

File MH29577
Project 10NK04383

June 08, 2010

REPORT

On

COMPONENT - Batteries, Household And Commercial

COMPLEMENTARY PRODUCT CATEGORY

COMPONENT - Information Technology Equipment Including Electrical
Business Equipment

Palladium Energy Inc.
Naperville, IL

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DESCRIPTION

PRODUCT COVERED:

USR, CNR Component - Rechargeable Li-ion Battery Pack, Model: BAT1S1P,
BAT1S1P-A.

ELECTRICAL RATING:

Model	Voltage (Nominal)	Capacity (Nominal)
*BAT1S1P, BAT1S1P-A	3.7 Vdc	1.59 Ah, 5.9 Wh (Sony cell) 1.5 Ah, 5.6 Wh (Hitachi cell)

Note: The packs have been tested based upon their electrical ratings 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
BAT1S1P, BAT1S1P-A	US454261 (Sony cell)	Lithium ion Polymer	1	1S/1P
	ICP494261 (Hitachi cell)	Lithium ion Prismatic	1	1S/1P
* - 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/DISCHARGING PARAMETERS:

Model	Standard Charge Current	Standard Charging Voltage	Standard Discharge Current
BAT1S1P, BAT1S1P-A	500 mA	12 Vdc	7 mA

GENERAL CONSTRUCTION:

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

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

The output of these battery packs has been determined to be limited power in accordance with Second Edition of UL 2054, Second Edition of UL 60950-1, and CAN/CSA-C22.2 No. 60950-1-07, Second Edition.

Products indicated as USR have been investigated using requirements contained in the Second Edition of UL 2054, Standard for Household and Commercial Batteries, issue dated October 29, 2004 and contains revisions through and including November 11, 2009.

Products indicated as USR have been investigated using requirements contained in the U.S. Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment, UL 60950-1, Second Edition, issue dated March 27, 2007.

Products indicated as CNR have been investigated using requirements contained in the Canadian Standard for the Safety of Information Technology Equipment, Including Electrical Business Equipment, Canadian Standards Association, CAN/CSA-C22.2 No. 60950-1-07, Second Edition, issue dated March 27, 2007.

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 manufacturers 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 that the compatibility of the host with the battery pack and the charger with the battery pack will needed to ensure that the battery pack is not used outside of its rated limits.
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 Model	Maximum Abnormal Charging Current	Maximum Abnormal Charging Voltage Limit
BAT1S1P, BAT1S1P-A (Sony cell)	250 mA (Q4 short)	12 Vdc
BAT1S1P, BAT1S1P-A (Hitachi cell)	225 mA (Q4 short)	12 Vdc

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 Model	10 x C5 constant current (CC) charge rate	5 x C5 constant current charge rate
BAT1S1P, BAT1S1P-A (Sony cell)	3180 mA 3060 mA	1590 mA 1530 mA
BAT1S1P, BAT1S1P-A (Hitachi cell)	3000 mA	1500 mA

The need to conduct additional abnormal/abusive charge testing in the end use application shall be determined.

3. The battery pack has been subjected to a short circuit test at both ambient ($20 \pm 5^{\circ}\text{C}$) and $55 \pm 2^{\circ}\text{C}$, with a resistance load in the range of $80 \pm 20 \text{ m}\Omega$. The need to conduct additional abnormal discharge testing shall be determined in the end use application.

4. The battery packs have been subjected to temperature testing under maximum load charging and discharging conditions and 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.

Model	Ambient Use Temperatures, °C
BAT1S1P, BAT1S1P-A	10~55

5. 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 Model	Maximum Rated Charge Voltage, V	Maximum Charge Current, mA
BAT1S1P, BAT1S1P-A (Sony cell)	12	270
BAT1S1P, BAT1S1P-A (Hitachi cell)	12	230

DISCHARGE LIMITS	
Battery Pack Model	Maximum Discharge Current, mA
BAT1S1P, BAT1S1P-A (Sony cell)	890
BAT1S1P, BAT1S1P-A (Hitachi cell)	892

Component	Model No.	Temperature Limits, °C
Cell	--	100

6. The battery pack enclosure has been determined with minimum V-1 or VTM-1 flammability in the minimum thickness, except for PWB component side. The suitability of the battery pack enclosure's flammability shall be determined in end product evaluation.

7. The battery pack does not employ a protective a mechanical enclosure in accordance with the enclosure requirements of UL 2054.

A mechanical enclosure to protect cells and internal circuitry and prevent user access under all conditions of use shall be provided in the end use application.

An evaluation of the mechanical enclosure's ability to prevent access to and protect cells and internal circuitry shall be conducted in the end use application.

8. The end use application shall consider the need for the following markings and instructions or equivalent 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.

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 not 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 Recognized Company, trade name, trademark or other descriptive marking, catalog or model number, electrical rating, Recognition Marking, and Recognition Marking for Canada.

Date of Manufacturer Marking - The date code consists of the following:

See Illustration 1.

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.
- c. Instructions regarding replacement batteries.

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 or the smallest unit package.

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 Pack, Model: BAT1S1P, Figs.1 thru **10**, and Ills.2 thru 3

1. Cell(s) - See tables and information below:

Battery Pack Model	Cell Manufacturer	Cell Part No.	Recognized Cells, Y or N*
BAT1S1P, BAT1S1P-A	Sony Energy Device Corp (MH12566)	US454261	Y
	Hitachi Maxell Ltd (MH12568)	ICP494261	Y
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 located within the pack in a manner that would not result in blocking of vents in the event of cell venting. 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
BAT1S1P, BAT1S1P-A	Cell was stuck to PWB by double adhesive tape.	Fig.4 and 6

Connections to cell terminals are constructed as noted below:

Pack Model No.	Description	Fig. No. or description
BAT1S1P, BAT1S1P-A	Metallic tabs connected cell terminals.	Fig.6 and 7

2. Battery Pack Plastic Frame - See Table Below:

Battery Pack Model	Overall Dimensions, L x W x H, mm	Minimum thickness, mm	Enclosure Material Manufacturer	Enclosure Material Designation	Enclosure material flame rating at Minimum Thickness*
BAT1S1P, BAT1S1P-A	76.1 x 53.5 x 13.7	--	Various	Various	V-1 minimum, 80°C minimum
* - V-0, V-1, or compliant with UL746C/UL 60950-1 20 mm Flame Test					

PWB secured to plastic frame by screws, and covered by labels.

3. PWB - R/C (ZPMV2), V-1 minimum, 105 °C minimum.

4. 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
BAT1S1P, BAT1S1P-A	*Protection IC	U10	Seiko	S-8261AANMD-G2NT2G	--
	Protection IC (Alternate)	U10	Seiko	S-8261AAOMD-G2OT2G	--
	Protection IC (Alternate)	U10	Seiko	S-8261ABIMD-G23IT2G	--
	Protection IC (Alternate)	U10	Seiko	S-8261ABRMD-G3RT2G	--
	Protection IC	U13	Maxim	DS2731	--
	Protection IC	U14	Seiko	S-8244	--
	MOSFET	Q4	AOS	A08814	--
	Resistor	R46	Various	Various	0.1 ohm, 0.25 W min.
	Inductor	L1	Various	Various	4.7 uH
	Inductor	L2	Various	Various	2.2 uH
	Fuse	F1	Littelfuse Inc (E10480)	0466 002	63 V, 2 A
	Fuse	F2	Sony Chemical & Information Device Corp (E167588)	SFH-1212	36 Vdc, 12 A
	Fuse (Alternat)	F2	Sony Chemical & Information Device Corp (E167588)	SFH-0412B	36 Vdc, 12 A
	*Polyswitch (Hitachi cell only)	PTC	Tyco Electronics Corp (E74889)	VLP220N-C30IIF Or VLP220N-C30F (R17)	Vmax 16 Vdc, Ih 2.2 A, It 5.3 A

See the following illustrations for details of protective circuitry:

Battery Pack Model Number	Illustration Number
BAT1S1P, BAT1S1P-A	2

5. Connectors and Receptacles - In low voltage secondary circuitry (SEC) (ELV, SELV), (RTRT2) or (ECBT2) and 30 V minimum, or copper alloy pins housed in bodies of (QMFZ2) and V-2 minimum. **See Figure 10 for alternative connectors.**

Inadvertent shorting of connector prevented by the following:

Battery Pack Model Number	Description of Mechanism to Prevent Inadvertent Short Circuiting of Connector Terminals
BAT1S1P, BAT1S1P-A	The output connector was recessed.

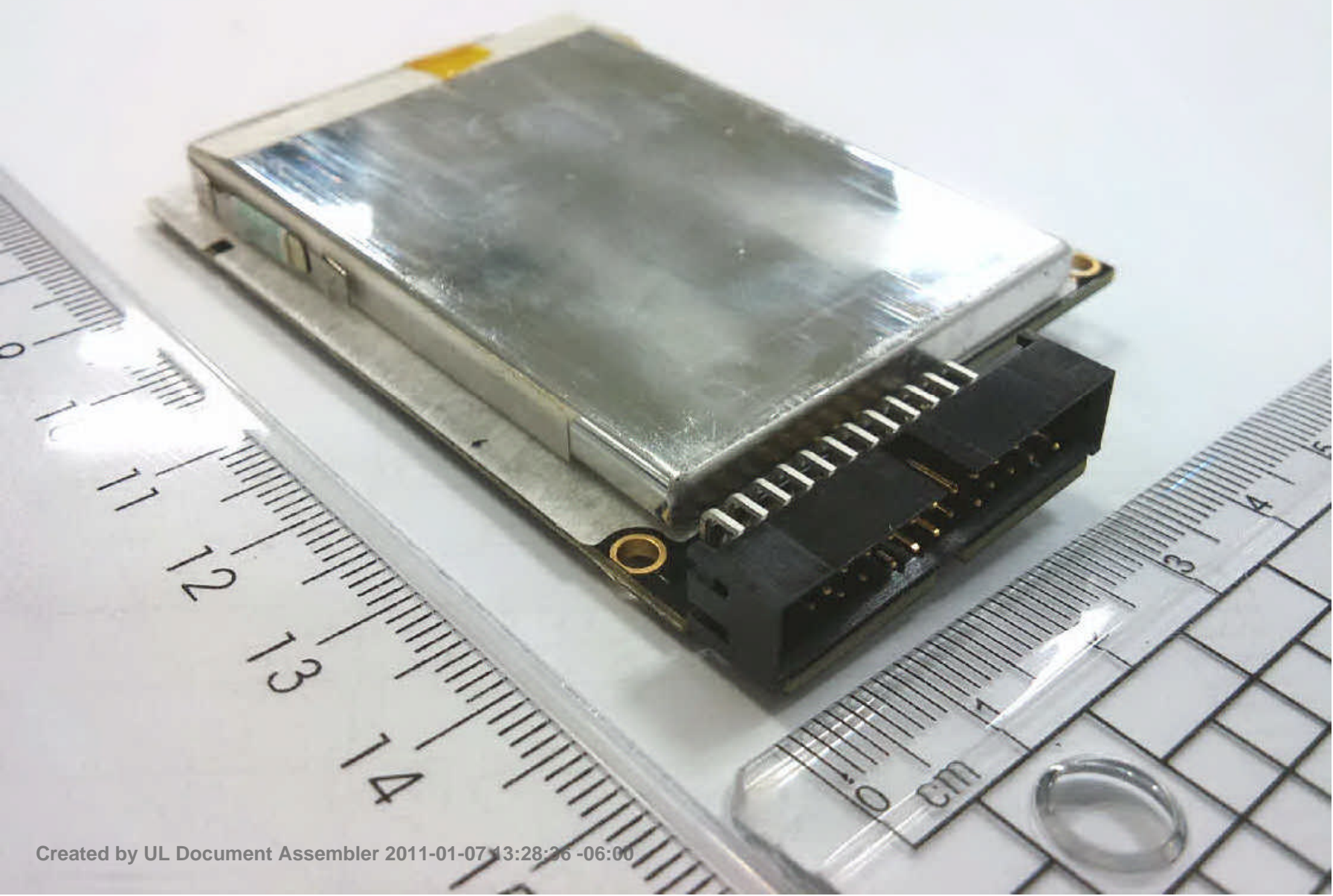
6. Insulation Tape - R/C (OANZ2), minimum 105°C.
7. Label - R/C (QMFZ2), Type FR700 by Sabic Innovative Plastics B V, VTM-1 minimum, 80°C minimum.

Label adhesive - 467MP by 3M.



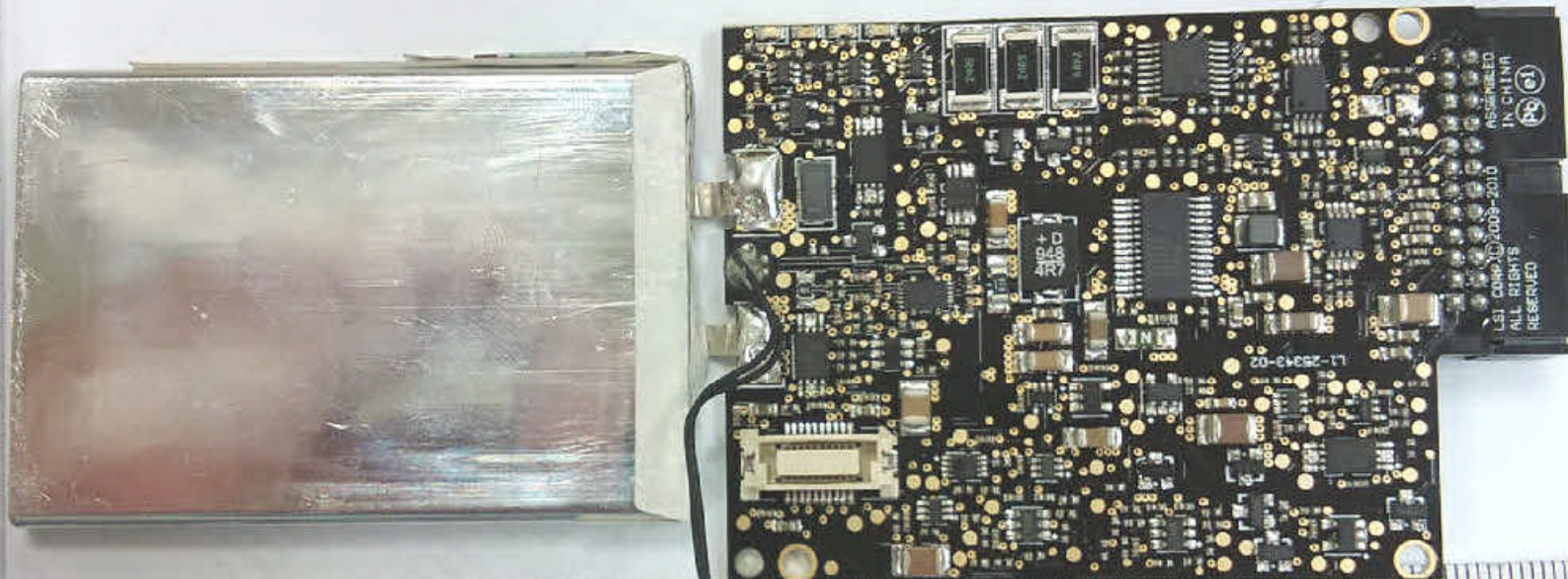


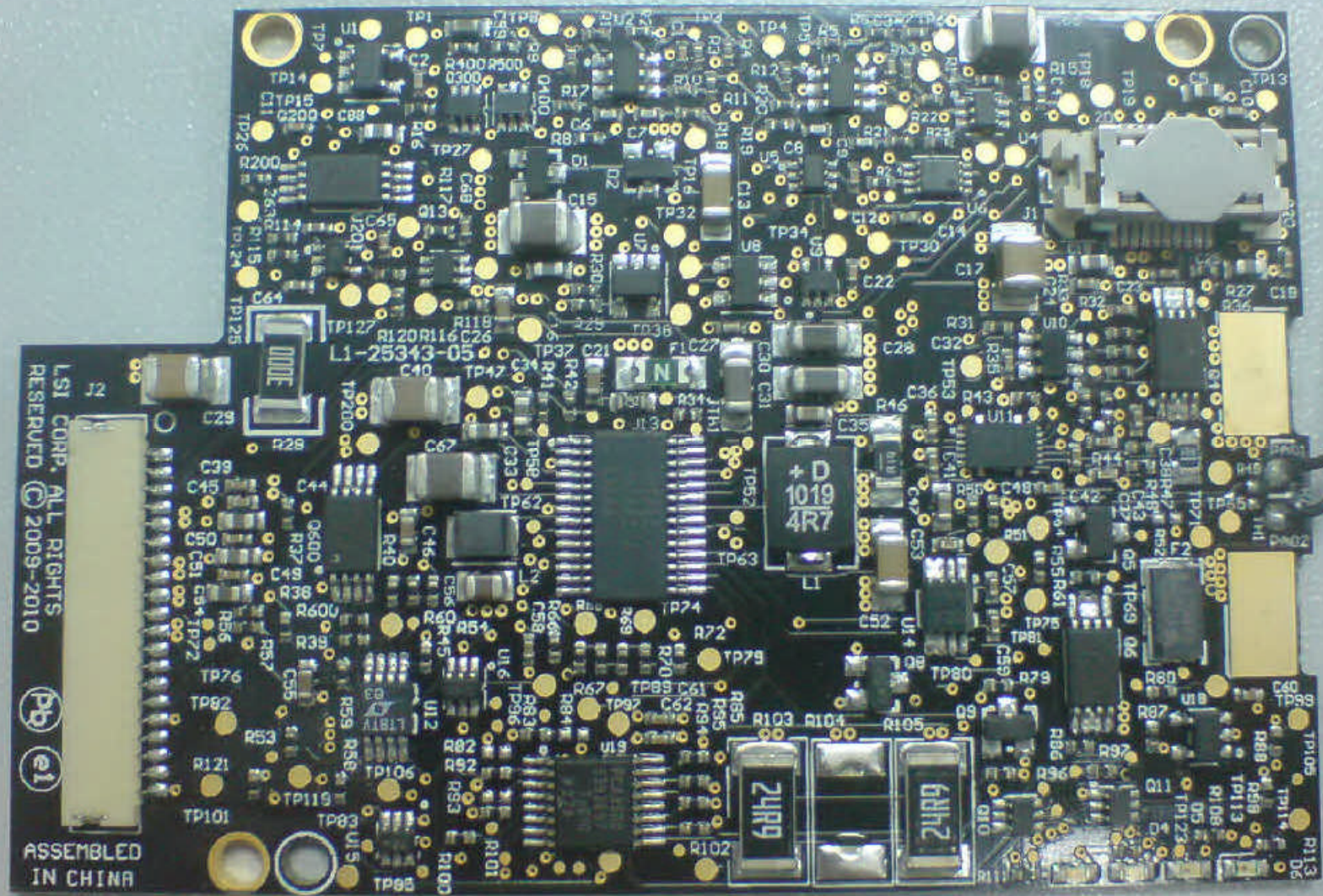


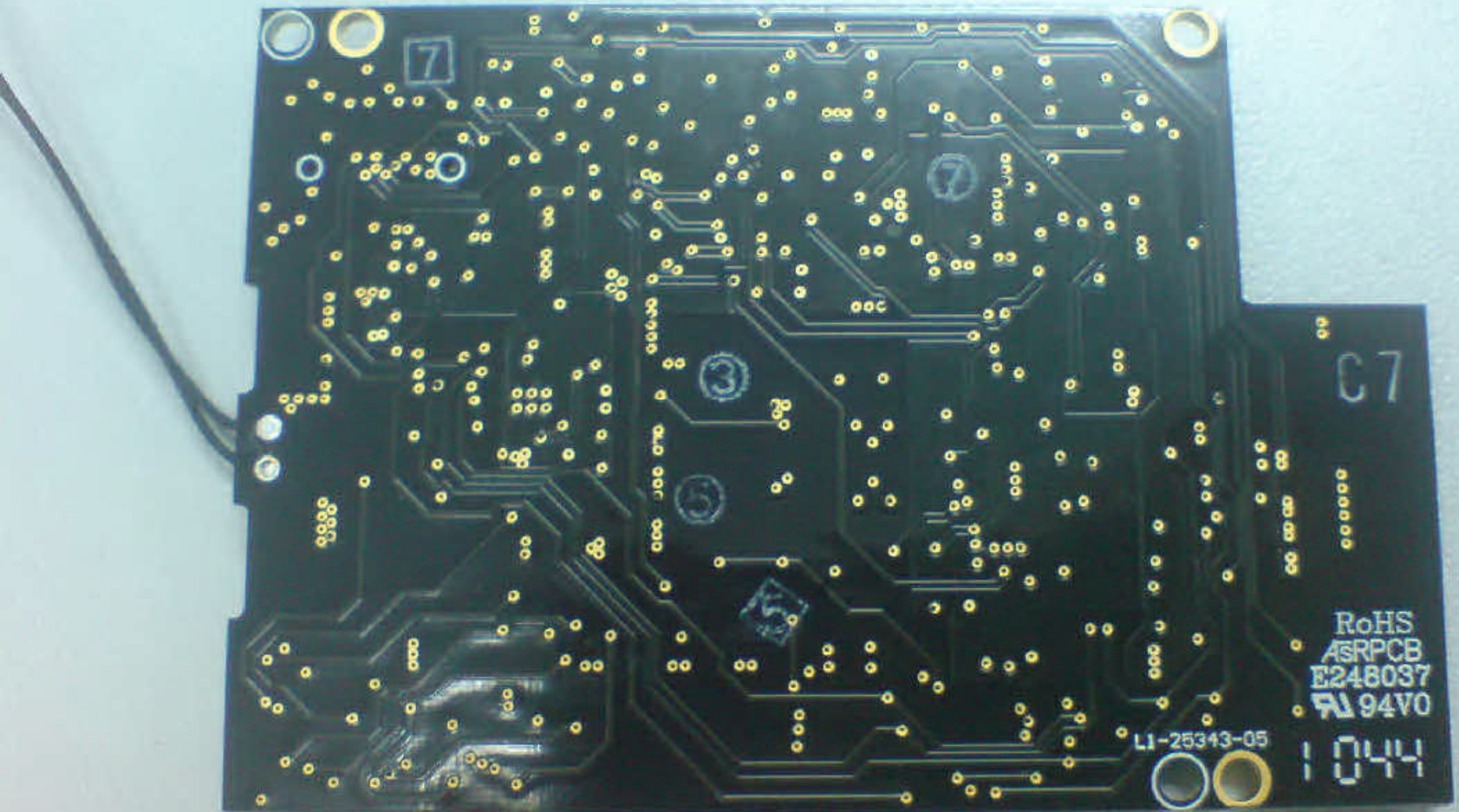


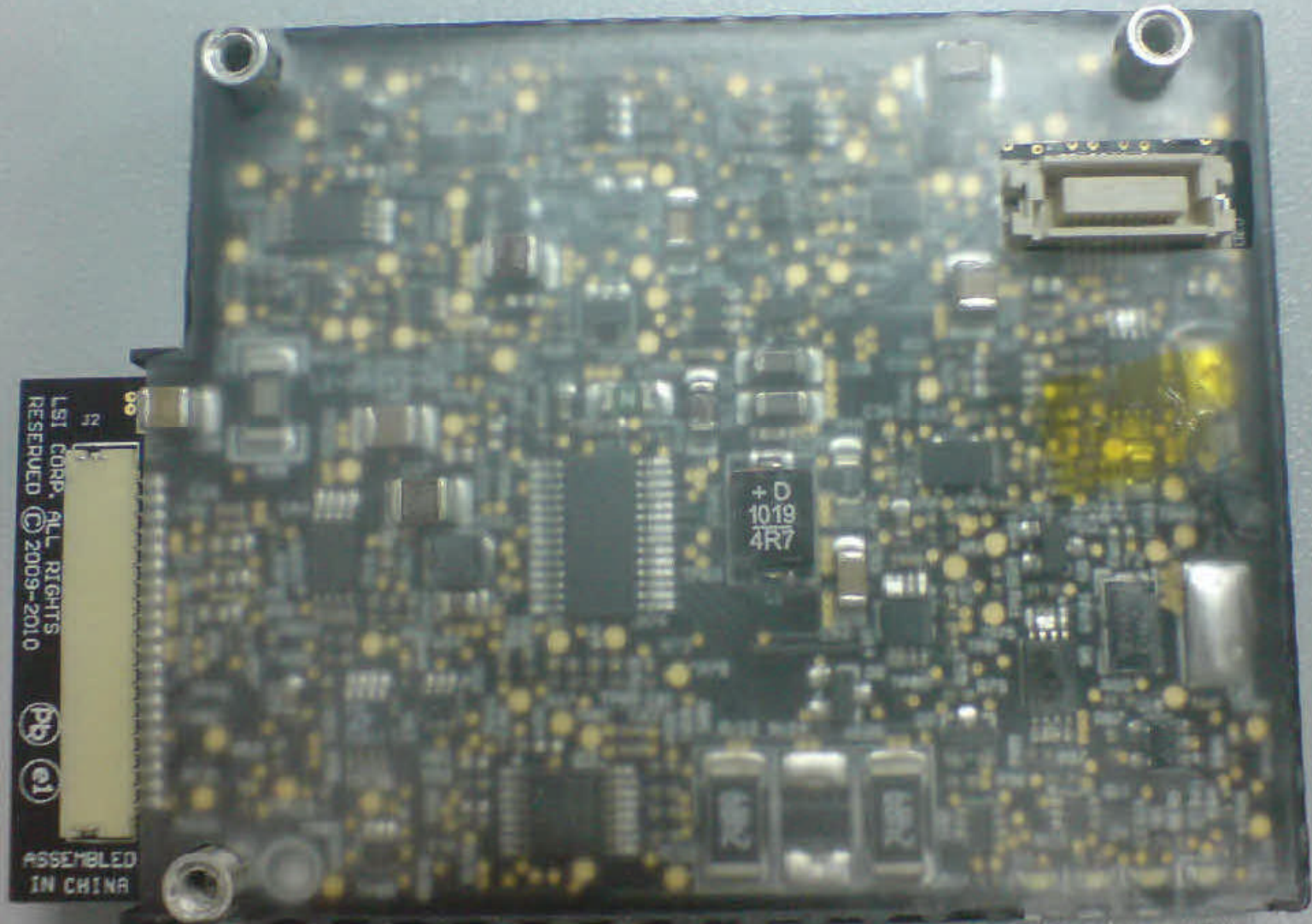












NOTES:

1. Part # 200577 Vol. 2 Sec. 34 ILL-1 Issued: 2010-06-08

a. TYPE: ARIAL, SWISS MONO, OR EQUIVALENT

b. POINT SIZE: 4 MINIMUM

2. ASSEMBLY NUMBER: L4-25343-02 (BAR-CODED AND HUMAN READABLE)

3. TRACER NUMBER: SAYWWSSSSSSss (BAR-CODED AND HUMAN READABLE)

a. S: DATA IDENTIFIER FOR LOT NUMBER OR

COMPONENT SERIAL NUMBER

b. A: MANUFACTURING SITE CODE (Y-PALLADIUM ENERGY SHANGHAI)

c. Y: LAST DIGIT OF MANUFACTURED YEAR.

d. WW: WORK WEEK OF MANUFACTURED YEAR.

e. SSSSS: SEQUENTIAL SERIAL NUMBER, 00001~99999

f. ss: CELL MANUFACTURING CODE; SO SONY CELL

4. BAR-CODE

a. SYMBOLOGY: CODE 128

b. HEIGHT: 0.10" MINIMUM

c. QUIET ZONE: 0.10" MINIMUM

d. DENSITY: 14 CHARACTERS PER INCH MAXIMUM

e. START/STOP CHARACTERS: NON-HUMAN READABLE

f. BAR CODE ALIGNMENT: CENTERED

g. HUMAN READABLE CENTERED ABOVE THE BAR CODE.

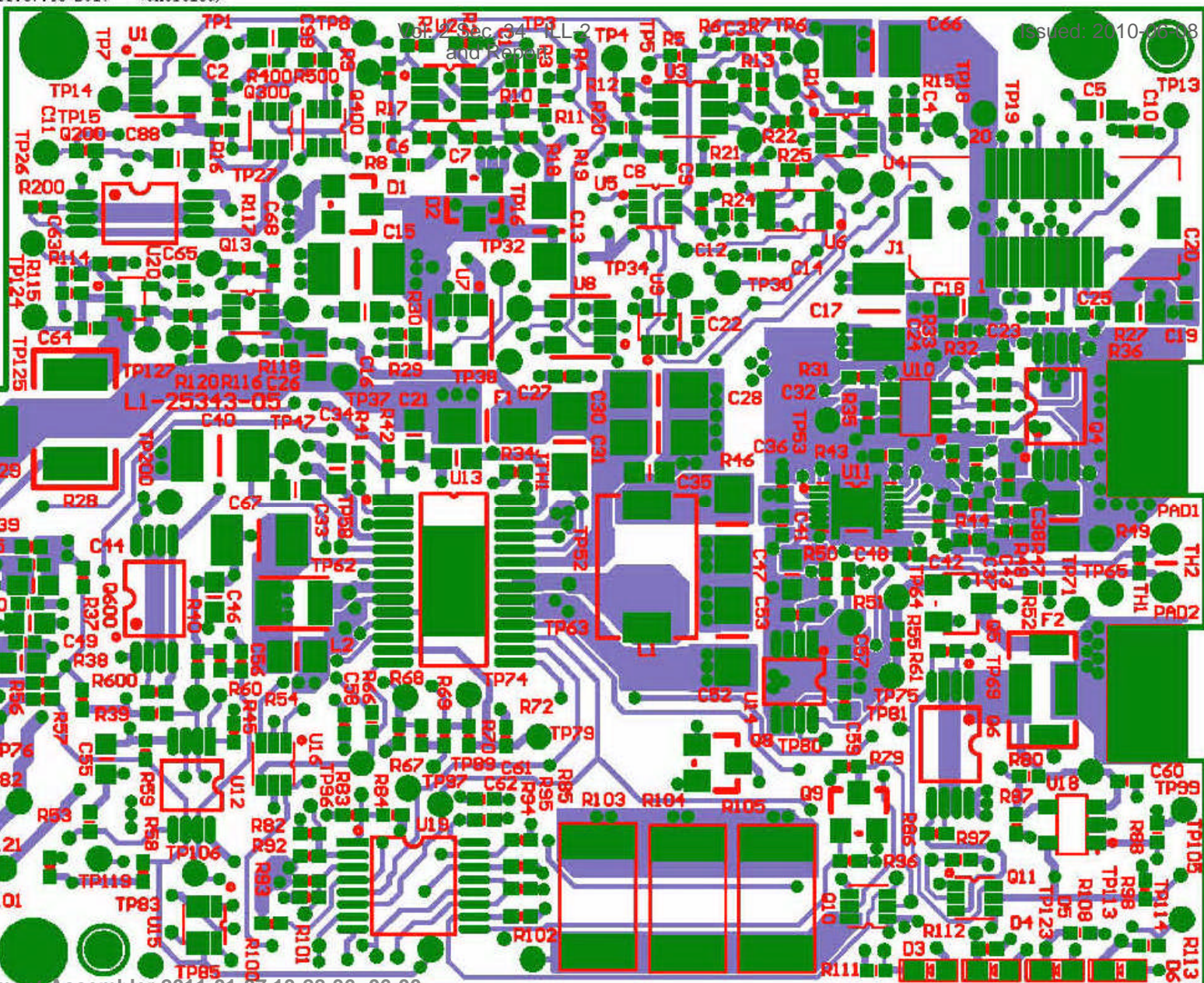
5. MODEL NUMBER "BAT X" WHERE X DENOTES CELL CONFIGURATION.

6. LABEL SHOULD BE PRINTED USING A UL RECOGNIZED PROCESS AND

MATERIALS. MATERIALS MUST BE ROHS COMPLIANT.

7. ART FOR REFERENCE ONLY.

8. USE Ricoh Co. Ltd., "B110C" OR "B110CR" THERMAL TRANSFER RIBBONS

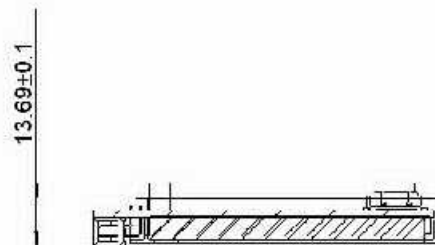


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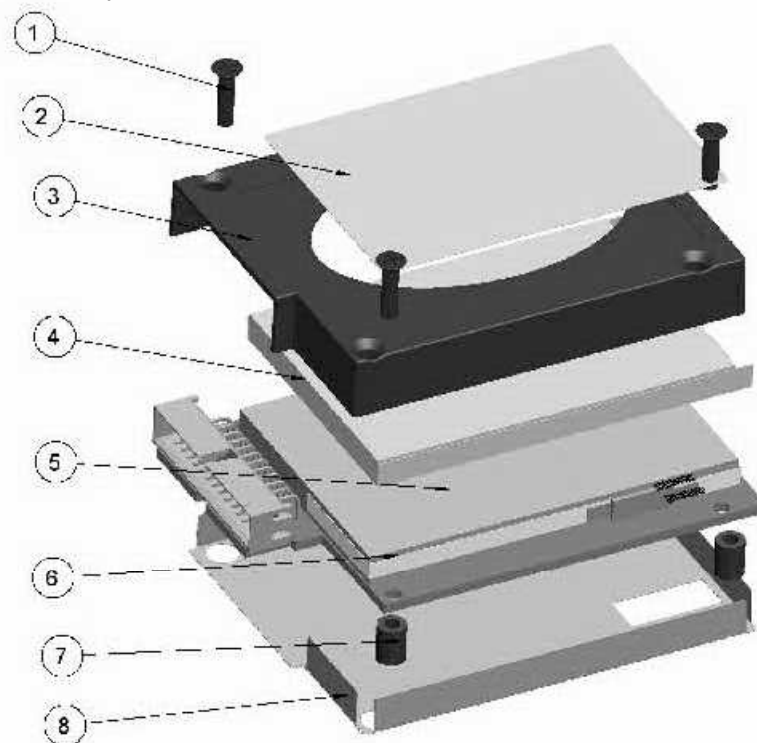
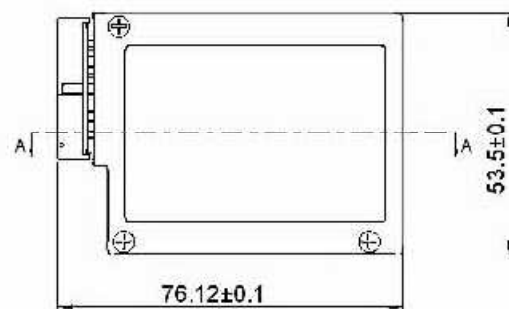
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IN** _____

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SECTION A-A



SCALE 1.500

NOTES:
UNLESS OTHERWISE SPECIFIED,
PART TO BE PACKED TO PREVENT DAMAGE DURING SHIPPING AND HANDLING

				PCB CHANGE		REV		LOCATION		DATE	
				PRELIMINARY RELEASE						10 Mar 10	
				CHNG DETAIL						08 Sep 12	
				CHNG NO.		NAME		SIGN		DATE	
				SCALE:		SLEAS					
				DESCRIPTION:						CHNG	
				IBBU08 ASM						-GS CHECK	
				PART NO. 10-25543-02						UNIT: mm	
				DRAWING NO.						SHEET	
				A10042						1/1	

TEST RECORD NO. 1

SAMPLES:

Samples of the Rechargeable Li-ion Battery Pack, Model as indicated below and constructed as described herein, was submitted by the manufacturer for examination and test.

Model No.	Nominal Voltage	Capacity	Maximum Charging Voltage	Maximum Charging Current	Maximum discharge Current	Dis-charge Cutoff Voltage	Cell Config xS/yP	Cell Mfg.	Cell Model Number
BAT1S1P	3.7 Vdc	1.59 Ah, 5.9 Wh	12 Vdc	500 mA	45 mA	N/A	1S/1P	Sony Energy Device Corp (MH12566)	US454261
	3.7 Vdc	1.5 Ah, 5.55 Wh	12 Vdc	500 mA	45 mA	N/A	1S/1P	Hitachi Maxell Ltd (MH12568)	ICP494261

GENERAL:

Test results relate only to the items tested.

The following tests were conducted.

Test Conducted	UL 2054 Section Reference (UL/CSA60950-1 Section Reference)	Compliant Results? [Y] [N]	Comments
SHORT CIRCUIT TEST - At Room Temperature: (Excessive Discharge)	9.7-9.12 (4.3.8)	Y	Pass
SHORT CIRCUIT TEST (At 55 C):	9.7 - 9.12	Y	Pass
ABNORMAL CHARGING TESTS: Secondary (Overcharging)	10.10 - 10.13 (4.3.8)	Y	Pass
ABUSIVE OVERCHARGE TEST:	11	Y	Pass
LIMITED POWER SOURCE TEST: (Limited Power Source Measurements)	13 (2.5)	Y	Pass
BATTERY PACK COMPONENT TEMPERATURE TEST (Maximum Temperatures)	13A (4.5)	Y	Pass

The test methods and results of the above tests have been reviewed and found in accordance with the requirements (unless noted otherwise in the table above) in the Standard for Household and Commercial Batteries, UL 2054, Second Edition, including revisions through revision date November 11, 2009.

The following tests conducted in accordance with UL 60950-1, 2nd Edition, 2007-03-27, Information Technology Equipment-Safety-Part 1: General Requirements were considered representative of the same tests required by Canadian Standards, CAN/CSA-C22.2 No. 60950-1-07, 2nd Edition, 2007-03, Information Technology Equipment-Safety-Part 1: General Requirements.

Test UL60950-1
4.3.8 - Battery Tests
4.6.5 - Barrier Adhesive Test

Barrier Adhesive Test is for end product's reference only.

UL 60950-1 Energy Hazard Measurements, Limited Power Source Measurements, Discharge of Battery Tests, and Heating Test were waived due to tests were conducted as part of UL2054, Section 9, Short Circuit Test, Section 13, Limited Power Source Test, and Section 13A, Component Temperature Test, because tests of UL2054 represent the worst-case parameters of the similar tests.

The test methods and results of the above tests have been reviewed and found in accordance with the requirements in the U.S. and Canadian (Bi-National) Standard for Safety of Information Technology Equipment-Safety-Part1: General Requirements, CAN/CSA-C22.2 No. 60950-1-07, and UL 60950-1, Second Edition, issue dated March 27, 2007.

Test Record Summary:

The results of this investigation indicate that the products evaluated comply with the applicable requirements in the U.S. Standard for Safety of Household and commercial Batteries, UL 2054 Second Edition, including revisions through revision date November 11, 2009, and the U.S. and Canadian (Bi-National) Standard for Safety of Information Technology Equipment-Safety-Part1: General Requirements, CAN/CSA-C22.2 No. 60950-1-07, and UL 60950-1, Second Edition, issue dated March 27, 2007, and, therefore, such products are judged eligible to bear UL's Mark as described on the Conclusion Page of this Report.

TEST RECORD NO. 2

GENERAL:

No test was deemed necessary, due to Model BAT1S1P employ the alternate model designation, BAT1S1P-A, employ the alternate connectors, and correct rating from 5.55 Wh to 5.6 Wh for Hitachi cell.

Test Record Summary:

The results of this investigation indicate that the products evaluated comply with the applicable requirements in the Batteries, Household and Commercial, UL 2054 2nd edition, including revisions through revision date November 11, 2009, and U.S. and Canadian (Bi-National) Standard for Information Technology Equipment - Safety - Part 1: General Requirements, 60950-1, 2nd Edition, 2007-03-27, CAN/CSA-C22.2 No. 60950-1-07, 2nd Edition, 2007-03, and, therefore, such products are judged eligible to bear UL's Mark as described on the Conclusion Page of this Report.

Test Record by:
GLORY KO
Associate Project Engineer

Reviewed by:
PERCY SHIH
Project Engineer

TEST RECORD NO. 3

GENERAL:

Update Schematic and alternate Fuse(F2), type SFH-0412B by Sony Chemical & Information Device Corp (E167588), and alternate IC(U10) sources, type S-8261AAOMD-G2OT2G, S-8261ABRMD-G3RT2G, S-8261ABIMD-G23IT2G.

No test was considered necessary due to not regard with safety investigation by engineer judgments.

Test Record Summary:

The results of this investigation indicate that the products evaluated comply with the applicable requirements in the Batteries, Household and Commercial, UL 2054 2nd edition, including revisions through revision date November 11, 2009, and U.S. and Canadian (Bi-National) Standard for Information Technology Equipment - Safety - Part 1: General Requirements, 60950-1, 2nd Edition, 2007-03-27, CAN/CSA-C22.2 No. 60950-1-07, 2nd Edition, 2007-03, and, therefore, such products are judged eligible to bear UL's Mark as described on the Conclusion Page of this Report.

Test Record by:
CHIALI HUANG
Engineer

Reviewed by:
WILLIAM WENG
Senior Project Engineer

CONCLUSION

Samples of the component covered by this Report have been found to comply with the requirements covering the category and the component is judged to be eligible for Component Recognition and Follow-Up Service. Under the Service, the manufacturer is authorized to use the Recognized Marking described in the Follow-Up Service Procedure on such products which comply with said Procedure and any other applicable requirements of Underwriters Laboratories Inc. Only those products which properly bear the Recognized Markings are considered as Recognized Components by Underwriters Laboratories Inc. Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

This Report is intended solely for the use of UL and the Applicant for establishment of UL certification coverage of the product under UL's Follow-Up Service. Any use of the Report other than to indicate that the sample(s) of the product covered by the Report has been found to comply with UL's applicable requirements is not authorized and renders the Report null and void. UL shall not incur any obligation or liability for any loss, expense, or punitive damages, arising out of or in connection with the use or reliance upon the contents of this Report to anyone other than the Applicant as provided in the agreement between UL and Applicant. Any use or reference to UL's name or certification mark(s) by anyone other than the Applicant in accordance with the agreement is prohibited without the express written approval of UL. Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

Report by:

Reviewed by:

GLORY KO
Associate Project Engineer

PERCY SHIH
Project Engineer