

32650 LiFePO4 Cylindrical Cell

Battery technical datasheet

3.2V — Marked Capacity 5000mAh (Verified real capacity: see Section 2)

1. Product Overview

This is a Lithium Iron Phosphate (LiFePO₄ / LFP) cell in the industrial 32650 form factor (32mm diameter x 65mm length), fitted with a bolt/stud terminal suitable for welding or direct bolting into battery packs. This cell is produced by a generic industrial supplier without an internationally documented brand, and no official datasheet is published by the original manufacturer.

This datasheet was prepared by Makers Electronics based on: (a) actual hands-on testing performed on samples from this batch, and (b) the standard, generally-known characteristics of LiFePO₄ chemistry. Please read the "Test Methodology & Disclaimer" section at the end of this document before relying fully on any figure.

2. Key Specifications

Parameter	Value and details
Chemistry	Lithium Iron Phosphate — LiFePO ₄ (LFP)
Form Factor / Size	Cylindrical 32650 — approx. 32mm diameter x 65mm length
Terminal Type	Bolt / Stud Terminal
Marked (Nameplate) Capacity	5000mAh (supplier's marketing figure)
Verified Capacity — Low/Medium Discharge Rate ($\leq 1C$)	3700 – 4700mAh (varies by sample) — highest confirmed reading: 4712mAh on a fully completed discharge test (2.5V cutoff, 14.7Wh, 1:34:15 runtime)
Verified Capacity — High Discharge Rate (tested at $\sim 4.5\text{-}5C$ / 22-24A)	$\approx 2300 - 2400\text{mAh}$ (natural reduction due to the Peukert effect at high current)
Nominal Voltage	3.2V
Max Charge Voltage	3.65V
Recommended Discharge Cutoff Voltage	2.5V
Absolute Minimum Voltage (never exceed)	2.0V
Internal Resistance — AC ESR Meter	7 – 20 m Ω (sample-to-sample variation observed)
Internal Resistance — Under Real DC Discharge Load (from tester)	$\approx 31\text{ m}\Omega$ (may include wiring/contact resistance; differs from static AC measurement)
Max Discharge Current Actually Tested Without Failure	22.76 – 24A ($\approx 4.5C$) — cell ran stably until approaching cutoff voltage (exact test duration not logged)

Parameter	Value and details
Max Continuous Discharge Current Recommended for Longevity	≈ 1C (approx. 4 – 5A) — conservative, despite the cell demonstrating much higher short/medium-term capability
Max Pulse Discharge Current (≤ 5 seconds)	≈ 5C (approx. 8 – 20A) — not manufacturer-certified
Recommended Max Charge Current	0.5C (approx. 2 – 2.5A) to prolong cell life
Discharge Operating Temperature Range	-20°C to 60°C (typical value for LFP chemistry)
Charge Temperature Range	0°C to 45°C (typical value for LFP chemistry)
Verified Weight (measured on 4 samples)	139 – 143g

3. Voltage Behavior and Discharge Curve

During real-world testing, the voltage was observed to remain nearly flat between 3.2V and 3.3V for most of the discharge period. This is expected and normal behavior for LiFePO₄ chemistry, known as the "Flat Voltage Plateau," followed by a sharp, rapid voltage drop as the cell approaches full depletion.

Practical implication: voltage alone cannot be reliably used to estimate remaining state of charge for most of the discharge cycle, since it stays nearly constant until the final moments. A Coulomb counter or a BMS with charge tracking is recommended for accurate state-of-charge estimation.

4. Internal Composition

Component	Material and description
Cathode (Positive Electrode)	Lithium Iron Phosphate (LiFePO ₄), thermally stable olivine structure
Anode (Negative Electrode)	Graphite
Separator	Porous, heat-resistant polymer membrane
Electrolyte	Lithium salt dissolved in an organic solvent
Outer Casing	Metal can (steel/aluminum), pressure-resistant, with a safety vent for gas release

5. Suitable Applications

- Home and small-scale solar energy storage systems
- Electric bike and e-scooter battery packs
- Low-to-medium power backup / UPS systems
- High-power flashlights and lighting equipment
- Industrial applications requiring high thermal safety and long cycle life

Not recommended for: applications requiring repeated pulse discharge currents above 2C, or devices that rely solely on voltage readings for precise state-of-charge estimation.

6. Safe Charging Guidelines

Only a charger specifically designed for LiFePO₄ chemistry should be used (cutoff voltage of 3.65V per cell). Using a standard Li-ion charger (4.2V) will stress the cell and significantly reduce its service life, and may cause permanent damage with repeated use.

It is recommended not to leave the cell fully charged (3.65V) for extended periods of non-use. For storage exceeding one month, keep the cell at a moderate charge level (approximately 3.3V).

7. Safety Notes

- Never exceed the maximum charge voltage of 3.65V per cell under any circumstances
- Never discharge the cell below 2.0V — this causes permanent, irreversible damage
- When assembling multiple cells into a pack, use a Battery Management System (BMS) to ensure cell balancing
- LiFePO₄ chemistry is more thermally stable than standard Li-ion chemistries (NMC/LCO) and less prone to explosion or fire, but it is not entirely risk-free under abuse conditions
- Avoid discharging above the recommended current values in this document, especially for samples with higher internal resistance (closer to 20-31 mΩ)

8. Additional High-Current Discharge Test Results

A constant-current discharge test was performed using a professional DC electronic load, set to a target current of 24.00A. During the test, an actual current of 22.756A flowed (approximately 4.5x the cell's rated 1C capacity) with no signs of sudden failure, swelling, or dangerous heat build-up — the recorded internal temperature during the test was only 31.4°C. [Exact test duration was not captured in this reading — to be added once timer data is available.]

The test ended naturally as voltage approached the configured cutoff point (2.5V), not due to cell failure or an emergency protection trip. This is strong practical evidence that the cell can tolerate discharge currents far higher than the conservative 1C estimate, over the short-to-medium term.

However, the capacity delivered at this high current rate (approximately 2300–2400mAh) is lower than the capacity measured at lower discharge rates (3700–4700mAh). This is expected, normal behavior across all battery types, known as the Peukert effect: the higher the discharge current, the lower the usable capacity that can actually be extracted, due to internal heat losses and voltage sag under load.

Practical recommendation: this cell can be used in applications requiring high currents for short-to-medium durations (such as power tools or high-current startup surges), but for continuous long-term use (such as solar energy storage systems), it is preferable to stay within the conservative current limit ($\approx 1C$) to preserve the maximum number of charge cycles and the longest possible service life.

Important note on test conditions: the relatively low temperature recorded during this test (31.4°C) may reflect the ventilation/cooling conditions of the test setup. In real-world use inside a sealed battery pack or plastic enclosure without adequate airflow, cell temperature is expected to rise higher at the same current, and high current may not be safe for repeated or prolonged use in that case. Any high-current recommendation in this document is conditional on adequate ventilation or cooling being present.

9. Test Methodology and Disclaimer

The real capacity (3700–4700mAh) and internal resistance (7–20 m Ω , AC method) figures in this document are based on actual measurements performed by Makers Electronics on samples from this specific batch, using a battery analyzer. These figures represent a realistic range and are not a guaranteed fixed value for every individual unit, given the absence of an official manufacturer datasheet and the quality variation observed between samples.

Values labeled "typical," "estimated," or "not directly tested" are drawn from the generally known characteristics of LiFePO₄ chemistry in the market, and are not the result of direct testing on this specific cell. Any industrial or commercial user is advised to perform a verification test on a sample from each new supply batch before use in critical applications.

Makers Electronics is not liable for any damage resulting from use of the battery outside the limits stated in this document, or from natural performance variation between different batches from the same supplier.