TEST REPORT

For

ShenZhen Newtowe Technology Co., Ltd

multi-function Smart USB car charger

Model No.: TR-24, TR-25, TR-24Q

Test Report Number: CQASZ20191200104SX

Shenzhen Huaxia Testing Technology Co., Ltd.

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TEST REPORT
UL 2089
Vehicle Battery Adapters

Report Number. ..... :	CQASZ20191200104SX
Date of issue ..... :	Dec. 16, 2019
Total number of pages ..... :	35
Testing Laboratory..... :	Shenzhen Huaxia Testing Technology Co., Ltd.
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Applicant's name..... :	ShenZhen Newtowe Technology Co., Ltd
Address ..... :	4th Floor 2#Yue Ming Street, Guan Tian Industrial Area ShiYan Town BaoAn District ShenZhen, China.
Test specification:	
Standard..... :	Test report form is based on the following requirements: UL 2089 Ed. 3 November 22, 2011+ Rev. May 07, 2018
Test procedure ..... :	Type test
Non-standard test method..... :	N/A

General disclaimer:

The test results presented in this report relate only to the object tested.
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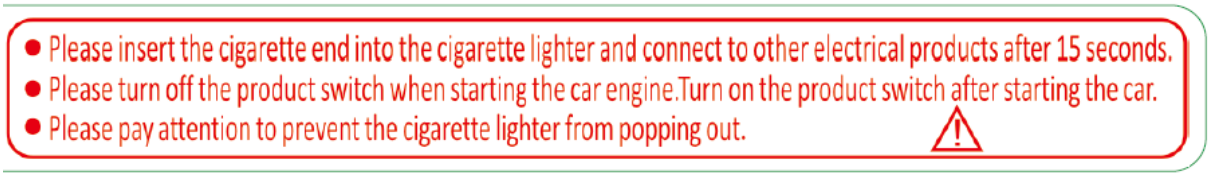
The authenticity of this Test Report and its contents can be verified by Shenzhen Huaxia Testing Technology Co., Ltd., responsible for this Test Report.

Test item description ..... :	multi-function Smart USB car charger
Trade Mark ..... :	TRONGER
Manufacturer ..... :	ShenZhen Newtowe Technology Co., Ltd
Address ..... :	4th Floor 2#Yue Ming Street, Guan Tian Industrial Area ShiYan Town BaoAn District ShenZhen, China.
Model/Type reference ..... :	TR-24, TR-25, TR-24Q
Ratings ..... :	Input: DC 12V-24V
	Output:
	Total output power: 180W(max):
	USB1: (QC3.0) DC 3.6-6.5V/3A, 6.5-9V/2A, 9-12/1.5A
	USB2-4: DC 5V, 3.6A(Max)
	Cigarette Lighter Hole Output: 12V-24V, 100W(max)

Copy of marking plate

The artwork below may be only a draft. Until approval by National Certification Bodies and they shall not be affixed to products.



Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing..... :	
Date of receipt of test item..... :	Dec. 10, 2019
Date(s) of performance of tests..... :	Dec. 10, 2019 to Dec. 12, 2019
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Name and address of factory (ies) ..... :	ShenZhen Newtowe Technology Co., Ltd 4th Floor 2#Yue Ming Street, Guan Tian Industrial Area ShiYan Town BaoAn District ShenZhen, China.
General product information:	
1. This car charger is designed to supply power for information technology equipment and use in automobile. 2. All of models are identical except for model names, it not affects safety. 3. The maximum ambient temperature is 35°C. Product size: Approx. 128mm(L)X76mm(W)X31.5mm(H)	

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
INTRODUCTION			P
2	**Components**		P
2.1.	Except as indicated in 2.2, a component of a product covered by this standard shall comply with the applicable requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.	(see appended table 2)	P
2.2	A component is not required to comply with a specific requirement that: a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or b) Is superseded by a requirement in this standard.		P
2.3	A component shall be used in accordance with its rating established for the intended conditions of use.		P
2.4	Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.		P

CONSTRUCTION			P
6	**Mechanical Assembly**		P
6.1	A unit shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without resulting in a risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other defects.		P
6.2	A unit shall have all parts reliably secured in place		P
6.3	An enclosure, an opening, a frame, a guard, a knob, a handle, or the like shall not be sufficiently sharp to constitute a risk of injury to persons in normal maintenance or use.		P
6.4	A unit shall be constructed so that it will not be necessary to open or remove the enclosure when the unit is used as intended.		P

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Clause	Requirement + Test	Result - Remark	Verdict
6.5	Each lampholder, switch, and similar component shall be mounted securely and shall be restrained from turning by more than friction between surfaces. For example, the use of a lock washer is an acceptable means to restrain the turning of a device having a single hole mounting means. Exception No. 1: A lampholder of a type in which the lamp cannot be replaced (such as a neon pilot or indicator light in which the lamp is sealed in by a nonremovable lens) need not be restrained from turning if rotation does not reduce spacings below the minimum acceptable values or produce stress on an electrical connection. Exception No. 2: A switch or other similar component need not comply with this requirement if the turning of such a component and servicing of the part introduces no additional risk of fire or electric shock, such as reduced spacings below minimum acceptable values or stress on an electrical connection.		N/A
6.6	A replaceable lamp in a unit shall be replaceable without opening the enclosure.		N/A
6.7	A nonreplaceable pilot lamp, such as an indicating-type overload- or short-circuit protector, a neon light, or an indicator light, is one in which the lamp is sealed-in, such as by an unremovable lens.		N/A
6.8	A switch or an overcurrent-protective device shall be located within the unit enclosure and protected in such a manner as not to be accessible or exposed to tampering nor subject to mechanical damage during normal use or as a result of abuse. This requirement does not apply to the actuating means of a switch.		P
6.9	The requirements in 6.8 also apply to the actuating means – toggle, handle, or the like – if the dislodging of such part exposes live parts or film-coated magnet wire that can be contacted as specified in Accessibility of Live Parts, Section 16.		N/A
6.10	The overall mass of the cigarette lighter connector shall not exceed 250 g (8.8 oz). The product of (the total mass) and (the distance between the center of gravity and the input contact positioned to simulate full insertion into a power outlet) shall not exceed 13500 g-mm (18.7 oz-in). For a unit with an attached cord, the determination shall be made with the cord severed at the enclosure, or at the strain-relief means if the strain-relief means is outside the enclosure. For a unit with a detachable cord, the determination shall be made with the cord severed from the mating connector connected to the cigarette lighter connector.	Total mass: 231g	P

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Clause	Requirement + Test	Result - Remark	Verdict
7	**Enclosure**		P
7.1	A unit shall be provided with an enclosure that shall house all current-carrying parts that present a risk of electric shock. The enclosure shall have the strength and properties necessary to reduce the risk of mechanical damage to the various parts		P
7.2	A unit shall have no openings larger than those complying with Section 16, Accessibility of Live Parts.	No openings	P
7.3	If an acceptable grade of vulcanized fiber is used as part of the enclosure for the support of parts (terminals and the like) that do not present a risk of fire or electric shock, the amount of fiber shall not be more than is necessary to support the parts in question. The fiber shall not be less than 1/32 in (0.8 mm) thick and shall not introduce a risk of fire, electric shock, or injury to persons as a result of abuse.		N/A
7.4	An enclosure constructed of sheet metal shall be formed from stock having a thickness not less than that specified in Table 7.1. The thickness of enclosure sheet metal other than steel or aluminum shall not be less than that specified in Table 7.1 for uncoated steel and shall have the necessary strength and rigidity.		N/A
7.5	In addition to the performance tests specified in this Standard, the material of a polymeric enclosure shall have a minimum flammability classification of V-0, V-1, or V-2 and shall provide the level of performance specified in Table 7.2 for the corresponding electrical properties. Exception: An enclosure material may be accepted based on the end-product tests specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.	V-0 material used	P
7.6	A conductive coating applied to a nonmetallic surface such as the inside surface of a cover, enclosure, and the like shall comply with the applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, unless it can be determined that flaking or peeling of the coating does not result in a reduction of spacings or the bridging of live parts that may result in a risk of fire, electric shock, or injury to persons.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
7.7	An adhesive used in the assembly of the enclosure shall be investigated as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. Exception: Methods utilizing fusion techniques, such as solvent cementing, ultrasonic welding, electromagnetic induction, and thermal welding need not be investigated.		N/A
8	**Protection Against Corrosion**		P
8.1	Except as noted in 2.2, iron and steel parts shall be protected against corrosion by galvanizing, plating, enameling, or other equivalent means if the corrosion of such unprotected parts would be likely to result in a risk of fire, electric shock, or injury to persons.		P
8.2	The requirement in 8.1 applies to all enclosing cases or to other parts upon which intended mechanical operation may depend. It does not apply to laminations and small minor parts of iron or steel, such as washers, screws, and bolts, that are not current carrying, if the corrosion of such unprotected parts would not be likely to result in a risk of fire, electric shock, or injury to persons, or result in the device not operating as intended. A part made of stainless steel does not require additional protection against corrosion.		N/A
9	**Switches**		P
9.1	The requirements in 9.2 and 9.3 apply to switches not in a Class 2 circuit, and to switches in a Class 2 circuit the breakdown of which electrically or mechanically is likely to result in a risk of fire or electric shock.		P
9.2	A switch subjected to a temperature higher than 50°C (122°F) shall be investigated with respect to the temperature limits of the materials used.		P
9.3	A switch or other control device shall be acceptable for the application and shall have current and voltage ratings not less than those of the load that it controls.		P
10	**Protective Devices**		P
10.1	A protective device built into a unit shall comply with the requirements for that device.		P
10.2	Crossed or nicked (reduced) cross-section conductors shall not be employed as a protective device.		P

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Clause	Requirement + Test	Result - Remark	Verdict
10.3	Protective devices as mentioned in 10.1 include, but are not limited to, eutectic material, fuses, overtemperature and overcurrent protectors, thermal protectors, and similar devices intended to interrupt or limit the flow of current as a result of overload.	Current fuse used	P
10.4	A manually reset thermostat shall be so constructed that automatic tripping of the thermostat is not precluded by any setting or position of the reset mechanism.		N/A
10.5	An automatically or manually reset protective device or replaceable overcurrent-protective device shall not open when the unit is delivering its rated output. See Temperature Test, Section 25.		N/A
10.6	A fuse or protective device shall be located in or adjacent to the cigarette lighter connector in the positive side of the supply.		P
10.7	The fuse or protective device required by 10.6 shall have a current rating not greater than the ampacity of the interconnecting cord as specified in Table 13.1, and in no case greater than 20 A.	32Vdc, 5A current fuse used	P
10.8	If the fuse or protective device is not located within the cigarette lighter connector, the length of wire between the connecting means and the protective device shall not be greater than 5 in (127 mm).		N/A
10.9	A protective device shall be acceptable for the application and shall have voltage and current ratings not less than those of the circuit in which it is connected.		P
11	**Components**		P
11.1	A component – a fixed resistor, PTC or NTC resistor, diode, or the like – used to limit the output of a unit to within the required current or power levels, or otherwise used to obtain acceptable performance, shall have permanence and stability so as not to decrease its limiting capacities. Among the factors considered when determining the acceptability of a limiting component are: a) Effect of operating temperature, b) Electrical stress level, and c) Resistance to moisture.		P
12	**Coil Insulation**		P
12.1	Coil insulation, unless inherently moisture resistant, shall be treated so as to render it moisture resistant.		P
12.2	Film-coated magnet wire is considered moisture resistant.		N/A
13	**Flexible Cords**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
13.1	A unit shall be provided with a flexible cord and shall be type SP-2, SPE-2, SPT-2, SV, SVE, SVT, S, SE, SO, SP-3, SPT-3, ST, STO, SJ, SJE, SJO, SJT, or SJTO. The length of cord external to the unit and including the cigarette lighter connector shall not be less than 3 ft (0.9 m) as measured from the end of the cigarette lighter connector to the point of attachment or entry. Cord AWG size shall be in accordance with Table 13.1. Exception No. 1: Output wiring for Class 2 or Low Voltage Limited Energy circuits may be parallel cord insulated with rubber, neoprene, or thermoplastic having a wall thickness of not less than 0.013 in (0.33 mm). Exception No. 2: For units rated 10 A or less, an equivalent style appliance wiring material (AWM) may be employed.		N/A
14	**Input Contacts**		P
14.1	The diameter of the center (positive) contact shall not be less than 9/64 in (3.57 mm).	5.49mm	P
15	**Output Connections**		P
15.1	**General**		P
15.1.1	A unit shall be provided with an output cord for each output, attached or detachable, which: a) Terminates in a connector for connection to a low voltage appliance; or b) Is permanently attached to an intermediate enclosure for filtering or regulating circuitry. The intermediate enclosure shall be provided with means for connection of the output consisting of a cord, insulated leads, output connectors, or battery receptacle.	Not provide, should be evaluated during national approval	N/A
15.2	**Low voltage limited energy circuits**		P
15.2.1	A low-voltage limited-energy (LVLE) circuit is defined as a circuit with an open-circuit potential of not more than 42.4 V peak ac, or 60 V dc, with the energy available to the circuit limited: a) So that the current under any condition of load including short circuit is not more than 8 A for potentials up to 42.4 V peak, and 150/Vmax for potentials from 30 to 60 V dc, measured after 1 minute of operation by: 1) An isolating transformer; or 2) A fixed impedance or reliable regulating network; or b) By a fuse or nonadjustable manually reset circuit protective device that is rated or set at not more than the value specified in Table 15.1.	USB output: 12Vdc, 1.77A, 21.24W Max.	P

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Clause	Requirement + Test	Result - Remark	Verdict
15.3	**Output connectors**		P
15.3.1	Output connectors mounted on the enclosure and intended for direct connection of accessories, such as separable battery holders and the like, shall provide a secure connection between mating parts. The connections shall be polarized if the output is direct-current or if multiple outputs are provided.		P
15.3.2	A fitting having female contacts shall be constructed so that it does not receive the blades of a standard attachment plug. A fitting having male contacts shall be constructed so that the contacts will not touch a live part of a standard attachment-plug receptacle.		P
15.4	**Bushings**		N/A
15.4.1	At a point where a flexible cord passes or is intended to pass through an opening in a metal wall, barrier, or enclosing case, there shall be a bushing or the equivalent that shall: a) Be secured in place; and b) Have a smooth, rounded surface against which the cord may bear.		N/A
15.4.2	If the cord hole is in a non-conducting material, a smooth, rounded surface is considered to be the equivalent of a bushing.		N/A
16	**Accessibility of Live Parts**		P
16.1	**General**		P
16.1.1	A live part that presents a risk of electric shock shall be located or enclosed so that protection against contact is provided.		N/A
16.1.2	The input impedance of the voltmeter used to measure voltage in accordance with 16.2.1 and 16.3.1 is to be a minimum of 1 MΩ. The input impedance of a meter with more than 1 MΩ input impedance can be lowered by using shunt impedance.		N/A
16.1.3	A guard, baffle, or cover that can be removed without using a tool is to be removed when determining if a live part is accessible to the user. A live part that can be contacted by the test pin, articulate probe, or accessibility probe illustrated in Figure 16.1, Figure 16.2, or Figure 16.4, is considered to be accessible.		N/A
16.2	**Live parts other than exposed wiring terminals**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
16.2.1	The test pin and articulate probe illustrated in Figures 16.1 and 16.2, respectively, when applied as described in 16.2.3, shall not contact any live part with a voltage greater than that specified in 16.2.2 with respect to the vehicle chassis or any other live part simultaneously accessible, in a different location, to the test pin or articulate probe.		N/A
16.2.2	The maximum voltages which may be accessible in accordance with 16.2.1 are: a) 42.4 V peak for sinusoidal or nonsinusoidal ac; b) 60 V for continuous dc; c) 24.8 V peak for dc interrupted at a rate of 200 Hz or less with approximately 50 percent duty cycle; and d) As indicated in Figure 16.3 for combinations of ac and dc. Exception: The voltage limits specified may be exceeded if the current through a 1500 W resistor connected between the accessible points does not exceed 0.5 mA.	All voltage within equipment blow 60VDC	P
16.2.3	The test pin and articulate probe referenced in 16.2.1 are to be applied with a force not exceeding 1 lbf (4.4 N) to determine whether the live parts are accessible. The test pin shall not be applied to fuseholders and the like		N/A
16.3	**Exposed wiring terminals**		P
16.3.1	The accessibility probe illustrated in Figure 16.4, when applied as described in 16.3.3 shall not contact an exposed wiring terminal with a voltage greater than that specified in 16.3.2 with respect to the vehicle chassis or to any other terminal simultaneously accessible to the probe.		P
16.3.2	The maximum voltages which may be accessible in accordance with 16.3.1 are: a) 42.4 V peak for sinusoidal or nonsinusoidal ac; b) 42.4 V for continuous dc; c) 24.8 V peak for dc interrupted at a rate of 200 Hz or less with approximately 50 percent duty cycle; and d) 42.4 V peak for combinations of ac and dc.		P
16.3.3	The accessibility probe referenced in 16.3.1 is to be applied with a force not exceeding 5.62 lbf (25N) to determine whether the exposed wiring terminals are accessible.		P
17	**Live Parts**		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
17.1	A current-carrying part shall be silver, copper, a copper alloy, plated iron or steel, stainless steel, or other corrosion-resistant alloys acceptable for the application.	Copper alloy was used	P
17.2	An uninsulated live part shall be secured to the base or mounting surface so that it will not turn or shift in position if such motion may result in a reduction of spacings below the minimum acceptable values.		P
17.3	Friction between surfaces is not acceptable as a means to prevent shifting or turning of a live part but a lock washer is acceptable.		N/A
18	**Strain Relief**		N/A
18.1	Strain relief shall be provided between the cigarette lighter connector and its adjacent cord, and shall be tested in accordance with the Strain Relief Test, Section 29.		N/A
18.2	Means shall be provided to prevent the cord or wiring from being pushed into the enclosure through the cord-entry hole when such displacement results in: a) Subjecting the cord or wiring to mechanical damage; b) Exposing the cord or wiring to a temperature higher than that for which it is rated; c) Reducing spacings (such as to a metal strain-relief clamp) below the minimum required values; or d) Damaging internal connections or components. To determine compliance, the cord shall be tested in accordance with Section 28A, Push-Back Relief Test.		N/A
19	**Internal Wiring**		P
19.1	The internal wiring of a unit shall consist of insulated conductors having mechanical strength, dielectric properties, and ampacity for the application.		P
19.2	Each splice and connection shall be mechanically secure, shall provide reliable electrical contact, and shall be provided with insulation at least equivalent to that of the wire involved unless acceptable permanent spacing between the splice and all other metal parts will be maintained. When determining the required minimum thickness of splice insulation, the circuit voltage and interaction with other circuits shall be taken into consideration.		P
19.3	A wire connector for making a splice in a unit shall be a type that is applied by a tool in which the applicable force of the tool making the splice is independent of the force applied by the operator of the tool.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
19.4	The connection between a lead, including a flexible cord, and the transformer winding or other part of the unit shall be soldered, welded, or otherwise securely connected within the enclosure. A soldered joint shall be mechanically secure before soldering.	Double fixed by soldering and glue	P
19.5	If a lead is rigidly held in place without the use of solder, or if it is retained in place so as not to be subjected to any motion, no additional mechanical security is required. Mechanical securement of a lead is not required if separation of the connection does not result in a risk of fire or electric shock.		N/A
19.6	Unless it is to be considered as an uninsulated live part, insulated internal wiring – including an equipment-grounding conductor – shall consist of wire of a type or types acceptable for the applicable, when considered with respect to: a) The temperature and voltage to which the wiring is likely to be subjected; b) Exposure to oil, grease, cleaning fluid, or other substances likely to have a deleterious effect on the insulation; and c) Other conditions of service to which it is likely to be subjected.		N/A
18.7	An insulated conductor shall be located or protected to reduce the risk of contact with any sharp edge, burr, fin, moving part, or the like, that can damage the conductor insulation.		P
20	**Insulating Materials**		P
20.1	Integral parts such as insulating washers and bushings, and bases or supports for mounting of live parts, shall be of moisture-resistant materials that will not be damaged by the temperatures and stresses to which they will be subjected under conditions of actual use.		P
20.2	An insulating material is to be investigated with respect to its acceptability for the application in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. Materials, such as mica, ceramic, or some molded compounds are usually acceptable for use as the sole support of live parts. If it is necessary to investigate a material to determine its acceptability, consideration is to be given to such factors as its mechanical strength, resistance to ignition sources, dielectric strength, insulation resistance, and heat-resistant properties in both the aged and unaged conditions, the degree to which it is enclosed, and any other features that could result in a risk of fire and electric shock.		P
21	**Printed-Wiring Boards**		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
21.1	A printed wiring board in a unit shall comply with the Standard for Printed-Wiring Boards, UL 796, and shall be classed V-1 or less flammable, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. Exception: A V-2 printed wiring board may be used if the unit is closed beneath the material or has an equivalent barrier.	V-1 or better PCB used	P

PERFORMANCE			P
22	**General**		P
22.1	The number of representative samples indicated in Table 22.1 shall be subjected to the tests described in Sections 23 – 29. Unless otherwise specified, all tests are to be conducted at the marked d-c voltage. The test supply of rated voltage shall have a minimum capacity of 30 A.		P
22.2	With respect to 22.1 and footnotes a and b of Table 22.1, a sample may be used for more than one test, provided that the previous test did not damage the sample.		P
22.3	The cheesecloth mentioned in this standard is to be bleached cheesecloth running 14 – 15 yd^2/lb (approximately 26 – 28 m^2/kg) and having what is known in the trade as a “count of 32 by 28,” that is, for any square inch, 32 threads in one direction and 28 threads in the other direction (for any square centimeter, 13 threads in one direction and 11 in the other direction).		P
22.4	The tests described in Sections 23 – 29 are to be conducted in an ambient air temperature within the range of 21 – 30°C (70 – 86°F). Exception: The normal temperature test described in Section 25, Temperature Test, with or without standard fuses, but without the other forms of overcurrent or overtemperature protectors may be conducted in an ambient air temperature within the range of 10 – 40°C (50 – 104°F).		P
22.5	For tests which specify rated load conditions, a sample is to be connected to the load specified in Table 22.2.		P
22.6	With reference to Table 22.2, if an output is rated in watts or volt-amperes, the rated output current is considered to be the quotient of the watt or volt-ampere rating and the voltage rating.		P
23	**Maximum Output Voltage Test**		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
23.1	The maximum output voltage under any load condition (including no load) between any two output terminations of a unit shall not be more than the peak voltages specified in 16.2.2.	(see appended table 23)	P
23.2	If a unit has more than one pair of output terminations, the output voltage mentioned in 23.1 is to be measured with any combination of interconnections of the output terminations.		P
23.3	The maximum voltage between output terminations of a multiple output unit may exceed the values specified in 23.1 when the output terminations are interconnected, if the following conditions are met: a) The maximum output voltage between any two terminations is not more than the values indicated in 16.2.2 when no connections are made between the output terminations; and b) The unit is marked in accordance with 32.6.		N/A
24	**Power Input Test**		P
24.1	The current or watts input to a vehicle battery adapter, when connected to a supply adjusted to the rated input voltage and supplying rated output into a load as described in Table 22.2, shall not be more than 110 percent of the rated value.	(see appended table 24)	P
24.2	A battery charger intended for use with a specific battery pack shall be tested using the battery pack as its intended load.		N/A
24.3	If a vehicle battery adapter intended to charge batteries is to be tested using a lead-acid battery or batteries as the load, each battery is to be discharged to 1.75 V per cell – measured with the load connected – at a rate not to exceed the discharge rate assigned by the battery manufacturer, but in any case, the rate of the discharge is not to exceed one-sixth of the ampere-hour capacity of the battery. See Table 22.2.		N/A
24.4	If a battery charger is to be tested with a typical 1.2 V per cell nickel-cadmium battery or batteries as the load, each battery is to be discharged to 0.9 V per cell – measured with the load connected – at a rate not to exceed the discharge rate assigned by the battery manufacturer.		N/A
24.5	If a battery charger is to be tested with a battery or batteries other than those specified in 24.3 and 24.4, the battery is to be discharged in accordance with the battery manufacturer's maximum recommended discharge rate to an appropriate discharge voltage.		N/A
25	**Temperature Test**		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
25.1	The unit shall be mounted as in intended service and connected as described in 24.1. With the unit operating at its maximum marked duty cycle, the unit shall not reach a temperature at any point high enough to cause a risk of fire, to damage any material used, or to exceed the temperature rises specified in Table 25.1.		P
25.2	If the load specified in 24.1 includes a variable resistance, the load is to be adjusted after 15 min of operation, if necessary, to return the output to the original value. If the load consists of a battery, the battery shall be discharged as specified in 24.4 or 24.5 as applicable.		P
25.3	If a battery charger which is not likely to be used for consecutive charging of batteries is tested with a battery load, the test is to be continued until temperatures peak. The load is to be replaced by a second discharged battery. The test is terminated when temperatures peak, or temperatures stabilize, whichever occurs first during the second load condition.		N/A
25.4	A battery charger which is likely to be used for consecutive charging of batteries is to be tested with the intended battery load. The test is to be conducted in accordance with 25.5.		N/A

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
25.5	With respect to 24.4, a consecutive charger is to be tested in accordance with the following: a) For a charger with no charge status indicator, the test is to be continued until temperatures peak. The load is to be replaced with another discharged battery. This sequence is to be repeated until maximum temperatures are obtained. b) For a charger with a visual charge status indicator, the test is to be continued until the visual indicator indicates that the charge cycle is complete. The load is to be replaced with another discharged battery. This sequence is to be repeated until maximum temperatures are obtained. c) For a charger with a charge time marking or instruction, the test is to be continued until the specified charge time has elapsed. The load is to be replaced with another discharged battery. This sequence is to be repeated until maximum temperatures are obtained. d) For a charger with both a visual charge status indicator and a charge time marking or instruction, the test is to be continued until the specified charge time has elapsed or until the visual indicator indicates that the charge cycle is complete, whichever occurs first. The load is to be replaced with another discharged battery. This sequence is to be repeated until maximum temperatures are obtained.		N/A
25.6	With reference to 25.1, a unit having voltage adjustment taps for intended use shall operate within the temperature limits at any setting including the maximum and intermediate positions.		N/A
25.7	A protective device shall not operate during the temperature test.		P
25.8	A unit intended for mounting or support in more than one position or in a confined location is to be tested in a manner representing the most severe conditions. An adjacent mounting or supporting surface is to consist of 1-in (25.4-mm) thick soft-pine boards.		N/A
25.9	Unless investigated and found acceptable, a supporting means formed of soft rubber or rubberlike material is to be removed prior to the temperature test. If the supporting means has a metal insert, such as a screw or rivet, the test is to be conducted with the power unit supported by the metal insert. At the request of the manufacturer, the test may be conducted without any means of support.		N/A

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
25.10	A thermocouple junction and the adjacent thermocouple lead wires are to be held securely in good thermal contact with the surface of which the temperature is being measured. Usually adequate thermal contact will result from securely taping or cementing the thermocouple in place but, if a metal surface is involved, brazing or soldering the thermocouple to the metal may be necessary.		P
25.11	Coil and winding temperatures are to be measured by thermocouples located on exposed surfaces, except that the resistance method may be used for a coil that is inaccessible for mounting thermocouples, such as a coil: a) Immersed in sealing compound, b) Wrapped with thermal insulation, or c) Wrapped with more than two layers of material such as cotton, paper, or rayon more than 1/32 in (0.8 mm) thick.		P
25.12	The temperature rise of a winding is determined by the resistance method by comparing the resistance of the winding at a temperature to be determined with the resistance at a known temperature according to the formula: The winding is to be at room temperature at the start of the test.		N/A
25.13	All values for temperature rises in Table 25.1 are based on an assumed ambient temperature of 25°C (77°F).		P
25.14	Thermocouples are to consist of wires not larger than 24 AWG and not smaller than 30 AWG. When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of 30 AWG iron and constantan wire and a potentiometer type instrument. Such equipment is to be used whenever referee temperature measurements by thermocouples are necessary. The thermocouples and related instruments are to be accurate and calibrated in accordance with good laboratory practice. The thermocouple wire is to conform with the requirements specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.		P
25.15	A temperature is considered to be constant when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 15 min, indicate no further increase.		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
26	**Dielectric Voltage-Withstand Test**		P
26.1	While still in a heated condition, a unit shall withstand for 1 min without breakdown the application of a 60-Hz essentially sinusoidal potential of: a) 500 V between a circuit operating at 60 V dc or less or 50 V ac rms (70 V peak) or less and dead metal parts; and b) 1000 V plus twice the maximum circuit voltage between a circuit operating at more than 60 V dc or more than 50 V ac rms (70 V peak) and dead metal parts.	(see appended table 26)	P
26.2	The unit is to be tested using a 500 VA or larger capacity transformer, the output voltage of which can be varied. The applied potential is to be increased from zero until the required test level is reached, and is to be held at that level for 1 minute. The increase in applied potential is to be at substantially uniform rate as rapid as is consistent with correct indication of its value by a voltmeter.		P
27	**Abnormal Tests**		P
27.1	**General**		P
27.1.1	A unit shall not emit flame or molten metal or become a risk of fire or electric shock when subjected to the reverse polarity test in 27.2, the component breakdown test in 27.3, and the battery-supply cord short circuit test in 27.4.		P
27.1.2	A risk of fire or electric shock is considered to exist if any of the following occurs: a) Charring of cheesecloth; b) Emission of flame or molten material from the unit enclosure and output cord, if provided; or, c) Any condition that exposes live parts which present a risk of electric shock as specified in Section 16, Accessibility of Live Parts.	No such risk	N/A
27.1.3	Each test is to be conducted on a separate sample unless the manufacturer requests that more than one test be conducted on the same sample.		P
27.1.4	A polarity-protection circuit provided to prevent output-current flow until a battery is connected as intended to the output is to be made inoperative so that the required output current will flow.		N/A
27.1.5	During all abnormal tests the unit is to be draped with a double layer of cheesecloth conforming to the outline of the unit.		P
27.2	**Reverse polarity test**		N/A

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
27.2.1	For a device intended for charging batteries and provided with nonpolarized output connections, the external output leads are to be connected in reverse polarity to a fully charged battery intended for the application. The unit is then to be connected to its maximum test voltage, and operated until the ultimate condition is observed, or 4 h if cycling of an automatically reset protector occurs.	The mechanical design prevent reverse connetion	N/A
27.3	**Component breakdown test**		P
27.3.1	A unit having components – such as diodes, resistors, transistors, capacitors, and the like – with a single component fault of short or open, shall not result in the output exceeding the levels specified in 16.3.2, or any condition as specified in 27.1.2. The unit is to be connected to the maximum test voltage and operated until ultimate conditions are observed, or for 4 h if cycling of an automatically reset protector occurs. Exception: This test need not be conducted for component breakdowns that result in open or short circuiting of the output.	(see appended table 27.3)	P
27.4	**Battery-supply cord short circuit test**		N/A
27.4.1	The battery-supply cord shall be short-circuited at any point on the cord, but not within 5 in (127 mm) of the cigarette lighter connector. As a result of this test, the fuse required by 10.7 and 10.8 shall open prior to any damage to the battery-supply cord or the cigarette lighter connector.		N/A
27.5	**Abnormal temperature test**		P
27.5.1	Immediately following the temperature test described in Section 24, one sample of the unit shall be subjected to the test described in 27.5.2 –27.5.4. As a result of the test, the unit shall not attain a temperature high enough to result in a risk of fire, electric shock, or damage to materials, or exceed the temperature rises specified in Table 25.1 by more than 20°C (36°F).	(see appended table 27.5)	P
27.5.2	The unit is to be tested in accordance with Temperature Test, Section 25 using the input voltages specified in 27.5.3 and 27.5.4, as applicable. The test is to be terminated when temperatures peak, stabilize, or decrease.		P
27.5.3	A unit intended to be connected to a nominal 12 Vdc supply shall be tested at the minimum input voltage at which the unit operates but not less than 10.5 Vdc. The test is to be repeated using the same sample at the maximum input voltage at which the unit operates but not greater than 14.5 Vdc.		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
27.5.4	A unit intended to be connected to a nominal 24 Vdc supply shall be tested at the minimum input voltage at which the unit operates but not less than 21 Vdc. The test is to be repeated using the same sample at the maximum input voltage at which the unit operates but not greater than 29 Vdc.		P
28	**Resistance to Crushing Test**		P
28.1	One sample of the cigarette lighter connector shall withstand for 1 min a steady crushing force of 75 lbf (334 N). The cigarette lighter connector is to be tested between two parallel, flat, maple blocks, each not less than 1/2 in (12.7 mm) thick. The crushing force is to be applied gradually in a direction normal to the mounting surface.		P
29	Strain Relief Test		N/A
29.1	The strain relief means provided between the battery-supply cord and cigarette lighter connector shall withstand for 1 min without displacement a direct pull of 20 lbf (89 N) applied to the cord, with the connections within the cigarette lighter connector disconnected. The strain relief is not acceptable if, at the point of disconnection of the conductors, there is such movement of the cord as to indicate that stress on the connections would have resulted.		N/A
29.2	A 20-lb (9 kg) weight is to be suspended from the cord so that the strain relief means will be stressed from any angle the construction permits.		N/A
30	**Push-Back Relief Test**		N/A
30.1	To determine compliance with 18.2, a product shall be tested in accordance with 30.2 without occurrence of any of the conditions specified in 18.2 (a) – (d).		N/A
30.2	The cord is to be held 1 inch (25.4 mm) from the point where the cord or lead emerges from the product and is then to be pushed back into the product. When a removable bushing which extends further than 1 inch is present it is to be removed prior to the test. When the bushing is an integral part of the cord, then the test is to be carried out by holding the bushing. The cord or lead is to be pushed back into the product in 1 inch (25.4 mm) increments until the cord buckles or the force to push the cord into the product exceed 6 pounds-force (26.7 N). The cord or lead within the product is to be manipulated to determine compliance with 18.2.		N/A

MARKINGS		P
31	**General**	P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
31.1	A unit shall be legibly and permanently marked where it is readily visible with the following: a) The manufacturer's name, trade name, or trademark; b) A distinctive catalog number or the equivalent; c) The input and output ratings in voltage, frequency, and amperes, watts, or volt-amperes; and Exception: The output rating need not be included in a unit intended to charge a specific battery or battery pack provided the unit is marked to indicate the battery or battery pack to be used. d) The date or other dating period of manufacture not exceeding any three consecutive months. Exception: The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer provided that the code: 1) Does not repeat in less than 20 years; and 2) Does not require reference to the production records of the manufacturer to determine when the product was manufactured.		P
31.2	With respect to the frequency marking mentioned in 31.1, the symbol illustrated in Figure 31.1 may be used for this marking.		P
31.3	Unless specifically exempt, markings required by this Standard shall be permanent. A permanent marking shall be molded, die-stamped, paint-stenciled; stamped or etched metal that is permanently secured; or indelibly stamped on a pressure-sensitive label secured by adhesive. The marking means shall comply with the Standard for Marking and Labeling Systems, UL 969. Ordinary usage, handling, storage, and the like of the unit are to be considered in determining whether a marking is permanent.		P
32	**Cautionary Markings**		P
32.1	A cautionary marking shall be prefixed by the word "CAUTION", "WARNING", or "DANGER" in letters not less than 1/8 in (3.2 mm) high. The remaining letters shall not be less than 1/16 in (1.6 mm) high		

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
32.2	There shall be a legible and durable marking for each interchangeable fuse as described in 10.8 indicating the ampere rating and the voltage rating of the fuse to be used for replacement. The marking shall be located so that it is understood as to which fuse or fuseholder the marking applies. A single marking is acceptable for a group of fuses. The marking shall consist of the word “CAUTION” and the following or the equivalent: “For continued protection against risk of fire, replace only with same type and ratings of fuse.”	Mentioned in user manual	P
32.3	A battery charger shall be marked, where readily visible to the user when connecting batteries, with the word “CAUTION” and the following or equivalent: “Charge only __ type rechargeable batteries. Other types of batteries may burst causing personal injury and damage.” Exception: A reference to a specific rechargeable battery or battery pack for which the charger is intended may be used in lieu of marking the type of batteries to be charged.		N/A
32.4	A cautionary marking shall be permanent and shall be located on a part that cannot be removed without impairing the operation of the unit.		P
32.5	A cautionary marking to instruct the operator shall be visible and legible to the operator during the intended operation of the unit.		P
32.6	With reference to 23.3, a multi-output unit shall be marked, where readily visible after installation, with the word “WARNING” and the following or equivalent: “To reduce the risk of fire or electric shock, do not interconnect output terminations.”		P

INSTRUCTIONS			P
33	**General**		P
33.1	A battery charger shall be provided with explicit important safety, operation, and maintenance instructions for the user; and if applicable, with assembly, moving and storage instructions.		P
33.2	The important safety instructions and instructions for user assembly, operation, maintenance, and moving and storage shall be in the same manual. The important safety instructions shall appear before the instructions for user assembly, operation, maintenance, and moving and storage		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
33.3	In an instruction manual intended for use with more than one model or type of battery charger, the instructions applicable to each model or type of battery charger shall be explicitly identified. Exception: Instructions that are exactly the same for more than one model or type of battery charger, and that will not result in confusion or misunderstanding due to different location of controls, operating modes, and the like, need not comply with this requirement.		N/A
33.4	Instructions shall be legible, and shall contrast with the background.		P
33.5	The headings for the important safety instructions, and the opening statements of the instructions specified in 33.12 – “IMPORTANT SAFETY INSTRUCTIONS” and “SAVE THESE INSTRUCTIONS”– shall be entirely in upper case letters not less than 3/16 in (4.8 mm) high or emphasized to distinguish them from the rest of the text. Upper case letters in the instructions shall not be less than 5/64 in (2.0 mm) high, and lower case letters shall not be less than 1/16 in (1.6 mm) high.		P
33.6	There shall be no substitute for the word “CAUTION”, “WARNING”, or “DANGER” in the text of the instructions.		P
33.7	The text of the instructions required by 33.12 shall be verbatim, or in equally definitive terminology. Exception: If a specific conflict in the application to a battery charger exists, or if the wording would be inappropriate, variations from the specified wording may be used.		P
33.8	An illustration may be used with a required instruction to clarify the intent, but shall not replace the instruction.		P
33.9	Important safety instructions shall warn the user of reasonably foreseeable risks of fire, electric shock, or injury to persons; and shall state the precautions that should be taken to reduce such risks.		P
33.10	The important safety instructions shall include the appropriate items in 33.12 followed by the appropriate instructions in Sections 34 – 37.		P
33.11	The items in the list in 33.12 shall be numbered, and other instructions deemed necessary by the manufacturer to reduce the risk of fire, electric shock, or injury to persons may be included.		P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
33.12	The important safety instructions shall include those items in the following list that are applicable to the particular battery charger. The statement "IMPORTANT SAFETY INSTRUCTIONS," shall precede the list and the statement "SAVE THESE INSTRUCTIONS" shall either precede or follow the list. The word "CAUTION," "WARNING," or "DANGER" shall be entirely in upper case letters. **IMPORTANT SAFETY INSTRUCTIONS** 1. SAVE THESE INSTRUCTIONS– This manual contains important safety and operating instructions for battery charger Model ____. Exception: If the instructions are exactly the same for all models, specific model numbers need not be specified. 2. Before using battery charger, read all instructions and cautionary markings on battery charger, battery, and product using battery. 3. CAUTION – To reduce risk of injury, charge only _____ type rechargeable batteries. Other types of batteries may burst causing injury to persons and damage. 4. Do not expose charger to rain, moisture, or snow. 5. Use of an attachment not recommended or sold by the battery charger manufacturer may result in a risk of fire, electric shock, or injury to persons. 6. To reduce risk of damage to cigarette lighter connector and cord, pull by cigarette lighter connector rather than cord when disconnecting charger. 7. Make sure cord is located so that it will not be stepped on, tripped over, or otherwise subjected to damage or stress. 8. Do not operate charger with damaged cord or cigarette lighter connector – replace it immediately. 9. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified serviceperson. 10. Do not disassemble charger; take it to a qualified serviceperson when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire. 11. To reduce risk of electric shock, unplug charger before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.		P
34	Assembly Instructions		N/A

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
34.1	The assembly instructions, if applicable, shall contain all information needed for proper assembly of parts, such as handles and shall be preceded by the heading “ASSEMBLY INSTRUCTIONS,” or the equivalent.		N/A
35	**Operating Instructions**		P
35.1	The operating instructions shall contain all applicable information needed to operate a vehicle battery adapter in the intended manner, and shall be preceded by the heading “OPERATING INSTRUCTIONS,” or the equivalent.		P
35.2	The operating instructions shall: a) Warn that the unit must be properly assembled in accordance with the assembly instructions before it is used. b) Explain and describe the location, function, and operation of each control of the unit, including all user-operated devices intended to reduce the risk of fire, electric shock, or injury to persons; and warn against tampering with such devices. c) Explain any automatic features if the marking on the unit includes the word “Automatic” such as “Automatic Battery Charger” or “Automatic Circuit Protector.”		P
35.3	The operating instructions for a unit rated greater than 100 VA input shall include the following or in equally definitive wording. The blanks shall be completed with appropriate current and voltage ratings based on the adapter input ratings. “CAUTION – Risk of Fire. Do not replace any vehicle fuse with a rating higher than recommended by the vehicle manufacturer. This product is rated to draw ___amperes from a ____V vehicle outlet. Ensure that the electrical system in your vehicle can supply this product without causing the vehicle fusing to open. This can be determined by making sure the fuse in the vehicle which protects the outlet is rated higher than ___amperes. Information on the vehicle fuse ratings are typically found in the vehicle operator’s manual. If a vehicle fuse opens repeatedly, do not keep on replacing it. The cause of the overload must be found. On no account should fuses be patched up with tin foil or wire as this may cause serious damage elsewhere in the electrical circuit or cause fire.”		N/A
36	**Maintenance Instructions**		N/A

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
36.1	The instructions for user maintenance shall include explicit instructions for all cleaning and minor servicing – lubrication, external adjustments, and the like – that should be performed by the user; and shall warn the user that all other servicing should be performed by qualified service personnel. User maintenance instructions shall be preceded by the heading “MAINTENANCE INSTRUCTIONS”, or the equivalent.		N/A
36.2	The user-maintenance instructions, as described in 36.1, shall not include operations that would require disassembly of the unit to accomplish.		N/A
37	**Moving and Storage Instructions**		N/A
37.1	If moving or storage of a unit could result in damage to the unit that could create a risk of fire, electric shock, or injury to persons during subsequent use, the instruction manual shall include explicit instructions for proper moving and storage. Such instructions shall be preceded by the heading “MOVING AND STORAGE INSTRUCTIONS”, or the equivalent.		N/A

APPENDIX A **Standards for Components**
Standards under which components of the products covered by this standard are evaluated include the following: Title of Standard − UL Standard Designation

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict

Attachment Plugs and Receptacles – UL 498

Class 2 Power Units – UL 1310

Controls for Household and Similar Use, Part 1: General Requirements, Automatic Electrical – UL 60730-1 and/or the applicable Part 2 standard from the UL 60730 series

Flexible Cords and Cables – UL 62

Fuseholders – Part 1: General Requirements – UL 4248-1

Insulating Materials – General, Systems of – UL 1446

Marking and Labeling Systems – UL 969

Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of – UL 94

Polymeric Materials – Long Term Property Evaluations – UL 746B Polymeric Materials – Short Term Property Evaluations – UL 746A Polymeric Materials – Use in Electrical Equipment Evaluations – UL 746C Printed-Wiring Boards – UL 796

Switches for Appliances – Part 1: General Requirements – UL 61058-1

Temperature-Indicating and -Regulating Equipment – UL 8731)

Thermal-Links – Requirements and Application Guide – UL 60691

Wire Connectors – UL 486A-486B

Wires and Cables, Thermoset-Insulated – UL 44

Wires and Cables, Thermoplastic-Insulated – UL 83

[1)] Note: Compliance with the UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict

2	**TABLE: List of critical components**				**P**
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity[1])
Fuse (F1)	DONGGUAN REOMAX ELECTRONICS TECHNOLOGY CO LTD	STC, SFC	10A/250V	UL 248-1, UL 248-14, CSA-C22.2 No. 248-1, CSA-C22.2 No. 248-14	UL E340427
PCB	SHENZHEN FUSHENG ELECTRONICS CO LTD	CB-D	V-0, 130°C	UL 94, UL 796	UL
(Alternative)	Various	Various	V-0, 130°C	UL 94, UL 796	UL
Plastic enclosure	Various	Various	V-1, 80°C	UL 94, UL 796	UL
Choke (L3, L4)	Various	Various	33UH, 130°C	UL 2089	Test with application
- Magnet wire	Various	Various	Min. 130°C	UL 1446	UL
- Heat-shrinkable tube	Various	Various	600V, min. 125°C	UL 224	UL
Power wire	Various	Various	600V, min. 125°C	UL 2089	Test with application
Switch	ZHEJIANG LECI ELECTRONICS CO LTD	RS601	250V,10A	ANSI/UL 1054	UL E258800

Supplementary information:

[1]) an asterisk indicates a mark which assures the agreed level of surveillance.

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict

23	**TABLE: Max. Output voltage**				**N/A**
Voltage (rated) (V)	Current (rated) (A)	Voltage (max.) (V)	Current (max.) (A)	VA (max.) (VA)	
12	1.5	12.1	1.77	21.42	
Supplementary information:					

24	**TABLE: Power Input**					**P**
U (V)	I (A)	I_{rated} (A)	P (W)	P_{rated} (W)	Condition/status	
12Vdc	6.358	--	76.3	--	Max normal load	
24Vdc	3.163	--	75.9	--	Max normal load	
Supplementary information:						

25	**TABLE: Thermal requirements**					**P**
	Supply voltage (V) .....:	24Vdc	12Vdc	--	--	—
	Ambient T_{min} (°C) .....:	35.0	35.0	--	--	—
	Ambient T_{max} (°C) .....:	35.0	35.0	--	--	—
Maximum measured temperature T of part/at::		T (°C)				Allowed T_{max} (°C)
Connector		50.9	58.1	--	--	--
F1 body		54.2	67.3	--	--	--
Internal wire		56.8	65.4	--	--	120
E-cap(C20)		58.8	60.5	--	--	105
PCB near U3		88.6	96.4	--	--	130
PCB near U4		87.4	90.6	--	--	130
PCB near U8		49.5	51.2	--	--	130
L3 winding		77.9	86.2	--	--	120
L4 winding		75.9	81.8	--	--	120
Internal plastic enclosure		70.2	71.3	--	--	--
External plastic enclosure		67.7	69.1	--	--	75
Supplementary information:						

Temperature T of winding:	t_1 (°C)	R (Ω)	t_2 (°C)	r (Ω)	T (°C)	Allowed T_{max} (°C)	Insulation class
--	--	--	--	--	--	--	--
Supplementary information:							

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict

26	**TABLE: Dielectric Voltage Withstand**			**P**
Test voltage applied between:		Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
Input to enclosure with metal foil		AC	500	No
Supplementary information:				

27.3	**TABLE: Component Breakdown Test**						**P**
	Ambient temperature (°C) .....:			25			—
Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation	
Capacitor (Model: UF1000)	Short circuit	24Vdc	<1S	F1	0	Unit output shutdown, F1 damaged, no hazards.	
U3 Pin 2-5	Short circuit	24Vdc	<1S	F1	0.001	Unit output shutdown, no damaged, no hazards	
U4 Pin 2-5	Short circuit	24Vdc	<1S	F1	0.001	Unit output shutdown, no damaged, no hazards	
USB output	Short circuit	24Vdc	<1S	F1	0.001	Unit output shutdown, no damaged, no hazards	
Supplementary information:							

27.5	**TABLE: Abnormal Temperature Test**					**P**
	Supply voltage (V) .....:	10.5Vdc	14.5Vdc	21.0Vdc	29.0Vdc	—
	Ambient T_{min} (°C) .....:	35.0	35.0	35.0	35.0	—
	Ambient T_{max} (°C) .....:	35.0	35.0	35.0	35.0	—
Maximum measured temperature T of part/at::		T (°C)				Allowed T_{max} (°C)
Test condition:		A	B	C	B	—
Connector		59.7	57.5	49.9	48.2	--
F1 body		69.2	64.7	54.9	53.3	--
Internal wire		66.9	64.9	57.7	54.1	120
E-cap(C20)		61.5	60.7	58.5	57.5	105
PCB near U3		93.6	93.7	89.5	87.2	130
PCB near U4		91.2	90.8	88.8	87.1	130
PCB near U8		51.5	51.4	50.5	50.1	130
L3 winding		86.7	86.7	80.3	79.1	120
L4 winding		82.3	81.2	78.1	77.5	120
Internal plastic enclosure		71.5	71.1	70.7	70.9	--

UL 2089					
Clause	Requirement + Test		Result - Remark		Verdict
External plastic enclosure		69.7	68.7	66.4	65.8	75
Supplementary information:						

Temperature T of winding:	t_1 (°C)	R (Ω)	t_2 (°C)	r (Ω)	T (°C)	Allowed T_{max} (°C)	Insulation class
--	--	--	--	--	--	--	--
Supplementary information:							

Photo documentation

Details of: Overview 01

Details of: Overview 02

Photo documentation

Details of: Overview 03

Details of: Internal view 01

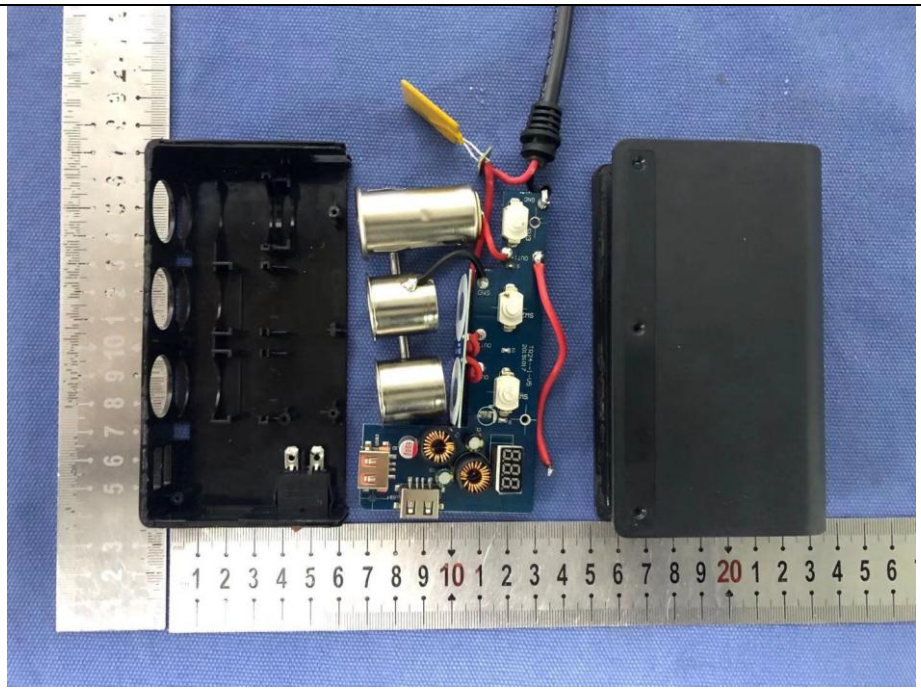
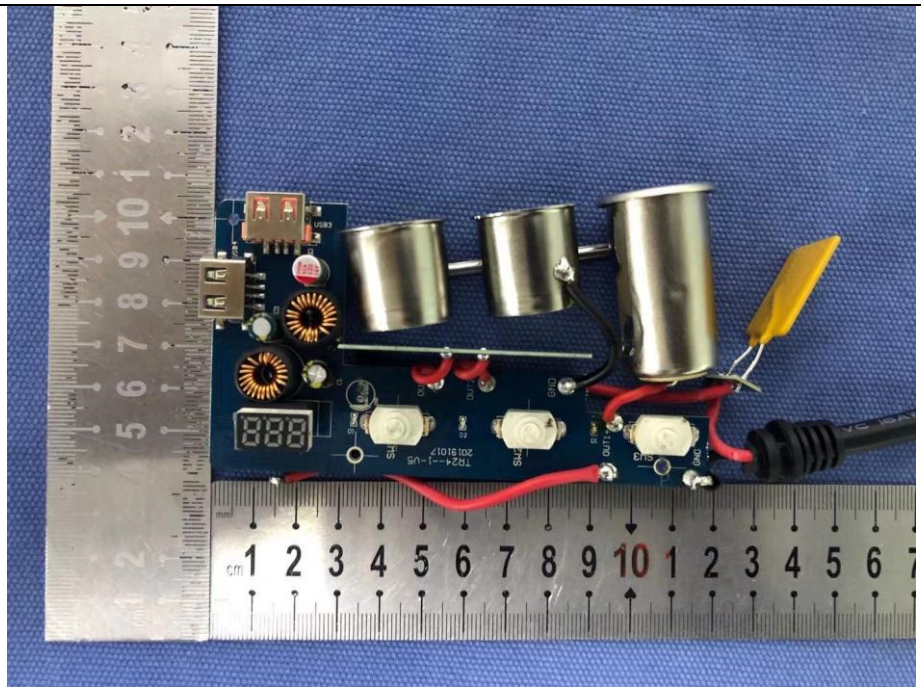
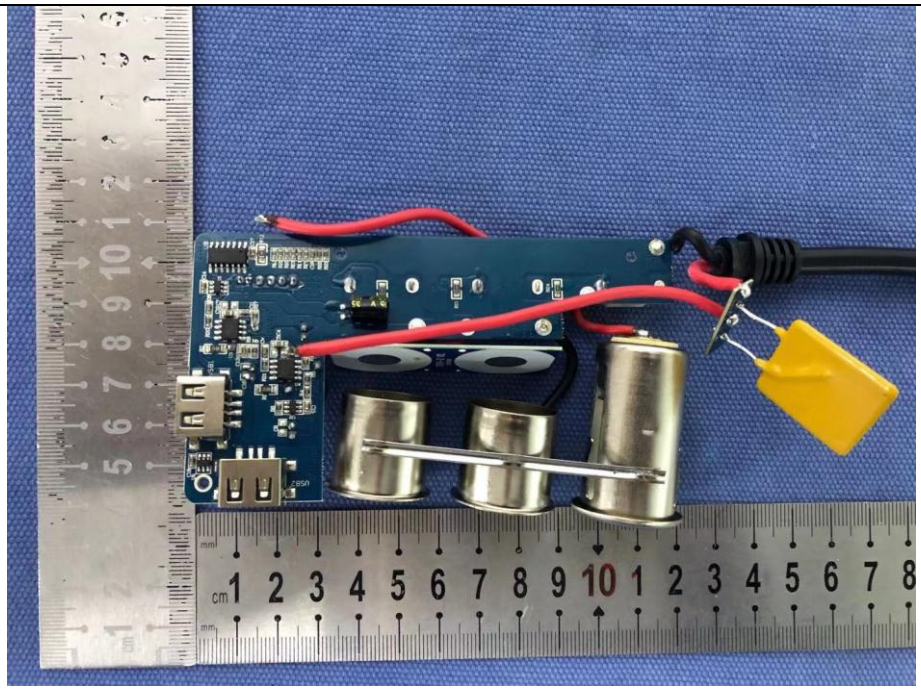


Photo documentation

Details of: PCB view 01



Details of: PCB view 02



The report end