Smart Battery Pack Module with GC1318-XXX

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Content

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Smart Battery Pack Module Features

1. Overview

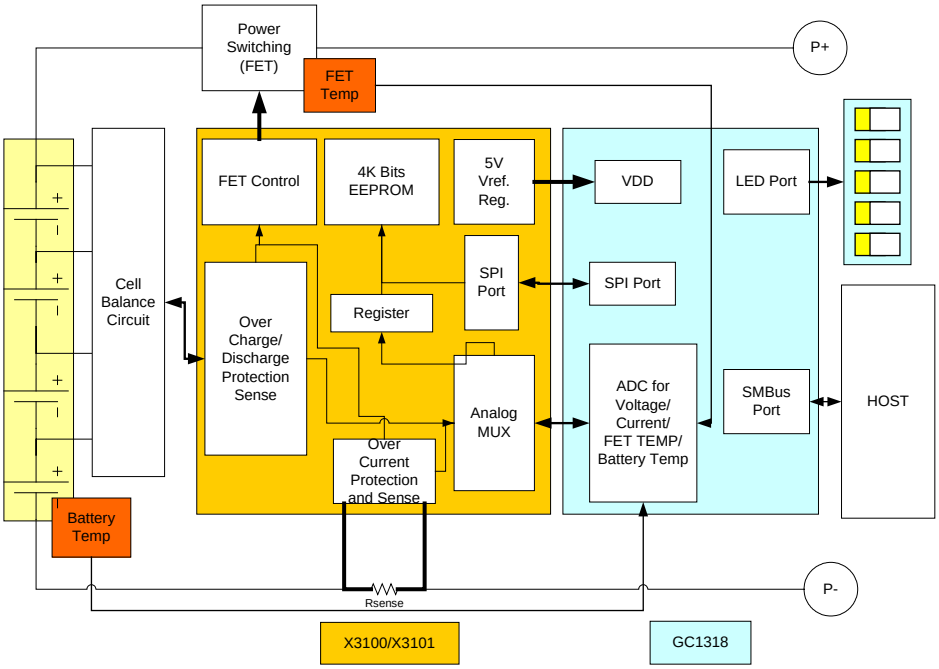
The Smart Battery Pack Module, GC-QC-318, includes the GC1318 and the detection and protection IC X3100/3101. This module has excellent performance in measuring the voltage/current, accounting the capacity, controlling the charging/discharging FET. It provides over-charging, over-discharging, over-current and temperature protections. Meanwhile, It also handles the ***Battery Cell Balancing*** function.

This module exchanges data and commands with the notebook computer through SMBus 2.0. The data format complies to SBdata1.1.

GC-QC-318 provides the completed functionality and safety to the Smart Battery Pack and extends the battery life.

2. Diagram

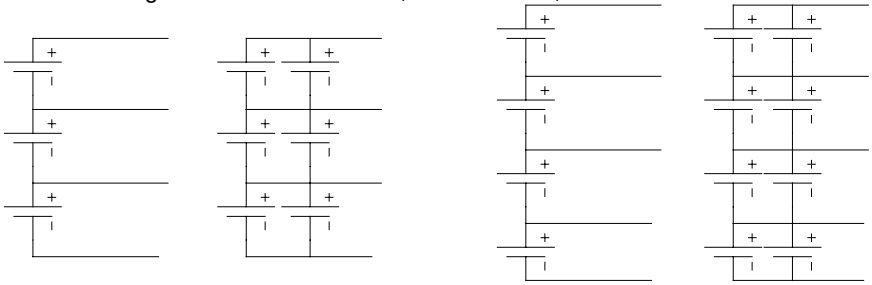
GC1318，X3100，FETS，Balancing, Voltage and Current Measuring



3. Solution Features

3.1. Connecting Method

Several connecting methods are as 3S-1P, 3S-2P. 4S-1P, 4S-2P.



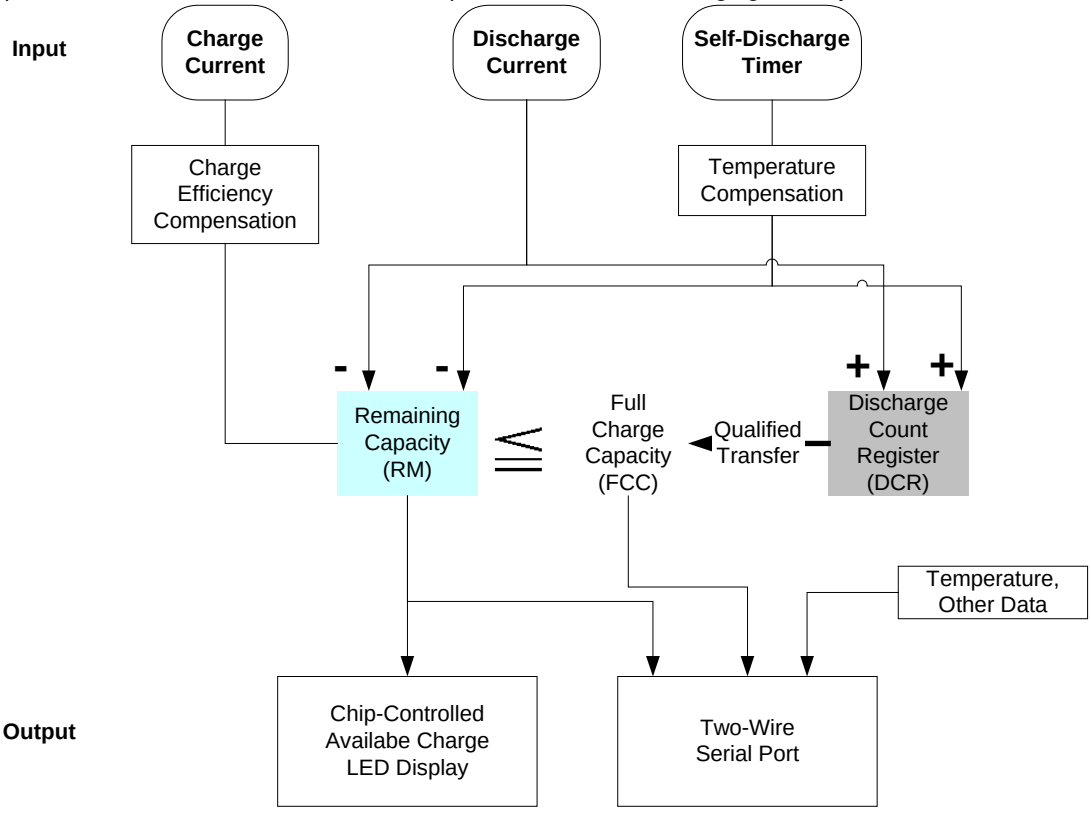
Note: **In 3S method, using X3101; In 4S method, using X3100.**

3.2. Measurement Precision

The A/D unit of GC1318 is 10 bits for the voltage and the temperature sensing.
With the gain of X3100/3101, the measurement precision of current can achieve 13-16 bits.

3.3. Capacity Calculation

GC-QC-318 accumulates a measure of charge and discharge current and estimates the self-discharging of this pack.
It compensates the current measurement of temperature and self-discharging and adjusts the RM to the accurate capacity.



3.4. FCC Self-Relearning

In a whole valid discharging process, It accumulates the change of capacity and gets the new FCC.

New FCC= Fcc initial + DCR（discharge to EDV2）+ FCC * Battery low%
Battery Low% is the capacity percent at EDV2 of a cell.

3.5. Difference Noticing in FCC

When the difference between the calculation and the actual capacity gets a setting value, the module will notice the host to execute a FCC relearning process.

3.6. Smart Capacity Adjustment

This module has three low voltage thresholds :EDV2，EDV1，EDV0。

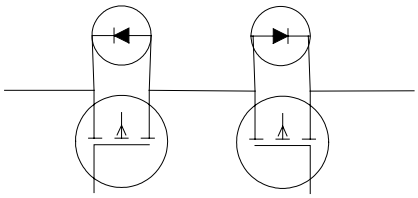
THRESHOLD	RELATIVE STATE OF CHARGE
EDV0	0%
EDV1	3%
EDV2	Battery Low %

EDV2，EDV1，ED0 can be set by software.
If the voltage decrease to EDV2 , It will adjust the RM to Battery Low

3.7. Cell Balancing Control

GC-QC-318 executes cells balancing in charging process. When the maximum difference in cells voltage exceeds the setting balance window, this module will by-pass part current of the higher cells.

3.8. Charging and Discharging FETS Control



X3100/X3101 connects CHARGING/DISCHARGING FETS。
GC1318 can control the FETS by X3100/X3101 while X3100/X3101 can control them separately.

3.9. Multi-Cell protection

GC-QC-318 can provides Over-charge, Over-discharge, Over-current, Over/Low temperature protections. When the parameter exceeds the threshold, the module will operate the FET through X3100/3101, and produce alarm information.

GC-QC-318 provides Multi-protection: measuring the parameters and controlling the FET by software according the thresholds, X3100/3101 monitoring and controlling the FET by the setting.

3.10. SMData 1.1 Protocol

Compliant to Smart Battery Data Specification Ver1.1 .
Measure and calculate parameters
Receive the setting by HOST
Broadcast alarm to HOST and CHARGER
Broadcast ChargingCurrent and ChargingVoltage to CHARGER

The command sets according SBDATA

FUNCTION	COMMAND	ACCESS	UNITS	FUNCTION	COMMAND	ACCESS	UNITS
ManufactureAccess	0x00	read/write	NA	ChargingCurrent	0x14	read	mA
RemaIningCapacityAlarm	0x01	read/write	mAh, 10mWh	ChargingVoltage	0x15	read	mV
RemainingTimeAlarm	0x02	read/write	Minutes	BatteryStatus	0x16	read	NA
BatteryMode	0x03	read/write	NA	CycleCount	0x17	read	cycles
AtRate	0x04	read/write	mA, 10mW	DesignCapacity	0x18	read	mAh, 10mWh
AtRateTimeToFull	0x05	read	minutes	DesignVoltage	0x19	read	mV
AtRateTimeToEmpty	0x06	read	minutes	SpecificationInfo	0x1a	read	NA
AtRateOK	0x07	read	Boolean	ManufactureDate	0x1b	read	NA
Temperature	0x08	read	0.1°K	SerialNumber	0x1c	read	integer
Voltage	0x09	read	mV	Reseved	0x1d-0x1f	0	0
Current	0x0a	read	mA	ManufactureName	0x20	read	string
AverageCurrent	0x0b	read	mA	DeviceName	0x21	read	string
MaxError	0x0c	read	percent	DeviceChemistry	0x22	read	string
RelativeStateOfCharge	0x0d	read	percent	ManufactureData	0x23	read	string
AbsoluteStateOfCharge	0x0e	read	percent	OptionalMfgFunction5	0x2f	Read/write	Word
RemainingCapacity	0x0f	read	mA, 10mW	OptionalMfgFunction4	0x3c	Read/write	Word
FullChargeCapacity	0x10	read	mA, 10mW	OptionalMfgFunction3	0c3d	Read/write	Word
RunTimeToEmpty	0x11	read	minutes	OptionalMfgFunction2	0x3e	Read	Word
AverageTimeToEmpty	0x12	read	minutes	OptionalMfgFunction1	0x3f	write	Word
AverageTimeToFull	0x13	read	minutes				

OptionalMfgFunction5~1 are the optional manufacture functions.

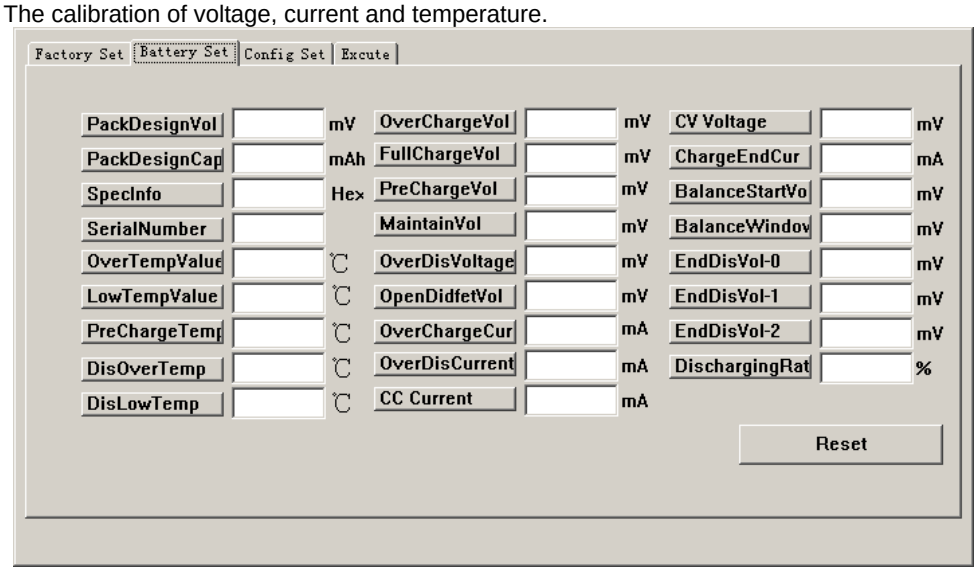
3.11. Data Transmit Protocol

Complaint to System Management Bus Specification Version 2.0.
Read/Write Word protocol, Read/Write Block protocol and PEC are supported.

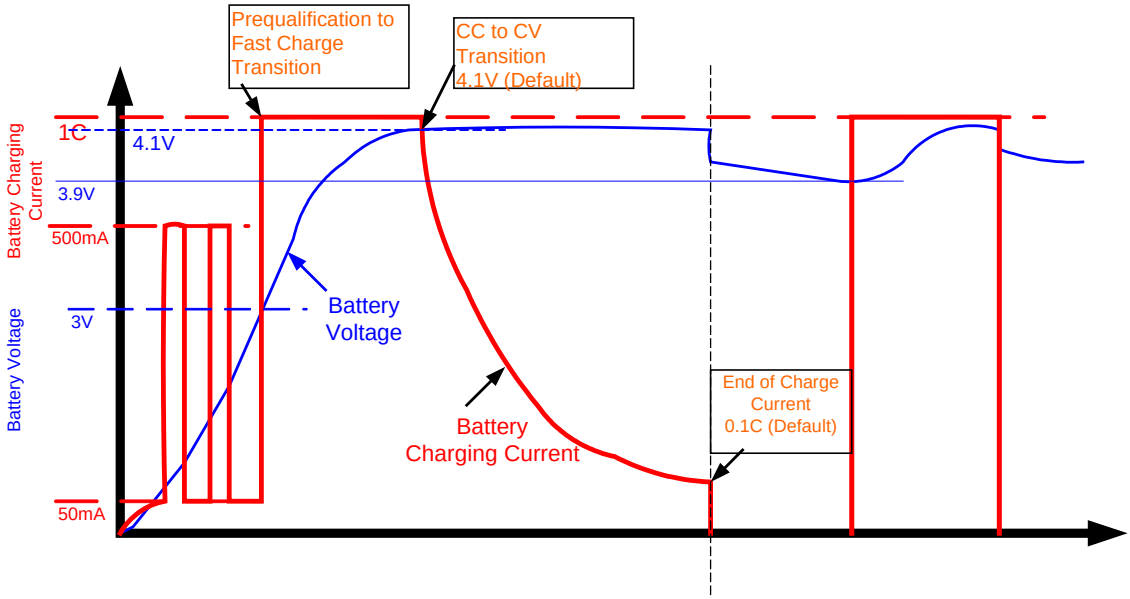
3.12. Parameter Setting

The parameters of cells and Pack and some thresholds can be set by soft.

1. The spec parameters of Pack: as DesignCapacity, DesignVoltage
2. The MFG data: as ManufactorName, DeviceName.
3. The thresholds
4. The calibration of voltage, current and temperature.



3.13. Effective Smart Charge Mode



(The FullCahrgeVoltage is 4.1V in this chat.)
According to the cells, GC-QC-318 executes a Smart charging process.
It includes pre-charging, wake-up, const current, const voltage and maintain process

3.14. Built-in 8K Bites EEPROM

With 8K bites EEPROM, GC-QC-318 registers the spec parameters and threshold data and the changing data in running.

3.15. SLEEP Mode

GC-QC-318 has several sleep modes to save power.

3.16. Password Management

GC-QC-318 can operate password management cooperated with custom.

3.17. LEDs Capacity Indication

GC-QC-318 has 4/5 LEDs to indicate the RM. This function can be set enable or disable by soft.

4 LEDS Indication	5 LEDS Indications	Estimated Battery Capacity
4 LEDS	5 LEDS	>75%
3 LEDS	4 LEDS	>50%
2LEDS	3LEDS	>25%
1 LEDS	2 LEDS	<25%
0 LEDS	1 LEDS	<6%

4. Module Interface to Notebook and Cells

To Notebook			The Cells Interface	
P+	Pack Power Positive		B+	Vcell1 Positive
P-	Pack Power Negative		CL2	Vcell1 Negative/Vcell2 Positive
SDA	Smbus Data		CL3	Vcell2 Negative/Vcell3 Positive
SCK	Smbus CLK		CL4	Vcell3 Negative/Vcell4 Positive
Safety Signal	Safety Signal Line		B-	Vcell4 Negative

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GC1318 SBData 1.1 Compliant Gas Gauge IC
For Use With XICOR X3100/X3101 Battery Management IC

5. Description

The GC1318 SBS-compliant gas gauge IC for battery pack in Li-ion or Li-polymer batteries. The GC1318 monitors capacity and other critical parameters of the battery pack. Through the SMBus 2.0 interface, GC11318 reports the battery information to the operating system with the format compliant to the SBData V1.1
It is designed to work with X3100 or X3101 (http://www.xicor.com/pdf_files/x3100.pdf), the battery protection and monitor IC for use in battery packs consisting of 4 or 3 series Lithium-Ion battery cells. Both devices provide internal over-charge, over-discharge, and over-current protection circuitry, internal EEPROM memory, an internal voltage regulator, and internal drive circuitry for external FET devices that control cell charge, discharge, and cell voltage balancing.
GC1318 and X3100/X3101 provide the completed functionality and safety and minimize component count and cost in smart battery circuits.

6. Features

- Provides Accurate Measurement of Available Charge in Li-Ion and Li-Polymer Batteries
- Data Format Supports the Smart Battery Specification (SBS) Data V1.1.
- Hardware Interface Supports the Smart Battery Bus (SMBus) 2.0.
- In-Application Programming Mode by GammaComm Programmer Loader
- Works With XICOR X3100/X3101 Battery Management IC to Provide Complete Pack
- Electronics for 3-4 Li-ion Cell With Few External Components
- Measures Battery Temperature, Charge/Discharge MOSFET with a High Resolution 10-Bit ADC
- Drives 4-5 LED Display for Remaining Capacity Indication
- 44-pad, QFP (10x10mm); 48 Pins LQFP(7x7mm)

7. Application

Notebook Computer Battery Pack

8. Functional Block Diagram

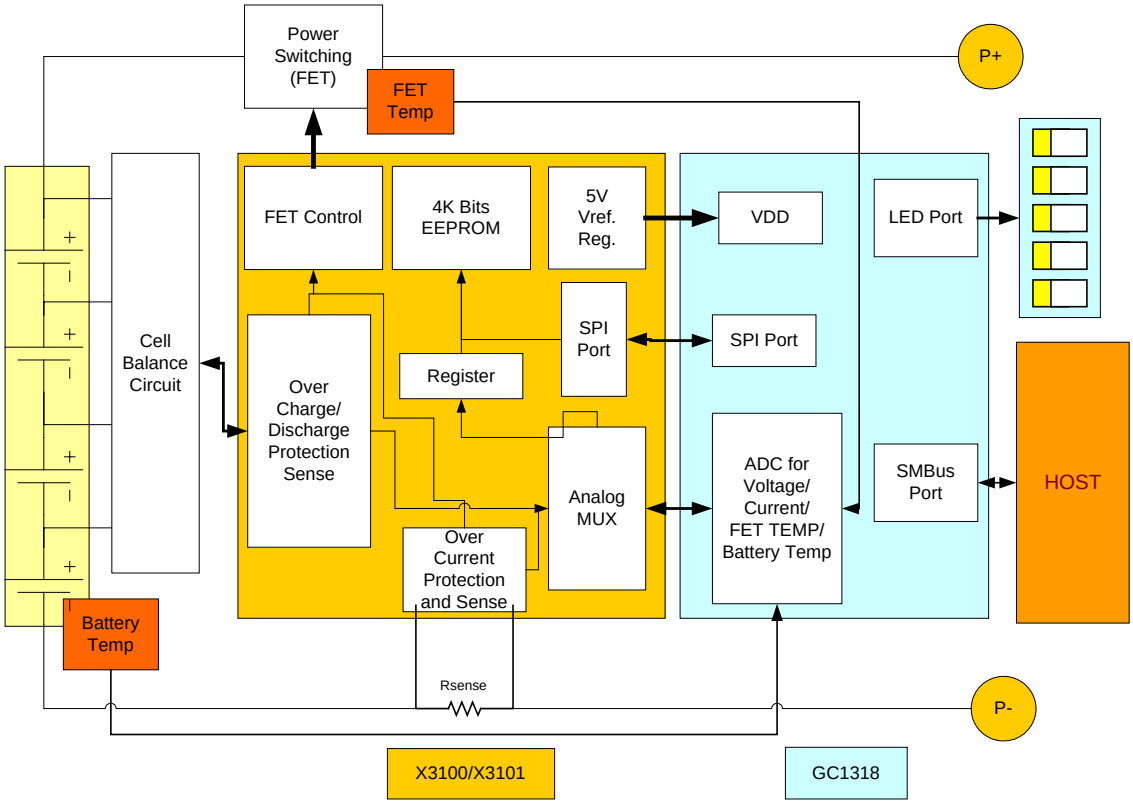

Fig.1 : Functional Block of GC1318 and X3100

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