Primary Lithium Cells
LiMnO$_2$
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The VARTA Microbattery lithium manganese dioxide cell chemistry was one of the first solid cathode cells commercially developed and is still the most widely used system today. These cells offer an excellent shelf life, good high-rate and low-rate capability, a wide operating temperature range and availability in button and cylindrical cell designs. Potential design-in applications for these products are electronic, telecommunication, metering, instrumentation, office and other portable equipment use. Based on the outstanding cell performance and reliability of these products, they have been able to meet and exceed the requirements of our customer base worldwide.

Advantages for VARTA Microbattery LiMnO₂ Cells

- High open circuit and load voltage (above 3.0 volts per cell)
- High energy density (400 Wh/kg and 600 Wh/l)
- High capacity and high rate cell construction
- Operation over a wide temperature range
- Flat discharge profile under low to medium rate applications
- Low self discharge (less than 1% per year at RT)
- Superior shelf life and operational life (Up to 10 years and more)
- UL Recognition
- Ability to provide a variety of laser welded termination tabs for all cell types

Energy Density for Primary Systems

FIG. 1
Comparison of different primary battery systems

A = Lithium
B = Silver-oxide
C = Alkaline
D = Zinc-chloride
VARTA Microbattery offers a complete range of primary lithium manganese dioxide cylindrical and button cells for memory backup and portable applications worldwide. The cylindrical cell configurations offer the high-capacity bobbin construction and high-power spirally wound product. The bobbin construction is targeted at low to moderate power requirements, dedicated for applications requiring up to a 10 years operational life at 20°C. Our spirally wound electrode product offers high-rate discharge capability, with an operational life in excess of 5 years. For compact and light weight equipment use we have a complete range of high performance primary lithium button cells.

**1.1 CONSTRUCTIONS OF LITHIUM CELLS**

Lithium Cylindrical Batteries

**FIG. 2 – BOBBIN CONSTRUCTION**  
Schematic construction of a Li/MnO₂ cylindrical cell (CR 1/2 AA).

**FIG. 3 – SPIRAL CONSTRUCTION**  
Schematic construction of a Li/MnO₂ cylindrical cell (CR 2/3 AH).
Lithium Button Cells

FIG. 4
Schematic construction of a Li/MnO₂ Button Cell

Sealing Technologies

FIG. 5 – CRIMP-SEALING
CR High Power Cylindrical Cells

FIG. 6 – LASER-SEALING
CR High Capacity Cylindrical Cells
1.2 CHARACTERISTICS AND APPLICATIONS

Main Applications

Both mechanical and electrical properties, together with reliability, ensure that VARTA Microbattery lithium batteries meet the requirements of modern electronics. They are therefore ideally suited as power sources for the long term supply of microelectronic circuitry.

Main Characteristics

- Long life expectancy and long operational life
- Low self discharge rate
- High energy density
- High cell voltage (3V)
- Wide temperature range
- High operating safety
- High reliability
- Resistance to corrosion with stainless steel case
- No leakage problems with an organic non-corrosive electrolyte

Temperature characteristics

![Temperature characteristics of CR 1/2 AA and CR AA cylindrical cells](image)

System properties of VARTA Microbattery Lithium Cells

<table>
<thead>
<tr>
<th>Series</th>
<th>CR Series Cylindrical Cells</th>
<th>CR Series Button Cells</th>
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<tbody>
<tr>
<td>System</td>
<td>Li/MnO₂</td>
<td>Li/MnO₂</td>
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<tr>
<td>Gravimetric energy density</td>
<td>250–300 Wh/kg</td>
<td>250–300 Wh/kg</td>
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<tr>
<td>Nominal voltage</td>
<td>3.0 V</td>
<td>3.0 V</td>
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<tr>
<td>Open circuit voltage</td>
<td>3.2 V</td>
<td>3.2 V</td>
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<tr>
<td>Available capacity range</td>
<td>950–2000 mAh</td>
<td>25–560 mAh</td>
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<tr>
<td>Storage life</td>
<td>&gt;10 years</td>
<td>&gt;10 years</td>
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<tr>
<td>Self discharge d=20°C</td>
<td>&lt;1% p.a.</td>
<td>&lt;1% p.a.</td>
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<td>Operating temperature</td>
<td>-30 ... +75°C</td>
<td>-20 ... +65°C</td>
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<td>Maximum temperature range (short term)</td>
<td>-40 ... +80°C</td>
<td>-40 ... +80°C</td>
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<tr>
<td>Storage temperature</td>
<td>-55 ... +70°C</td>
<td>-55 ... +70°C</td>
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</table>

TAB. 1
1) CR 2/3 AH, CR 2, (>5 years)
2) CR 2/3 AH (-20 ... +65°C)
3) max. two weeks
4) μA-range
5) Recommended room temperature
## 1.3 APPLICATIONS FOR PRIMARY LITHIUM CELLS

<table>
<thead>
<tr>
<th>Applications</th>
<th>Button Cells</th>
<th>Cylindrical Cells (Spirally wound)</th>
<th>Cylindrical Cells (Bobbin construction)</th>
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<td>Cellular Telephone</td>
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### TAB. 2
Application list
1.4 SELECTION GUIDE

To enable battery selection the following is required:

- discharge current and maximum discharge time
- capacity
- operating temperature range
- self discharge
- surplus capacity requirement
- cell size

FIG. 8
CAPACITY RETENTION
Capacity retention characteristics of VARTA Microbattery Lithium Cells
Cylindrical Cells CR…AA and CR…A

FIG. 9
STORAGE BEHAVIOR
Typical storage behaviour at room temperature 21°C of CR 1/2 AA

FIG. 10
BATTERY SELECTION DIAGRAM
Discharge current/ Operating time
## 2.1 TYPES – TECHNICAL DATA

<table>
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<tr>
<th>Type</th>
<th>Order No.</th>
<th>Nominal voltage (V)</th>
<th>Typical capacity (mAh)</th>
<th>Standard load (kΩ)</th>
<th>Max. discharge current (continuous) (mA)</th>
<th>Max. discharge current (pulse) (mA)</th>
<th>Weight (g)</th>
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<td>CR 1/3 N</td>
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<td>170</td>
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<td>6231 210 501</td>
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<td>165</td>
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<td>280</td>
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<td>20</td>
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**TAB. 3**

Technical data, CR Primary Lithium Button Cells

1) Nominal capacity is determined to an end voltage of 2.0 V (type 2 CR 1/3 N: 4.0 V) when the battery is allowed to discharge at standard load level at 20°C.
### 2.2 ASSEMBLIES

#### CR 1/3 N

<table>
<thead>
<tr>
<th>Type</th>
<th>Order No.</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Fig. No.</th>
<th>Remarks</th>
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<tr>
<td>CR 1/3 N</td>
<td>6131 101 501</td>
<td>11.6</td>
<td>10.8</td>
<td>0.4</td>
<td>–</td>
<td>7.8</td>
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<td>CR 1/3 N SLF</td>
<td>6131 201 501</td>
<td>13.0</td>
<td>1.0</td>
<td>10.0</td>
<td>1.0 ±0.3</td>
<td>11.5 ±0.5</td>
<td>12.0 ±0.15</td>
<td>1.0 ±0.3</td>
</tr>
<tr>
<td>CR 1/3 N LF</td>
<td>6131 301 501</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>11.5</td>
<td>12.0</td>
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<table>
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<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Fig. No.</th>
<th>Remarks</th>
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<tr>
<td>2 CR 1/3 N (p 28 pxl)</td>
<td>6231 210 501</td>
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<td>25.1</td>
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<td>6.0</td>
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<tr>
<td>3 CR 1/3 N</td>
<td>6331 101 501</td>
<td>12.2</td>
<td>32.2</td>
<td>0.4</td>
<td>–</td>
<td>7.8</td>
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</table>

**TAB. 4**
Tag material: nickel plated sheet-steel. SLF: tip tinned.
Custom made assemblies are available on request for large volume.

![Fig. 11](image1.png)
![Fig. 12](image2.png)
![Fig. 13 LF](image3.png)
![Fig. 14 SLF](image4.png)
### Primary Lithium Cells

**CR 1216**
- Order No.: 6216 101 501
- A: 12.5
- B: 1.6
- C: 0.2
- D: –
- E: 10.0
- F: –
- G: –
- H: –
- K: –
- L: –
- Fig. No.: 15

**CR 1220**
- Order No.: 6220 101 501
- A: 12.5
- B: 2.0
- C: 0.3
- D: –
- E: 10.0
- F: –
- G: –
- H: –
- K: –
- L: –
- Fig. No.: 15

**CR 1616**
- Order No.: 6616 101 501
- A: 16.0
- B: 1.6
- C: 0.2
- D: –
- E: 12.0
- F: –
- G: –
- H: –
- K: –
- L: –
- Fig. No.: 15

**CR 1620**
- Order No.: 6620 101 501
- A: 16.0
- B: 2.0
- C: 0.02
- D: –
- E: 12.9
- F: –
- G: –
- H: –
- K: –
- L: –
- Fig. No.: 15

**CR 2016**
- Order No.: 6016 101 501
- A: 20.0
- B: 1.6
- C: 0.1
- D: –
- E: –
- F: –
- G: –
- H: –
- K: –
- L: –
- Fig. No.: 15

**CR 2025**
- Order No.: 6025 101 501
- A: 20.0
- B: 2.5
- C: 0.2
- D: –
- E: –
- F: –
- G: –
- H: –
- K: –
- L: –
- Fig. No.: 15

**Tab. 5.1**

Tag material: nickel plated sheet-steel. SLF: tip tinned.

Custom made assemblies are available on request for large volume.

<table>
<thead>
<tr>
<th>Type</th>
<th>Order No.</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>K</th>
<th>L</th>
<th>Fig. No.</th>
<th>Remarks</th>
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**Fig. 15**
![Fig. 15](image1)

**Fig. 16 SLF**
![Fig. 16 SLF](image2)

**Fig. 17 LF**
![Fig. 17 LF](image3)

**Fig. 18 PCB 3**
![Fig. 18 PCB 3](image4)
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<td>16 tag 0.25 mm</td>
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<td>10</td>
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<td>10.0</td>
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**TAB. 5.2**

Tag material: nickel plated sheet-steel. SLF: tip tinned.

1) using Molex 51021-03 connector (Other wire connectors and wire length are available on request.)

2) in shrink sleeve with wire and connector

Custom made assemblies are available on request for large volume.

---

**FIG. 19 PCB 2**

**FIG. 20 WC**

**FIG. 21 SMT**
2.3 PERFORMANCE DATA

FIG. 22 – CR 1216
Discharge characteristics
at room temperature (21°C)

FIG. 23 – CR 1216
Temperature characteristics
Constant load 39 kΩ

FIG. 24 – CR 1216
Operating voltage vs. current drain
Voltage at 50% discharge

FIG. 25 – CR 1216
Cell capacity vs. discharge current
FIG. 26 – CR 2016
Discharge characteristics at room temperature (21°C)

FIG. 27 – CR 2016
Temperature characteristics
Constant load 15 kΩ

FIG. 28 – CR 2016
Operating voltage vs. current drain
Voltage at 50% discharge

FIG. 29 – CR 2016
Cell capacity vs. discharge current
FIG. 30 – CR 2025
Discharge characteristics
at room temperature (21°C)

FIG. 31 – CR 2025
Temperature characteristics
Constant load 10 kΩ

FIG. 32 – CR 2025
Operating voltage vs. current drain
Voltage at 50% discharge

FIG. 33 – CR 2025
Cell capacity vs. discharge current
**FIG. 34 – CR 2032**
Discharge characteristics at room temperature (21°C)

**FIG. 35 – CR 2032**
Temperature characteristics
Constant load 5.6 kΩ

**FIG. 36 – CR 2032**
Operating voltage vs. current drain
Voltage at 50% discharge

**FIG. 37 – CR 2032**
Cell capacity vs. discharge current
FIG. 40 – CR 2430
Load: cont. R = 15 kΩ
Mean discharge current at temperature:
- d = 0°C ~175 μA
- d = -10°C ~170 μA
- d = -20°C ~155 μA

FIG. 41 – CR 2450
Load: cont. 5.6 kΩ: U_b
Pulse: 2 s/2 h 100 Ω: U_t
Internal Resistance R_i calculated from U_b and U_t at R_t = 100 Ω and T_t = 2s
Temperature: d = 20°C
3. CR HIGH CAPACITY PRIMARY LITHIUM CYLINDRICAL CELLS
3.1 TYPES – TECHNICAL DATA

<table>
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<th>Type</th>
<th>Order No.</th>
<th>Nominal voltage (V)</th>
<th>Nominal capacity at 20°C, down to 2.0 V, load (mAh)</th>
<th>Max. continuous discharge current (mA)</th>
<th>Weight (g)</th>
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<td>6237 101 301</td>
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<td>1350 mAh – 1.0 kΩ</td>
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<td>6117 101 301</td>
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<td>2000 mAh – 1.0 kΩ</td>
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<td>21.5</td>
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<tr>
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<td>6238 101 301</td>
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<td>1350 mAh – 1.0 kΩ</td>
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<td>17.0</td>
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TAB. 6
Technical data, CR High Capacity Primary Lithium Cylindrical Cells
### 3.2 ASSEMBLIES

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<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
<th>L</th>
<th>M</th>
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<th>Tag</th>
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<td>7.0 0.6 42</td>
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<th>H</th>
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<th>C</th>
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<td>3.5</td>
<td>2.1</td>
<td>33.7</td>
<td>2.5</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>CR 2/3 A CD</td>
<td>6238 501 301</td>
<td>17</td>
<td>33.5</td>
<td>45.0</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>49</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 7**

Material: nickel plated sheet-steel, tag thickness: 0.15 mm till 0.25 mm. SLF: tip tinned, all types in green shrink sleeve.

1) using connector: JST type: PHR2 (Other connector types available on request.)

Custom made assemblies are available on request for large volume.

---

**Diagrams**

- **FIG. 48**: Ni Ø 0.8 mm - tinned
- **FIG. 49**: Ni Ø 0.8 mm - tinned
- **FIG. 50**: Ni Ø 0.8 mm - tinned
- **FIG. 51**: Ni Ø 0.8 mm - tinned
3.3 PERFORMANCE DATA

**FIG. 52** – CR 1/2 AA
**FIG. 56** – CR 2/3 AA
**FIG. 60** – CR AA
Discharge characteristics at room temperature (21°C)

**FIG. 53** – CR 1/2 AA
**FIG. 57** – CR 2/3 AA
**FIG. 61** – CR AA
Temperature characteristics at 5.6 kΩ

**FIG. 54** – CR 1/2 AA
**FIG. 58** – CR 2/3 A
**FIG. 62** – CR AA
Operating voltage vs. current drain, Voltage at 50% discharge

**FIG. 55** – CR 1/2 AA
**FIG. 59** – CR 2/3 AA
**FIG. 63** – CR AA
Cell capacity vs. discharge current
FIG. 64 – CR 2/3 A
Discharge characteristics at room temperature (21°C)

FIG. 65 – CR 2/3 A
Temperature characteristics
Constant load 5.6 kΩ

FIG. 66 – CR 2/3 A
Operating voltage vs. current drain
Voltage at 50% discharge

FIG. 67 – CR 2/3 A
Cell capacity vs. discharge current
4. CR HIGH POWER PRIMARY LITHIUM CYLINDRICAL CELLS
4.1 TYPES – TECHNICAL DATA

<table>
<thead>
<tr>
<th>Type</th>
<th>Order No.</th>
<th>Nominal voltage (V)</th>
<th>Nominal capacity at 20°C, load (mAh)</th>
<th>Max. continuous discharge current (mA)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR 2/3 AH</td>
<td>6215 101 501</td>
<td>3</td>
<td>1500 mAh – 200 Ω</td>
<td>1500</td>
<td>16</td>
</tr>
<tr>
<td>CR 123 A</td>
<td>6205 210 501</td>
<td>3</td>
<td>1500 mAh – 200 Ω/2.0 V</td>
<td>1400</td>
<td>17</td>
</tr>
<tr>
<td>CR 2</td>
<td>6206 210 501</td>
<td>3</td>
<td>850 mAh – 200 Ω/1.8 V</td>
<td>885</td>
<td>11</td>
</tr>
</tbody>
</table>

**TAB. 8**
Technical data, CR High Power Primary Lithium Cylindrical Cells

1) Current value for obtaining 50% capacity  
2) in blister card (1 pc)

4.2 ASSEMBLIES

**TAB. 9**
Material: nickel plated sheet-steel, tag thickness: 0.15 mm till 0.25 m. SLF: tip tinned.
Custom made assemblies are available on request for large volume.
4.3 PERFORMANCE DATA

**FIG. 71 – CR 2/3 AH**
Discharge characteristics at room temperature (21°C)

**FIG. 72 – CR 2/3 AH**
Temperature characteristics
Constant load 5.6 kΩ

**FIG. 73 – CR 2/3 AH**
Pulse discharge characteristics

1) Load: 0.9 A, 3 sec. on, 27 sec. off

2) After storage at 60°C/100 days

**FIG. 74 – CR 2/3 AH**
Typical discharge curve
Load: cont. 560 Ω
Pulse load: 2 sec./min 3 Ω (parallel)
Primary Lithium Cells

**FIG. 75 – CR 123 A**
Discharge characteristics
at room temperature (21°C)

**FIG. 76 – CR 123 A**
Temperature characteristics
Constant load 5.6 kΩ

**FIG. 77 – CR 123 A**
Pulse discharge characteristics

1) Load: 0.9 A, 3 sec. on, 27 sec. off
2) After storage at 60°C/100 days

**FIG. 78 – CR 123 A**
Typical discharge curve
Load: cont. 560 Ω
Pulse load: 2 sec./min 3 Ω (parallel)
FIG. 79 – CR 2
Discharge characteristics at room temperature (21°C)

FIG. 80 – CR 2
Pulse discharge characteristics

FIG. 81 – CR 2
Discharge temperature characteristics
5. GENERAL DESIGN CHARACTERISTICS

Battery Selection

In order to ensure optimum battery performance for the primary CR Button, the cylindrical CR High Power and cylindrical High Capacity cells, we suggest consideration of the following design-in requirements. They are the nominal and operating voltage, load current and profile, the duty cycle, temperature requirements and shelf life for the application. These characteristics for each battery type must be evaluated against the design requirements to select the most appropriate product that fulfills these requirements.

Design-in Considerations

**VARTA Microbattery Primary Lithium Batteries** offer lightweight packaged power for a variety of portable electric and electronic equipment. They are suitable as a main or standby power source for memory (RAM) and Real-Time clock (RTC) applications.

The Lithium Batteries are blocked from the power supply by means of a diode to prevent discharge of the battery into the DC supply during shut down.

The voltage drop across D1 should be taken into account as the minimum voltage of the load that has to be maintained under all circumstances.

Blocking diode D2 and D3 prevents the battery from being charged through the power supply. The amount of accumulated reverse current (IR) should be kept around 1% of the cell's typical capacity during its standby life time. A maximum of 5μA continuously must not be exceeded.

In the absence of a DC supply voltage, the lithium battery supplies the load with the necessary power.

As diodes fail at low current levels by an alloy-effect causing a severe reduction in impedance, an additional safety device must be incorporated.
UL-Recognition

All VARTA Microbattery Lithium Cells and Batteries listed in Tab. 10 are recognized by Underwriters Laboratories Inc. under UL-file number MH 13654 (N).

The cells are marked with the Recognized Component Mark.

Underwriters Laboratories requires for lithium cells/batteries a circuit, which must contain a protective component to prevent charging. In case of diode failure a current limiting resistor must be chosen according to the values listed in Tab. 10.

Please also pay attention to the Safety Guidelines on page 34.

For safety tests of the cells, “UL” requires either an additional diode, or a resistor, limiting the current to a safe level of 4 mA (for all cylindrical CR… A(A) lithium mass cells).

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

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

Printed Circuit Board Mounting

Never solder on the body of the battery directly, use a battery equipped with PC-mount terminals. When using automatic soldering apply 250–270 °C within 5 seconds. Make sure that the battery is not suspended or dropped into the soldering bath.

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

For safety aspects please consult Varta Microbattery before performing these extreme tests:

### Compression Test

1120 kg

- no significant electrolyte loss
- no rupturing

### In Short Circuit

Condition 24 h, 0.1 Ω

- after 24 h the bottom of the cell is curved by only 0.1 mm; diameter unchanged
- no electrolyte creepage or loss
- no rupturing

### Test at 150°C for 2 Hours

- no electrolyte creepage or loss
- no rupture
- no fire
- no explosion
- open circuit voltage almost unchanged at 3.2 V
- the cell base bowed, causing cell height to increase by 1 mm, diameter unchanged

### Puncture Test total Penetration of the Cell by a Nail Ø 3mm

- no splashing or pressurized electrolyte loss
- no rupturing

### Short Circuit

In table 11 the temperature is listed at short circuit at an ambient temperature of 20°C, 40°C and 70°C.

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>CR 1/2 AA</th>
<th>CR 2/3 AA</th>
<th>CR AA</th>
</tr>
</thead>
<tbody>
<tr>
<td>20°C</td>
<td>24°C</td>
<td>28°C</td>
<td>24°C</td>
</tr>
<tr>
<td>40°C</td>
<td>50°C</td>
<td>50°C</td>
<td>47°C</td>
</tr>
<tr>
<td>70°C</td>
<td>88°C</td>
<td>84°C</td>
<td>77°C</td>
</tr>
</tbody>
</table>

**TAB. 11**

### Vibration Test

**Frequency range**

- 5 Hz = 55 Hz = 500 Hz = 55 Hz = 5 Hz

**Amplitude at frequency range:**

- 5 to 55 Hz: ± 0.75 mm

**Acceleration at frequency range:**

- 55 Hz to 500 Hz: 100 m/s²

**Cycle duration:** 15 min

**Oscillation time of each main axis:** 3 h

**TAB. 12**

### Temperature Characteristics

**FIG. 79**

**CR 1/2 AA, Temperature characteristics**

Conditions: 20 h/20°C: 15 kΩ, 4 h/at various temp.: 270 kΩ

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Voltage U [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = -30°C</td>
<td>3.9</td>
</tr>
<tr>
<td>B = 20°C</td>
<td>3.7</td>
</tr>
<tr>
<td>C = 75°C</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Result**

Without changing of the electrical values the following Li-cell can be exposed to this vibration test:

- CR 1/2 AA
- CR 2/3 AA
- CR AA

**TAB. 12**
5.2 SAFETY GUIDELINES

Please see www.varta-microbattery.com/top/trans-safe for latest information about Transportation, Safety and Recycling Note for Batteries.
### 5.4 APPLICATION CHECK LIST

<table>
<thead>
<tr>
<th>Customer:</th>
<th>Application:</th>
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</table>

<table>
<thead>
<tr>
<th>Requested quantity:</th>
<th>Batteries per annum:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of battery:</th>
<th>Primary power source:</th>
<th>MBU:</th>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U&lt;sub&gt;max&lt;/sub&gt;:</th>
<th>U&lt;sub&gt;min&lt;/sub&gt;:</th>
<th>U&lt;sub&gt;cutoff&lt;/sub&gt;:</th>
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</table>

<table>
<thead>
<tr>
<th>I&lt;sub&gt;max&lt;/sub&gt;:</th>
<th>I&lt;sub&gt;min&lt;/sub&gt;:</th>
<th>I&lt;sub&gt;average&lt;/sub&gt;:</th>
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</table>

<table>
<thead>
<tr>
<th>Current profile:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Operating temperature:</th>
<th>max (°C):</th>
<th>min (°C):</th>
<th>average (°C):</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Temperature profile:</th>
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</thead>
</table>

<table>
<thead>
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<th>Storage temperature</th>
<th>max (°C):</th>
<th>min (°C):</th>
<th>average (°C):</th>
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</thead>
</table>

<table>
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<th>Storage time:</th>
<th>Operating time:</th>
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<table>
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<th>Dimensions:</th>
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<tr>
<th>Remarks:</th>
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Product Portfolio

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<tr>
<th>Primary Batteries</th>
<th>Rechargeable Batteries</th>
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<tr>
<td>Silver Oxide Button Cells</td>
<td>Li-Polymer</td>
</tr>
<tr>
<td>Lithium-Manganese Cells</td>
<td>NiMH Button Cells (V...H / HR / HT / HRT)</td>
</tr>
<tr>
<td>Lithium-Thionyl-Chloride Cells</td>
<td>Cylindrical &amp; Prismatic</td>
</tr>
<tr>
<td>Zinc Air Cells</td>
<td>Li-Ion &amp; NiMH Cells</td>
</tr>
<tr>
<td>Alkaline Batteries</td>
<td></td>
</tr>
<tr>
<td>Lithium Button Cells</td>
<td></td>
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