



昌 勃 股 份 有 限 公 司
DR.POWER CORPORATION
零 件 規 格 書 / 承 認 書
SPECIFICATION FOR APPROVAL

CUSTOMER : _____

DESCRIPTION : _____

MODEL : _____

CUSTOMER PART NO : _____

APPROVED SIGNATURES

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Rev	Date	Description	Designed	Checked	Approved
A	2021/5/10	Release		PO Chen	

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	Document Name		Rev.	1.0
	Model No.	INR 21700-50E-3S11P		

Revision of Specification

Rev.	Date	Description	Prepared	Approved
1.0	2021/5/10	First Issue	Simon	Simon

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	Model No.	INR 21700-50E-3S11P		

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1. Scope

This specification shall be applied to Sonata Lithium Ion battery pack (3 series 11 parallel)

* Recharge battery after long time storage before use.

2. Composition

The Single cell consists of **4900** mAh capacity also Battery Pack **53.9** Ah combines with protection circuit and thermal protection.

3. Product specification

No	Item	Rating performance	Remark
1	Typical Capacity	53.9 Ah	0.2C discharging to 3.0V
2	Nominal voltage	10.8 v	
3	Maximum charge voltage	12.75 v	
4	The end of discharging voltage	7.5 v	
5	Suggestive charging current(standard)	2450mA	0°C to 40°C
6	Suggestive charging current(Max)	4900mA	0°C to 40°C
7	Suggestive continuous discharging current	9.8A	-20°C to 60°C
8	Suggestive continuous discharging current (Max)	<12A	0°C to 60°C
9	Internal resistance	< mΩ	Measured by the alternate current method (1Khz)
10	Outer Dimension(mm) (L*W*T)	150*96.5*76mm (Max)	
11	Weight	2357	g
12	Storage temperature (At the shipment state)	Less than 1 months	-20°C ~ +60°C
		Less than 3 months	-20°C ~ +45°C,
		Less than 1 years	-20°C ~ +23°C,

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4. Protection Circuit Module

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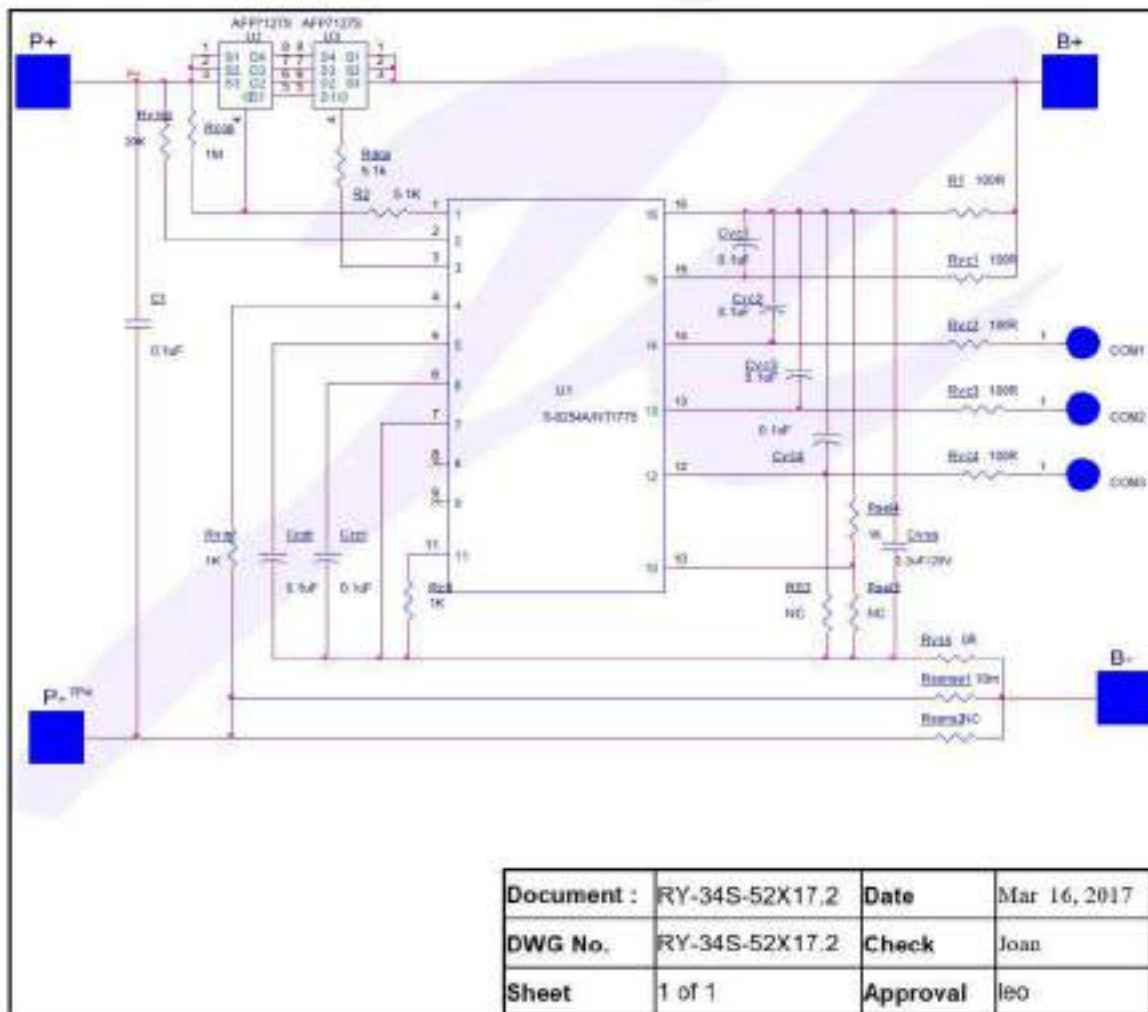
1. Introduction :

This specification provides engineering information and electrical specifications for the protection circuit module of Li-ion cells.

2. Description :

The RY-34S-52X17.2 PCM provides protection functions for three-cell Li-ion battery. The semiconductor devices with ESD protections are utilized on RY-34S-52X17.2 PCM.

3. Circuit diagram :



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4. Major components :

ITEM	P/N	Package
Li-ion Protection IC	NT1775-AAN	16-Pin TSSOP
MOSFET	FKBB3105	TDFN 3.3*3.3

5. Bill of materials :

Document : RY-34S-52X17.2

Revision : A

Date : Mar 16, 2017

No.	Bill of materials for 3S1P			Q'ty	Maker	REMARK
	Ref.	Part Name	DESCRIPTION			
1	Cvc1	Capacitor	0.1 μ F / 50V	1	Yageo, or equivalent	
2	C1	Capacitor	0.1 μ F / 50V	1	Yageo, or equivalent	
3	Cvc2	Capacitor	0.1 μ F / 50V	1	Yageo, or equivalent	
4	Cvc3	Capacitor	0.1 μ F / 50V	1	Yageo, or equivalent	
5	Ccdt	Capacitor	0.1 μ F / 50V	1	Yageo, or equivalent	
6	Ccct	Capacitor	0.1 μ F / 50V	1	Yageo, or equivalent	
7	Cvss	Capacitor	2.2 μ F / 25V	1	Yageo, or equivalent	
8	Cvc4	Capacitor	0.1 μ F / 50V	1	Yageo, or equivalent	
9	Rsc13	Resistor	1K Ω \pm 5%	NC	Yageo, or equivalent	
10	Rs3	Resistor	100R \pm 5%	NC	Yageo, or equivalent	
11	Rvini,R ctl	Resistor	1K Ω \pm 5%	2	Yageo, or equivalent	

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No.	Bill of materials for 3S1P			Q'ty	Maker	REMARK
	Ref.	Part Name	DESCRIPTION			
12	Rsel4	Resistor	1K Ω \pm 5%	1	Yageo, or equivalent	
13	R2, Rdop	Resistor	5.1K Ω \pm 5%	2	Yageo, or equivalent	
14	Rcop	Resistor	1M \pm 5%	1	Yageo or equivalent	
15	Rvc1	Resistor	100R \pm 5%	1	Yageo, or equivalent	
16	R1	Resistor	100R \pm 5%	1	Yageo, or equivalent	
17	Rvc2	Resistor	100R \pm 5%	1	Yageo, or equivalent	
18	Rvc3	Resistor	100R \pm 5%	1	Yageo, or equivalent	
19	Rvc4	Resistor	100R \pm 5%	NC	Yageo, or equivalent	
20	Rsense1	Resistor	10m Ω \pm 1%	1	Yageo, or equivalent	
21	Rsens2	Resistor	10m Ω \pm 1%	NC	Yageo, or equivalent	
22	Rvmp	Resistor	20k \pm 5%	1	Yageo, or equivalent	
24	Rvss	Resistor	0R \pm 5%	1	Yageo, or equivalent	
25	RT	Thermistor	10K Ω \pm 1%	1	Joinset, or equivalent	
26	UI	Protection IC	NT1775-AAN	1	Neotec or equivalent	
27	U2,U3	MOSFET	FKBB31.5	1	Fetek or equivalent	
28	-	PCB	RY-34S-52X17.2	1	equivalent	

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6. Absolute maximum rating :

Parameter	Rating	Unit
Operating temperature range	-40 ~ +85	°C
Operating humidity range	Less than 85% RH	%RH
Storage temperature range	-40 ~ +125	°C
Storage humidity range	Less than 85% RH	%RH
Voltage between terminals of V+ and V-	40	V
Voltage Between terminals of B+ and B-	25	V

Remarks :

- (1) The negative voltage is not allowed to be applied between the charge / discharge terminals (+ and -) or between the cell connection terminals (B+ and B-)

7. Basic functions :

(1) Over-charge protection

Over-charge occurs whenever the voltage applied to battery is over 4.25V.

Protection circuit on RY-34S-52X17.2 should stop charging the battery when over-charge condition occurs and any deformation in the outer appearance of the Lithium cell connected to RY-34S-52X17.2 should not occur.

(2) Over-discharge protection

Over-discharge occurs whenever the battery is discharged with voltage below 2.5V.

Protection Circuit on RY-34S-52X17.2 should stop discharging the cells when over-discharge condition occurs.

(3) Over-current protection

Over-current condition occurs when excessive discharge current occurs (The excessive current threshold is higher than 0.1V when NT1775-AAN is used.)

Protection circuit on RY-34S-52X17.2 should stop discharging the cell when over-current condition occurs.

(4) Short-circuit protection

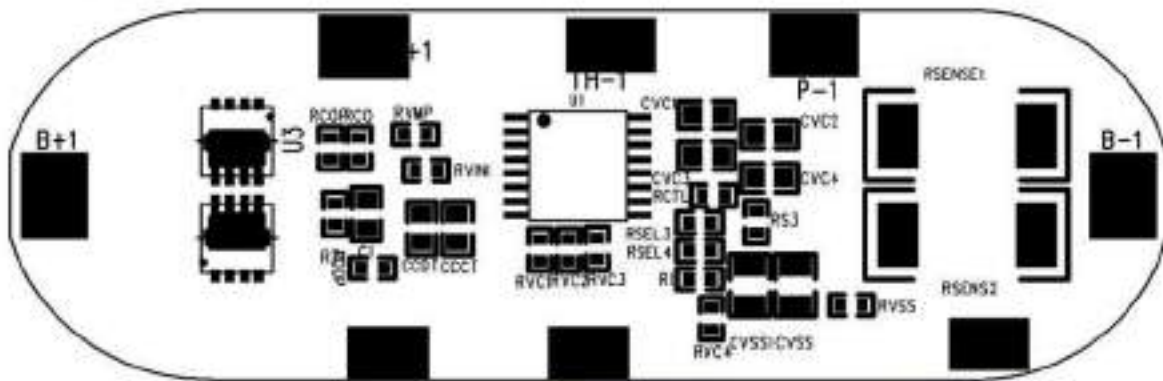
Short-circuit condition occurs when the terminals between + and - is shortened.

Protection circuit on RY-34S-52X17.2 should stop discharging the cell when short-circuit condition occurs and temperature of MOSFET should not be overheated.

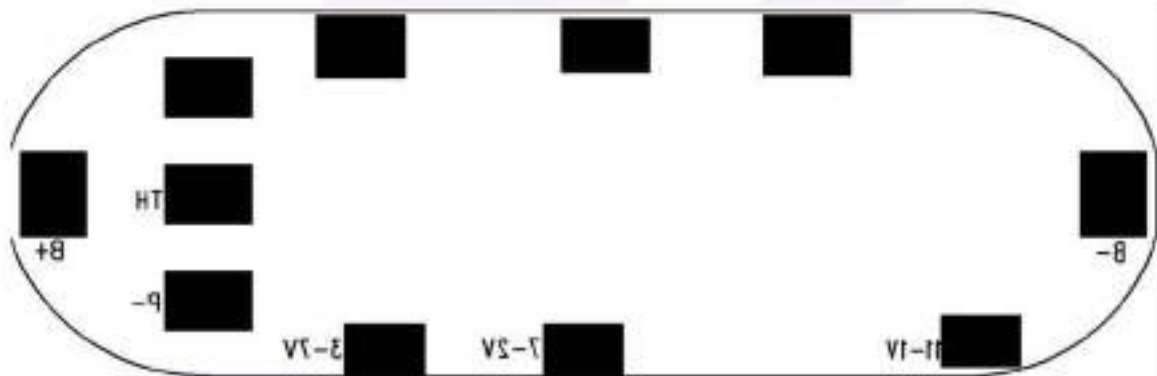
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8. Pin Layout Diagram :

Component side :



Solder side



PIN	Description
B+	Battery+
B-	Battery-
3-7V*	Battery COM 1
7-2V*	Battery COM 2
11+1V*	Battery COM 3NC
P+	Phone + / Charger +
P-	Phone - / Charger -
NTC	10K 1%

*COM marked point voltage value, based on the standard voltage of 3.7V batteries, the positive end of the measurement starting point, and gradually move was made in the negative terminal voltage.

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9. Electrical characteristics :

9.1 Parameters of protection circuit (@25°C) :

No	Item	Specification	Unit
1	Over-charge detection voltage	4.2500±0.025	V
2	Over-charge release voltage	4.1500±0.050	V
3	Over-discharge detection voltage	2.50±0.080	V
4	Over-discharge release voltage	3.00±0.100	V
5	Over-current detection voltage	0.10±0.025	V
6	Over-charge detection delay time	500~1500	msec
7	Over-discharge detection delay time	50~150	msec
8	Over current detection delay time	5~15	msec
9	Supply current (Normal mode)	~30	μA
10	Supply current (Protection mode)	< 0.1	μA

9.2 Requirement of protection functions (@25°C) :

No.	Item	Criteria
1	Over-charge inhibition	4.2500±0.025 (from cell terminal)
2	Over-charge protection recovery method	When the battery is connected to the cellular phone, the protective condition is released.
3	Over-discharge inhibition	2.50±0.080 (from cell terminal)
4	Over-discharge protection recovery method	When the battery is charged, the protective condition is released.
5	Over-current protection	7.5~12.4A
6	Over-current release	Reset by load release

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10. Specification of PCB :

Material	FR-4
Dimension	52X17.2 (+/- 0.2)mm
Thickness	0.8(+/- 0.15)mm (overall)
UL	94V-0

1. Material 1 oz copper double sided bonded to FR-4 base material.
2. 2 layers with through hole.
3. All through hole connections to have solder resist applied.
4. Printed Silk.
5. Contacts are Sn

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5. Battery Specification

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Spec. No.	INR21700-50E	Version No.	0.2
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Specification of Product

Tentative

- 1. Customer :
- 2. Product : Lithium-ion Rechargeable Cell
- 3. SDI Model : **INR21700-50E**
- 4. Approved by

Division			
Signature			
Date	/ /	/ /	/ /

5. Date of Application (YY/MM/DD) : 2017/12/19

6. Supplier : **SAMSUNG SDI Co., Ltd.**
Battery Business Division

Issued	Checked	Approved

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Revision history

Revision No.	Date (yr-m-d)	Page	Item	Description	Changes / Author
v0.0	'17-10-13			First version (Tentative)	JH, Lee
v0.1	'17-10-31			Packaging, condition update	JH, Lee Lucy Kim
v0.2	'17-12-07			Add Standard characteristics (Tentative ver.)	SoonChul Byun Wayne Kim

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1. Scope

This product specification has been prepared to specify the rechargeable lithium-ion cell ('cell') to be supplied to the customer by Samsung SDI Co., Ltd.

2. Description and Model

2.1 Description	Cell (lithium-ion rechargeable cell)
2.2 Model	INR21700-50E
2.3 Site	Manufactured in Korea

3. Nominal Specifications (*1)

Item	Specification
3.1 Standard discharge Capacity	Min 4,900mAh - Charge : 0.5C(2,450mA), 4.2V, 0.02C(98mA) cutoff @ RT - Discharge : 0.2C(980mA), 2.5V cutoff @ RT * 1C = 4,900mA
3.2 Rated discharge Capacity	Min 4,753mAh - Charge : 0.5C(2,450mA), 4.2V, 0.02C(98mA) cutoff @ RT - Discharge : 1C(4,900mA), 2.5V cutoff @ RT
3.3 Charging Voltage	4.2V
3.4 Nominal Voltage	3.6V
3.5 Charging Method	CC-CV (constant voltage with limited current)
3.6 Charging Current	Standard charge: 2,450mA
3.7 Charging Time	Standard charge: 3hours
3.8 Max. Charge Current	4,900mA (not for cycle life)
3.9 Max. Discharge Current	9,800mA (for continuous discharge) 14,700mA (not for continuous discharge)
3.10 Discharge Cut-off Voltage	2.5V
3.11 Cycle life	Capacity ≥ 3,802mAh @ after 500cycles (80% of the Rated Discharge Capacity @ RT) - Charge : 0.5C(2,450mA), 4.2V, CCCV 0.05C(245mA) cut-off @ RT - Discharge: 1C(4,900mA), 2.5V cut-off @ RT
3.13 Recovery characteristics	Capacity recovery (after the storage) ≥ 4,278mAh (90% of the Rated Discharge Capacity @ RT) - Charge : 0.5C(2,450mA), 4.2V, 0.02C(98mA) cutoff @ RT - Storage : 30 days @ 60°C - Discharge : 1.0C(4,900mA) 2.50V cut-off @ RT
3.14 Cell Weight	69g max
3.15 Cell Dimension	Cell height : Max.70.80mm Diameter : Φ Max.20.25mm

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3.16 Operating Temperature ^{(*)2} (Cell Surface Temperature)	Charge : 0 to 45°C Discharge : -20 to 60°C
3.17 Storage Temperature ^{(*)3}	1 year : -20~23°C 3 months : -20~45°C 1 month : -20~60°C

Note (*1): Protection function of the battery pack should be set within the specified charge, discharge and temperature range in the Cell Specification.

Note (*2): Discharge OTP(over temp. protection) should not be over 60°C of the cell surface temperature. Protection set should be based on the location of the cell surface with the highest temp increase part of the battery pack

Note (*3): If the cell is kept as ex-factory status (30% of charge), the capacity recovery rate is more than 80%.

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4. Outline Dimensions

See the Fig. 1

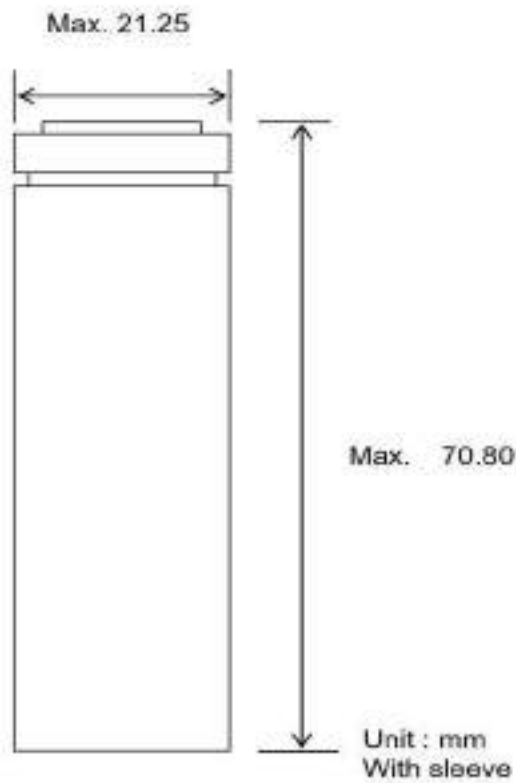


Fig. 1 Outline Dimensions of INR21700-50E

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5. Appearance

There shall be no such defects as scratch, rust, discoloration, leakage which may adversely affect commercial value of the cell.

6. Standard Test Conditions

6.1 Environmental Conditions

Unless otherwise specified, all tests stated in this specification are conducted at temperature $23 \pm 3^{\circ}(\text{@RT})$ and humidity under 65%.

6.2 Measuring Equipment

(1) Amp-meter and Volt-meter

The amp-meter and volt-meter should have an accuracy of the grade 0.5mA and mV or higher.

(2) Slide caliper

The slide caliper should have 0.01 mm scale.

(3) Impedance meter

The impedance meter with AC 1kHz should be used.

7. Characteristics

7.1 Standard Charge

This "Standard Charge" means charging the cell with charge current of 0.5C (2,450mA) and constant voltage 4.2V and 0.02C(98mA) cut-off in CV mode at 23°C.

7.2 Standard Discharge Capacity

The standard discharge capacity is the initial discharge capacity of the cell, which is measured with discharge current of 0.2C(980mA) with 2.50V cut-off at 23°C within 1 hour after the Standard charge.

$$\text{Standard Discharge Capacity} \geq 4,900\text{mAh}$$

7.3 Rated Discharge Capacity

The rated discharge capacity is the initial discharge capacity of the cell, which is measured with discharge current of 1C(4,900mA) with 2.50V cut-off at 23°C within 1 hour after the Standard charge.

$$\text{Rated Discharge Capacity} \geq 4,753\text{mAh (97\% of 4,900mAh)}$$

7.4 Initial internal impedance

Initial internal impedance measured at AC 1kHz after Standard charge.

$$\text{Initial internal impedance} \leq 35\text{m}\Omega$$

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7.5 Temperature Dependence of Discharge Capacity

Discharge capacity comparison at each temperature, measured with discharge constant current 1C(4,900mA) and 2.50V cut-off with follow temperature after the standard charging at 23°C.

Charge Temperature	Discharge temperature		
23°C	-10°C	23°C	40°C
Relative Capacity	60%	97%	97%

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is 3 hours.
Percentage as an index of the Standard discharge capacity (=4,900mAh) at 23°C is 100%.

7.6 Discharge Rate Capabilities

Discharge capacity is measured with the various currents in under table and 2.50V cut-off after the Standard charge at 23°C.

	Discharge condition		
Current	0.2C (980mA)	1C (4900mA)	2C (9800mA)
Relative Capacity	100%	97%	95%

Note: Percentage as an index of the Standard discharge capacity (=4,900mAh) is 100%.

7.7 Cycle Life

Each cycle is an interval between the charge (charge current 2,450mA) with 0.05C(245mA) cut-off and the discharge (discharge current 4,900mA) with 2.50V cut-off. Capacity after 500cycles.

Capacity \geq 3,802mAh (80% of Rated Capacity)

7.9 Recovery Characteristics

Capacity after storage for 30days at 60°C after the Standard charged at 23°C, measured with discharge current 4,900mA with 2.50V cut-off at 23°C.

Capacity recovery(after the storage) \geq 4,278mAh (90% of Rated Capacity)

7.10 Status of the cell as of ex-factory

The cell should be shipped in 3.43V ~ 3.63V Charging voltage range.

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8. Mechanical Characteristics

8.1 Drop Test

Test method: Each fully charged cell or battery is dropped three times from a height of 1.0 m onto a concrete floor. The cells or batteries are dropped so as to obtain impacts in random orientations. After the test, the sample shall be put on rest for a minimum of one hour and then a visual inspection shall be performed.

Criteria: No fire, no explosion

Drop test shall be performed with the IEC 62133

8.2 Vibration Test

Test method: As to the UN transportation regulation(UN38.3), for each axis (X and Y axis with cylindrical cells) 7Hz→200Hz→7Hz for 15min, repetition 12 times totally 3hours, the acceleration 1g during 7 to 18Hz and 8g (amplitude 1.6mm) up to 200Hz.

Criteria: No leakage, with less than 10mV of OCV drop

Vibration test shall be performed with the UN38.3 standard

9. Safety

9.1 Overcharge test

Test method: To charge the standard charged cell with 4.2V and 3C (7,35A) at 23°C for 7 hours

Criteria: No fire, and no explosion.

Overcharge test shall be performed with the UL1642 standard

9.2 External short-circuit test

Test method: Fully rated charged cell is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of $80 \pm 20 \text{ m}\Omega$. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2 V and the battery case temperature has returned to $\pm 10^\circ\text{C}$ of ambient temperature. The return to near ambient of the battery (cell) casing in an indication of ultimate results. Tests are to be conducted at $20 \pm 5^\circ\text{C}$ and at $55 \pm 5^\circ\text{C}$.

Criteria: No fire, and no explosion.

External short-circuit test shall be performed with the UL1642 standard

9.3 Forced discharge test

Test method: A discharged cell is subjected to a reverse charge at 1.0C(4,900mA) for 90 min.

Criteria: No fire, and no explosion.

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Forced discharge test shall be performed with the IEC62133 standard

9.4 Heating test

Test method: To heat up the standard charged cell at heating rate 5°C per minute up to 130°C and keep the cell in oven for 30 min.

Criteria: No fire, and no explosion.

Heating test shall be performed with the UL1642 standard(10 min) & GB31241 standard(30 min).

10. Warranty

Samsung SDI will be responsible for replacing the cell against defects or poor workmanship for 15 months from the date of shipping. Any other problems caused by malfunction of the equipment or unsuitable use of the cell are not under this warranty.

The warranty set forth in proper use, handling conditions described above, and excludes in the case of a defect which is not related to manufacturing of the cell.

11. Others

11.1 Storage for a long time

If the cell is kept for a long time (3months or more), It is strongly recommended that the cell is preserved at dry and low-temperature.

11.2 Other

Any matters that specifications does not have, should be conferred with between the both parties.

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12. Packaging

See Fig.2: Package Drawing

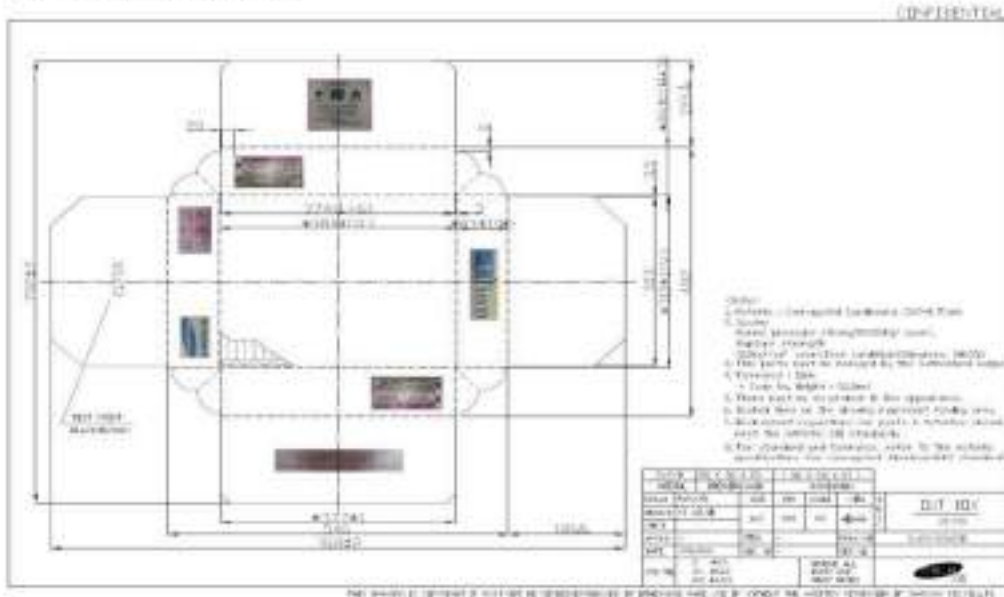


Fig. 2-1. Outer box package drawing.

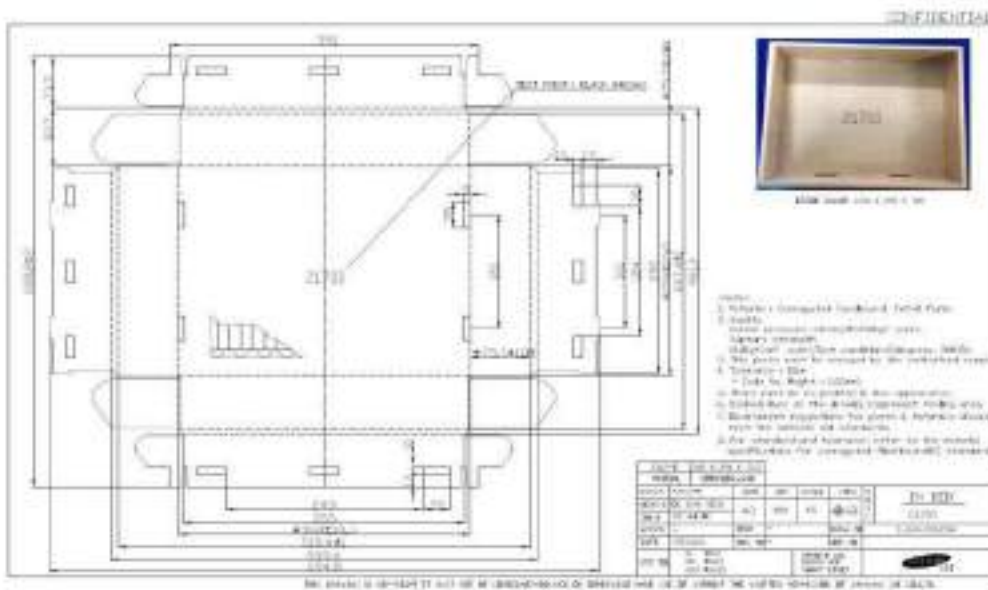


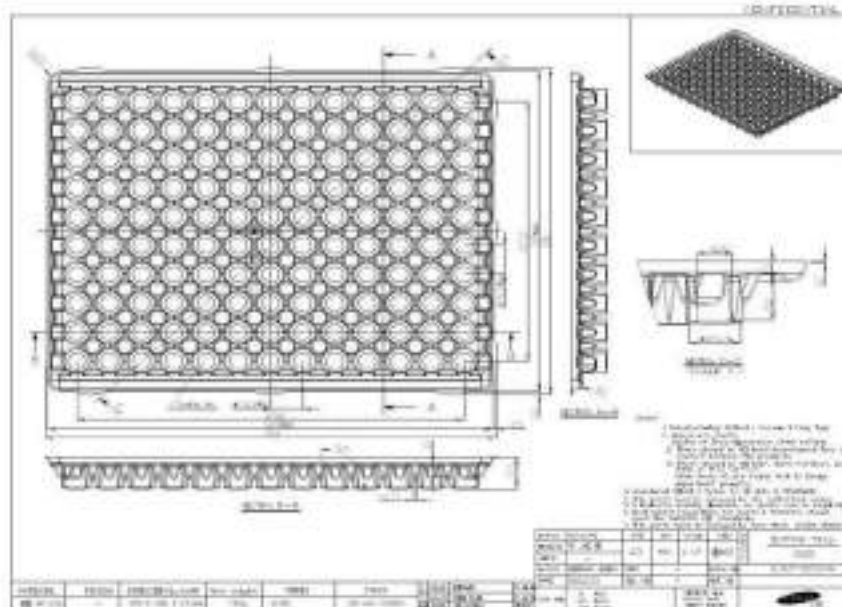
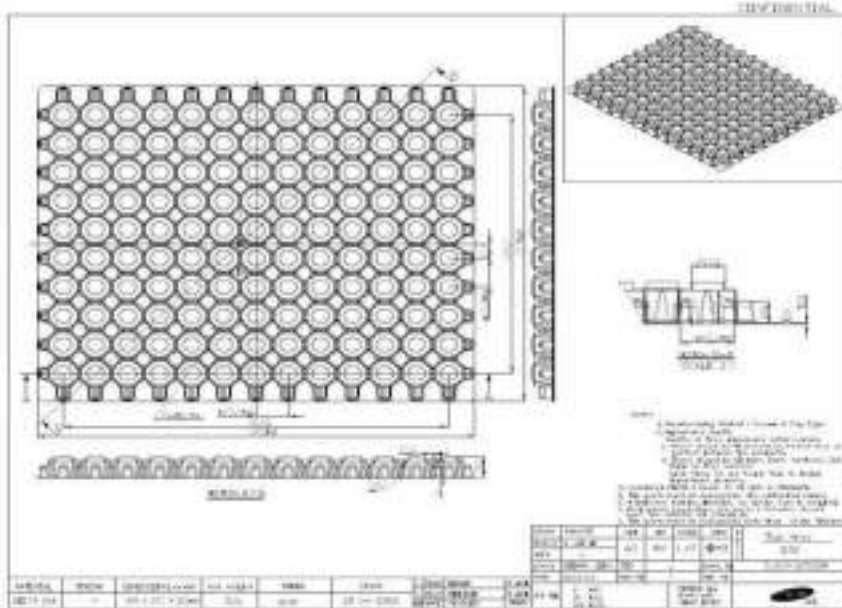
Fig. 2-2. Inner box package drawing.

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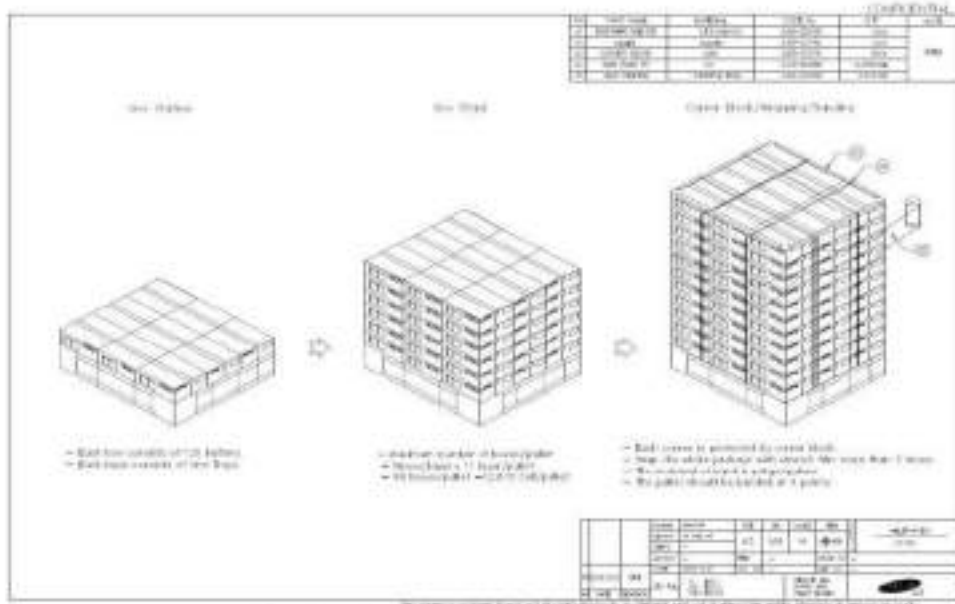


Fig. 2-5. Pallet packaging process

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Proper Use and Handling of Lithium Ion Cells

See before using lithium-ion cell

This document has been prepared to describe the appropriate cautions and prohibitions, which the customer should take or employ when the customer uses and handles the lithium ion cell to be manufactured and supplied by Samsung SDI Co., Ltd., in order to obtain optimum performance and safety.

1. Charging

1.1 Charging current

Charging current should be less than maximum charge current specified in the product specification.

1.2 Charging voltage

Charging should be done by voltage less than that specified in the product specification.

1.3 Charging time

Continuous charging under specified voltage does not cause any loss of performance characteristics. However, the charge timer is recommended to be installed from a safety consideration, which shuts off further charging at time specified in the product specification.

1.4 Charging temperature

The cell should be charged within a range of specified temperatures in the specification.

1.5 Reverse charging

The cell should be connected, confirming that its poles are correctly aligned. Inverse charging should be strictly prohibited. If the cell is connected improperly, it may be damaged.

2. Discharging

2.1 Discharging

The cell shall be discharged continuously at less than maximum discharge current specified in the product specification. In case of the higher discharge current should be set, it shall be discussed together with SDI.

2.2 Discharging temperature

2.2.1 The cell should be discharged within a range of temperatures specified in the product specification.

2.2.2 Otherwise, it may cause loss of characteristics.

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2.3 Over-discharging

- 2.3.1 The system should be equipped with a device to prevent further discharging exceeding discharging cut-off voltage specified in the product specification.
- 2.3.2 Over-discharging may cause loss of performance, characteristics of battery function.
- 2.3.3 Over-discharging may occur by self-discharge if the battery is left for a very long time without any use.
- 2.3.4 The charger should be equipped with a device to detect cell voltage and to determine recharging procedures.

3. Storage

3.1 Storage conditions

- 3.1.1 The cell should be stored within a range of temperatures specified in the product specification.
- 3.1.2 Otherwise, it may cause loss of performance characteristics, leakage and/or rust.

3.2 Long-term storage

- 3.2.1 The cell should be used within a short period after charging because long-term storage may cause loss of capacity by self-discharging.
- 3.2.2 If long-term storage is necessary, the cell should be stored at lower voltage within a range specified in the product specification, because storage with higher voltage may cause more loss of performance characteristics.
- 3.2.3 Store the battery at 0 ~ 23°C, low humidity (below 65%), no dust and no corrosive gas atmosphere.

4. Cycle life

4.1 Cycle life performance

- 4.1.1 The cell can be charged/discharged repeatedly up to times specified in the produce specification with a certain level of capacity also specified in the product specification.
- 4.1.2 Cycle life may be determined by conditions of charging, discharging, operating temperature and/or storage.

5. Battery Pack Assembly

5.1 Prohibition of usage of damaged cell

- 5.1.1 The cell should be inspected visually before battery assembly.
- 5.1.2 The cell should not be used if sleeve-damage, can-distortion and/or electrolyte-smell is detected.

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5.2 Terminals handling

5.2.1 Excessive force on the negative terminal should be avoided when external strip terminal is welded.

5.3 Transportation

5.3.1 If the cell is necessary to be transported to such as the battery manufacturer, careful precautions should be taken to avoid damage of cell.

6. Others

6.1 Disassembly

6.1.1 The cell should not be dismantled from the battery pack.

6.1.2 Internal short-circuit caused by disassembly may lead to heat generation and/or venting.

6.1.3 When the electrolyte is coming in contact with the skin or eyes, wash immediately with fresh water and seek medical advice.

6.2 Short-circuiting

6.2.1 Short-circuit results in very high current which leads to heat generation.

6.2.2 An appropriate circuitry should be employed to protect accidental short-circuiting.

6.3 Incineration

6.3.1 Incinerating and disposing of the cell in fire are strictly prohibited, because it may cause rupture and explosion.

6.4 Immersion

6.4.1 Soaking the cell in water is strictly prohibited, because it may cause corrosion and leakage of components to be damaged to functions.

6.5 Mixing use

6.5.1 Different types of cell, or same types but different cell manufacturer's shall not be used, which may lead to cell imbalance, cell rupture or damage to system due to the different characteristics of cell.

6.5.2 Do not mix use the cells from different batches/ranks even they are the same cell types from the same manufacturer.

6.6 Battery disposal

6.6.1 Although the cell contains no environmentally hazardous component, such as lead or cadmium, the battery should be disposed according to the local regulations when it is disposed.

6.6.2 The cell should be disposed with a discharged state to avoid heat generation by an inadvertent short-circuit.

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6.7 Caution

- 6.7.1 The Battery used in this device may present a risk of fire or chemical burn if mistreated.
- 6.7.2 Do not disassemble, expose to heat above 100°C or incinerate it.
- 6.7.3 Replace battery with Samsung SDI battery only.
- 6.7.4 Use of another battery may present a risk of fire or explosion.
- 6.7.5 Dispose of used battery promptly.
- 6.7.6 Keep away from children.
- 6.7.7 Do not disassemble and do not dispose of in fire.

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Pack Design Guideline for Lithium Ion Cells

If a customer's battery pack cannot meet Pack Design Guideline, SDI cannot take responsibility for a quality issue about a battery cell.

1. Electrical design

1.1 Charge

- 1.1.1 Stop charging the battery if charging isn't completed within the specified time.
- 1.1.2 The battery can be used within the following temperature ranges.
Don't exceed these ranges.
Charge temperature ranges : 0°C ~ 45°C
- 1.1.3 Charge current must be controlled by specified value in Cell specification.
- 1.1.4 Cut-off Voltage of charging must be under 4.2V.
- 1.1.5 Charger must stop charging battery by detecting either charging time or current specified in Cell's specification.
- 1.1.6 Recharge Voltage must be at least 0.1V lower than Max charging Voltage.
- 1.1.7 Do not charge the battery under 1.0V voltage.
- 1.1.8 Voltage range of the battery for pre-charge mode is 1.0 ~ 3.0V with a charging current of 0.1 ~ 0.5C

1.2 Discharge

- 1.2.1 Discharge current must be controlled by specified value in Cell's specification.
- 1.2.2 Cut-off Voltage of discharging must be over 2.5V.
- 1.2.3 The battery can be used within the following temperature ranges.
Don't exceed these ranges.
Discharge temperature ranges : -20°C ~ 60°C

1.3 Storage

Store the battery at low temperature (below 60°C, 20°C is recommended), low humidity(below 65%), no dust and no corrosive gas atmosphere.

1.4 Design of positioning the battery pack in application and charger

To prevent the deterioration of the battery performance caused by heat, battery shall be positioned away from the area where heat is generated in the application and the charger.

1.5 Safety Device

Be sure adopting proper safe device such as PTC specified type or model in Cell Specification. If you intend to adopt different safety device which is not specified in Cell Specification, please contact Samsung SDI to investigate any potential safety problem. Be sure designing 2nd protective devices such as PTC & PCM at the same time to protect Cell just in case one protective device is fault.

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2. Design of System

2.1 Connection between the cell and the battery

- 2.1.1 The cell should not be soldered directly with other cells. Namely, the cell should be welded with leads on its terminal and then be soldered with wire or leads to solder.
- 2.1.2 Otherwise, it may cause damage of component, such as separator and insulator, by heat generation.

2.2 Positioning the battery in the System

- 2.2.1 The battery should be positioned as possible as far from heat sources and high temperature components.
- 2.2.2 Otherwise, it may cause loss of characteristics.
- 2.2.3 The recommended spacing between the cells is more than 1mm.

2.3 Mechanical shock protection of the battery

- 2.3.1 The battery should be equipped with appropriate shock absorbers in the pack in order to minimize shock, which can damage the cells. .
- 2.3.2 Otherwise, it may cause shape distortion, leakage, heat generation and/or rupture and/or open circuit.
- 2.3.3 Ultrasonic should not be used when manufacturing battery packs as it can damage the connection between component parts.

2.4 Short-circuit protection of the cell

- 2.4.1 The cell is equipped with an insulating sleeve to protect short-circuit which may occur during transportation, battery assembly and /or system operation.
- 2.4.2 If the cell sleeve is damaged by some causes such as outside impact, it may cause short-circuit with some wiring inside the battery.

2.5 Connection between the battery and charger/system

- 2.5.1 The battery should be designed to be connected only to the specified charger and system.
- 2.5.2 A reverse connection of the battery, even in the specified system, should be avoided by employing special battery design such as a special terminals.

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2.6 Pack design

- 2.6.1 The current consumption of the battery pack should be under 10uA after shut down.
- 2.6.2 Cell voltage monitoring system.
The system (charger or pack) should be equipped with a device to monitor each voltage of cell block to avoid cell imbalance which can cause damage to the cells.
- 2.6.3 The battery pack or system should have warning system such as over temperature, over voltage, over current, and so on.
- 2.6.4 Mechanical design

Item	Portable IT	Power-Tool	Medical	E-Bike	E-Scooter	EV/LEV	ESS/UPS
<input type="checkbox"/> Need partitions(separator) between BMS and a Cell	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
<input type="checkbox"/> Need to check if the pack is designed to be able to avoid thermal runaway (1KWh t)					<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
<input type="checkbox"/> Need to analyze the battery pack's thermal distribution and its effect on the pack's life cycle.					<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
<input type="checkbox"/> Need to use a non-flammable (V0 level) case	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="checkbox"/> Need to apply improved material (Steel) to the case						<input checked="" type="radio"/>	<input checked="" type="radio"/>
<input type="checkbox"/> Need to analyze the battery pack's structure, system, installation status and use environment						<input checked="" type="radio"/>	<input checked="" type="radio"/>

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Handling precaution and prohibitions of lithium rechargeable cells and batteries

Inaccurate handling of lithium ion and lithium ion batteries rechargeable battery may cause leakage, heat, smoke, an explosion, or fire. This could cause deterioration of performance or failure. Please be sure to follow instructions carefully.

1. Safety precaution and prohibitions

To assure product safety, describe the following precautions in the instruction manual of the application.

2. Danger

2.1 Electrical misusage

- 2.1.1 Use dedicated charger.
- 2.1.2 Use or charge the battery only in the dedicated application.
- 2.1.3 Don't charge the battery by an electric outlet directly or a cigarette lighter charger.
- 2.1.4 Don't charge the battery reversely.

2.2 Environmental misusage

- 2.2.1 Don't leave the battery near the fire or a heated source.
- 2.2.2 Don't throw the battery into the fire.
- 2.2.3 Don't leave, charge or use the battery in a car or similar place where inside of temperature may be over 60°C.
- 2.2.4 Don't immerse, throw, wet the battery in water / seawater.

2.3 Others

- 2.3.1 Don't fold the battery cased with laminated film such as pouch and Polymer.
- 2.3.2 Don't store the battery in a pocket or a bag together with metallic objects such as keys, necklaces, hairpins, coins, or screws.
- 2.3.3 Don't short circuit (+) and (-) terminals with metallic object intentionally.
- 2.3.4 Don't pierce the battery with a sharp object such as a needle, screw drivers.
- 2.3.5 Don't heat partial area of the battery with heated objects such as soldering iron.
- 2.3.6 Don't hit with heavy objects such as a hammer, weight.
- 2.3.7 Don't step on the battery and throw or drop the battery on the hard floor to avoid mechanical hock.
- 2.3.8 Don't disassemble the battery or modify the battery design including electric circuit.
- 2.3.9 Don't solder on the battery directly.
- 2.3.10 Don't use seriously scared or deformed battery.
- 2.3.11 Don't put the battery into a microwave oven, dryer ,or high-pressure container.
- 2.3.12 Don't use or assemble the battery with other makers' batteries, different types and/or models of batteries such as dry batteries, nickel-metal hydride batteries, or nickel-cadmium batteries.
- 2.3.13 Don't use or assemble old and new batteries together.

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3. Warning

- 3.1** Stop using the battery if the battery becomes abnormally hot, or discoloration, deformation, or abnormal conditions is detected during use, charge, or storage.
- 3.2** Keep away from fire immediately when leakage or foul odors are detected. If liquid leaks onto your skin or cloths, wash well with fresh water immediately.
- 3.3** If liquid leaking from the battery gets into your eyes, don't rub your eyes and wash them with clean water and go to see a doctor immediately.
- 3.4** If the terminals of the battery become dirty, wipe with a dry cloth before using the battery.
- 3.5** Cover terminals with proper insulating tape before disposal.

4. Caution

- 4.1** Electrical misusage
 - Battery must be charge with constant current-constant voltage (CC/CV).
- 4.2** Others
 - 4.2.1 Keep the battery away from babies and children to avoid any accidents such as swallow.
 - 4.2.2 If younger children use the battery, their guardians should explain the proper handling method and precaution before using.
 - 4.2.3 Before using the battery, be sure to read the user's manual and precaution of its handling.
 - 4.2.4 Before using charger, be sure to read the user's manual of the charger.
 - 4.2.5 Before installing and removing the battery from application, be sure to read user's manual of the application.
 - 4.2.6 Replace the battery when using time of battery becomes much shorter than usual.
 - 4.2.7 Cover terminals with insulating tape before proper disposal.
 - 4.2.8 If the battery is needed to be stored for an long period, battery should be removed from the application and stored in a place where humidity and temperature are low.
 - 4.2.9 While the battery is charged, used and stored, keep it away from object materials with static electric chargers.

5. Safety Handling Procedure for the Transporter

5.1 Quarantine

Packages that are crushed, punctured or torn open to reveal contents should not be transported. Such packages should be isolated until the shipper has been consulted, provided instructions and, if appropriate, arranged to have the product inspected and repacked.

5.2 Spilled Product

In the event that damage to packaging results in the release of cells or batteries, the spilled products should be promptly collected and segregated and the shipper should be contacted for instructions.

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6. Product Label




Product Label Dimension: 45*25mm
 White

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 Battery Pack Assembly Date Code / 3-Digits.

 Product Series Number per Lot. / 4-Digits.



Battery Pack Assembly Date Code / 3-Digits.

年	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
簡碼	9	A	B	C	D	E	F	G	H	I	J	K	L	M	N
月	1	2	3	4	5	6	7	8	9	10	11	12			
簡碼	1	2	3	4	5	6	7	8	9	A	B	C			
日	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
簡碼	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
日	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
簡碼	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
日	31														
簡碼	V														

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7.Safety device



SEKI CONTROLS
Preventing hazards due to overheating worldwide.
SEKI is always by your side.



SINCE 1980 ISO 9001/T#001

THERMAL PROTECTOR

ST-22











- **TEMPERATURE SETTING RANGE (at no load)**
50°C to 150°C in increments of 5°C
- **TOLERANCE**
Indicated temp. ± 5°C
- **ON-OFF DIFFERENTIAL TEMP. (general)**
30 ± 15K
- **HEAT ENDURANCE**
Open temp. +50°C/continuity, 200°C/1min
- **CYCLE LIFE(Resistive Load)**
10A/125V AC 10,000 cycles, 7A/250V AC 10,000cycles
3A/48V DC 6,000 cycles, 2.2A/48V DC 10,000cycles
- **CONTACT CAPACITY**
Min. Current 50mA/ repeatedly,
Max. Current 30A/5 cycles
- **CONTACT SYSTEM**
Normally closed

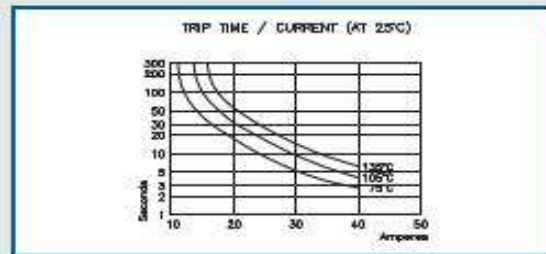
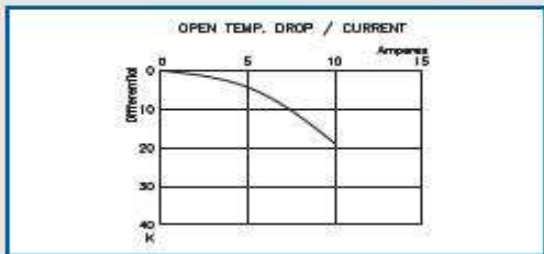
- **FEATURE**
 - Snap Action
 - Automatic Reset Bimetal
 - Moisture/ Dust-Proof
 - Superior Heat Response
 - PBT Resin Case with Epoxy Seal
 - Customization upon Request
- **APPLICATION**
Overheat protection for Electric Motors, Battery Chargers, Transformers, Power Supplies, Heating Pads, Fluorescent Ballasts, OA-Machines, Solenoids, LED Lighting, etc.

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• APPROVAL/RATINGS

Agency	Standard	Category	Electrical Ratings	Max Temp.	File NO.
UL	UL 2111	Thermal Protector	AC 125V/250V, 1/2 HP	150°C	E162232
		DC (Thermal Protective Device)	DC 48V/2,2A 10,000 cycles		
	UL 873	Resistive	AC 125V/10A, 250V/7A 10,000 cycles	130°C	E162183
		Incandescent Lamp	AC 125V/4A, 250V/2A 10,000 cycles		
CSA	CSA C22.2 No.77	Fluorescent Lamp/Ballast	AC 250V/1A 10,000 cycles	150°C	203758
	CSA C22.2 No.24	Motor Protectors	AC 250V, 1/2HP		
VDE	EN-60730-2-2	Appliance Type	AC 250V, 1/2HP, 6,000 cycles	150°C	1916600-4510-0003
	EN-60730-2-9	Thermal Motor Protector	AC 250V		
	EN-60730-2-3	Thermal Cut-Out	AC 250V/7A(4A) Resistive(Inductive) 10,000Cycles		
CQC	GB14536.1-2008 GB14536.3-2008 GB14536.10-2008	Thermal Ballast Protector	AC 250V/1A	150°C	CQC08002022430
		Thermal Protector	Motor Protector AC 125V/250V, 1/2HP		
		Thermal Protector	Resistive AC 125V/10A, 250V/7A 10,000 cycles Inductive AC 125V/4A, 250V/2.5A 10,000 cycles		
KC	K60730-1 K60730-2-9	Thermal Protector	AC 250V/5A	150°C	2H02003-100018

• LEAD WIRE SPECIFICATION

- W-Type : UL3266 AWG22 Stranded. Standard Length: 70mm long with 7mm stripped
- P-Type : ø0.7 Tinned Lead. Standard Length: 25mm

* The length can be adjustable on demand.

• WARNING

You may happen to encounter counterfeits of SEKI products in the market, all of which cause a serious damage by their serious defectives in quality. Therefore it is strongly recommended that you purchase authentic SEKI products from our AUTHORIZED distributors.

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(주)세기컨트롤
SEKI CONTROLS CO., LTD.

TECHNICAL SPECIFICATION OF THERMAL PROTECTOR, ST-22

1. APPLICATION SCOPE

ST-22 is an Automatic Reset Thermal Protector and is applied to OVERHEAT PROTECTION.

2. STRUCTURE

2-1. Type: Single-Pole Type using Bi-metal

2-2. Dimension: Please refer to the attachment.

3. SPECIFICATIONS

3-1. Electrical Ratings

Rated Voltage	AC 125 V	AC 250 V	DC 48 V
Rated Current	8 A	5 A	3 A
Rated Load	Resistive Load		

3-2. Pre-setting Temperature

Operating Temperature	Preset Temp. $\pm 5^{\circ}\text{C}$
Reset Temperature	Operating Temp. $- 30^{\circ}\text{C} \pm 15^{\circ}\text{C}$

During rising of temperature, when the contacts are open, it's called "Open Temperature". During dropping of temperature, when the contacts are closed, it's called "Reset Temperature".

Calibration Verification: The temperature in a convection oven (electrically heated, static air-oven) is to be increased or decreased at the rate of 1°C per minute. The current should be within 100mA.

3-3. Insulation Resistance

Insulation resistance between on-current-part and off-current-part (case & terminal) should be over $100\text{M}\Omega$ when measured with DC500V tester.

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8. Hook-Up Wires



瑞興電線電纜有限公司
REI HSING ELECTRIC WIRE AND CABLE CO., LTD.

電子線系列

PVC電子線

UL 1007

UL Subject 758 UL FILE NO. E108485
CSA Standard CSA FILE NO. LL84687

HOOK-UP WIRE 80°C 300V

說明

- 導體使用單絲或絞線 32-16AWG 裸銅或鍍錫銅
- PVC絕緣或依客户要求使用無毒PVC絕緣
- 額定溫度: 80°C, 額定電壓: 300Volts
- 可通過UL VW-1 及 CSA FT1, 垂直型耐燃測試

應用

- 一般電子, 電器設備內部配線。

Product Description

- Tinned, annealed, stranded or Solid copper conductor, 32-16AWG
- PVC insulation or non-toxic PVC insulation
- Rated temperature: 80°C, Rated voltage: 300 volts
- Passed UL VW-1 & CSA FT1 vertical flame test

Applications

- For general purpose internal wiring of electrical, and electrical equipment

構造及電氣性能(Structure & electric properties)



UL 1007 CSA TR-84	額定 Range		導體 Conductor		絕緣體 Insulation		公差值 Tolerance mm	最大導體 阻抗 Maximum Conductor Resistance Ω/km	容許電流 Permissible Current A	最小絕緣 阻抗 Minimum Insulation Resistance MΩ/km	絕緣耐電壓 (VAC/min) Insulation Potential Strength
	溫度 Temp °C	電壓 Voltage V	線號 AWG	橫成 NO./mm	厚度 Thickness mm	外徑 O.D. mm					
絞線 (Stranded)	80 °C	300V	32	7/0.080	0.38	1.00	±0.10	703.0	1.60	15	2000
			30	7/0.100	0.38	1.10	±0.10	397.0	2.0		
			28	7/0.127	0.38	1.20	±0.10	248.0	2.5		
			26	7/0.160	0.38	1.30	±0.10	152.0	3.5		
	90 °C	300V	24	11/0.160	0.38	1.45	±0.10	88.6	5.0		
			22	17/0.160	0.38	1.60	±0.10	62.5	7.0		
			20	21/0.180	0.38	1.85	±0.10	39.5	9.0		
			18	34/0.180	0.38	2.10	±0.10	24.4	13.0		
Top-Coated (ATC) 先絕後絞	80 °C	300V	30	7/0.100	0.38	1.10	±0.10	397.0	2.0		
			28	7/0.127	0.38	1.20	±0.10	248.0	2.5		
	90 °C	300V	26	7/0.160	0.38	1.30	±0.10	152.0	4.0		
			24	7/0.200	0.38	1.45	±0.10	88.6	5.3		
	80 °C	300V	22	7/0.254	0.38	1.60	±0.10	62.5	7.2		
			20	7/0.320	0.38	1.85	±0.10	39.5	10.0		
Solid(TA) 單絲	80 °C	300V	28	1/0.320	0.38	1.15	±0.10	232.1	2.9		
			26	1/0.404	0.38	1.25	±0.10	155.0	3.8		
	90 °C	300V	24	1/0.511	0.38	1.40	±0.10	82.4	5.3		
			22	1/0.643	0.38	1.55	±0.10	60.1	7.2		
80 °C	300V	20	1/0.813	0.38	1.70	±0.10	37.0	8.4			
		18	1/1.020	0.38	1.96	±0.10	23.6	13.0			

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9. Finished Goods Package Drawing



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10. Outer Dimension

