

BATTERY TECHNOLOGIES

Battery Options



There are a multitude of different battery technologies available. There are some really great resources available for the nitty gritty details behind battery chemistries. Wikipedia is especially good and all encompassing. This tutorial focuses on the most often used batteries for embedded systems and DIY electronics.

Terminology

Here are some terms often used when talking about batteries.

Capacity - Batteries have different ratings for the amount of power a given battery can store. When a battery is fully charged, the capacity is the amount of power it contains. Batteries of the same type will often be rated by the amount of current they can output over time. For example, there are 1000mAh (milli-Amp Hour) and 2000mAh batteries.

Nominal Cell Voltage - The average voltage a cell outputs when charged. The nominal voltage of a battery depends on the chemical reaction behind it. A lead-acid car battery will output 12V. A lithium coin cell battery will output 3V.

The key word here is “nominal”, the actual measured voltage on a battery will decrease as it discharges. A fully charged LiPo battery will produce about 4.23V, while when discharged its voltage may be closer to 2.7V.

Shape - Batteries come in many sizes and shapes. The term ‘AA’ references a specific shape and style of a cell. There are a large variety.

Primary vs. Secondary - Primary batteries are synonymous with **disposable**.

Once fully-drained, primary cells can't be recharged (reliably/safely). Secondary batteries are better known as **rechargeable**. These require another power source to fully charge back up, but they can fully charge/discharge many times over their life. In general primary batteries have a lower discharge rate, so they'll last longer, but they can be less economical than rechargeable batteries.

Common batteries, their chemistry, and their nominal voltage

Battery Shape	Chemistry	Nominal Voltage	Rechargeable?
AA, AAA, C, and D	Alkaline or Zinc-carbon	1.5V	No
9V	Alkaline or Zinc-carbon	9V	No
Coin cell	Lithium	3V	No
Silver Flat Pack	Lithium Polymer (LiPo)	3.7V	Yes
AA, AAA, C, D (Rechargeable)	NiMH or NiCd	1.2V	Yes
Car battery	Six-cell lead-acid	12.6V	Yes

Energy Density - Combining capacity with shape and size of a battery, the energy density of a battery can be calculated. Different technologies allow different densities. For example, lithium batteries typically pack more juice into a given volume than alkaline or coin cell batteries.

Internal Discharge Rate - Have you ever tried to start a car that has been sitting for 6 months? Batteries discharge when sitting on the shelf or when unused. The rate at which the battery discharges itself over time is called internal discharge rate.

Safety - Because batteries store power, they are basically very tiny explosives. To prevent harm, batteries are designed to be as safe as possible. Most batteries technologies are designed to discharge safely in the event of misuse. If you hook up an alkaline battery incorrectly, it may get hot to the touch but should not catch fire. Most Lithium Polymer batteries have safety circuits built-in to prevent damage to battery and prevent it from unsafe usage.

Source: <https://learn.sparkfun.com/tutorials/battery-technologies>