

SALES PROGRAM AND TECHNICAL HANDBOOK



Primary Lithium Cylindrical Cells Lithium-Thionyl-Chloride

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Subject to change without further notice. Errors excepted. For latest technical data please refer to our data sheets, which you will find on our website www.varta-microbattery.com.

1. GENERAL INFORMATION

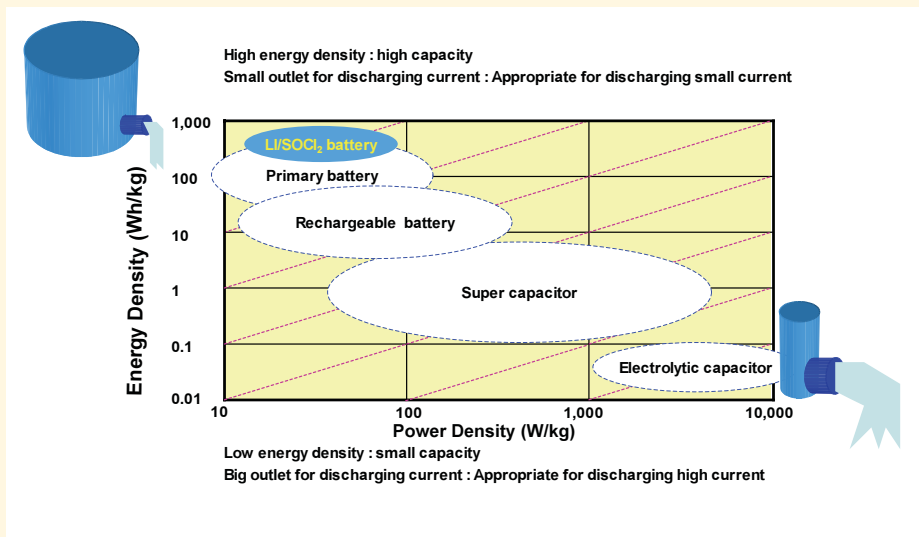
The VARTA Microbattery lithium thionyl chloride cell chemistry offers an excellent shelf life, good low-current capability, a wide operating temperature range and availability in cylindrical cell designs. Potential design-in applications for these products are electronic, telecom-

munication, metering, safety, security, instrumentation, industrial and other portable equipment use. Based on the outstanding cell performance and reliability of these products, they have been able to meet and exceed the requirements of our customer base worldwide.

Advantages for VARTA Microbattery Li-/SOCl₂ Cells

- High open circuit and load voltage (above 3.6 volts per cell)
- High energy density (760 Wh/kg and 1250 Wh/l)
- High capacity cell construction
- Operation over a wide temperature range
- Flat discharge profile under low to medium current applications
- Low self discharge (less than 1% per year at RT)
- Superior shelf life and operational life (Up to 15 years and more)
- UL Recognition
- Ability to provide a variety of laser welded termination tabs for all cell types

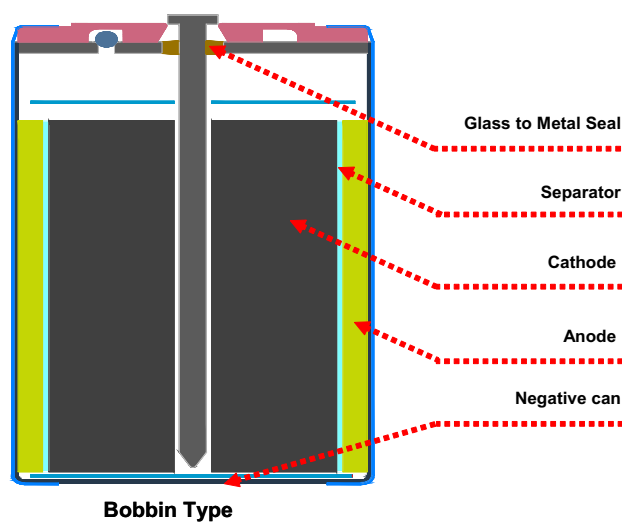
Li/SOCl₂ has the biggest energy density among primary Batteries



1.1 CONSTRUCTIONS OF LITHIUM THIONYL CHLORIDE CELLS

VARTA Microbattery offers a complete range of primary lithium cylindrical and button cells for metering memory back-up and portable applications worldwide. The cylindrical lithium thionyl chloride cell configurations offer the high-capacity bobbin construction. The bobbin construction is targeted at low to moderate power requirements, dedicated for applications requiring up to a 15 years operational life at 20°C.

Construction



1.2 CHARACTERISTICS

Main Applications

Both mechanical and electrical properties, together with reliability, ensure that VARTA Microbattery lithium thionyl chloride batteries meet the requirements of modern electronics.

They are therefore ideally suited as power sources for the long term supply of microelectronic security. Due to their extended energy density and high voltage level they are ideally suited as power sources for metering medical home and office security systems.

Main Characteristics

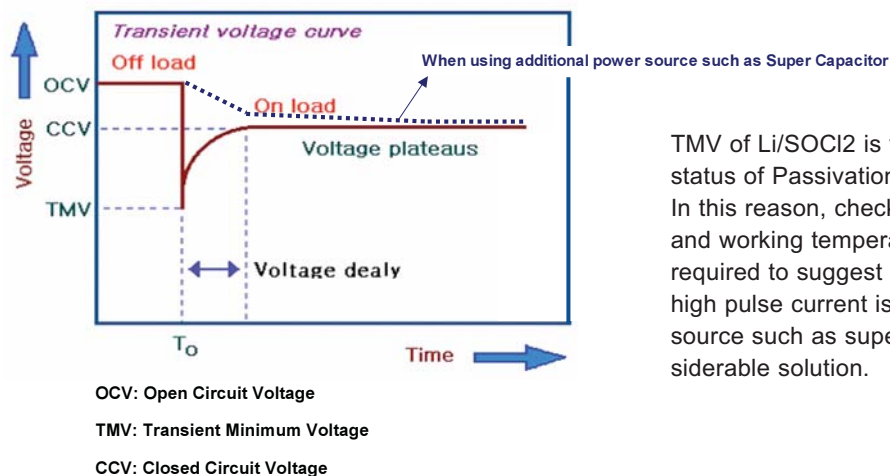
- Long life expectancy and long operational life
- Low self discharge rate
- High energy density (up to 1280Wh/l)
- High cell voltage (3.6V)
- Wide temperature range (-55 to +85°C)
- High operating safety
- High reliability
- Resistance to corrosion with stainless steel case
- No leakage problems
- Non flammable electrolyte
- Inorganic electrolyte
- Non pressurized
- Corrosive electrolyte

Transient Minimum Voltage (TMV)

Lithium thionyl chloride battery has very low self discharge rate than other conventional batteries. That is due to the passivation layer formed on the lithium surface as explained above. This layer effectively prevents the self-discharge of the lithium as it is non-conductive. Therefore, this layer should be broken at the initial stage of discharge to allow lithium ion to flow.

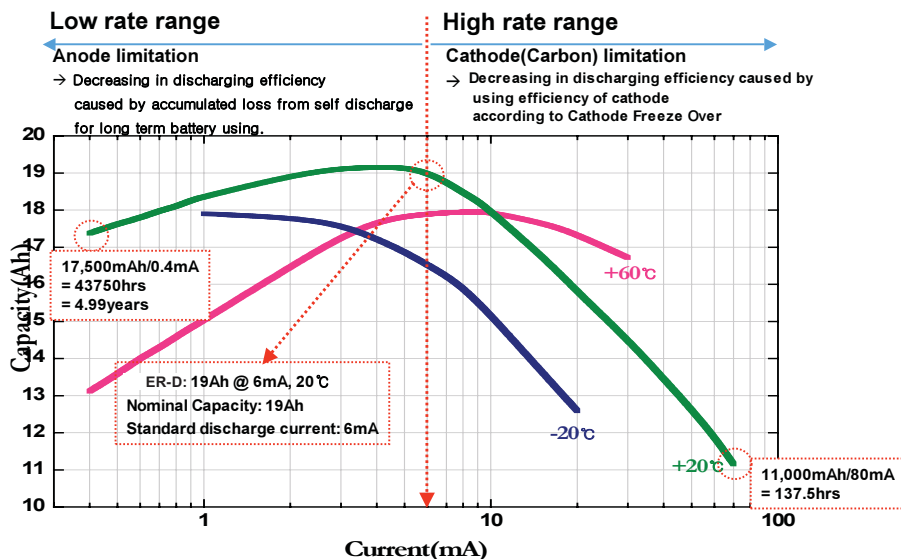
In the process, the layer adds to internal resistance, causing a momentary voltage drop, which is called TMV (Transient Minimum Voltage). The voltage of cells kept under proper conditions immediately recovers to normal operational voltage after TMV. TMV varies depending on the thickness and density of the passivation layer. The higher the discharge current gets, the lower TMV becomes. The passivation layer makes the shelf life longer by effectively preventing self-discharge but it brings about TMV. Thus, this must be fully considered, when the device is designed.

Pulse Curve of Li/SOCl₂ Battery



TMV of Li/SOCl₂ is very changeable depending on status of Passivation Film (thickness, structure). In this reason, checking power profile, cut-off voltage and working temperature range of application are required to suggest right battery solution. In case that high pulse current is required, using additional power source such as super capacitor could be one of considerable solution.

Discharge Capacity of Li/SOCl₂ Battery



1.3 APPLICATIONS

Utility Meters

Electricity Meters, Gas Meters, Water Meters, Calorimeters, Automatic Meter Reading (AMR).

Safety/Security Systems

Door Lockers, Security and Alarm Systems, Smoke and other Sensors and Detectors, Burglar Alarm Systems.

Automotive Electronics

Mileage or Kilometer Counters, Onboard Computers, Electronic Monitoring, Navigational Equipment, Airbag Sensor and Gas Generators, Car radios, Container temperature loggers, Community Traffic Control Systems, Traffic Volume Control, Traffic Chart Recorders, Taximeters.

Asset Tracking

Personal Identification, RF-ID Transponder, Bar Code Reader, Scanner, Goods Tracking, Trailer Identification, Goods Locationing.



Utility Meters



Security Systems



Toll Pass



Asset Tracking

Automation

Memory back-up, Intelligent Interfaces, Personal Computers, Intelligent Typewriters, Address Printers, Envelopment Franking Machines, Cash Points, Scales, Copy Machines, Cash Register.

Vending Machines

Ticket Vending Machines, Newspaper Vending Machines, Cigarette Vending Machines, Sweet Vending Machines, Drink Vending Machines, Parking Meter.

High End Consumer

Audio and Video Memory back-up and RTC, Video Games, Gambling Machines, SCUBA Diving Meters, Altimeters, Marine Electronics, Ski Bindings, Portable Timing Units for sports events, Pigeon Flight Time Recorders.

Industrial/Medical Instrumentation

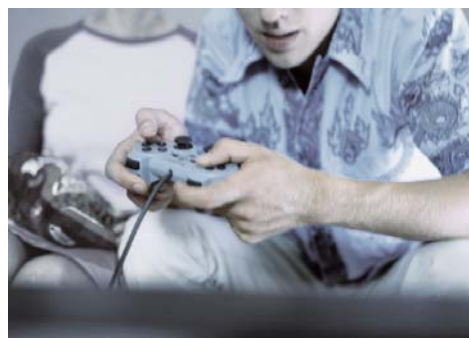
Industrial Clocks, Pulse-/Event-Counters, High Voltage Power Line Fault Detectors, Remote Data Logging and Data Acquisition Systems, Seismic Measurement Equipment, Biotelemetry, Telemetry Equipment, Weather Balloon Transmitters, Automatic Weather Monitoring Stations, Compass Illumination, Caliper Pig for pipeline maintenance, Oscilloscopes, Medical Instruments, Gauges.



Automation



Vending Machines

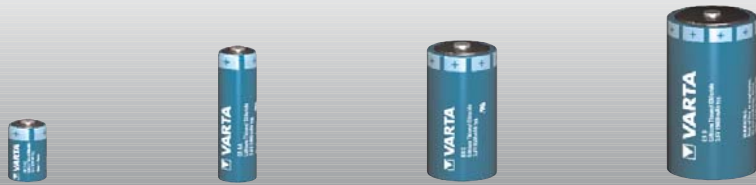


High End Consumer



Industrial/Medical Instrumentation

2. LITHIUM THIONYL CHLORIDE CELLS



Key Characteristics

- High and stable operating voltage
- Low self-discharge rate (less than 1% after 1 year of storage at + 20°C)
- Bobbin type
- Non-flammable inorganic electrolyte
- Hermetic glass-to-metal sealing
- UL recognized (file number MH13654(N))
- ISO9001:2000, ISO14001:2004 approved
- Size 1/2 AA, AA non-restricted for transport
- Size C, D class 9 restricted for transport

2.1 TYPES TECHNICAL DATA

ER 1/2 AA

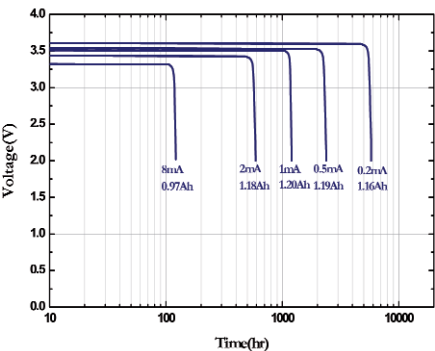
Specifications

Nominal voltage	3.6 V
Nominal capacity (at 1 mA, 20 °C, 2.0 V cut off)	1.2 Ah
Discharge current to achieve half capacity	20 mA
Max. pulse discharge current	50 mA
Weight	9.0 g
Operating temperature range	-55 ~ 85 °C

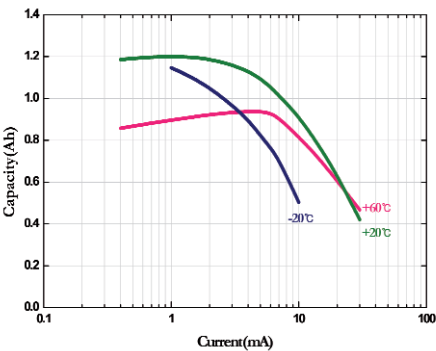


Max. pulse current / 0.1 second pulses, drained every 2 min at + 20 °C from undischarged cells with 10 µA base current, yield voltage readings above 3.0 V. The readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions.

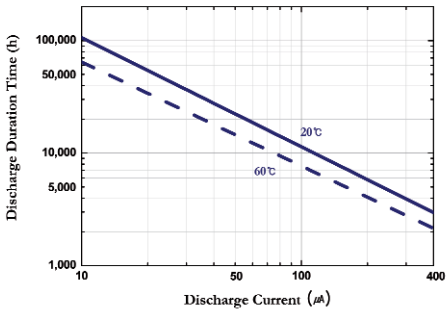
Continuous Discharge at 20°C



Capacity vs. Current



Discharge Current vs. Duration Time



This data was made on basis of nominal capacity for the purpose of enabling users to forecast approximate life time. In order to calculate precise life time under various environments, we recommend you to consult VARTA Microbattery.

Warning: Fire, explosion and severe burn hazard. Do not recharge, crush, disassemble, heat, above 212 °F (100 °C), incinerate, short circuit or expose contents to water. Keep battery out of reach of children and in original package until ready to use. Dispose of used batteries promptly.

Note: Any information given here is for reference only. Information is also dependent on actual conditions of use and does not guarantee future performance. And subject to change.

In case where the products are improved, the specifications described herein are subject to change.

ER AA

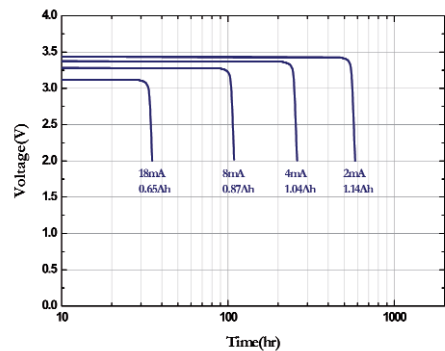
Specifications

Nominal voltage	3.6 V
Nominal capacity (at 2 mA, 20 °C, 2.0 V cut off)	2.5 Ah
Discharge current to achieve half capacity	60 mA
Max. pulse discharge current	100 mA
Weight	16.0 g
Operating temperature range	-55 ~ 85 °C

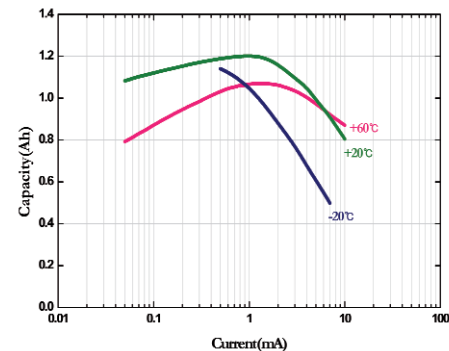


Max. pulse current / 0.1 second pulses, drained every 2 min at + 20 °C from undischarged cells with 10 μ A base current, yield voltage readings above 3.0 V. The readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions.

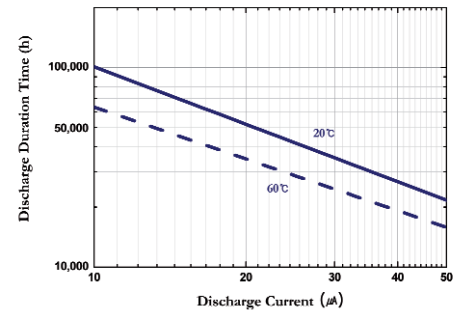
Continuous Discharge at 20°C



Capacity vs. Current



Discharge Current vs. Duration Time



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Warning: Fire, explosion and severe burn hazard. Do not recharge, crush, disassemble, heat, above 212 °F (100 °C), incinerate, short circuit or expose contents to water. Keep battery out of reach of children and in original package until ready to use. Dispose of used batteries promptly.

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ER C

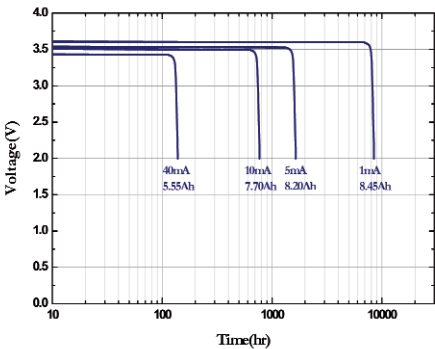
Specifications

Nominal voltage	3.6 V
Nominal capacity (at 4 mA, 20 °C, 2.0 V cut off)	8.5 Ah
Discharge current to achieve half capacity	80 mA
Max. pulse discharge current	180 mA
Weight	51.0 g
Operating temperature range	-55 ~ 85 °C

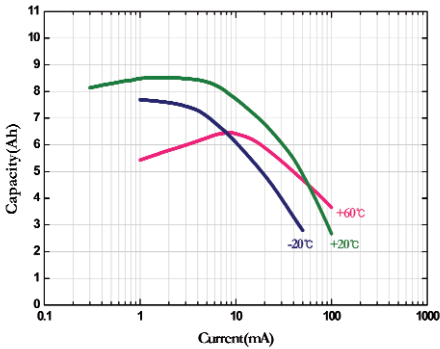


Max. pulse current / 0.1 second pulses, drained every 2 min at + 20 °C from undischarged cells with 10 μ A base current, yield voltage readings above 3.0 V. The readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions.

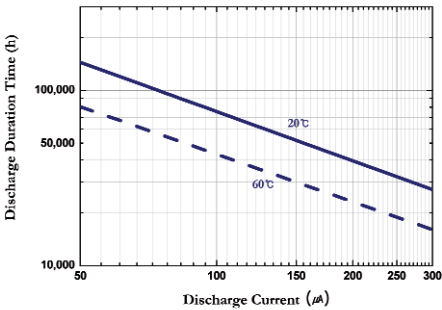
Continuous Discharge at 20°C



Capacity vs. Current



Discharge Current vs. Duration Time



This data was made on basis of nominal capacity for the purpose of enabling users to forecast approximate life time.
In order to calculate precise life time under various environments, we recommend you to consult VARTA Microbattery.

Warning: Fire, explosion and severe burn hazard. Do not recharge, crush, disassemble, heat, above 212 °F (100 °C), incinerate, short circuit or expose contents to water. Keep battery out of reach of children and in original package until ready to use. Dispose of used batteries promptly.

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In case where the products are improved, the specifications described herein are subject to change.

ER D

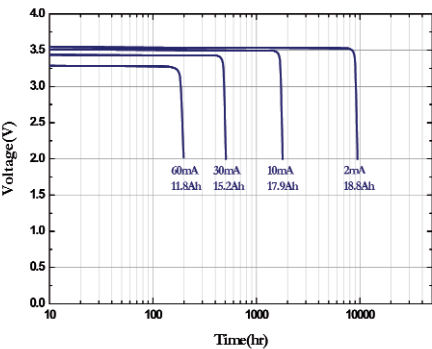
Specifications

Nominal voltage	3.6 V
Nominal capacity (at 6 mA, 20 °C, 2.0 V cut off)	19.0 Ah
Discharge current to achieve half capacity	100 mA
Max. pulse discharge current	250 mA
Weight	100.0 g
Operating temperature range	-55 ~ 85 °C

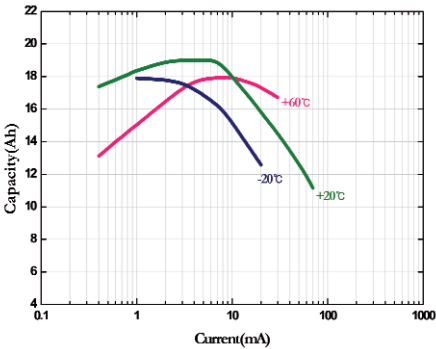


Max. pulse current / 0.1 second pulses, drained every 2 min at + 20 °C from undischarged cells with 10 μ A base current, yield voltage readings above 3.0 V. The readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions.

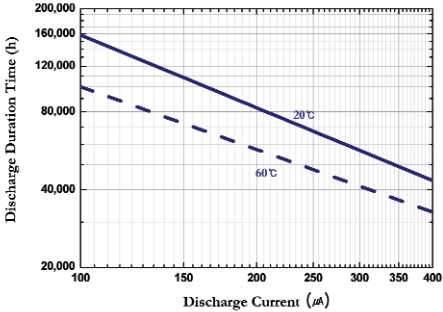
Continuous Discharge at 20°C



Capacity vs. Current



Discharge Current vs. Duration Time



This data was made on basis of nominal capacity for the purpose of enabling users to forecast approximate life time. In order to calculate precise life time under various environments, we recommend you to consult VARTA Microbattery.

Warning: Fire, explosion and severe burn hazard. Do not recharge, crush, disassemble, heat, above 212 °F (100 °C), incinerate, short circuit or expose contents to water. Keep battery out of reach of children and in original package until ready to use. Dispose of used batteries promptly.

Note: Any information given here is for reference only. Information is also dependent on actual conditions of use and does not guarantee future performance. And subject to change.

In case where the products are improved, the specifications described herein are subject to change.

2.2 ASSEMBLIES

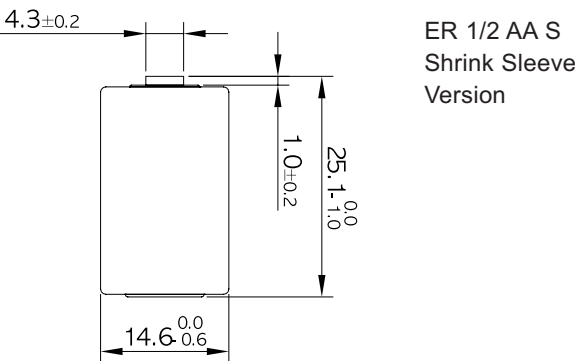
ER 1/2 AA

Standard Battery Assembly Version Overview

Article Designation	Order No.
ER 1/2 AA S	7126 101 511
ER 1/2 AA ST	7126 301 301
ER 1/2 AA PCBS	7126 701 301
ER 1/2 AA PCBD-7.5N	7126 201 382
ER 1/2 AA PCBD-7.5	7126 201 302
ER 1/2 AA PCBD-10.0N	7126 201 381
ER 1/2 AA CD	7126 501 301

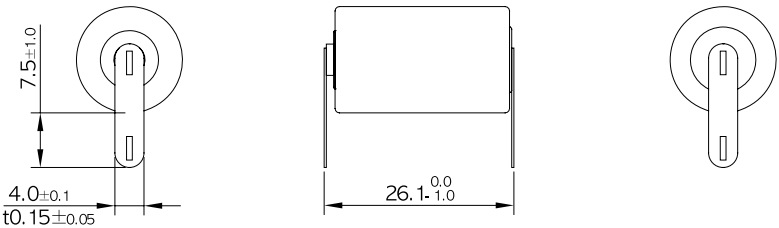


Scheme

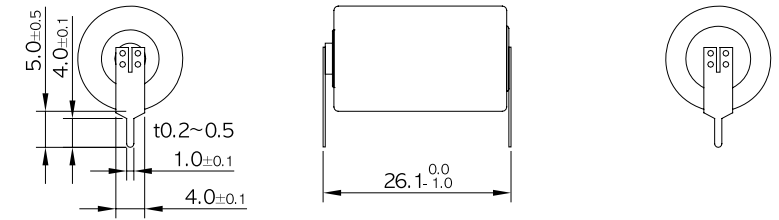


Battery Dimension

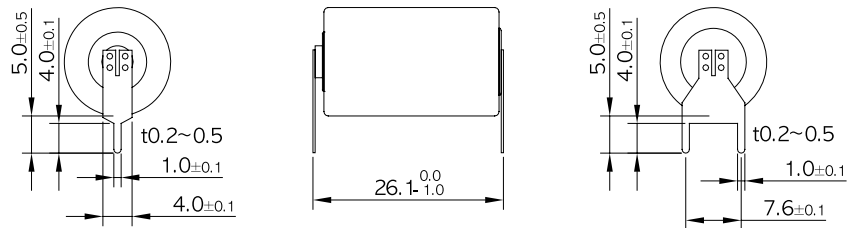
ER 1/2 AA ST
Solder Tag Version



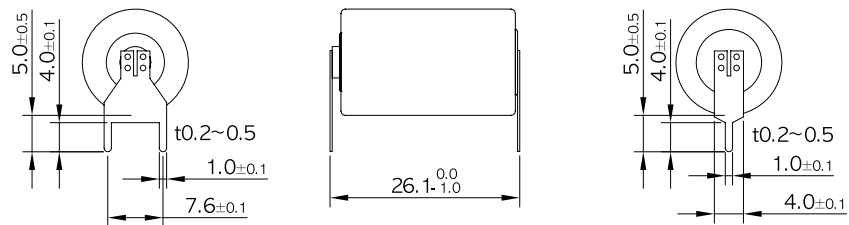
ER 1/2 AA PCBS
Single Tag Version



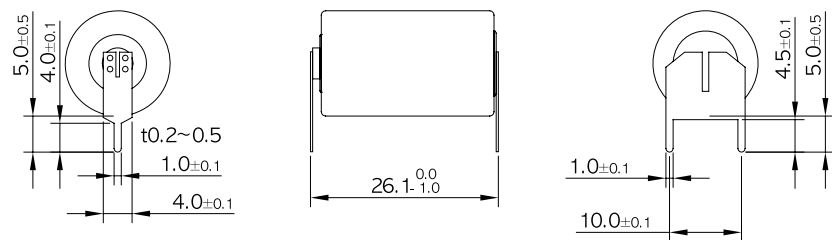
ER 1/2 AA PCBD-7.5N
Single Double (7.5)
Tag Version
Non Std Polarity



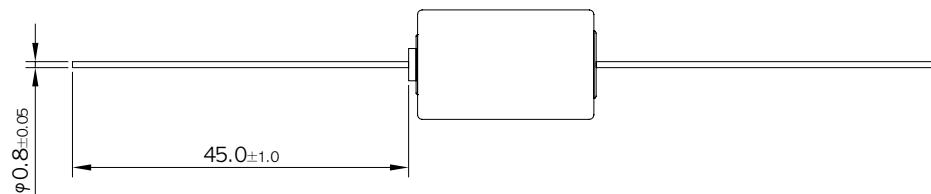
ER 1/2 AA PCBD-7.5
Single Double (7.5)
Tag Version



ER 1/2 AA PCBD-10.0N
Single Double (10.0)
Tag Version
Non Std Polarity



ER 1/2 AA CD
Contact Disc + wire



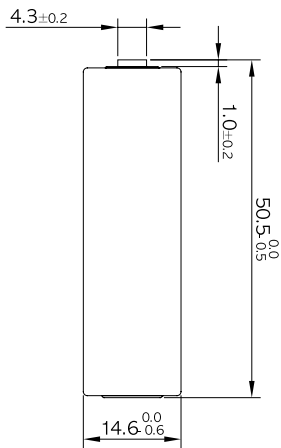
ER AA

Standard Battery Assembly Version Overview

Article Designation	Order No.
ER AA S	7106 101 511
ER AA ST	7106 301 301
ER AA PCBS	7106 701 301
ER AA PCBD-7.5N	7106 201 382
ER AA PCBD-7.5	7106 201 302
ER AA PCBD-10.0N	7106 201 381
ER AA CD	7106 501 301



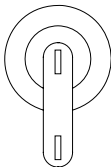
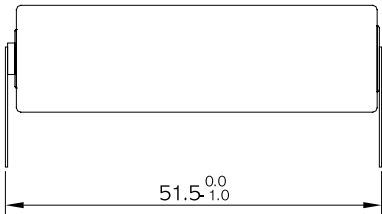
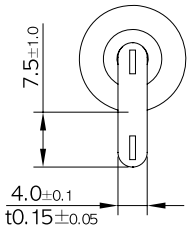
Scheme



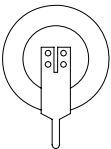
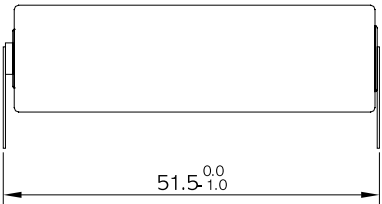
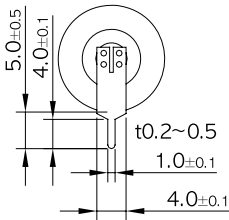
ER AA S
Shrink Sleeve
Version

Battery Dimension

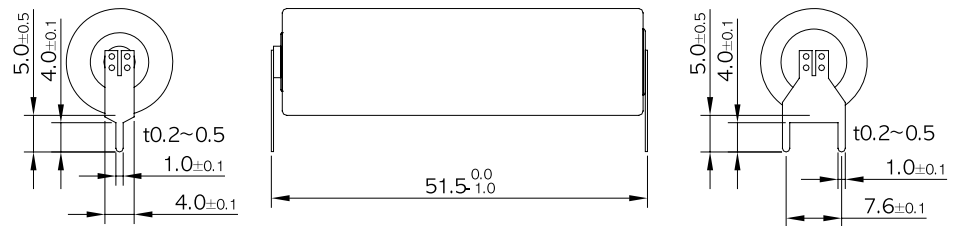
ER AA ST
Solder Tag Version



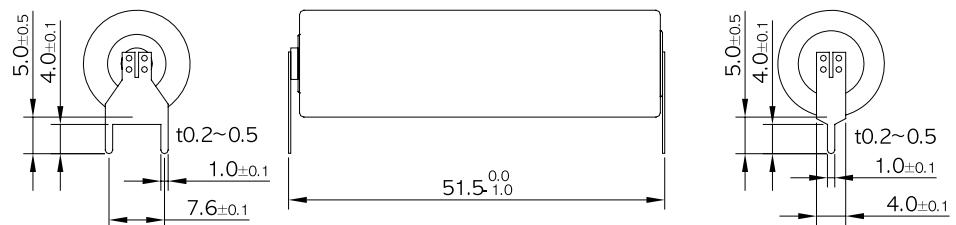
ER AA PCBS
Single Tag Version



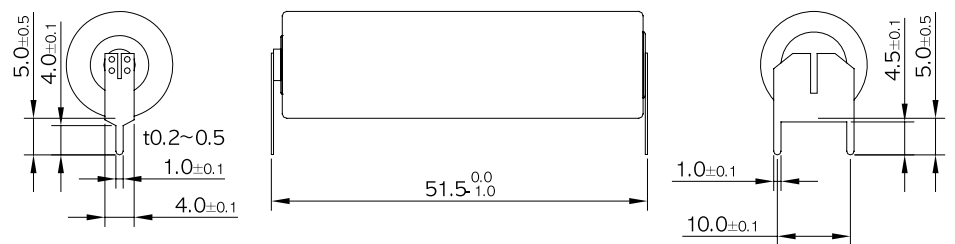
ER AA PCBD-7.5N
Single Double (7.5)
Tag Version
Non Std Polarity



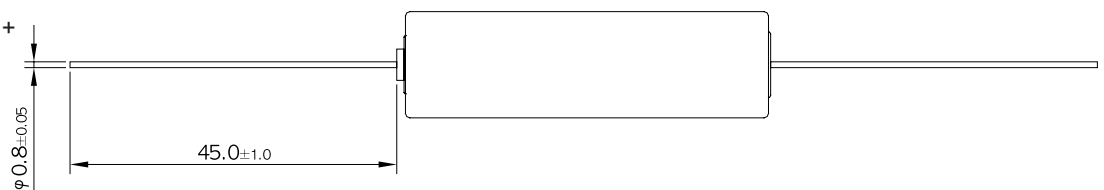
ER AA PCBD-7.5
Single Double (7.5)
Tag Version



ER AA PCBD-10.0N
Single Double (10.0)
Tag Version
Non Std Polarity



ER AA CD
Contact Disc +
wire



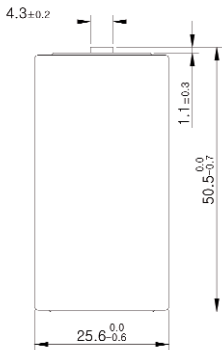
ER C

Standard Battery Assembly Version Overview

Article Designation	Order No.
ER C S	7114 101 511
ER C ST	7114 301 301
ER C CD	7114 501 301



Scheme



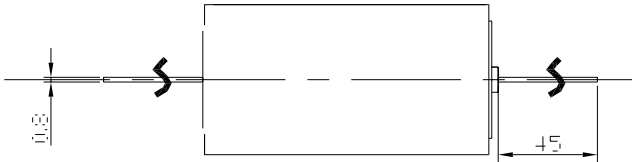
ER C S
Shrink Sleeve
Version

Battery Dimension

ER C ST
Solder Tag Version



ER C CD
Contact Disc + wire



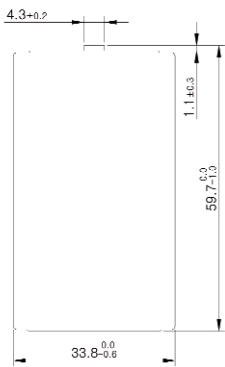
ER D

Standard Battery Assembly Version Overview

Article Designation	Order No.
ER D S	7120 101 511
ER D ST	7120 301 301
ER D CD	7120 501 301



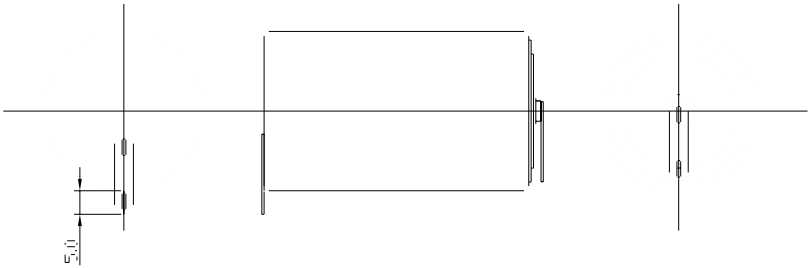
Scheme



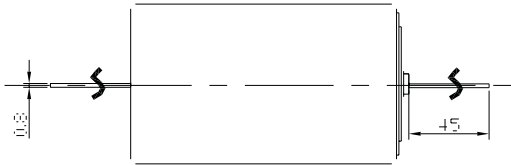
ER D S
Shrink Sleeve
Version

Battery Dimension

ER D ST
Solder Tag Version



ER D CD
Contact Disc + wire



3. GENERAL DESIGN CHARACTERISTICS

3.1 CELL ORIENTATION

According to the cell orientation, the capacity during discharge can be affected because of the different position of electrolyte and amount against lithium and cathode. There are three possible cell orientations when the cell is installed to the applied device as figure among.

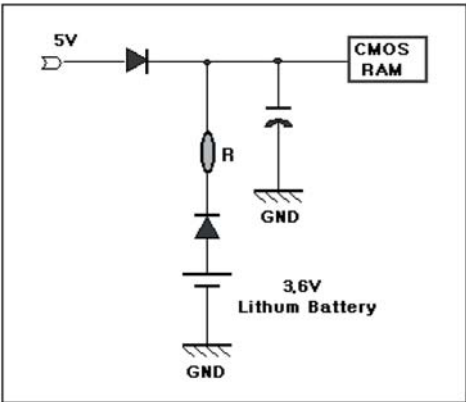


- Under upright installation, the capacity is not affected whether discharge current is high, nominal or low.
- Under horizontal installation, the capacity of smaller size (1/2 AA, AA) is not affected whether discharge current is high, nominal or low. The capacity of bigger size (C, D) cannot be affected when discharge current is low or normal but it can be affected when discharge current is high. (About 15~30% of capacity reduction at higher discharge current will be expected.)
- Under upside down installation, the capacity of smaller size (1/2 AA, AA) is less affected whether discharge current is high, nominal or low. However, the capacity of bigger size (C, D) especially at higher discharge current is affected. Under upside down installation, the lithium and cathode is located in a fixed area whereas the electrolyte falls to the bottom in this case. At the top of the cell there is a space leaving an area of the anode and cathode, not covered by the electrolyte. Bigger size cells have a bigger empty space, so the capacity decrease in upside down installation is higher than in cells of smaller size. (About 20~40% of its capacity at same higher discharge current.)

3.2 CIRCUIT DESIGN FOR MEMORY BACK-UP

VARTA lithium batteries are recognized and accepted by UL with file No. MH28122. Underwriter’s Laboratories (UL) recommends the following circuit design requirements to use VARTA lithium batteries.

VARTA lithium cells should not be connected in series with an electrical power source that would increase the forward current through the cells. Figure among is a generally recommended circuit design for memory back-up using VARTA lithium batteries.



General Circuit Design of Memory Back-up

The circuit for these cells shall include one of followings:

- Two suitable diodes or the equivalent are connected in series with the cells to prevent any reverse (charging) current. The second diode is used to provide protection in the event that one should fail. Quality control, or equivalent procedures, shall be established by device manufacturer to insure the diode polarity is correct for each unit, or
- A blocking diode or the equivalent to prevent any reverse (charging) current and a resistor to limit the current in case of a diode failure. The resistor should be sized to limit the reverse (charging) current to the maximums shown below.

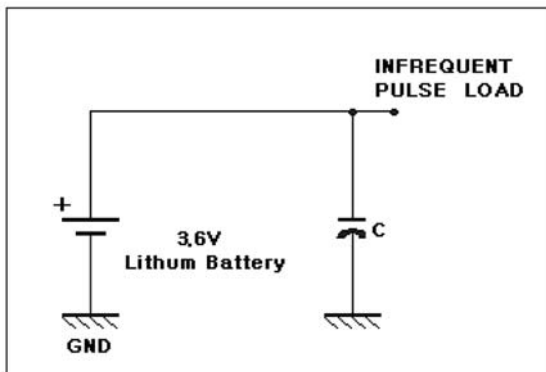
Model	Maximum
ER 1/2 AA	15 mA
ER AA	15 mA
ER C	15 mA
ER D	150 mA

The storage, handling, and disposal of these cells should be in accordance with the “Warning Notice” which is printed on VARTA cells as follows:
“WARNING: Fire, explosion, and severe burn hazard. Do not recharge, crush, disassemble, heat above 100°C (212°F), incinerate, or expose contents to water.”

3.3 CAPACITOR SUPPORT

It is normal that the internal resistance of a lithium battery can be increased after long storage without an appropriate discharge rate or very irregular but higher pulse discharge. The internal resistance can also be dramatically increased when the discharge with smaller continuous load is performed for several years (around 80% of capacity discharge). The full capacity of the lithium battery cannot be supplied by the end of lifetime because the operating voltage can drop caused by

increased internal resistance under long discharge. In addition, under higher current levels Voltage Delay Curves or under lower operating temperatures, TMV drop can be severe and operating voltage can be reduced. In that case, VARTA recommends using batteries with capacitor support to maximize performance by the end of service life.



Typical Design of Capacitor Support

Formula to choose capacitor value can be suggested by capacitor manufacturers as follows;

Type of Capacitor: Electrolytic capacitor, Super Capacitor, Gold Capacitor

Formula for Capacitor Size: $C = U / R \times t / \Delta V$

C: Capacitor

U: Basic voltage (working voltage under basic current)

$R = R_L + R_C$

RL: Resistance of load circuit (voltage / pulse current)

RC: Internal resistance of capacitor C (mΩ value with small effect)

t: Back-up time

ΔV: Allowed voltage drop

In actual case, customers shall choose a capacitor size with about 2 times of the above calculation to cover various environmental conditions sufficiently.

There is some leakage current in the capacitor and it could be related to the consumption of battery capacity. It is normally small but must be taken into account against battery capacity.

3.4 BATTERY ASSEMBLY

The work of battery assembly requires experience. Customers who are not qualified in battery assembly should not attempt to assemble batteries. Especially, Li-SOCl₂ batteries which have a glass-to-metal sealing around the head terminal and a bottom insulator inside the bottom case, so careful assembly is necessary to avoid any mechanical damage or problem. VARTA cannot take any responsibility for quality problems caused by incorrect battery assembly. Therefore, please let VARTA or a qualified assembler assemble batteries for you.

3.5 SOLDERING

VARTA provides batteries with various terminal types to mount cells to printed circuit boards by soldering. VARTA's terminals are made of nickel and some are pre-soldered with SnPb around the tips of the terminal for easier soldering.

Following are the available soldering methods.
More information can be available upon request.

Hand Soldering

Using manual soldering iron by skilled persons.

Precautions

- Do not allow soldering iron to contact the body of the battery because of higher generation of battery heat.
- Finish the soldering work on a termination within a short period of time (max. 5 sec.)
- Do not overheat battery during soldering.

Wave Soldering

Using automatic soldering baths on a mass-production line.

Precautions

- Do not drop cells in the solder bath.
- Keep the temperature of solder bath within 260~280°C.
- Dipping time shall be within 5 sec.
- Do not overheat battery during soldering.

4. SAFETY TESTS

4.1 GENERAL

Basically, VARTA lithium batteries are safely designed to endure various environmental conditions. The design of the hermetically seal rim and the glass-to-metal welding can give the battery high endurance in various environmental conditions such as variant temperatures, humidity and vibration. Also, the position of lithium against the inner wall of the cell case makes heat dissipated to the outside easier when inside heat is generated. Therefore, there is no concern over safety when the suggested cautions are followed during usage, handling or storage.

However, there might be some possibilities of mishandling or misuse by the customer. Thus, following simulation tests have been performed. The test conditions are based on the procedures of the UL standard tests and Military Standards for environmental and safety testing. The abnormal test is only carried out to check the behavior of the batteries under misuse conditions and make certain the batteries react in a safe manor.

UL-Recognition

All **VARTA** Microbattery Lithium Cells and Batteries listed below are recognized by Underwriters Laboratories Inc. under UL-file number MH13654(N).



The cells are marked with the Recognized Component Mark.

Underwriters Laboratories requires for lithium cells/ batteries a circuit, which must contain a protective component to prevent charging. In case of diode failure a current limiting resistor must be chosen according to the values listed in Tab. below.

Please also pay attention to the Safety Guidelines on the Material Safety Datasheet at www.varta-microbattery.com.

For safety tests of the cells, “UL” requires either an additional diode, or a resistor, limiting the current to a safe level as “portable”.

It should be noted that the value of the resistor has to be calculated using the higher power supply voltage – not the battery voltage.

The supply voltage to the load can be calculated by the battery voltage drop across the diode and the resistor.

Printed Circuit Board Mounting

Never solder on the body of the battery directly, use a battery equipped with PC-mount terminals. When using automatic soldering apply 260–280 °C within 5 seconds. Make sure that the battery is not suspended or dropped into the soldering bath.

Do not heat above 80 °C to avoid leakage caused by deterioration in the battery’s performance.

Model	Primary Type (a)	Max. Abnormal Charging Current, mA	Max. Charge Voltage	Replacement (b), (c)
ER 1/2 AA	Lithium/thionyl chloride	15	12	Technician
ER AA	Lithium/thionyl chloride	15	12	Technician
ER C	Lithium/thionyl chloride	15	4.2	Technician
ER D	Lithium/thionyl chloride	150	4.2	Technician

(a) These cells and batteries are not rechargeable. The circuit containing these cells or batteries is to contain a protective component which prevents charging. The circuitry is to include a current-limiting component intended to protect the cell or battery, in the event the protective component malfunctions, from a charging current in excess of the maximum abnormal charging current indicated.

(b) Technician – These cells and batteries are intended for use in applications subject to replacement only by a trained service.

(c) The Max. Charge Voltage noted in the column is the maximum voltage employed during the abnormal charging test of the secondary lithium cell. However, the maximum recommended charging voltage for lithium cells is 4.2 V, unless indicated otherwise in the individual Recognitions.

Marking: Company name, model designation, date of manufacture and the Recognized Component Mark on the individual cell/battery or the smallest shipping container.

4.2 TRANSPORTATION OF VARTA MICROBATTERY LITHIUM CELLS AND BATTERIES

In general, lithium batteries are subjected to the transport regulations for Dangerous Goods.

But almost all batteries sold by VARTA Microbattery can be transported using exemptions based on the requirements of special provisions ADR 188 (road), RID 188 (rail), IMDG code 188 (sea), DOT / 49 CFR 173.185 (U.S.A. generally) and IATA DGR packaging instruction 968 part 1 (air).

Our product-dependant “Declarations of Conformity (DOCs)” give the final details whether the batteries must be transported on the full Dangerous Goods level (4.2.2) or using exemptions (4.2.1).

The current status of transport regulations is reflected in VARTA’s “Transportation-, Safety- and Recycling Note for Batteries”, which are available on our web page and which are updated regularly.

4.2.1 TRANSPORT OF BATTERIES USING EXEMPTIONS

This chapter is valid for most of our products.

4.2.1.1 ADR/RID AND IMDG-CODE SPECIAL PROVISION 188

“Cells and batteries offered for transport are not subject to other provisions of these Regulations if they meet the following:

- For a lithium metal alloy cell, the lithium content is not more than 1 g;
- For a lithium metal battery the aggregate lithium content is not more than 2 g;
- Each cell or battery is of the type proved to meet the requirements of each test in the Manual of Tests and Criteria, Part III, sub-section 38.3;
- Cells and batteries, except when installed in equipment, shall be packed in inner packagings that completely enclose the cell or battery. Cells and batteries shall be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit. The inner packagings shall be packed in strong outer packagings which conform to the provisions of 4.1.1.1, 4.1.1.2, and 4.1.1.5 (IATA DGR packaging instruction 968 part 1).
- Cells and batteries when installed in equipment shall be protected from damage and short circuit, and the equipment shall be equipped with an effective means of preventing accidental activation. When lithium batteries are installed in equipment, the equipment shall be packed in strong outer packagings constructed of suitable material of adequate strength and

design in relation to the packaging’s capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained;

- Except for packages containing no more than four cells installed in equipment or no more than two batteries installed in equipment, each package shall be marked with the following:
 - an indication that the package contains “lithium metal” cells or batteries;
 - an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information;
- Each consignment of one or more packages marked in accordance with paragraph shall be accompanied with a document including the following:
 - an indication that the package contains “lithium metal”;
 - an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information;

- Except when lithium batteries are installed in equipment, each package shall be capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell to cell) contact and without release of contents; and
- Except when lithium batteries are installed in or packed with equipment, packages shall not exceed 30 kg gross mass."

As used above and elsewhere in these Regulations, "lithium content" means the mass of lithium in the anode of a lithium metal cell. Separate entries exist for lithium metal batteries to facilitate the transport of these batteries for specific modes of transport and to enable the application of different emergency response actions.

Labeling and marking

Labeling of the goods to be dispatched e.g.:



Upon every transport of lithium batteries the delivery note must show the following:

CAUTION!

Lithium Batteries! Handle with care!

not restricted – no dangerous goods transport

According SP 188 ADR/RID/IMDG-Code;

IATA Packing instruction 965 Part 1 for Lithium Ion Batteries and Packing instruction 968 Part 1 for Lithium Metal Batteries

If package is damaged, batteries must be quarantined. Inspected and repacked.

For Emergency information call:

+49 (7961) 921110 (USA: 011 49 7961 921110)

4.2.1.2 IATA (AIR TRANSPORT)

Transportation of batteries has to follow Packing Instruction 968 Part 1:

„Lithium metal cells and batteries offered for transport are not subject to other additional requirements of these Regulations if they meet the following requirements:

- A lithium metal cell, the lithium content is not more than 1g;
- A lithium metal battery, the aggregate lithium content is not more than 2 g;
- Each cell or battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3.

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery. Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Cells and batteries must be packed in strong outer packagings that conform to 5.0.2.4, 5.0.2.6.1 and 5.2.12.1.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein; shifting of the contents so as to allow battery to battery (or cell to cell) contact; release of contents.

- The gross quantity per package is max 2.5 kg.
Each package must be labelled with a lithium battery handling label (Figure as below)."



CAUTION!

Lithium Metal Batteries! Handle with care! ### not restricted – no dangerous goods transport ### according IATA Packing instruction 968 Part 1 for Lithium Ion Batteries."

Transportations of Cells or Batteries packed with equipment or contained in equipment have to follow Packing Instructions 969 Part 1 or 970 Part 1.

4.2.2 DANGEROUS GOODS TRANSPORT OF BATTERIES

This chapter is valid for products with cells of types ER C and ER D.

4.2.2.1 ADR/RID AND IMDG-CODE FOR BATTERIES EXCEEDING THE LIMITS OF SP188

- Batteries have to be transported as Dangerous Goods, class 9.
- Lithium metal batteries UN 3090, lithium metal batteries packed with equipment or contained in equipment UN 3091.
- Each cell or battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3.
- Each packaging must comply with the UN specification packagings, and must be labelled and packed according the requirements of Packing Instruction 903.

4.2.2.2 IATA FOR BATTERIES EXCEEDING THE LIMITS FROM PACKING INSTRUCTION 968 PART 1

- Lithium metal batteries have to be transported as Dangerous Goods according to Packing Instruction 968 Part 2, class 9 UN 3090
- Each cell or battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3.
- Each packaging must comply with the UN specification packagings, and must be labelled and packed according the requirements of Packing Instruction 968 Part 2.
- Transportations of cells or batteries packed with equipment or contained in equipment have to follow Packing Instructions 969 Part 2 or 970 Part 2, class 9 UN 3091

4.2.3 TRANSPORTATION OF PRIMARY LITHIUM BATTERIES IN THE U.S.A.

Effective December 29, 2004, the DOT requires that the outside of each package that contains primary lithium batteries, regardless of size or number of batteries, be labeled with the following statement: "PRIMARY LITHIUM BATTERIES – FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT". The labeling

requirement covers shipments via highway, rail, vessel or cargo-only aircraft and covers all shipments inside, into or out of the US. The label must be in contrasting color and the letters must be 12 mm (0.5 in) in height for packages weighing more than 30 kg and 6 mm (0.25 in) in height for packages weighting less than 30 kg.

4.2.4 GENERAL REMARK

The exemptions from dangerous goods regulations are only applicable with respect to the delivery form in which the products are dispatched by VARTA Microbattery. Any re-packaging or assembly of cells is in the responsibility of the customer. Especially in the case of lithium systems new safety tests may be necessary; note that the maximum amount of lithium according to special provi-

sions 188 (ADR/RID/IMDG-Code) or Packaging Instruction 965 Part 1 (IATA) may be exceeded as a consequence of assembly.

The given emergency number is only valid for transports initiated by VARTA Microbattery.

4.3 OEM – APPLICATION CHECK LIST

1. PROJECT INFORMATION

From (Writer)	Sales Agreement
Customer	Application
Name of the project	Country

2. MARKETING DATA

Yearly expectation of sales	Per batch of
Estimated selling price	Expected data of first order
Lifetime of the project	Start of volume production
Competitors	
Substitution of existing product	Which
Comments	

3. WHAT IS REQUIRED?

		Reply wishes for	Reply provided for
Feasibility study, preliminary proposal	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Technical proposal	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Preliminary drawing	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Samples to run electric tests	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Samples (with dummy cells)	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Prototypes (for qualification by the customer)	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Preliminary cost estimation (+/- 20%)	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Development and industrial cost estimation	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Product cost estimation (+/- 5%)	Yes <input type="checkbox"/> No <input type="checkbox"/>		

4. TECHNICAL REQUIREMENTS

4.1. Storage before use

Duration

Temperature min.

Average

max.

Humidity

4.2. Storage into the device before operating

Duration

Temperature min.

Average

max.

Humidity

4.3. Specific tests prior incorporation

4.4. Electric data

Required minimum life time in use

Maximum voltage

Nominal capacity

Cut off voltage

Required minimum capacity

Current profile (average current, current pulse strength, pulse duration, pulse rate...)

Others

4.5. climatic data

Operating temperature min.

Average

max.

Humidity

Others

4.6. Mechanical data (vibration, drop, bump, shock, ...)

Mention the applicable specification and enclose the document if necessary

4.7. Available dimensions: (weight, volume, if possible enclose the user drawing of the prospect)

4.8. Assembly (describe or enclose a drawing)

4.9. Applicable specifications / standards

UL ☐ BS UN ☐ IEC86-4 ☐ Other ☐

Reference and issue

4.10. Reliability level – Guarantees

4.11. Labeling and Packaging

VARTA standard labeling and packaging ☐

Customised labeling ☐ (enclose the customer specification)

Customised packaging ☐ (enclose the customer specification)

4.12. Attached documents

Samples ☐

Competitor samples ☐

Drawing ☐

Specification of the customer ☐

Copy of specific standards ☐






Samples of connector ☐

Samples of specific components ☐

Other ☐

4.13. Additional information

Product Portfolio

Primary Batteries					
	VARTA CardPower (Li-Polymer)		Lithium Cylindrical Cells		Zinc Air Cells
	Alkaline Batteries		Lithium Button Cells		Silver Oxide Button Cells
Rechargeable Batteries					
	Li-Polymer		Ni-MH Button Cells (V...H / HR / HT / HRT)		Cylindrical & Prismatic Li-Ion & Ni-MH Cells

Global Contacts

Germany and Central Europe
VARTA Microbattery GmbH
 Daimlerstraße 1
 73479 Ellwangen, Germany
 Tel +49 79 61 921 - 0
 Fax +49 79 61 921 - 553

China
 Hongkong
 VARTA Microbattery Pte. Ltd.
 Room 1702-3, 17/F., Fullerton Centre
 19 Hung to Road, Kwun Tong
 Kowloon, Hongkong
 Tel +852 28 98 83 73
 Fax +852 28 97 76 09

Beijing
 VARTA Microbattery Pte. Ltd.
 Room 05, 11/F., Xinyi Commercial Building
 3A Xinyijiayuan, Chongwenmenwai Avenue
 Chongwen District, Beijing
 China 100062
 Tel +86 10 67 09 60 57, 67 09 60 58
 Fax +86 10 67 09 60 59

Shanghai
 VARTA Microbattery (Shanghai) Co. Ltd.
 Block 3, Shanghai Pudong Chuansha
 Industrial Park
 No. 6999 Chuansha Road
 Pudong New Area
 201202 Shanghai, China
 Tel +86 21 58 59 83 85
 Fax +86 21 58 59 33 13

Asia Pacific
 VARTA Microbattery Pte. Ltd.
 300, Tampines Avenue 5, #05-01
 Tampines Junction, 529653 Singapore
 Tel +65 6 260 58 01
 Fax +65 6 260 58 12

Japan
 VARTA Microbattery Pte. Ltd.
 Kyobashi Y'SUS Bldg, 3F.
 1-6-12, Kyobashi, Chuo-Ku
 Tokyo 104-0031, Japan
 Tel +81 3 35 67 81 71
 Fax +81 3 35 67 81 75

Taiwan
 VARTA Microbattery Pte. Ltd.
 11F-4, No.130, Section 2
 Chung Hsiao East Road
 Taipei 10053, Taiwan
 Tel +886 2 33 93 15 57
 Fax +886 2 33 93 15 56

America
 VARTA Microbattery, Inc.
 1311 Mamaroneck Avenue, Suite 120
 White Plains, NY 10605, USA
 Tel +1 914 592 25 00
 Fax +1 914 345 04 88

UK and Ireland
 VARTA Microbattery GmbH
 17 Progress Business Centre,
 Whittle Parkway, Slough SL 1 6DQ, GB
 Tel +44 16 28 60 79 30
 Fax +44 16 28 60 79 39

France
 VARTA Microbattery SARL
 12 - 14, Rue Raymond RIDEL
 92250 La Garenne Colombes, France
 Tel +33 1 47 84 84 54
 Fax +33 1 47 84 28 32

Distributors Internet

Distributors and representations in all major countries world wide. Consult our Webpage.
 For e-mail contact please visit: <http://contact.varta-microbattery.com>
 For more information please visit our website: www.varta-microbattery.com

VARTA Microbattery is a Company of
 Montana Tech Components AG,
 Hauptstrasse 35, 5737 Menziken, Switzerland

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 TECH COMPONENTS