1.0 Reference and Address			
Report Number	220510031GZU-001	DRAFT Issued: 5-Sep-2022	For Review and Comment
Standard(s)	Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications [ANSI/CAN/UL 1973:2018 Ed.2]		

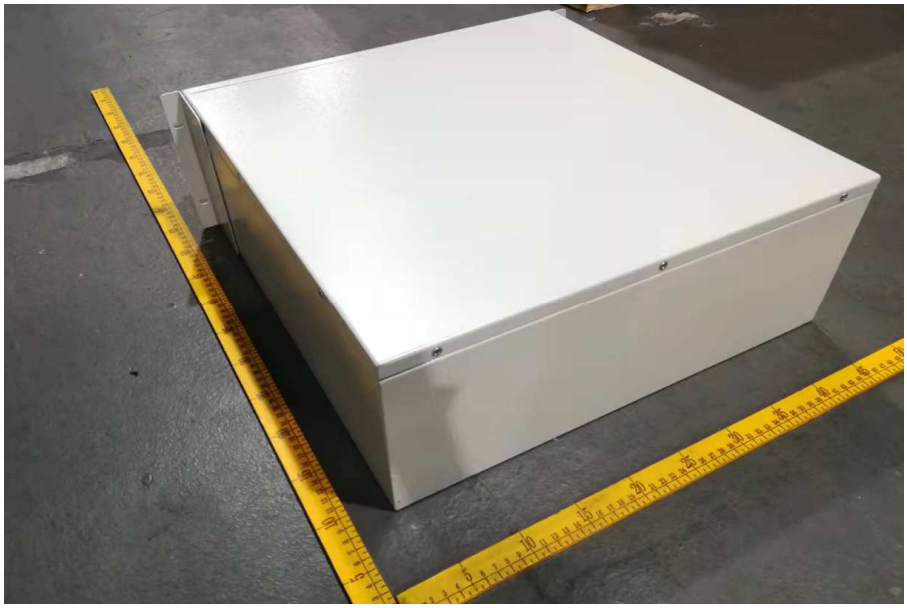
Applicant	Hocan Group Co., Ltd	Manufacturer	**Zhuhai SEPICN Electronics And Technology Co., Ltd**
Address	Room 905 Working Berg, Commercial Bldg, 41-47 MARBLE RD Hong Kong SAR	Address	No. 16, 1st, Jinyuan Rd, Jinding, ZHUHAI CITY Guangdong 519085
Country	China	Country	China
Contact	Wang Min	Contact	Wang Min
Phone	0756-3386227	Phone	0756-3386227
FAX	NA	FAX	NA
Email	sales@sepicn.com	Email	sales@sepicn.com

2.0 Product Description	
Product	Lithium ion Battery
Brand name	(SK)
Description	The product covered in this report is a Rechargeable Lithium-ion Battery system and Home Energy Storage System which contains 16 cells in 16S1P, and has overcharge, over-discharge, over current and short-circuits proof circuit. Indoor use only.
Models	SK48V100
Model Similarity	NA
Ratings	Nominal Voltage: 51.2Vdc Rated Capacity: 100Ah Nominal Energy: 5120Wh Operating Ambient Temperature: 0°C~55°C (Charge), -15°C~55°C (Discharge) Short Current and Duration: 1600A, 5ms
Other Ratings	NA
Conditions of Acceptability	The products covered in this Report are incomplete in construction features or limited in performance capabilities and are intended for use and evaluation in other products. Consideration should be given to the following when the component is used in or with another product. 1. Suitability of the enclosure should be evaluated when installed in the end product. 2. Temperature Testing should be performed on this component when installed in the end product. 3. The IP code should be evaluated when installed in the end product. 4. Manual disconnect device shall be provided and evaluated when installed in the end product. 5. System safety analysis should be evaluated when installed in the end product. 6. The battery pack only provide one overcharge and overdischarge protective circuits and controls, and the single fault conditions should be evaluated when installed in the end product.

3.0 Product Photographs

Photo 1 -External view

Photo 2 - External view



3.0 Product Photographs

Photo 3 - External view

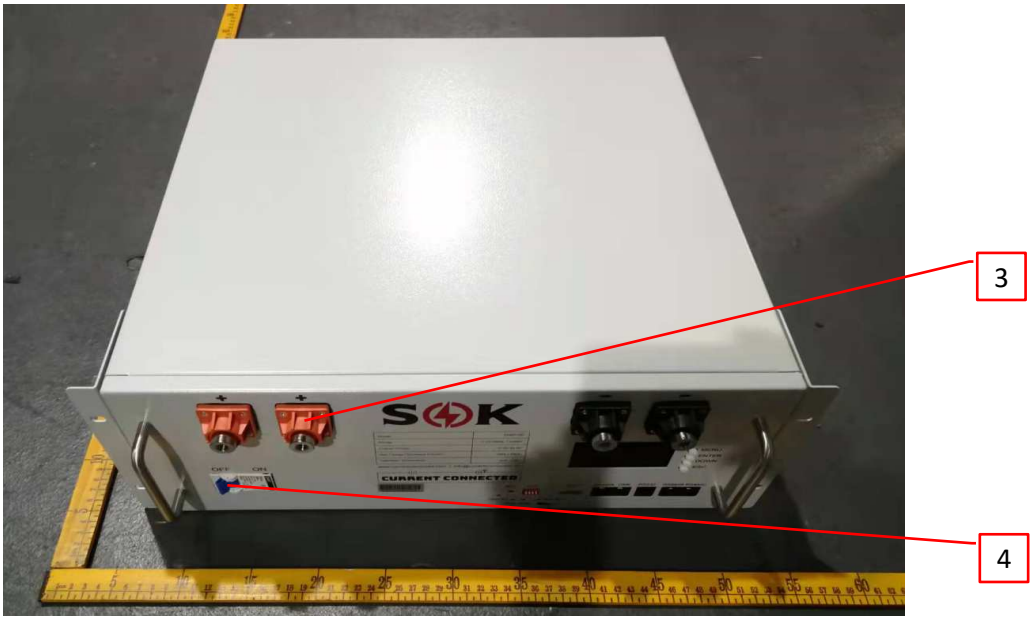


Photo 4 - External view

3.0 Product Photographs

Photo 5 - Internal view

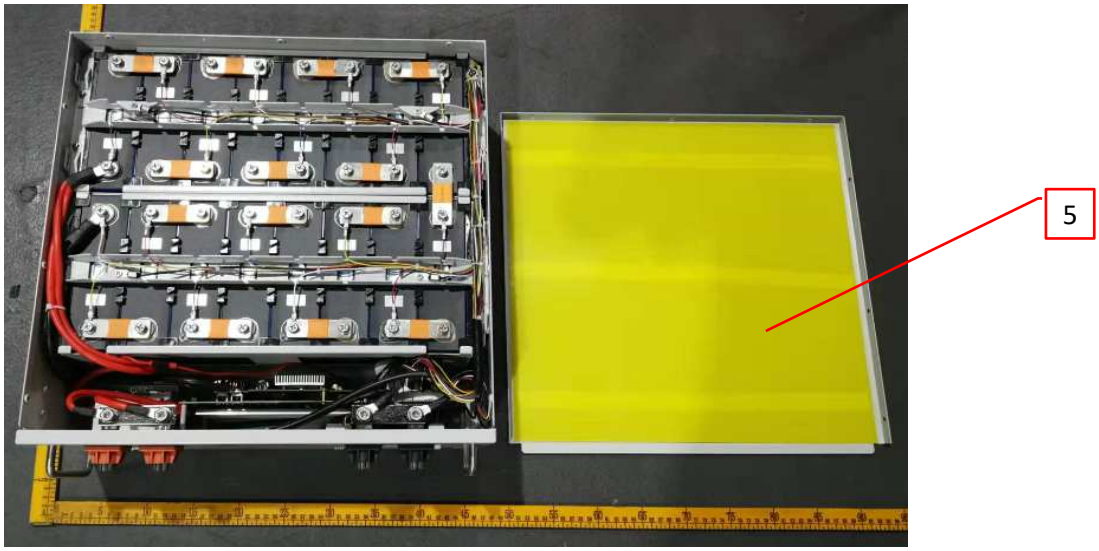
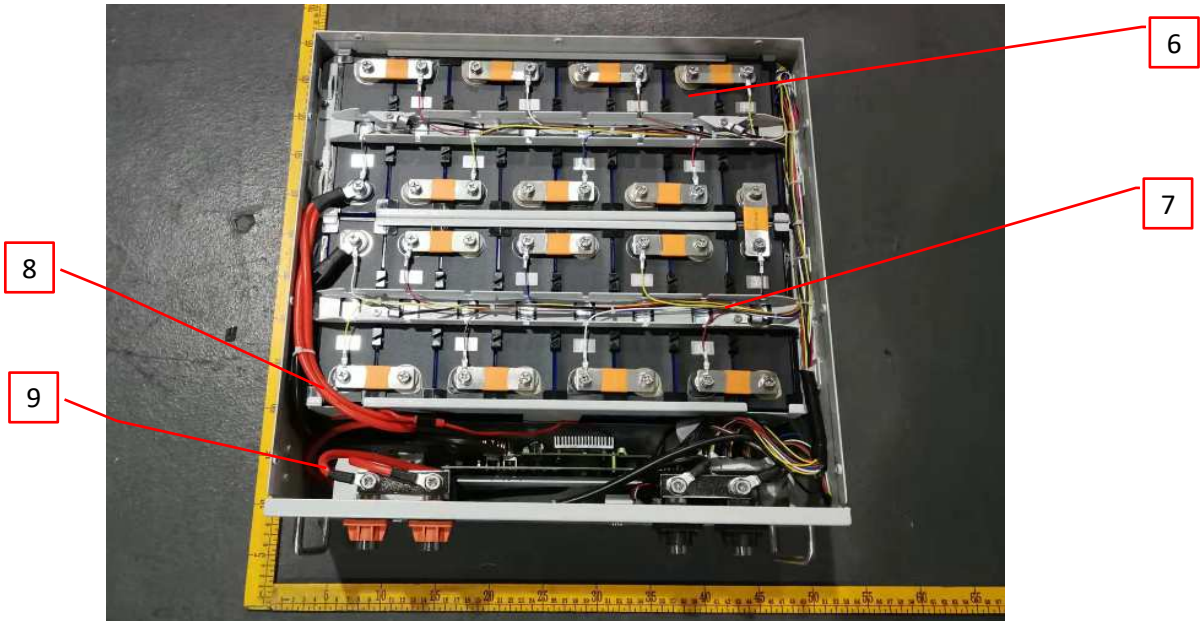


Photo 6 - Internal view



3.0 Product Photographs

Photo 7- Internal view

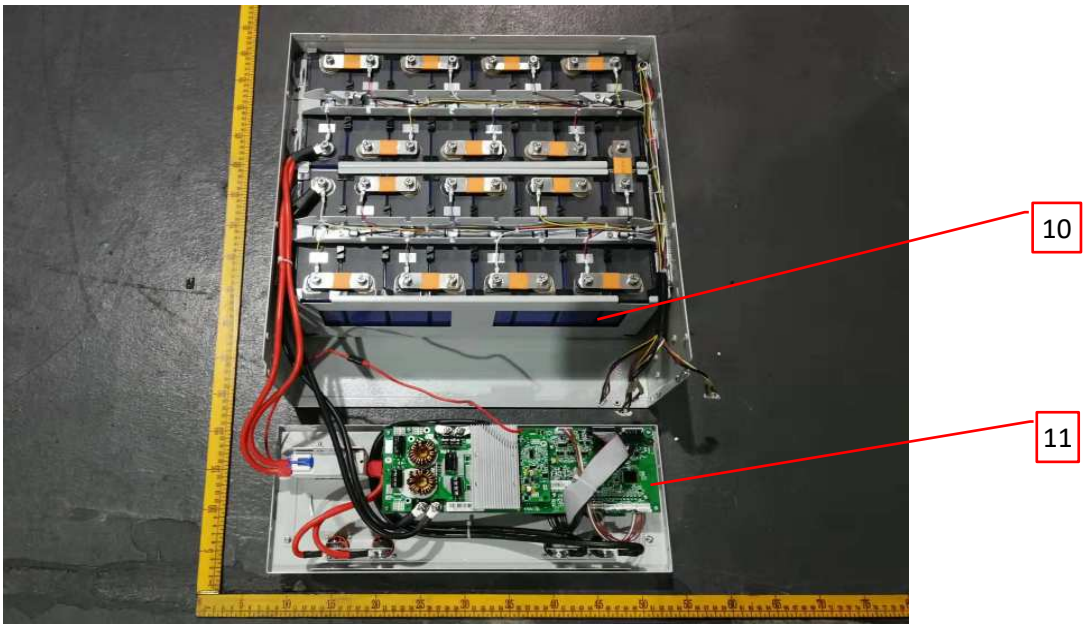
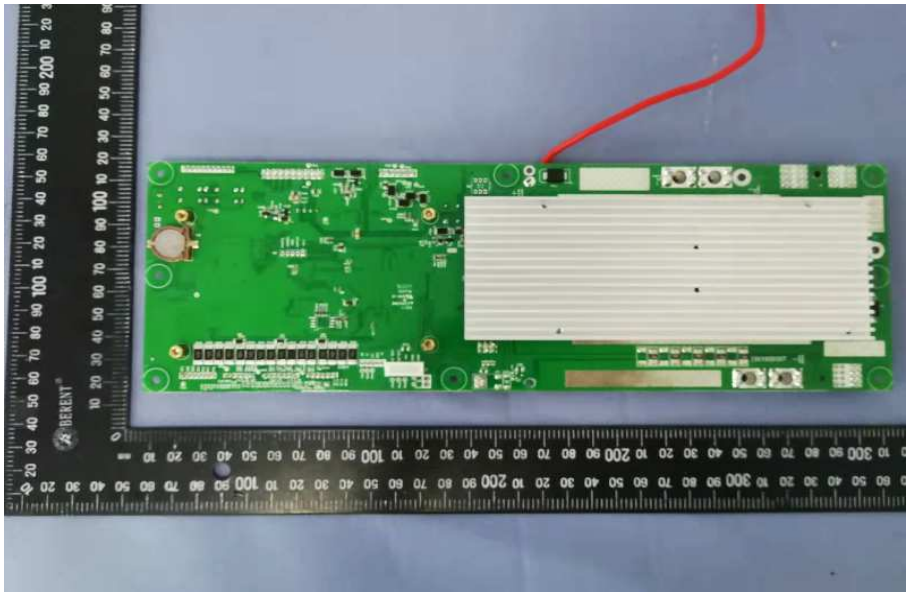


Photo 8 - PCB view



3.0 Product Photographs

Photo 9 - PCB view

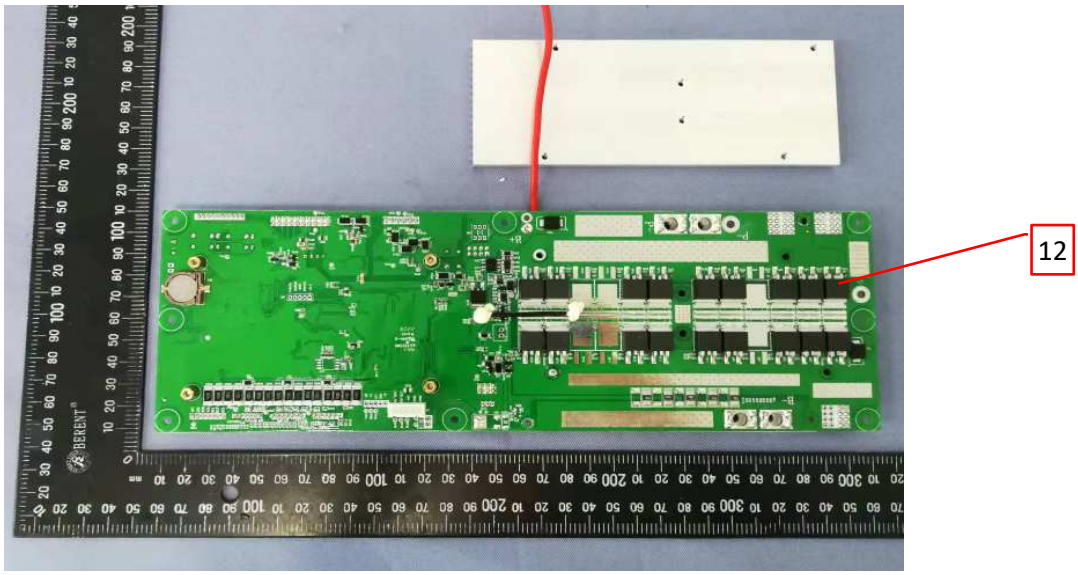
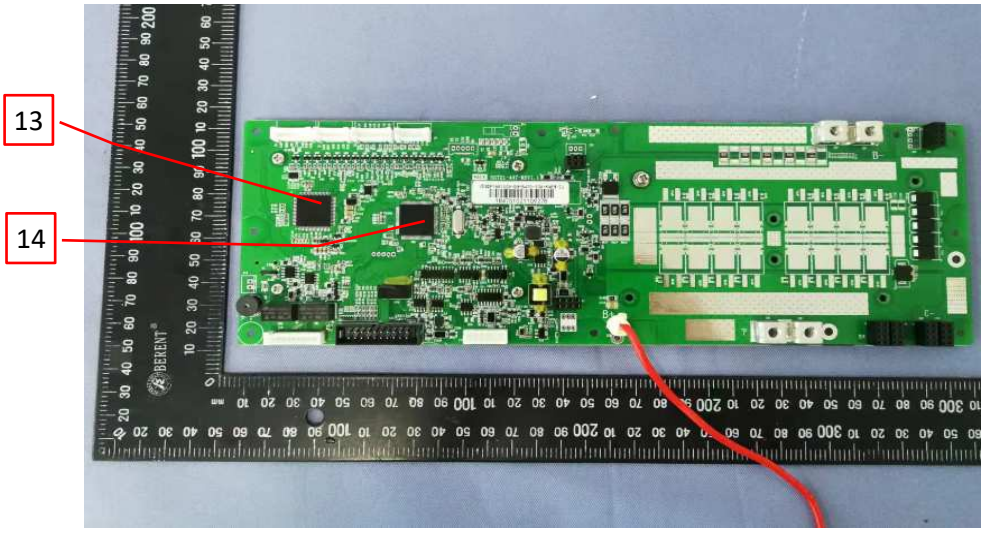


Photo 10- PCB view



3.0 Product Photographs

Photo 11 - PCB view

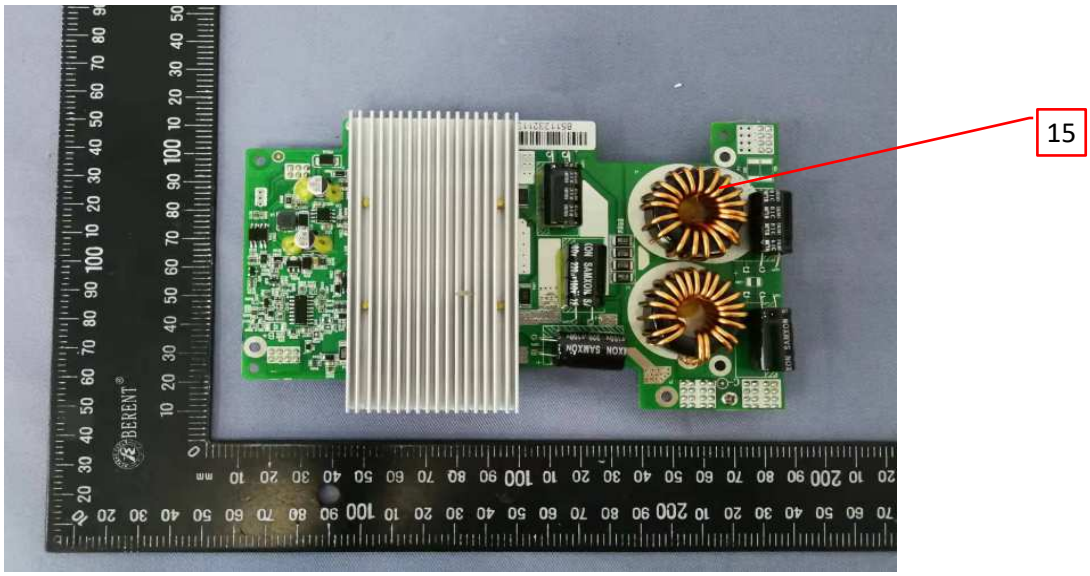
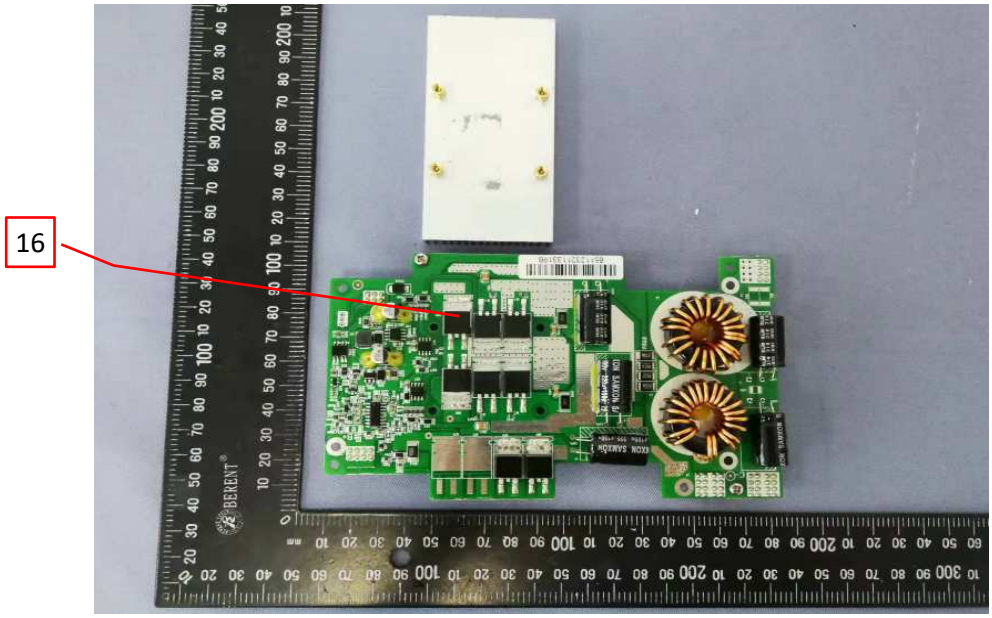


Photo 12- PCB view



3.0 Product Photographs

Photo 13 - PCB view

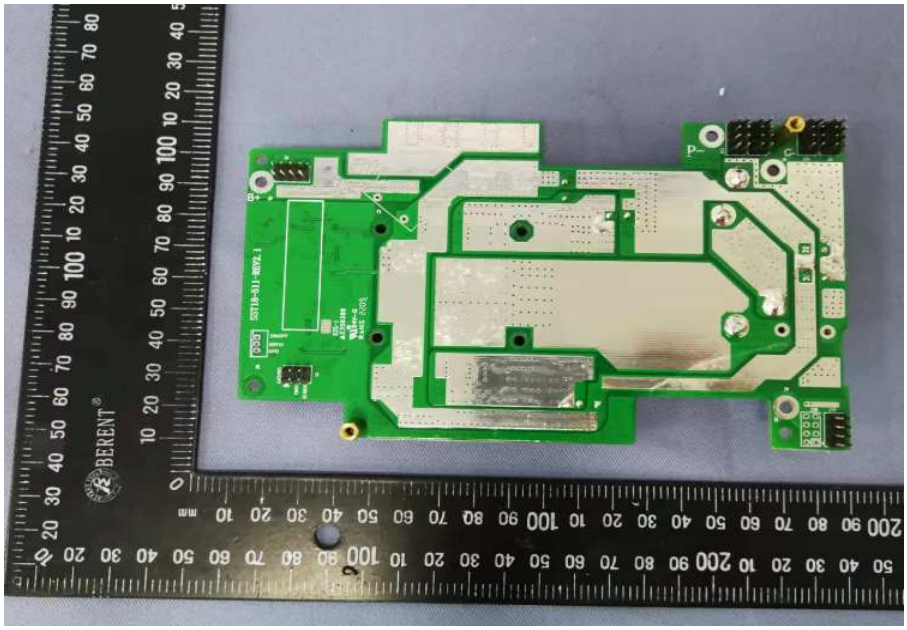
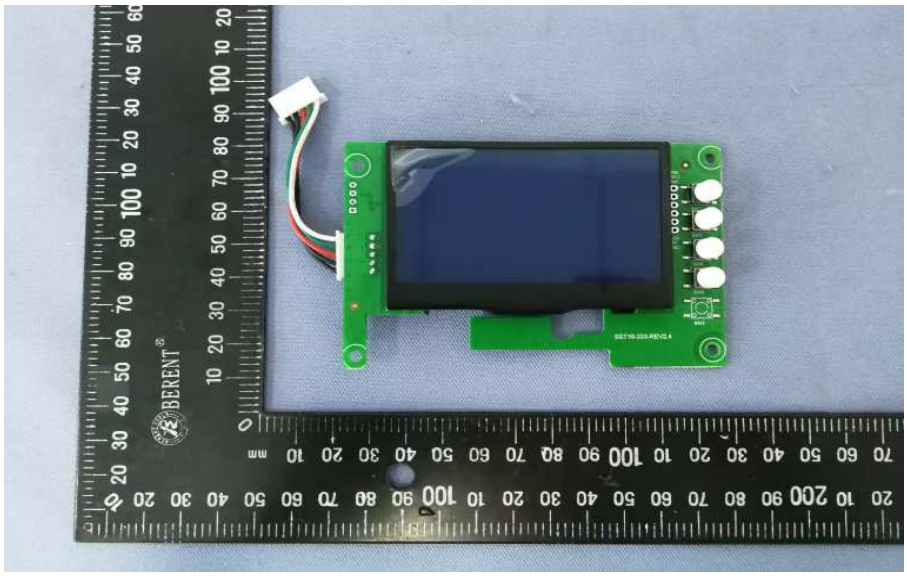


Photo 14- PCB view



3.0 Product Photographs

Photo 15 - PCB view

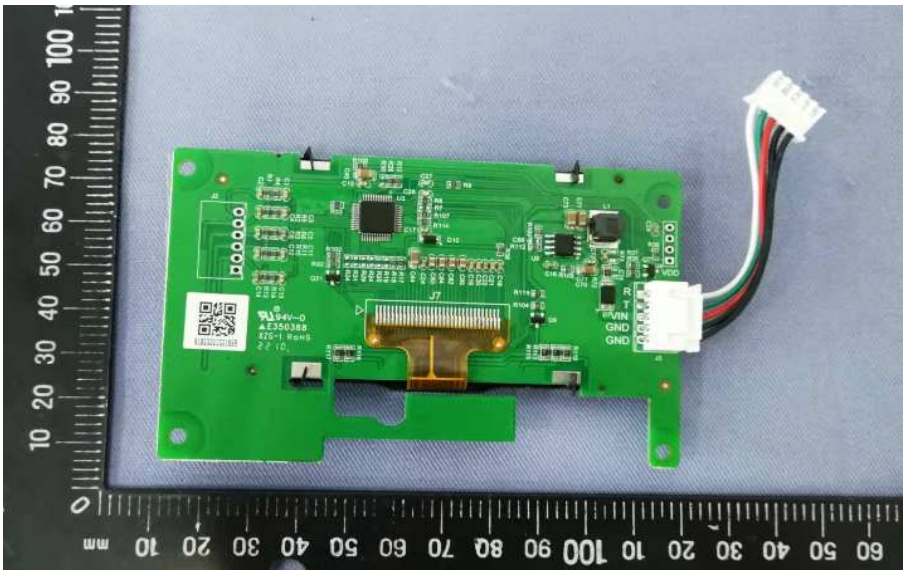
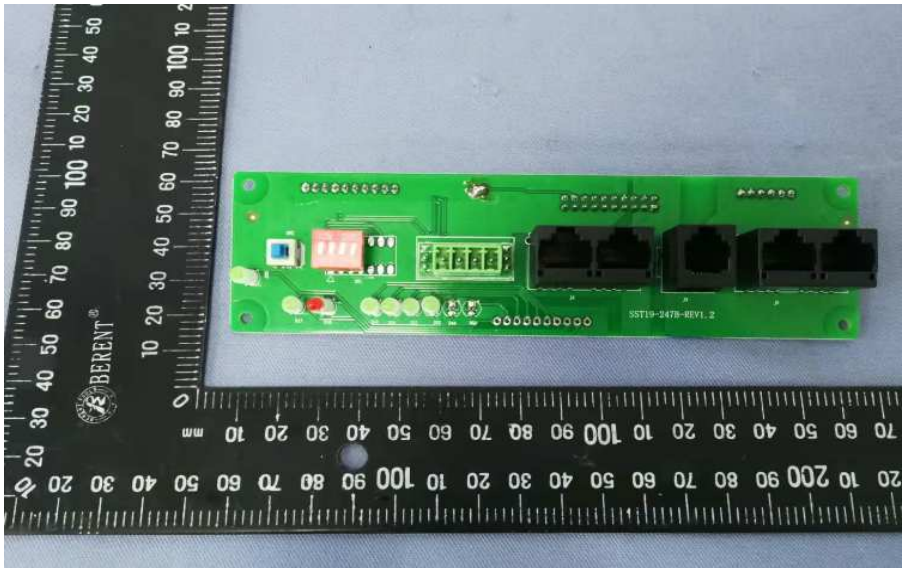
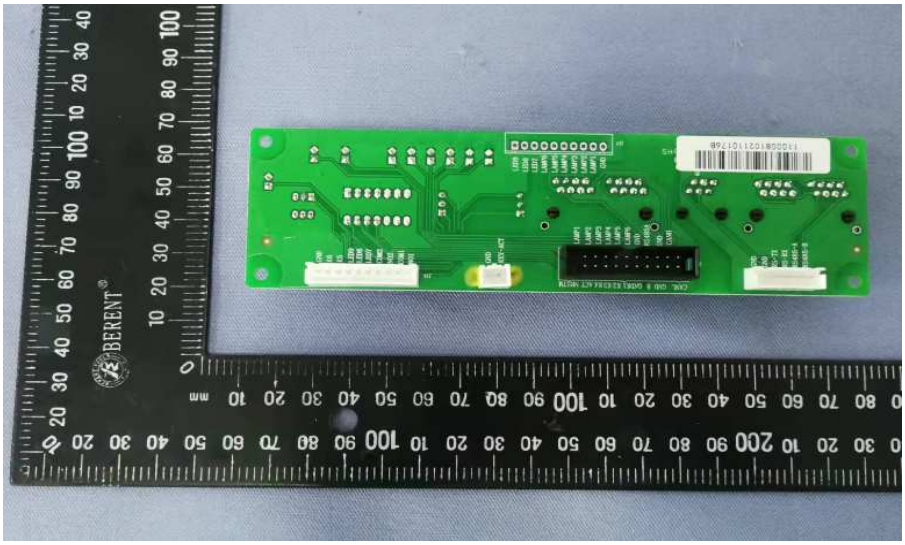


Photo 16- PCB view



3.0 Product Photographs

Photo 17 - PCB view



4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity [3]
1	1	External Metal Enclosure	Guangxi Iron and Steel Group Co., Ltd.	48100-case	Material: SPCC, 442mm x460mmx177mm, Minimum thickness: 1mm	NR
3	2	Label	ZHONGSHAN ZHANTU PRINTING CO LTD	ZT969-1	Steel surface: 150°C.	cURus
				ZT969-2		cURus
				ZT969-3		cURus
			Various	Various	Steel surface: 150°C.	cURus
3	3	Terminal	SHENZHEN CONNECTION ELECTRONIC CO LTD	ACTB135	Rated 600 Vdc, 310 A	cURus
3	4	Breaker	ZHEJIANG CHINT ELECTRICS CO	DZ158-125	Rated 60Vdc, 125A, 1P	cURus
5	5	Insulation film	JIANGSU RODA ELECTRON MATERIAL CO LTD	RH150	V-0, 90°C, min thickness: 0.38mm	cURus
6	6	Cell Holder	FORMOSA CHEMICALS & FIBRE CORP PLASTICS DIV	AC310(+)	V-0, RTI Imp: 85°C, Min thickness: 1.5mm	cURus
6	7	Internal wire	DONGGUAN WENCHANG ELECTRONIC CO LTD	1430	Connect to battery Minimum 24AWG, minimum 300V, minimum 105°C, VW-1	cURus
			Various	1430		cURus
6	8	Cord	Dongguan Dingpai Electronic Technology Co Ltd	3512	Minimum 7AWG, minimum 600V, minimum 200°C, VW-1	cURus
			Various	3512		cURus
6	9	Cord	SHENZHEN SHUNJIA ELECTRICAL TECHNOLOGY CO LTD	3135	Connect to terminal Min 16AWG, 600V, min 105 °C	cURus
			Various	3135		cURus
7	10	Cell	Jiangxi Ganfeng Battery Technology Co Ltd(BBGA2. MH63648)	48173125-100Ah	3.2V, 100Ah	UR
7	11	PCB	Kingboard electronics Co., LTD	KB-6160A	V-0, 130°C	cURus
			Various	Various	V-0, 130°C	cURus
9	12	MOSFET	CRMICRO	CRSS028N10N	QP1 to QP24 VDS=100V, VGS=±20V D=200A, TJ=-55~175ºC	NR

4.0 Critical Components

Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity [3]
10	13	IC	SINO WEALTH ELECTRONIC LTD.	SH367309U/048UR	U7 Supply voltage: Vbat= 8.5 V~65V Topr: -40°C ~ 85°C	NR
10	14	MCU	HUADA	HC32F460PETB	UM1 VBAT=1.8~3.6V, TA=-40~105ºC LQFP100-0.5-14X14	NR
11	15	Inductor	GLR	T106060-7.5uH-H-GLR	L1 and L2 7.5uH, 105°C	NR
12	16	MOSFET	China Resources Microelectronics (Chongqing) Limited	CRSS057N10N	QC1, QC2, QC3, QC4 VDS=100V, VGS=±20V, ID=120A, TJ=-55~150ºC	NR

NOTES:

1) Not all item numbers are indicated (called out) in the photos, as their location is obvious.

2) “Various“ means any type, from any manufacturer that complies with the "Technical data and securement means" and meets the "Mark(s) of conformity" can be used.

3) Indicates specific marks to be verified, which assures the agreed level of surveillance for the component. "NR" - indicates Unlisted and only visual examination is necessary. "See 5.0" indicates Unlisted components or assemblies to be evaluated periodically refer to section 5.0 for details.

5.0 Critical Unlisted CEC Components

No Unlisted CEC components are used in this report.

6.0 Critical Features

Recognized Component - A component part, which has been previously evaluated by an accredited certification body with restrictions and must be evaluated as part of the basic product considering the restrictions as specified by the Conditions of Acceptability.

Listed Component - A component part, which has been previously Listed or Certified by an accredited Certification Organization with no restrictions and is used in the intended application within its ratings.

Unlisted Component - A part that has not been previously evaluated to the appropriate designated component standard. It may also be a Listed or Recognized component that is being used outside of its evaluated Listing or component recognition.

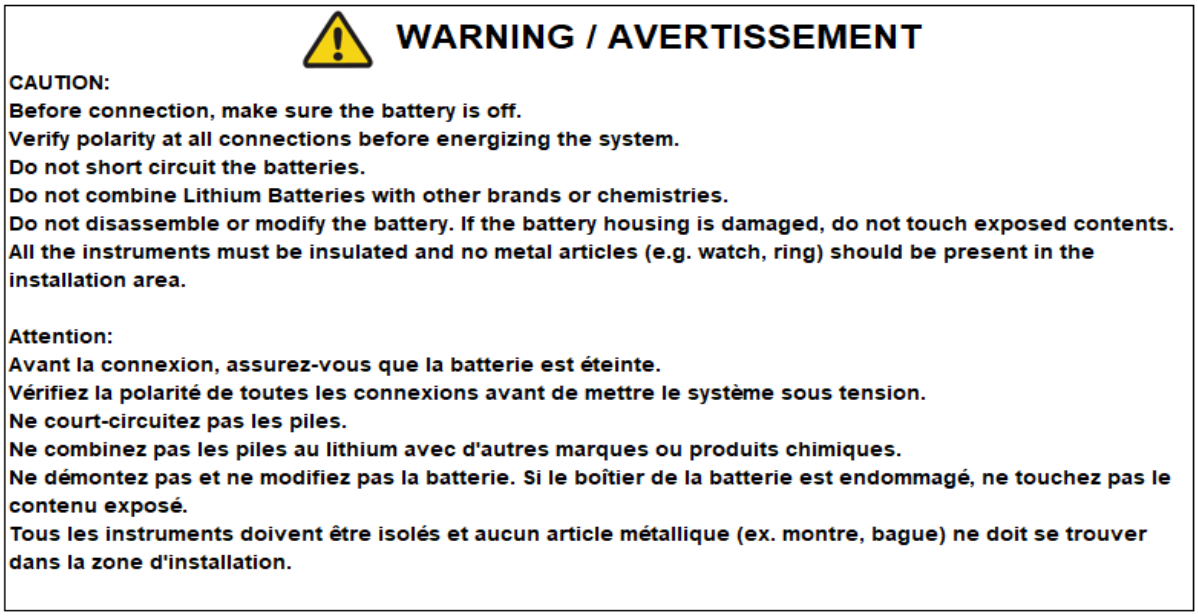
Critical Features/Components - An essential part, material, subassembly, system, software, or accessory of a product that has a direct bearing on the product's conformance to applicable requirements of the product standard.

Construction Details - For specific construction details, reference should be made to the photographs and descriptions. All dimensions are approximate unless specified as exact or within a tolerance. In addition to the specific construction details described in this Report, the following general requirements also apply.

1. Mechanical Assembly - Components such as switches, fuseholders, connectors, wiring terminals and display lamps are mounted and prevented from shifting or rotating by the use of lockwashers, starwashers, or other mounting format that prevents turning of the component.
2. Corrosion Protection - All ferrous metal parts are protected against corrosion by painting, plating or the equivalent.
3. Polarized Connection - This product is provided with a polarized power supply connection.
4. Internal Wiring - Internal wiring is routed away from sharp or moving parts. Internal wiring leads terminating in soldered connections are made mechanically secure prior to soldering. Recognized Component separable (quick disconnect) connectors of the positive detent type, closed loop connectors, or other types specifically described in the text of this report are also acceptable as internal wiring terminals. At points where internal wiring passes through metal walls or partitions, the wiring insulation is protected against abrasion or damage by plastic bushings or grommets. Details please see Sec. 4.0.
5. Schematics - Refer to Section 7.0, Illustration 2, 2a, 2b and 2c for schematics requiring verification during Field Representative Inspection Audits.
6. Markings - The product is marked on a labeling system as described in item 2 of Section 4.0 as follows:
   - Applicant's name,brand name;
   - Model number;
   - Electrical ratings(in volts dc and capacity in Ampere hours or Watt hours and chemistry);
   - Polarity of battery system terminals.
   - Maximum short circuit current and duration;
   - Date of manufacturer.
7. Cautionary Markings - Refer to Section 7.0, Illustration 1.
8. Installation, Operating and Safety Instructions - Instructions for installation and use of this product are provided by the manufacturer. Refer to Section 7.0, lllustration 5 and 5a.

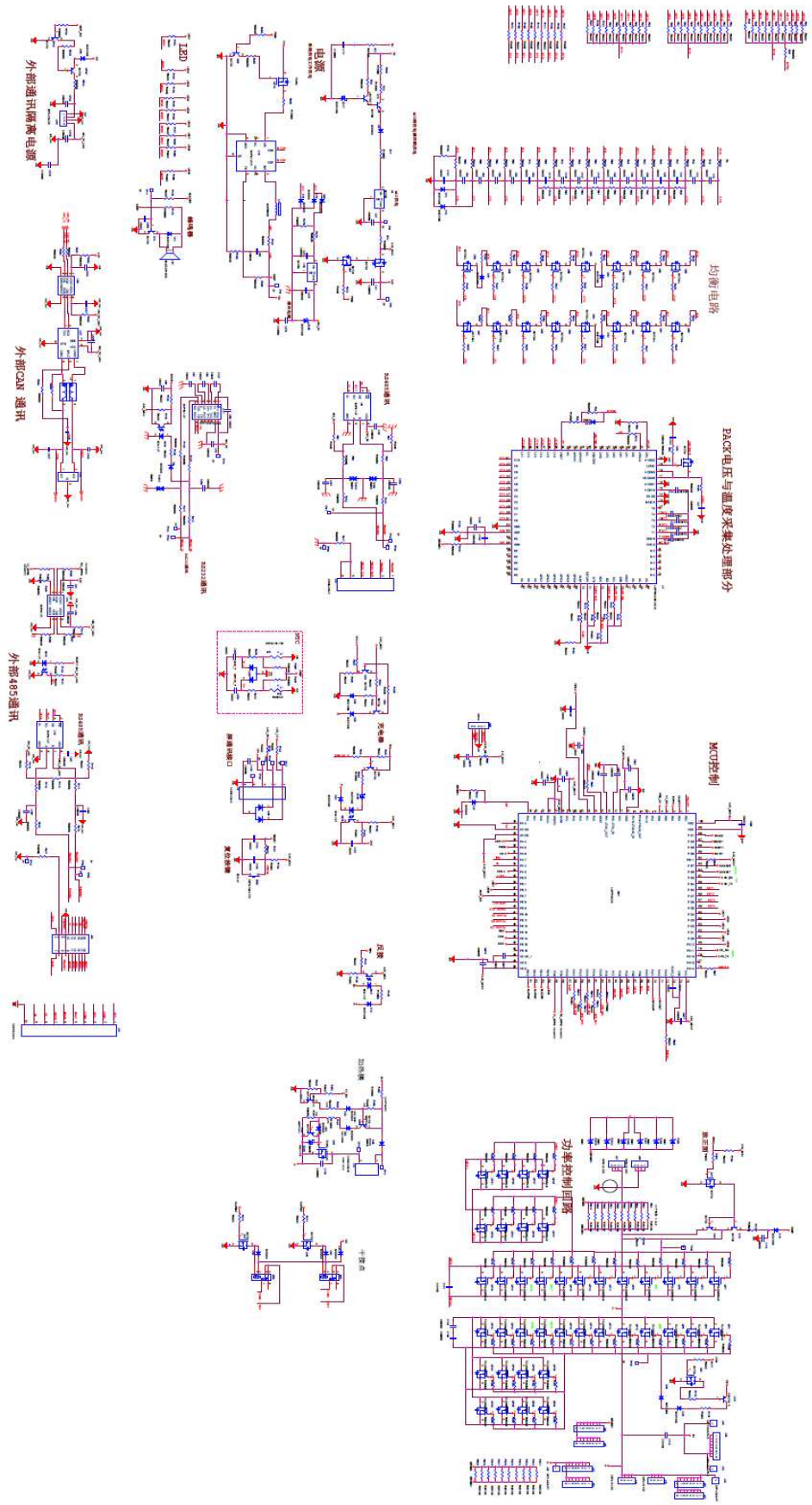
7.0 Illustrations

Illustration 1 - Cautionary marking



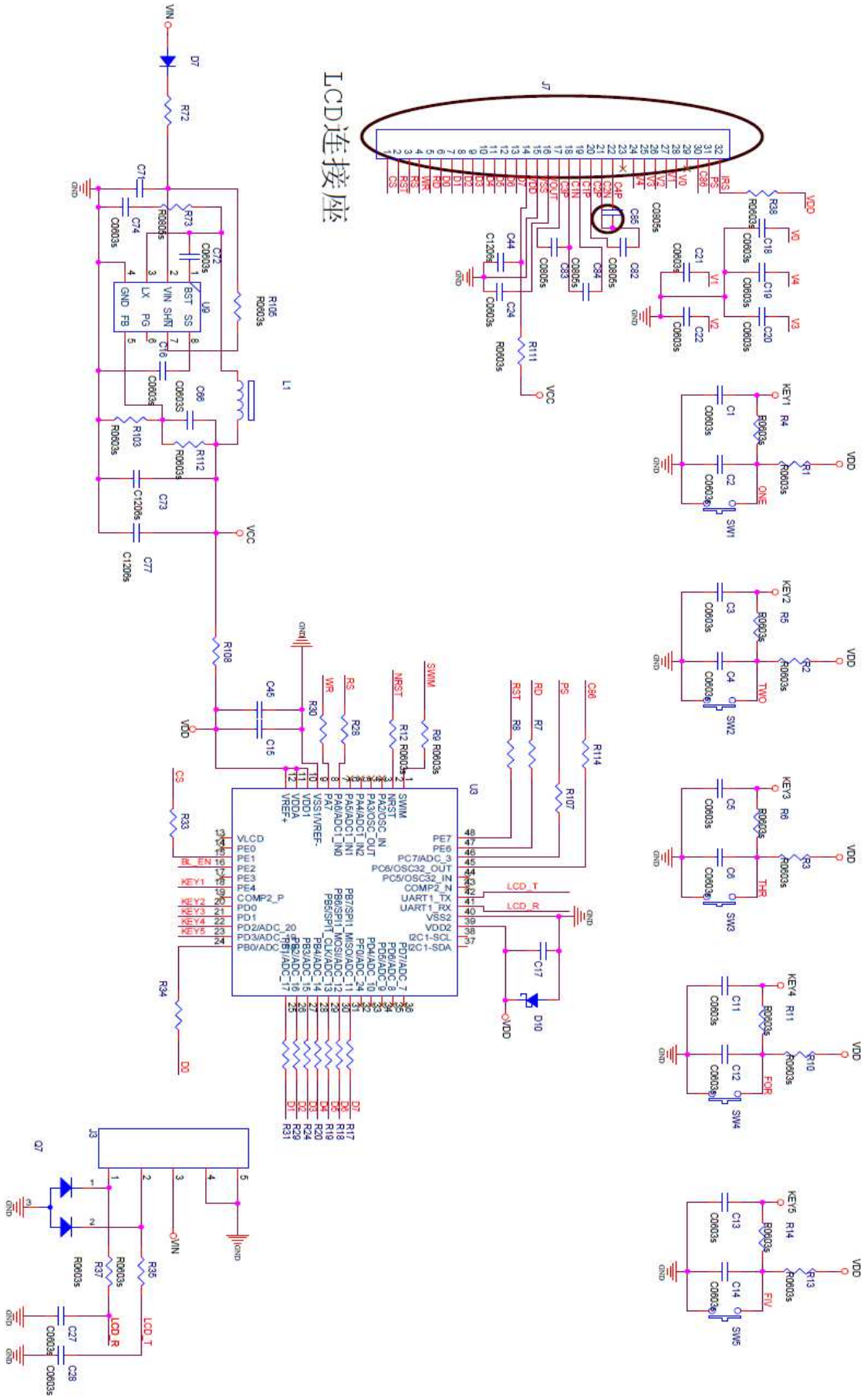
7.0 Illustrations

Illustration 2 - Circuit diagram



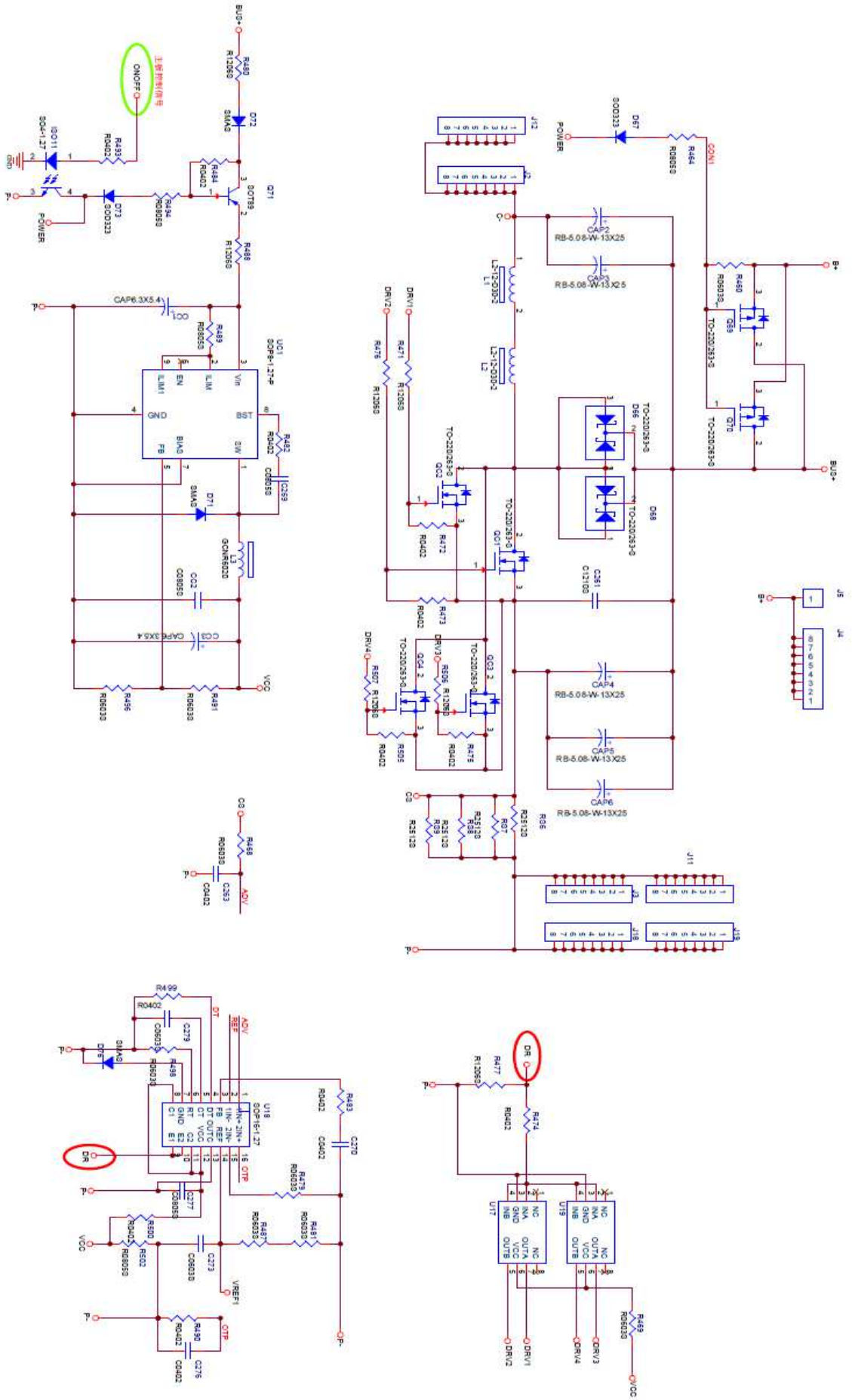
7.0 Illustrations

Illustration 2a - Circuit diagram



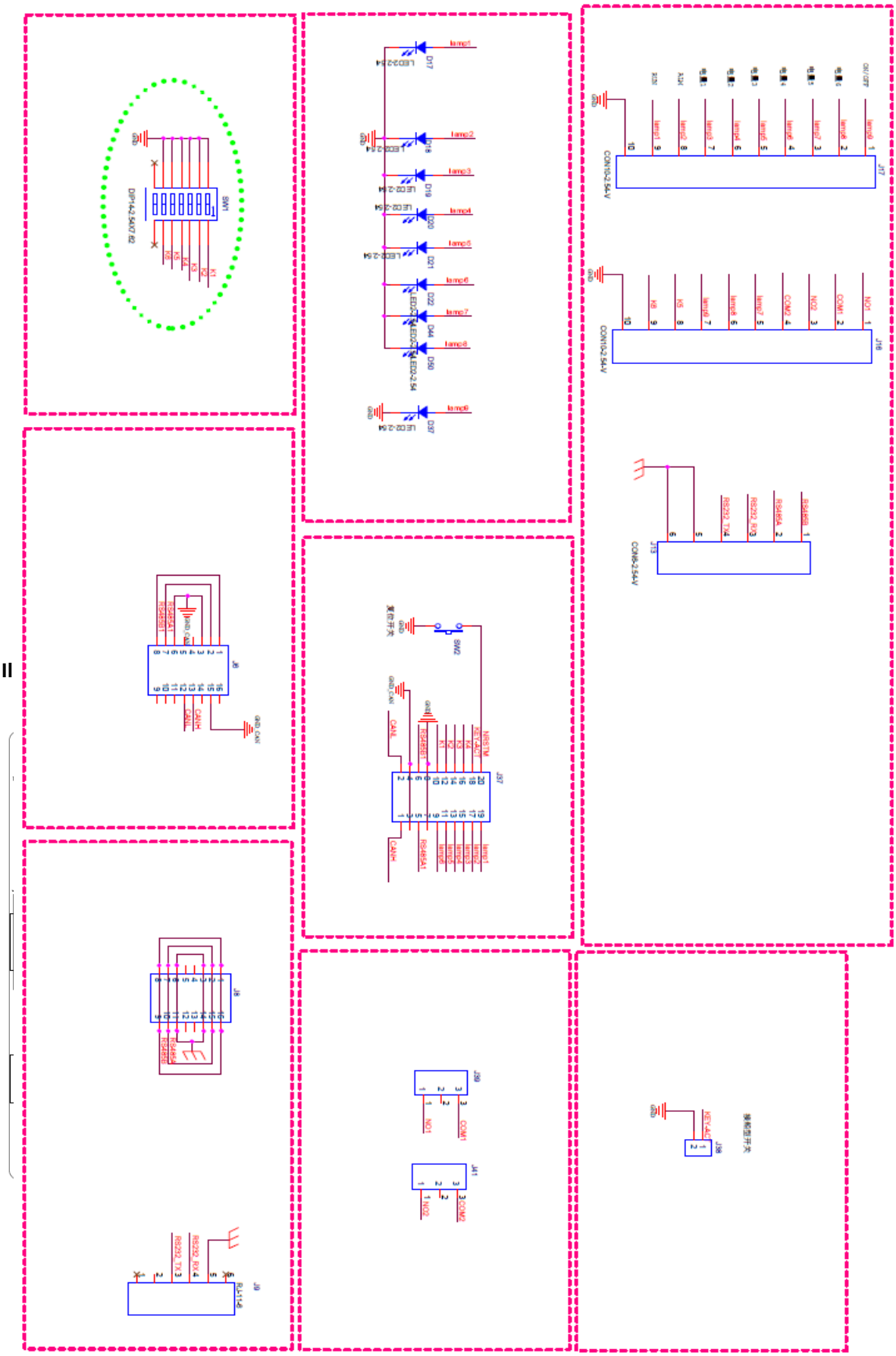
7.0 Illustrations

Illustration 2b- Circuit diagram



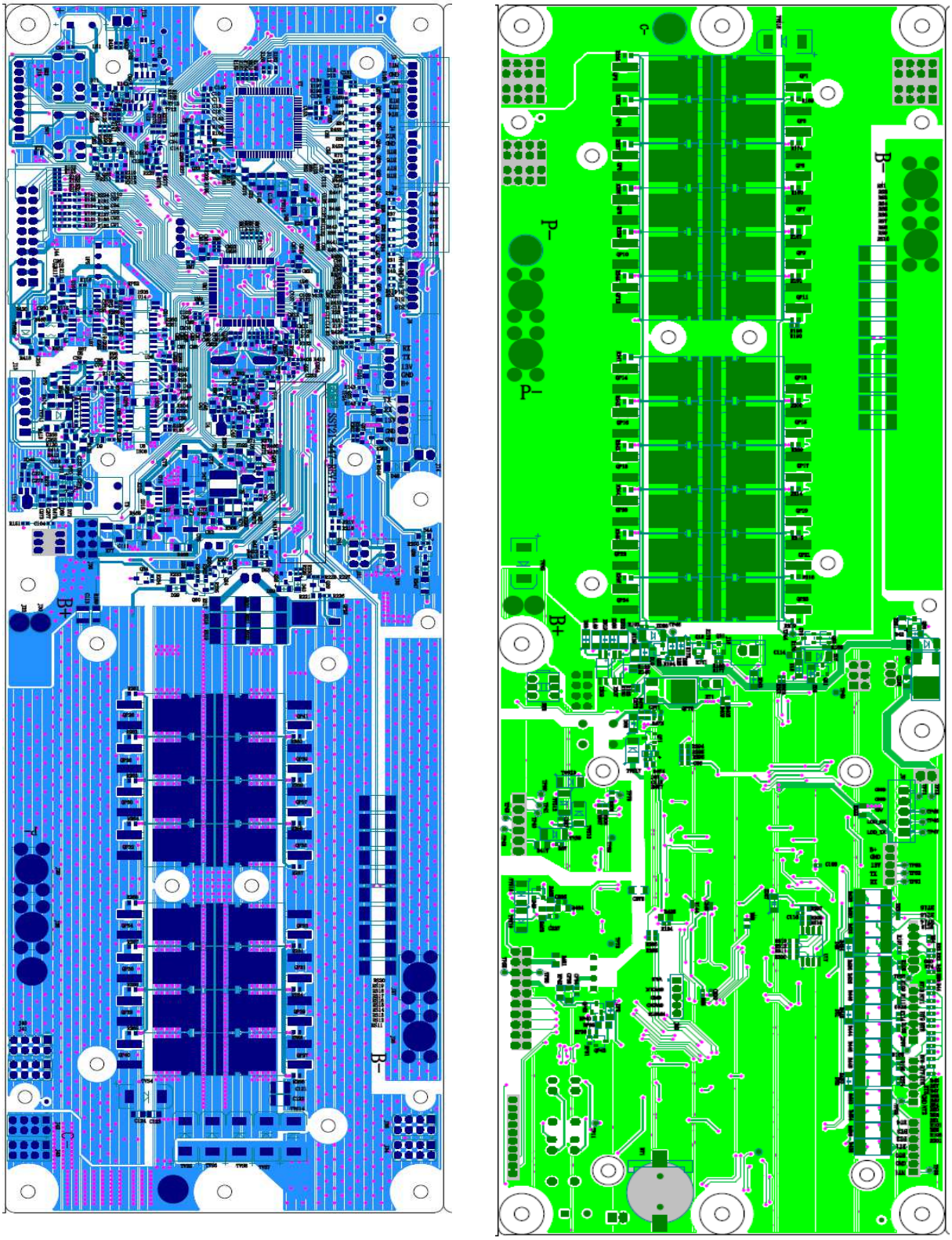
7.0 Illustrations

Illustration 2c- Circuit diagram



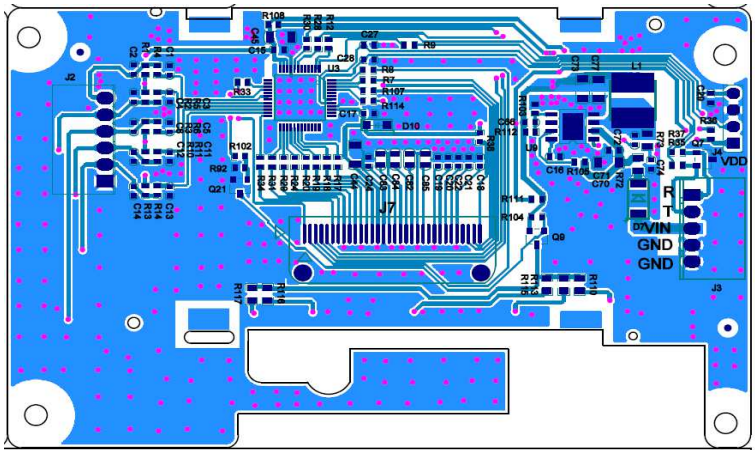
7.0 Illustrations

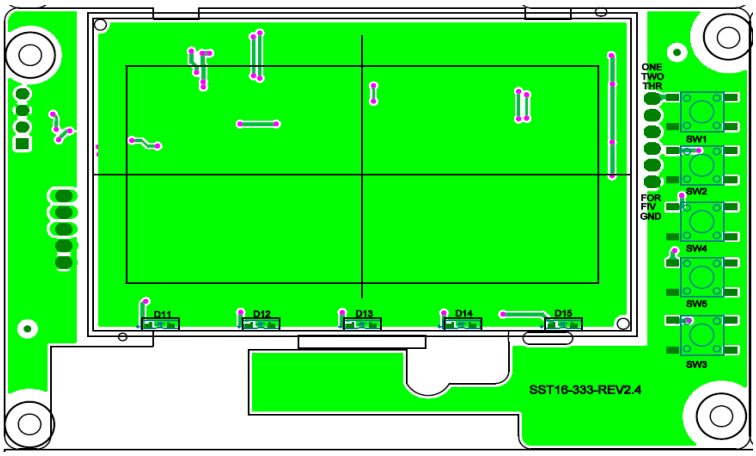
Illustration 3 - PCB layout

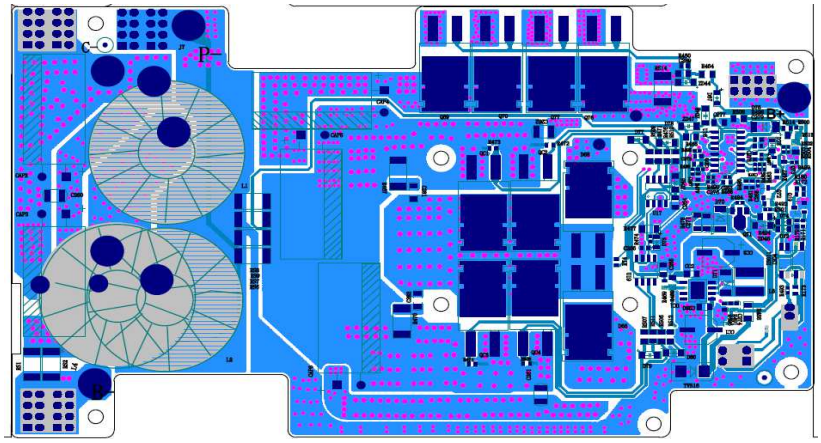


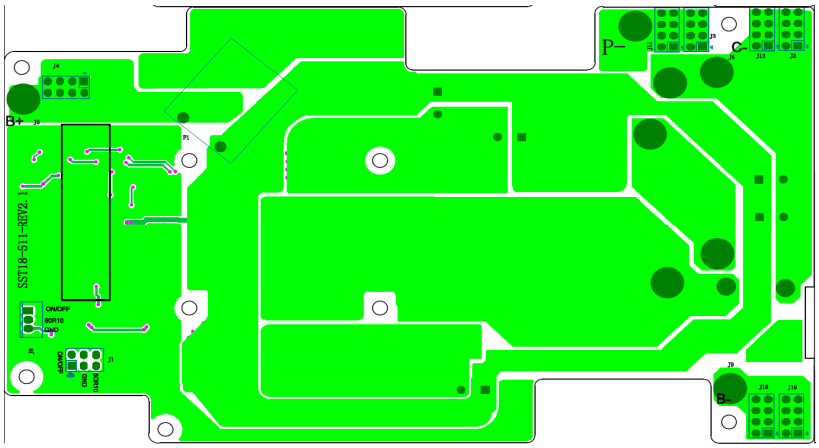
7.0 Illustrations

Illustration 3a - PCB layout



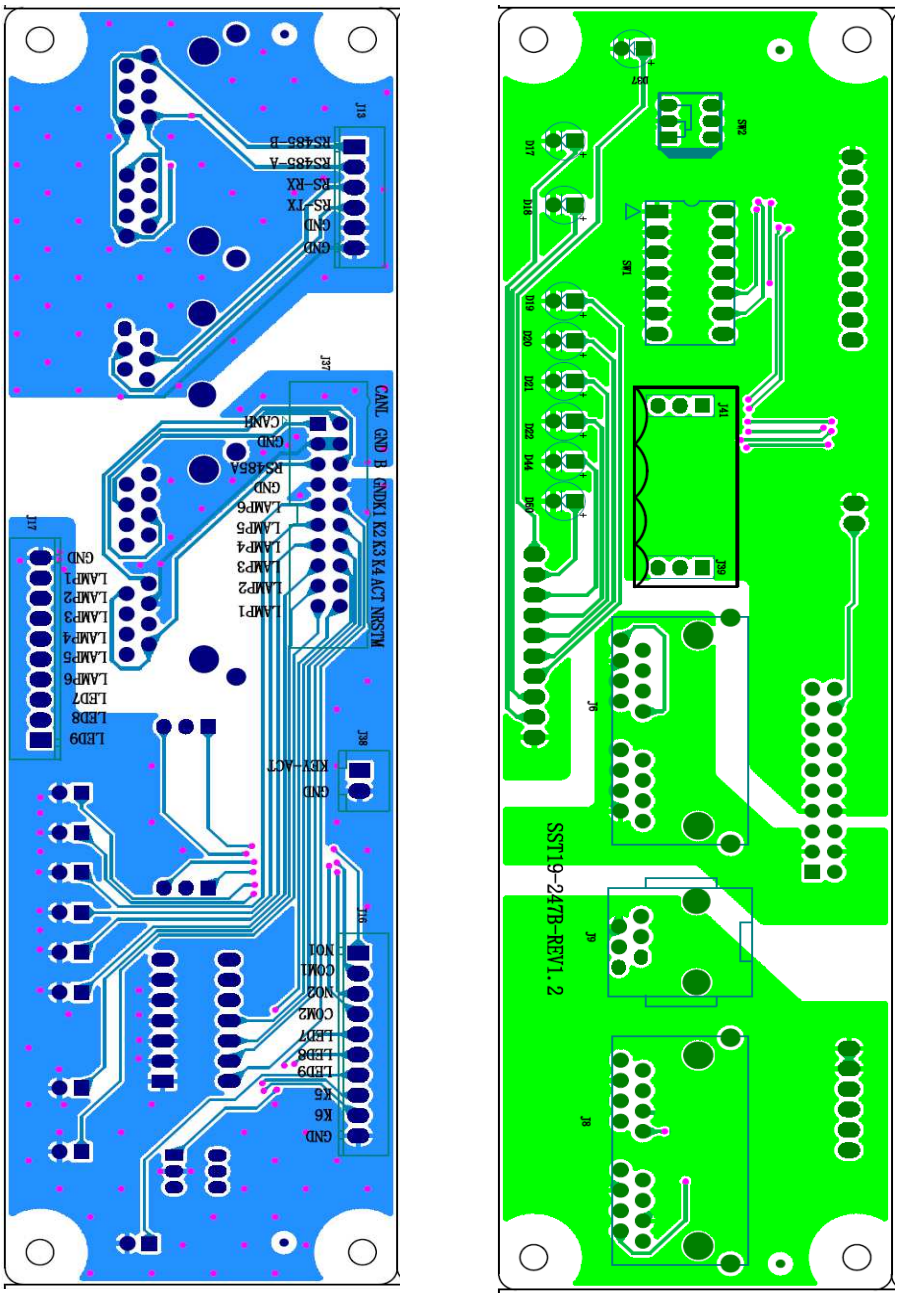






7.0 Illustrations

Illustration 3b - PCB layout



7.0 Illustrations

Illustration 4 - The specification of battery module

Product technical data	
Model	SK48V100
Configuration: XP/YS	16S1P
Technology	Lithium ion
Capacity, Ah	100
Nominal Voltage, Vdc	51.2
Standard Charging Current, A	20
Standard Full Charging Voltage, Vdc	57.6
End of Charging Current, A	5
Maximum Charging Current, A	100
Maximum Charging Voltage, Vdc	58.4
Standard Discharging Current, A	20
Discharge End Point Voltage, Vdc	42.5
Maximum Discharge Current, A	100
Charging Temperature Range, °C	0~55
Discharging Temperature Range, °C	-15~55

7.0 Illustrations

Illustration 5 - User manual (Representative)(Partial)

Background

SOK Battery has a long history of delivering both the highest quality battery and safest overall design at a value conscious price point. This tre continues with the release of the SK48V100, a true Grade A+ Lithium Iron Phosphate ($LiFePO_4$) battery pack designed to be easily installed into standard 19" EIA server-rack type battery enclosures or the custom-built SOK Server Rack.

A 16S (48v nominal) 5.12 kW-h LiFePO4 battery bank is paired with a digital battery management system (BMS), to provide automated and maintenance free battery operation, with a typical lifespan of over 4000 cycles. The assembly features full CAN bus & RS485 protocols to pair with most common 48V inverters, as well as RS-232 control for PC configuration.

Front View of SK48v100 Server Rack Battery

Use Applications

The SK48V100 battery is ideal for medium to large-scale off-grid and grid-interactive energy storage systems (ESS), telecom & server room backup, as well as mobile installations requiring a 48v battery.

Applications that require reliability, expandability, quality, safety, and serviceability are well-suited for this battery array. The SK48V100 can easily be expanded up to 15 modules per master battery, for a total system size of 76.8 kW-h per battery cluster. In special circumstances, multiple battery clusters may be interconnected for even larger centrally managed systems.

Advantages

The SOK engineers plan future serviceability into the initial design of all battery assemblies. On rare occasion, products in the real world can fail, depending on the usage, environment, and build quality. Failures can be caused by shipping damage, installer error, downstream equipment malfunction, natural aging, and unavoidable environmental factors such as lightning.

Competing batteries on the market are not designed for serviceability, being **permanently** assembled using techniques such as IR-Laser Welding of aluminum cell-interconnection busbars, plastic injection-molded cases, and permanent epoxy potting. These processes are great for single-use disposable products, but a poor choice for systems expected to last decades. When parts within these permanently assembled packs fail, the entire module is rendered useless and needs to be disposed of as E-waste and replaced as a complete unit. Any attempt to service would certainly void your warranty and the likelihood of a successful service is slim to none.

SOK Battery believes that these products are an investment and should not be thrown away if something goes wrong; products should withstand the test of time. The SOK Battery SK48V100 is engineered so that every single part within the battery pack can be field serviced and replaced by either an authorized service agent, or the end customer. This means less downtime and lower repair costs to the end-customer, as well as a decreased environmental impact.

SOK Battery is the leader in battery technology, paving the way for many battery manufacturers to follow.

7.0 Illustrations

Illustration 5a - User manual(Representative)(Partial)

SOK Owner / Operator Manual: Chapter 3 – Power Up Procedure

Pre-Charge Circuit Description

The SK48v100 contains an Internal Pre-Charge Circuit. Before powering up, we highly recommend understanding the pre-charge circuit and how it plays a factor in powering up the system safely.

Common in Inverters, battery chargers, and solar controllers is a sizable bank of capacitors on their DC bus to smooth out any ripple that may cause interference with normal operation.

When you apply a voltage across a capacitor it initially appears to be a short-circuit, that is, the voltage across the capacitor is zero. LiFePO4 Batteries in general have a very low internal resistance. This means that it is easy for very large currents to be delivered instantaneously. If there is very little resistance in the circuit, such closing of a circuit breaker, then the current will be extremely high for a brief instant. In this instant extremely high currents will flow through the closing contacts.

The large Voltage difference and sudden high current (known as an inrush current) can cause damage to various components such as circuit breakers, fuses, BMS units, and the capacitors themselves. This may not show up as a failure immediately, but the damage can reappear as a different issue later. This inrush current certainly will exceed the rating of the BMS, fuses, capacitors and circuit breakers.

This can all be prevented using a pre-charge resistor circuit. The pre-charge resistor allows the capacitors in the controller to slowly charge BEFORE the BMS fully activates. This means that the powering-up of inverters and chargers is regulated and graceful, rather than abrupt and volatile.

Proper Power-Up with Pre-Charge Circuit

In order to properly utilize the pre-charge circuit, you must take special care to follow the power-up steps in the correct order, otherwise the benefits of having a pre-charge circuit are negated.

1. Open all DC circuit breakers and switches in the system, they should already be off during the wiring process. If you have a battery charger or solar controller, turn it to the “OFF” position.
2. Ensure the BMS(s) in all batteries have been de-activated.
    - If the BMS is active, you can turn it off by pressing and holding the “RST” button with a small screwdriver or similar object for approximately 3 seconds, releasing the button when the SOC% lights begin to flash. A few seconds after releasing, all lights and the display display will turn off, which indicates the battery has shut down.
3. Turn on / close all DC breakers or disconnects in the system but leave any chargers off. This includes turning on the DC breaker of all the SK48v100 unit(s).
4. Again, briefly press the “RST” button of the master battery. This will immediately engage the pre-charge circuit of the master battery, which will charge any capacitors first. After pre-charging is complete, the pre-charge circuit will be automatically disengaged and the main power circuit will be enabled.
5. If additional batteries in the system have not turned on automatically by this point, turn them on by briefly pressing their “RST” button.

Warning: The pre-charge only works during the power-up procedure of the BMS. If you shut off any disconnects or trip any breakers during normal operation, the system must be fully shut down and this process must be repeated, otherwise damage can occur. Inrush damage is not covered under warranty.

8.0 Test Summary					
Evaluation Period	12-May-2022 to 30-Aug-2022			Project No.	220510031GZU
Sample Rec. Date	12-May-2022	Condition	Prototype	Sample ID.	S220510031-001~004
Test Location	Intertek Testing Services Shenzhen Ltd. Zengcheng Branch C2-1, Heping Xu, Yongning Street, Zengcheng District, Guangzhou, China				
Test Procedure	Testing Lab				
Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.					
The following tests were performed:					
Test Description			[ANSI/CAN/UL 1973:2018 Ed.2] Clauses	--	--
Overcharge			15	--	--
Short Circuit			16	--	--
Overdischarge Protection			17	--	--
Temperature and Operating Limits Check			18	--	--
Imbalanced Charging			19	--	--
Dielectric Voltage Withstand			20	--	--
Working Voltage Measurements			23	--	--
Static Force			28	--	--
Impact			29	--	--
Drop Impact (rack mounted module)			30	--	--
Wall Mount Fixture/Handle Test			31	--	--
Single Cell Failure Design Tolerance(lithium ion)			39	--	--
Evaluation Period	12-May-2022 to 30-Aug-2022			Project No.	220510031GZU
Sample Rec. Date	12-May-2022	Condition	Prototype	Sample ID.	S220510031-005
Test Location	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch Room 02, & 101/E201/E301/E401/E501/E601/E701/E801 of Room 01 1-8/F., No. 7-2. Caipin Road, Science City, GETDD, Guangzhou, Guangdong, China				
Test Procedure	Testing Lab				
Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.					
The following tests were performed:					
Test Description			[UL 60730-1:2016 Ed.5] & [CSA E60730-1:2015 Ed.5+A1:2017] Clauses	--	--
MANUFACTURING DEVIATION and DRIFT			15	--	--
Environmental stress of temperature			16.2	--	--
EMC requirements - immunity			26	--	--
Controls using software			H.11.12	--	--
Thermal cycling test			H.17.1.4.2	--	--
Electromagnetic compatibility (EMC) requirements – immunity			H.26.14	--	--
Component testing reviewer			Runze Hu	--	--

8.1 Signatures			
A representative sample of the product covered by this report has been evaluated and found to comply with the applicable requirements of the standards indicated in Section 1.0.			
Completed by:	David Yao	Reviewed by:	Carl Chen
Title:	Engineer	Title:	Reviewer
Signature:	*Signature on file*	Signature:	*Signature on file*

9.0 Correlation Page For Multiple Listings

The following products, which are identical to those identified in this report except for model number and Listee name, are authorized to bear the ETL label under provisions of the Intertek Multiple Listing Program.

BASIC LISTEE	Hocan Group Co., Ltd
Address	Room 905 Working Berg, Commercial Bldg, 41-47 MARBLE RD Hong Kong SAR
Country	China
Product	Lithium ion Battery

MULTIPLE LISTEE 1	None
Address	
Country	
Brand Name	
ASSOCIATED MANUFACTURER	
Address	
Country	

MULTIPLE LISTEE 1 MODELS	BASIC LISTEE MODELS

MULTIPLE LISTEE 2	None
Address	
Country	
Brand Name	
ASSOCIATED MANUFACTURER	
Address	
Country	

MULTIPLE LISTEE 2 MODELS	BASIC LISTEE MODELS

MULTIPLE LISTEE 3	None
Address	
Country	
Brand Name	
ASSOCIATED MANUFACTURER	
Address	
Country	

MULTIPLE LISTEE 3 MODELS	BASIC LISTEE MODELS

10.0 General Information

The Applicant and Manufacturer have agreed to produce, test and label ETL Listed products in accordance with the requirements of this Report. The Manufacturer has also agreed to notify Intertek and to request authorization prior to using alternate parts, components or materials.

COMPONENTS

Components used shall be those itemized in this Intertek report covering the product, including any amendments and/or revisions.

LISTING MARK

The ETL Listing mark applied to the products shall either be separable in form, such as labels purchased from Intertek, or on a product nameplate or other media only as specifically authorized by Intertek. Use of the mark is subject to the control of Intertek.

The mark must include the following four items:

1) applicable country identifiers "US" and/or "C" or "US", "C" and "EU"
2) the word "Listed" or "Classified" or "Recognized Component" (whichever is appropriate)
3) a control number issued by Intertek
4) a product descriptor that identifies the standards used for certification. Example:

For US standards, the words, “Conforms to” shall appear with the standard number along with the word, “ Standard” or “Std.” Example: “Conforms to ANSI/UL Std. XX.”

For Canadian standards, the words “Certified to CAN/CSA Standard CXX No. XX.” shall be used, or abbreviated, “Cert. to CAN/CSA Std. CXX No. XX.”

Can be used together when both standards are used.

If all standards on the ATM have the same standard title, the shared title or its abbreviation may be used in place of the examples above. Example: "Medical Electrical Equipment" or "MEE"; "Information Technology Equipment" or "ITE"; "Audio/Video Information And Communication Technology Equipment" or "A/V ICTE".

Note: A facsimile must be submitted to Intertek, Attn: Follow-up Services for approval prior to use. The facsimile need not have a control number. A control number will be issued **after signed Certification Agreements** have been received by the Follow-up Services office, approval of the facsimile of your proposed Listing Mark, satisfactory completion of the Listing Report, and scheduling of a factory assessment in your facility.

MANUFACTURING AND PRODUCTION TESTS

Manufacturing and Production Tests shall be performed as required in this Report.

FOLLOW-UP SERVICE

Periodic unannounced audits of the manufacturing facility (and any locations authorized to apply the mark) shall be scheduled by Intertek. An audit report shall be issued after each visit. Special attention will be given to the following:

1. Conformance of the manufactured product to the descriptions in this Report.
2. Conformance of the use of the ETL mark with the requirements of this Report and the Certification Agreement.
3. Manufacturing changes.
4. Performance of specified Manufacturing and Production Tests.

In the event that the Intertek representative identifies non-conformance(s) to any provision of this Report, the Applicant shall take one or more of the following actions:

1. Correct the non-conformance.
2. Remove the ETL Mark from non-conforming product.
3. Contact the issuing product safety evaluation center for instructions.

10.1 Evaluation of Unlisted Components

Because Unlisted Components are uncontrolled, and they do not fall under a third party follow up program, Intertek may require these components to be tested and/or evaluated at least once annually, more often for certain components, as part of the independent certification process. The Unlisted Components in Section 5.0 require testing and/or evaluation as indicated.

Sample Disposition: Due to the destructive nature of the testing, all samples will be discarded at the conclusion of testing unless, the manufacturer specifically requests the return of the samples. The request for return must accompany the initial component shipment.

11.0 Manufacturing and Production Tests

The manufacturer agrees to conduct the following Manufacturing and Production Tests as specified:

Required Tests

None

12.0 Revision Summary

The following changes are in compliance with the declaration of Section 8.1:

Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
				None