

Portable Battery Pack Buyers Guide

What is a Portable Battery Pack?

Portable battery packs are a form of mobile power supply that provides convenient mobile charging for smartphones, phablets, tablets and other 3C accessories. They are multipurpose, small in size, safe, reliable and long in life.



Mobile Battery Pack: Basics

Basic components of a portable battery pack comprise of the following: battery, circuit board, USB output, micro USB input, power switch and LED indicator. The battery cell is discharged via the Micro-USB output and USB output.



Battery Cell Types

Li-ion (Lithium-ion) :

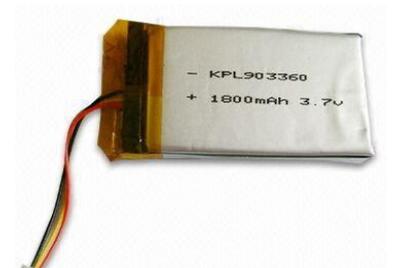
Regular (18650) lithium cells are characterized by uniform size (Diameter: 18mm, Height: 65mm) Single battery holds an average 2200~2600mAh and are mainly manufactured in Japan/Korean/China. Grade A lithium cell batteries holds an average 3000~3400mAh but are mainly manufactured in Japan and Korean for their respective markets only. Li-ion cells have high energy densities and costs less than Li-Polymer due to cheaper and quicker production methods.



Li-Polymer :

Battery has high plasticity that resemble a plastic film and therefore can be adapted to match a variety of packaging shapes and sizes. They do not have a uniform size like lithium ion cells. They also have a greater life cycle degradation rate than Li-ion and is around 20% lighter.

Due to high costs, majority is produced in Mainland China. Apple's iPhones and iPads use li-polymer to match their slim designs.



What is Fast Charging? (2A)

2A (2.1A) is a form of high current output, which is suited to large mobile devices with larger battery capacities (4,000-11,500mAh). Most unknown brands using a low-cost strategy may state a 2A

output but charging usually lasts around 5-10minutes before dropping to 1.0A as the device is unable to stabilise the 2.0A current, otherwise generated heat may cause damage. LUXA2 batteries perform consistently at 2.0A, which is equivalent to the original travel charger.

Power Conversion & Efficiency Calculated

Mobile power supply capacity is directly related to battery capacity of mobile device. Assume you have a 5000mAh battery pack to charge an iPhone 5 (1440mAh). Using the mathematical sum of 5000/1440 to identify how many times a device can be charged, figures indicate it can be charged 3.47 times, but the actual use is 2.36 times. Why is this?

The reason for this is because the battery cell voltage is 3.7 – 4.2V, whilst the mobile device is charged at 5V. This results in power transfer loss.

Battery capacity conversion calculations:

- Mobile power capacity x Product conversion efficiency (75~90%) = Actual discharge of capacity
- Actual discharge capacity x Conversion efficiency (85~90%) = actual charge capacity into apparatus
- Actual charge capacity / unit build battery capacity = actual charging time

Product Capacity	iPhone5 1440mAh	iPad mini 4400mAh	iPad 4 11500mAh	Galaxy S4 2600mAh	Note2/3 3200mAh	Nexus5 2300mAh	Nexus7 4325mAh	HTC New One 2300mAh
Efficiency 85%	-	-	-	-	-	-	-	-
(PL1) 2,800mAh	133%	43%	17%	74%	60%	83%	44%	83%
(P2) 5,000mAh	236%	78%	30%	131%	107%	148%	79%	148%
(PL2) 6,000mAh	284%	93%	36%	157%	128%	178%	94%	178%
(P1PRO) 7,000mAh	331%	109%	42%	183%	149%	207%	110%	207%
Efficiency 90%	-	-	-	-	-	-	-	-
(P-Mini) 20,800mAh	1042%	341%	131%	577%	469%	652%	347%	652%
(P-MEGA) 41,600mAh	2084%	682%	262%	1154%	938%	1304%	694%	1304%

**Above in comparison with LUXA2 product range*

Power Bank Charging Times

Power bank charging times will vary with the external power supply used. For instance, the majority of desktop and laptops use a USB2.0 (5V/500mAh) or USB3.0 (5V/900mAh) output, whilst a standard wall charger may use a (5V/1A) or (5V/2A) output. In these examples, the (5V/2A) output will charge fastest.

Action under 5000mAh Power as an example:

- $5000\text{mAh} / 500\text{mAh (USB2.0)} / 0.85(\text{Energy conversion efficiency}) = 11.76 \text{ hours}$
- $5000\text{mAh} / 900\text{mAh (USB3.0)} / 0.85 = 6.53 \text{ hours}$
- $5000\text{mAh} / 1000\text{mAh (AC)} / 0.85 = 5.88 \text{ hours}$
- $5000\text{mAh} / 2000\text{mAh (AC)} / 0.85 = 2.94 \text{ hours}$

**Above is based on theoretical calculations as due to battery energy losses*

Things to watch out for :

1. *Large capacity and cheap price* - Price reflects quality, therefore battery packs claiming to have a high capacity but much cheaper than a battery pack with lower capacity is something users need to be cautious of.
2. *High capacity and low weight* - Battery capacity is proportional to weight.
3. *Small size and high capacity* - Volume is proportional to battery capacity.
4. *Warranty period less than 1 year* - Possibility of recycled batteries used.
5. *No battery certifications* - No third party certification licensing unit provided therefore users will have no idea how safe the device really is.

How to properly use your mobile battery pack :

1. Do not charge and discharge your battery pack at the same time as it may cause abnormal operation that may result in damage.
2. Do not place in hot areas or fire as it may result in the battery exploding.
3. Do not use in areas of high humidity as battery it may cause rust or short circuit the boards
4. Do not place near children.

What is MFI Apple Certification?

Apple MFI Certification (see logo: right) represents a label that is printed on product packaging.



This certification is given upon passing Apple's technical approval with a device having a 30 pin, or 8 pin connector and to ensure a device is fully compatible with Apple products. A certain amount of royalty is paid to apple for this certification, therefore products under this specification are usually

priced higher. This however does not guarantee that manufacturers will not use inferior grade products or false battery capacities in their production. Increasingly worrying is the amount of products that have not been certified yet have the apple MFI certified logo.

Flight Safety Regulations

According to flight safety regulations, any charging equipment (spare or installed power should be clearly labelled in (watts) and must not exceed 43,200mAh. To calculate this:

Watt-hours(Wh)	Use of equipment	Specifications	Hand Carry	Checked-in Luggage
100 watts or less	Mobile battery packs, cameras, portable notebook with lithium battery	Installed in device	Allowed	Allowed but recommended to put in hand luggage
		Standby (bulk)	Allowed but must comply with certain provisions	Not allowed
100-160 watts	Laptop batteries and professional audio, visual equipment with lithium battery	Installed in device	Allowed	Allowed but recommended to put in hand luggage
		Standby (bulk)	Allowed but limited to 2 per passenger	Not allowed
160 watts or more	Industrial equipment, hybrid cars, mobile tools and large lithium batteries	Must be in accordance with the International Air Transport Association Dangerous Goods declaration as cargo handling and transportation rules. As a result of disability, health, age and temporary problems (physical injury) passengers that need to use lithium-ion battery-powered electric wheelchairs or other similar auxiliary tools should contact the airline for assistance.		

WH(Wh) that is the power unit with the formula $P(\text{power WH}) = V(\text{voltage V}) \times I(\text{capacity mAh}) / 1000$

Using LUXA2's P-MEGA 41,600mAh Power Station as an example:

$(41,600\text{mAh} / 1000) \times 3.7\text{V} = 41.6\text{A} \times 3.7\text{V} = 153.92\text{Wh} \rightarrow$ can be placed in hand luggage

$160\text{Wh} / 3.7\text{V} = 43,200\text{mAh} \rightarrow$ maximum allowed to be carried on plane

Other Relevant Information :

1. Korean batteries (Samsung, LG) with single cell of 2200mAh (Li-ion) costs around \$2.

Therefore a 18000mAh battery pack core battery possesses around 8 batteries (\$16), plus electronics components, housing, labour costs, shipping, vendor costs and channel profits may be sold to consumers at \$15-20? This is of course no possible as a more reasonable product pricing range should be around \$35-40.

2. A standard 2200~2600mAh Li-ion battery weighs around 45-46g plus electronic components and

case should therefore weigh around 70g. On some Internet sites there are some high capacity battery packs 18000mAh that weigh only around 380-400g. This is not possible.