Packaging of Batteries

Primary Battery

Single Use, Not Rechargeable

A variety of standard sizes of primary cells. From left: 4.5V multicell battery, D, C, AA, AAA, AAAA, A23, 9V multicell battery, *(top)* LR44, *(bottom)* CR2032

Capacity Information - https://en.wikipedia.org/wiki/List_of_battery_sizes

https://en.wikipedia.org/wiki/Primary_battery

Button Cell

Button Battery Types

There are several different types of **batteries**, each with its own chemical composition and performance characteristics. The most common types of button batteries include:

Alkaline

Alkaline button batteries are typically used in low-drain devices, such as watches and calculators. They have a voltage range of 1.5 to 1.6 Volts and a capacity range of 50 to 150 milliampere-hours (mAh).

Lithium

Lithium button batteries are commonly used in high-drain devices, such as digital cameras and electronic toys. They have a voltage range of 3 to 3.6 Volts and a capacity range of 40 to 240 mAh.

Silver Oxide

Silver oxide button batteries are commonly used in medical devices, such as hearing aids and pacemakers. They have a voltage range of 1.5 to 1.6 Volts and a capacity range of 20 to 100 mAh.

Zinc-Air

Zinc-air button batteries are commonly used in hearing aids. They have a voltage range of 1.4 to 1.45 Volts and a capacity range of 50 to 130 mAh.

Button Cell Battery Sizes

Button batteries come in a variety of sizes, which are designated by a code. The first two digits indicate the diameter of the battery in millimetres, while the third digit indicates the height of the battery in tenths of millimetres.

Common sizes of button batteries include:

- **1220**: 12mm diameter, 2.0mm height
- **1620**: 16mm diameter, 2.0mm height
- **2032**: 20mm diameter, 3.2mm height
- **2450**: 24mm diameter, 5.0mm height

https://en.wikipedia.org/wiki/Button_cell
https://uk.rs-online.com/web/content/discovery/ideas-and-advice/button-batteries-guide

Letter Code

First Letter

Letter code	Common name
L	Alkaline
S	Silver
P	Zinc-air
C	Lithium
B	
G	
Z	Nickel oxyhydroxide
M, N (withdrawn)	Mercury

The second letter, **R**, indicates a round (cylindrical) form.

Diameter Codes

Number code	Nominal diameter (mm)	Tolerance (mm)
4	4.8	±0.15
5	5.8	±0.15
6	6.8	±0.15
7	7.9	±0.15
9	9.5	±0.15
10	10.0	±0.20
11	11.6	±0.20
12	12.5	±0.25
16	16.0	±0.25
20	20.0	±0.25
23	23.0	±0.50
24	24.5	±0.50
44	11.6	±0.20

CR2032: lithium, 20 mm diameter, 3.2 mm height

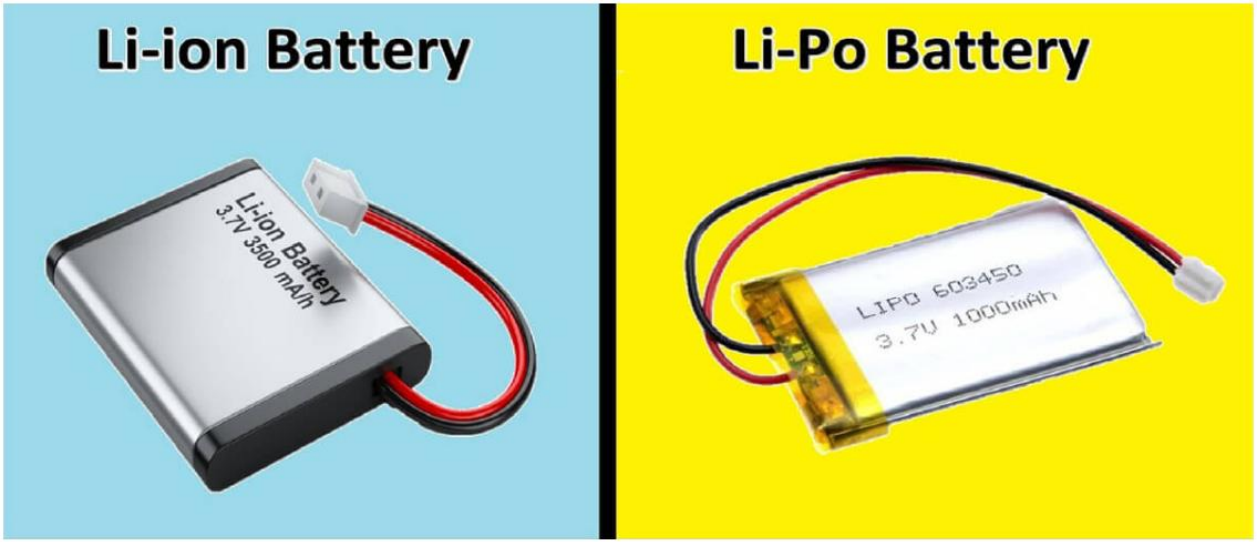
https://en.wikipedia.org/wiki/Button_cell

Comparison

Battery Type	Capacity (mAh)	Nominal Voltage	Chemistry	Typical Use Cases	Reference
AA	500 - 3300	1.5V	Alkaline, NiMH, Li-ion, Zinc-Carbon, Carbon Zinc	Remote controls, toys, wall clocks, digital cameras, medical devices	Wikipedia
AAA	500 - 1200	1.5V	Alkaline, Lithium, NiMH, Carbon Zinc	Remote controls, calculators, laser pens, flashlights, toys	Wikipedia
9V	400 - 1200	9V	Alkaline, Lithium, NiMH, NiCd, LiMnO2, Carbon Zinc	Smoke detectors, walkie-talkies, portable electronics	Wikipedia
CR1212	18	3.0V	Lithium	Electric water heaters, rice cookers, timers, wireless earphones, car audio	WinPow
CR1620	65 - 80	3V	Lithium	Car keys, remote controls, micro flashlights, digital watches, credit card-sized devices	Etechnophiles
CR2032	220	3V	Lithium	Motherboards, scales, remote controls	BatteryStation

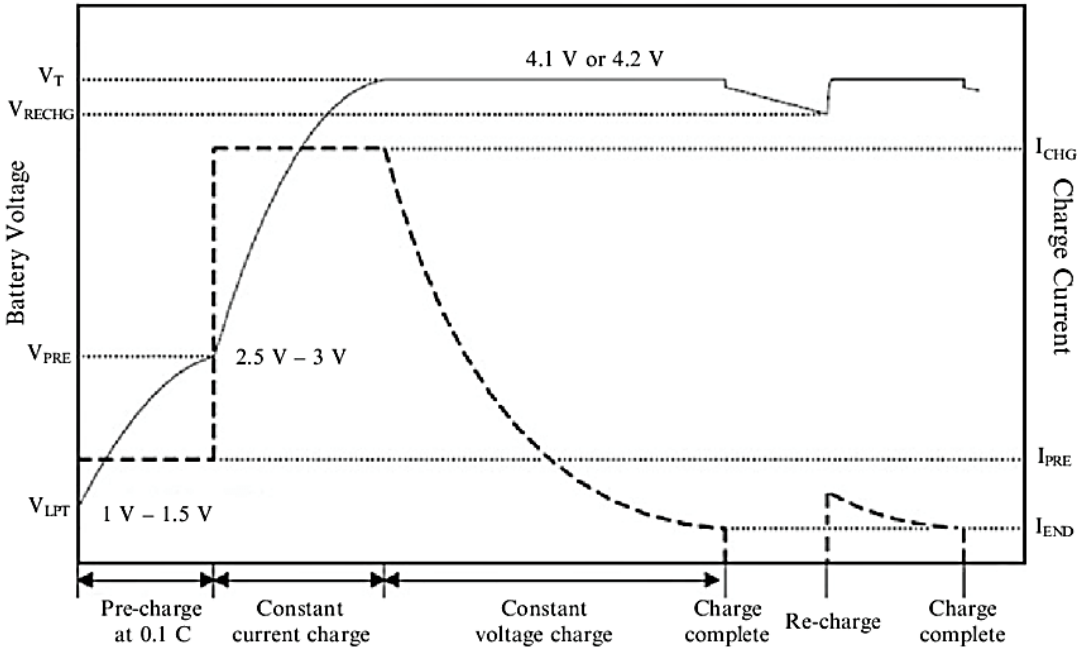
Secondary Battery

Li-ion Uses A Liquid Electrolyte. Li-po Uses A Polymer Electrolyte → Flexibility In Shaping The Battery



https://www.takomabattery.com/ultimate-buying-guide-for-lithium-polymer-battery/

Li-Ion/Po Charging Profile



I_{CHG}: Charge current.
0.5C-1C can be considered as fast charge.
I_{PRE}: Pre-charge current, e.g. 0.1 C.
I_{END}: Ending charge current, e.g. 0.02 C.
V_T: Battery terminal voltage.
V_{RECHG}: Threshold voltage to start recharge.
V_{PRE}: Voltage when pre-charge finished.
V_{LPT}: Low protection threshold voltage.

Young, K. & Wang, Caisheng & Wang, Le & Strunz, K.. (2013). Electric Vehicle Battery Technologies. Electric Vehicle Integration into Modern Power Networks. 15-56. 10.1007/978-1-4614-0134-6_2.

DigiKey

All Products

Enter keyword or part #

Accessories

261 Items

Chassis Mount Resistors

23,453 Items

Chip Resistor - Surface Mount

9,83,169 Items

Resistor Networks, Arrays

37,021 Items

Specialized Resistors

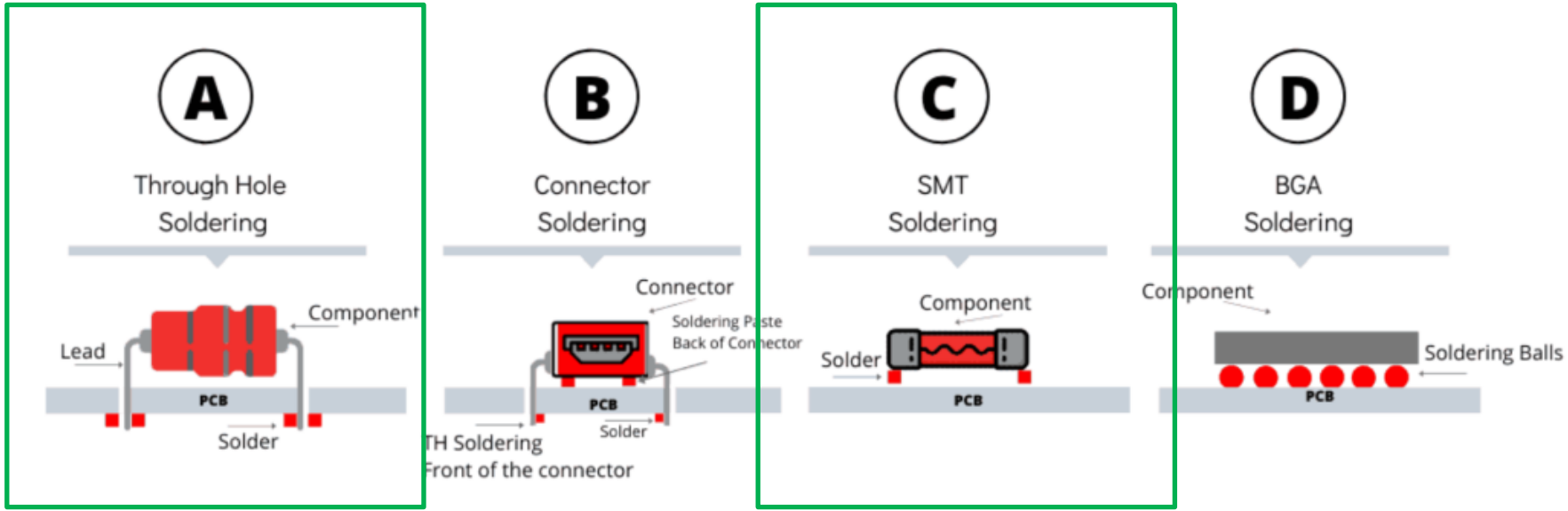
781 Items

Through Hole Resistors

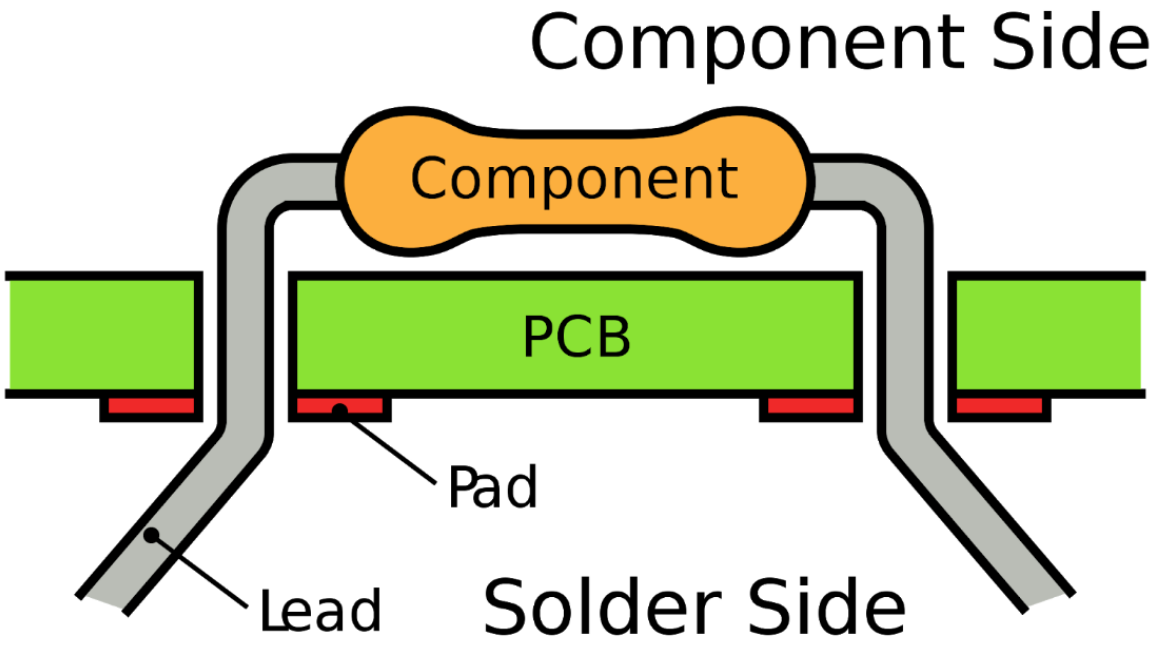
5,07,221 Items

TITOMA

Design for Manufacturing Asia



https://titoma.com/blog/smt-smd-bga-tht-meaning



https://resources.altium.com/p/why-use-through-hole-technology-in-pcb-design

SMD Resistor Sizes

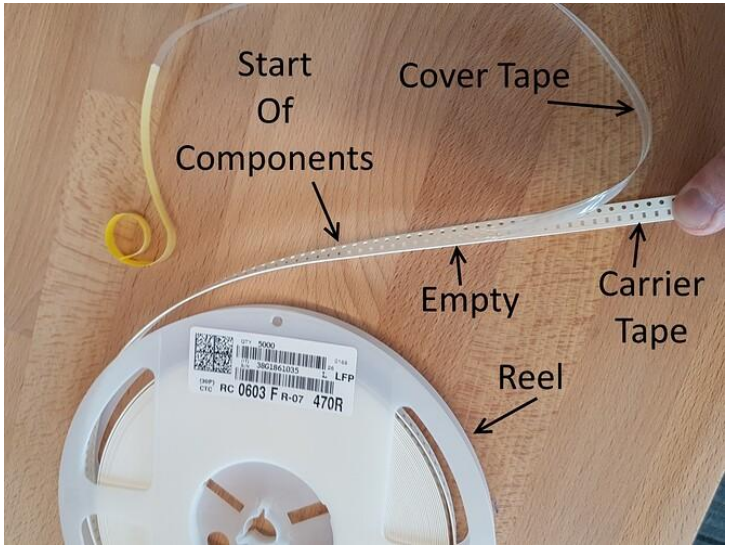
Code		Length (l)		Width (w)		Height (h)		Power
Imperial	Metric	inch	mm	inch	mm	inch	mm	Watt
0201	0603	0.024	0.6	0.012	0.3	0.01	0.25	1/20 (0.05)
0402	1005	0.04	1.0	0.02	0.5	0.014	0.35	1/16 (0.062)
0603	1608	0.06	1.55	0.03	0.85	0.018	0.45	1/10 (0.10)
0805	2012	0.08	2.0	0.05	1.2	0.018	0.45	1/8 (0.125)
1206	3216	0.12	3.2	0.06	1.6	0.022	0.55	1/4 (0.25)
1210	3225	0.12	3.2	0.10	2.5	0.022	0.55	1/2 (0.50)
1812	3246	0.12	3.2	0.18	4.6	0.022	0.55	1
2010	5025	0.20	5.0	0.10	2.5	0.024	0.6	3/4 (0.75)
2512	6332	0.25	6.3	0.12	3.2	0.024	0.6	1

- Similar for Capacitors, LEDs etc.,
- For the course, 0402 (Imperial) package size will be used.

https://eepower.com/resistor-guide/resistor-standards-and-codes/resistor-sizes-and-packages/

Cut Tape vs. Reel

Tape and Reel

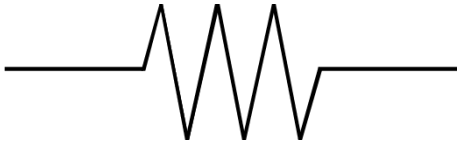


Cut-Tape

https://forum.digikey.com/t/a-closer-look-at-taped-packaging-including-cut-tape-and-tape-and-reels/17211

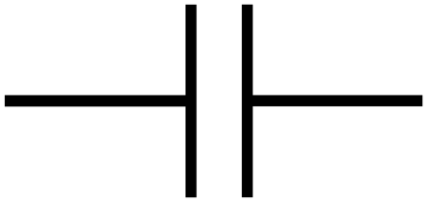
Component Parameters

Resistor



- Resistance
- Power Rating
- Package (e.g., 0402)

Capacitor

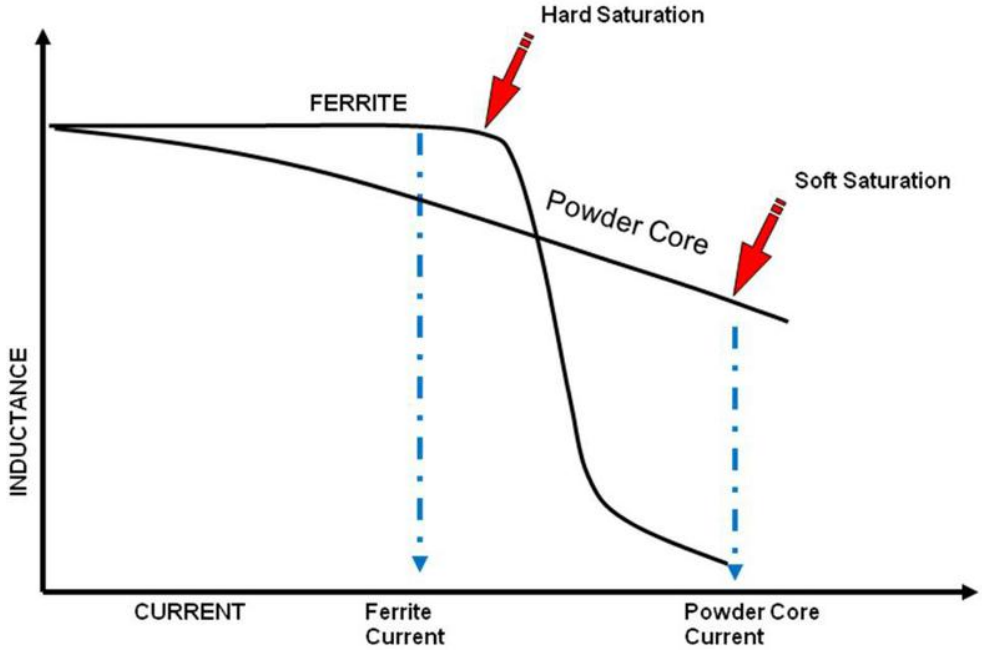


- Capacitance
- Voltage Rating
- Package (e.g., 0402)

Inductor

- Inductance
- Saturation Current
- Package (e.g., 0402)

Inductor Saturation



https://www.powersystemsdesign.com/power-inductors-and-peak-current-handling-capability/22
digikey: Part# LQW18ASR11G0ZD