

**MSDS CML18**

VARTA bzw. BAK 3,7V / 3,7Wh Lithium Ionen Batterie verbaut in Gerät (1 Stück)

= Lithium ion battery contained in equipment UN3481

**Produkt:** CML18

**Ordercodes:** 71449811; CML18\*; 71488756; 71488758; 71488767; 71550073; 71550075;  
71550076; 71631651

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### Rechargeable Lithium Ion Battery

Series: LIC..., LIP..., LPP...

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## 1 Identification of the product and of the company undertaking

### Product details

Trade name	Rechargeable lithium ion battery
Electrochemical system:	Lithium ion
Anode (negative):	Carbon (proprietary)
Cathode (positive):	Metal oxide (proprietary)

This MSDS applies to the following cell types and batteries assembled from these types.

The values listed for energy and voltage are given for reference only; they are not contractual assurances of product attributes and may differ from values given in specifications, data sheets or other documents or on the products.

Type	Energy per cell	Nominal voltage per cell
LIC 14500 PD	3.0Wh	3.7 V
LIC 18650-15 LC	5.6Wh	3.6 V
LIC 18650-20 RC	7.2Wh	3.6 V
LIC 18650-22 AL *	7.9Wh	3.6 V
LIC 18650-22 BT	8.1 Wh	3.6 V
LIC 18650-22 FC	8.0Wh	3.6 V
LIC 18650-22 PC	7.8 Wh	3.7 V
LIC 18650-22 S3B *	8.0Wh	3.6 V
LIC 18650-25 FKD	9.3Wh	3.7 V
LIC 18650-26 FC	9.6Wh	3.7 V
LIC 18650-26 HC	9.4 Wh	3.7 V
LIC 18650-26 JC	9.5 Wh	3.63 V
LIC 18650-26SKE	9.5 Wh	3.65 V
LIC 18650-29 EC	10.4 Wh	3.7 V
LIC 18650-29 FC	10.7 Wh	3.7 V
LIC 18650-30 BC	11.2 Wh	3.7 V
LIC 18650-32MH1B	11.8 Wh	3.7 V
LIC 18650-35EC	12.2 Wh	3.6 V
LIC 18650-FTC1H	3.5 Wh	3.2 V
LIC 18650-M26B	9.4 Wh	3.6 V

\* These cells contain SVHC substances > 0.1 % (see section 3)

continued on next page

Type	Energy per cell	Nominal voltage per cell
LIC 18650-M26SB	9.4 Wh	3.6 V
LIC 18650-M29B	10.5 Wh	3.67V
LIC 18650-VTC4H	7.6 Wh	3.6 V
LIC 18650-VTC5AH	9.4 Wh	3.6 V
LIC 26650-30 H	9.6 Wh	3.2 V
LIP 103450 AC	8.4 Wh	3.7 V
LIP 103450 SC	7.5 Wh	3.7 V
LIP 103450-CAT	7.3 Wh	3.7 V
LIP 383450 AJL *	2.8 Wh	3.7 V
LIP 423048 AJL *	2.6 Wh	3.7 V
LIP 423450 AJL *	3.2 Wh	3.7 V
LIP 463048 FD	2.7 Wh	3.7 V
LIP 523450 AJL *	4.1 Wh	3.7 V
LIP 553450 WC	4.2 Wh	3.7 V
LIP 663450 MTC	4.9 Wh	3.7 V
LPP 383450 PL *	2.6 Wh	3.7 V
LPP 402025 CE *	0.5 Wh	3.7 V
LPP 402934 E *	1.1 Wh	3.7 V
LPP 422339 PL *	1.3 Wh	3.7 V
LPP 423566 BE *	4.2 Wh	3.7 V
LPP 442834 PVL *	1.5 Wh	3.7 V
LPP 443441 S *	2.4 Wh	3.7 V
LPP 454261 8TH	5.9 Wh	3.7 V
LPP 463149 S *	2.6 Wh	3.7 V
LPP 486588 H	13.0 Wh	3.7 V
LPP 503562 S *	4.5 Wh	3.7 V
LPP 503759 8HH	5.2 Wh	3.7 V
LPP 503759 DL *	4.6 Wh	3.7 V
LPP 523450 S *	3.7 Wh	3.7 V
LPP 553048 PL *	3.0 Wh	3.7 V
LPP 553436 S *	2.9 Wh	3.7 V
LPP 683566 BE *	6.7 Wh	3.7 V
LPP 702035 PVL *	1.6 Wh	3.7 V
LPP 702035 S *	1.6 Wh	3.7 V
LPP 751930 PL *	1.5 Wh	3.7 V

\* These cells contain SVHC substances > 0.1 % (see section 3)

### Supplier details

Address: VARTA Storage GmbH  
Nürnbergger Straße 65  
D-86720 Nördlingen  
Germany

Emergency Phone Number: +49 7961 921 110 (VAC)

### Legal remark (EU)

These batteries are no "substances" or "mixtures" according to Regulation (EC) No 1907/2006 EC. Instead they have to be regarded as "articles"; no substances are intended to be released during handling. Therefore there is no obligation to supply a safety data sheet according to Regulation (EC) 1907/2006, Article 31.

### General remark

This information is provided as a service to our customers. The details presented are in accordance with our present knowledge and experiences. They are no contractual assurances of product attributes.

## 2 Hazards identification

The battery is sealed hermetically. Thus, the ingredients have no hazard potential, except the battery is violated or dismantled.

If in case of mistreatment the ingredients are released, a spontaneously flammable gas mixture may be released under certain circumstances (measures according to sections 4 to 6).

Attention: If batteries are treated wrong the danger of burns or bursts occurs. Batteries must not be heated above 100 °C or incinerated. The battery contents must not get in contact with water. If the negative electrode gets in contact with water or humidity hydrogen gas is formed, which may inflame spontaneously.

## 3 Composition/information on ingredients

### Ingredients

Content	CAS no.	EC no.	Material	Hazard Categories	Hazard Statements
20 – 50 %	proprietary	proprietary	Metal oxide (proprietary)	Skin Sens. 1, Acute Tox. 2, Resp. Sens. 1, Carc. 1B, STOT RE 1, Aquatic Chronic 3	H317, H330, H334, H350, H372, H412
10 – 30 %	proprietary	proprietary	Carbon (proprietary)		
10 – 20 %	proprietary	proprietary	Electrolyte (proprietary)	Flam. Liq. 2, Skin Corr. 1B, Eye Dam. 1, Skin Sens. 1, Muta. 2, Carc. 2, Aquatic Chronic 2	H225, H312, H314, H317, H341, H351, H411

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Content	CAS no.	EC no.	Material	Hazard Categories	Hazard Statements
2 – 10 %	7429-90-5	231-072-3	Aluminum foil		
2 – 10 %	7440-50-8	231-159-6	Copper foil		
< 5 %	proprietary	proprietary	Binder		
Remainder	proprietary	proprietary	Inert materials		

For full text of hazard statements see section 16.

During charge process a lithium carbon intercalation phase is formed, which is highly flammable and corrosive, but not released under the circumstances of normal usage.

#### SVHC substances according to REACH (Article 33)

Content	CAS no.	EC no.	Material
> 0.1 %	1120-71-4	214-317-9	1,3-Propanesultone (only for cells marked with * in section 1)

For information to allow safe use: see section 7.

#### Substances relevant for Battery Directive 2006/66/EC

Content	CAS no.	EC no.	Material
< 10 mg/kg	7439-92-1	231-100-4	Lead
< 1 mg/kg	7440-43-9	231-152-8	Cadmium
< 1 mg/kg	7439-97-6	231-106-7	Mercury (none intentionally introduced, see section 12)

## 4 First-aid measures

After inhalation:	Fresh air. Seek for medical assistance.
After skin contact:	Remove solid particles immediately. Flush affected areas with plenty of water (at least 15 min). Remove contaminated cloth immediately. Seek for medical assistance.
After eye contact:	Flush the eye gently with plenty of water (at least 15 min). Seek for medical assistance.
After ingestion of battery components:	Drink plenty of water. Avoid vomiting. Seek for medical assistance. No trials for neutralization.

### 5 Fire-fighting measures

Suitable extinguishing media:	Metal fire extinction powder, rock salt or dry sand shall be used. In case only water is available, it can be used in large amounts.
Extinguishing media with limited suitability:	Carbon dioxide (CO <sub>2</sub> ) is not suitable. Water in small quantities may have adverse effects.
Special protection equipment during fire-fighting:	Contamination cloth including breathing apparatus.
Special hazard:	Cells may explode and release metal parts. At contact of electrolyte with water traces of hydrofluoric acid may be formed. In this case avoid contact and take care for good ventilation. At contact of charged anode material with water extremely flammable hydrogen gas is generated.
Attention:	Do not let used extinguishing media penetrate into surface water or ground water. If necessary, thicken water or foam with suitable solids. Dispose of properly.

### 6 Accidental release measures

Person related measures:	Wear personal protective equipment adapted to the situation (protection gloves, face protection, breathing protection).
Environment protection measures:	In the event of battery rupture, prevent skin contact and collect all released material in a plastic lined container. Bind released ingredients with powder (rock salt, sand). Dispose of according to the local law and rules. Avoid leached substances to penetrate into the earth, canalization or water.
Treatment for cleaning:	If battery casing is dismantled, small amounts of electrolyte may leak. Package the battery tightly including ingredients together with lime, sand or rock salt. Then clean with water.

### 7 Handling and storage

Guideline for safe handling:	<ul style="list-style-type: none"><li>• Always follow the warning information on the batteries and in the manuals of devices. Only use the recommended battery types.</li><li>• Keep batteries away from children. Keep small cells and batteries which are considered swallowable out of the reach of children.</li><li>• For devices to be used by children, the battery casing should be protected against unauthorized access.</li><li>• Unpacked batteries shall not lie about in bulk.</li><li>• In case of battery change always replace all batteries by new ones of identical type and brand.</li><li>• Do not swallow batteries. Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion. In case of ingestion of a cell or battery, seek medical assistance promptly.</li><li>• Do not throw batteries into water.</li><li>• Do not throw batteries into fire.</li><li>• Avoid deep discharge.</li><li>• Do not short-circuit batteries.</li><li>• Use recommended charging time and current.</li><li>• Do not open or disassemble batteries.</li></ul>
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Supply to private end users:	<p>In case the products are supplied to private end users packed with equipment or contained in equipment it is strongly recommended to follow UL product and instruction manual requirements. The product is required to be marked with a graphical symbol that alerts the user to refer to the instruction manual.</p> <p>The instruction manual itself is required to contain</p> <ul style="list-style-type: none"><li>• a warning marking with text to alert the user of the potential chemical burn hazard associated with coin/button battery ingestion,</li><li>• an instruction as to the presence of a coin/button cell battery,</li><li>• possible effects of battery ingestion,</li><li>• an instruction to keep batteries away from children,</li><li>• an advice to seek immediate medical attention if it suspected that batteries have either been swallowed or placed inside any part of the body.</li></ul> <p>Further advice for parents: <a href="http://buttonbatterysafety.com">http://buttonbatterysafety.com</a> <a href="http://www.productsafety.gov.au/news/the-battery-controlled-button-battery-safety">http://www.productsafety.gov.au/news/the-battery-controlled-button-battery-safety</a></p>
Environmental conditions:	<p>-20 °C to 20 °C for storage -20 °C to 60 °C for short exposition (e.g. transport)</p> <p>Avoid large temperature changes. Do not store close to heating devices. Avoid direct sunlight. At higher temperature the electrical performance may be reduced. Storage of unpacked batteries can cause short circuit and heat generation.</p>
Storage category according to TRGS 510:	<p>It is recommended to consider the "Technical Rule for Hazardous Substances TRGS 510 - Storage of hazardous substances in nonstationary containers" and to handle lithium ion batteries according to storage category 11 ("combustible solids").</p>
Storage of large amounts:	<p>Follow the recommendations of the German Insurance Association (GDV - "Gesamtverband der Deutschen Versicherungswirtschaft e.V.") concerning lithium batteries: <a href="https://vds.de/fileadmin/vds_publicationen/vds_3103en_web.pdf">https://vds.de/fileadmin/vds_publicationen/vds_3103en_web.pdf</a></p> <p>In case of storage of large amounts (used storage volume &gt; 7 m<sup>3</sup> and/or more than 6 pallets) batteries shall be stored in fire-resistant or separated rooms or areas (e.g. warehouse or container for hazardous materials). Mixed storage with other products is not allowed. The storage area shall be monitored by an automatic fire detection system, connected to a permanently manned place. A fire-extinguishing system shall reflect the extinguishing agents mentioned in section 5.</p>

## 8 Exposure controls/personal protection

Under normal conditions (during charge and discharge) release of ingredients does not occur.

## 9 Physical and chemical properties

Not applicable if closed.

## 10 Stability and reactivity

Dangerous reactions: When heated above 100 °C the risk of rupture occurs.

## 11 Toxicological information

Under normal conditions (during charge and discharge) release of ingredients does not occur. In case of accidental release see information in sections 2 to 4 and 6.

Swallowing of a battery can be harmful. Call the local Poison Control Centre for advice and follow-up. See section 4.

## 12 Ecological information

VARTA LIC/LIP/LPP series lithium ion batteries do not contain heavy metals as defined by the European directives 2006/66/EC Article 21; they comply with the chemical composition requirements of this Directive.

Mercury has not been "*intentionally introduced (as distinguished from mercury that may be incidentally present in other materials)*" in the sense of the U.S.A. "*Mercury-Containing and Rechargeable Battery Management Act*" (May 13 1996).

The Regulation on Mercury Content Limitation for Batteries promulgated on 1997-12-31 by the China authorities including the State Administration of Light Industry and the State Environmental Protection Administration defines "*low mercury*" as "*mercury content by weight in battery as less than 0.025 %*", and "*mercury free*" as "*mercury content by weight in battery as less than 0.0001 %*". And therefore: VARTA LIC/LIP/LPP series lithium ion batteries belong to the category of mercury-free battery (mercury content lower than 0.0001 %).

## 13 Disposal considerations

In order to avoid short circuit and heating, used VARTA LIC/LIP/LPP series lithium ion batteries should never be stored or transported in bulk. Proper measures against short circuit are:

- Storage of batteries in original packaging
- Coverage of the terminals
- Embedding in dry sand

### European Union

In the European Union, manufacturing, handling and disposal of batteries is regulated on the basis of the DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 September 2006 on batteries and accumulators and repealing Directive 91/157/EEC. Customers find detailed information on disposal in their specific countries using the web site of the European Portable Batteries Association ([www.epbaeurope.net/legislation\\_national.html](http://www.epbaeurope.net/legislation_national.html)).

Importers and users outside EU should consider the local law and rules.

### USA

VARTA LIC/LIP/LPP series lithium ion batteries are classified by the federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream. These batteries, however, do contain recyclable materials and are accepted for recycling by Call2Recycle, Inc. Please go to their website at [www.call2recycle.org](http://www.call2recycle.org) for additional information.

## 14 Transport information

VARTA LIC/LIP/LPP series lithium ion batteries are considered to be UN 3480 Lithium Ion Batteries, and are tested according to subsection 38.3 of the "*UN Manual of Tests and Criteria*" for compliance with the requirements of special provisions ADR 188, IMDG 188, as well as the requirements of DOT / 49 CFR § 173.185, and the requirements of IATA DGR packing instruction 965. Test results as well as other relevant information required for transportation are given in dedicated "*Supplier's Test Summaries*".

Please note that for some products state of charge and VARTA packaging are not designed for air transport in bulk; this does not affect air transport of batteries packed with equipment or contained in equipment.

Transportations of cells or batteries packed with equipment or contained in equipment have to follow the appropriate regulations for UN 3481.

During the transportation of large amounts of batteries by ship, trailer or railway, do not store them in places of high temperature and do not allow them to be exposed to condensation. During the transportation do not allow the packaging to be damaged,



as a damage of the packaging may cause fire. In the event packaging is damaged, special procedures must be used including inspection and repackaging if necessary and handle with care.

Code of practice for packaging and shipment of secondary batteries given in IEC 62133: The packaging shall be adequate to avoid mechanical damage during transport, handling and stacking. The materials and pack design shall be chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of moisture.

Compilations of transport requirements for Lithium batteries can be found in:

<https://www.lithium-batterie-service.de/en/>

<https://www.iata.org/whatwedo/cargo/dgr/Documents/lithium-battery-shipping-guidelines.pdf>

Each cell or battery is manufactured under a quality management program according to IATA DGR clause 3.9.2.6, ADR clause 2.2.9.1.7 e), and IMDG code clause 2.9.4.5.

## 15 Regulatory information

### Marking consideration

European Union: According to "DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC" the batteries have to be marked with the crossed wheel bin symbol: According to Commission Regulation (EU) No 1103/2010 portable secondary (rechargeable) batteries and accumulators shall be marked with a capacity marking, except those which are incorporated or designed to be incorporated in appliances before being provided to end-users, and not intended to be removed.

Rechargeable Lithium ion batteries, which contain electronic modules (e.g. PCM) and which are subjected to the EMC directives 2004/108/EC or 2014/35/EU (as they are end-user replaceable devices), must undergo a EU conformity assessment and must wear the CE marking.

According to Dangerous Goods Regulations (see section 14) battery packs have to be marked with the Watt-hour rating.

### Water hazard class

The regulations of the German Federal Water Management Act (WHG) are not applicable as VARTA LIC/LIP/LPP series lithium ion batteries are articles and not substances, thus there is no risk of water pollution, except the batteries are violated or dismantled.

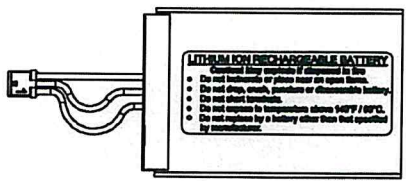
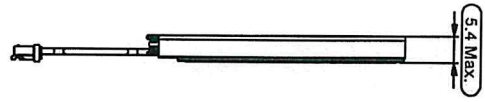
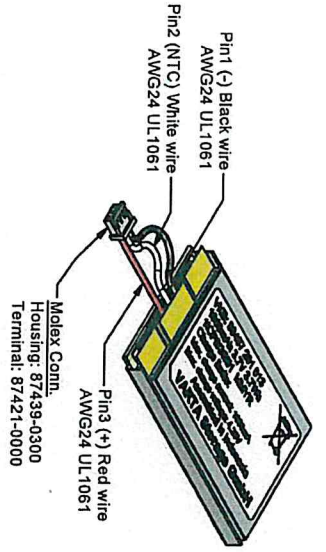
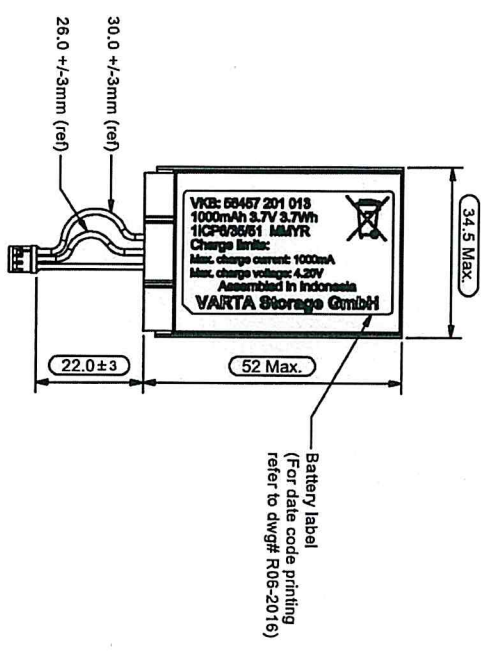
## 16 Other information

Note:	Date of issue of the transport regulations: ADR 2019, RID 2019, IATA DGR 2020 (61 <sup>st</sup> edition), IMDG Code 2018, DOT / 49 CFR 2019. Latest covered modification of the European Battery Directive 2006/66/EC: Directive (EU) 2018/849.
RoHS:	See special Declaration <a href="https://www.varta-storage.com/wp-content/uploads/General-Declarations-RoHS_Declaration_VS.pdf">https://www.varta-storage.com/wp-content/uploads/General-Declarations-RoHS_Declaration_VS.pdf</a>
REACH:	See special Declaration <a href="https://www.varta-storage.com/wp-content/uploads/General-Declarations-REACH_Declaration_VS.pdf">https://www.varta-storage.com/wp-content/uploads/General-Declarations-REACH_Declaration_VS.pdf</a>
Issued by:	VARTA Microbattery GmbH Quality / Environmental Management
Contact:	<a href="https://www.varta-storage.com/contact-storage/?lang=en">https://www.varta-storage.com/contact-storage/?lang=en</a>
Updates:	Current SDS can be downloaded from VARTA's web page <a href="https://products.varta-microbattery.com/en/news-downloads/document-search.html">https://products.varta-microbattery.com/en/news-downloads/document-search.html</a> (select Document Type "MATERIAL SAFETY DATA SHEET").

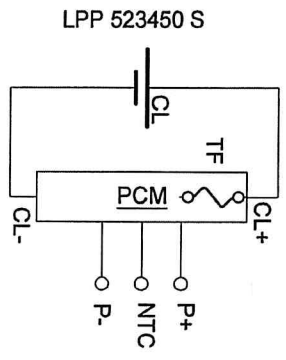
VKB: 56457 201 013  
 1000mAh 3.7V 3.7Wh  
 1ICP6/35/51 MMYR  
 Charge limits:  
 Max. charge current: 1000mA  
 Max. charge voltage: 4.20V  
 Assembled in Indonesia  
**VARTA Storage GmbH**

**Battery label**

Date code, MMYR:  
 MM = Month -> Feb = 02  
 Y = Year -> 2016 = 6  
 R = Week Identification:  
 A = day 1 to 7 (of the month)  
 B = day 8 to 15  
 C = day 16 to 23  
 D = day 24 to 28/29/30/31



**CIRCUIT DIAGRAM**



**Preliminary Specification**

**1. General:**  
 Battery Pack Incl. safety circuit, and wire connector  
 Cell: LPP 523450 S  
 PCM: BPF-01 A  
 NTC: 10.0kΩ ±1% B=3380K  
 ID: None  
 Configuration: 1S layout  
 Weight: appr. 20g

**2. Electrical Specifications:**  
 Rated Capacity: 950mAh min, 1000mAh typical  
 Nominal Voltage: 3.7V  
 Watt-hour rating: 3.7Wh  
 Charging Method: Constant Current + Constant Voltage  
 Max. Charge Voltage [V]: 4.20V  
 Max. Continuous Charge Current: 1000mA (limited by cell DS)  
 Rec. Charge cut off: 10mA or timer 3.5h  
 Max. Continuous Discharge Current: 2000mA (limited by cell DS)  
 Rec. Discharge cut off: 3.0V  
 Internal Impedance: approx. 117mΩ  
 Exp. Cycle Life: 500 cycles ≥ 80% (1C/1C) at 23±5°C

**Cell protection**  
 Overcharge Detection: 4.275V ± 0.025V (0.70 to 1.30sec. delay, release 4.275V ± 0.025V)  
 Overdischarge Detection: 2.30V ± 0.058V (14 to 26msec. delay, resume 2.30V ± 0.058V)  
 Overcurrent Detection @discharge: 2.0A to 4.5A (8.0 to 16.0msec. delay)

**3. Ambient Conditions**  
 Temperature Range  
 -Charge: 0°C to +45°C  
 -Discharge: -20°C to +60°C  
 -Charge Retention/Storage [%]: 1 month at -20°C to +60°C >80%  
 3 month at -20°C to +45°C >80%  
 1 year at -20°C to +30°C >80%  
 -Humidity: 65 ± 20%RH

**4. Environmental and Safety**  
 Please follow VARTA Handling and Safety Precautions for Lilon & LiPolymer  
 The cell used is a UL recognized component according to UL 1642  
 This battery is certified according to IEC62133 edition 2  
 and the battery parts are RoHS-Compliant  
 - Battery visible surface to be free from scratches, marks and foreign substances  
 - Production code printed according to MMYR  
 - Battery label has to be printed by Thermal transfer printer  
 - These dimensions are considered inspectable

0		16-1003		Initial release, updated connector Type & wire lengths. Wires were UL1007, added date code detail & taped wire length		2016-03-23		Ready	
Customer:		Material:		Refer to part list #717145		Date		Name	
Projection:		Dwg. No.:		717145		Date		Name	
Dimensions in mm		Prepared & Checked:		Verified & Approved		Date		Name	
Tolerance: ISO 2768-m		2016		ready		Date		Name	
Scale: NTS		VKB Order No.:		56457 201 013		Date		Name	
Rights reserved to make technical changes, as a result of further development, without notice. This drawing is the property of VARTA Microbattery.		4/0/0		VARTA		Date		Name	



# Supplier's Test Summary

in accordance with UN Manual of Tests and Criteria  
Part III, subsection 38.3  
ISO/IEC 17050-1 Format

Test summary no. 2020-05-18-01

## Information about the manufacturer

**Name** PT. VARTA Microbattery (Indonesia)  
**Address** Batamindo Industrial Park  
Jalan Gaharu Lot 23, Jalan Angsana Lot 307-310  
Mukakuning Batam, Kepulauan Riau 29433, Indonesia

## Object of the declaration

**Type of battery** Rechargeable lithium ion battery  
**Article** 1/LPP 523450 S PCM W  
**Material no.** 715555  
**VKB no.** 56457 201 012  
**IEC Designation** 1ICP6/35/51  
**Voltage** 3.7V  
**Watt-hour rating** 3.7Wh  
**Mass (approx.)** 20g

The object of the declaration described above is in conformity with the requirements of the following document:

Documents No.	Title	Edition / Date of issue
ST/SG/AC.10/11/Rev.6 Amend. 1	Recommendations on the Transport of Dangerous Goods, UN Manual of Tests and Criteria, Part III, subsection 38.3	2017

## Test Report

**Document ref no.** JTA0207  
**Document date** 2020-05-04

## List of Tests conducted and results

Test Item	Test Result	Test Item	Test Result
T1. Altitude Simulation	Pass	T5. External Short-circuit	Pass
T2. Thermal Test	Pass	T6. Crush	Pass*
T3. Vibration	Pass	T7. Overcharge	Pass
T4. Shock	Pass	T8. Forced Discharge	Pass*

\* Reference to report of LPP 523450 S cell

## Test laboratory

The tests were performed by the following test laboratory

<b>Name</b>	PT. VARTA Microbattery (Indonesia)
<b>Address</b>	Application Test Lab Batamindo Industrial Park Jalan Angsana Lot 310 Mukakuning Batam Kepulauan Riau 29433 Indonesia
<b>Phone</b>	+62 770611099
<b>E-mail</b>	<a href="mailto:info@varta-microbattery.com">info@varta-microbattery.com</a>
<b>Website</b>	<a href="http://www.varta-microbattery.com">www.varta-microbattery.com</a>

VARTA Microbattery Pte Ltd  
300 Tampines Avenue 5  
#05-01 Income@Tampines Junction  
Singapore 529653

Phone : (65) 6260 5801  
Fax : (65) 6260 5812  
[info@varta-microbattery.com](mailto:info@varta-microbattery.com)  
[www.varta-microbattery.com](http://www.varta-microbattery.com)  
RCB (Certificate of Incorporation) No. 197201703

Page no.: 1 of 2



**Supplier's Test Summary**  
in accordance with UN Manual of Tests and Criteria  
Part III, subsection 38.3  
ISO/IEC 17050-1 Format

**Additional information**

In original VARTA packaging the products comply with the following special provisions of international transport regulations:

- ADR/RID/ADN/IMDG Code: Special Provision 188
- DOT / 49 CFR: §173.185 (c) (sea and land transport only)

VARTA packaging for this product is not designed for air transport.

State of charge of the batteries is greater than 30 % and thus not appropriate for air transport.

The products have been manufactured under a quality management programme according to ADR clause 2.2.9.1.7 (e) and IMDG code clause 2.9.4.5.

Singapore, 18 May 2020  
(place and date of issue)



(company stamp)

(signature)  
Eric Tan  
Manager  
Technical Support

# Specification of Li-polymer Rechargeable Battery

Model No.: LP-523450-1S-3

Reported by: 陈声宇      Date: Jan,02,2012

Checked by: \_\_\_\_\_      Date : Jan,02,2012

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## 1. Scope

This specification describes the definition, technical requirement, testing method, warning and caution of the Lithium ion polymer rechargeable battery. The specification only applies to DUBILIER'S Li-ion battery.

## 2. Product Model

Battery type: Rechargeable Lithium-ion Polymer Battery

Battery Model: LP-523450-1S-3

## 3. Ratings

- 3.1. Nominal Capacity[at 0.2C]: 930mAh (min );  
980mAh (typical )
- 3.2. Nominal Voltage: 3.7V (average voltage at 0.2C discharge)
- 3.3. Charging Voltage: 4.20 ±0.05V
- 3.4. Max. Charging Current: 930mA
- 3.5. Charging Method: constant current constant voltage
- Standard Charge: 465mA (constant current) charge to 4.20V, then 4.2V  
(constant voltage) for 3.5hr or 19mA(0.02C) cut off
- Quick Charge: 930mA(constant current) charge to 4.20V, then 4.2V  
(constant voltage) for 3.0hr or 19mA (0.02C) cut off
- 3.6. Max. Continuous Discharge Current: 1860mA
- 3.7. Discharge Cut-off Voltage: 2.75V
- 3.8. Battery Dimensions (Refer to the attached drawing)
- Thickness: 5.0±0.2  
( Measured with weighing 300gf at 25±2°C )
- Width: 33.5±1  
( Measured with weighing 300gf at 25±2°C )
- Length: 51±1
- 3.9. Battery Weight: 20±1g
- 3.10. Operating Temperature
- Discharge: -20°C ~ +60°C
- Charging: 0°C ~ +45°C
- Storage in a 50% charged state
- | Temperature range | Duration | Typ. Capacity recovery |
|-------------------|----------|------------------------|
|-------------------|----------|------------------------|

-20°C - +80°C	10 days	50%(expected)
-20°C - +60°C	1month	75%(expected)
-20°C - +45°C	3months	70%(expected)
-20°C - +25°C	1year	80%(expected)

## 4. Battery Performance

### 4.1. Visual Inspection

There shall be no such defects as remarkable scratches, cracks, leakage or deformations.

### 4.2. Test Condition

#### 4.2.1. Standard Test Condition

Test new cells within one month after shipment from our factory and the cells shall not be cycled over five times before the tests.

All the tests in this specification shall be conducted in an ambient temperature of 25°C

±5°C under a humidity of 25% to 85%, unless otherwise specified.

#### 4.2.2 Measuring Instrument or Apparatus

4.2.2.1. The dimension measurement shall be implemented by instruments with equal or more precision of 0.01mm.

4.2.2.2 Standard class specified in the national standard or more sensitive class having inner impedance more than 10kΩ/V.

4.2.2.3 Impedance shall be measured by a sinusoidal alternating current method (1kHz LCR meter).

4.2.2.4 The current measurement shall be implemented by instrument with equal to more precision scale of ±0.1% and the constant voltage precision should be implemented with ±0.5%, and the timing precision should be not below ±0.1%.

4.2.2.5 The temperature measurement shall be implemented by instrument with equal or more precision seal of ±0.5°C.

### 4.3 Electrical Characteristics

#### 4.3.1 Standard Charge

The cell shall be charged at a constant current of 0.5C to 4.2V and then at constant voltage of 4.2V with a charging time of 3.5 hours or 0.02C cut off.

#### 4.3.2 Rated Capacity (0.2C): 930mAh (minimum)

The capacity shall be measured at a discharge current of 0.2C and a cut-off voltage of 2.75V after the standard charge (Section 4.3.1.)

#### 4.3.3 High Rate Discharge Capacity (1C): 85% (minimum) of Rated Capacity

The capacity shall be measured at a discharge current of 1C and a cut-off voltage

of 2.75V after the standard charge (Section 4.3.1.)

4.3.4 Low Temperature Discharge Capacity (0°C): 80% (minimum) of Rated Capacity

The capacity shall be measured at a discharge current of 0.2C in an ambient temperature of 0°C±2°C and a cut-off voltage of 2.75V after the standard charge (Section 4.3.1.)

4.3.5 Low Temperature Discharge Capacity (-10°C): 70% (minimum) of Rated Capacity

The capacity shall be measured at a discharge current of 0.2C in an ambient temperature of -10°C±2°C and a cut-off voltage of 2.75V after the standard charge (Section 4.3.1.)

4.3.6 High Temperature Discharge Capacity (60°C): 100% (minimum) of Rated Capacity

The capacity shall be measured at a discharge current of 0.2C in an ambient temperature of 60°C±2°C and a cut-off voltage of 2.75V after the standard charge (Section 4.3.1.)

4.3.7. Storage Characteristics (25°C)

Capacity Retention: 85% (minimum) of Rated Capacity

Capacity Recovery: 90% (minimum) of Rated Capacity

The capacity retention shall be measured at a discharge current of 0.2C and a cut-off voltage of 2.75V after standard charge (Section 4.3.1.) and being stored for 28 days

at 25°C±5°C. Then, the capacity recovery shall be measured at a discharge current of 0.2C and a cut-off voltage of 2.75V after standard charge (Section 4.3.1.).

4.3.8. Storage Characteristics (45°C)

Capacity Retention: 60% (minimum) of Rated Capacity

Capacity Recovery: 70% (minimum) of Rated Capacity

The capacity retention shall be measured at a discharge current of 0.2C and a cut-off voltage of 2.75V after standard charge (Section 4.3.1.) and being stored for 28 days at

45°C±5°C. Then, the capacity recovery shall be measured at a discharge current

Of 0.2C and a cut-off voltage of 2.75V after standard charge (Section 4.3.1.)

4.3.9 Internal Impedance: 95mΩ( type ) ; 130mΩ( max)

The internal impedance shall be measured at a sine wave alternative current process of 1kHz after the standard charge.

4.3.10. Cycle Life :

The cycle life shall be conducted as the following procedures :

Step 1: charge the cell with the standard charge (as of section 4.3.1);

Step 2: discharge the cell at 0.5C to 2.75V,

Step 3: repeat Step 1 and Step 2 for 500 times.

The capacity after 300 cycles is expected to be equal to or more than 80% of the rated capacity. The capacity after 500 cycles is expected to be equal to or more than 60% of the



rated capacity.

4.3.11 Open Circuit Voltage: 3.6V ~ 4.1V as of shipment.

#### 4.4 Mechanical Performance

4.4.1 Vibration Test: 95% (min) of Rated Capacity, No Leakage

After standard charge (Section 4.3.1.), the battery is vibrated with an amplitude of 0.8mm (1.6mm total maximum excursion) for 60 minutes in three mutually perpendicular directions. The vibration is performed between 10Hz and 55Hz at a rate of 1Hz per minute. After the completion of the vibration, the capacity shall be measured at a discharge current of 0.2C and a cut-off voltage of 2.75V.

#### 4.5 Environmental Performance

4.5.1 Thermal Shock Test: No Leakage, No Fire, No Explosion

The battery is stored at  $75^{\circ}\text{C}\pm 5^{\circ}\text{C}$  for 48 hours, moved to a temperature of  $-20^{\circ}\text{C}\pm 5^{\circ}\text{C}$  within 5 minutes and stored for 6 hours after standard charge (Section 4.3.1.).

#### 4.6 Safety Performance

4.6.1 Short Circuit Test: No Fire, No Explosion

After standard charge (Section 4.3.1.), the battery shall be subjected to a short-circuit condition with a wire of resistance less than  $50\text{m}\Omega$  for 1 hour.

4.6.2 Overcharge Test: (with a PCM) No Fire, No Explosion

After standard charge (Section 4.3.1.), the battery shall be charged at 1C /12V for 2.5 hrs.

4.6.3 Thermal Exposure Test No Fire, No Explosion

After standard charge (Section 4.3.1.), the battery is placed in an oven and is heated up at a rate of  $5^{\circ}\text{C}$  until the temperature reaches  $130^{\circ}\text{C}$ . The oven shall be maintained at  $130^{\circ}\text{C}$  for 60 minutes.

**5. Delivery Condition:** about 50% charged.

## 6. Lithium Ion Polymer Battery Handling Guideline

6.1 In case of contacting the materials from a damaged or ruptured cell or battery:

Eye contact: Washing immediately with plenty of water and soap or for at least 15 minutes. Get medical attention.

Skin Contact: Washing immediately with water and soap. Inhalation of Vented Gas: Remove to fresh air. Get medical attention. Ingestion: Get medical attention immediately.

6.2 Keep away batteries from children.

6.3 The cells/ batteries are requested to be stored within a proper temperature range specified in this specification.

6.4 Do not store batteries in a manner that allows terminals to short circuit.

6.5 Do not place batteries near heating sources, nor exposed to direct sunlight for long periods. Elevated temperatures can result in reduced battery service life.

6.6 Charging Battery

Use only approved chargers and procedures. Improperly charging a cell or battery may cause

the cell or battery to flame or damage.

Charge the battery using the “CC/CV” or constant current /constant voltage method.

Do not charge the battery with a current or voltage higher than the specified maximum value in this specification. The absolute maximum charging voltage is 4.25V per cell.

Prohibit reverse charging of the battery. The battery must be connected correctly.

#### 6.7 Discharging Battery

Discharge battery at the max current specified in this specification. If you plan to discharge battery at a higher current than the max current, please consult us.

Avoid discharge the battery below 2.75V for each cell.

Do not over-discharge the battery. Over-discharging can damage the performance of the battery. It should be noted that the cell/battery would be at an over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell/battery shall be charged periodically to maintain between 3.7V and 4.1V.

#### 6.8 Operation Temperature

The battery shall be operated (stored, charged and discharged) in the temperature specified in This specification.

#### 6.9 Cell/Battery Protection Circuit Module (PCM)

The cell/battery must be equipped with a PCM that protects the cell/battery from overcharging, over-discharging and over-current.

#### 6.10 Battery Short Circuit

Do not short-circuit a battery. A short circuit can result in over-heating of the terminals and provide an ignition source. More than a momentary short circuit will generally reduce the cell or battery service life and can lead to ignition of surrounding materials or materials within the cell or battery if the seal integrity is damaged. Extended short-circuiting creates high temperature in the cell and at the terminals. Physical contact to high temperatures can cause skin burns. In addition, extended short-circuit may cause the cell or battery to flame.

#### 6.11 Prohibit reversing cell polarity within a battery assembly.

#### 6.12 The cell edge of the heat seal zone is electrically conductive. Avoid the edge cross battery terminals, PCB, or conductive surfaces.

#### 6.13 Do not bend, fold or fall the battery or part of the battery. It may cause the battery be damaged and result in the battery swelling, leaking, explosion or ignition

#### 6.14 Do not open or manipulate the folded cell edge.

#### 6.15 Do not bend or fold the sealing edge. And do not tear off the sealing film.

#### 6.16 Battery Pack Design

The battery housing should have sufficient mechanical strength.

No sharp edge components shall be inside the battery housing. The sharp edge may destroy the cell packaging.

No cell movement is allowed in the battery housing.

The ultrasonic head shall not directly/ or indirectly pressed the cell if you need to enclose the battery housing by ultrasonic method. Please consult us for designing the ultrasonic head. Avoid designing airtight battery housing.

#### 6.17 Battery Assembly

We recommend ultrasonic welding or spot welding to connect battery with PCM or other parts. If you employ manual solder method to connect tab with PCM, please pay attention to the followings:

Use a solder with temperature controlled and ESD.

Soldering temperature should not exceed 300°C.

Soldering time should not be longer than 3s.

Soldering times should not exceed 5 times.

Keep battery tab cold down before next time soldering.

Do not directly heat cell body. It may cause the battery be damaged by heat above 90°C

#### 6.18 Battery Disassembly

Never disassemble a battery.

Should a battery unintentionally be crushed, thus releasing its contents, rubber gloves must be used to handle all battery components. Avoid inhalation of any vapors that may be emitted.

6.19 Do not mixed Batteries and Types. Avoid to use old and new cells or cells of different sizes, different chemistry or types in the same battery assembly.

#### 6.20 Other Warnings

Do not heat or dispose the battery into fire, water or other liquids.

Do not put the battery into microwave, washing machine or drying machine.

Do not use a damaged battery.

#### 6.21 Others

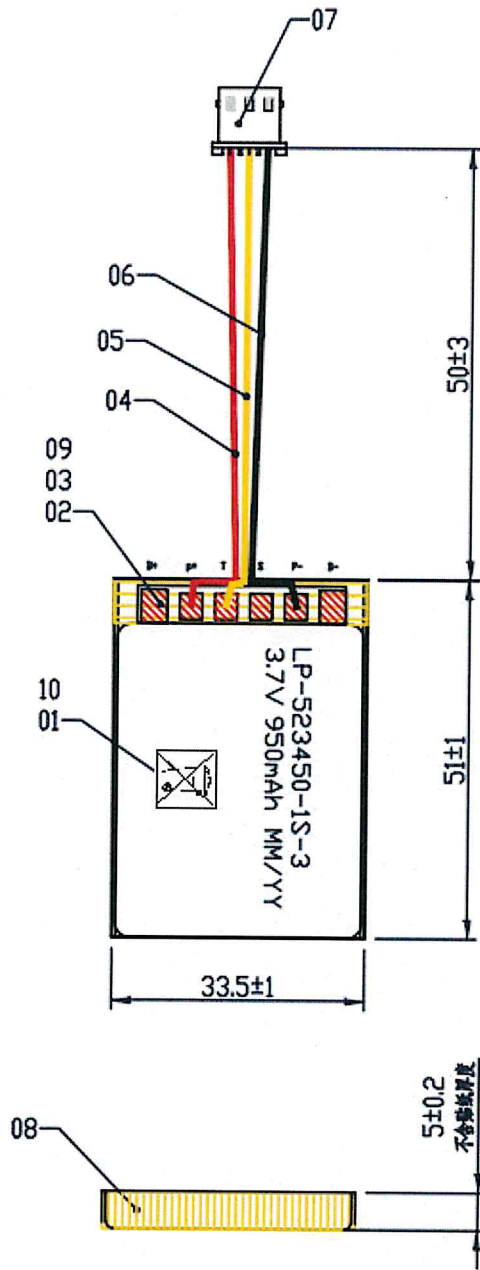
Dubilier shall make no liability for problems that occur when the above specifications are not followed.

## 7. Remarks

If any matter with this specification arises, it shall be revised by mutual agreements.

## 8. Drawing

序号	零件名称	型号	数量
01	电芯/Cell	523450P	1
02	保护板/Pcm	318B 2.5V截止电压/cut off	1
03	热敏电阻/NTC	25°C 10K±1	1
04	红线/Red Wire(+)	UL1007#24	1
05	黄线/Yellow Wire(NTC)	UL1007#24	1
06	黑线/Black Wire(-)	UL1007#24	1
07	插头/Connector	5264-3P正向/Positive	1
08	绝缘胶布/Insulating Tape	橙色/Orange	1
09	绝缘胶布/Insulating Tape	橙色/Orange	2
10	贴纸/Label	00-787(透明底黑色图案8*8)	1



## Data sheet for protect circuit board

### 1. Type and Model

2. Type: Protection Module for Li Ion/Li-Polymer Battery Pack

3.1 Absolute Maximum Ratings (for Ricoh R5402N204KD)

3.2 Supply Voltage: -0.3V to 12 V

3.3 Operating Temperature: -40°C to 85°C

3.4 Storage Temperature: -55°C to 125°C

### 4. Electrical Characteristics (for Ricoh R5402N204KD)(T=25°C )

The followings is referring to the specs of R5402N204KD of Ricoh (for details, see R5402N204KD ). These specs are guaranteed by design not by production tests.

4-A.1 Input Voltage:	1.5V (min)		5.0V(max)
4-A.2 Overcharge Detection :	4.175V (min)	4.200V(Typ)	4.225V(max)
4-A.3 Output Delay of Overcharge:	0.7s (min)	1.0s(Typ.)	1.3s (max)
4-A.4 Overcharge Release :	3.85V(min)	3.90V(Typ)	3.95V(max)
4-A.4 Over-discharge Detection :	2.438V (min)	2.500V(Typ)	2.562V(max)
4-A.5 Output Delay of Over-discharge:	14ms (min)	20ms(Typ.)	26ms(max)
4-A.6 Over-discharge Release :	2.925V (min)	3.000V(Typ)	3.075V(max)
4-A.7 Over Discharge-Current Detection :	0.185V (min)	0.20V(Typ)	0.225V(max)
4-A.8 Overcharge-Current Detection :	0.17V (min)	0.20V(Typ)	0.23V(max)
4-A.9 Over Discharge-Current Value:	3.0A(min)	4.0A(Typ)	7.0A (max)
4-A.10 Over charge-Current Value:	3.0A(min)	4.0A(Typ)	7.0A (max)
4-A.11 Output Delay of Over-Discharge-Current	8ms (min)	12ms(Typ.)	16ms (max)

4-A.12 Output Delay of 5ms (min) 8ms(Typ.) 11ms (max)

Over-charge-Current:

4-A.13 Short Protection Voltage: 0.55V (min) 0.8 V (Typ) 1.0V (max)

4-A.14 Output Delay of 230(Min) 300  $\mu$ s(Typ ) 500 $\mu$ s(max)

Short Protection:

4-A.15 Supply Current (active status): 4.0 $\mu$ A (Typ) 8.0 $\mu$ A (max)

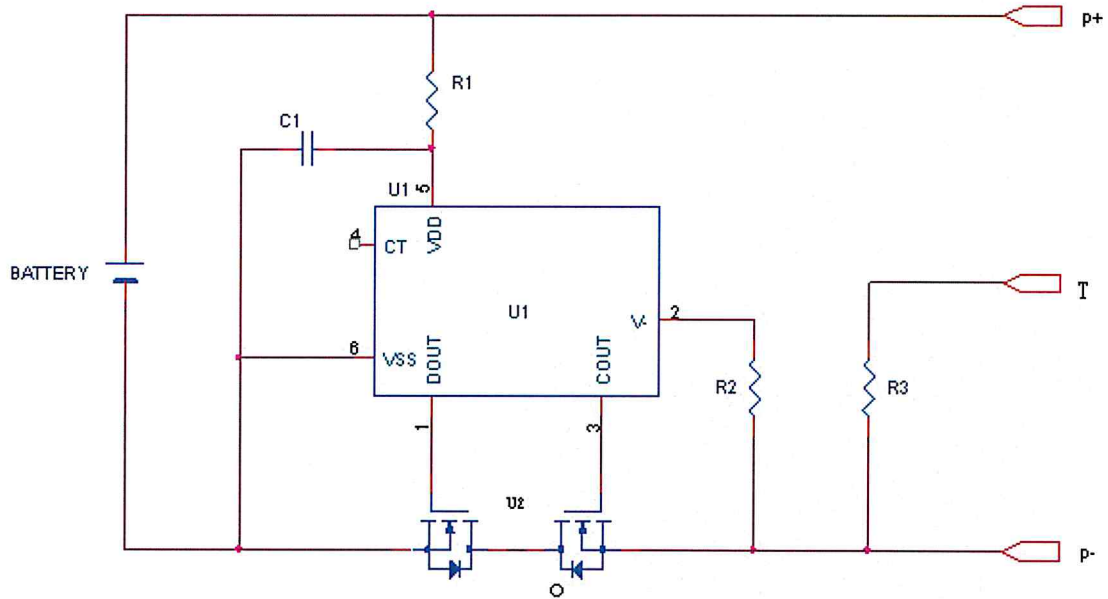
4-A.16 Supply Current (Standby): 1.2 $\mu$ A (Typ) 2.00 $\mu$ A (max)

4-A.17 PCM Resistance : 35m $\Omega$ (min) 50m $\Omega$ (Typ) 60m $\Omega$ (max)

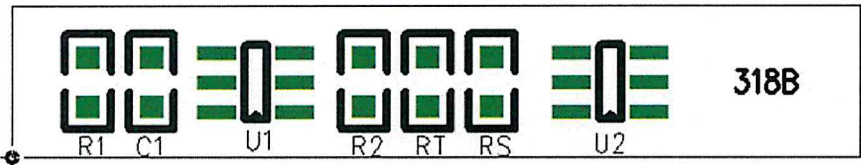
5. Part List ( for 5402N101KD OR LV51140T OR Equivalent )

Part Number	Part Name	Qty	Remark
Ricoh R5402N204KD or Equivalent	Control IC	1	U1
SMS8205 or STS8205 or SMS2017or Equivalent	MOSFET	1	U2
330 $\Omega$ (0603)	Resister	1	R1
1k $\Omega$ (0603)richo	Resister	1	R2
10k(0603)	NTC	1	R3
0.1 $\mu$ F(0603)	Capacitor	1	C1

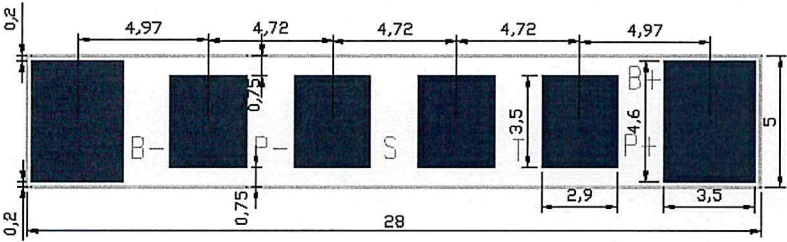
## 6. PCM Circuit Diagram (R5402N204KD or Equivalent)







Maps for PCM318B





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### Lithium Battery Test Summary

Product Manufacturer: SHENZHEN BAK TECHNOLOGY CO.,LTD.

Room 306, West Four Row, Heshuikou Village, Heshuikou Community,  
Gongming Town, Guangming New District, Shenzhen, China

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Email: [sale6@bak-tech.com](mailto:sale6@bak-tech.com)

Web: [www.bak-tech.com](http://www.bak-tech.com)

Test Laboratory: PONY Testing International Group

Building 6 of Zhongxing Industry city, Chuangye Road, Nanshan District,  
Shenzhen, China.

Telephone number: +86-755-26050909

Email: [sz@ponytest.com](mailto:sz@ponytest.com)

Web: [www.ponytest.com](http://www.ponytest.com)

Description of Product:

Model Number: LP-523450-1S-3

Type: Lithium rechargeable battery

Physical description: Prismatic

Mass: 19.2g

Watt-hour rating: 3.52Wh

Test Report No.: W03203028221D

Date of test report: 2012.04.16

Reference edition: United Nations Recommendations On The Transport Of Dangerous Goods, Manual Of Tests And Criteria.

UN Manual of Tests and Criteria	Results
T1: Altitude simulation	Pass
T2: Thermal test	Pass
T3: Vibration	Pass
T4: Shock	Pass
T5: External short-circuit	Pass
T6: Crush	Pass
T7: Overcharge	Pass
T8: Forced discharge	N/A(Not applicable)

Name and Title of Signatory

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Manager