Specification for Battery Pack

Rechargeable Li-ion Polymer Battery Pack
Model : 295050 750mAh 1S1P

Revisions:

Revision	Date	Initials	Comments
1	2016.01.29	S.H Choi	First draft

References:

Ref no	Document ID	Description
1	Attached	Battery Assembly Drawing
2	Attached	Cell Specification
3	Attached	PCM Specification
4		
5		
6		
7		
8		

References:

Cusmomer

Section	Checked	Checked	Approval
Sign			
Name			
Date			

GSP

Section	Prepared	Checked	Approval
Sign			
Name	S.H Choi		William
Date	2016.01.29		2016.01.29

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Contents:

1 General

1.1 Purpose

The purpose of this document is to specify the electrical and environmental requirements for the battery pack for the project 1S/295050 with Safety Circuit

1.2 Battery pack description

The battery pack contains 1S rechargeable lithium-Ion polymer 295050 and all necessary Protection circuitry. It is covered by a customized PCM. 3contact Wire connector are used for connecting to the application.

2 Applicable documents

The battery package is keeping the mentioned generic standards regarding the (EU) Battery Directive 2006/66/IEC.

For handling precautions and prohibitions, refer to [4]. The document 'Handling Precautions and Prohibitions' is an integral part of this specification. All guide-lines and instructions given within the 'Handling Precautions and Prohibitions' must be strictly observed.
In case this document is not attached to this specification, please contact your local sales engineer to get a copy .

3 Mechanical specification

3.1 Units of measure

mA	milliamps
mAh	milliamp hours @ C/5 rate
ms	milliseconds
Ah	amp hours @ C/5 rate
V	volts
C	total capacity of the battery in mAh, measured at a discharge rate of C/5 mA
%	percent
°C	degrees Celsius

3.2 External connections

Pin1:	Ex (+)
Pin1:	TH(10Kohm)
Pin2:	Ex (-)

3.3 Main Components

1) Cell: Rechargeable lithium-Ion Polymer Please refer to [2]
2) Safety circuit: Please refer to [3]

3.4 Mechanical outline

For detailed battery drawing please refer to [1]

4 Performance specification

4.1 Cell type

Cell is Li-ion polymer
For details refer to [2]

4.2 Operating Temperature:

For Charging: 0 to +45°C
For Discharge: -20 to +60°C

4.3 Storage Characteristics:

-20 ~ 45℃ for 1Month
-20 ~ 35℃ for 6Months

4.4 Overall Electrical specification

No.	Item	Specification
1	Minimum Capacity	750mAh
2	Nominal voltage	3.7V
3	Charging voltage	4.20 V
4	Charging method	Constant Current / Constant Voltage
5	Discharge Cut off voltage	3.0 V
6	Impedance at 1kHz	Appr. 220 mOhm (Initial)
7	Max charging current	0.5C (375mA)
8	Max Discharge current	1.0C (750mA)
9	Cycle life	300cycle. 80% initial capacity, Charge：0.2C to 4.2V Discharge：0.2C to 3.0V
10	Operating temperature	For charging: 0 to +45°C For discharge: -20 to +60°C
11	Weight	g approx.

4.5 Shipping Conditions

The battery shall be shipped in about 20~50% charged state.

4.6 Packaging

For packaging please refer to []

5 Protection circuit

For details see [3]

6 Test specification

6.1 Appearance

There shall be no such defect as rust, discoloration, leakage that may adversely affect commercial value of the battery.

6.2 Standard test conditions

6.2.1 Test Conditions

Unless otherwise specified, all tests stated in this specification are conducted at temperature 20± 5°C and humidity 60 ± 15%.

6.2.2 Measuring Equipment:

(1) Amp-meter and voltmeter.
The amp-meter and voltmeter must have an accuracy of the grade 0.5 or higher.

(2) Voltmeter:
The voltmeter must have impedance of more than 1000 Ohm/Volt.

(3) Impedance:
Total external resistance including amp-meter and wire is less than 0.01 Ohm with AC 1kHz should be used.

6.3 Electrical Characteristic

6.3.1 Initial Capacity Test

Initial capacity should be larger than 750mAh with a discharge current of 150mA and cut off at 3.0V measured after fully charged.

6.3.2 Internal Resistance Test

The total impedance of the battery pack should be about 220 mOhm initial, AC measured at 1kHz fully charged. In shipping status the total impedance should be about 220 mOhm, partially charged.

6.3.3 Cycle Life Test / Battery Performance

The cycle times is not less than 300 cycle.
Test condition: Charge：0.2C to 4.2V , Discharge：0.2C to 3.0V
When the discharge capacity reduced to 80% of initial capacity, Stop testing

6.4 Environmental Specification

6.4.1 Vibration Test / Shock Test

Covered by UN-Test

6.4.2 Drop Test of Battery Pack

Upon impact of charged battery to 4.2V following free fall from a given height onto a specific surface together with the related device, it must remain fully functional. No loose parts after drop test

Height of drop: 1 m
Type of surface: Concrete
Direction of fall: The device will be dropped free one time in three mutually perpendicular directions from the height of 1.0mm.

Result:
After the test the battery pack must be fully functional. No leakage of cells may occur. No change of internal impedance (± 10 mOhm AC)

6.5 Recycling and Environmental Compatibility

The battery pack is RoHS compliant.

6.6 Safety Characteristic of bare cell ➔Pending

Covered by UL1642 and UN/DOT approved cell

6.7 Safety Characteristic of the Battery ➔Pending

Covered by UN/DOT approval of battery

7 Approvals

7.1 UL approval of cell ➔Pending

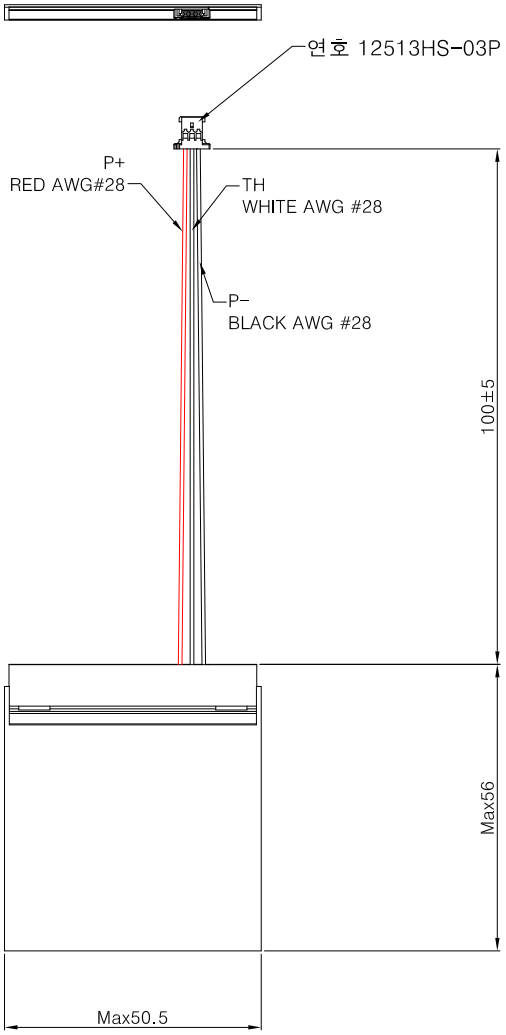
The cell is compliant to UL1642

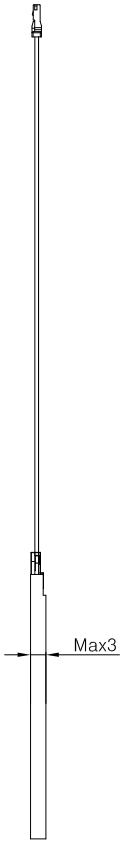
7.2 UN/DOT approval of the battery ➔Pending

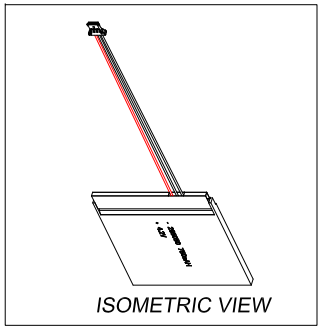
The battery meets the requirements of the tests according to the “Recommendations of the transport of Dangerous Goods, UN Manual of Tests and Criteria, Part III, subsection 38.3”
for Details refer to []

Attached 1. Battery Assembly Drawing

No	PART NAME	MATERIAL	MATERIAL DIM	Q'TY	TREATMENT
1					







No	Date	Name	Revisions
2			
1			

A3	SCALE	1/1	DATE	2016.01.29	GENERAL TOLERANCE	0.0±0.5 0.00±0.13 0.000±0.015
	VIEW		DIM.	mm		
DESIGNED		J. S LEE	MATERIAL			
CHECKED			TITLE		Battery Pack assy	
APPROVED			MODEL		신우 1S1P	
			DRAWING NO.			

Attached 2. Cell Specification

AMENDMENT RECORDS

Revision History

版本记载

REVISION	DATE	ORIGINATOR	REASON FOR REVISION
A00	2016.1.18	Yu Yuqiang	Original Release

Content

1. Scope 范围

This specification describes the performance, testing method, warning and caution of the lithium-ion polymer rechargeable battery.

The specification applies to polymer battery supplied by Shenzhen EPT Battery Co., Ltd.

本标准描述了聚合物锂离子电池的性能、测试方法及注意事项。

本标准适用于深圳市量能科技有限公司生产的聚合物锂离子电池。

2. Picture of battery 电池图

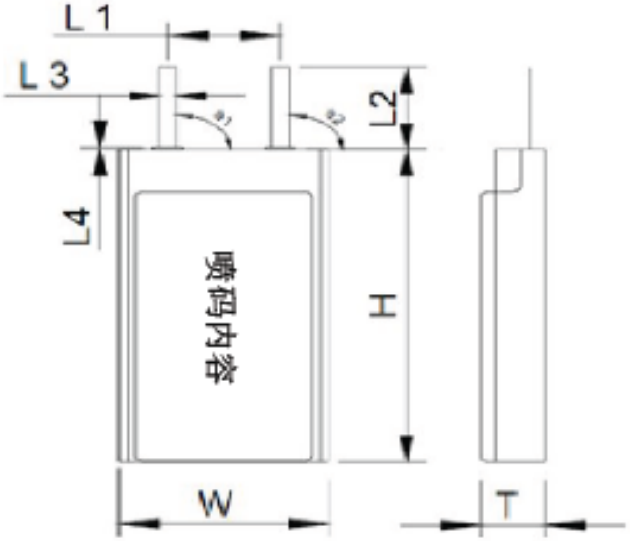


Fig. (1) The Dimension of Cell
图 (1) 单体电池外形尺寸图

Item 项目	Specifications 规格
T	2.90mm max.
W	50.5mm max.
H	50.5mm max.
L1	35.50±2.0mm
L2	10.0 ±2.0 mm
L3	2.0 ±0.1mm
L4	1.0 ±0.8mm
α 1	90±5 °
α 2	90±5 °

3. Basic Performance 基本性能

Single cell parameters 单体电芯参数

No.	Item 项目	Specification 性能	
1	Rated Capacity 额定容量	750mAh ,0.2 C discharging	
2	Minimum Capacity 最小容量	750mAh ,0.2 C discharging	
3	Energy density 能量密度	383Wh/L	
4	Normal Voltage 标称电压	3.7V	
5	O.C.V 出厂电压	3.80±0.15V	
6	Charge Ending Voltage 充电截止电压	4.20V	
7	Discharge Ending Voltage 放电截止电压	3.0V	
8	Standard charging 标准充电	23±2℃ 0.2C constant current charge to4.2V, then constant voltage4.2V charge till charged current declines to 0.02C	
9	Charge current 充电电流	Standard charge:0.2C	
		Rapid charge:0.5C	
10	charging Time 充电时间	Standard charge:5.5~6.5 h	
		Rapid charge:1.5~2.5 h	
11	Max. Charging Current 最大充电电流	0.5C (10℃~+45℃)	
12	Standard discharging Current 标准放电电流	-10℃~+55℃ 0.2C (constant current discharge to 3.0V)	
13	Max. Discharging Current 最大放电电流	1C (0℃~+55℃)	
14	Operating environment 工作环境	Charging: 0℃~45℃ Discharging: -20℃~+60℃	
15	Cell Impedance 单电芯内阻	MAX120mohm, (4.2V AC 1KHz measured)	
16	Dimension of Single Cell\ 单电芯尺寸	Thickness	Max2.90mm
		Width	Max50.5mm
		Height	Max50.5mm

4. Electrical Characteristics 电性能

4.1 Normal Test Conditions 标准测试条件

Temperature: 23±2℃

Relative Humidity: 45%~85%RH

Atmospheric pressure: 86~106 KPa

除非另有规定，本规格书中的各项测试应在标准大气条件下进行：

温度： 23±2℃

相对湿度：45%~85%RH

大气压力：86~106 KPa

4.2 Electrochemical Performance 电性能

NO. 序号	Item 项目	Criterion 性能标准	Test Method 测试方法
1	0.2C Discharging 0.2C 放电	Discharging time is not less than 5h. 放电时间应不小于 5h.	After standard charging, rest 0.5~1.0h, then 0.2C discharge to ending voltage. 标准充电后，电芯放置 0.5~1.0h，再 0.2C放电至终止电压。
2	1C Discharging 1C放电	Discharging time is not less than 51 minutes . 放电时间应不小于 51min	After Standard Charging, rest 0.5~1.0h, then 1C discharge to ending voltage . 标准充电后，电芯放置 0.5~1.0h，再 1C 放电至终止电压。
3	Cycle life 循环寿命	The cycle times is not less than 300 循环次数不小于 300 次	Test condition: Temperature: 23±2℃ Charge: 0.2C to4.2V Discharge: 0.2C to 3.0V When the discharge capacity reduced to 80% of rated capacity, Stop testing 测试条件: 温度：23±2℃ 充电：0.2C充电到4.2V 放电：0.2C放电到3.0V 当放电容量降至额定容量的 80%时，停止测试。

4	**Self-discharge 自放电**	Discharging time is not less than 4.25 hours. 放电时间应不低于 4.25h	After Standard Charging, test condition: Temperature: 20±5℃ Storage Time: 28days Then 0.2C discharge to ending voltage 标准充电后，测试条件如下： 温度：20±5℃ 搁置时间：28 天 再以 0.2C 放电至终止电压。
5	**Different Temperature Discharge Performance** 不同温度放电性能	After Standard Charging , Then to be discharged at several temperatures listed in below table. Cells shall be stored for4 hours at the test temperature prior to discharging and then shall be discharged at the test temperature by 0.2C to 3.0V . Each cell shall meet or exceed the requirements of below table . 标准充电后，再按下表中的温度要求放电，电池必须先在该试验温度下放置 4 个小时后再以 0.2C 放电至 3.0V，在每一个温度中的放电时间应不小于下表中的要求。	

No. （序号）	Item （项目）	Temperature & 0.2C Capacity （温度或 0.2C 容量）	
1	Discharge Temperature （放电温度）	-10℃(0.2C)	55℃(0.2C)
2	Discharge Time （放电时间）	3h	5h

4.3 Environment Characteristics 环境性能

NO 序号	Item 项目	Criterion 性能标准	Test Method 测试方法
1	**Constant temperature and constant humidity test** 恒定湿热	No explosion, no fire, no leakage. Discharging time is not less than 3hours 不起火、不爆炸、不泄漏。 放电时间不低于 3h.	After Standard Charging, test condition: Temperature: 40±5℃ Relative Humidity: 90~95%RH Storage Time: 48 hours Then return to room temperature for 2 hours, Then 0.2C discharged to ending voltage. 标准充电后，测试条件如下： 温度：40±5℃ 相对湿度：90~95% 放置时间：48 小时 电芯取出在室温下放置 2 小时，然后以 0.2C 电流放电至终

			止电压。
2	**Vibration test** **振动**	No explosion, no fire , no leakage. 不起火、不爆炸、不泄漏。	After Standard Charging, fixed the cell to vibration table, then subjected to vibration test for 3hours per axis of XYZ axes. Frequency change time: 15 min Vibration frequency: 7Hz~200Hz~7Hz Excursion (single amplitude): 0.8mm 电芯按标准充电后，固定在振动台上，然后沿 XYZ 每个坐标方向振动 3h. 频率变化时间：15 min 振动频率：7Hz~200Hz~7Hz 位移幅值(单振幅)：0.9mm
4	**Free fall test** **自由跌落**	No Leakage ,no explosion , no fire , Voltage offset≤10%. 不漏液，不爆炸，不起火。	The battery to be fully charged with standard charging condition , then fall from height of 1.0m and hit onto concrete ground. Drop every surface, a total of 6 times. 电池标准充电后，让其从 1.0m 高处自由落下，跌落在混凝土地。每面跌了一次，共 6 次。

4.4 Safety Characteristics 安全性能

NO 序号	Item 项目	Criterion 性能指标	Test Method 测试方法
1	**Overcharge test** **过充电性能**	No explosion, no fire 不起火、不爆炸	Discharge : 1C to3.0V Charge : 3C charge to 4.6V, and maintain 7 h. 放电：1C 放电至 3.0V 充电：3C 充电 4.6V，保持 7 小时
2	**Short circuit test** **短路**	No explosion, no fire 不起火、不爆炸	After Standard Charging, Short circuit the positive and negative, and the resistance of copper wire is 80±20mΩ ,When the temperature falls 20%lower than the peak , Stop testing or Short circuit time reached 24hours. 标准充电后，使用总内阻 80±20mΩ的导线短路正负极，当电池温度下降到比峰值低约 20%时或者短路时间达到 24h，结束试验。
3	**Thermal test** **热冲击**	No explosion, no fire 不起火、不爆炸	Put cell into an hot box, test condition: Temperature Rate : 5±2℃ /min Ending temperature :130℃±2℃ Keep temperature for 10 minutes , Then stop testing.

			将电芯放置于热箱中，测试条件如下： 升温速率：5±2℃/min 终止温度：130℃±2℃ 保持此温度 10min，然后停止测试。
Note: Above testing of safe characteristics must be with protective equipment. 备注：以上安全性能实验应在有保护措施的条件下进行。			

5. Storage and Shipment Requirement 存储及运输要求

Any issues not covered in this specification should be discussed between the customer and our company

Item 项目		Requirement 要求
Storage environment 储存环境	Short period less than 1 month 短期少于 1 个月	-20°C～+45°C，85%RH Max
	Long period more than 3 month 长期超过 3 个月	-10°C～+35°C，85%RH Max
	Recommend storage 推荐存储	15°C-35°C，85%RH Max
Long time storage : If the cell is stored for a long time, the cell's storage voltage should be 3.7-3.9V and the cell is to be stored in a condition as No.4.1.Also, it is recommended to charge the cell every six months.		

任何本说明书中未提及的事项，须经双方协商确定

6. Warning and Cautions 警告及注意事项

Danger warning (it should be described in manual or instruction for users, indicated especially) to prevent the possibility of the battery from leaking, heating, explosion. Please observe the following precautions:

危险警告：(应在使用说明手册或说明书中，特别注明）为防止电池可能发生泄漏，发热，爆炸，请注意以下预防措施：

- Don't immerse the battery in water and seawater. Please put it in cool and dry environment if no using.
  严禁将电池浸入海水或水中，保存不用时，应放置在阴凉干燥的环境中。
- Do not discard or leave the battery near a heat source as fire or heater
  禁止将电池在热高温源（如火、加热器）旁等使用、留置或丢入。

- Being charged, using the battery charger specifically for that purpose
  充电时请选用锂离子电池专用充电器。
- Don't reverse the positive and negative terminals
  严禁颠倒正负极使用电池。
- Don't connect the battery to an electrical outlet directly.
  严禁将电池直接接入电源插座。
- Don't connect the positive and negative terminal directly with metal objects such as wire. Short terminals of battery is strictly prohibited, it may damage battery.
  禁止用金属直接连接电池正负极短路，任何时候禁止短路电芯，它会导致电芯严重损坏。
- Do not transport and store the battery together with metal objects such as necklaces, hairpins.
  禁止将电池与金属，如发夹，项链等一起运输或贮存。
- Do not strike , throw or trample the battery.
  禁止敲击或抛掷，踩踏电池等。
- Do not directly solder the battery and pierce the battery with a nail or other sharp object
  禁止直接焊接电池和用钉子或其它利器刺穿电池。
- Do not use lithium ion battery and others different lithium polymer battery model in mixture
  禁止与液态锂离子或不同型号的聚合物锂电池混合使用
- Prohibition of use of damaged cells
  禁止使用已损坏的电芯
- Don't bend or fold sealing edge. Don't open or deform folding edge Don't fillet the end of the folding edge
  禁止弯折顶封边，禁止打开或破坏折边，禁止导折电芯折边底部
- Don't fall, hit, bend battery body.
  禁止坠落、冲击、弯折电芯。
- Battery pack designing and packing Prohibition injury batteries.
  电池外壳设计和包装禁止损伤电池。
- Never disassemble the cells
  在任何情况下不得拆卸电芯
- The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.
  更换电芯应由电芯供应商或设备供应商完成，用户不得自行更换。
- Keep the battery away from babies.
  电池应远离小孩.

Caution 小心

- Do not use or leave the battery at very high temperature conditions (for example, strong direct

sunlight or a vehicle in extremely hot conditions). Otherwise, it can overheat or fire or its performance will be degenerate and its service life will be decreased.

禁止在高温下（直热的阳光下或很热的汽车中）使用或放置电池，否则可能会引起电池过热，起火或功能失效，寿命减短。

- Do not use it in a location where is electrostatic and magnetic greatly, otherwise, the safety devices may be damaged, causing hidden trouble of safety.

  禁止在强静电和强磁场的地方使用，否则易破坏电池安全保护装置，带来不安全的隐患。

- If the battery leaks, and the electrolyte get into the eyes. Do not wipe eyes, instead, rinse the eyes with clean running water, and immediately seek medical attention. Otherwise, eyes injury can result.

  如果电池发生泄漏，电解液进入眼睛，请不要揉擦，应用清水冲洗眼睛，并立即送医治疗，否则会伤害眼睛。

- If the battery gives off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during use, recharging or storage, immediately remove it from the device or battery charge and stop using it.

  如果电池发出异味，发热，变色，变形或使用，贮存，充电过程中出现任何异常现象，立即将电池从装置或充电器中移离并停用。

- In case the battery terminals are dirt, clean the terminals with a dry cloth before use. Otherwise power failure or charge failure may occur due to the poor connection with the instrument.

  如果电池弄脏，使用前应用干布抹净，否则可能会导致接触不良功能失效。

- Prohibition of use of damaged cells

  禁止使用已损坏的电芯

- Be aware discharged batteries may cause fire; tape the terminals to insulate them.

  废弃之电池应用绝缘纸包住电极，以防起火，爆炸。

7. Note 声明

Note (1): The customer is requested to contact in advance if and when the variations of the operating conditions described in this document. Additional experimentation may be required to verify performance and safety under such conditions.

声明一：

客户若需要将电芯用于超出文件以外的设备，或在文件规定以外的使用条件下使用电芯，应事先联系。因为需要进行特定的实验测试以核实电芯在该使用条件下的性能及安全性。

Note (2): take no responsibility for any accident when the cell is used under conditions outside of this specification.

声明二：

对于在超出文件规定以外的条件下使用电芯而造成的任何意外事故，概不负责。

Note (3): inform the customer in writing of improvement(s) regarding proper use and handling of the cell if it is deemed necessary.

Energy reserves the right to revise this specification before the customer signs the datasheet. If a revision is required, notify the customer.

声明三：

如有必要会以书面形式告知客户有关正确操作使用电芯的改进措施。

在规格书未签确前，本公司有权对本产品规格书进行修订，如有必要修订后将会通知客户。

Appendix.附录

N/A

Attached 3. PCM Specification

To :

APPROVAL SHEET

PRODUCT		:	Protection Circuit Module
PRODUCT	NO.	:	GSP 600 (LI506)
REVISION	NO.	:	A1
CELL	Type	:	1 Cell

	Checked 1	Checked 2	Approved

	Designed	Checked1	Approved
GSP Co., Ltd.			
	S.J KIM		**William**

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	PRODUCT GROUP	ISSUED DATE
지에스피(주)	Protection Circuit Module	2015-11-10

NO.	Date	Item	VERSION
1	15/11/10	1) INITIAL RELEASE	A1

CONTENTS

1. SPECIFICATION

1.1 SCOPE

This specification applies to Lithium battery protection module, GSP-600.

1.2 FUNCTION

1) Over charge detection

2) Over discharge detection

3) Over current detection

4) Short detection

1.3 MECHANICAL CHARACTERISTICS

1) PCB MATERIAL : FR-4, 1 oz, 2Layers, 0.6 T ± 0.2(mm)

2) PCM SIZE : 40(L) x 3.5(W) x 0.75(T) mm

1.4 ELECTRIC FEATURES

1.4.1 ABSOLUTE FEATURES

1) Maximum input voltage : 12VDC

2) Maximum charge current : 1.5A

3) Maximum discharge current : 1.5A

4) Maximum operating temperature : -40˚C ~ +85˚C

5) Maximum storage temperature : -55˚C ~ +125˚C

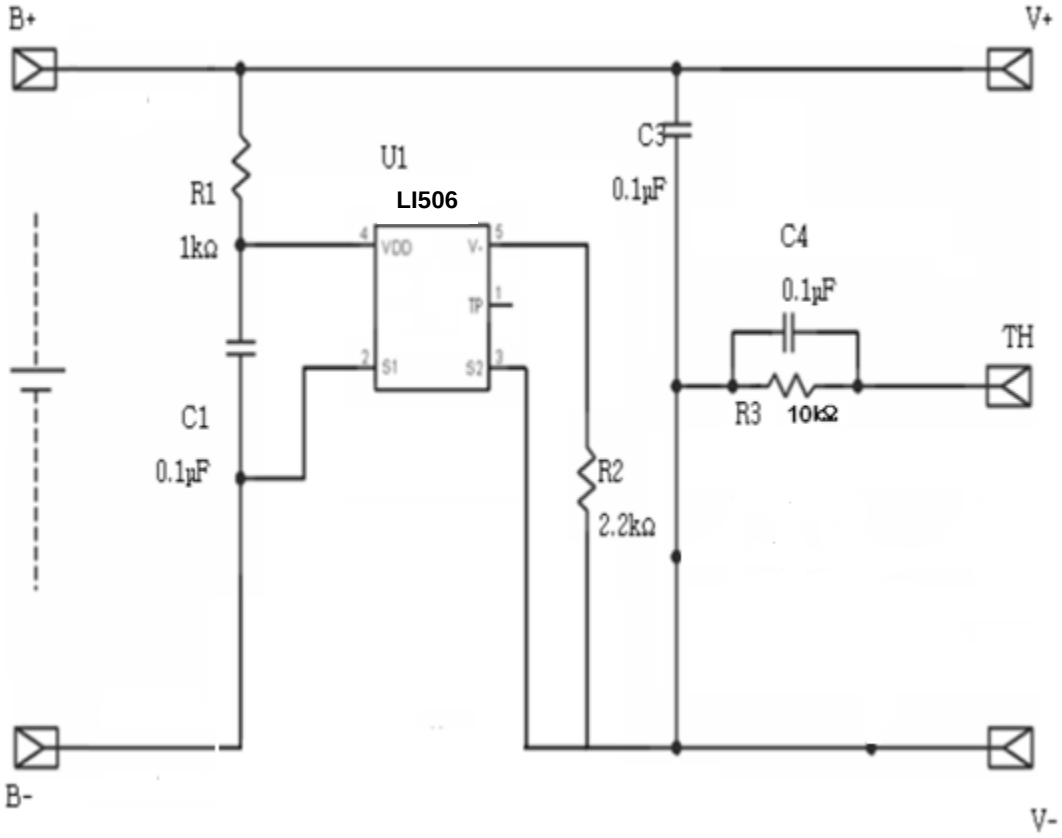
1.4.2 ELECTRIC CHARACTERISTICS(@25℃)

1) Over charge detection voltage : 4.265V ± 35mV
2) Over discharge detection voltage : 2.300V ± 110mV
3) Over discharge current detection : 1.5A – 4.0A
4) Over charge current detection : 1.5A – 4.0A
5) Over charge detection delay time : 700.0mSec ~ 1300.0mSec
6) Over discharge detection delay time : 0.6mSec ~ 1.4mSec
7) Over discharge current detection delay time : 4mSec ~ 22mSec
8) Over charge current detection delay time : 5.0mSec ~ 35.0mSec
9) Consumption current
   – Operating mode : Max 7.0 uA (Typ. 3.0 uA.)
   – Power - saving mode : Max 0.5 uA.
10) Thermistor : 8 – 12KΩ

1.4.3 RELIABILITY TEST

1) Vibration test : 10 ~ 55Hz(Movement Time: 1 Minute), 1.5mm, X,Y,Z each 1 Hour
2) Humidity test : +60 ˚C 85%RH
3) High temperature : +85 ˚C 1,000 Hours
4) Low temperature : -25 ˚C 1,000 Hours
5) ESD : Normal operation in all parts
   at ±10KV (CONTACT), ±15KV(AIR) condition

2. CIRCUIT DIAGRAM

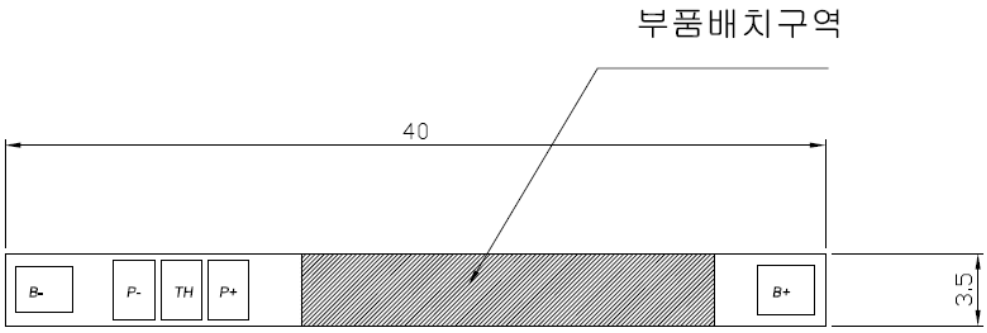


Pin name	Pin descriptions
B+	Connect positive terminal of cell.
B-	Connect negative terminal of cell.
P+	Contact positive terminal of output.
P-	Contact negative terminal of output.
TH	Contact NTC thermistor terminal of output.

3. PCB LAYOUT

TOP PATTERN	
TOP SOLDER MASK	
TOP SILK	
BOTTOM PATTERN	
BOTTOM SILK	

4. PCB MECHANICAL DRAWING



TOP SIDE(Component Side)

Remark

1. ONECHIP MP45A 적용

NOTES

1. Material: FR-4 0.6T
2. Part must be RoHs compliant.
3. "▲" These dimensions are considered inspectable
4. Hold Current:

5. PARTS LIST

NO	LOCATION	품명	규격	사이즈	소요량	VENDER
1	U1	ONE CHIP	LI506	TEP-6L	1	ITM Semiconductor
2	R1	CHIP RESISTOR	1.0KΩ(±5%)	1005(0402)	1	KMMAYA,YAEGO
3	R2		2.2KΩ(±5%)	1005(0402)	1	KMMAYA,YAEGO
4	R3(TH)	THEMISTOR	10KΩ(±3%) B-3435K	1005(0402)	1	JOINSET
6	C1	CHIP CAPACITOR	0.1μF 16V(80/-20%)	1005(0402)	1	MURATA,PYCOMP ,YAGEO
7	C3		0.1μF 25V(80/-20%)	1005(0402)	1	MURATA,PYCOMP, YAGEO
9	C4		0.1μF 25V(80/-20%)	1005(0402)	1	MURATA,PYCOMP, YAGEO

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6. DATA SHEET