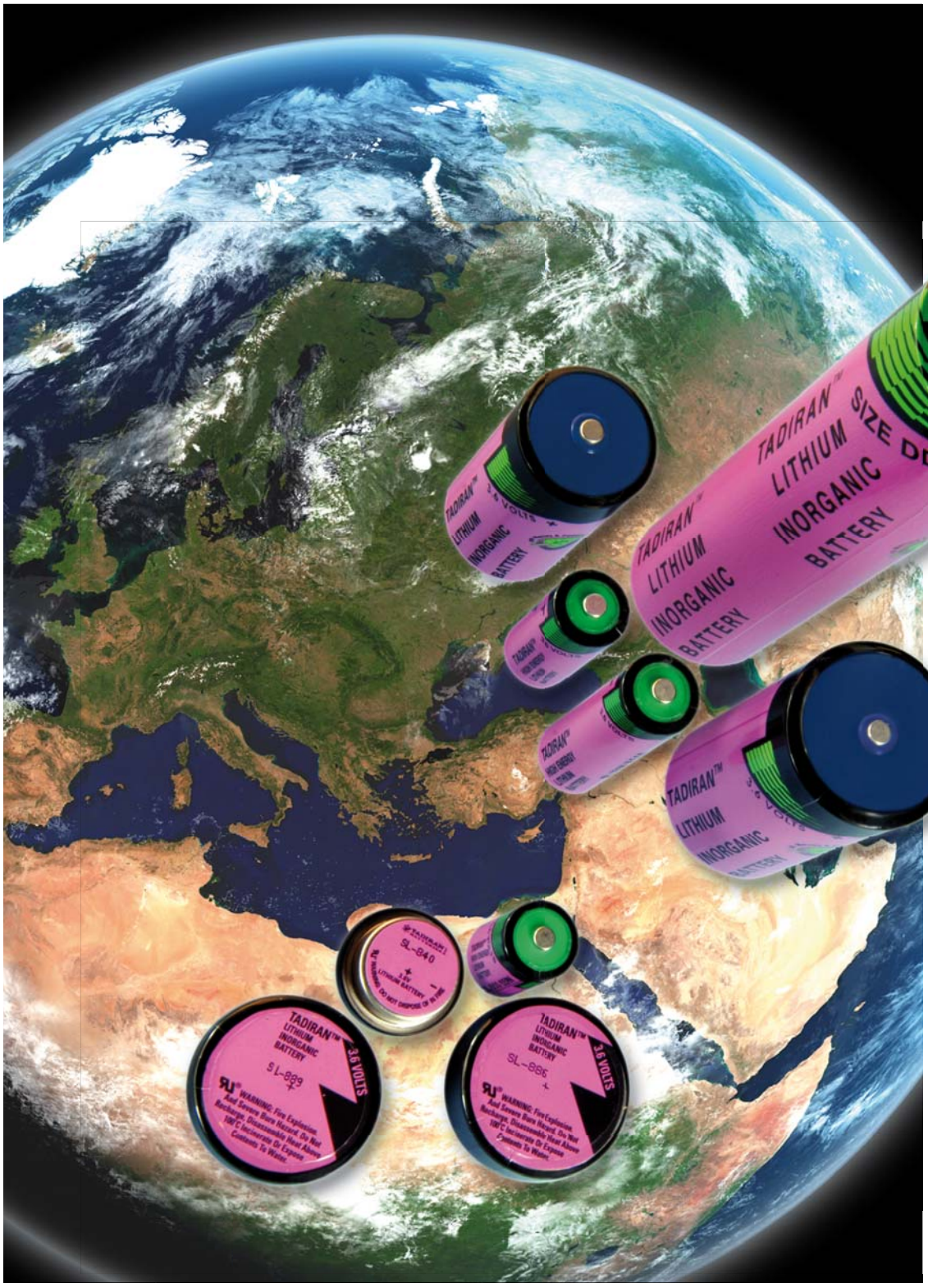
Tadiran Lithium Batteries



Product Data Catalogue

TADIRAN BATTERIES

Overview Product Line

TADIRAN BATTERIES

Page	Contents
3	About Tadiran
4	Safety
5	**Lithium Thionyl Chloride (LTC) Batteries**

	Model	Terminations	Catalogue number*)	Size	Nominal voltage	Nominal capacity	Nominal current	Max. cont. discharge current	Temperature range	Dimensions (mm)
	SL-300 series: for standard use and stand-by									
6	SL-350	/S /T /P /PR /PT	11 1 0350x 00	½AA	3.6 V	1.2 Ah	0.6 mA	6 mA	–55 ... +85 °C	Ø 14.5 x 25
7	SL-361	/S /T /P /PR /PT	11 1 0361x 00	⅔AA	3.6 V	1.6 Ah	1 mA	10 mA	–55 ... +85 °C	Ø 14.5 x 33
8	SL-360	/S /T /P /PR /PT	11 1 0360x 00	AA	3.6 V	2.4 Ah	2 mA	20 mA	–55 ... +85 °C	Ø 14.5 x 50
	SL-500 series: for extended temperature range									
9	SL-550	/S /T /P /PR /PT	11 1 0550x 00	½AA	3.6 V	0.8 Ah	0.6 mA	6 mA	–55 ... +130 °C	Ø 14.5 x 25
10	SL-561	/S /T /P /PR /PT	11 1 0561x 00	⅔AA	3.6 V	1.0 Ah	1 mA	10 mA	–55 ... +130 °C	Ø 14.5 x 33
11	SL-560	/S /T /P /PR /PT	11 1 0560x 00	AA	3.6 V	1.7 Ah	2 mA	20 mA	–55 ... +130 °C	Ø 14.5 x 50
	SL-700 / SL-2700 series: for enhanced start									
12	SL-750	/S /T /P /PR /PT	11 1 0750x 00	½AA	3.6 V	1.1 Ah	1 mA	50 mA	–55 ... +85 °C	Ø 14.5 x 25
13	SL-761	/S /T /P /PR /PT	11 1 0761x 00	⅔AA	3.6 V	1.5 Ah	1.3 mA	75 mA	–55 ... +85 °C	Ø 14.5 x 33
14	SL-760	/S /T /P /PR /PT	11 1 0760x 00	AA	3.6 V	2.2 Ah	2 mA	60 mA	–55 ... +85 °C	Ø 14.5 x 50
15	SL-2770	/S /T /P	11 2 1770x 00	C	3.6 V	8.5 Ah	3 mA	230 mA	–55 ... +85 °C	Ø 26 x 50
16	SL-2780	/S /T /P	11 2 1780x 00	D	3.6 V	19 Ah	4 mA	340 mA	–55 ... +85 °C	Ø 33 x 60
17	SL-2790	/S /T	11 2 1790x 00	DD	3.6 V	35 Ah	10 mA	450 mA	–55 ... +85 °C	Ø 33 x 123
	SL-800 / SL-2800 series: XOL for extended operating life									
18	SL-840	Solder pins	11 1 18404 00	BEL	3.6 V	0.42 Ah	0.5 mA	5 mA	–55 ... +85 °C	Ø 18.5 x 7
19	SL-889	Solder pins	11 1 18894 00	1/10D	3.6 V	1 Ah	0.5 mA	10 mA	–55 ... +85 °C	Ø 33 x 6
20	SL-886	Solder pins	11 1 18864 00	⅙D	3.6 V	1.5 Ah	0.5 mA	10 mA	–55 ... +85 °C	Ø 33 x 10
21	SL-850	/S /T /P /PR /PT	11 1 0850x 00	½AA	3.6 V	1.2 Ah	0.5 mA	20 mA	–55 ... +85 °C	Ø 14.5 x 25
22	SL-861	/S /T /P /PR /PT	11 1 0861x 00	⅔AA	3.6 V	1.6 Ah	0.5 mA	30 mA	–55 ... +85 °C	Ø 14.5 x 33
23	SL-860	/S /T /P /PR /PT	11 1 0860x 00	AA	3.6 V	2.4 Ah	1 mA	60 mA	–55 ... +85 °C	Ø 14.5 x 50
24	SL-2870	/S /T /P	11 2 1870x 00	C	3.6 V	8.5 Ah	3 mA	75 mA	–55 ... +85 °C	Ø 26 x 50
25	SL-2880	/S /T /P	11 2 1880x 00	D	3.6 V	19 Ah	4 mA	100 mA	–55 ... +85 °C	Ø 33 x 60

***) Available terminations**

Termination	/S	/T	/P	/PR	/PT
x	1	2	3	6	8

EXAMPLE: for termination /PT is x = 8 and SL-850/PT has catalogue number 11 1 08508 00

Page	
26	***PulsesPlus*™ Batteries**

	Model	Termination	Catalogue number	Configuration Primary cell	Configuration HLC	Nominal voltage	Nominal capacity	Max. pulse current[1)]	Dimensions (mm)
27	TLP-91111/A/SM	Flying leads	17 91111 101	AA	1550	3.6 V	2.40 Ah	3 A	55 x 32 x 16
28	TLP-91311/A/SM	Pressure contacts	17 91311 101	AA	1520	3.6 V	2.40 Ah	1 A	Ø 16.5 x 75
28	TLP-91311/A/ST	Solder tags	17 91311 102	AA	1520	3.6 V	2.40 Ah	1 A	Ø 16.5 x 75
29	TLP-92111/A/SM	Flying leads	17 92111 101	C	1550	3.6 V	8.50 Ah	3 A	55 x 44 x 28
30	TLP-92311/A/SM	Flying leads	17 92311 101	C	1520	3.6 V	8.50 Ah	1 A	Ø 29 x 67
31	TLP-93111/A/SM	Flying leads	17 93111 101	D	1550	3.6 V	19.0 Ah	3 A	64 x 50 x 35
32	TLP-93311/A/SM	Flying leads	17 93311 101	D	1520	3.6 V	19.0 Ah	1 A	Ø 34 x 78
33	TLP-96111/A/SM	Flying leads	17 96111 101	½AA	1550	3.6 V	1.2 Ah	3 A	55 x 32 x 16
34	TLP-96311/A/SM	Pressure contacts	17 96311 101	½AA	1520	3.6 V	1.2 Ah	1 A	Ø 16.5 x 50
34	TLP-96311/A/ST	Solder tags	17 96311 102	½AA	1520	3.6 V	1.2 Ah	1 A	Ø 16.5 x 50
35	TLP-97111/A/SM	Flying leads	17 97111 101	⅔AA	1550	3.6 V	1.6 Ah	3 A	55 x 32 x 16
36	TLP-97311/A/SM	Pressure contacts	17 97311 101	⅔AA	1520	3.6 V	1.6 Ah	1 A	Ø 16.5 x 58
36	TLP-97311/A/ST	Solder tags	17 97311 102	⅔AA	1520	3.6 V	1.6 Ah	1 A	Ø 16.5 x 58

Page	
37	**Hybrid Layer Capacitors (HLC) for use in *PulsesPlus*™ Batteries**

	Model	Maximum charge voltage	Maximum charging current	Max. cont. discharge current	Max. pulse discharge current	Maximum capacity (3.6 V)	Maximum capacity (3.9 V)	Discharge end voltage	Cell impedance	Dimensions (mm)
38	HLC-1020	3.95 V	8 mA	0.25 A	0.75 A	12.5 mAh	20 mAh	2.5 V	≤ 400 mΩ	Ø 10 x 20
38	HLC-1020L	3.95 V	6 mA	0.15 A	0.5 A	8 mAh	12.5 mAh	2.5 V	≤ 600 mΩ	Ø 10 x 20
39	HLC-1520A	3.95 V	25 mA	0.5 A	2 A	39 mAh	58 mAh	2.5 V	≤ 250 mΩ	Ø 15 x 20
40	HLC-1530A	3.95 V	50 mA	0.75 A	3 A	70 mAh	105 mAh	2.5 V	≤ 140 mΩ	Ø 15 x 27
41	HLC-1550A	3.95 V	100 mA	2 A	5 A	155 mAh	236 mAh	2.5 V	≤ 100 mΩ	Ø 15 x 50

Page	
42	**Tadiran Lithium Metal Oxide (TLM) Batteries**

	Model	Nominal voltage	Max. cont. discharge current	Max. pulse discharge current	Maximum capacity	End voltage	Cell impedance	Capacity retention[2)]	Dimensions (mm)
43	TLM-1520HP	4.1 V	1.25 A	3.5 A	135 mAh	2.8 V	≤ 250 mΩ	89 %	Ø 15 x 20
44	TLM-1530HP	4.1 V	2.25 A	6.5 A	240 mAh	2.8 V	≤ 175 mΩ	89 %	Ø 15 x 27
45	TLM-1550HP	4.1 V	5 A	15 A	550 mAh	2.8 V	≤ 100 mΩ	89 %	Ø 15 x 50

Page	
46	Transport Regulations
47	Questionnaire

[1)] pulse duration 1 s to 3 V; [2)] after 10 years of storage at RT

About Tadiran

Tadiran Batteries GmbH
Tadiran Batteries GmbH is one of the leading manufacturers of primary (non rechargeable) lithium batteries in Europe.

The company was founded as a Joint Venture between Tadiran and Sonnenschein in 1984 and – under the name of Sonnenschein Lithium – has successfully served the market for more than 25 years.

Together with its parent company Tadiran Batteries Ltd., the company is continuously improving its performance with regard to products, highest quality and customer service.

Tadiran Batteries Ltd. is fully owned by Saft groupe S.A. (Euronext: SAFT).

The main focus of the company is to achieve a maximum customer satisfaction. Thus the guide line is to be the best in design-in, in full technical support and logistics.

The company is committed to the world class philosophy. The management system is certified to ISO 9001 (Quality) and – since 1999 – to ISO 14001 (Environment).

Tadiran Batteries GmbH employs approx. 100 people and has its production facilities in Büdingen, close to Frankfurt, Germany.

The company is a leader in the development of lithium batteries for industrial use. Its Lithium Thionyl Chloride (LTC) technology is well established for more than 30 years. Tadiran LTC batteries are suitable where a 3.6 Volt high energy primary battery is required for up to 25 years and more stand alone operation.

The ***PulsesPlus***™ technology, providing high current pulses in combination with high energy, has been successfully introduced into the market and plays a significant role especially for long distance communication (e.g. GSM) modules.

The TLM technology has been developed for applications requiring high power discharge after a long storage time, e.g. as a back up battery for emergency call devices in automotive telematic systems.

Customer benefits
Tadiran has focused its ongoing efforts on promoting the understanding and further development of lithium batteries. This determination offers to the customer a number of decisive benefits such as:

- Access to over 40 years of experience in research and development, production and marketing
- Adaptability and reliability in meeting rapidly evolving customer needs
- Detailed technical support in terms of design and application – before, during and after the purchase
- Highly qualified experts available for support on short notice
- Customized production of single- and multi-cell batteries to meet specific requirements
- Reliable delivery, secured by contractual agreements and second sourcing.

For successful use of a battery, the co-operation between the supplier and the customer must commence at the earliest possible point: at times it is simply more economical to design a circuit for the characteristics of the best suitable energy supply, rather than having to forgo its advantages because it is too late for changes.

Environment
The European Battery Directive 2006/66/EC restricts the use of certain hazardous substances in batteries and establishes rules for the collection, treatment, recycling and disposal of waste batteries and accumulators. It is transposed individually in each EU member state.

The following information is important for end users of batteries:

Batteries are marked with the crossed-out wheeled bin symbol.

The symbol reminds end users that batteries must not be disposed as municipal waste, but collected separately. Used batteries can be returned at the point of sale at no charge.

The reason for these regulations is that there are a number of environmental concerns which arise when dealing with the waste management of batteries and accumulators. These relate for the most part to the metals contained in these batteries. Mercury, lead and cadmium are by far the most problematic substances in the battery waste stream. Other metals commonly used in batteries, such as zinc, copper, manganese, lithium and nickel, may also constitute environmental hazards.

However, the new regulations apply to all batteries and not just to hazardous ones because all batteries contain substances which are more or less harmful to the environment and because experience with previous regulations showed that 'all battery' collection schemes are more efficient than separate schemes for certain types of portable batteries.

Batteries should be recycled because battery recycling helps to save resources by allowing for the recovery of valuable metals such as nickel, cobalt and silver and requires less energy consumption. For example, using recycled cadmium and nickel requires respectively 46 % and 75 % less primary energy than the extraction and refining of virgin metals.

This information is based on the 'Q&A on the Batteries Directive 2006/66/EC' document and was downloaded from the European Commission website.

A Technical Notice is available upon request with details on the disposal service offered by Tadiran.

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Safety

Standards
General safety recommendations for lithium batteries have been published in the standards UL 1642 and IEC 60086-4.

UL-recognition
Tadiran Lithium Batteries are recognized by UL under file MH 12827. The following text or a modified version thereof appears on each battery:

WARNING:
Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

Protection against charging
Whenever lithium batteries are not the single power source in a circuit the following measures are recommended by the Underwriters Laboratories:

The battery should not be connected in series with an electrical power source that would increase the forward current through the battery.

The circuit shall include one of the following:

A. Two suitable diodes in series with the battery to prevent any reverse (charging) current. The second diode provides protection if the other one fails; or
B. A blocking diode or the equivalent to prevent any reverse (charging) current and a resistor to limit current in case of a diode failure (see figure 1). The resistor should be sized to limit the reverse (charging) current to the maximums $I_{R\,max}$ shown below.

In addition to this UL requirement, which gives the safety limits, Tadiran Batteries recommend to limit the reverse (charging) current to values below 10 µA. This will ensure that service life is not affected.

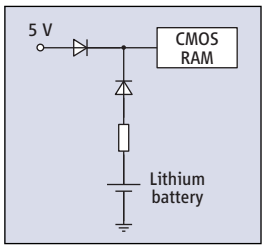

Figure 1: *Safety wiring for memory back-up representing case B of UL recommendations*

Type	$I_{R\,max}$
SL-350	15 mA
SL-360	50 mA
SL-361	20 mA
SL-550	15 mA
SL-560	50 mA
SL-561	15 mA
SL-750	15 mA
SL-760	50 mA
SL-761	20 mA
SL-840	15 mA
SL-850	15 mA
SL-860	50 mA
SL-861	20 mA
SL-886	25 mA
SL-889	20 mA
SL-2770	15 mA
SL-2780	50 mA
SL-2790	100 mA
SL-2870	15 mA
SL-2880	50 mA
TLM-1520HP	100 mA
TLM-1530HP	100 mA
TLM-1550HP	100 mA

Protection against forced discharge
Forced discharge of a cell can occur when it is connected in series with other cells and when it is not protected with a by-pass diode.

In these cases the maximum continuous discharge currents have to be reduced to the following values:

Type	$I_{F\,max}$
SL-350	20 mA
SL-360	40 mA
SL-361	25 mA
SL-550	20 mA
SL-560	40 mA
SL-561	25 mA
SL-750	50 mA
SL-760	40 mA
SL-761	25 mA
SL-840	5 mA
SL-850	20 mA
SL-860	40 mA
SL-861	25 mA
SL-886	15 mA
SL-889	15 mA
SL-2770	50 mA
SL-2780	100 mA
SL-2790	125 mA
SL-2870	30 mA
SL-2880	60 mA
TLM-1520HP	500 mA
TLM-1530HP	500 mA
TLM-1550HP	500 mA

Battery packs
The design and assembly of battery packs require special skills, expertise and experience. Therefore it is not recommended that the end user attempt to self-assemble battery packs. It is preferable that any battery using lithium cells be fabricated by Tadiran to ensure proper battery design and construction (see figure 2). A full battery assembly service is available from Tadiran who can be contacted for further information. If for any reason, this is not possible, Tadiran can review the pack design in confidence to ensure that the design is safe (in assembly and use) and capable of meeting stated performance requirements.

Figure 2: *Upon request, Tadiran designs, tests, and manufactures customized battery packs.*

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Lithium Thionyl Chloride (LTC) Batteries

Introduction

The Lithium Thionyl Chloride (LTC) battery
The Tadiran lithium thionyl chloride inorganic electrolyte battery is a power source that is suited to the requirements of the new generation in microelectronics. For example, CMOS memories as well as utility meters require a lightweight power source to provide a safe and reliable performance over a wide range of environmental conditions, for long periods of time.

The Tadiran lithium battery is a component that can be permanently connected to a circuit and, in many cases, will last the entire lifetime of the equipment.

Battery characteristics
The major advantages of the Tadiran lithium battery are:

High cell voltage
The battery has a nominal voltage of 3.6 Volts, which is considerably higher than any other commercially available primary cell.

Wide temperature range
The batteries are capable of operating in a wide temperature range normally from –55 °C to +85 °C. One series, however, has an extended temperature range of up to +130 °C.

High energy density
The electrochemical system offers the highest energy density of any available primary battery: up to ~650 Wh / kg and ~1280 Wh / dm^3 (see figure 2).

Superior shelf life and reliability
The Tadiran lithium battery has an outstandingly long shelf life. Tests have shown that storage for ten years at room temperature results in a capacity loss of less than 1 % per year.

Tadiran lithium batteries are also extremely reliable. Failure rates in memory back-up applications were found to be below 200 fit (fit: Failures in Time. 1 fit = 1 failure in 10^9 component hours).

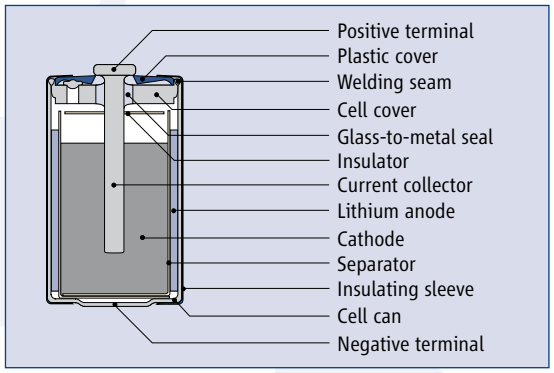

Figure 1: *Cross sectional view of a ½AA size cell (bobbin-design)*

Safe design
The battery's design has a major influence on its safety characteristics (see figure 1).

In the bobbin version, the cathode is cylindrical in shape. The anode is swaged against the inner wall of the battery case. This offers several advantages in terms of safety. In the event of an unintentional short-circuit, the discharge currents do not become very strong. The heat generated, primarily at the contact surface between the anode and cathode, can easily be channelled to the outside. This design leads to a safe battery that needs no additional rupture vent.

In the flat battery versions, the anode is pressed onto the bottom of the case, and the cathode is disk-shaped. Flat batteries are wider than they are high. They are just as safe as the bobbin type batteries.

Hermetically sealed case
The hermetically sealed case is essential for the long shelf life and inherent safety of the devices in which the batteries are used. The cover is welded to the can. A glass-to-metal seal is used to insulate the positive terminal.

The chemical reaction
The battery consists of a lithium (Li) anode, a carbon (C) cathode, and a non-aqueous electrolyte (a solution of lithium tetra-chloroaluminate in thionyl chloride). This solution performs a dual task: as the electrolyte for ion transport, and as an active depolarizer.

The Teflon™-bonded carbon cathode serves as a catalyst for cathodic reduction.

The generally accepted reaction mechanisms are as follows:
- Anodic reaction:
  $4\ Li \rightarrow 4\ Li^+ + 4\ e^-$
- Cathodic reaction:
  $2\ SOCl_2 + 4\ e^- \rightarrow SO_2 + S + 4\ Cl^-$
- Overall reaction:
  $4\ Li + 2\ SOCl_2 \rightarrow S + 4\ LiCl + SO_2$

Most of the sulphur dioxide generated during discharge dissolves in the electrolyte, preventing pressure build-up within the battery.

Long-term behaviour
The long shelf life of the Tadiran lithium batteries is a result of the fact that a thin protective layer of LiCl forms on the anode as soon as the lithium first comes into contact with the electrolyte. This layer prevents further reaction or loss of capacity on stand. The problem of anode corrosion, as occurs in aqueous systems, is thus eliminated.

On the other hand, the protective layer on the anode may cause a delay in the voltage build-up if relatively high loads are applied, or after extended storage at elevated temperatures. This voltage delay is not experienced at all in microampere applications, such as in typical CMOS circuits.

Features and attributes of the various series

SL-300 series
Keywords: standard use and stand-by
- Excellent shelf life (10 years)
- Extremely low self-discharge (1 % or less per year)
- Suited for long-term use with low current
- For operation at low current levels with long stands
- Intermittent discharge with medium current level provided the average is not below the active current level (2 µA / cm² anode surface area)
- Temperature range from –55 °C to +85 °C

SL-500 series
Keywords: extended temperature range
- Extension of temperature range up to +130 °C
- Somewhat smaller capacity
- Otherwise like the SL-300 series

SL-700 series
Keywords: for enhanced start
- Major improvement of voltage delay (TMV) at the start of discharge at medium current levels
- Intermittent discharge at medium current levels
- Best results if used after no more than 3 years of storage
- Otherwise like the SL-300 series

SL-2700 series (iXtra)
Keywords: for fast voltage recovery after long term storage and/or use
- Higher voltage under pulse load even with low background currents
- Improved voltage delay behaviour at ambient and elevated temperatures
- Fast voltage recovery after long term storage
- More capacity
- Higher discharge rate
- No orientation effect

SL-800/2800 series (XOL)
Keywords: for eXtended operation life
- More capacity
- Extra low self discharge
- Extra low passivation during long term use

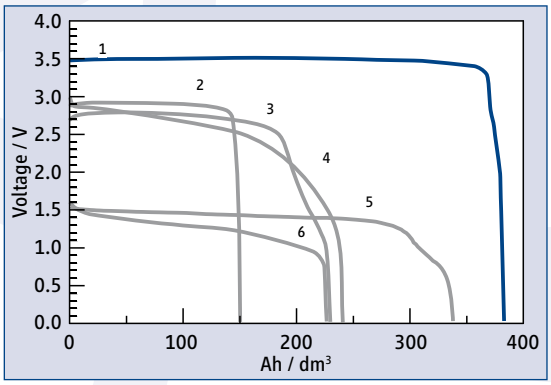

Figure 2:
Comparison of different battery systems. The curves represent typical best values of commercial cylindrical cells when discharged at +25 °C at the 1000 hour rate. The area under the curves corresponds to the energy density listed below.
1 $Li/SOCl_2$ 1280 Wh / dm³
2 Li/SO_2 430 Wh / dm³
3 Li/CF_x 550 Wh / dm³
4 Li/MnO_2 580 Wh / dm³
5 Li/FeS_2 450 Wh / dm³
6 Alkaline 280 Wh / dm³

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Any values given here are for informational purposes only. They also depend on actual conditions of use and are not warranties of future performance. Subject to change.

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LTC Batteries

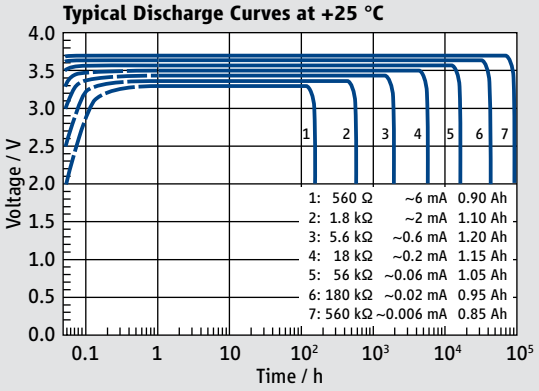
SL-350 Size: ½AA

› Standard use and stand-by

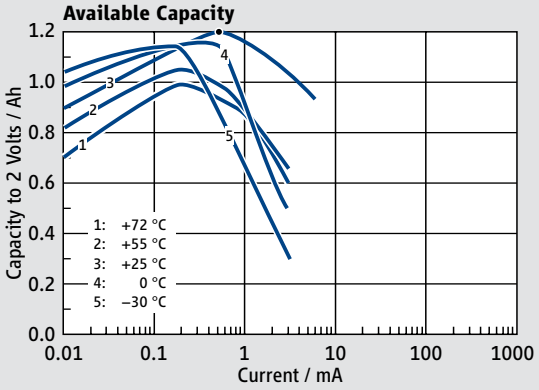
Performance Data
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.2 Ah
Nominal current	0.6 mA
Max. continuous discharge current	6 mA
Anode surface area	6 cm^2
Lithium content	0.35 g
Weight	9.6 g
Volume	4 cm^3
Temperature range	–55 °C ... +85 °C

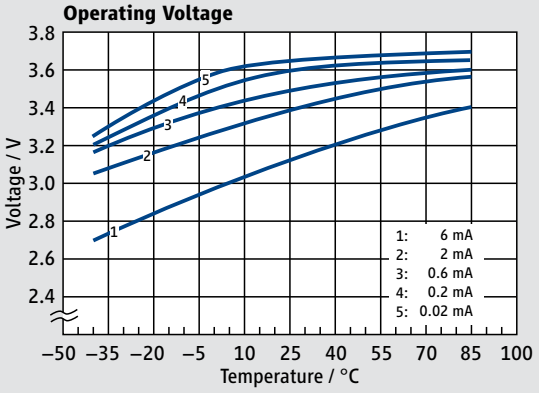
Typical Discharge Curves at +25 °C



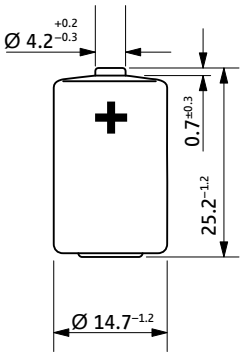
Available Capacity



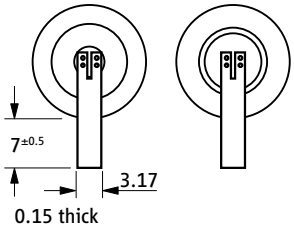
Operating Voltage



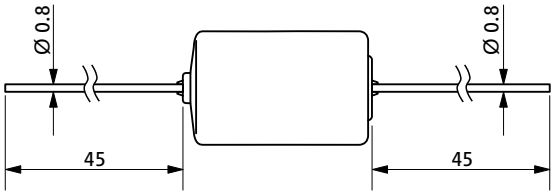
SL-350/S



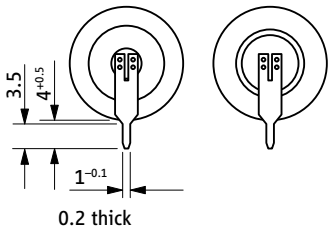
SL-350/T



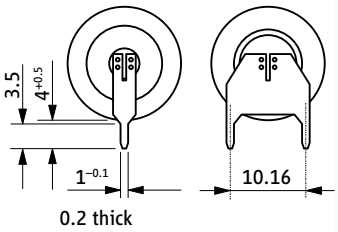
SL-350/P



SL-350/PR



SL-350/PT



Available Terminations		Catalogue No.
SL-350/S	Standard	11 1 03501 00
SL-350/T	Tags	11 1 03502 00
SL-350/P	Pins	11 1 03503 00
SL-350/PR	Pins radial	11 1 03506 00
SL-350/PT	Polarized tags	11 1 03508 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

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PDC13Eng

LTC Batteries

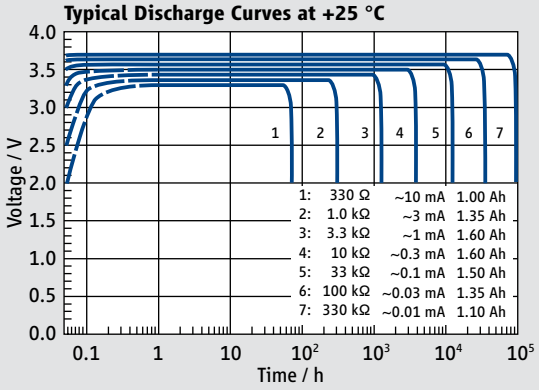
SL-361 Size: 2/3AA

› Standard use and stand-by

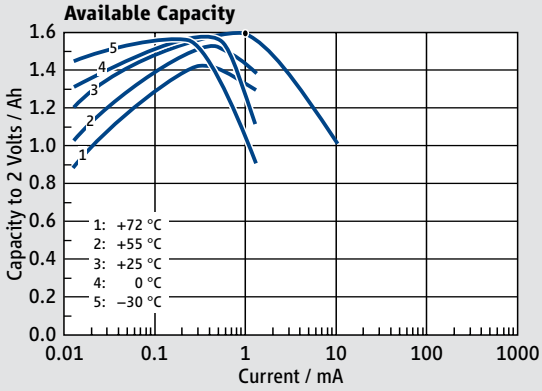
Performance Data
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.6 Ah
Nominal current	1 mA
Max. continuous discharge current	10 mA
Anode surface area	9 cm^2
Lithium content	0.5 g
Weight	12.5 g
Volume	5.2 cm^3
Temperature range	–55 °C ... +85 °C

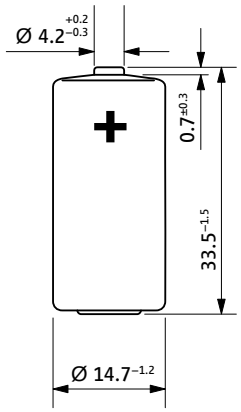
Typical Discharge Curves at +25 °C



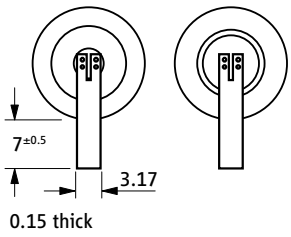
Available Capacity



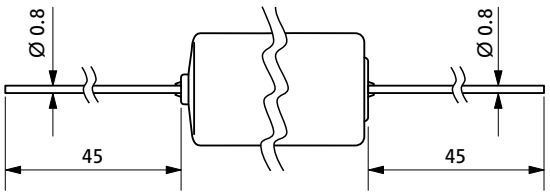
SL-361/S



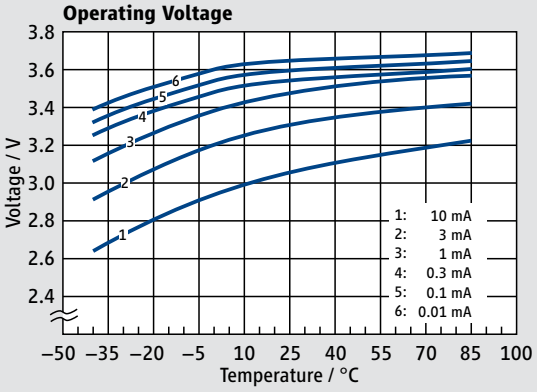
SL-361/T



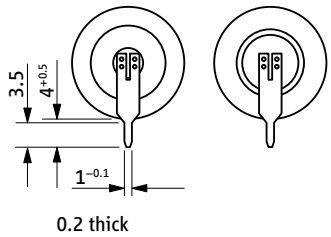
SL-361/P



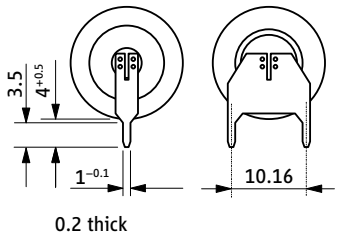
Operating Voltage



SL-361/PR



SL-361/PT



Available Terminations		Catalogue No.
SL-361/S	Standard	11 1 03611 00
SL-361/T	Tags	11 1 03612 00
SL-361/P	Pins	11 1 03613 00
SL-361/PR	Pins radial	11 1 03616 00
SL-361/PT	Polarized tags	11 1 03618 00

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PDC13Eng

LTC Batteries

SL-360 Size: AA

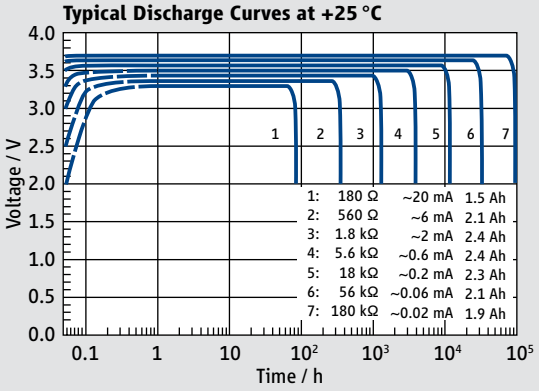
› Standard use and stand-by

Performance Data

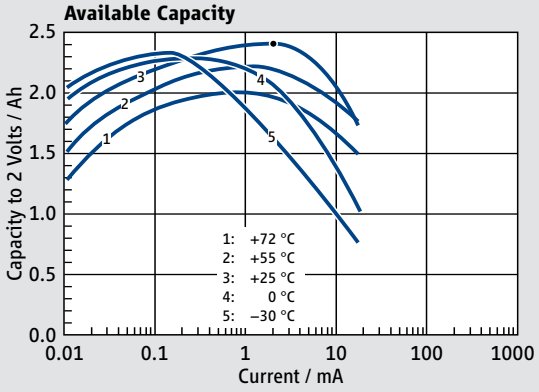
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	2.4 Ah
Nominal current	2 mA
Max. continuous discharge current	20 mA
Anode surface area	14 cm^2
Lithium content	0.65 g
Weight	18 g
Volume	8 cm^3
Temperature range	–55 °C ... +85 °C

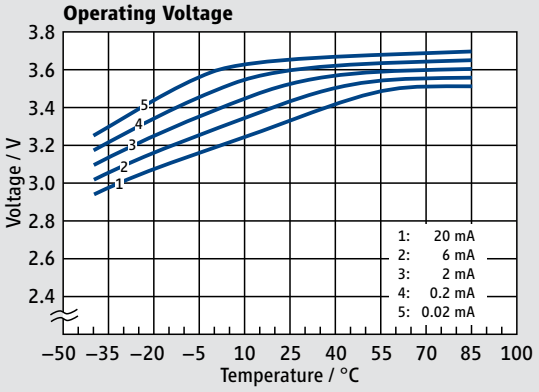
Typical Discharge Curves at +25 °C



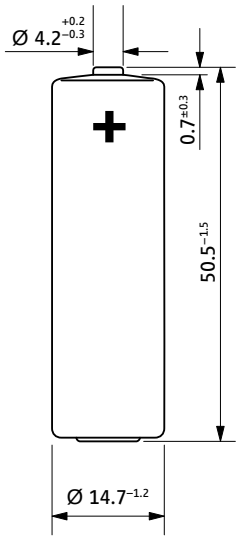
Available Capacity



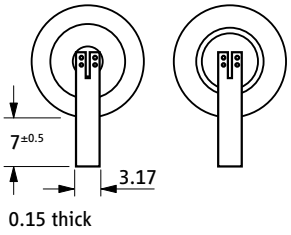
Operating Voltage



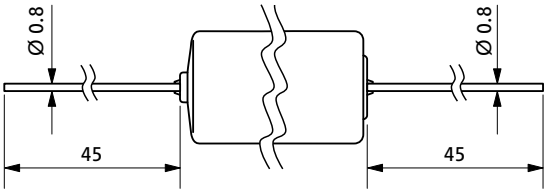
SL-360/S



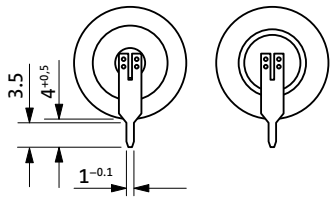
SL-360/T



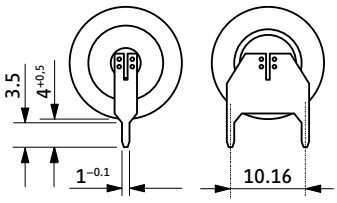
SL-360/P



SL-360/PR



SL-360/PT



Available Terminations		Catalogue No.
SL-360/S	Standard	11 1 03601 00
SL-360/T	Tags	11 1 03602 00
SL-360/P	Pins	11 1 03603 00
SL-360/PR	Pins radial	11 1 03606 00
SL-360/PT	Polarized tags	11 1 03608 00

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PDC13Eng

LTC Batteries

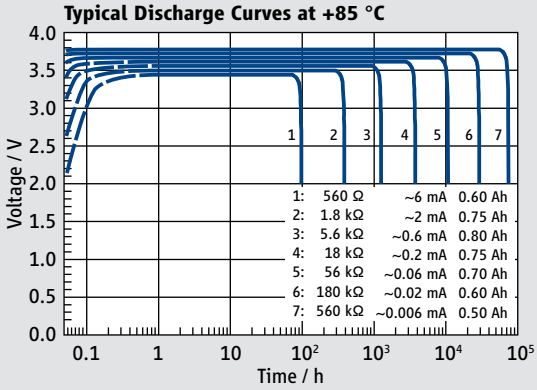
SL-550 Size: ½AA

› Extended temperature range

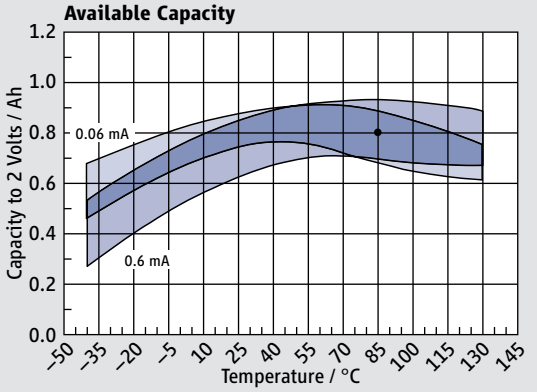
Performance Data
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	0.8 Ah
Nominal current	0.6 mA
Max. continuous discharge current	6 mA
Anode surface area	6 cm^2
Lithium content	0.35 g
Weight	9.6 g
Volume	4 cm^3
Temperature range	–55 °C ... +130 °C

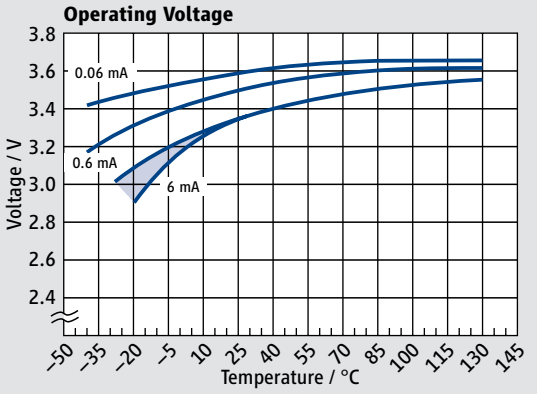
Typical Discharge Curves at +85 °C



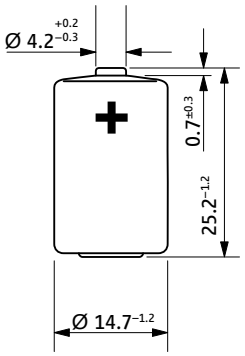
Available Capacity



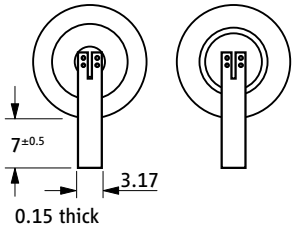
Operating Voltage



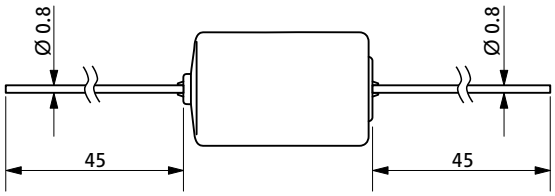
SL-550/S



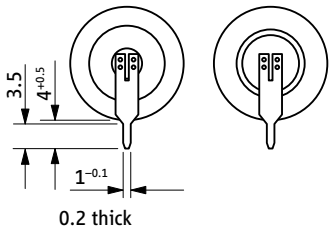
SL-550/T



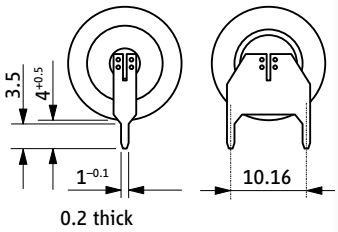
SL-550/P



SL-550/PR



SL-550/PT



Available Terminations		Catalogue No.
SL-550/S	Standard	11 1 05501 00
SL-550/T	Tags	11 1 05502 00
SL-550/P	Pins	11 1 05503 00
SL-550/PR	Pins radial	11 1 05506 00
SL-550/PT	Polarized tags	11 1 05508 00

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PDC13Eng

LTC Batteries

SL-561 Size: 2/3AA

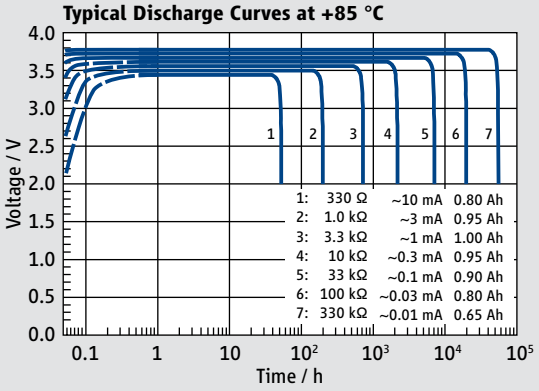
› Extended temperature range

Performance Data

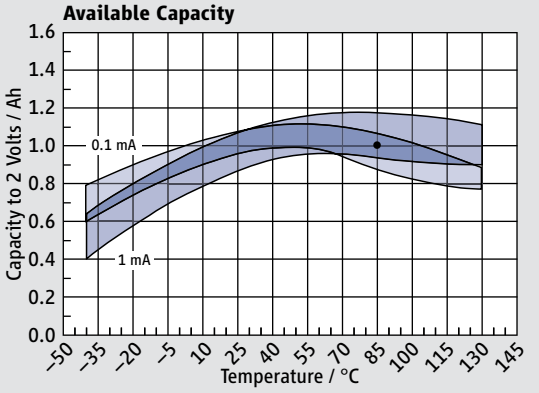
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.0 Ah
Nominal current	1 mA
Max. continuous discharge current	10 mA
Anode surface area	9 cm^2
Lithium content	0.5 g
Weight	12.5 g
Volume	5.2 cm^3
Temperature range	–55 °C ... +130 °C

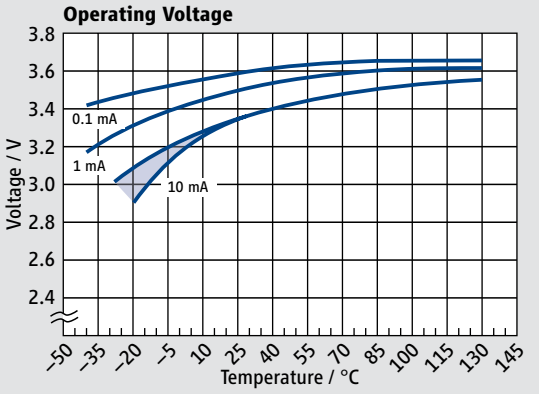
Typical Discharge Curves at +85 °C



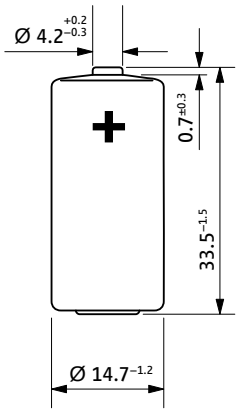
Available Capacity



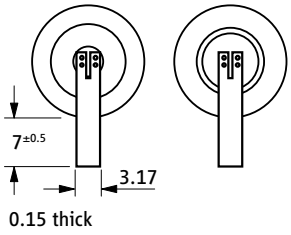
Operating Voltage



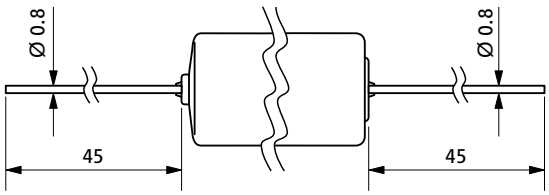
SL-561/S



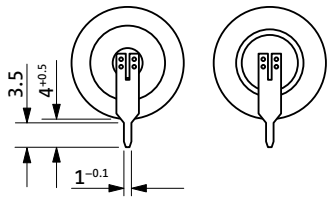
SL-561/T



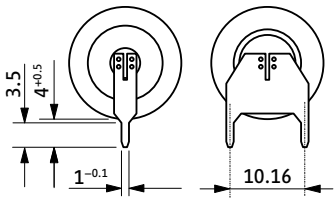
SL-561/P



SL-561/PR



SL-561/PT



Available Terminations		Catalogue No.
SL-561/S	Standard	11 1 05611 00
SL-561/T	Tags	11 1 05612 00
SL-561/P	Pins	11 1 05613 00
SL-561/PR	Pins radial	11 1 05616 00
SL-561/PT	Polarized tags	11 1 05618 00

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PDC13Eng

LTC Batteries

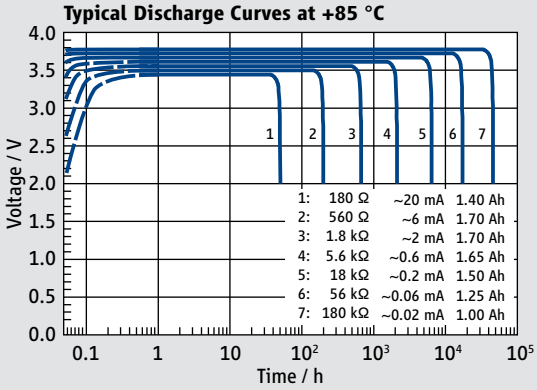
SL-560 Size: AA

› Extended temperature range

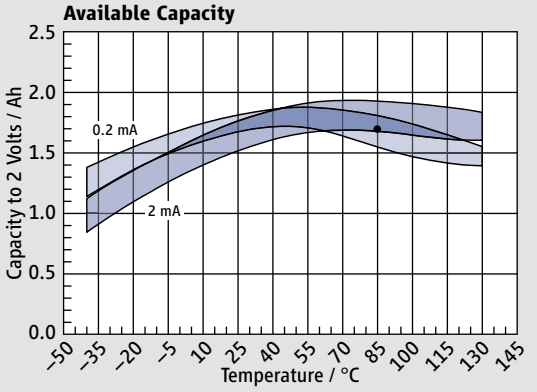
Performance Data
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.7 Ah
Nominal current	2 mA
Max. continuous discharge current	20 mA
Anode surface area	14 cm^2
Lithium content	0.65 g
Weight	18 g
Volume	8 cm^3
Temperature range	–55 °C ... +130 °C

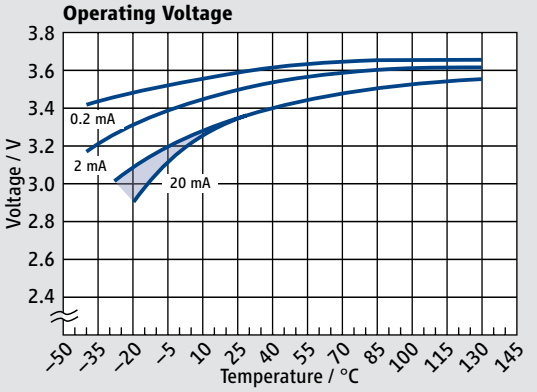
Typical Discharge Curves at +85 °C



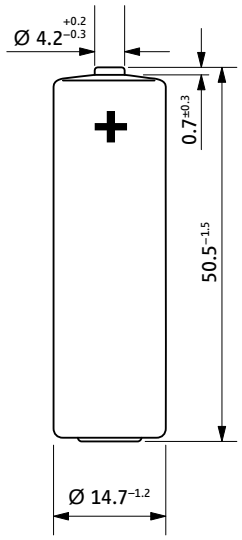
Available Capacity



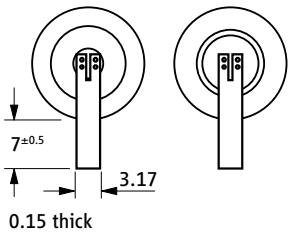
Operating Voltage



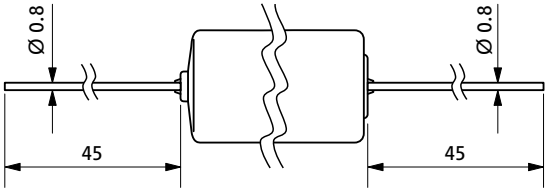
SL-560/S



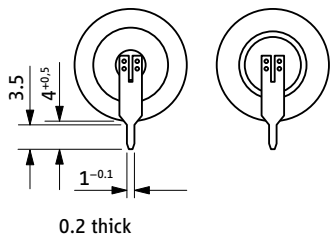
SL-560/T



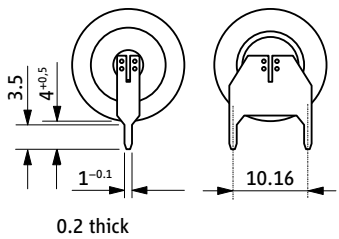
SL-560/P



SL-560/PR



SL-560/PT



Available Terminations		Catalogue No.
SL-560/S	Standard	11 1 05601 00
SL-560/T	Tags	11 1 05602 00
SL-560/P	Pins	11 1 05603 00
SL-560/PR	Pins radial	11 1 05606 00
SL-560/PT	Polarized tags	11 1 05608 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 150 °C, incinerate, or expose contents to water.

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PDC13Eng

LTC Batteries

SL-750 Size: ½AA

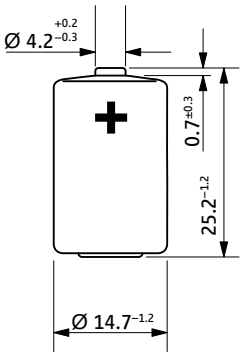
› iXtra – long term high performance

Performance Data

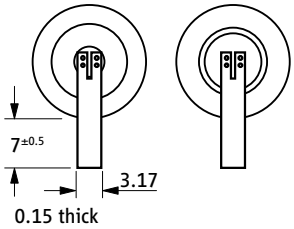
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.1 Ah
Nominal current	1 mA
Max. continuous discharge current	50 mA
Pulse current capability	100 mA
Anode surface area	6 cm^2
Lithium content	0.35 g
Weight	9.6 g
Volume	4 cm^3
Temperature range	–55 °C ... +85 °C

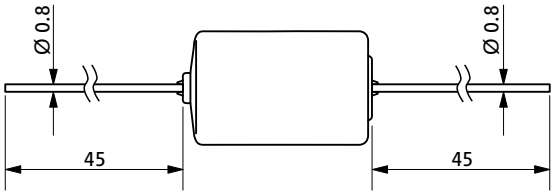
SL-750/S



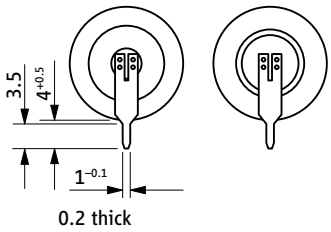
SL-750/T



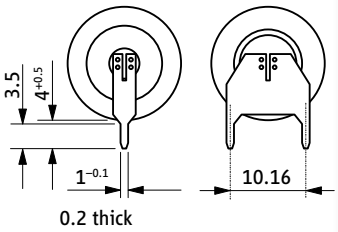
SL-750/P



SL-750/PR



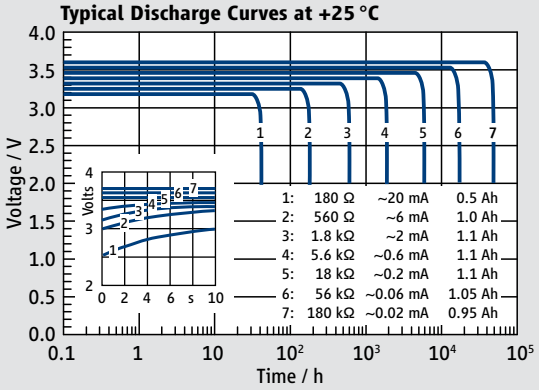
SL-750/PT



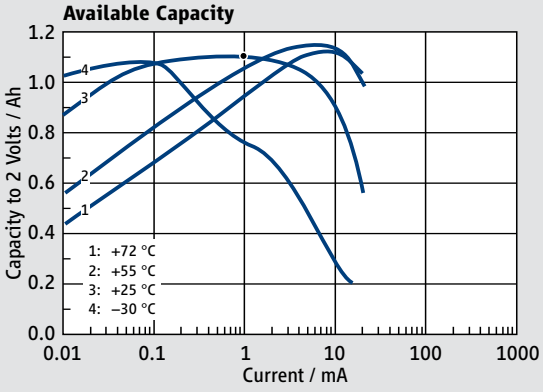
Available Terminations		Catalogue No.
SL-750/S	Standard	11 1 07501 00
SL-750/T	Tags	11 1 07502 00
SL-750/P	Pins	11 1 07503 00
SL-750/PR	Pins radial	11 1 07506 00
SL-750/PT	Polarized tags	11 1 07508 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

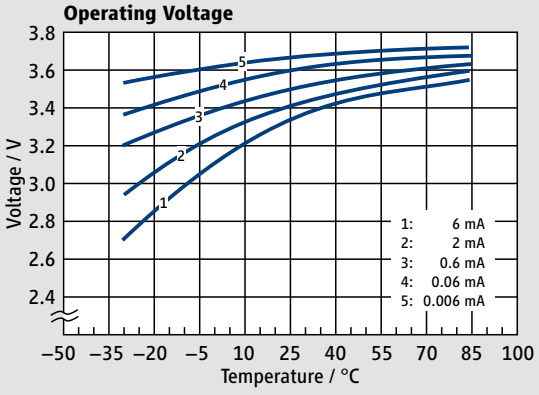
Typical Discharge Curves at +25 °C



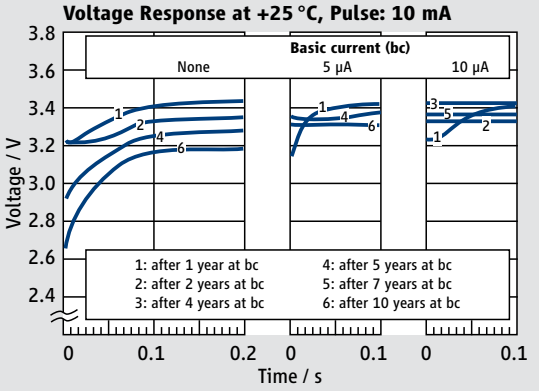
Available Capacity



Operating Voltage



Voltage Response at +25 °C, Pulse: 10 mA



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LTC Batteries

SL-761 Size: 2/3AA

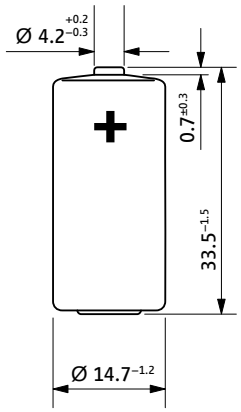
› iXtra – long term high performance

Performance Data

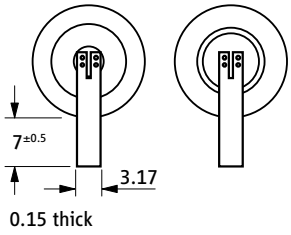
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.5 Ah
Nominal current	1.3 mA
Max. continuous discharge current	75 mA
Pulse current capability	150 mA
Anode surface area	9 cm^2
Lithium content	0.5 g
Weight	12.5 g
Volume	5.2 cm^3
Temperature range	–55 °C ... +85 °C

SL-761/S

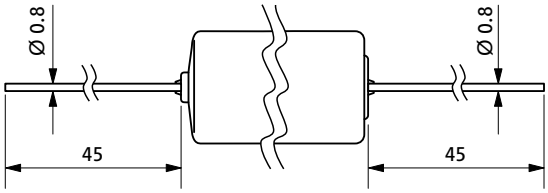


SL-761/T

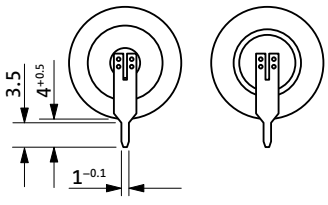


0.15 thick

SL-761/P

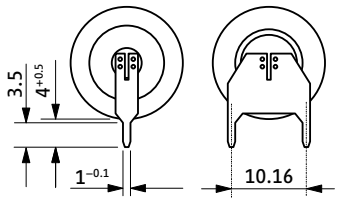


SL-761/PR



0.2 thick

SL-761/PT

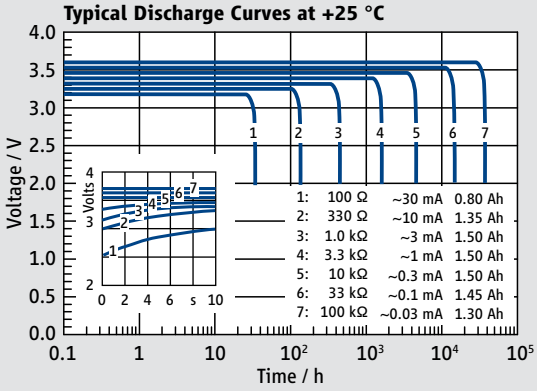


0.2 thick

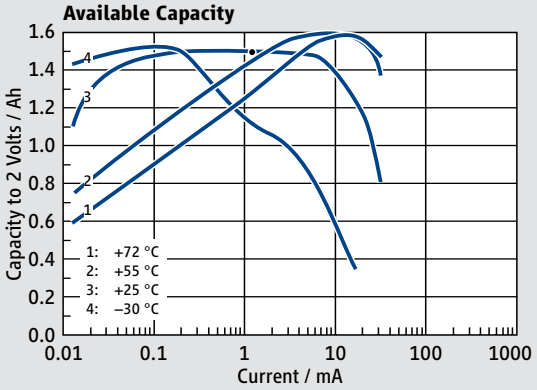
Available Terminations		Catalogue No.
SL-761/S	Standard	11 1 07611 00
SL-761/T	Tags	11 1 07612 00
SL-761/P	Pins	11 1 07613 00
SL-761/PR	Pins radial	11 1 07616 00
SL-761/PT	Polarized tags	11 1 07618 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

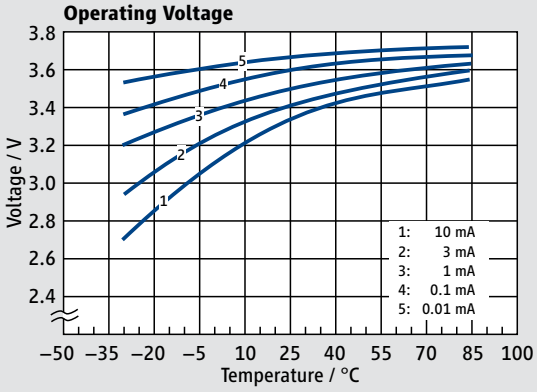
Typical Discharge Curves at +25 °C



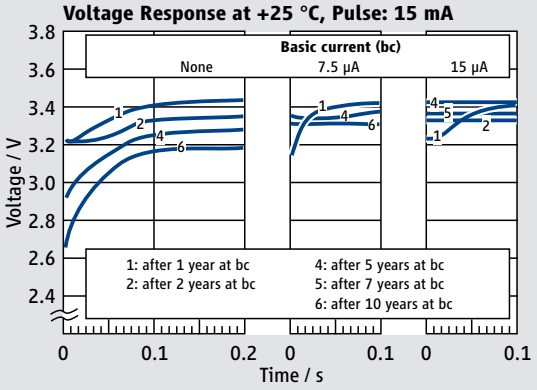
Available Capacity



Operating Voltage



Voltage Response at +25 °C, Pulse: 15 mA



PDC13Eng

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LTC Batteries

SL-760 Size: AA

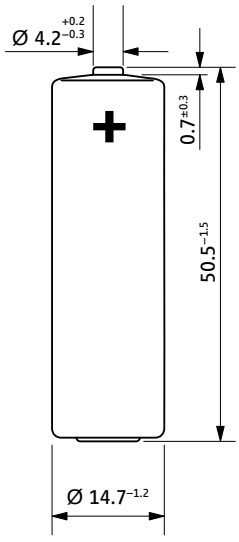
› Lithium Xtra – enhanced start

Performance Data

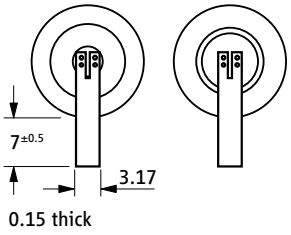
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	2.2 Ah
Nominal current	2 mA
Max. continuous discharge current	60 mA
Pulse current capability	140 mA
Anode surface area	14 cm^2
Lithium content	0.65 g
Weight	18 g
Volume	8 cm^3
Temperature range	–55 °C ... +85 °C

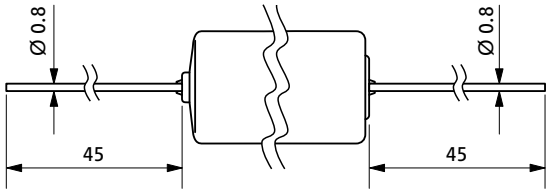
SL-760/S



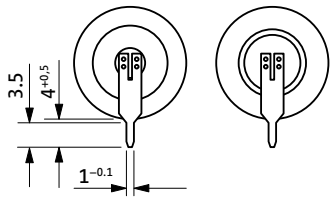
SL-760/T



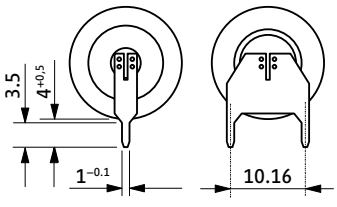
SL-760/P



SL-760/PR



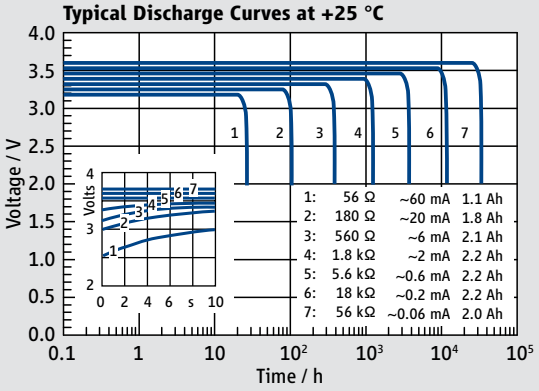
SL-760/PT



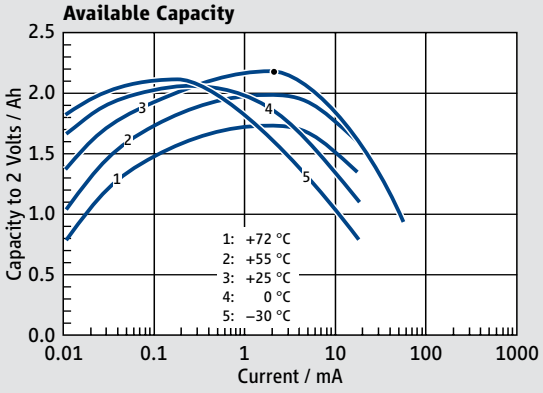
Available Terminations		Catalogue No.
SL-760/S	Standard	11 1 07601 00
SL-760/T	Tags	11 1 07602 00
SL-760/P	Pins	11 1 07603 00
SL-760/PR	Pins radial	11 1 07606 00
SL-760/PT	Polarized tags	11 1 07608 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

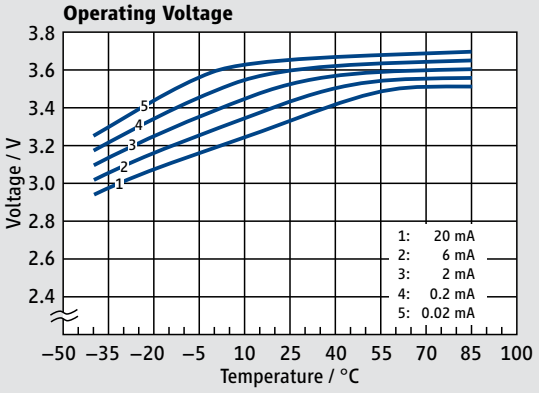
Typical Discharge Curves at +25 °C



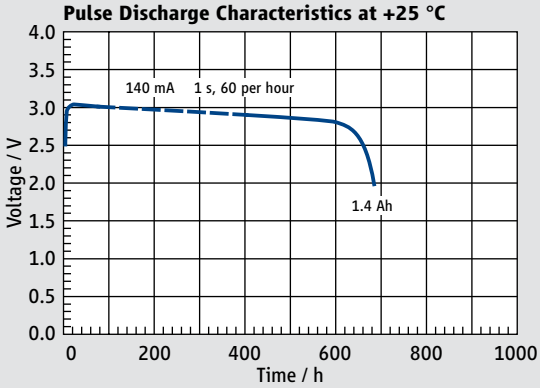
Available Capacity



Operating Voltage



Pulse Discharge Characteristics at +25 °C



PDC13Eng

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LTC Batteries

SL-2770 Size: C

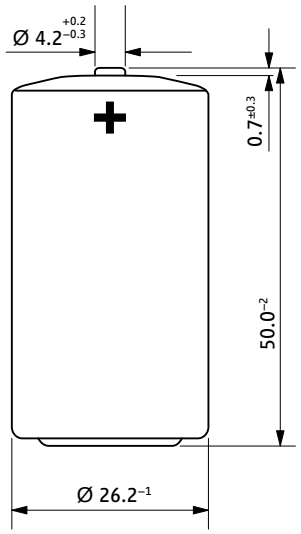
› iXtra – long term high performance

Performance Data

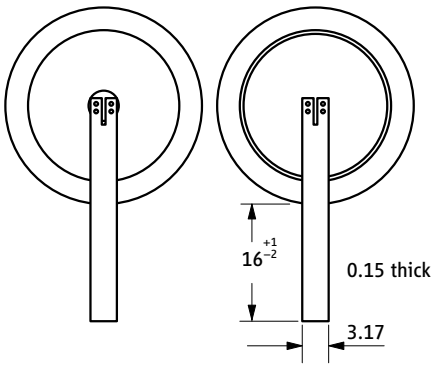
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	8.5 Ah
Nominal current	3 mA
Max. continuous discharge current	230 mA
Pulse current capability	400 mA
Anode surface area	30 cm^2
Lithium content	2.5 g
Weight	49.5 g
Volume	26 cm^3
Temperature range	–55 °C ... +85 °C

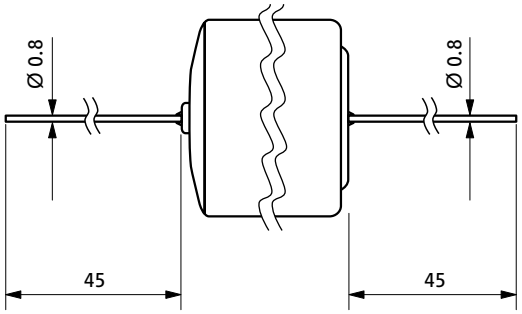
SL-2770/S



SL-2770/T



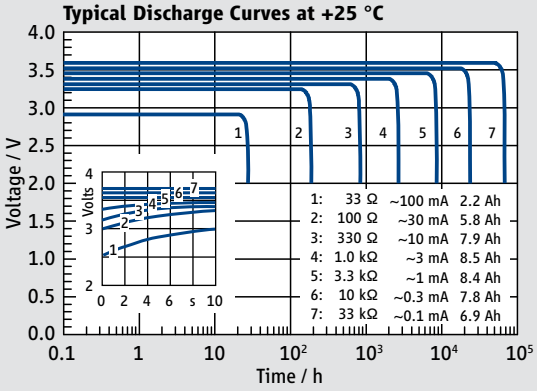
SL-2770/P



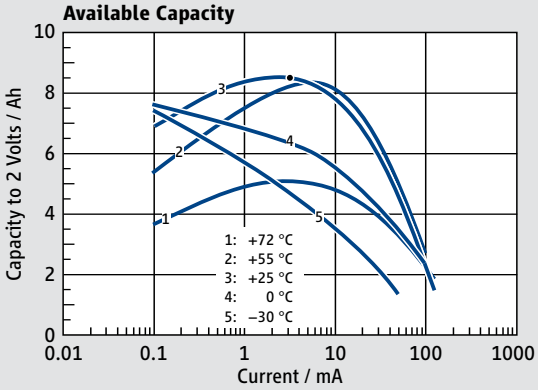
Available Terminations		Catalogue No.
SL-2770/S	Standard	11 2 17701 00
SL-2770/T	Tags	11 2 17702 00
SL-2770/P	Pins	11 2 17703 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

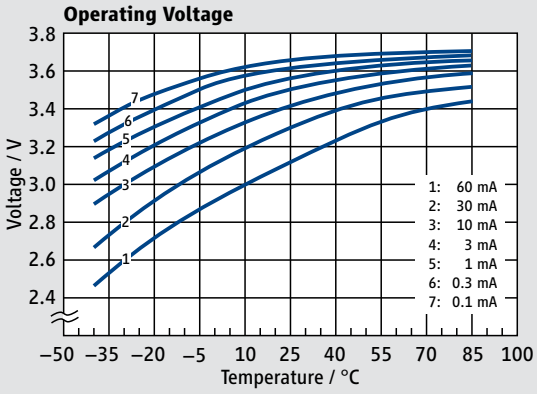
Typical Discharge Curves at +25 °C



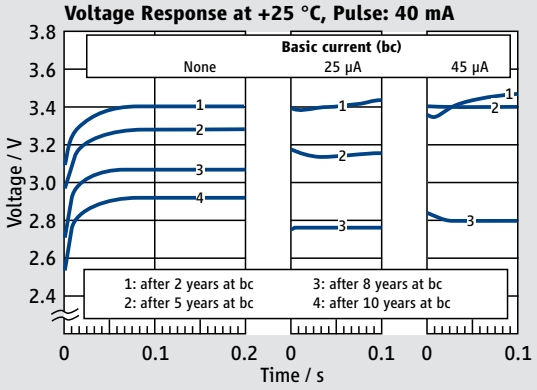
Available Capacity



Operating Voltage



Voltage Response at +25 °C, Pulse: 40 mA



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LTC Batteries

SL-2780 Size: D

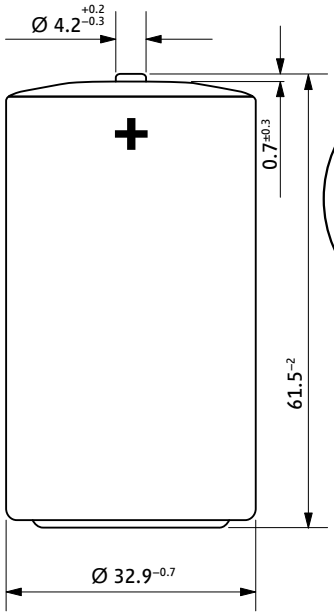
› iXtra – long term high performance

Performance Data

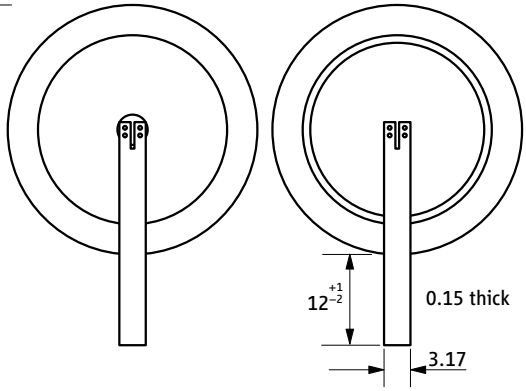
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	19 Ah
Nominal current	4 mA
Max. continuous discharge current	340 mA
Pulse current capability	600 mA
Anode surface area	45 cm^2
Lithium content	5 g
Weight	93 g
Volume	51 cm^3
Temperature range	–55 °C ... +85 °C

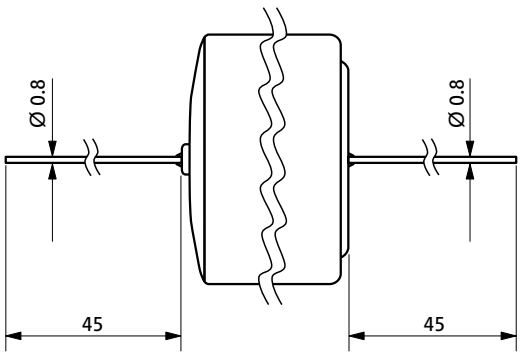
SL-2780/S



SL-2780/T



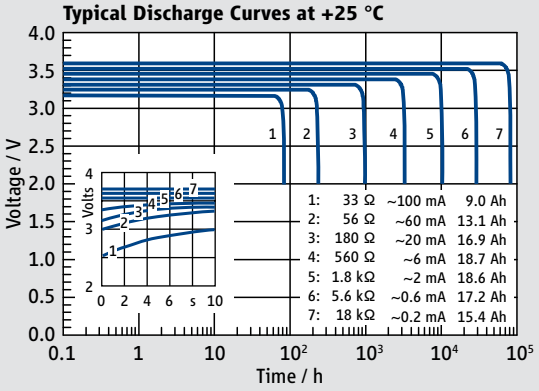
SL-2780/P



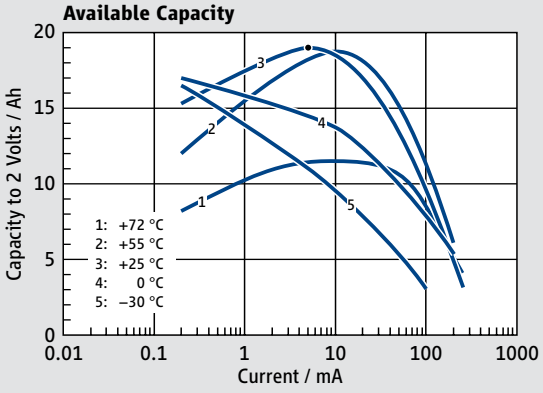
Available Terminations		Catalogue No.
SL-2780/S	Standard	11 2 17801 00
SL-2780/T	Tags	11 2 17802 00
SL-2780/P	Pins	11 2 17803 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

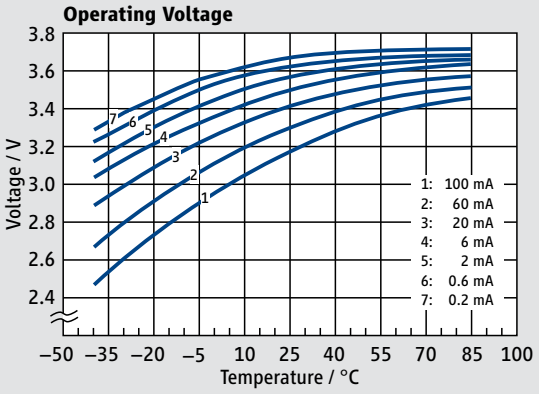
Typical Discharge Curves at +25 °C



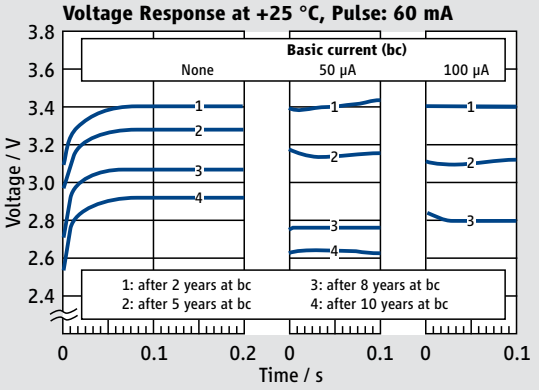
Available Capacity



Operating Voltage



Voltage Response at +25 °C, Pulse: 60 mA



PDC13Eng

Any values given here are for informational purposes only. They also depend on actual conditions of use and are not warranties of future performance. Subject to change.

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LTC Batteries

SL-2790 Size: DD

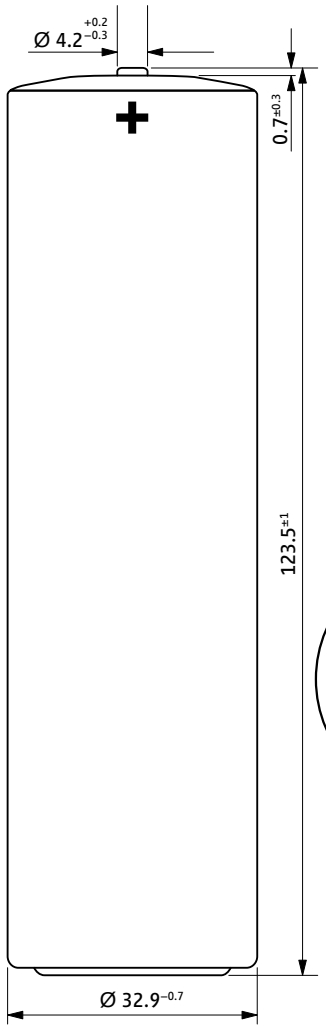
› iXtra – long term high performance

Performance Data

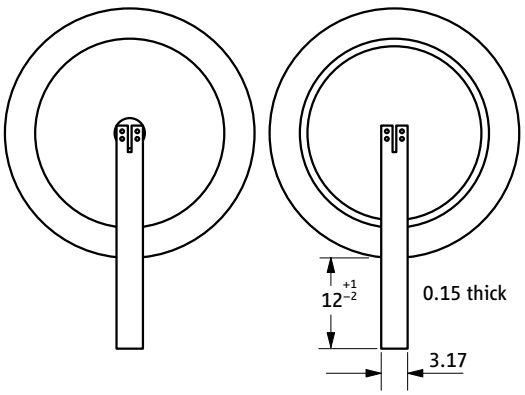
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	35 Ah
Nominal current	10 mA
Max. continuous discharge current	450 mA
Pulse current capability	1000 mA
Anode surface area	90 cm^2
Lithium content	10 g
Weight	190 g
Volume	105 cm^3
Temperature range	–55 °C ... +85 °C

SL-2790/S



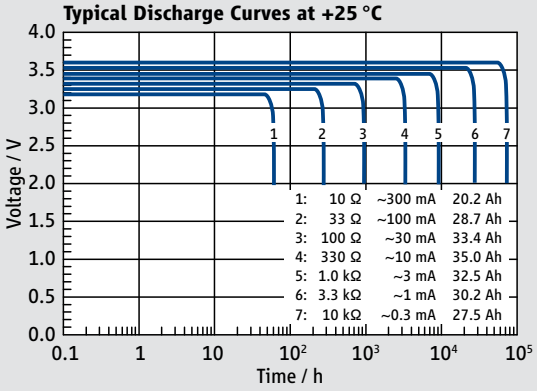
SL-2790/T



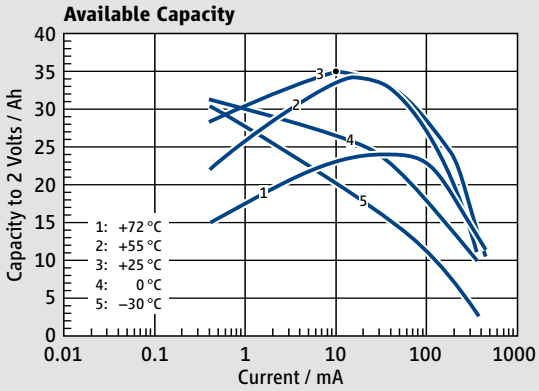
Available Terminations		Catalogue No.
SL-2790/S	Standard	11 2 17901 00
SL-2790/T	Tags	11 2 17902 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

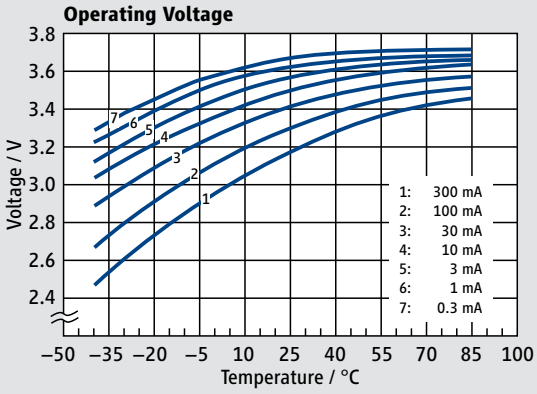
Typical Discharge Curves at +25 °C



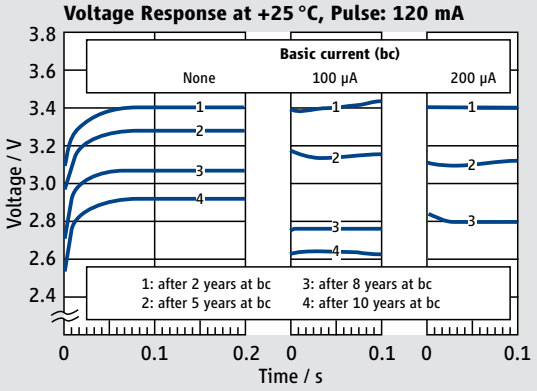
Available Capacity



Operating Voltage



Voltage Response at +25 °C, Pulse: 120 mA



PDC13Eng

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LTC Batteries

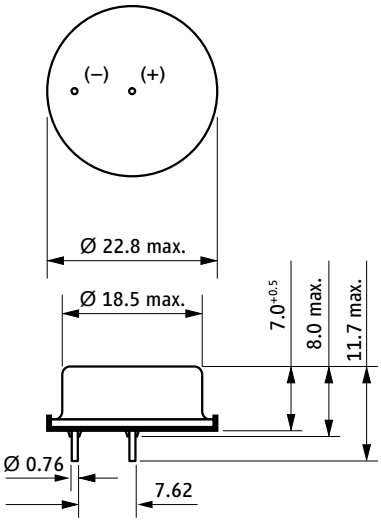
SL-840 Size: BEL

› XOL – extended operating life

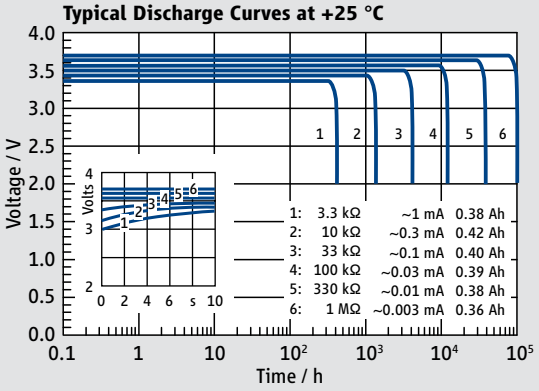
Performance Data
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	0.42 Ah
Nominal current	0.5 mA
Max. continuous discharge current	5 mA
Pulse current capability	10 mA
Anode surface area	2.4 cm^2
Lithium content	0.13 g
Weight	6 g
Volume	2.1 cm^3
Temperature range	–55 °C ... +85 °C

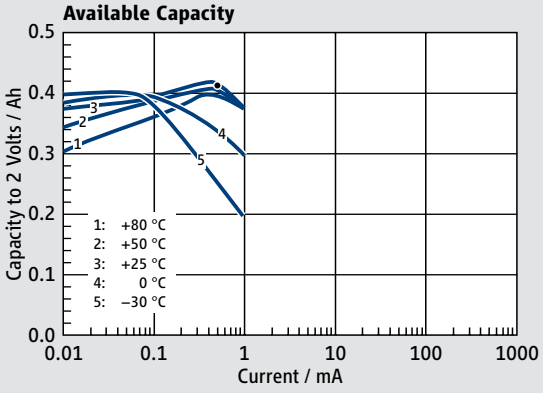
SL-840



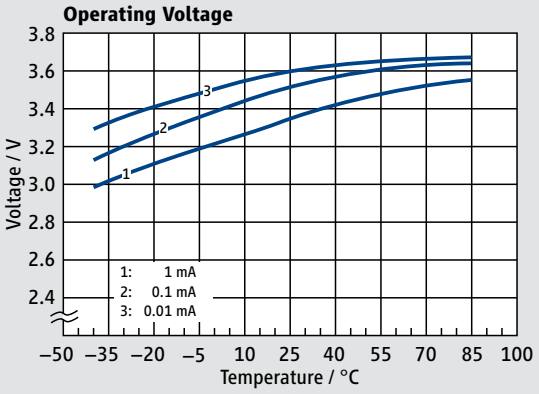
Typical Discharge Curves at +25 °C



Available Capacity



Operating Voltage



Available Terminations		Catalogue No.
SL-840/P	Pins	11 1 18404 00

WARNING:
Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

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PDC13Eng

LTC Batteries

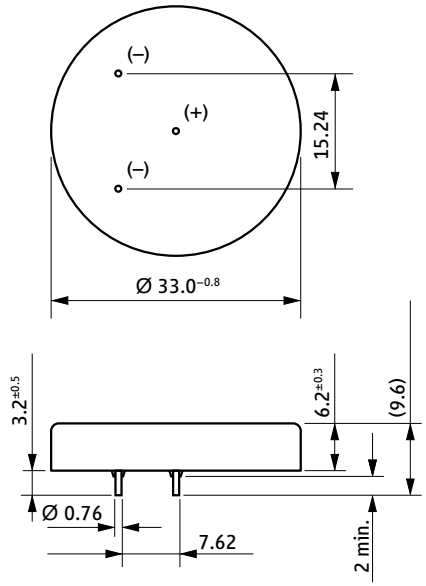
SL-889 Size: 1/10D

› XOL – extended operating life

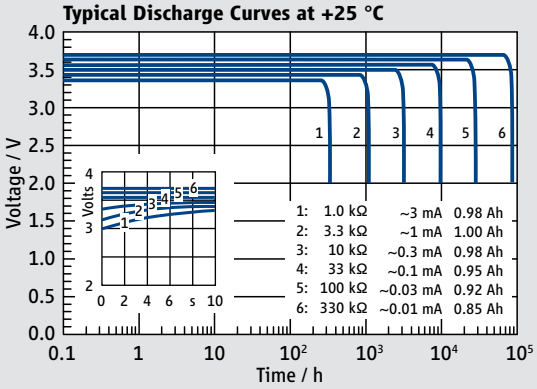
Performance Data
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1 Ah
Nominal current	0.5 mA
Max. continuous discharge current	10 mA
Pulse current capability	20 mA
Anode surface area	7.5 cm^2
Lithium content	0.3 g
Weight	16 g
Volume	5 cm^3
Temperature range	–55 °C ... +85 °C

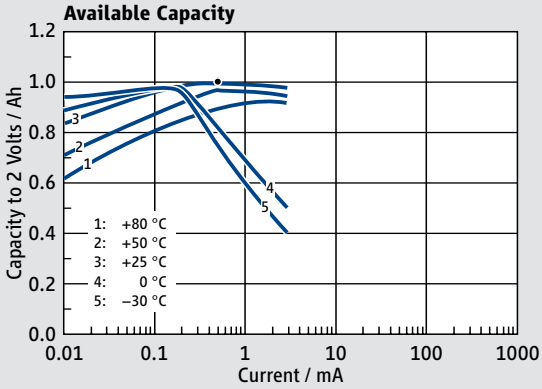
SL-889



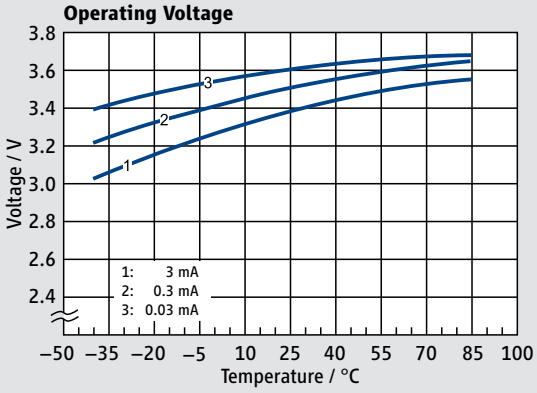
Typical Discharge Curves at +25 °C



Available Capacity



Operating Voltage



Available Terminations		Catalogue No.
SL-889/P	Pins	11 1 18894 00

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PDC13Eng

LTC Batteries

SL-886 Size: 1/6D

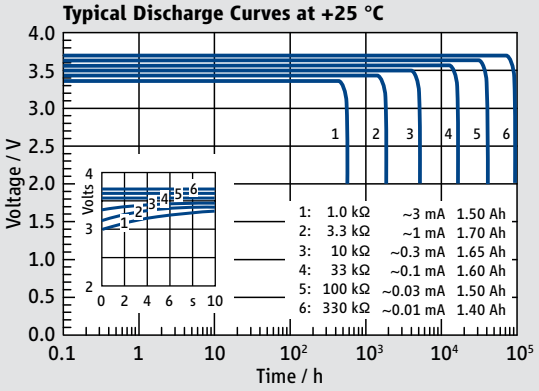
› XOL – extended operating life

Performance Data

(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.7 Ah
Nominal current	0.5 mA
Max. continuous discharge current	10 mA
Pulse current capability	20 mA
Anode surface area	7.5 cm^2
Lithium content	0.5 g
Weight	21 g
Volume	8.2 cm^3
Temperature range	–55 °C ... +85 °C

Typical Discharge Curves at +25 °C



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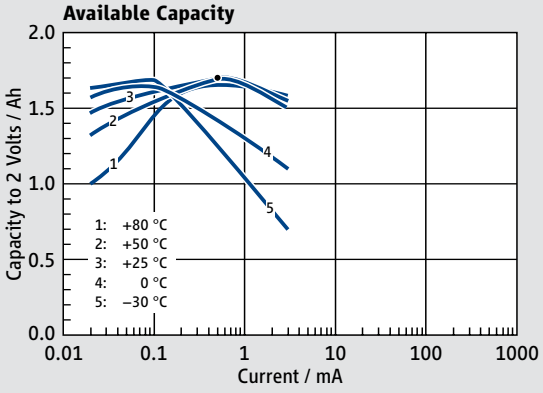
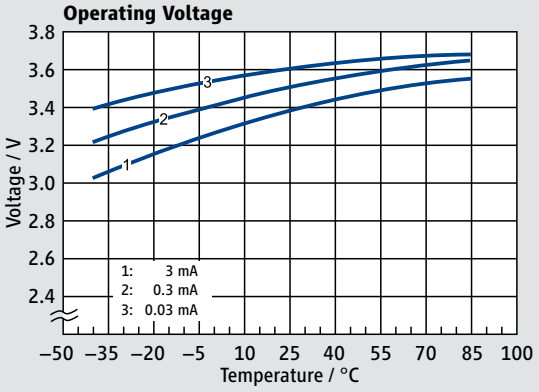
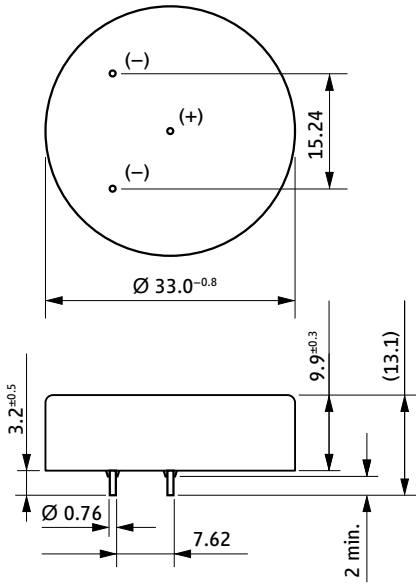


Operating Voltage



SL-886



WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

Available Terminations		Catalogue No.
SL-886/P	Pins	11 1 18864 00

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PDC13Eng

LTC Batteries

SL-850 Size: ½AA

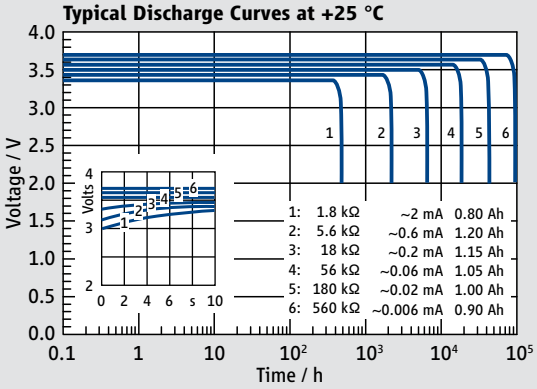
› XOL – extended operating life

Performance Data

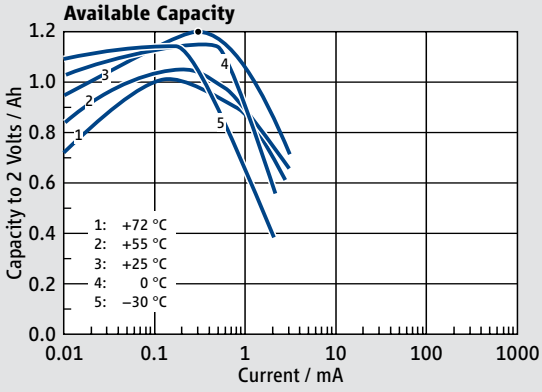
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.2 Ah
Nominal current	0.5 mA
Max. continuous discharge current	20 mA
Pulse current capability	50 mA
Anode surface area	6 cm^2
Lithium content	0.35 g
Weight	9.6 g
Volume	4 cm^3
Temperature range	–55 °C ... +85 °C

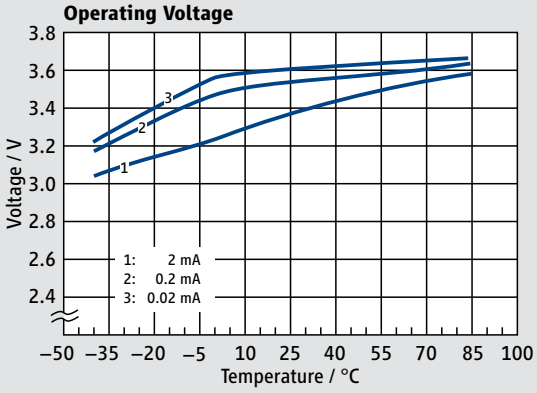
Typical Discharge Curves at +25 °C



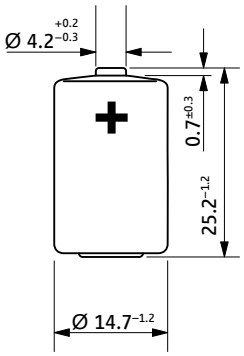
Available Capacity



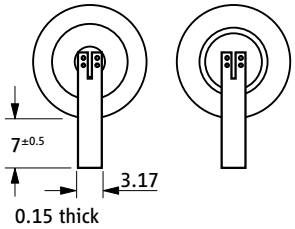
Operating Voltage



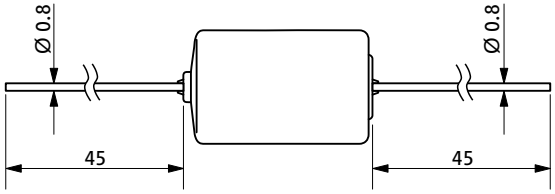
SL-850/S



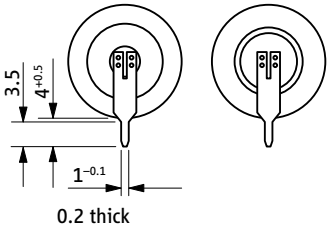
SL-850/T



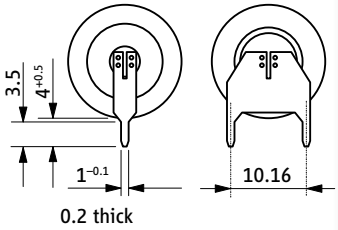
SL-850/P



SL-850/PR



SL-850/PT



Available Terminations		Catalogue No.
SL-850/S	Standard	11 1 08501 00
SL-850/T	Tags	11 1 08502 00
SL-850/P	Pins	11 1 08503 00
SL-850/PR	Pins radial	11 1 08506 00
SL-850/PT	Polarized tags	11 1 08508 00

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PDC13Eng

LTC Batteries

SL-861 Size: 2/3AA

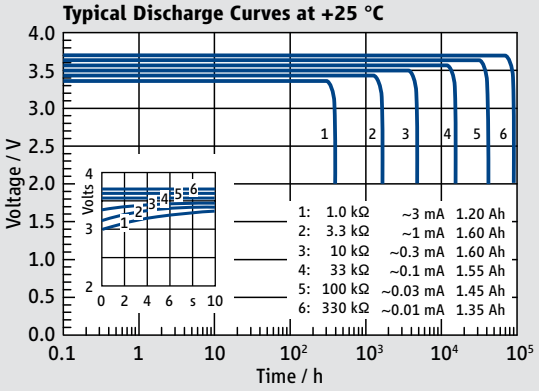
› XOL – extended operating life

Performance Data

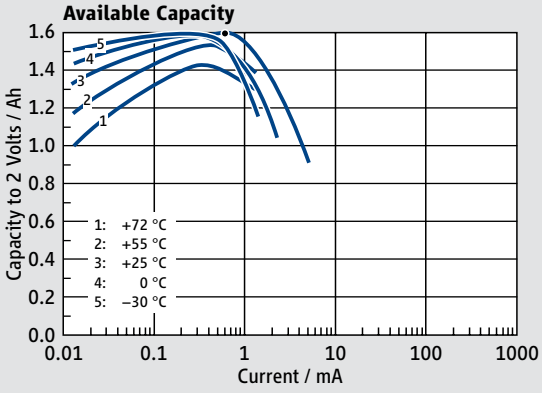
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	1.6 Ah
Nominal current	0.5 mA
Max. continuous discharge current	30 mA
Pulse current capability	75 mA
Anode surface area	9 cm^2
Lithium content	0.5 g
Weight	12.5 g
Volume	5.2 cm^3
Temperature range	–55 °C ... +85 °C

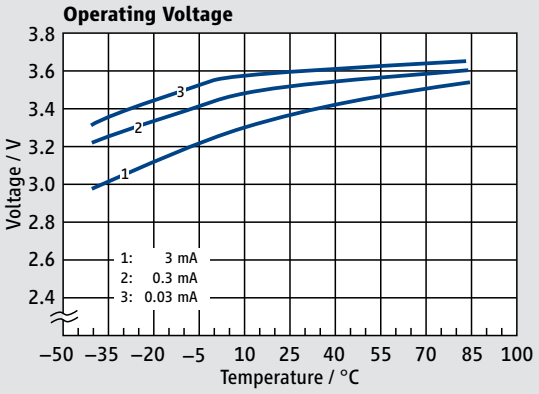
Typical Discharge Curves at +25 °C



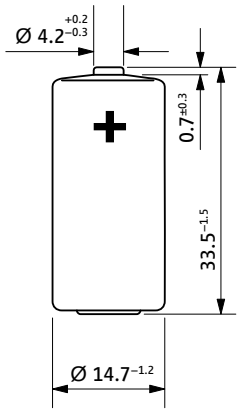
Available Capacity



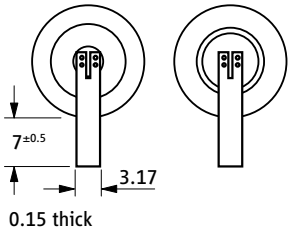
Operating Voltage



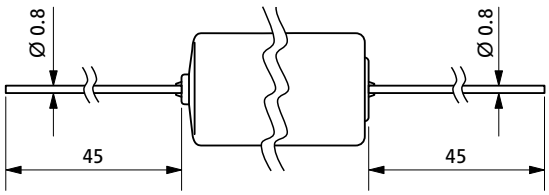
SL-861/S



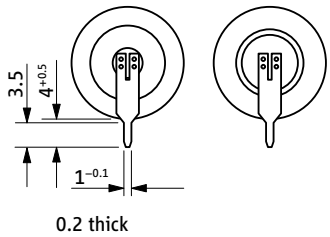
SL-861/T



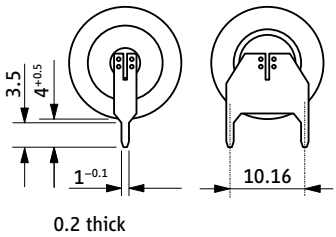
SL-861/P



SL-861/PR



SL-861/PT



Available Terminations		Catalogue No.
SL-861/S	Standard	11 1 08611 00
SL-861/T	Tags	11 1 08612 00
SL-861/P	Pins	11 1 08613 00
SL-861/PR	Pins radial	11 1 08616 00
SL-861/PT	Polarized tags	11 1 08618 00

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PDC13Eng

LTC Batteries

SL-860 Size: AA

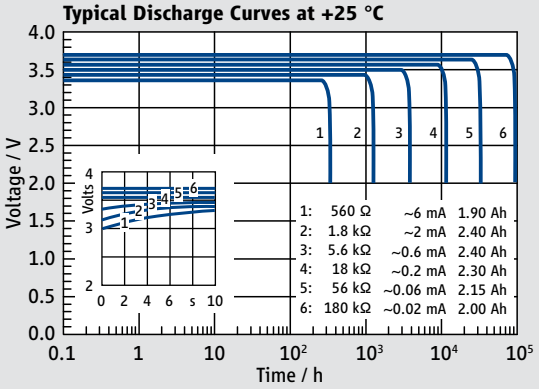
› XOL – extended operating life

Performance Data

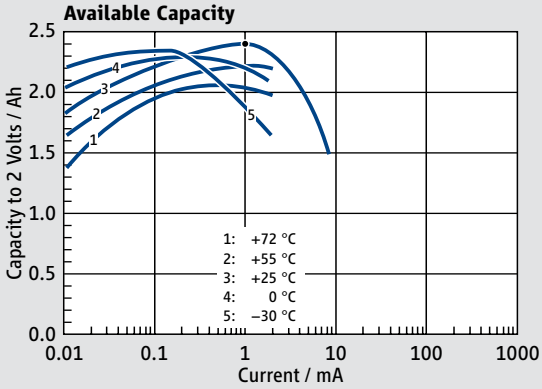
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	2.4 Ah
Nominal current	1 mA
Max. continuous discharge current	60 mA
Pulse current capability	120 mA
Anode surface area	14 cm^2
Lithium content	0.65 g
Weight	18 g
Volume	8 cm^3
Temperature range	–55 °C ... +85 °C

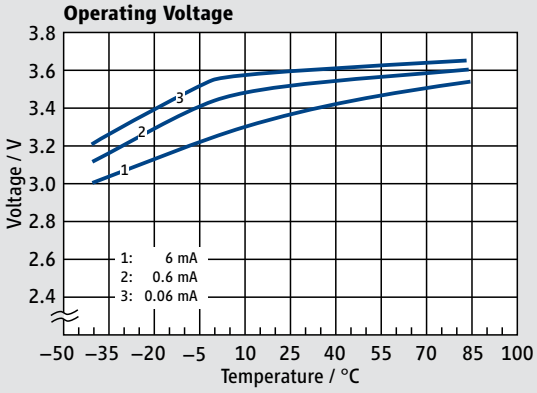
Typical Discharge Curves at +25 °C



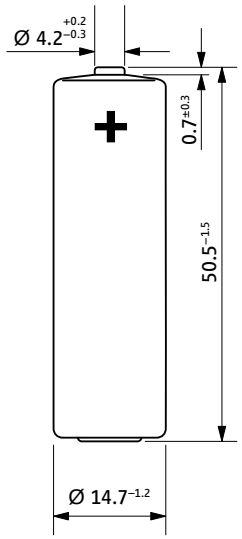
Available Capacity



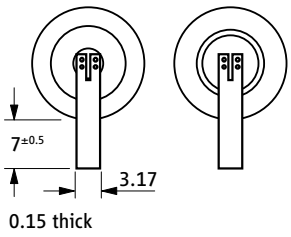
Operating Voltage



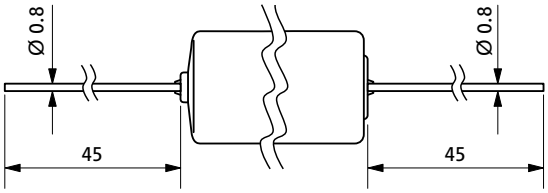
SL-860/S



SL-860/T



SL-860/P



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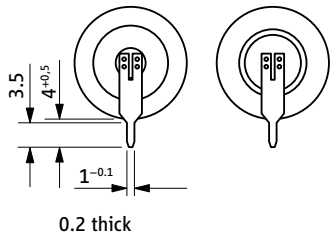
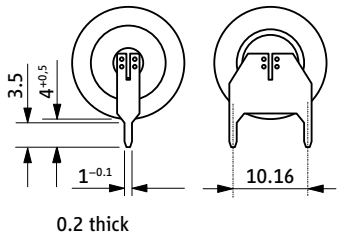


SL-860/PT



Available Terminations		Catalogue No.
SL-860/S	Standard	11 1 08601 00
SL-860/T	Tags	11 1 08602 00
SL-860/P	Pins	11 1 08603 00
SL-860/PR	Pins radial	11 1 08606 00
SL-860/PT	Polarized tags	11 1 08608 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

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LTC Batteries

SL-2870 Size: C

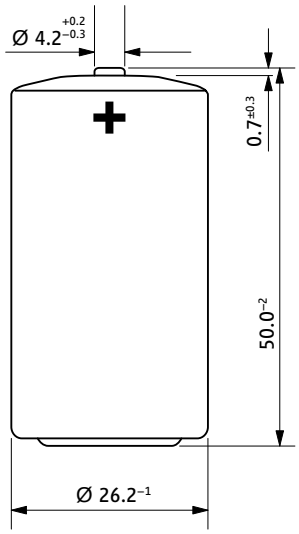
› XOL – extended operating life

Performance Data

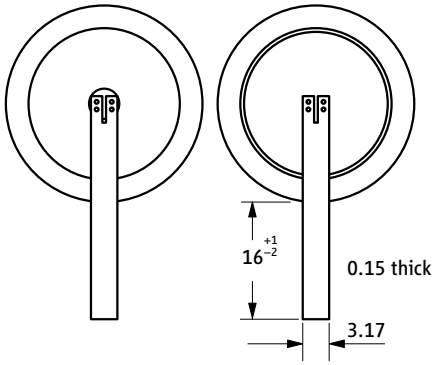
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	8.5 Ah
Nominal current	3 mA
Max. continuous discharge current	75 mA
Pulse current capability	200 mA
Anode surface area	30 cm^2
Lithium content	2.5 g
Weight	49.5 g
Volume	26 cm^3
Temperature range	–55 °C ... +85 °C

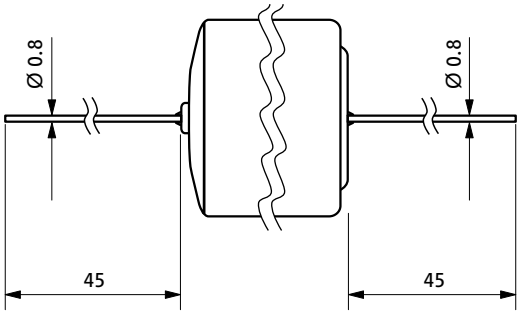
SL-2870/S



SL-2870/T



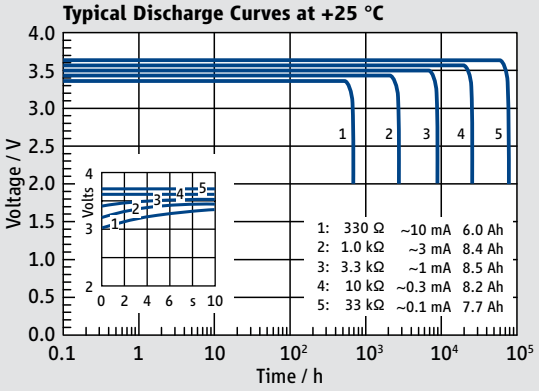
SL-2870/P



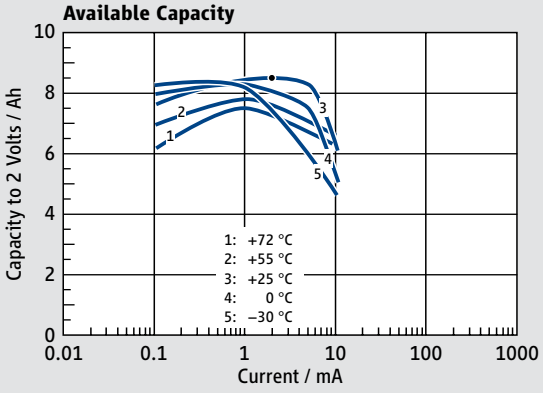
Available Terminations		Catalogue No.
SL-2870/S	Standard	11 2 18701 00
SL-2870/T	Tags	11 2 18702 00
SL-2870/P	Pins	11 2 18703 00

WARNING: Fire, explosion, and severe burn hazard. Do not recharge, disassemble, heat above 100 °C, incinerate, or expose contents to water.

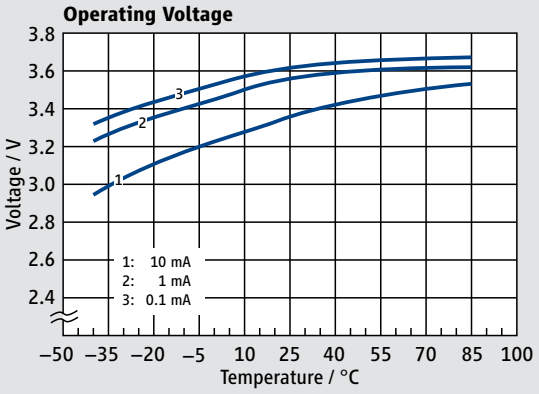
Typical Discharge Curves at +25 °C



Available Capacity



Operating Voltage



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LTC Batteries

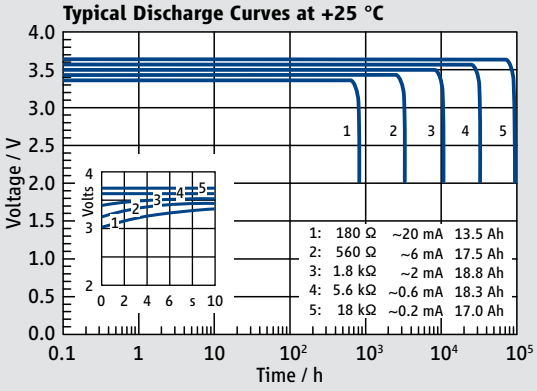
SL-2880 Size: D

› XOL – extended operating life

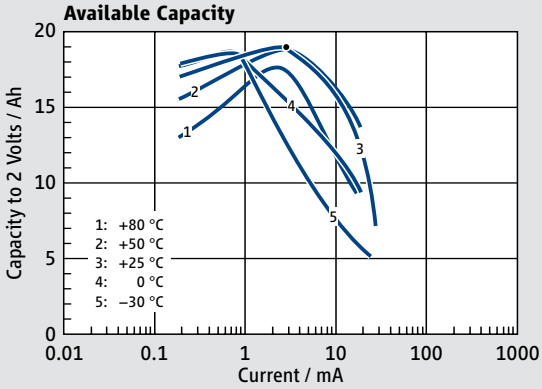
Performance Data
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Thionyl Chloride
Nominal voltage	3.6 V
Nominal capacity	19 Ah
Nominal current	4 mA
Max. continuous discharge current	100 mA
Pulse current capability	250 mA
Anode surface area	45 cm^2
Lithium content	5 g
Weight	93 g
Volume	51 cm^3
Temperature range	–55 °C ... +85 °C

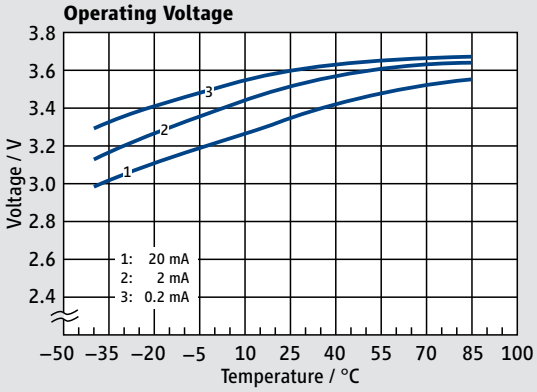
Typical Discharge Curves at +25 °C



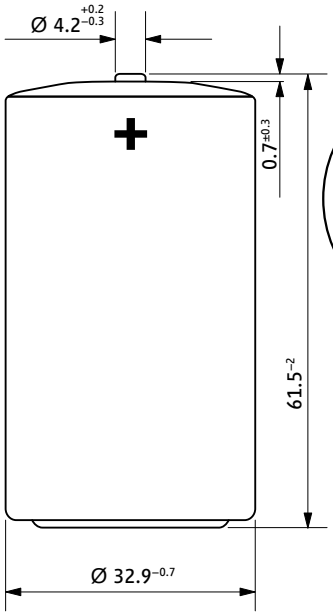
Available Capacity



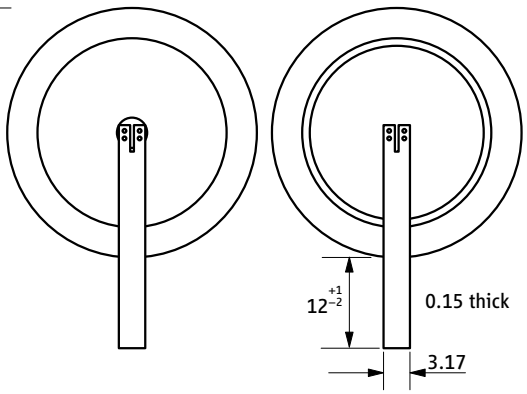
Operating Voltage



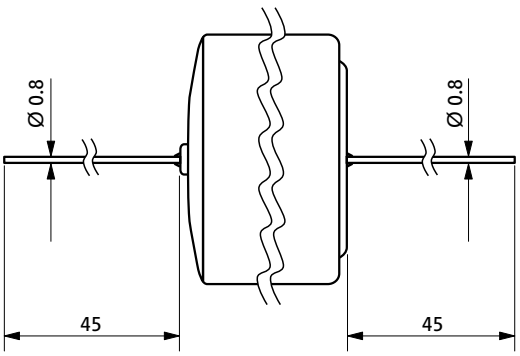
SL-2880/S



SL-2880/T



SL-2880/P



Available Terminations		Catalogue No.
SL-2880/S	Standard	11 2 18801 00
SL-2880/T	Tags	11 2 18802 00
SL-2880/P	Pins	11 2 18803 00

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PulsesPlus™ Batteries

Introduction

The *PulsesPlus*™ battery

The *PulsesPlus*™ battery series was introduced by Tadiran Batteries in order to extend the range of applications for the Lithium Thionyl Chloride (LTC) battery by eliminating the voltage delay, increasing the pulse current capability and minimizing the impedance loss of the battery. A proprietary Hybrid Layer Capacitor (HLC) was developed for this purpose. A *PulsesPlus*™ battery is formed by connecting one or more primary lithium thionyl chloride batteries in parallel with one or more HLCs.

The Hybrid Layer Capacitor

This HLC is a secondary element. Its electrodes comprise Lithium Intercalated Compounds and are spirally wound. The HLC has been optimized with respect to self discharge, temperature range and durability by carefully selecting the material properties of the electrodes and the hermetical glass to metal seal.

Performance

As a result, the *PulsesPlus*™ battery outperforms conventional high rate lithium batteries such as lithium sulphur dioxide (Li/SO_2) batteries, lithium manganese dioxide (Li/MnO_2) batteries as well as spirally wound lithium thionyl chloride ($Li/SOCl_2$) batteries. Compared to these battery systems, *PulsesPlus*™ batteries deliver higher voltage and higher capacity. These batteries also offer unmatched service life due to their extremely low self-discharge.

Advantages

The performance advantages of the *PulsesPlus*™ battery include:

- Higher voltage – 3.6 V versus 3.0 V
- Higher capacity – e.g. 19 Ah for D size cell (versus 7 Ah for other Lithium batteries)
- Lower self discharge – less than 1 % per year (versus 5 % per year with spiral wound)
- Lower impedance (internal resistance)
- High pulse current capability
- No passivation effect
- High reliability (hermetic laser sealing, glass-to-metal seal)
- Widest operating temperature – –40 °C to +85 °C (versus 0 °C to +60 °C)
- Greater safety, UL registration of the component cells

No impedance loss

The *PulsesPlus*™ battery overcomes the impedance loss which occurs when an LTC battery is used to deliver high pulse currents over a long time. This effect is demonstrated in figure 1 where a D-size cell was discharged under a continuous load of ~50 µA and short pulses of 150 mA.

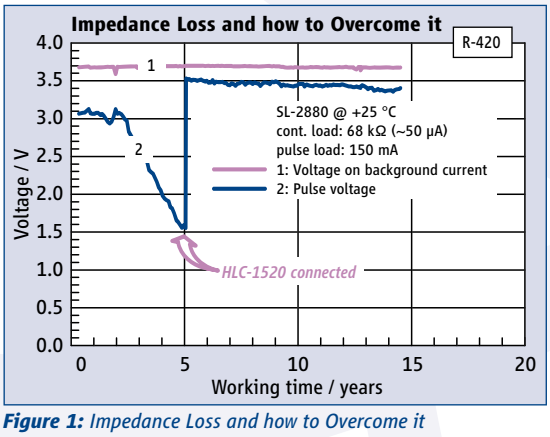

Figure 1: *Impedance Loss and how to Overcome it*

The battery is able to deliver this current at a voltage level of 3 Volts, at least for a period of 2 years. From the low average current draw of 50 µA, one would be misled to assume that the battery could continue to deliver these pulse currents for more than 10 or 20 years.

However, after 2 years, the voltage level under pulse load starts to decline reaching as low as 1.5 Volts after 5 years. At this voltage level, most applications would stop to work and the battery would be considered as discharged. However, it is not, as can be seen from the red curve showing the battery voltage under background load. It stays at 3.6 Volts, even after 5 and 10 years. Connecting Tadiran's Hybrid Layer Capacitor (HLC) in parallel solves the problem. The HLC maintains its low internal resistance throughout the remaining battery life. Meanwhile, the test has been continued and battery life has reached more than 14 years. The pulse voltage stayed above 3.4 Volts during this time period.

Application in GSM modules

One major application for *PulsesPlus*™ batteries is in GSM communication modules for data exchange. GSM is the global system for mobile communication also used for mobile phones. The GSM network uses a multiplexing technology called time division multiple access (TDMA) in order to provide multiple communication channels with the same signal, dividing it into 8 time slots. A typical TDMA transmission requires a basic current of 150 mA and a pulse current of 2 A for 577 µs every 4.615 ms. Figure 2 shows the voltage behaviour of a *PulsesPlus*™ battery with one HLC-1550A under these conditions at various temperature levels between –40 °C and +25 °C. The chart shows two curves for each temperature level. The upper curve corresponds to the voltage level under the background current of 150 mA while the lower curve corresponds to the voltage level under the peak current of 2 A. Curves at higher temperatures are not shown but can be considered to lie slightly above the curves for +25 °C.

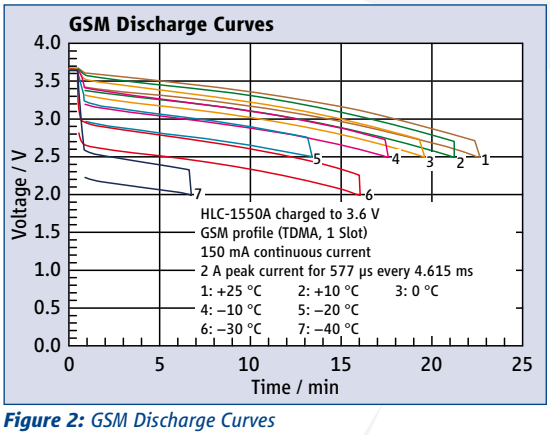

Figure 2: *GSM Discharge Curves*

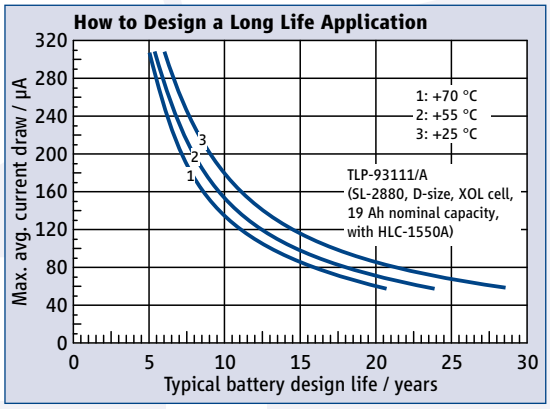

Figure 3: *How to Design a Long Life Application*

Extremely low self discharge

The *PulsesPlus*™ battery can be used where 20 years of continuous power are required for applications including GSM and radio modules. This is due to the stability of both Tadiran's primary LTC battery and the HLC with respect to the sealing system, the internal resistance, and the self-discharge.

Fit for 20 years of life

Figure 3 shows the maximum average current draw of a TLP-93111/A *PulsesPlus*™ battery as a function of the design life of the battery. This battery will typically deliver 20 years operation life when the average current is not more than 87.5 µA at +25 °C. Under these conditions, the accumulated self discharge loss of the battery is less than 15 % during its operating life. As a result it is fair to say that Tadiran's *PulsesPlus*™ battery is the smallest and most cost effective battery for a 20 year stand alone power supply.

Variable design

PulsesPlus™ batteries can be assembled in a great variety of combinations. The primary cell can be selected from Tadiran's large range of 3.6 Volt LTC batteries. A special range of LSC (Lithium Sulphuryl Chloride) cells with a nominal voltage of 3.9 Volts is also available, often allowing a more economic approach where equipment needs to operate at very low temperatures. Each of these primary cells can be combined with one or more HLCs from a range of four sizes. Series and parallel combinations of more primary cells extend the voltage range and capacity range where necessary. Only a few standard combinations can be shown in this catalogue. Contact Tadiran for a customized application proposal.

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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

TLP-91111/A

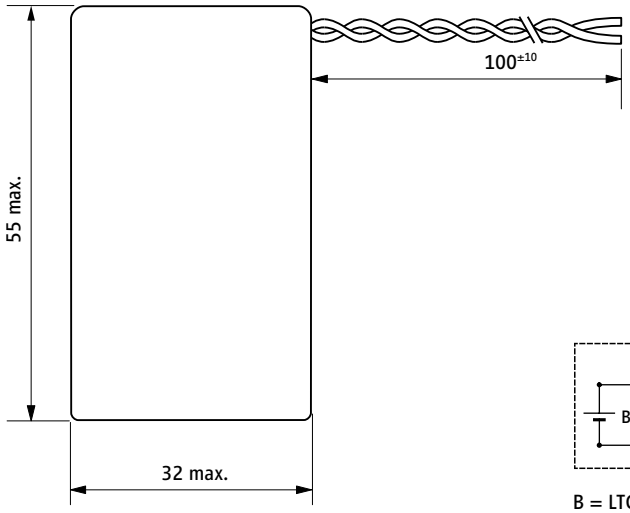
- High energy
- Up to 3 A pulse capability
- Instant voltage response
- No passivation effect

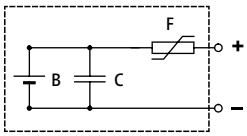
Performance Data

(Typical values for batteries stored at +25 °C for one year)

System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	2.4 Ah
Nominal current	2 mA
Max. 1 s pulse to 3 V	3 A
Max. pulse length @ 0.5 A to 2.8 V	1000 s
Delay time to 3 V @ 0.5 A	none
Weight	55 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	87 %

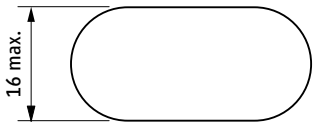
TLP-91111/A/SM





B = LTC battery
C = HLC
F = PTC (optional)

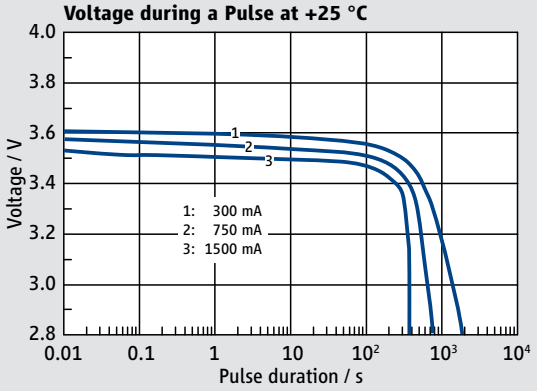
Both the LTC battery and the HLC are UL recognized.



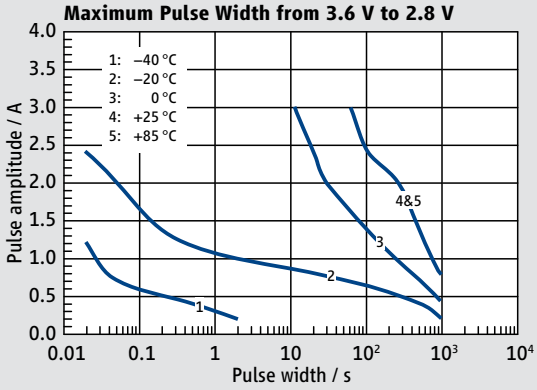
WARNING:
Risk of fire or explosion. Do not charge, incinerate, disassemble, heat above 100 °C, or expose contents to water.

Available Terminations		Catalogue No.
TLP-91111/A/SM	Flying leads	17 91111 101

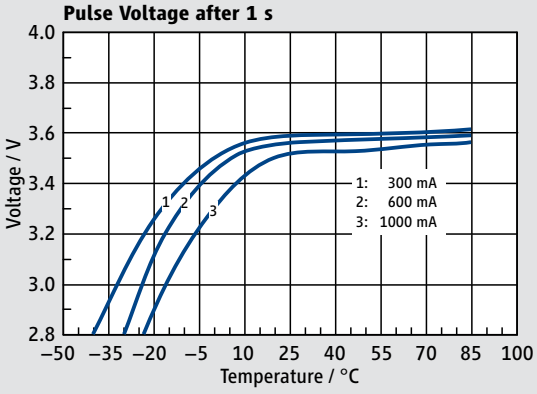
Voltage during a Pulse at +25 °C



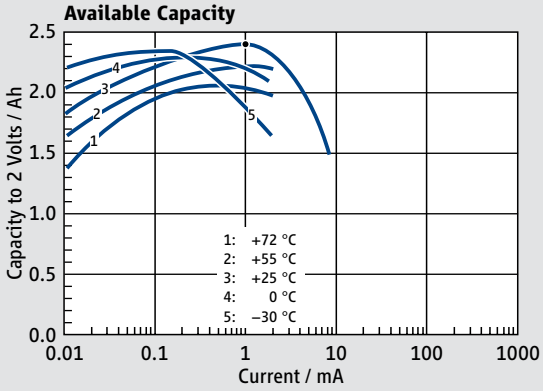
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

TLP-91311/A

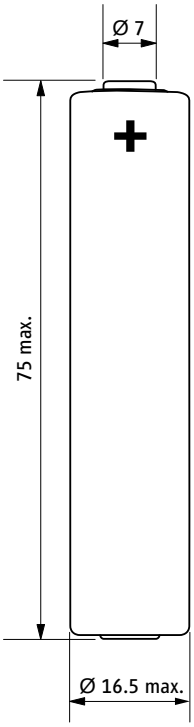
- High energy
- Up to 1 A pulse capability
- Instant voltage response
- No passivation effect

Performance Data

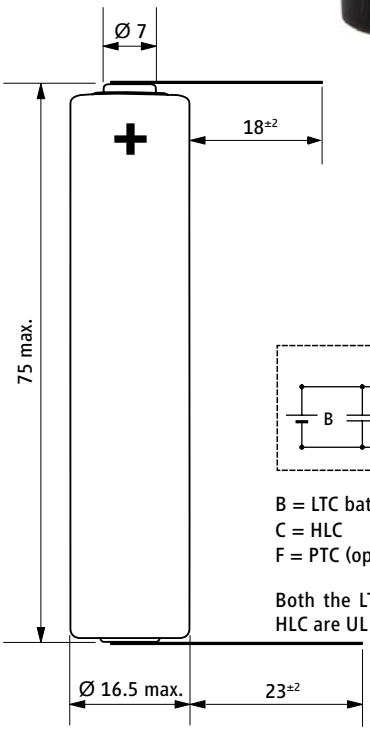
(Typical values for batteries stored at +25 °C for one year)

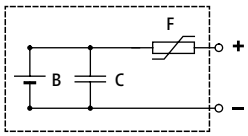
System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	2.4 Ah
Nominal current	2 mA
Max. 1 s pulse to 3 V	1 A
Max. pulse length @ 0.125 A to 2.8 V	1000 s
Delay time to 3 V @ 0.125 A	none
Weight	40 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	90 %

TLP-91311/A/SM



TLP-91311/A/ST

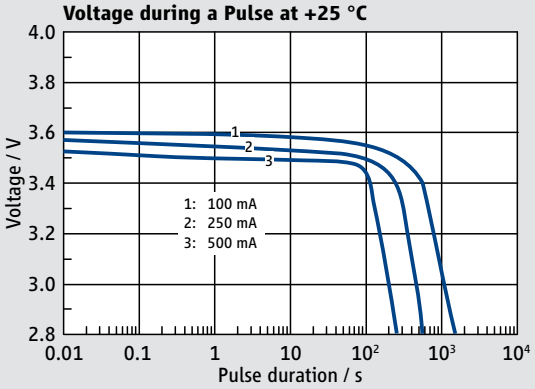




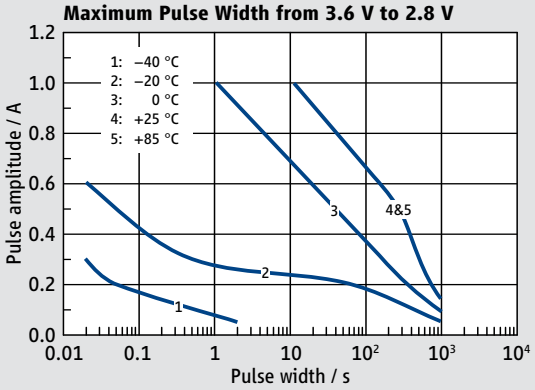
B = LTC battery
C = HLC
F = PTC (optional)

Both the LTC battery and the HLC are UL recognized.

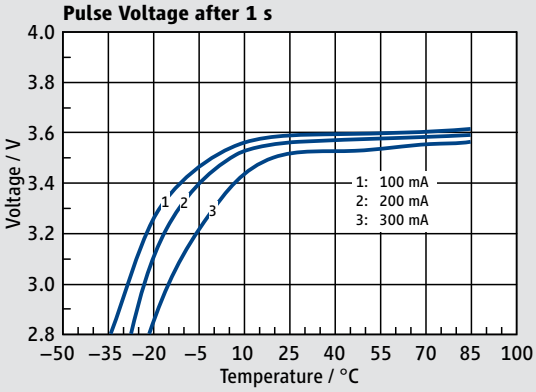
Voltage during a Pulse at +25 °C



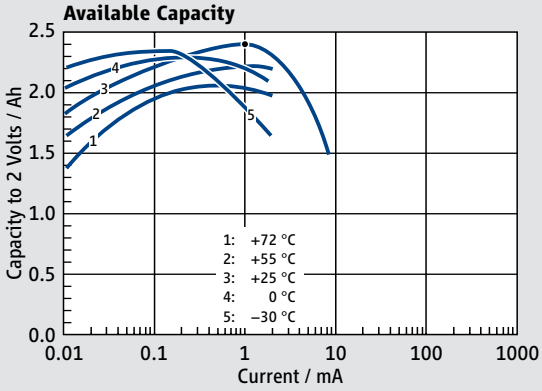
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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Available Terminations		Catalogue No.
TLP-91311/A/SM	Pressure contacts	17 91311 101
TLP-91311/A/ST	Solder tags	17 91311 102

WARNING:
Do not charge. Battery can explode if disassembled, heated above 100 °C, incinerated, or contents exposed to water.

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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

TLP-92111/A

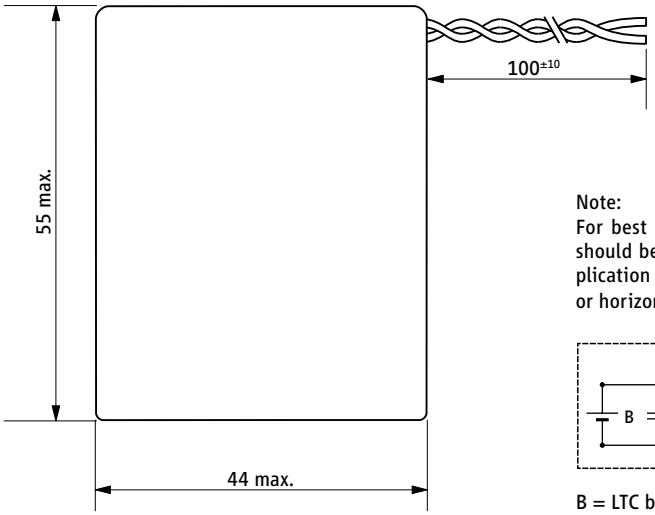
- High energy
- Up to 3 A pulse capability
- Instant voltage response
- No passivation effect

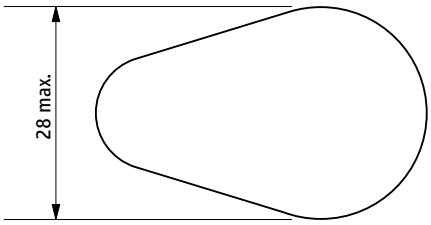
Performance Data

(Typical values for batteries stored at +25 °C for one year)

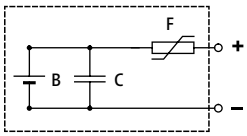
System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	8.5 Ah
Nominal current	3 mA
Max. 1 s pulse to 3 V	3 A
Max. pulse length @ 0.5 A to 2.8 V	1000 s
Delay time to 3 V @ 0.5 A	none
Weight	100 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	93 %

TLP-92111/A/SM





Note:
For best performance battery should be mounted in the application in upright or horizontal orientation.



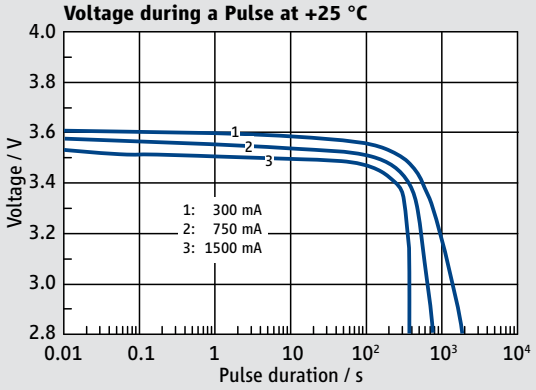
B = LTC battery
C = HLC
F = PTC (optional)

Both the LTC battery and the HLC are UL recognized.

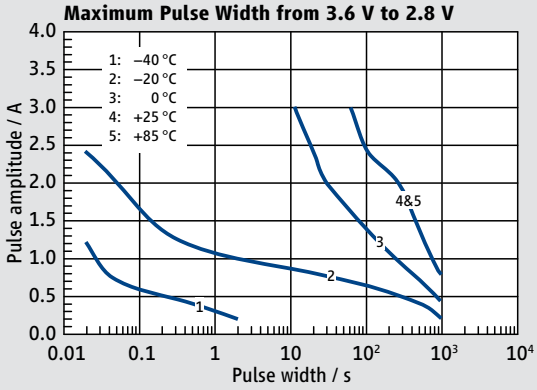
WARNING:
Risk of fire or explosion. Do not charge, incinerate, disassemble, heat above 100 °C, or expose contents to water.

Available Terminations		Catalogue No.
TLP-92111/A/SM	Flying leads	17 92111 101

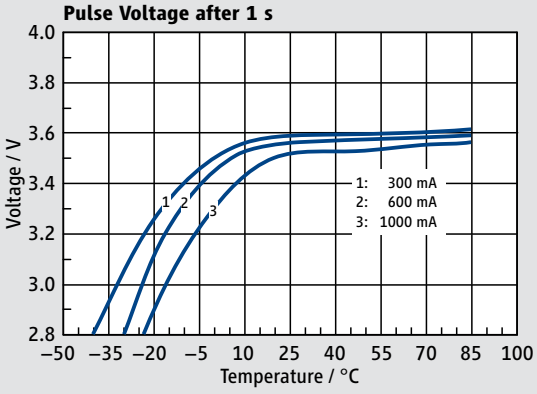
Voltage during a Pulse at +25 °C



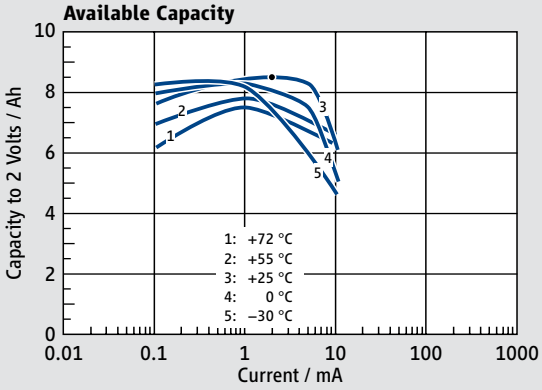
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

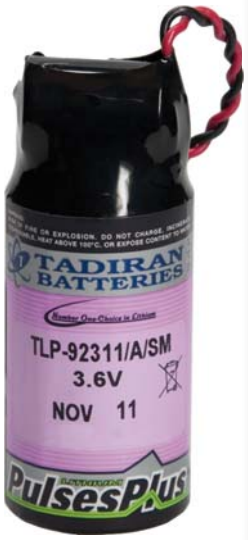
TLP-92311/A

- High energy
- Up to 1 A pulse capability
- Instant voltage response
- No passivation effect

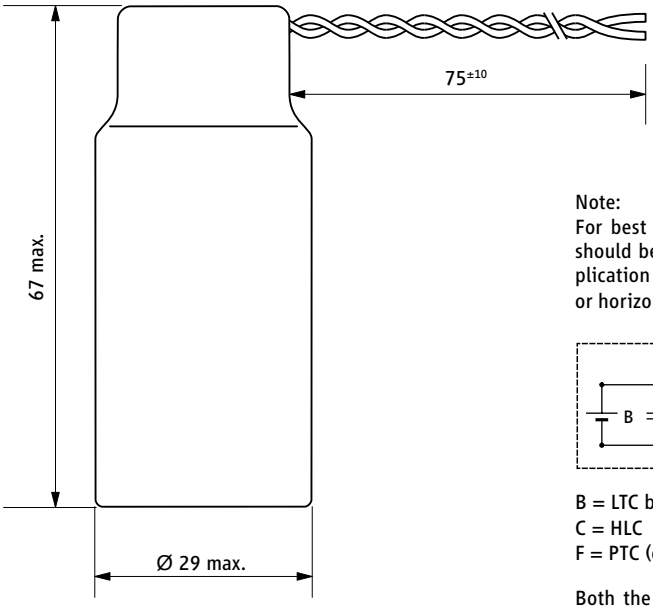
Performance Data

(Typical values for batteries stored at +25 °C for one year)

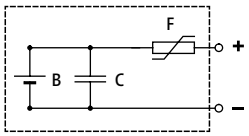
System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	8.5 Ah
Nominal current	3 mA
Max. 1 s pulse to 3 V	1 A
Max. pulse length @ 0.125 A to 2.8 V	1000 s
Delay time to 3 V @ 0.125 A	none
Weight	80 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	93 %



TLP-92311/A/SM



Note:
For best performance battery should be mounted in the application in upright or horizontal orientation.

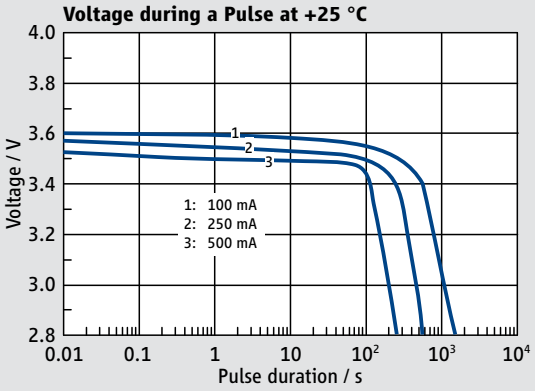


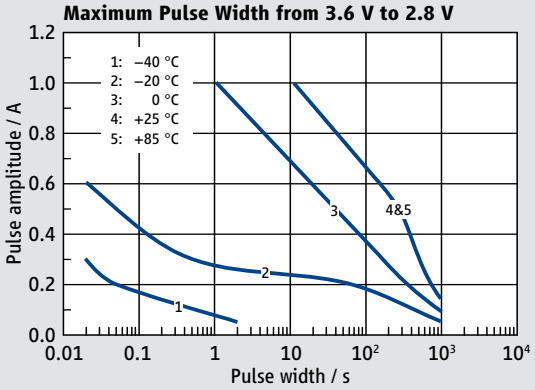
B = LTC battery
C = HLC
F = PTC (optional)

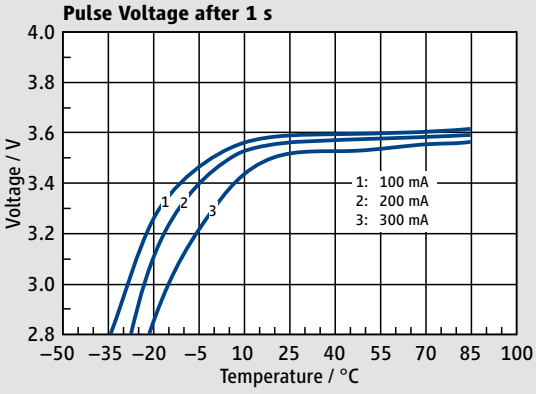
Both the LTC battery and the HLC are UL recognized.

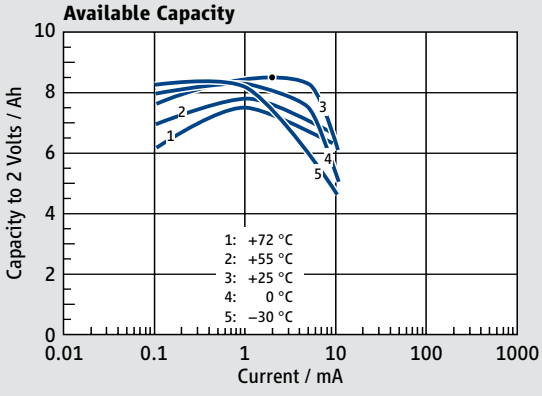
WARNING:
Risk of fire or explosion. Do not charge, incinerate, disassemble, heat above 100 °C, or expose contents to water.

Available Terminations		Catalogue No.
TLP-92311/A/SM	Flying leads	17 92311 101









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PulsesPlus™ LITHIUM

TLP-93111/A

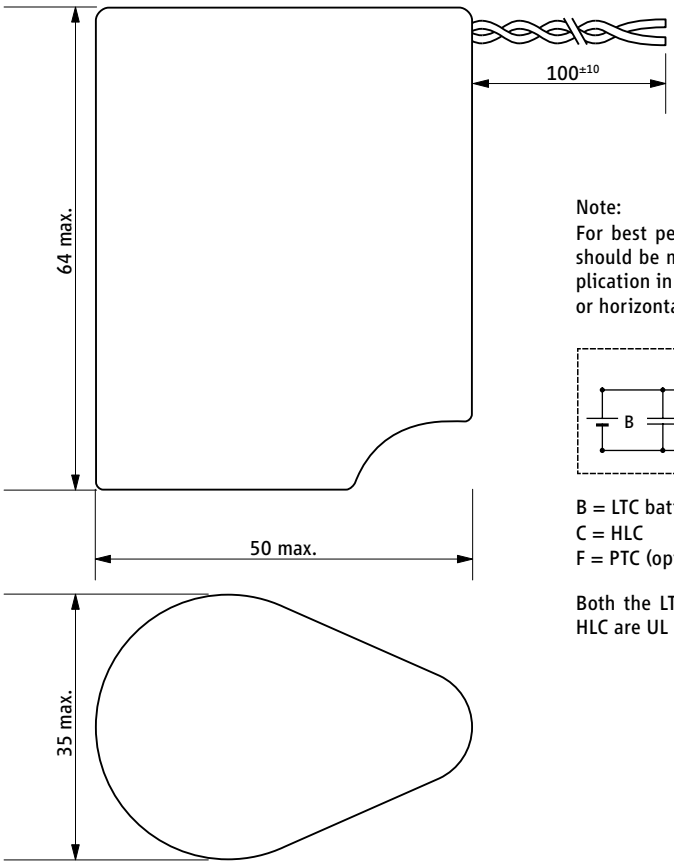
- High energy
- Up to 3 A pulse capability
- Instant voltage response
- No passivation effect

Performance Data

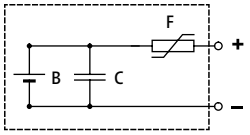
(Typical values for batteries stored at +25 °C for one year)

System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	19 Ah
Nominal current	4 mA
Max. 1 s pulse to 3 V	3 A
Max. pulse length @ 0.5 A to 2.8 V	1000 s
Delay time to 3 V @ 0.5 A	none
Weight	140 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	96 %

TLP-93111/A/SM



Note:
For best performance battery should be mounted in the application in upright or horizontal orientation.



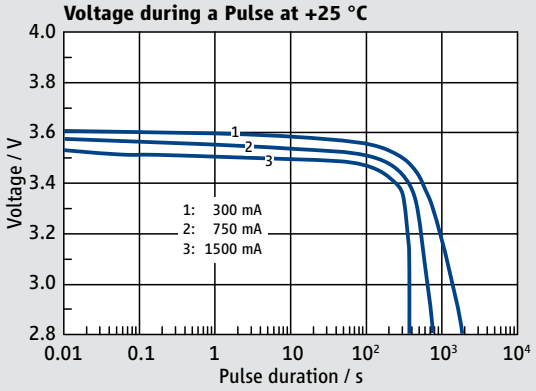
B = LTC battery
C = HLC
F = PTC (optional)

Both the LTC battery and the HLC are UL recognized.

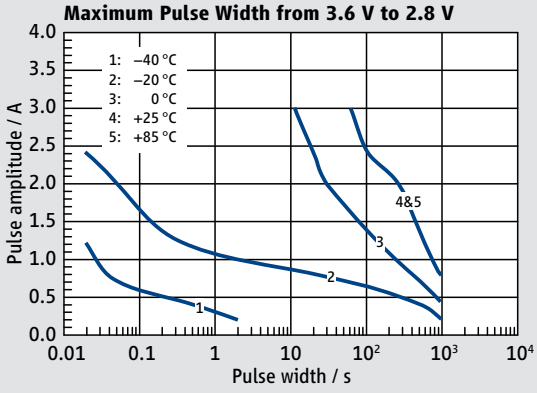
WARNING:
Risk of fire or explosion. Do not charge, incinerate, disassemble, heat above 100 °C, or expose contents to water.

Available Terminations		Catalogue No.
TLP-93111/A/SM	Flying leads	17 93111 101

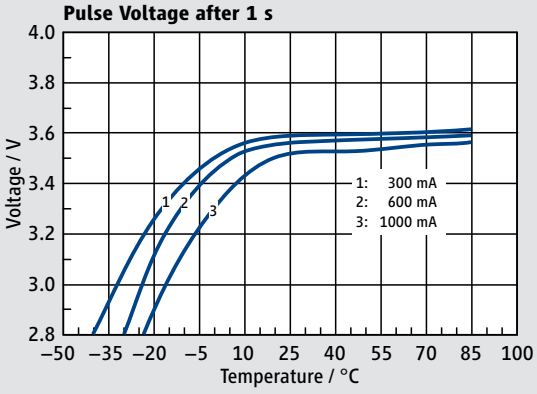
Voltage during a Pulse at +25 °C



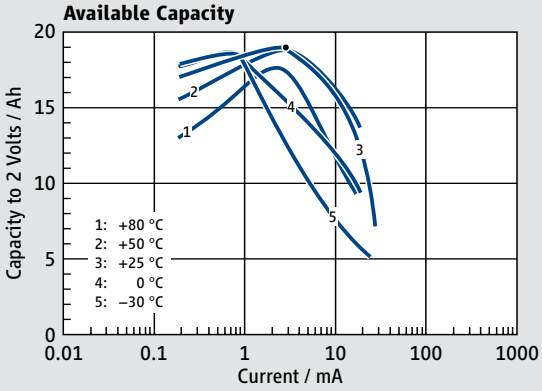
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

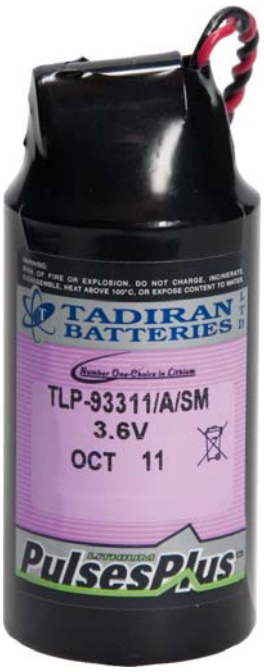
TLP-93311/A

- High energy
- Up to 1 A pulse capability
- Instant voltage response
- No passivation effect

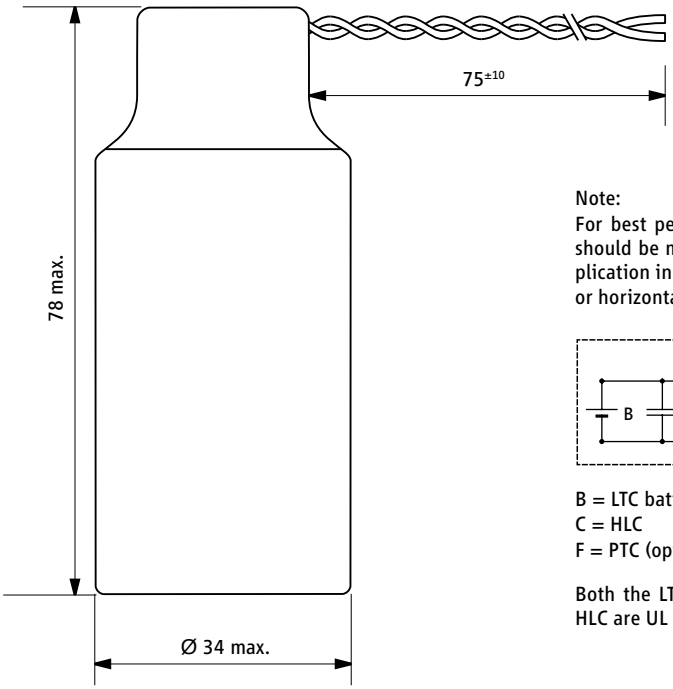
Performance Data

(Typical values for batteries stored at +25 °C for one year)

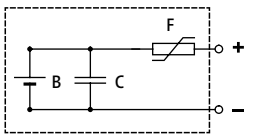
System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	19 Ah
Nominal current	4 mA
Max. 1 s pulse to 3 V	1 A
Max. pulse length @ 0.125 A to 2.8 V	1000 s
Delay time to 3 V @ 0.125 A	none
Weight	120 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	96 %



TLP-93311/A/SM



Note:
For best performance battery should be mounted in the application in upright or horizontal orientation.



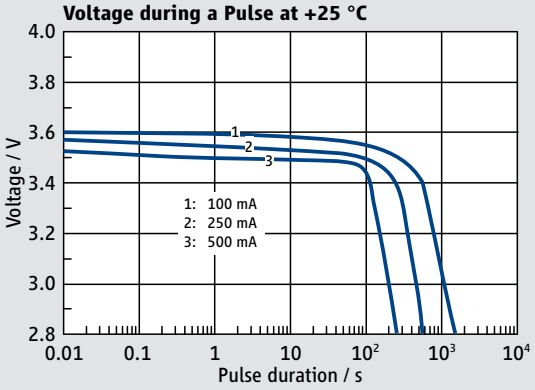
B = LTC battery
C = HLC
F = PTC (optional)

Both the LTC battery and the HLC are UL recognized.

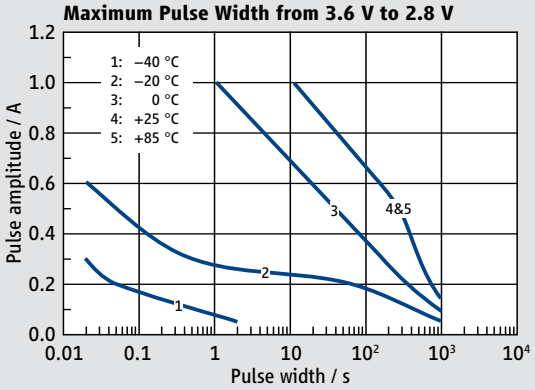
WARNING:
Risk of fire or explosion. Do not charge, incinerate, disassemble, heat above 100 °C, or expose contents to water.

Available Terminations		Catalogue No.
TLP-93311/A/SM	Flying leads	17 93311 101

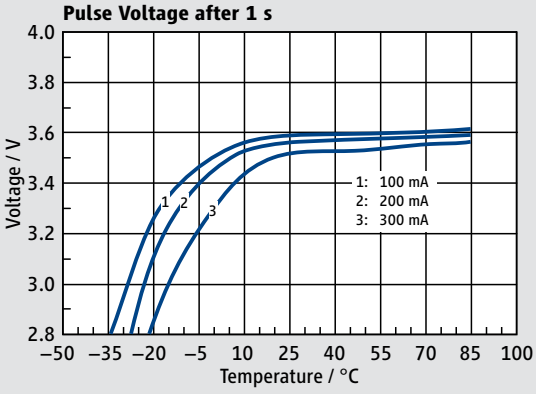
Voltage during a Pulse at +25 °C



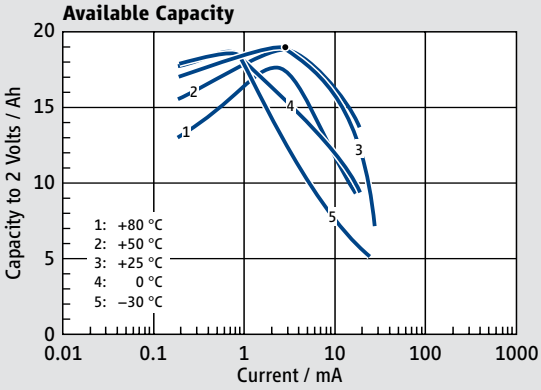
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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TADIRAN BATTERIES

TLP-96111/A

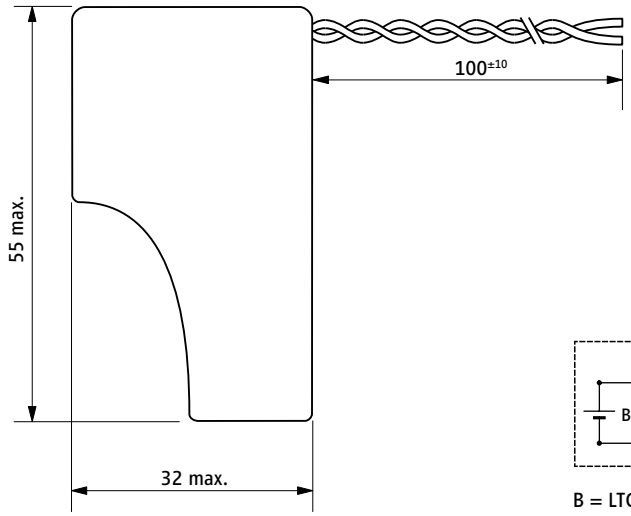
- High energy
- Up to 3 A pulse capability
- Instant voltage response
- No passivation effect

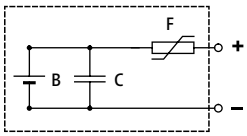
Performance Data

(Typical values for batteries stored at +25 °C for one year)

System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	1.2 Ah
Nominal current	0.6 mA
Max. 1 s pulse to 3 V	3 A
Max. pulse length @ 0.5 A to 2.8 V	1000 s
Delay time to 3 V @ 0.5 A	none
Weight	45 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	78 %

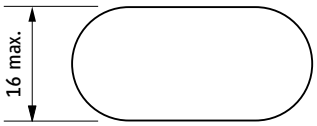
TLP-96111/A/SM





B = LTC battery
C = HLC
F = PTC (optional)

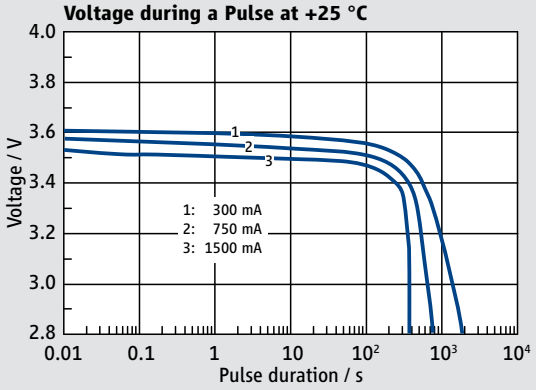
Both the LTC battery and the HLC are UL recognized.



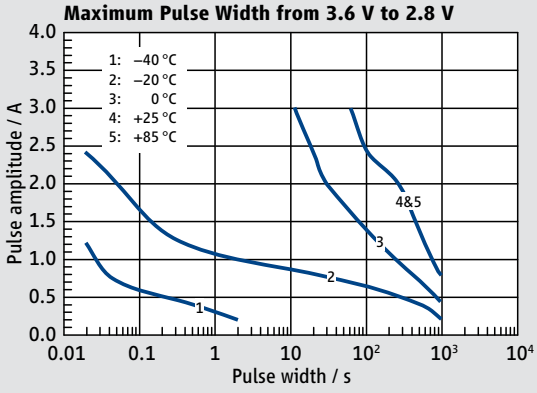
WARNING:
Risk of fire or explosion. Do not charge, incinerate, disassemble, heat above 100 °C, or expose contents to water.

Available Terminations		Catalogue No.
TLP-96111/A/SM	Flying leads	17 96111 101

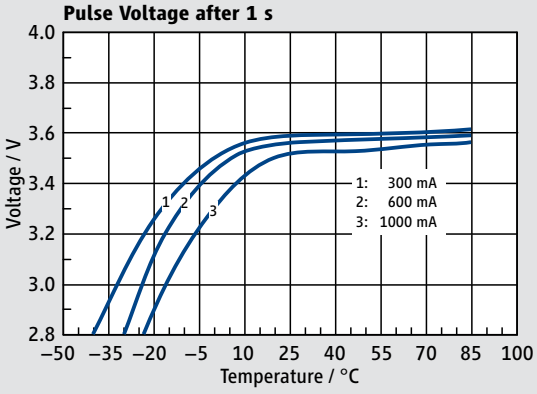
Voltage during a Pulse at +25 °C



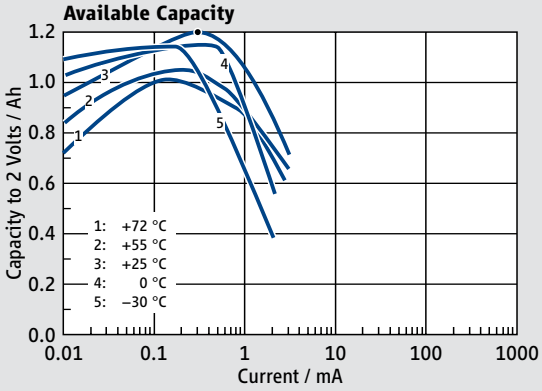
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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TADIRAN BATTERIES

TLP-96311/A

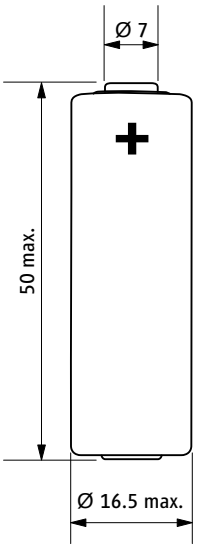
- High energy
- Up to 1 A pulse capability
- Instant voltage response
- No passivation effect

Performance Data

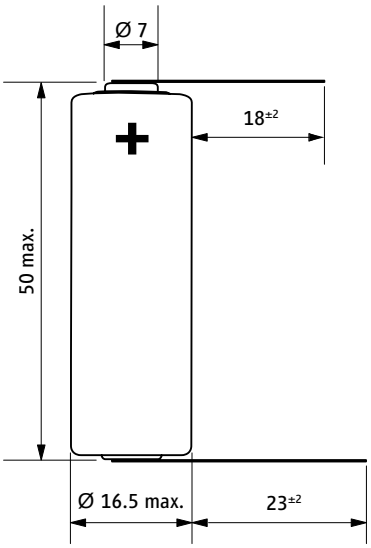
(Typical values for batteries stored at +25 °C for one year)

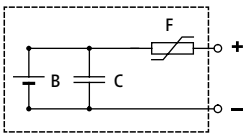
System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	1.2 Ah
Nominal current	0.6 mA
Max. 1 s pulse to 3 V	1 A
Max. pulse length @ 0.125 A to 2.8 V	1000 s
Delay time to 3 V @ 0.125 A	none
Weight	30 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	83 %

TLP-96311/A/SM



TLP-96311/A/ST





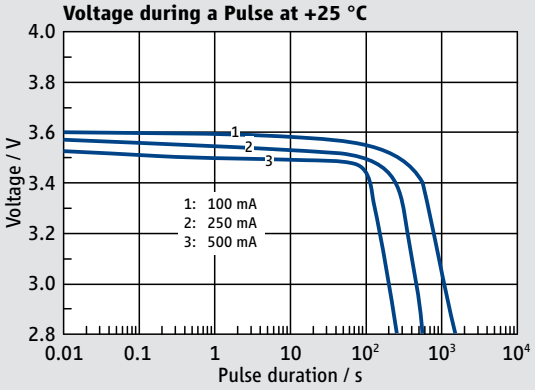
B = LTC battery
C = HLC
F = PTC (optional)

Both the LTC battery and the HLC are UL recognized.

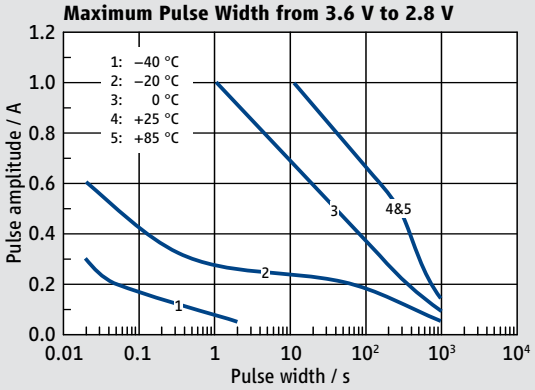
WARNING:
Do not charge. Battery can explode if disassembled, heated above 100 °C, incinerated, or contents exposed to water.

Available Terminations		Catalogue No.
TLP-96311/A/SM	Pressure contacts	17 96311 101
TLP-96311/A/ST	Solder tags	17 96311 102

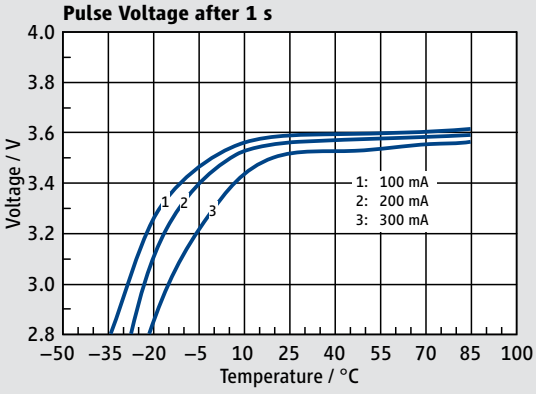
Voltage during a Pulse at +25 °C



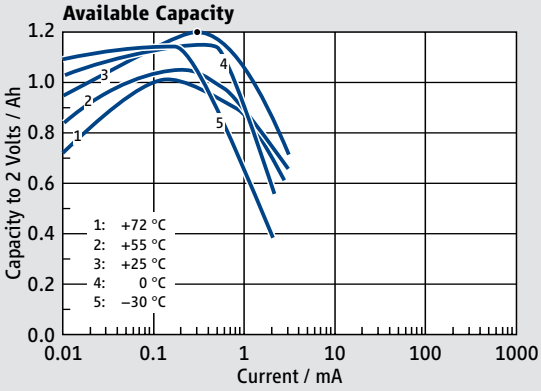
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

TLP-97111/A

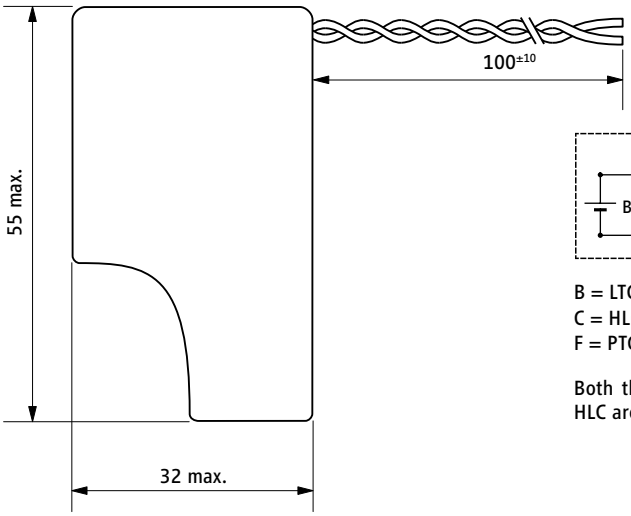
- High energy
- Up to 3 A pulse capability
- Instant voltage response
- No passivation effect

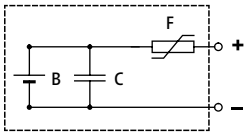
Performance Data

(Typical values for batteries stored at +25 °C for one year)

System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	1.6 Ah
Nominal current	1 mA
Max. 1 s pulse to 3 V	3 A
Max. pulse length @ 0.5 A to 2.8 V	1000 s
Delay time to 3 V @ 0.5 A	none
Weight	45 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	80 %

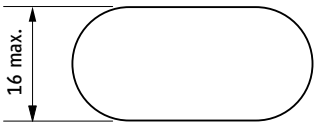
TLP-97111/A/SM





B = LTC battery
C = HLC
F = PTC (optional)

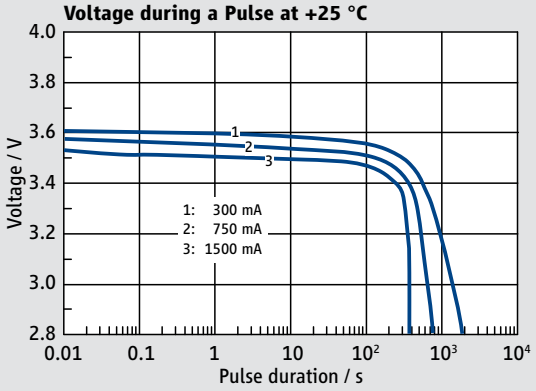
Both the LTC battery and the HLC are UL recognized.



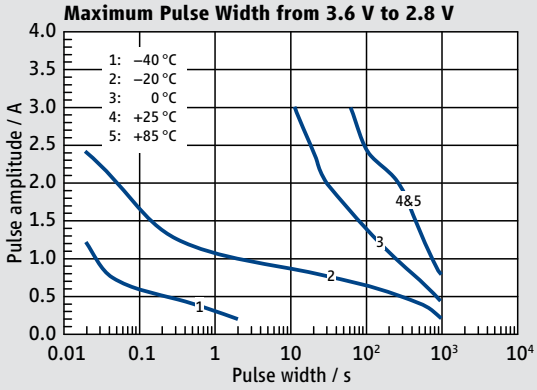
WARNING:
Risk of fire or explosion. Do not charge, incinerate, disassemble, heat above 100 °C, or expose contents to water.

Available Terminations		Catalogue No.
TLP-97111/A/SM	Flying leads	17 97111 101

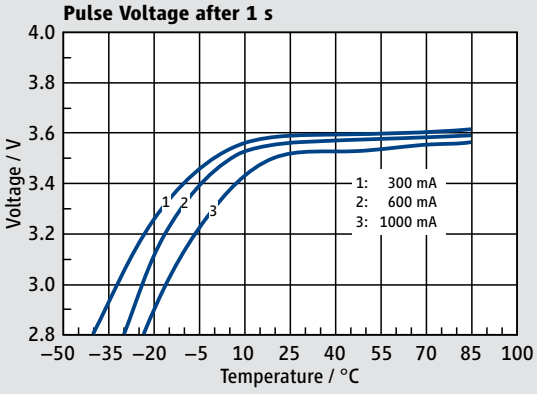
Voltage during a Pulse at +25 °C



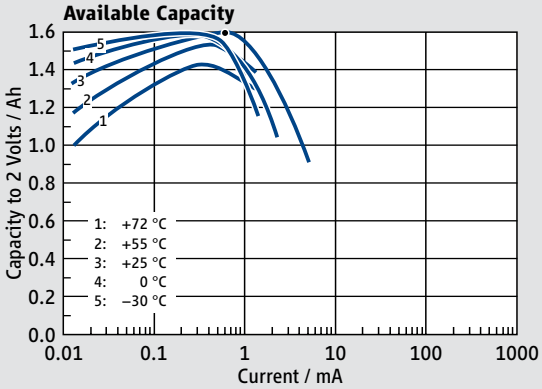
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

TLP-97311/A

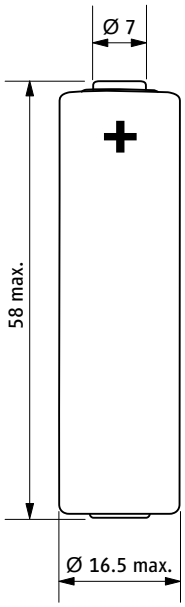
- High energy
- Up to 1 A pulse capability
- Instant voltage response
- No passivation effect

Performance Data

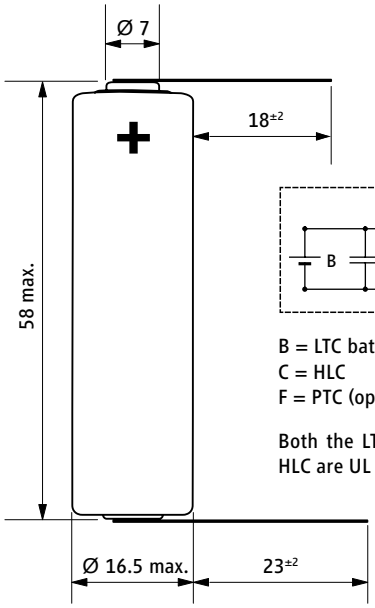
(Typical values for batteries stored at +25 °C for one year)

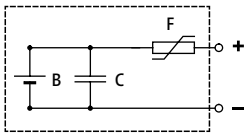
System	LTC and HLC
Nominal voltage	3.6 V
Nominal capacity	1.6 Ah
Nominal current	1 mA
Max. 1 s pulse to 3 V	1 A
Max. pulse length @ 0.125 A to 2.8 V	1000 s
Delay time to 3 V @ 0.125 A	none
Weight	35 g
Temperature range	–40 °C ... +85 °C
Capacity retention after 10 year storage	85 %

TLP-97311/A/SM



TLP-97311/A/ST

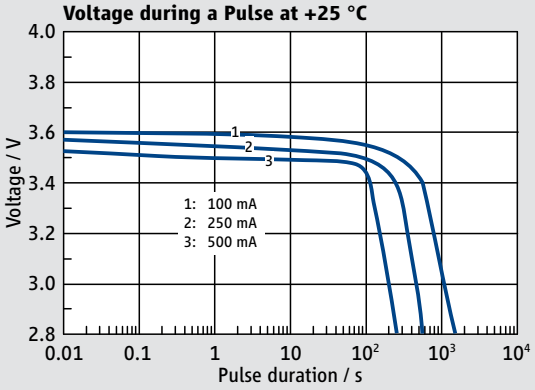




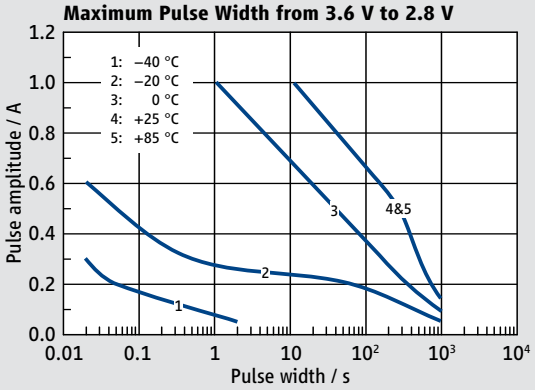
B = LTC battery
C = HLC
F = PTC (optional)

Both the LTC battery and the HLC are UL recognized.

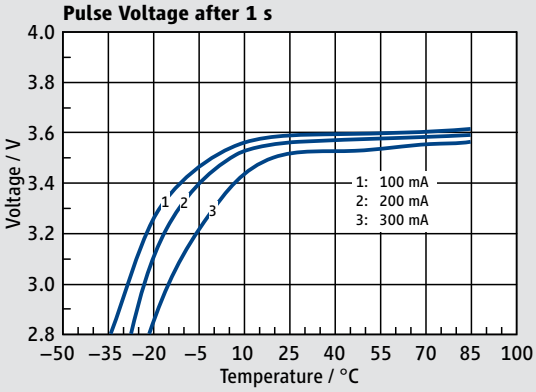
Voltage during a Pulse at +25 °C



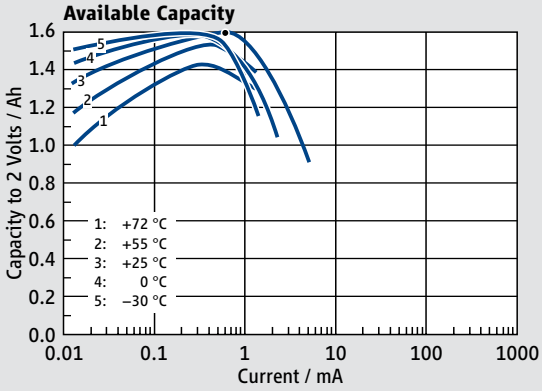
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Available Capacity



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Available Terminations		Catalogue No.
TLP-97311/A/SM	Pressure contacts	17 97311 101
TLP-97311/A/ST	Solder tags	17 97311 102

WARNING:
Do not charge. Battery can explode if disassembled, heated above 100 °C, incinerated, or contents exposed to water.

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Hybrid Layer Capacitors (HLCs)

Introduction

Properties
Hybrid Layer Capacitors are a kind of rechargeable battery. They are used as a capacitor in ***PulsesPlus***™ batteries, where they are connected in parallel to Tadiran Lithium Batteries. The electrodes of HLCs comprise Lithium intercalation compounds. They have low impedance and can deliver high current pulses. The performance and reliability properties of HLCs have been carefully optimized to match those of Tadiran Lithium Batteries. The result is a battery with a maximum of both energy and power density for stand alone use of up to 25 years.

HLCs are normally charged to 3.6 V, optionally to 3.9 V.

Safety
WARNING:
HLCs are designed for use in ***PulsesPlus***™ batteries. When used independently, they must not be fast charged.

Overcharge above 3.95 V may lead to capacity loss and/or an increase of internal resistance.

Overcharge above 4.4 V may lead to excessive internal pressure. This may result in explosion or rupture.

Transport
HLCs have passed the UN transport tests. They contain less than 0.3 g lithium equivalent and are not restricted under international dangerous goods regulations. They can be transported by air according to IATA DGR, Packing Instructions 968-970 and by rail/road/sea according to RID/ADR/IMDG code, special provision 188.

.

Temperature range	–40 °C ... +85 °C	for operation in ***PulsesPlus***™ batteries
	–30 °C ... +60 °C	for independent storage and use

Electrical characteristics		
Discharge end voltage	2.8 V	Discharge below 2.5 V at +25 °C and discharge below 2 V at –40 °C may lead to an increase of the internal resistance.
Max. charge voltage	3.95 V	

Shelf life	**in *PulsesPlus*™ batteries**	**used independently**
@ +25 °C	10 years	3 years
@ +60 °C	7 years	4 weeks
@ +85°C	≥ 1 year	1 week

Cycle life	**at 3.6 V**	**at 3.9 V**
to 1 % DOD[1)]	400000 cycles	100000 cycles
to 10 % DOD	40000 cycles	10000 cycles
to 100 % DOD	4000 cycles	1000 cycles

[1)] DOD = depth of discharge

PDC13Eng

PulsesPlus™

TADIRAN BATTERIES

HLC-1020

- Delivering high current pulses
- Up to 25 years lifetime and more
- Wide operating temperature range
- Low self discharge

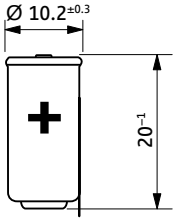
Performance Data

(Typical values in *PulsesPlus*™ batteries stored at +25 °C)

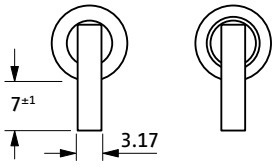
System	Lithium Intercalated Compounds	
Version	HLC-1020	(HLC-1020L)
Nominal voltage	3.6 V / optional 3.9 V	
Nominal capacity	45 As @ 3.7 V 70 As @ 3.9 V	(30 As @ 3.7 V) (45 As @ 3.9 V)
Nominal current	15 mA	
Max. continuous discharge current	250 mA	(150 mA)
Pulse current capability	750 mA	(500 mA)
Max. charge voltage	3.95 V	
Max. charge current	8 mA	(6 mA)
Discharge end voltage	2.5 V	
Cell impedance	max. 400 mΩ	(max. 600 mΩ)
Lithium content	0.01 g	
Weight	4.2 g	

For more data please refer to page 37.

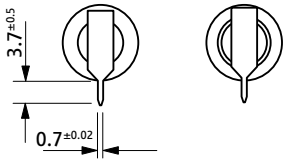
HLC-1020(L)/S



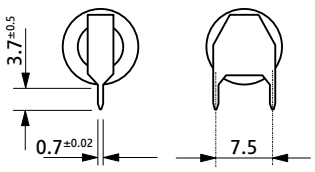
HLC-1020(L)/T



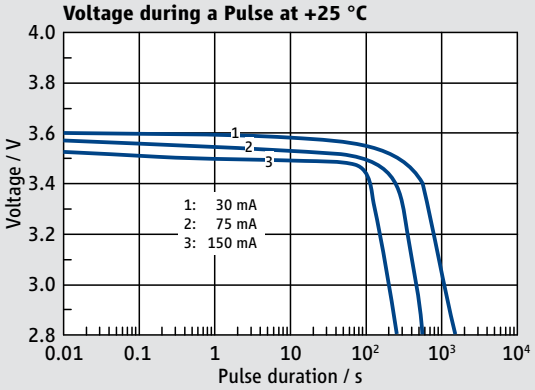
HLC-1020(L)/PT2



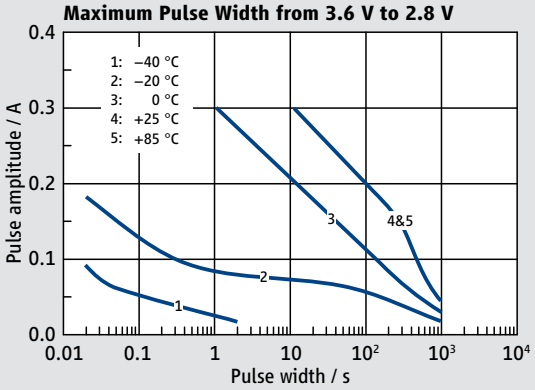
HLC-1020(L)/TP



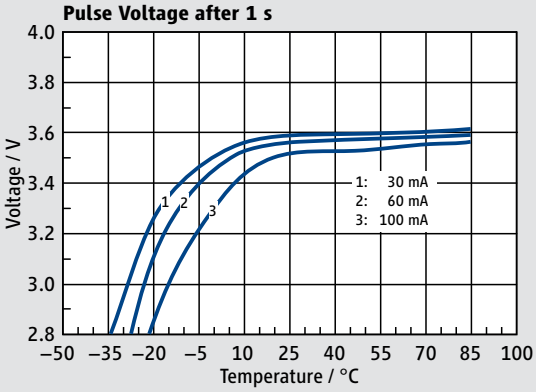
Voltage during a Pulse at +25 °C



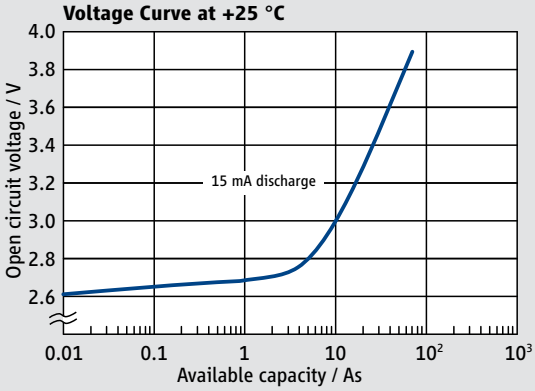
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Voltage Curve at +25 °C



Available Terminations		Catalogue No.
HLC-1020/S	Standard	13 0 11021 02
HLC-1020/T	Tags	13 0 11022 02
HLC-1020/PT2	Pins radial	13 0 11026 02
HLC-1020/TP	Polarized tags	13 0 11027 02
HLC-1020L/S	Standard	13 0 13021 02
HLC-1020L/T	Tags	13 0 13022 02
HLC-1020L/PT2	Pins radial	13 0 13026 02
HLC-1020L/TP	Polarized tags	13 0 13027 02

CAUTION: Fire, explosion, and severe burn hazard. Do not disassemble, heat above 100 °C, or incinerate.

Use as part of *PulsesPlus*™ battery only. Do not charge above 3.95 V.

Any values given here are for informational purposes only. They also depend on actual conditions of use and are not warranties of future performance. Subject to change.

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PDC13Eng

PulsesPlus™

HLC-1520A

TADIRAN BATTERIES

- Delivering high current pulses
- Up to 25 years lifetime and more
- Wide operating temperature range
- Low self discharge

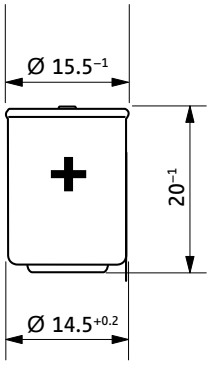
Performance Data

(Typical values in ***PulsesPlus***™ batteries stored at +25 °C)

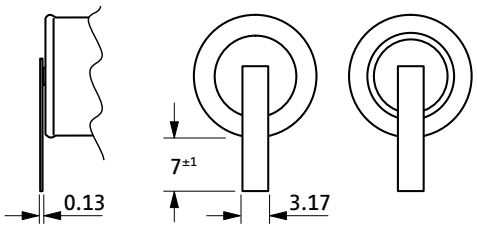
System	Lithium Intercalated Compounds
Nominal voltage	3.6 V, optional 3.9 V
Nominal capacity	140 As (39 mAh) @ 3.6 V 210 As (58 mAh) @ 3.9 V
Nominal current	25 mA
Max. continuous discharge current	500 mA
Pulse current capability	2000 mA
Max. charge voltage	3.95 V
Max. charge current	25 mA
Discharge end voltage	2.5 V
Cell impedance	max. 250 mΩ (@ 1 kHz, RT)
Lithium content	0.02 g @ 3.6 V 0.03 g @ 3.9 V
Weight	7.7 g

For more data please refer to page 37.

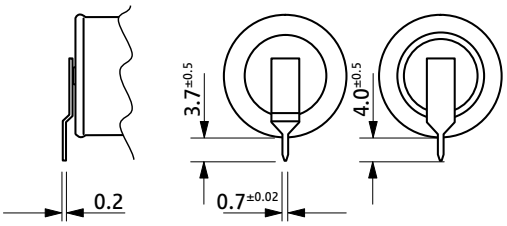
HLC-1520/S



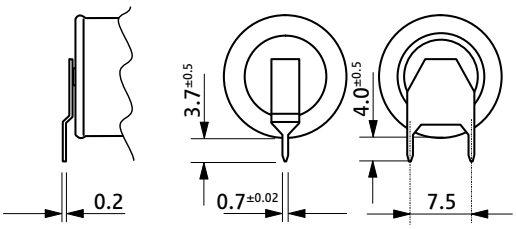
HLC-1520/T



HLC-1520/PT2



HLC-1520/TP

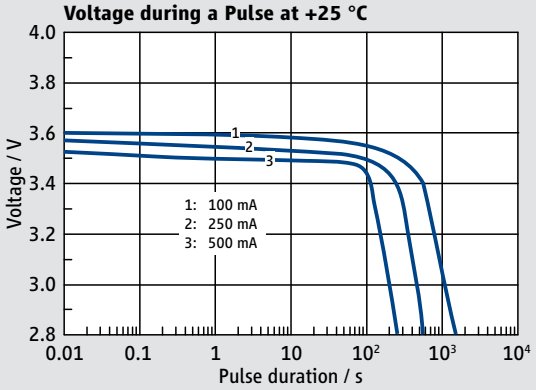


Available Terminations		Catalogue No.
HLC-1520A/S	Standard	13 0 11521 02
HLC-1520A/T	Tags	13 0 11522 02
HLC-1520A/PT2	Pins radial	13 0 11526 02
HLC-1520A/TP	Polarized tags	13 0 11527 02

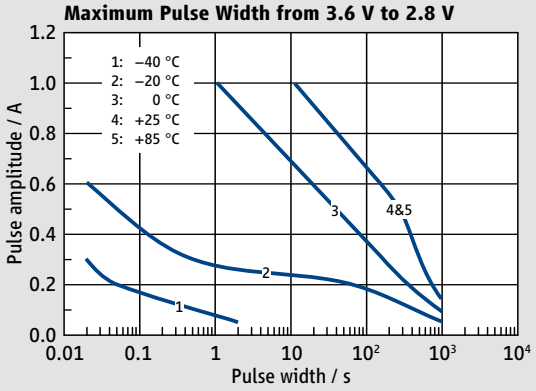
CAUTION: Fire, explosion, and severe burn hazard. Do not disassemble, heat above 100 °C, or incinerate.

Use as part of ***PulsesPlus***™ battery only. Do not charge above 3.95 V.

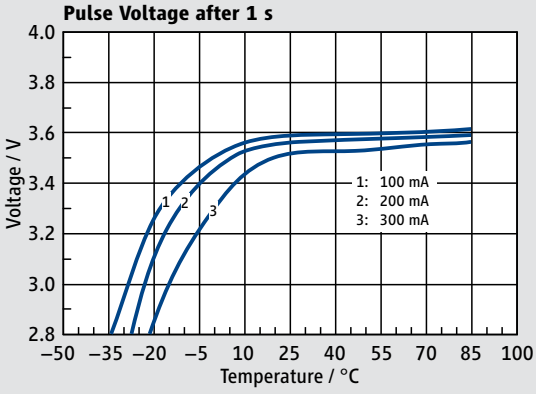
Voltage during a Pulse at +25 °C



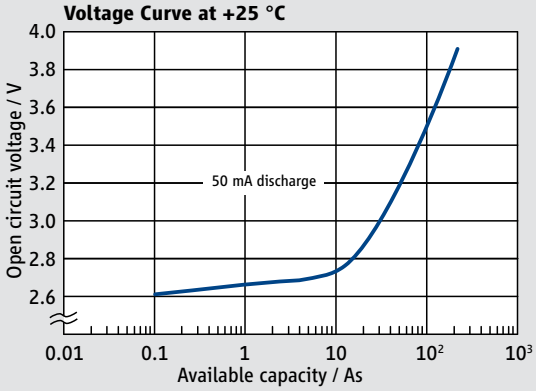
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Voltage Curve at +25 °C



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PulsesPlus™

HLC-1530A

TADIRAN BATTERIES

- Delivering high current pulses
- Up to 25 years lifetime and more
- Wide operating temperature range
- Low self discharge

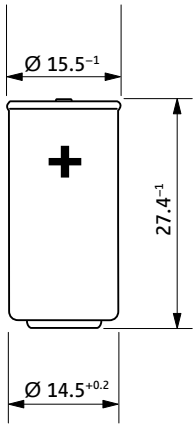
Performance Data

(Typical values in ***PulsesPlus***™ batteries stored at +25 °C)

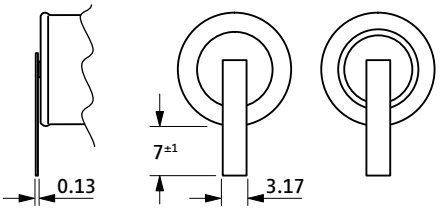
System	Lithium Intercalated Compounds
Nominal voltage	3.6 V, optional 3.9 V
Nominal capacity	250 As (70 mAh) @ 3.6 V 380 As (105 mAh) @ 3.9 V
Nominal current	50 mA
Max. continuous discharge current	750 mA
Pulse current capability	3000 mA
Max. charge voltage	3.95 V
Max. charge current	50 mA
Discharge end voltage	2.5 V
Cell impedance	max. 140 mΩ (@ 1 kHz, RT)
Lithium content	0.02 g @ 3.6 V 0.05 g @ 3.9 V
Weight	10.3 g

For more data please refer to page 37.

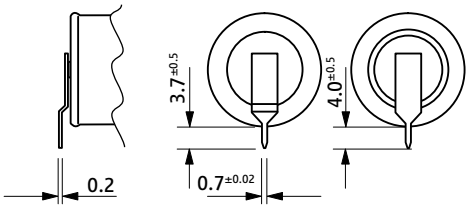
HLC-1530/S



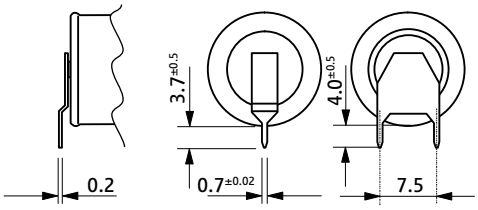
HLC-1530/T



HLC-1530/PT2



HLC-1530/TP

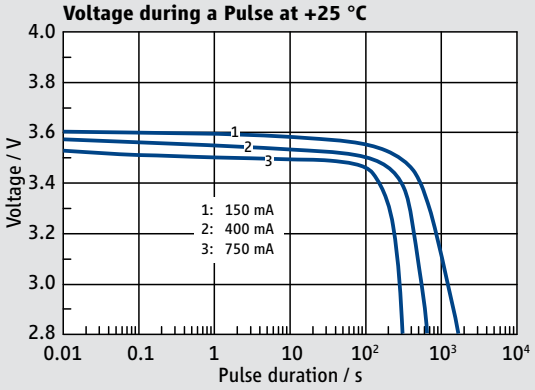


Available Terminations		Catalogue No.
HLC-1530A/S	Standard	13 0 11531 02
HLC-1530A/T	Tags	13 0 11532 02
HLC-1530A/PT2	Pins radial	13 0 11536 02
HLC-1530A/TP	Polarized tags	13 0 11537 02

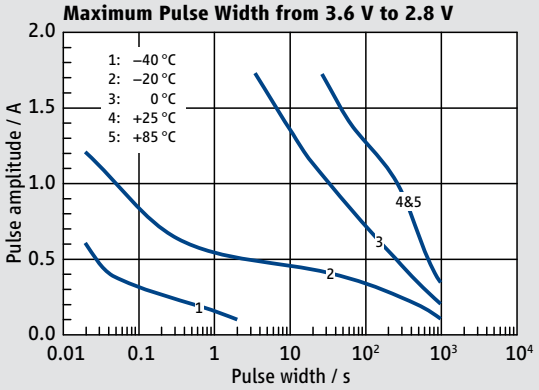
CAUTION: Fire, explosion, and severe burn hazard. Do not disassemble, heat above 100 °C, or incinerate.

Use as part of ***PulsesPlus***™ battery only. Do not charge above 3.95 V.

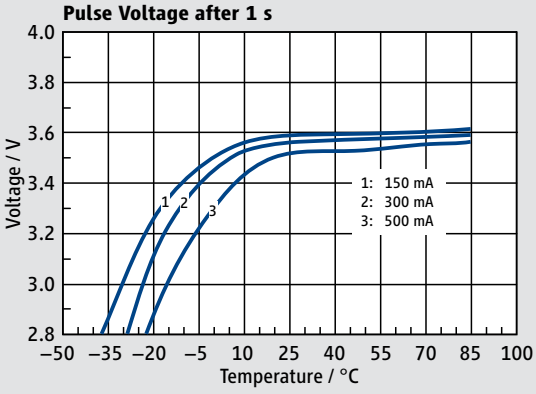
Voltage during a Pulse at +25 °C



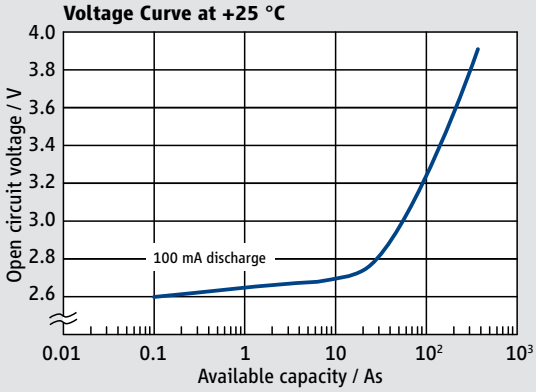
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Voltage Curve at +25 °C



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PulsesPlus™ LITHIUM

TADIRAN BATTERIES

HLC-1550A

- Delivering high current pulses
- Up to 25 years lifetime and more
- Wide operating temperature range
- Low self discharge

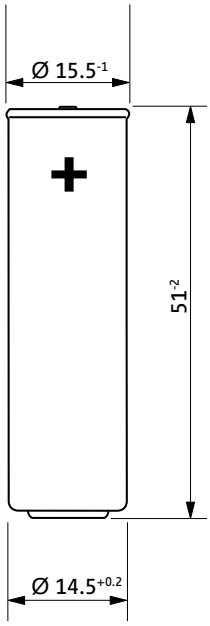
Performance Data

(Typical values in *PulsesPlus*™ batteries stored at +25 °C)

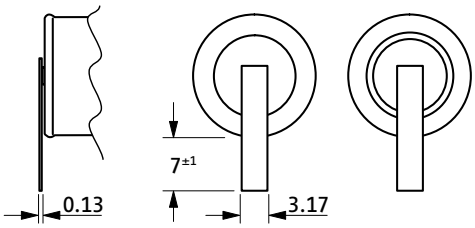
System	Lithium Intercalated Compounds
Nominal voltage	3.6 V, optional 3.9 V
Nominal capacity	560 As (155 mAh) @ 3.6 V 850 As (240 mAh) @ 3.9 V
Nominal current	50 mA
Max. continuous discharge current	2000 mA
Pulse current capability	5000 mA
Max. charge voltage	3.95 V
Max. charge current	100 mA
Discharge end voltage	2.5 V
Cell impedance	max. 100 mΩ (@ 1 kHz, RT)
Lithium content	0.05 g @ 3.6 V 0.10 g @ 3.9 V
Weight	20 g

For more data please refer to page 37.

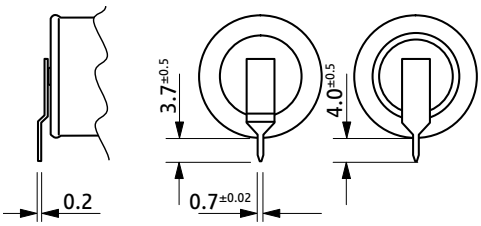
HLC-1550/S



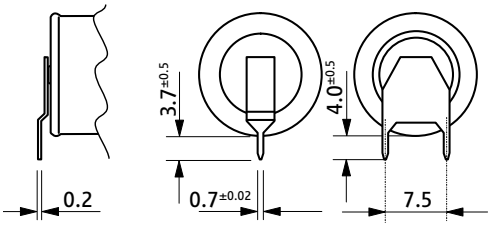
HLC-1550/T



HLC-1550/PT2



HLC-1550/TP

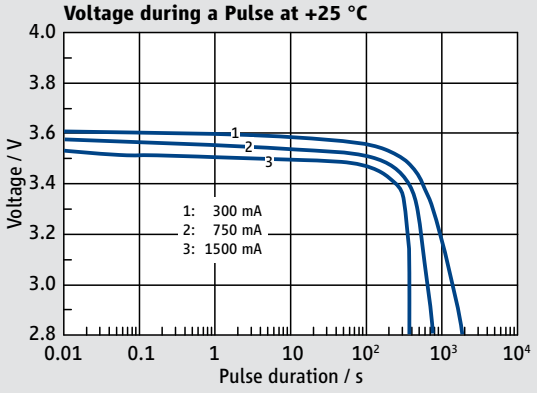


Available Terminations		Catalogue No.
HLC-1550A/S	Standard	13 0 11551 02
HLC-1550A/T	Tags	13 0 11552 02
HLC-1550A/PT2	Pins radial	13 0 11556 02
HLC-1550A/TP	Polarized tags	13 0 11557 02

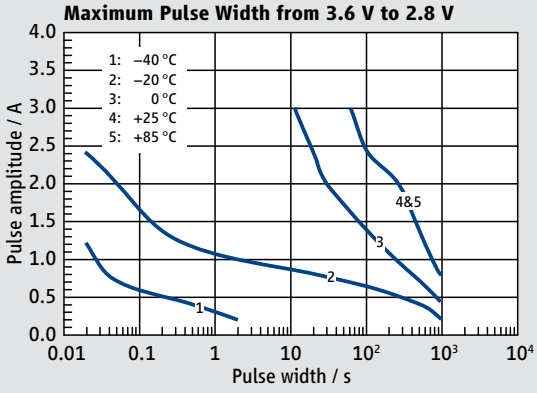
CAUTION: Fire, explosion, and severe burn hazard. Do not disassemble, heat above 100 °C, or incinerate.

Use as part of *PulsesPlus*™ battery only. Do not charge above 3.95 V.

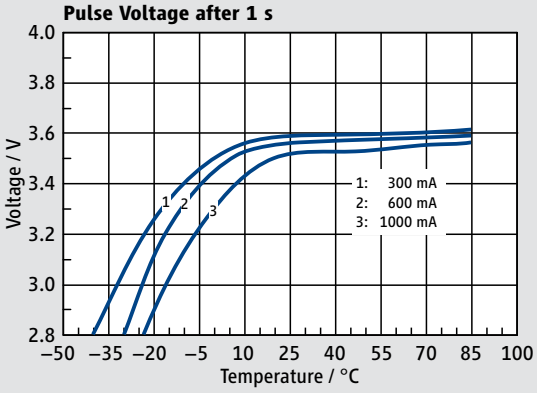
Voltage during a Pulse at +25 °C



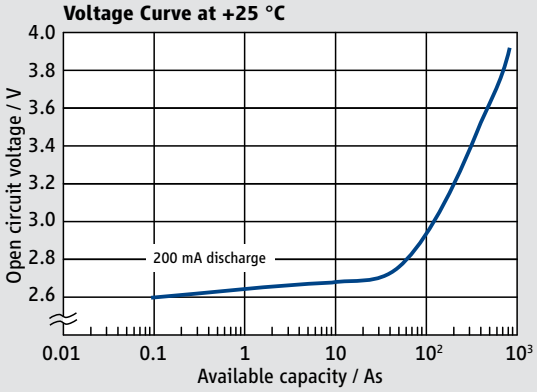
Maximum Pulse Width from 3.6 V to 2.8 V



Pulse Voltage after 1 s



Voltage Curve at +25 °C



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TLM LITHIUM

TADIRAN BATTERIES

Introduction

The TLM battery
The Tadiran TLM series, the newest product innovation from Tadiran Batteries, is distinguished by its extremely high power in the decisive moment – when it really matters! It stands for guaranteed power even after long storage or stand-by up to more than 10 years. Its outstanding properties make it the ideal back-up battery for the eCall system, surgical instruments, and other special applications.

Military version
TLM batteries are also available in a more robust version for military applications. For more information see www.tadiranbatteries.de >> products >> TLM batteries >> Military version.

Advantages
- High voltage 4.0 V
- Very high pulse current capability
- Immediate response, no passivation effect
- Wide operating temperature range (–40 °C to +85 °C)
- High reliability (hermetic laser sealing, glass-to-metal seal)
- Outstanding storage capability (up to 10 years)
- Recognized safety (UL)
- Very low self discharge
- Easy health monitoring during storage

Outperforms competition
Compared to other commercial high rate lithium batteries, TLM batteries are superior with respect to their voltage, energy content, and temperature behaviour.

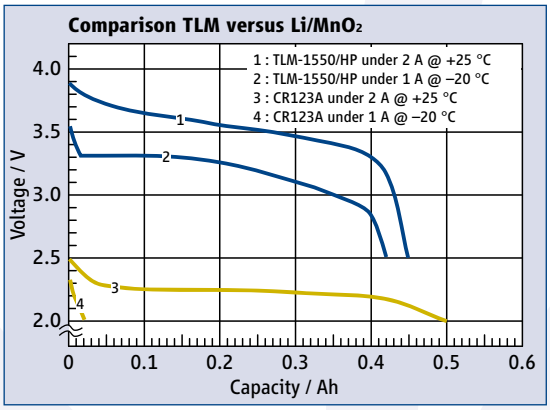

Figure 1: *Comparison TLM versus Li/MnO_2*

Figure 1 shows a comparison with CR123A batteries. These batteries have almost the same volume as TLM-1550HP and belong to the Lithium Manganese Dioxide 3 Volt system. Under a 2 Ampere discharge at room temperature, they deliver almost the same capacity as TLM-1550HP but at much lower voltage. Under 1 Ampere discharge at –20 °C, CR123A delivers almost no capacity above 2 Volts, while TLM-1550HP still delivers more than 70 % of its nominal capacity.

Application in eCall modules
One major application for TLM batteries is the so-called Autonomous Telematics Box or Advanced Telematics Module where the TLM battery serves as the back-up battery for eCall, the automatic emergency call system for cars in Europe. The requirements for this system include operation under high pulse currents at low temperature at any time up to 10 years after installation. Even under these severe conditions, an air time of more than 10 minutes is required. During this air time, the system exchanges both car condition and position data and voice signals between the car and an emergency call centre.

Smallest high power battery
Figure 2 shows the behaviour of TLM-1550HP under these conditions. The battery was subjected to accelerated ageing by storing it at +72 °C for 3 weeks prior to the test.

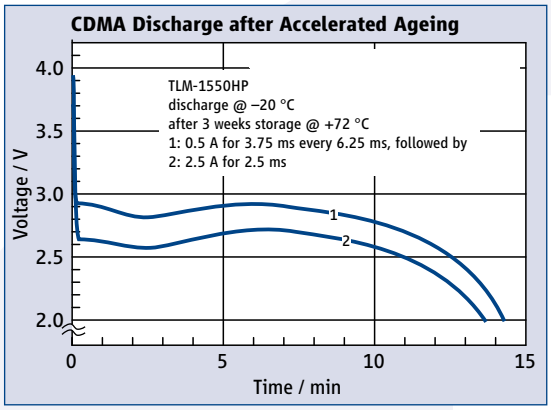

Figure 2: *CDMA Discharge after Accelerated Ageing*

It was then cooled down to –20 °C and discharged under a simulated application load profile comprising 2.5 A of 2.5 ms duration every 6.25 ms on a basic load of 0.5 A. The upper curve (1) shows the voltage on the basic load while the lower curve (2) shows the voltage during the 2.5 A pulses. The discharge duration is clearly in excess of 10 minutes. TLM-1550HP is the smallest battery commercially available on the market that can fulfil these requirements.

Enduring low impedance
For demanding applications like the back-up battery in eCall systems, the durability of the battery in a wide temperature range is a decisive factor. Especially two parameters need to be sufficiently low and stable: self discharge and internal resistance. The development of self discharge, expressed as capacity loss over storage time, is shown in the data sheets of TLM batteries on the following pages while Figure 3 shows the development of the internal resistance of TLM-1550HP over time at two different storage temperatures. It remains within the specified limits, even after storage at +72 °C for 3 years.

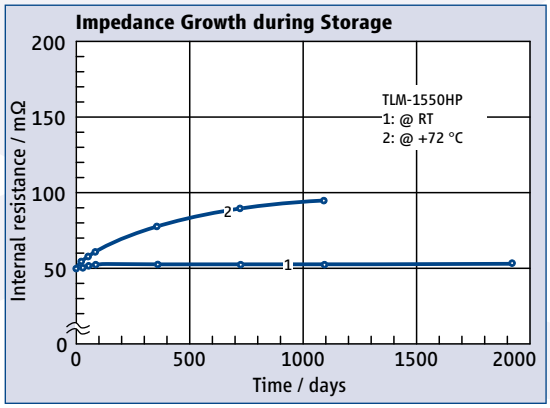

Figure 3: *Impedance Growth during Storage*

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TLM LITHIUM

TADIRAN BATTERIES

TLM-1520HP

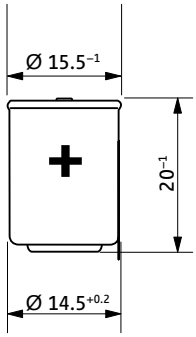
- High power 4 Volt cell
- No voltage delay
- Long shelf life
- End of life indication capability

Performance Data

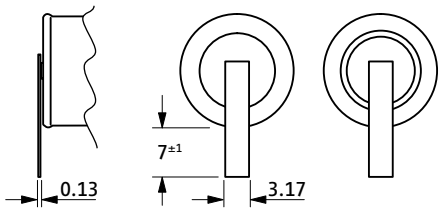
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Metal Oxide
Nominal voltage	4.0 V
Nominal capacity	135 mAh
Nominal current	12 mA
Max. continuous discharge current	1.25 A
Pulse current capability	3.5 A
Cell impedance	max. 250 mΩ
Anode surface area	90 cm^2
Lithium content	0.04 g
Weight	9 g
Volume	3.2 cm^3
Temperature range	–40 °C ... +85 °C

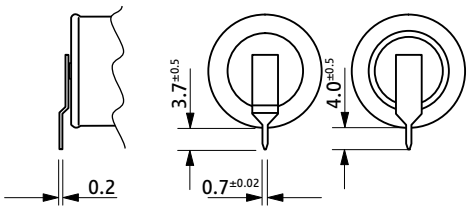
TLM-1520HP/S



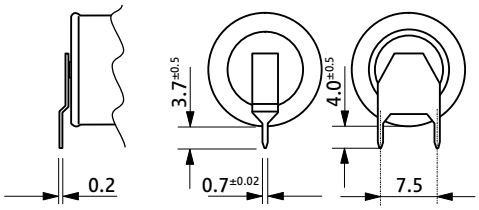
TLM-1520HP/T



TLM-1520HP/PT2



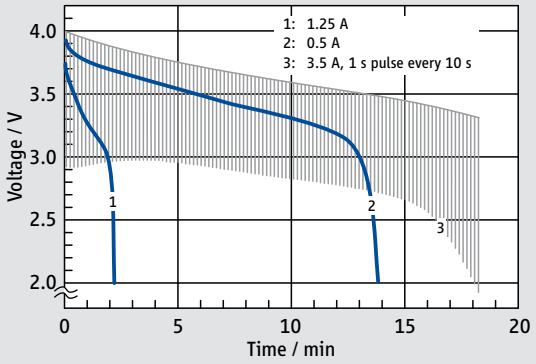
TLM-1520HP/TP



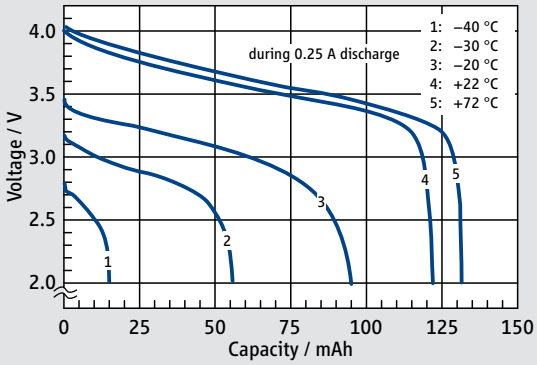
Available Terminations		Catalogue No.
TLM-1520HP/S	Standard	12 0 12521 02
TLM-1520HP/T	Tags	12 0 12522 02
TLM-1520HP/PT2	Pins radial	12 0 12526 02
TLM-1520HP/TP	Polarized tags	12 0 12527 02

WARNING: Fire, explosion, and severe burn hazard. Do not charge, disassemble, heat above 100 °C, incinerate, or short circuit.

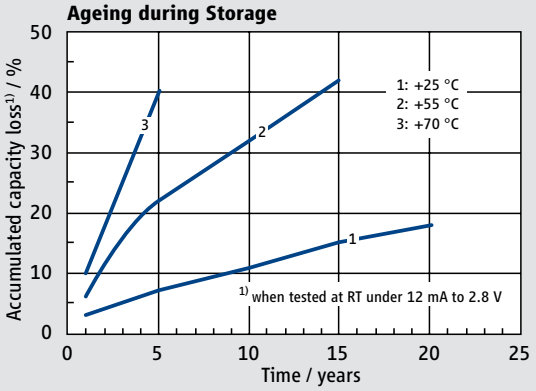
Discharge Capability at +25 °C



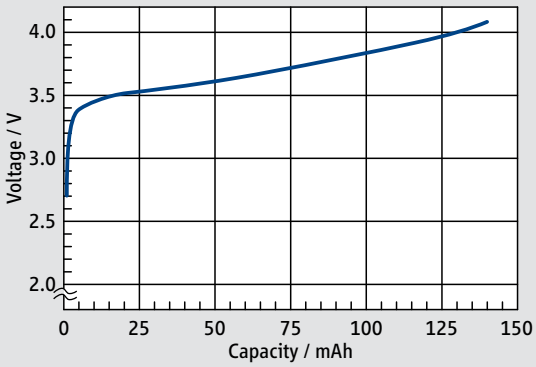
Temperature Behaviour



Ageing during Storage



Voltage Curve



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TLM LITHIUM

TADIRAN BATTERIES

TLM-1530HP

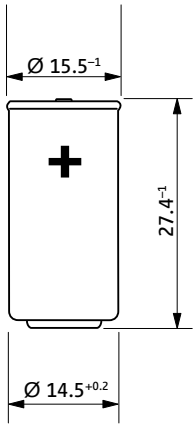
- High power 4 Volt cell
- No voltage delay
- Long shelf life
- End of life indication capability

Performance Data

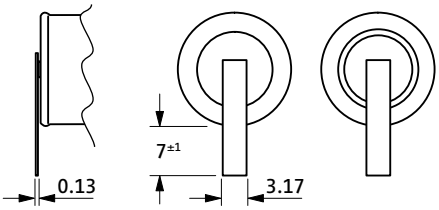
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Metal Oxide
Nominal voltage	4.0 V
Nominal capacity	240 mAh
Nominal current	20 mA
Max. continuous discharge current	2.5 A
Pulse current capability	6.5 A
Cell impedance	max. 175 mΩ
Anode surface area	160 cm^2
Lithium content	0.08 g
Weight	11 g
Volume	4.4 cm^3
Temperature range	−40 °C ... +85 °C

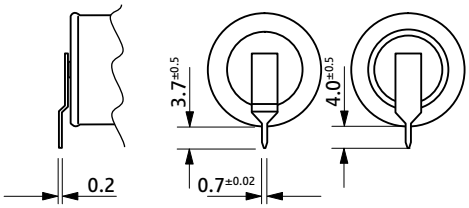
TLM-1530HP/S



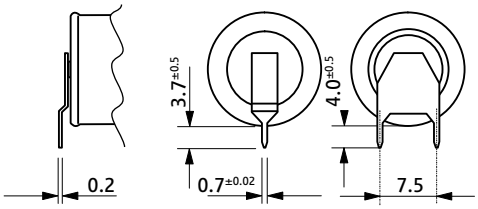
TLM-1530HP/T



TLM-1530HP/PT2



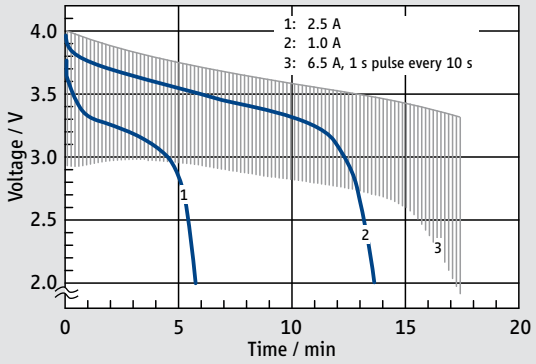
TLM-1530HP/TP



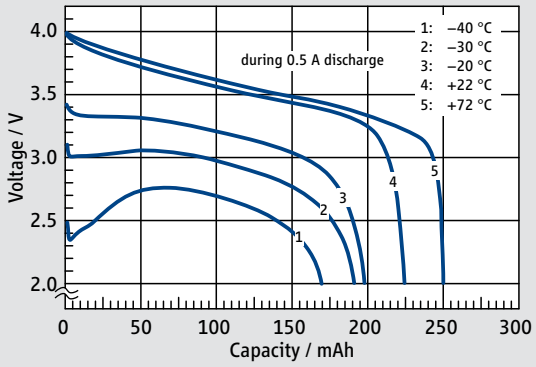
Available Terminations		Catalogue No.
TLM-1530HP/S	Standard	12 0 12531 02
TLM-1530HP/T	Tags	12 0 12532 02
TLM-1530HP/PT2	Pins radial	12 0 12536 02
TLM-1530HP/TP	Polarized tags	12 0 12537 02

WARNING: Fire, explosion, and severe burn hazard. Do not charge, disassemble, heat above 100 °C, incinerate, or short circuit.

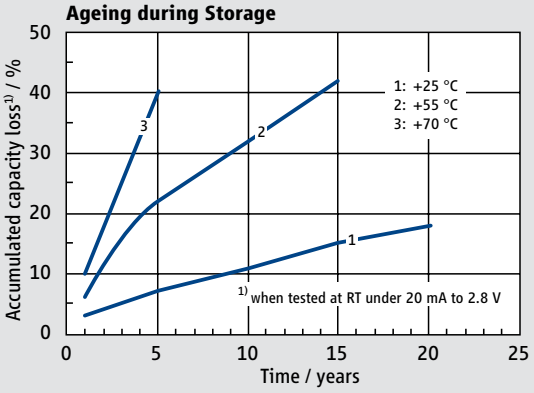
Discharge Capability at +25 °C



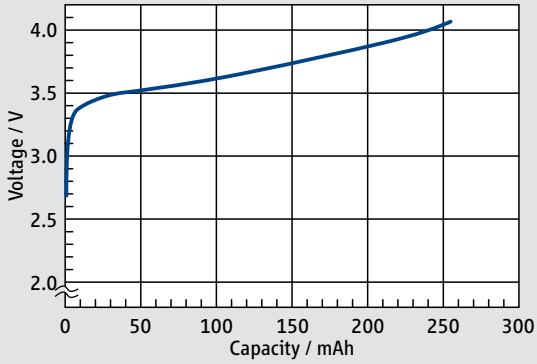
Temperature Behaviour



Ageing during Storage



Voltage Curve



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TLM LITHIUM

TADIRAN BATTERIES

TLM-1550HP

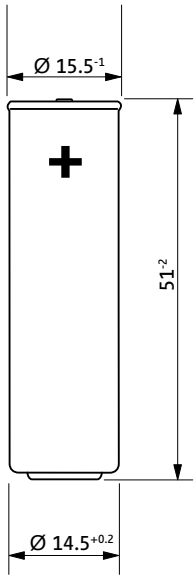
- High power 4 Volt cell
- No voltage delay
- Long shelf life
- End of life indication capability

Performance Data

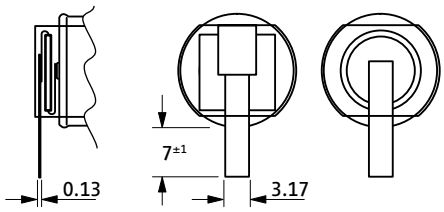
(Typical values for batteries stored at +25 °C for one year)

System	Lithium Metal Oxide
Nominal voltage	4.0 V
Nominal capacity	550 mAh
Nominal current	50 mA
Max. continuous discharge current	5 A
Pulse current capability	15 A
Cell impedance	max. 100 mΩ
Anode surface area	360 cm^2
Lithium content	0.18 g
Weight	20 g
Volume	8 cm^3
Temperature range	–40 °C ... +85 °C

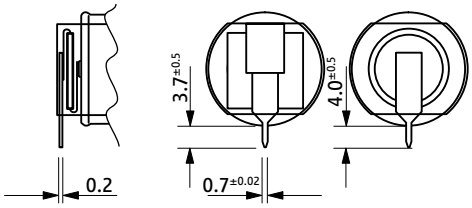
TLM-1550HP/S



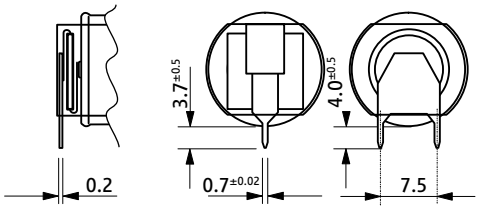
TLM-1550HP/Z2/T



TLM-1550HP/Z2/PT2



TLM-1550HP/Z2/TP

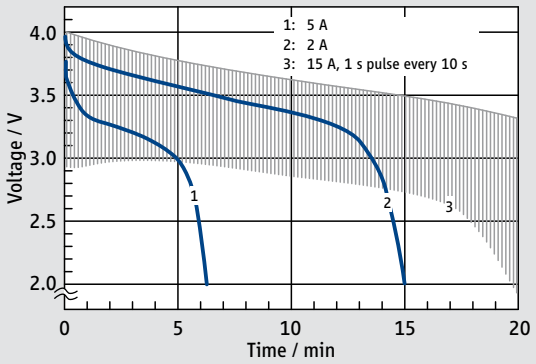


Available Terminations		Catalogue No.
TLM-1550HP/S	Standard	12 0 12551 02
TLM-1550HP/Z2/T	Tags*	12 1 12552 02
TLM-1550HP/Z2/PT2	Pins radial*	12 1 12556 02
TLM-1550HP/Z2/TP	Polarized tags*	12 1 12557 02

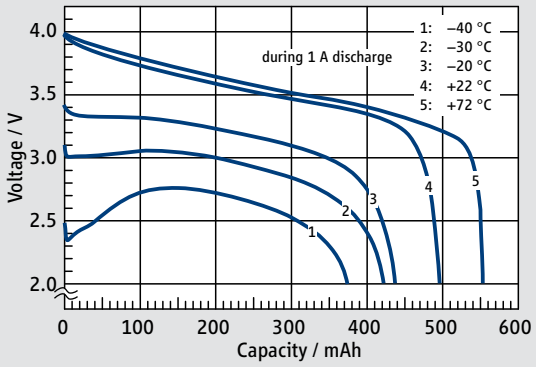
** with PTC SRP 200*

WARNING: Fire, explosion, and severe burn hazard. Do not charge, disassemble, heat above 100 °C, incinerate, or short circuit.

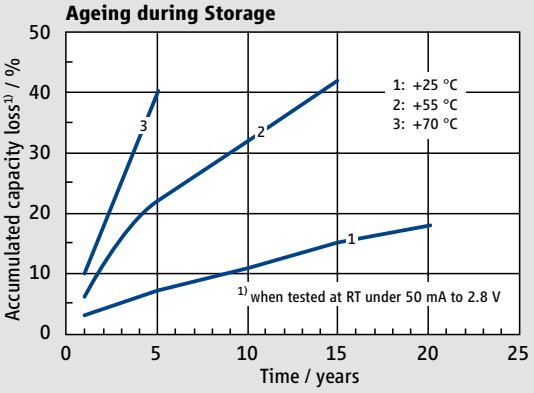
Discharge Capability at +25 °C



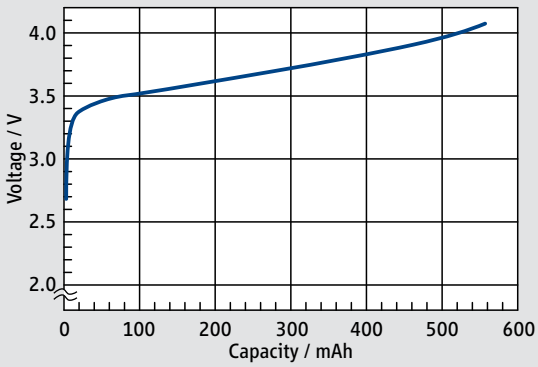
Temperature Behaviour



Ageing during Storage



Voltage Curve



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Transport Regulations

Exemptions
Lithium metal batteries are dangerous goods, UN No. 3090. Therefore they are generally subject to transport regulations, depending on the transport mode. However, most Tadiran Lithium Batteries listed in the product data catalogue are exempted from the regulations if the following conditions are given:

- The batteries have not more than 2 g lithium content, each cell not more than 1 g lithium content (see table 1).
- The batteries have passed the UN tests (see table 1).
- The batteries shall be packed in inner packagings that completely enclose them. They shall be protected so as to prevent short circuits.
- The package is marked with a notice indicating that it contains lithium batteries and shall – if damaged – be quarantined, inspected and repacked (see also lithium battery handling label).
- The gross mass does not exceed 30 kg per package (2.5 kg for air transport).
- The packaging shall be strong and capable of withstanding a 1.2 m drop test.
- For more conditions see special provision 188 (ADR/RID/IMDG-Code) and section II of packing instructions 968-970 (IATA DGR).
- New ICAO regulations for air transport have come into force on January 1st, 2013. Under the new regulations, exemptions of lithium metal batteries are limited to 0.3 g lithium content per battery or 2 batteries per package under Packing Instruction 968 I.B.

Size/Type	Model					Exempted	Lithium content (g)	UN Tests passed
BEL	SL-340			SL-740	SL-840	Yes[1)]	0.13	YES
1/6D	SL-386			SL-786	SL-886	Yes[1) 2)]	0.5	YES
1/10D	SL-389			SL-789	SL-889	Yes[1)]	0.3	YES
1/2AA	SL-350		SL-550	SL-750	SL-850	Yes[1) 2)]	0.35	YES
2/3AA	SL-361		SL-561	SL-761	SL-861	Yes[1) 2)]	0.5	YES
AA	SL-360	SL-460	SL-560	SL-760	SL-860	Yes[1) 2)]	0.65	YES
C	SL-770			SL-2770	SL-2870	No	2.5	YES
D	SL-780			SL-2780	SL-2880	No	5	YES
DD	SL-790			SL-2790		No	10	YES
Hybrid Layer Capacitors	HLC-1020 (3.7 V and 3.9 V)					Yes[1)]	0.01	YES
	HLC-1520 (3.7 V)					Yes[1)]	0.02	YES
	HLC 1520 (3.9 V)					Yes[1)]	0.04	YES
	HLC-1550 (3.7 V)					Yes[1)]	0.07	YES
	HLC-1550 (3.9 V)					Yes[1)]	0.13	YES
TLM batteries	TLM-1520HP					Yes[1)]	0.04	YES
	TLM-1530HP					Yes[1)]	0.08	YES
	TLM-1550HP					Yes[1)]	0.18	YES

Table 1: *Classification of Tadiran Lithium Batteries*

[1)] if conditions mentioned in the text are fulfilled
[2)] see also IATA DGR under UN 3090 / PI 968 / Table 968-II

Classification of lithium batteries
Tadiran Lithium Batteries are lithium metal batteries. Table 1 indicates which Tadiran Lithium Batteries are exempted from to the dangerous goods regulations and which are not.

UN tests
Table 1 also shows the status of UN-tests for Tadiran Lithium Batteries according to the UN Handbook of Tests and Criteria, part III, sub-section 38.3. Regarding Tadiran Lithium Batteries not listed in table 1, please apply to Tadiran Batteries for a confirmation.

For more information on classification and transport regulations, please refer to the Technical Notice on Transport Regulations available on the Tadiran Batteries GmbH website.

Regulations
It is necessary to refer to the listed regulations and instructions for detailed information. They are revised on a regular basis. The tables are based on the revisions effective in January 2013.

The applicable documents are:
ADR:
European Agreement concerning the International Carriage of Dangerous Goods by Road

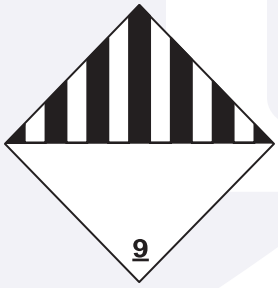
IATA DGR:
International Air Transport Association, Dangerous Goods Regulations

ICAO:
International Civil Aviation Organization, Technical Instructions for the Safe Transport of Dangerous Goods by Air

IMDG Code:
International Maritime Dangerous Goods Code

RID:
International Statutory Order on the Conveyance of Dangerous Goods by Rail

UN:
United Nations Recommendations on the Transport of Dangerous Goods



Class 9 label, reduced size, black on white

Handling label "Cargo aircraft only", reduced size, black on orange

Lithium battery handling label, reduced size

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Questionnaire

TADIRAN BATTERIES
Fax to: +49 (0)6042 954-190
Mail to: info@tadiranbatteries.de

PROJECT DESCRIPTION

Project | Application code

Company | Department

Name | Telephone | Telefax

Address

Quantity 1st / 2nd / 3rd year | First Delivery | Competition

BATTERY DESCRIPTION

Type of Battery *(for battery packs please attach extra questionnaire)* | Application | ☐ Back-Up ☐ Power Source

Size / Height | Width / Diameter | Length | Weight Limit

Terminals | Connector | Cable | *(Please enclose drawing of battery)*

ELECTRICAL REQUIREMENTS

Minimum Voltage (Cut-off) | Average Voltage | Maximum Voltage | Capacity

Basic Current | Average Current | Maximum Current | Expected Operation Life

Pulse Load Profile *(Please enclose drawing of pulse load profile)* | First Occurrence of Pulse Load

ENVIRONMENTAL REQUIREMENTS

Storage Temperature min | mean | max | Storage Time before Use

Operating Temperature min | mean | **max** | *(Please enclose temperature profile)*

Operating Conditions *(Humidity, Vibration, Shock, Pressure etc.)* | Orientation during Discharge

ADDITIONAL INFORMATION

Sales Office | Registration No. | Date | Name

Tadiran Lithium Batteries – Applications

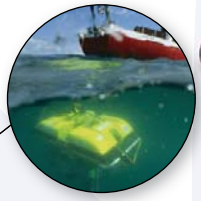
Utility metering
- Automatic meter reading
- Electricity, gas, water, heat, calorimeters
- Heat cost allocators
- Prepayment meters
- Communication modules

Tracking
- Animals
- Corrosion
- Data loggers
- Electronic toll collection
- On-board units
- Personal
- Pipelines
- Railways
- Trucks, containers, trailers

High end consumer
- Diving computers
- Set top boxes
- Sports electronics

Military
- Emergency power supply for UAVs
- Fuzes
- Gas masks
- Guidance systems
- Night vision goggles
- Targeting devices

Alarm and security systems
- Electronic safes
- Encryption systems
- Sensors/detectors
- Wireless alarms PIR



Off-shore
- Beacons
- Buoys
- Life jacket lights
- Oil drilling/MWD
- Seismic sensors

Automotive
- Airbags
- Automatic collision devices
- Belt tensioners
- Brake controllers
- Communication systems
- Digital tachographs
- Doors/latches
- Engine controllers
- In-car computers
- Stolen vehicle recovery systems
- Telematics/eCall
- Tyre pressure monitoring systems

Medical
- Defibrillators
- Dispensers
- Implantable devices
- Infusion pumps
- Surgical instruments

Industrial automation
- Process automation
- Controllers
- Fault detectors
- Industrial PCs
- Process logic control

Instrumentation
- Electronic scales
- Gambling machines
- Taximeters
- Vending machines

Office automation
- Cash machines
- Point of sale terminals
- Telephone exchange boards

Lithium Thionyl Chloride (LTC) batteries
PulsesPlus™ batteries
Tadiran Lithium Metal Oxide (TLM) batteries

Your Distributor

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