File E184259

Project 4791422917

September 18, 2024

REPORT

On

UNLISTED COMPONENT – BATTERIES, HOUSEHOLD AND COMMERCIAL

for use only in

APPLICANT'S CLASSIFIED, LISTED OR RECOGNIZED PRODUCTS,
SYSTEMS OR COMPONENTS

Simplo Technology Co., Ltd.
Hsinchu Hsien 303 Taiwan

DESCRIPTION

PRODUCT COVERED:

Unlisted Component – Rechargeable Li-ion Battery, Model 20HK2.

ELECTRICAL RATING:

Model	Voltage (Nominal), Vdc	Capacity (Nominal), mAh
20HK2	15.6	4102mAh / 64Wh
Note: The packs have been tested based upon their electrical rating but no capacity performance testing has been conducted. In addition, no testing with a host product including a charger has been conducted.		

CELL CHEMISTRY AND CONFIGURATION:

Pack Model	Cell Model	Cell Chemistry and Type#	Number of Cells	Configuration *: X-S/Y-P
20HK2	664863C	Lithium ion	4	4-S/1-P
20HK2	CA664863U-Q2	Lithium ion	4	4-S/1-P
20HK2	664863AFR	Lithium ion	4	4-S/1-P
* - X = No. of cells in series; Y = Number of parallel strings # - e.g. lithium ion cylindrical, lithium ion prismatic, lithium ion polymer (soft pouch), Ni-Cad prismatic, etc.				

MANUFACTURER'S RECOMMENDED CHARGING PARAMETERS:

Model	Standard Charging Current, A	Standard Charging Voltage, Vdc	Maximum Charging Current, A	Maximum Charging Voltage, Vdc
20HK2 (with ATL Cell)	--	--	0~15 °C: 1280mA to charging voltage 16~45 °C: 1. CCCV: 2048mA to charging Voltage 2. Express charge boost: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage 3. ExpChgPLLM: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage. (Test with worse condition: 7962mA)	18.04V
20HK2 (with CosMX Cell)	--	--	0~15 °C: 1408mA to charging voltage 16~45 °C: 1. CCCV: 2048mA to charging Voltage 2. Express charge boost: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage 3. ExpChgPLLM: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage (Test with worse condition: 7962mA)	18.04V
20HK2 (with Springpower/Highpower Cell)	--	--	0~15 °C: 1280mA to charging voltage 16~45 °C: 1. CCCV: 2048mA to charging Voltage 2. Express charge boost: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage 3. ExpChgPLLM: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage. (Test with worse condition: 7962mA)	18.04V

GENERAL CONSTRUCTION:

See Section General for general construction details employed on these products.

TECHNICAL CONSIDERATIONS (NOT FOR FIELD REPRESENTATIVE'S USE):

Products have been investigated using requirements contained in the Second Edition of UL 2054, Third Edition, dated November 17, 2021, including revisions through revision date March 10, 2022.

Condition of Acceptability - When installed in the end product, consideration shall be given to the following:

1. These battery packs have been evaluated based upon manufacturer's specifications for charging, discharging and temperature limits. They have not been evaluated in combination with charger(s) or host product(s). Additional evaluation to determine compliance will be required on the combination(s) in the end product evaluation.

2. The battery pack was subjected to the Abnormal Charging test of UL 2054 which is a high rate charging test for 7 hours minimum based upon the parameters noted in the table below, with acceptable results. The end product evaluation shall determine that the maximum current and the maximum voltage limit noted below are not exceeded under any single fault conditions of the charging circuit.

Abnormal Charging Test Values		
Battery Pack Models	Maximum Charging Current, mA	Maximum Charging Voltage Limit, Vdc
20HK2 (with ATL Cell)	23886 (7962x3) (The worst condition)	18.04
20HK2 (with CosMX Cell)	23886 (7962x3) (The worst condition)	18.04
20HK2 (with Highpower/Springpower Cell)	23886 (7962x3) (The worst condition)	18.04

The battery pack was also subjected to the Abusive Overcharge test of UL 2054 with acceptable results. The abusive overcharge test consisted of charging the pack at a constant current charge rate until ultimate results, based upon the parameters noted in the table below.

Abusive Overcharge Test Values		
Battery Pack Models	10 x C5 constant current (CC) charge rate, mA	5 x C5 constant current charge rate, mA)
20HK2 (with ATL Cell)	8204 (4102x2)	4102
20HK2 (with CosMX Cell)	8204 (4102x2)	4102
20HK2 (with Highpower/Springpower Cell)	8204 (4102x2)	4102

The need for additional evaluation of the charging circuit and battery combination shall be determined in the end use application.

3. The battery pack has been subjected to a short circuit test at both ambient (20 ± 5°C) and 55 ± 2°C, with a resistance load in the range of 80 ± 20 mΩ. The need to conduct additional abnormal discharge testing shall be determined in the end use application.

4. The output of the battery pack has been determined to be a non-limited power source in accordance with the Second Edition of UL 2054. For non-limited power sources, the need for additional protective circuitry and an appropriate fire enclosure for the end product, which is supplied by the battery pack, shall be determined in the end product evaluation.

5. The battery packs have been evaluated for use in a maximum ambient as noted below. If used in an ambient in excess of the maximum values noted, additional evaluation may be necessary.

Models	Ambient Use Temperatures Range, C
20HK2	0~45

6. A temperature test with the battery pack in the end use installation shall be conducted under both maximum charging and discharging conditions. During the temperature test, the following temperature limits on temperature sensitive components shall not be exceeded:

Charge Limits		
Battery Pack Models	Maximum Rated Charge Voltage, V	Maximum Charge Current, A
20HK2 (with ATL Cell)	18.04 V	0~15 °C: 1280mA to charging voltage 16~45 °C: 1. CCCV: 2048mA to charging Voltage 2. Express charge boost: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage 3. ExpChgPLLM: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage. (Test with worse condition: 7962mA)
20HK2 (with CosMX Cell)	18.04 V	0~15 °C: 1408mA to charging voltage 16~45 °C: 1. CCCV: 2048mA to charging Voltage 2. Express charge boost: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage 3. ExpChgPLLM: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage (Test with worse condition: 7962mA)
20HK2 (with Highpower/Springpower Cell)	18.04 V	0~15 °C: 1280mA to charging voltage 16~45 °C: 1. CCCV: 2048mA to charging Voltage 2. Express charge boost: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage 3. ExpChgPLLM: 7680mA to 4300mV, 6272mA to 4450mV, then 2048mA charging Voltage. (Test with worse condition: 7962mA)

Discharge Limits	
Battery Pack Models	Maximum Discharge Load, A/W
20HK2 with ATL cell	7.5A
20HK2 with CosMX cell	7.5A
20HK2 with Highpower/Springpower Cell	7.5A
Note: Discharge mode 10.05A then 5.129A comply with system application and manufacturer’s declaration.	

Component	Model No.	Temperature Limits, °C
Cell	664863C	85
Cell	CA664863U-Q2	85
Cell	664863AFR	85
PWB	--	130
Plastic Frame	NH-5008(+)	80
Plastic Frame	KFN-30S	80
Connector (Plastic)	--	80

7. The Suitability of the battery pack enclosure’s flammability shall be determined in end product evaluation.

8. The battery pack enclosure not rigid design but pass mechanical tests (Including 250 N steady force test and Mold stress relief test). Shall be determined in end product evaluation.

9. The end use application shall consider the need for the following markings and instructions for the safe use of the battery pack:

Marking:

"Replace battery with (battery Recognized Company or end product manufacturer's name, part number) only. Use of another battery may present a risk of fire or explosion."

or "See Operating or maintenance Instructions for type of battery to be used" or equivalent with instructions for replacement of the correct battery pack provided.

or A symbol indicating the need to refer to the instruction manual may be used instead of the text noted above. An acceptable symbol is a combination of ISO 7010 – M002 (refer to instruction manual/booklet) and ISO 7010 – W001 (general warning sign), as depicted below:

Instructions:

a. A warning notice with the following or equivalent:

"Caution – The battery used in this device may present a risk of fire or chemical burn if mistreated. Do no disassemble, heat above (manufacturer's maximum temperature limit), or incinerate. Replace battery with (battery manufacturer's name or end product manufacturer's name and part number) only. Use of another battery may present a risk of fire or explosion."

b. Complete instructions as to how to replace the battery including the following or equivalent statement:

"Dispose of used battery promptly. Keep away from children. Do not disassemble and do not dispose of in fire."

MARKINGS/INSTRUCTIONS:

All markings shall be legible and permanent such as ink stamped, etched, adhesive labels, etc. All adhesive labels shall be R/C (PGDQ2) component marking and labeling systems or printed on R/C (PGJI2) Component Printing Materials.

Nameplate Marking – The Company name, trade name, trademark or other descriptive marking, catalog or model number, electrical rating, and manufacturer date code.

This battery pack may bear additional markings as described in Report E184259-A7039, which covers the end-product certification

Date of Manufacturer Marking - See Section General for information on date of manufacturer marking.

The date code consists of the following: See the ILL. 1 for details.

Factory Location Marking - See Section General for manufacturing location marking.

Cautionary Markings/Instructions - Each 1) battery pack; or 2) the smallest unit package, must be marked with; or 3) instructions provided with each battery, must include the following statements or equivalent:

a. An attention word such as "CAUTION", “WARNING”, or “DANGER”, and a brief description of possible hazards associated with mishandling of the battery pack such as burn hazard, fire hazard, explosion hazard, and

b. A list of actions to take to avoid possible hazards, such as do not crush, disassemble, dispose of in fire, or similar actions.

A lithium ion battery pack shall be marked with the following or equivalent: “CAUTION: Risk of Fire and Burns. Do Not Open, Crush, Heat Above (manufacturer’s specified maximum temperature) or Incinerate. Follow Manufacturer’s Instructions.” This wording or equivalent shall also be included in the instructions packaged with the battery pack.

Charging Marking/Instructions - Recommended charging information is also provided on the product, its smallest packaging unit, or the instructions provided with each battery pack.

The charging limits as outlined in the Manufacturer’s Recommended Charging Parameters Table above are provided as part of these instructions.

Rechargeable Li-ion Battery, Model 20HK2,
See Figs. 1 thru 9 for additional views of overall battery constructions.
For model 20HK2 with PWB View: Figs. 5 thru 6, Ills. 2.

1. Cell – See tables and information below:

Battery Pack Model	Cell Manufacturer	Cell Part No.	Cells, Y or N*	File Reference, (Unrecognized cells)	
20HK2	Amperex Technology Limited.	664863C	Y	MH27725	2011-07-27
20HK2	CosMX Technology Shenzhen Co., Ltd.	CA664863U-Q2	Y	MH49033	2016-10-13
20HK2	SPRINGPOWER TECHNOLOGY SHENZHEN CO LTD / (Huizhou Highpower Technology Co., Ltd.)	664863AFR	Y	MH46844	2014-08-01

Note: See Cell Chemistry and Configuration Table at beginning of report for information on type of cells, number of cells and their configuration in the battery pack circuit.

Cells are secured in their enclosure and prevented from movement that would cause damage to connections and short circuit of parts by:

Pack Model No.	Description	Cell Layout Figs. No.
20HK2	Plastic Frame	Fig. 3

Connections to cell terminals are constructed as noted below:

Pack Model No.	Description	Figs. No.
20HK2	Metal Plate	Fig. 3

2. Battery Pack Enclosure/Case – See Table Below:

Battery Pack Model	Overall Dimensions, L x W x H, mm	Minimum thick-ness, mm	Enclosure Material Manufacturer	Enclosure Material Designation	Enclosure material flame rating at Minimum Thickness
20HK2 (Pack Frame)	See Ill.3	0.521 mm	QINGDAO HAIER NEW MATERIAL R & D CO LTD	NH-5008(+)	V-0, PC material, 80°C at min. 0.8mm thickness. Overall 295.1 by 77.7 by 7.7mm, secured together by plastic frame, label and mylar.
20HK2 (Pack Frame) (Alternate)	See Ill.3	0.517 mm	Kotec Corp	KFN-30S	V-0, PC material, 80 °C at min. 0.8mm thickness. Overall 295.1 by 77.7 by 7.7mm, secured together by plastic frame, label and mylar.
20HK2 (Pack Frame) (Alternate)	--	0.8 mm	Interchangeable	Interchangeable	V-0, PC material, 80 °C. Overall 295.1 by 77.7 by 7.7mm, secured together by plastic frame, label and mylar.
20HK2 (Mylar Sheet)	See Ill.3	0.05 mm	SHENZHEN TEESUN TECHNOLOGY CO LTD	TS-FR1360	VTM-0, 80 degree C at min. 0.05mm thickness. Overall 293.5mm x 76.0mm x 0.23 mm.
20HK2 (Mylar Sheet) (Alternate)	See Ill.3	0.125 mm	Hunan Dobesty Optical Material Co Ltd	DB98KJ	VTM-0, 80 degree C at min. 0.125mm thickness. Overall 293.5mm x 76.0mm x 0.23 mm.
20HK2 (Mylar Sheet) (Alternate)	--	0.05 mm	Interchangeable	Interchangeable	VTM-0, 80 degree C. at min. 0.05mm thickness. Overall 293.5mm x 76.0mm x 0.23 mm.
- V-0, V-1, or compliant with UL746C 20mm Flame Test					

3. Protective Circuitry – Consists of the following Components:

Battery Pack Model No.	Type of Protective Component	Location of Component Within Pack	Component Manufacturer	Component Part No.	Component Ratings
20HK2	Fuse	F1	POLYTRONICS TECHNOLOGY CORP	CLM1612P1412C-AS or CLM1612P1412-AS (#)	(JDYX2), rated 12 A, 36 Vdc.
	Fuse (Alternate)	F1	Dexerials Corp.	SFJ-1412W	(JDYX2), rated 12 A, 36 Vdc.
	MOSFETs	Q1, Q2	Sinopower	SM3420NHQAC-TRG	30Vdc, 21.6A
	MOSFETs (Alternate)	Q1, Q2	UBIQ	QN3001M3E	30Vdc, 21A
	IC	U1	Renesas	RAJ240297C30DNP#HC0	--
	IC (Alternate)	U2	UPI	uP8308PDN8-9K	--
	IC (Alternate)	U2	Nisshinbo	R5439K334JA-TR	--
	IC (Alternate)	U2	Interchangeable	Interchangeable	--
	Thermostats	On cell	Bourns KK	NR85ABH	DC 12 V, 25 A, 85±5 °C
	Thermostats (Alternate)	On cell	Bourns KK	NX82ABB	DC 9 V, 35 A, 82±5 °C

	Sensor Resistor	R12	TA-I	RLM12FTCMR002	2 m ohm, 1 W
	Sensor Resistor (Alternate)	R12	Interchangeable	Interchangeable	2 m ohm, min. 1 W
	Thermistor	RT1	Thinking Electronic Industrial Co., Ltd.	TSM0A103F34D1RZ	(XGPU2), NTC type, 10 K ohm at 25 degree C
	Thermistor (Alternate)	RT1	JOYIN	JSNA103F344FT	(XGPU2), NTC type, 10 K ohm at 25 degree C
	Thermistor (Alternate)	RT1	MURATA	NCP15XH103F03RC-S	(XGPU2), NTC type, 10 K ohm at 25 degree C
	Thermistor (Alternate)	RT1	Interchangeable	Interchangeable	(XGPU2), NTC type, 10 K ohm at 25 degree C
	MOSFET	Q3	Sinopower	SM2406NSANC-TRG	--
	MOSFET (Alternate)	Q3	MATSUKI	ME2306A	--
	MOSFET (Alternate)	Q3	PANJIT	PJA3422	--
Note#: Fuse (F1) type CLM1612P1412C-AS is similar to type CLM1612P1412-AS except for Model designation and the color of plastic cover, this difference doesn’t affect test result.					

See the following illustrations for details of protective circuitry:

Battery Pack Model Number	Figure Number
20HK2	ILL.2

4. Inadvertent shorting of connector prevented by the following:

Battery Pack Model Number	Description of Mechanism to Prevent Inadvertent Short Circuiting of Connector Terminals
20HK2	Recessed Construction

5. Printed Wiring Board –(ZPMV2), rated V-0, 130 degree C max.
Note: The P/N 112-6163H Rev.2 of PWB is similar to P/N 112-6163H Rev. X (X=A~C) of PWB except for different version numbers, it does not affect the test results.

6. Internal Plastic Part Materials (for parts greater than 1750mm^3 or 4g) – (QMFZ2), minimum V-0 or VTM-0.

7. Connectors and Receptacles - (QMFZ2), Copper alloy pins housed in bodies of plastic rated V-0 minimum, 80 degree C.

7a. Connectors and Receptacles (Alternate) – (ECBT2, RTRT2), Plastic rated V-0 min.

8. Nameplate Marking Label – (PGDQ2) – Type JST-073 by Chongqing Jingshangtong Electronic Technology Co. Ltd., max. 100 degree C if max., surface temperature not specified.

8a. Nameplate Marking Label – (PGDQ2) (Alternate) – Type HY-31-116 by SUZHOU DACHANG PRINTING TECH CO. LTD., max. 80 degree C if max., surface temperature not specified.

8b. Nameplate Marking Label – (PGDQ2) (Alternate) – Max. 100 degree C if max., surface temperature not specified.

8-1&
8a-1&
8b-1. Nameplate Marking Label material – (OCDT2) – Type FR 53651P(a) by PETROIS (Guangdong) Company Limited., VTM-0, minimum thickness 0.04 mm.

8c. Nameplate Marking Label – (PGDQ2) (Alternate) – Type HY-24-3667 by SUZHOU DACHANG PRINTING TECH CO. LTD., max. 80 degree C if max., surface temperature not specified.

8d. Nameplate Marking Label – (PGJI2) (Alternate) – Type JST-065 by Chongqing Jingshangtong Electronic Technology Co. Ltd., max. 80 degree C if max., surface temperature not specified.

8e. Nameplate Marking Label – (PGDQ2) (Alternate) – Type JST-065-1 by Chongqing Jingshangtong Electronic Technology Co. Ltd., max. 80 degree C if max., surface temperature not specified.

8f. Nameplate Marking Label – (PGDQ2) (Alternate) – Max. 80 degree C if max., surface temperature not specified.

8c-1&
8d-1&
8e-1&
8f-1. Nameplate Marking Label material – (OCDT2) – Type LHF-360 by Chongqing Lihefeng New Material Co. Ltd., VTM-0, minimum thickness 0.03 mm.