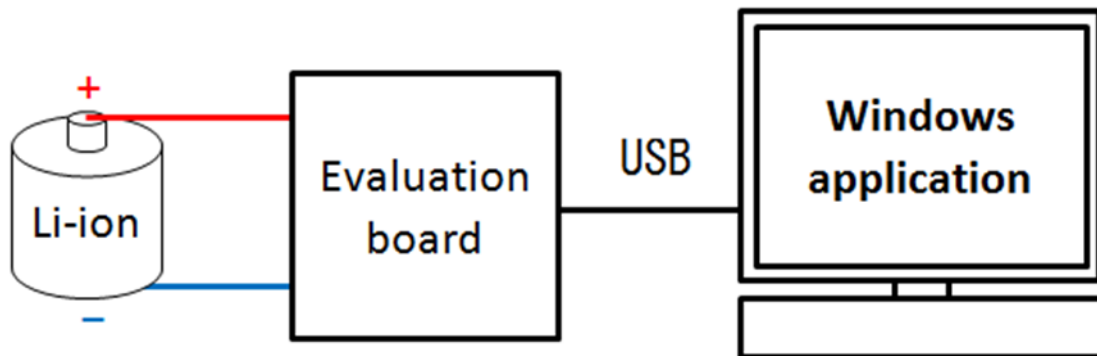
## 1.2 Evaluation board



## 1.3 Windows application

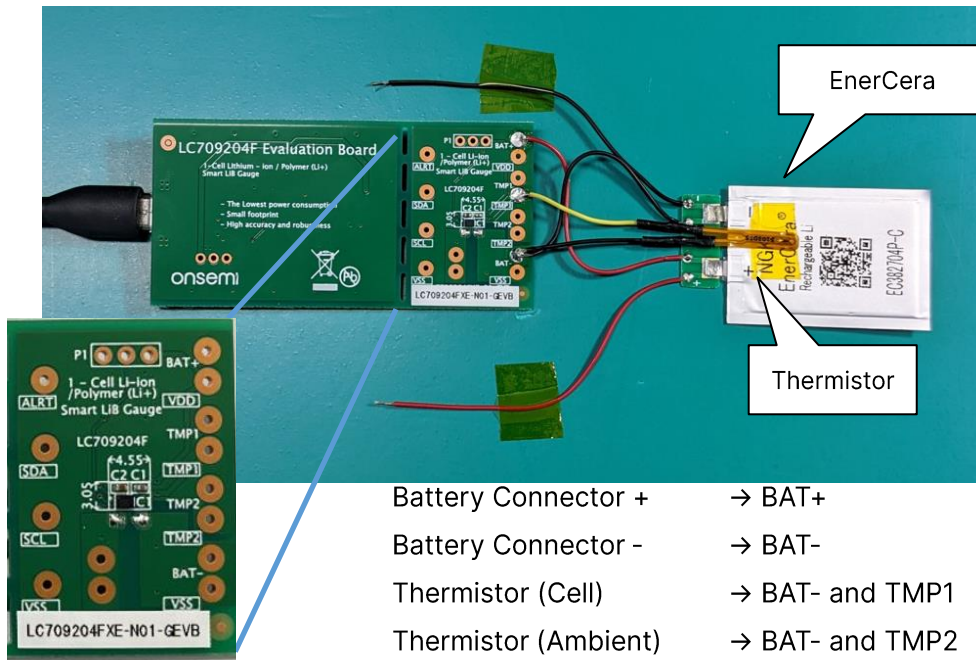
- FGICTool.exe. The software can be downloaded at onsemi Web site. ([Software](#))

## 1.4 Evaluation board Block diagram



## 2 How to connect Evaluation board

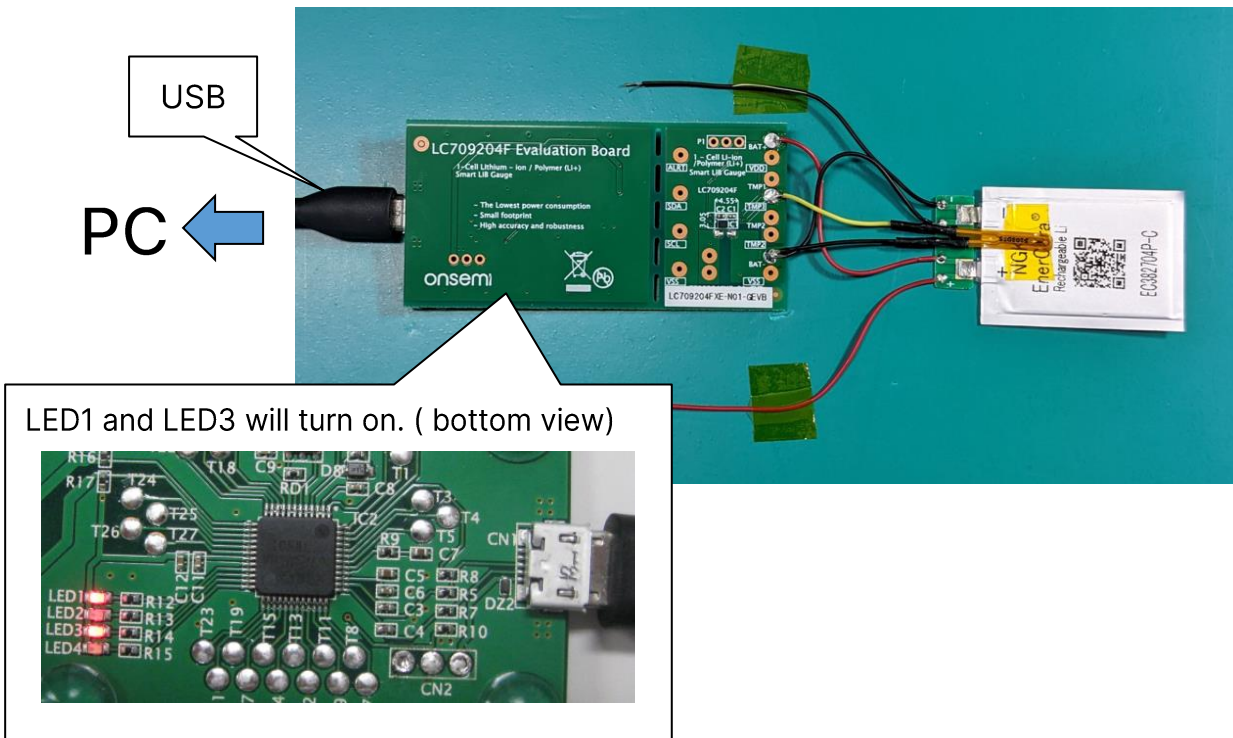
### 2.1 Connection of Evaluation board and Battery



- Battery Connector + → BAT+
  - Battery Connector - → BAT-
  - Thermistor (Cell) → BAT- and TMP1
  - Thermistor (Ambient) → BAT- and TMP2
- Note: 10 kΩ NTC thermistor is required.

Ex. SEMITEC 103JT-025

### 2.2 Connection of PC and Evaluation board

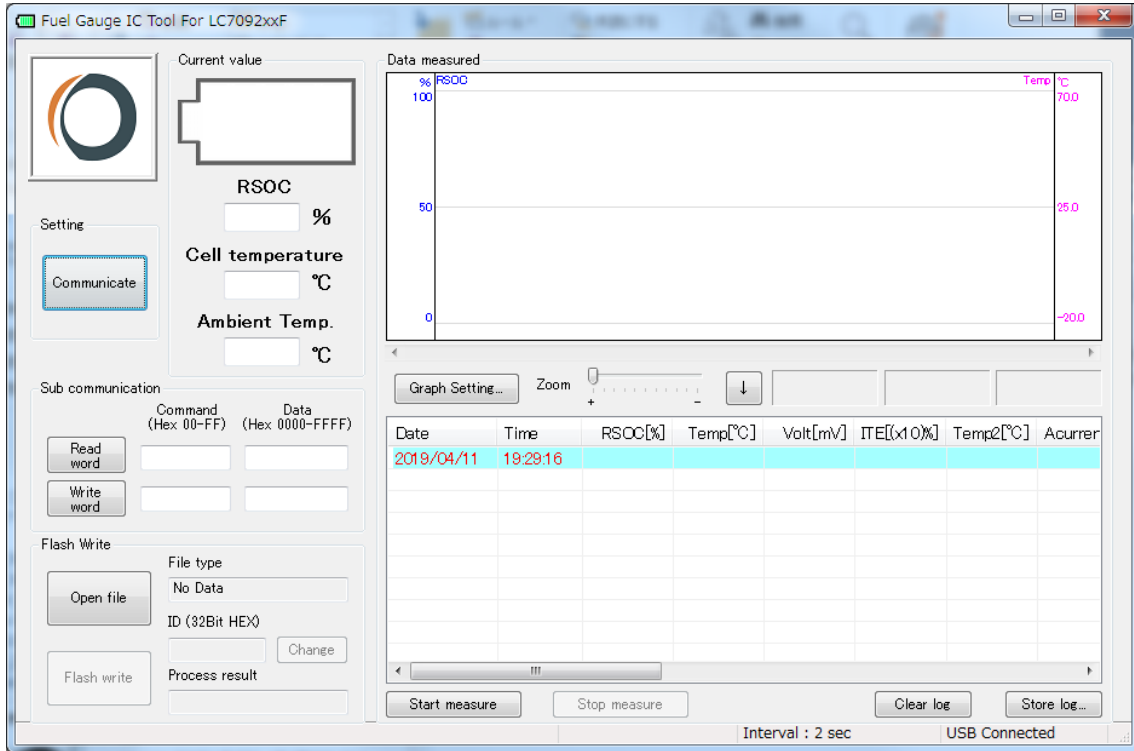


LED1 and LED3 will turn on. ( bottom view)

### 3 How to start application

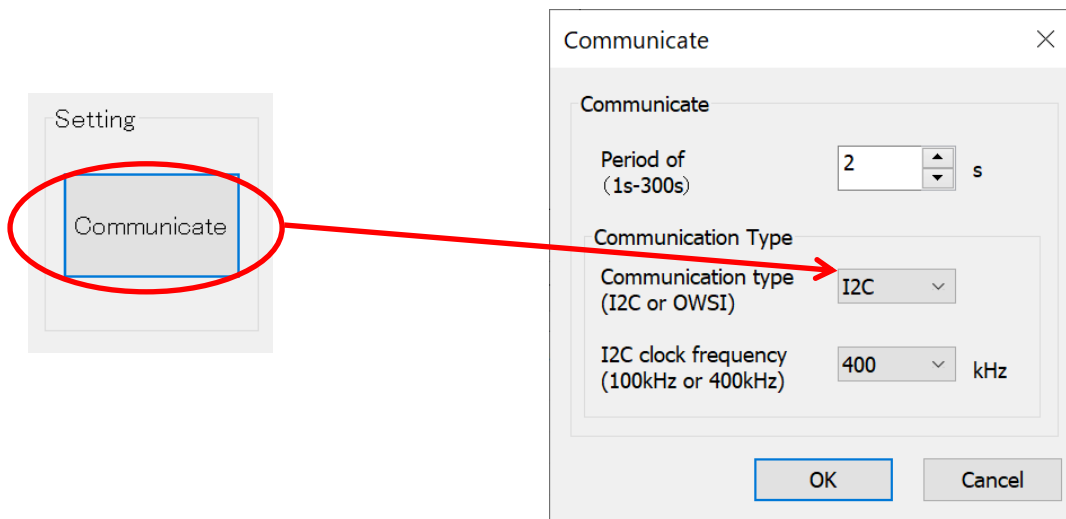
#### 3.1 Start application

- Click "FGICTool.exe"

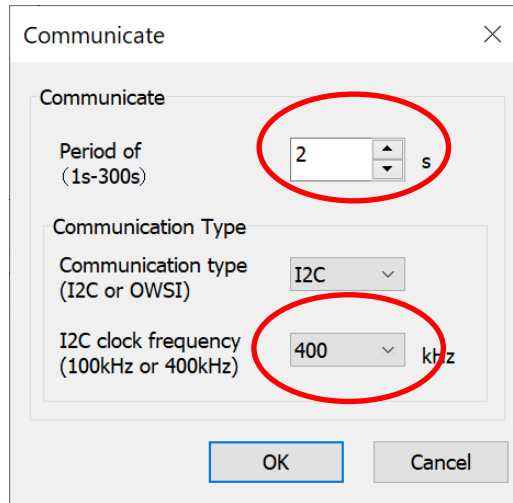


#### 3.2 Select communication type

- Click "Communicate" and select I2C.



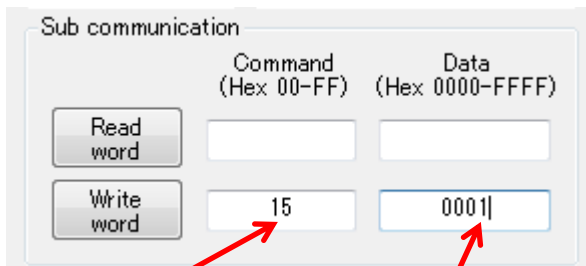
- Select time interval of log and I2C clock frequency.



## 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	0x0002
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- Click "Write word".



## 4.2 Set APA

Set APA parameter that is suitable for your battery. Refer the table below about typical APA.

- Setting registers

- Input 「0B」 in the Command field.

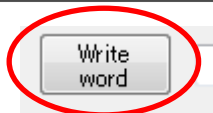
- Input 「0000 to FFFF (a value suitable for your battery)」 in the Data field.

Note: For example the set value in APA register is 0x0A0A for 0x0A APA value.

The screenshot shows a 'Sub communication' window with two columns: 'Command (Hex 00-FF)' and 'Data (Hex 0000-FFFF)'. There are 'Read word' and 'Write word' buttons. The 'Write word' button is active, and the Command field contains '0B' and the Data field contains '0001'. Red arrows point from the 'Write word' button to the Command and Data fields.

0x0B.	APA <sub>+</sub> (Adjustment Pack Application).	R/W.	0x0000 to 0xFFFF.	Sets Adjustment parameter..	-.
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- Click "Write word".



### Typical APA

Battery Type	Battery Product Code	APA[15:8],APA[7:0]
EC01	EC382704P-T EC382504P-C	0x00, 0x00
EC02	EC382704P-C	0x00, 0x00
EC03	EC382204P-C EC302304P-C	0x0A, 0x0A
EC04	EC382704P-H	0x0A, 0x0A

### 4.3 Select battery profile

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

- Setting registers

- Input 「12」 in the Command field.

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

0x12	Change Of The Parameter	R/W	0x0000 to 0x0004	Selects a battery profile.	0x0000
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- Click "Write word".



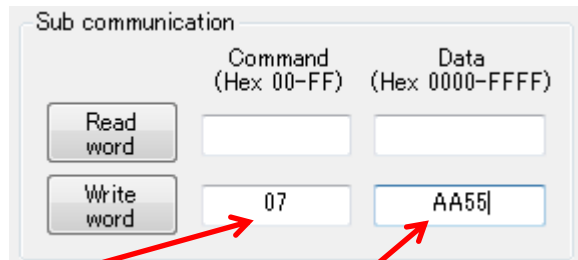
IC Type	Battery Type	Battery Product Code	Number of The Parameter (0x1A)	Change of The Parameter (0x12)
LC709204FXE -01TBG	EC01	EC382704P-T EC382504P-P	0x1011	0x0000
	EC02	EC382704P-C		0x0001
	EC03	EC382204P-C EC302304P-C		0x0002
		EC04		EC382704P-H



#### 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	Initialize RSOC with current voltage when 0xAA55 is set	-
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- Click "Write word".

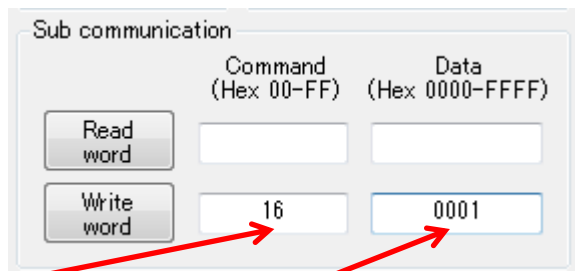


Note: The accuracy of the Initialization requires the OCV reading to be taken with minimal load or charge, under 0.025C, on the battery. (i.e. less than 0.6mA for 24mAh design capacity battery.)

#### 4.5 Set Thermistor mode

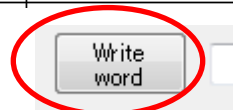
Select Thermistor mode.

- Setting registers
  - Input 「16」 in the Command field.
  - Input 「0001」 in the Data field.



0x16	Status Bit	R/W	0x0000 to 0x0003	BIT0: Controls TSENSE1 thermistor, BIT1: Controls TSENSE2 thermistor	0x0000
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- Click "Write word".



Note: This setting is not required if this LSI receives Cell temperature from Master device via I2C.

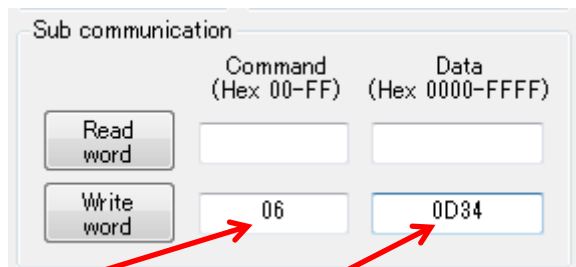
## 4.6 Set Thermistor B

Set a value that is suitable for your thermistor for TSENSE1, TSENSE2. Refer to the datasheet of the thermistor for the B constant.

- Setting registers

-Input 「06」 in the Command field.(「0E」 TSENSE2 )

-Input 「B constant」 in the Data field.



0x06	TSENSE1 Thermistor B	R/W	0x0000 to 0xFFFF	K	Sets B-constant of the TSENSE1 thermistor	0x0D34 (3380K)
0x0E	TSENSE2 Thermistor B	R/W	0x0000 to 0xFFFF	K	Sets B-constant of the TSENSE2 thermistor	0x0D34 (3380K)

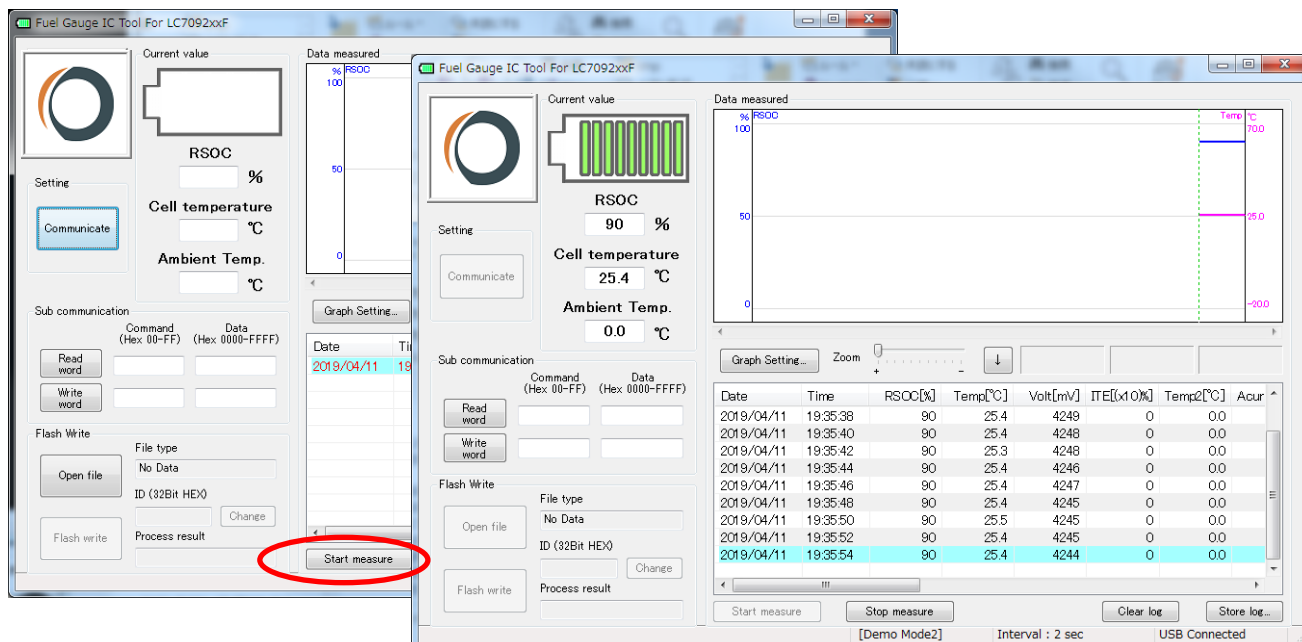
- Click "Write word".



## 5 Starting evaluation

### 5.1 Measurements and Logging

- Click "Start measure".



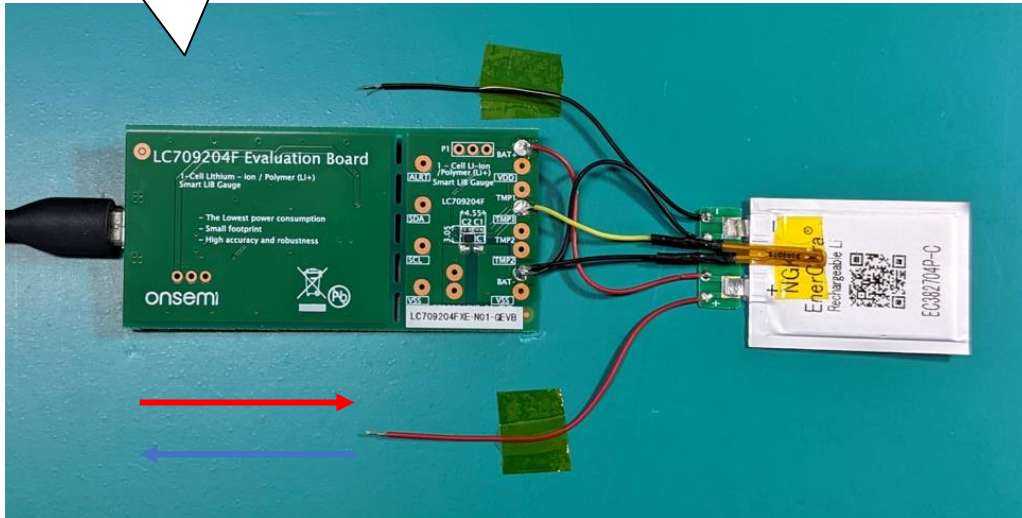
- Application starts measurements and logging.

## 5.2 Start charging/discharging

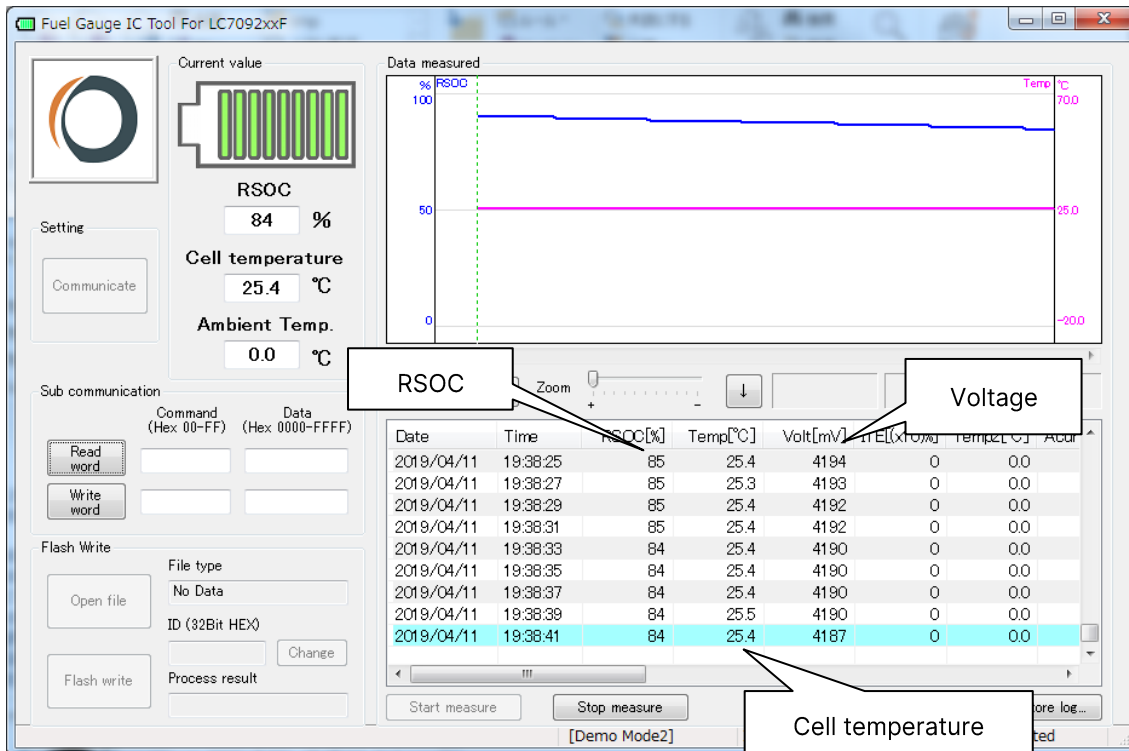
- Connect charger/load to your battery.

Charge or Discharge Example

- Battery charger
- Load equipment
- Various device



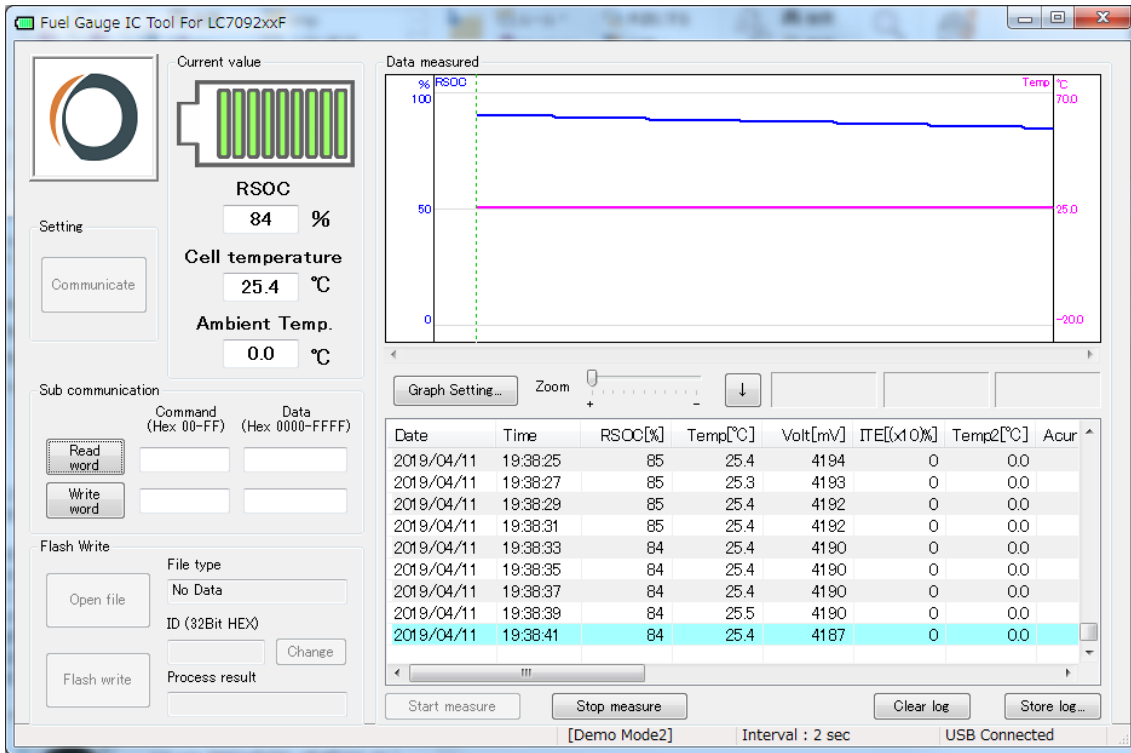
## 5.3 Logging while Charging/Discharging



Display in GUI	Command Code	Register Name	Comment
RSOC	0x0D	RSOC	
Temp	0x08	Cell Temperature	
Volt	0x09	Cell Voltage	
ITE	0x0F	ITE	
Temp2	0x30	Ambient Temperature	
Acurrent	N/A	N/A	Acurrent=0 for LC709204FXE
MaxCellVolt	0x2A	Maximum Cell Voltage	
MinCellVolt	0x2B	Minimum Cell Voltage	
MinDcurrent	N/A	N/A	MinDcurrent=0 for LC709204FXE

## 5.4 End the measurements

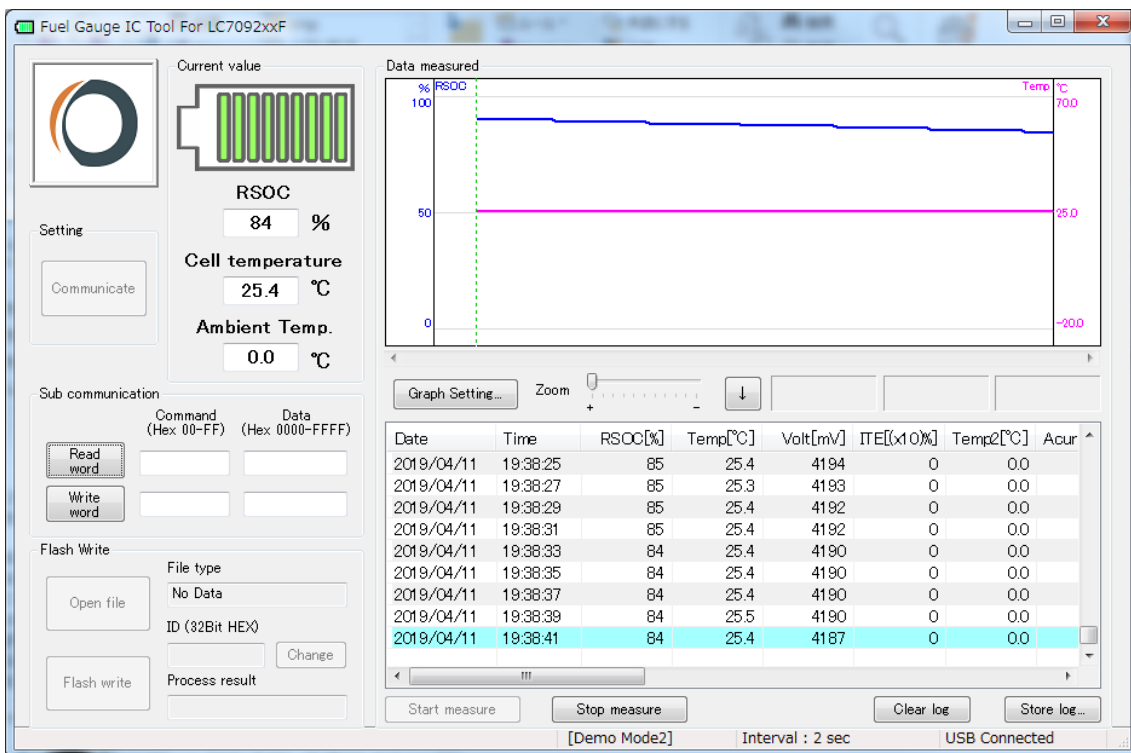
- To end, click “Stop measure”.



## 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.

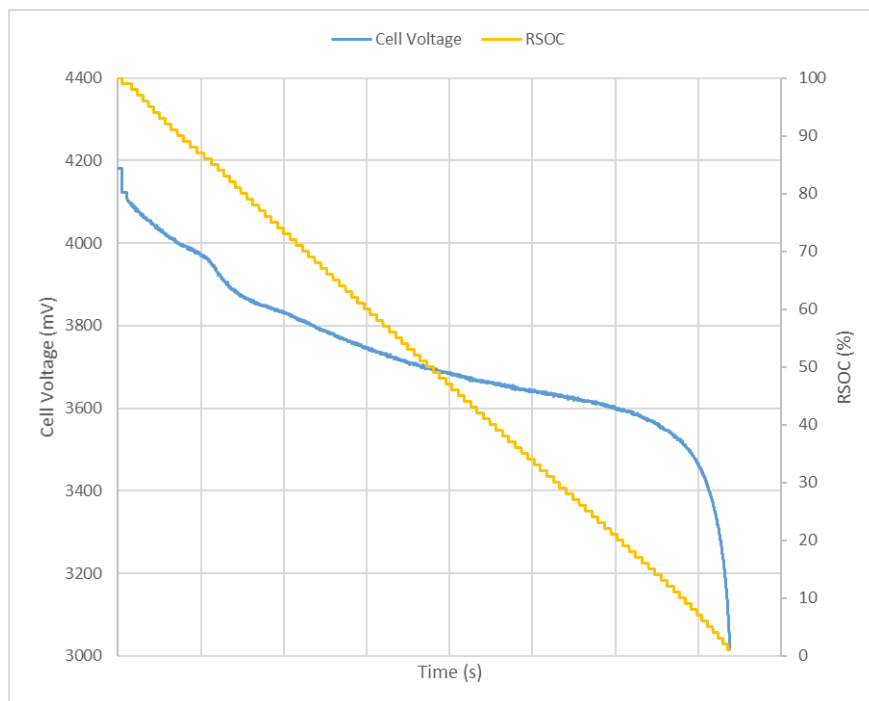
- Change the file format from .txt to .csv. Example) test.txt → test.csv.

2017/05/08 20:04:25, 99, 19.4, 4091	11	2017/5/8 20:04	99	19.4	4091
2017/05/08 20:04:27, 99, 19.4, 4087	12	2017/5/8 20:04	99	19.4	4087
2017/05/08 20:04:29, 99, 19.4, 4087	13	2017/5/8 20:04	99	19.4	4087
2017/05/08 20:04:31, 99, 19.4, 4087	14	2017/5/8 20:04	99	19.4	4087
2017/05/08 20:04:33, 99, 19.4, 4087	15	2017/5/8 20:04	99	19.4	4087
2017/05/08 20:04:35, 99, 19.4, 4084	16	2017/5/8 20:04	99	19.4	4084
2017/05/08 20:04:37, 99, 19.4, 4084	17	2017/5/8 20:04	99	19.4	4084
2017/05/08 20:04:39, 99, 19.4, 4084	18	2017/5/8 20:04	99	19.4	4084
2017/05/08 20:04:41, 99, 19.4, 4080	19	2017/5/8 20:04	99	19.4	4080
2017/05/08 20:04:43, 99, 19.4, 4080	20	2017/5/8 20:04	99	19.4	4080
2017/05/08 20:04:45, 99, 19.4, 4080	21	2017/5/8 20:04	99	19.4	4080
2017/05/08 20:04:47, 99, 19.4, 4080	22	2017/5/8 20:04	99	19.4	4080
2017/05/08 20:04:49, 99, 19.4, 4077	23	2017/5/8 20:04	99	19.4	4077
2017/05/08 20:04:51, 99, 19.4, 4077	24	2017/5/8 20:04	99	19.4	4077
2017/05/08 20:04:53, 99, 19.4, 4077	25	2017/5/8 20:04	99	19.4	4077
2017/05/08 20:04:55, 99, 19.4, 4077	26	2017/5/8 20:04	99	19.4	4077
2017/05/08 20:04:57, 99, 19.4, 4077	27	2017/5/8 20:04	99	19.4	4077
2017/05/08 20:04:59, 99, 19.4, 4077	28	2017/5/8 20:04	99	19.4	4077

## 5.7 Graph

### 5.7.1 .csv file

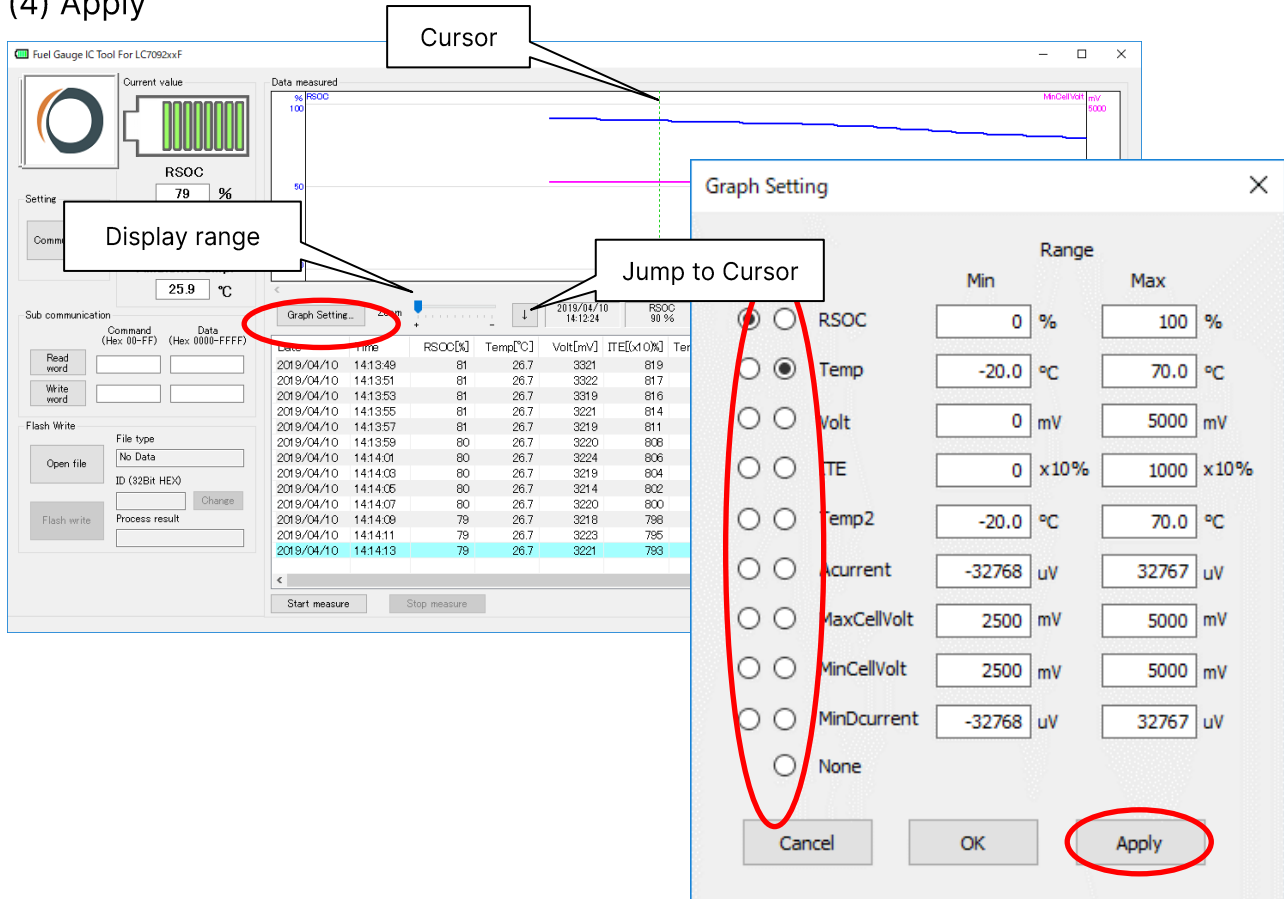
- Graph the .csv file.



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

### 5.7.2 Graph in FGICTool.exe

- (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. What is the difference between LC709204FXE-N01-GEVB and LC709204FXE-01-GEVB?

A. Each evaluation board supports different batteries. LC709204FXE-N01-GEVB is a special evaluation board that supports EnerCera batteries. If you use EnerCera batteries, use LC709204FXE-N01-GEVB.

Also, the LC709204FXE-01TBG in mass production is shipped with a different battery profile built in than this board. If the battery profile of this board is used in mass production, it is necessary to download it is battery profile (LC709204FXE-N01-DATA.zip) from web site and update the profile of LC709204FXE-01TBG by yourself.



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.

## 7 Related Documents

Please obtain the latest documents about LC709204F at onsemi Web site ([www.onsemi.com](http://www.onsemi.com)). Search part number: LC709204F.

- 1) LC709204F, *Smart LiB Gauge Battery Fuel Gauge LSI for 1-Cell Lithium-ion/Polymer (Li+) Data Sheet*
- 2) LC709204F, *Application Note*
- 3) LC709204F, *Evaluation Board Documents*
- 4) LC709204F, *Software FGICTool*

## 8 Revision history

Version	Date	Details
1.0	9/21/2022	Initial release