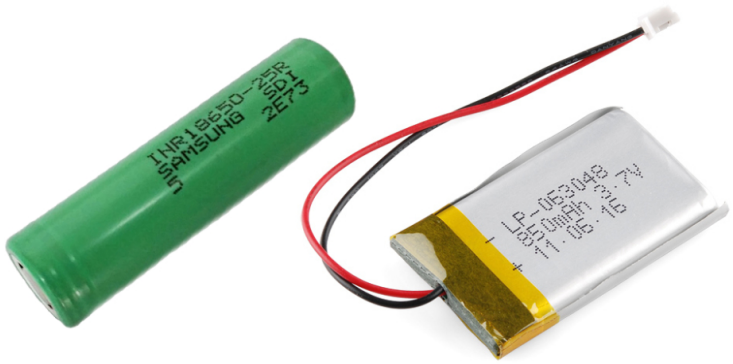
Building Batteries with 1 Port Play and Charge

Discussion in 'Guide Submissions Archive' started by Miceeno, Aug 25, 2017.

Miceeno
member
Joined: Nov 30, 2016
Messages: 89
Likes Received: 153
Portables: 4

Lithium batteries or Li-Ion/Li-Po batteries are the clear choice for building a portable because other battery chemistries don't have the same energy density. The only caveat with lithium batteries is they **CAN and WILL** spontaneously combust if you miss use them. In this thread I intend to provide explanation on how to safely use lithium batteries. I will also outline how to build a "1 port play and charge" system to power your portable.

Li-Ion vs. Li-Po



Li-Ion 18650 Cell **Li-Po Cell**

When it comes to lithium cells there are only two options to really consider, these are 18650 Li-Ion cells and flat packed Li-Po cells. While choosing cells, only cells from leading manufacturers (LG, Panasonic, Samsung, Sony, etc.) should be considered. These cells are better built and safer to use than Chinese counterfits. As well as the capacity of these cells are closer to what's advertised.

I specify 18650 Li-Ion cells over all the other standard sizes of Li-Ion cells for one simple reason, Tesla uses 18650 cells. While Tesla cells aren't widely available on the market, they are driving the competition to make higher capacity cells at a lower cost. Before Tesla's Gigafactory the average high capacity cell from the leading manufacturers was 2500mAh. Today the leading manufactures are starting to break the 3000mAh barrier. Panasonic has some that are labeled at 3400mAh but the actual capacity is lower (more on this later).

As for the Li-Po cells, there's more variety in the form factor so there isn't a recommended physical size. One thing to note about Li-Po flat pack cells is that they are very fragile. Excessive heat from improper charging and discharging can cause these cells to swell. **Once these cells swell they are a ticking time bomb!** The form factor also contributes to the fragility of this type of cell. They are soft and malleable when compared to the hard shell of an 18650 cell. This makes Li-Po cells prone to punctures from surrounding through-hole mounted components in a portable. If you puncture a cell it will go up in an inferno.

For a first time battery builder, I'd recommend the 18650 cells over the Li-Po cells for the sake of safety. Although the Li-Po cell's form factor will allow for a much thinner portable. Most quality 18650 cells have a safety fuse inside them that will pop when too much current is drawn from the cell or (more likely) when they get too hot while trying to solder to them. It's still possible to safely solder to an 18650 it just requires the area to be roughed up a little with sandpaper, some flux, and a lot of heat over a short period of time. It's easier to just use battery holders for 18650 cells because they are cheap and cells can be easily swapped out.

If Li-Po cells are chosen, then soldering directly to the cell is the only option. Try to find Li-Po cells with long wires already attached. Long wires will allow for more solder time because the heat will penetrate the cell slower. If the cell doesn't have attached wires then allow the cell to cool between soldering each contact. If you get a Li-Po too hot it will swell and should be discarded.

How Many Cells

Lithium cells have a nominal voltage of 3.6-3.7 volts while the operating voltage range is generally from 4.2 volts to 3.0 volts (although this can vary, some cells can happily discharge down to 2.5 volts so check the data sheet). **Never ever use cells that have been outside the operating voltage.** If a cell exceeds 4.2 volts it **CAN and WILL** blow up. If a cell goes below 3.0 volts the battery chemistry can be damaged causing reduced battery life, increased internal resistance, and an imbalance in the battery pack (more on this later).

This operating voltage range must be taken in consideration while designing a battery. It's crucial to make sure the max charge voltage and max discharge voltage are within the acceptable range for the input voltage on the voltage regulators in your portable. The way to control the voltage of a battery is to change the number of cells in series. Conversely, the number of cells in parallel will change the capacity. The number of cells in series and parallel are denoted by "s" and "p" values when describing a battery. As well as the battery's voltage is described by the nominal voltage. Here's a table of basic battery configurations based off of a 3.7v 2500mAh cell. The "s" number and "p" number are multiplied to give you total number of cells. So a 2s1p 7.4v 2500mAh battery has 2 cells. And a 4s3p 14.8v 7500mAh battery has 12 cells. **NOTE: A lithium battery requires a protection board so continue reading to that section before building a battery.**

3.7v 2500mAh Cell Series and Parallel Configurations

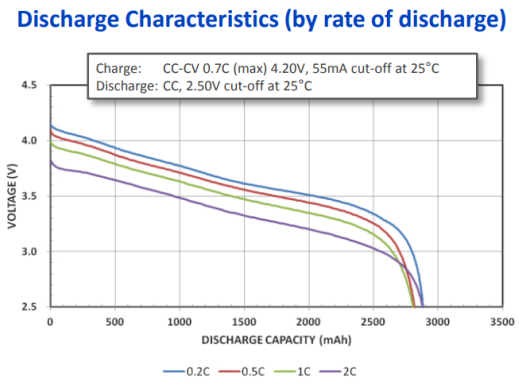
	1s	2s	3s	4s
1p	3.7v 2500mAh	7.4v 2500mAh	11.1v 2500mAh	14.8v 2500mAh
2p	3.7v 5000mAh	7.4v 5000mAh	11.1v 5000mAh	14.8v 5000mAh
3p	3.7v 7500mAh	7.4v 7500mAh	11.1v 7500mAh	14.8v 7500mAh
4p	3.7v 10,000mAh	7.4v 10,000mAh	11.1v 10,000mAh	14.8v 10,000mAh

Discharging

When a cell discharges, the voltage drops in a curve (see the graph below). This discharge characteristic can greatly reduce battery life in a portable that relies on low-dropout (LDO) regulators to make the required input voltage.

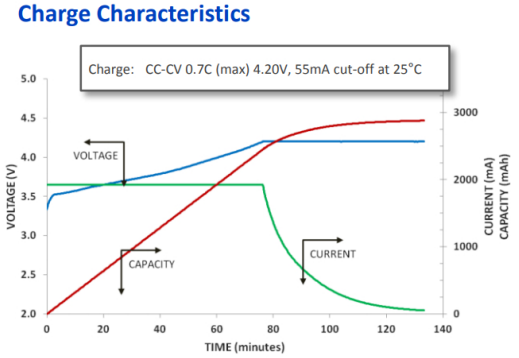
For example, a Nintendo 64 requires input voltages of 3.3 volts and 5 volts to operate. Most people use a TI 08080 switching regulator to get 3.3 volts, but rely on the built in LDO regulator to provide 5 volts. Depending on the N64's revision, the built in LDO regulator has a dropout voltage of 1.6-2.0 volts. So if a 2 cell 7.4 volt battery is being used, which operates from 8.4 volts to 6.0 volts, the bottom 30% of the battery's capacity cannot be used. Once the battery voltage drops below 7.0-6.6 volts the LDO stops making 5 volts.

The solution to this problem is to either build a better 5 volt regulator. Or to simply build a 3 cell 11.1 volt battery that operates from 12.6 volts down to 9.0 volts.



Charging

Lithium cells require a special kind of charging when compared to other battery chemistry types. This type of charging is often refered to as "Smart Charging" otherwise known as a Constant Current / Constant Voltage Charging (or a CC/CV Charging). The charge cycle starts with Constant Current while the voltage slowly ramps up. Once the cells reach around 70-80% capacity (around 4.1 volts) the charger goes into a Constant Voltage mode while the current tapers down (see the graph below).



C Rating

A specification that needs attention while building batteries is the "C" rating (Capacity Rating). It's basically the mAh rating of the battery converted to amps. In a 7.4v 2500mAh 2s1p battery 1C equals 2.5 amps. In a 7.4v 5000mAh 2s2p battery 1C equals 5 amps. Simple enough. **The C rating is important because cells can generally only be discharged at 1-2C and charged at 0.5-1C** (refer to the datasheet for your cells). So a 7.4v 2500mAh 2s1p battery can be safely discharged at 2.5 amps (1C) and it will last one hour. If it is discharged at 5 amps (2C) with will only last half an hour. If we wanted to charge this battery at 0.5C, then we would need a charger that can provide 1.25 amps which will take a little over two hours to charge. Or if we had a charger that could charge at 2.5 amps (1C) the battery will charge in a little over one hour.

When talking about discharging batteries, C ratings are more important when dealing with motors in R/C's and EV's. DC motors require a lot of amps and will over draw current from batteries. In our application it's not as much of an issue unless you are planning to run a power hungry console like an original PS3 (200ish watts) off batteries. Whereas the average Nintendo 64 portable draws around 12 watts. Which can be powered by a 7.4v 2500mAh 2s1p battery that can safely provide 18.5 watts of power continuously while being discharged at 1C (7.4v * 2.5Ah = 18.5w).

C rating is more important to portablizing when considering a charger. Try to find a charger that can charge at 0.5C to 1C of your battery. If your charger has a smaller charge current than 0.5C then it will take longer to charge your battery.

Internal Resistance

Another characteristic of building a battery is the internal resistance of the cells. Every cell has a certain amount of internal resistance. This internal resistance is what causes capacity variation from cell to cell from the same lot. Over many cycles the internal resistance increases causing reduced cell capacity and voltage drop. If a cell is allowed to operate outside the 4.2-3.0 volt range or draw more than 2C continuously, the lithium chemistry breaks down, increasing internal resistance. Increased internal resistance will also manifest itself in large batteries as voltage drop.

For example, I have 4 new 10s2p batteries that have a max voltage that varies from 40.5-41.5 volts from battery to battery. In a perfect world they

would all have a max voltage of 42 volts. So don't be alarmed if you see a small voltage drop across your battery. In my 20 cell batteries there's a 0.025-0.075 volt drop per cell. This sort of a voltage drop is meaningless in our application of building portables but in the R/C and EV world it causes a decrease in the max RPM of motors.

Battery Life

Finally, the last thing to know about choosing cells is how to roughly calculate battery life. Basically, if a battery is discharged at 1C it will be fully discharged in 1 hour (and discharged at 2C in half an hour). If the nominal voltage is multiplied by the amp hours (not milliamps hours, mAh) you get watt hours. So a 7.4v 2500mAh 2s battery is 18.5 watt hours.

7.4v * 2.5Ah = 18.5wh

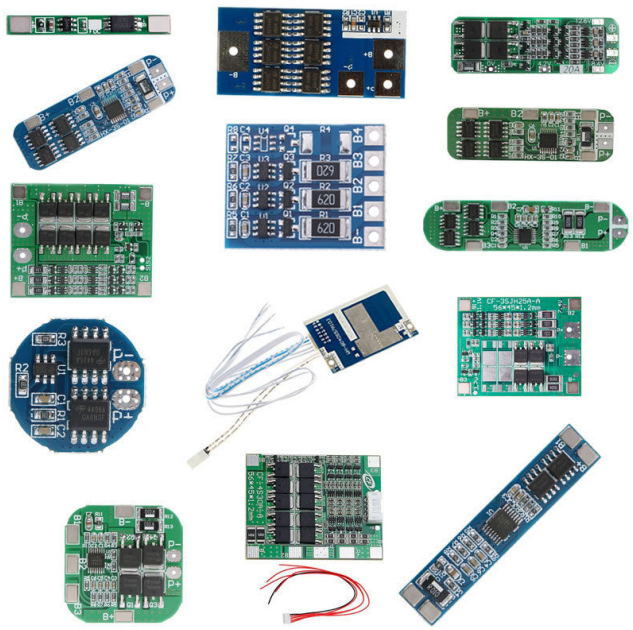
Now divide the watt hours of the battery pack by the power draw of the portable in watts. In the case of a basic Nintendo 64 portable that draws 12 watts you get 1.54h.

18.5wh / 12w = 1.54h

Wait, we aren't done yet. This is the theoretical battery life in a perfect world. It doesn't take into account the variable internal resistance of the cells or the energy lost to heat (cells get warm when they discharge). So to be on the safe side subtract 25% which gives an estimated battery life of 1.16 hours or about 70 minutes.

1.54h * .75 = 1.16h

Battery Protection Boards (PCB/PCM/BMS)



(Pictured)
http://www.ebay.com/itm/1S-2S-4S-3S...650-Li-ion-Lithium-Battery-Cell-/192217997007

When implementing lithium batteries you **must ALWAYS use a protection board.** There are basic protection boards and some that are more robust. These are usually listed with a variety of names which adds to the confusion. They can be called some of the following PCB, PCM, BMS, and/or CMB.

A PCB/PCM (Protection Circuit Board / Protection Circuit Module) is the simplest of the protection boards. These boards provide short circuit protection, over-current protection, over-volt protection, and under-volt protection. At the very least you must use one of these.

A BMS (Battery Management System) does everything a PCB/PCM can but with the added feature of balancing cells. The way a BMS balances cells is to provide resistance to individual cells to slightly discharge them when they exceed 4.20 volts. For our purposes I will be referring to any PCB/PCM/BMS that has individual connections to each cell as a BMS. Using a BMS is much safer then a PCB/PCM with no drawbacks.

The primary reason to use a BMS over a PCB/PCM is cells in a battery can get imbalanced over time. It's important to use matched cells to combat this. However, cells with the same part number can slightly vary in capacity from cell to cell. In the table below I've made a hypothetical scenario of what can happen over time with an unbalanced pack without a BMS. As you can see the more cycles the more out of balance the cells get. The real danger is that with these cells in series the voltage always adds up to safe levels. So the PCB/PCM will never trip the over-voltage or under-voltage protection. While the Cell #3 is continually getting over-charged (risking explosion) and Cell's #1 and #2 are getting over-discharged. The more a cell goes below 3.0v the more damage to the lithium chemistry. This damage reduces capacity thus further imbalancing the battery pack.

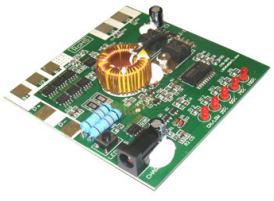
Hypothetical Unbalanced Battery

	1st Cycle		5th Cycle		10th Cycle	
	Charge	Discharge	Charge	Discharge	Charge	Discharge
Cell #1 (2400mAh)	4.20v	2.97v	4.15v	2.92v	4.04v	2.75v
Cell #2 (2500mAh)	4.20v	2.99v	4.19v	2.98v	4.10v	2.89v
Cell #3 (2700mAh)	4.20v	3.04v	4.26v	3.10v	4.46v	3.36v
Total Battery Voltage	4.20v	3.00v	4.20v	3.00v	4.20v	3.00v

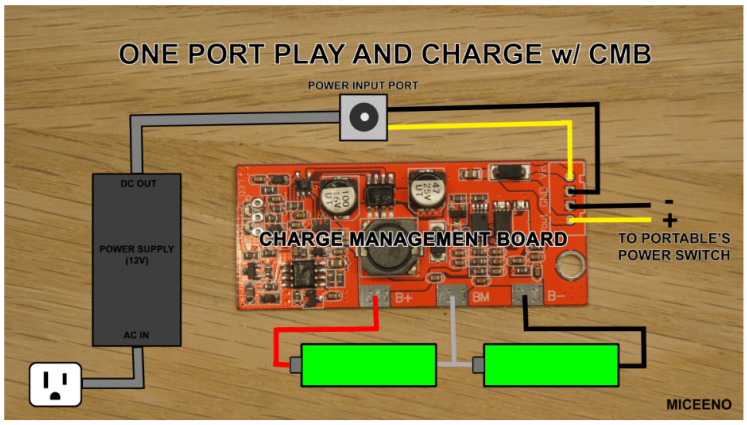
NOTE: After cells are connected to a protection board, it's common for these protection boards to behave erratically until a charge current is applied to the Charge Terminal on the board. This is because the board needs to be turned on in a sense. The behavior that is common is either no voltage on the Output Terminal or the voltage drops to zero the moment you try to draw from the Output Terminal.

If it's not labeled, a good rule of thumb is that on a PCB/PCM or a BMS the Charge Terminal and the Output terminal are shared. However, on a CMB (see below) it's a feature to have separate Charge and Output Terminals.

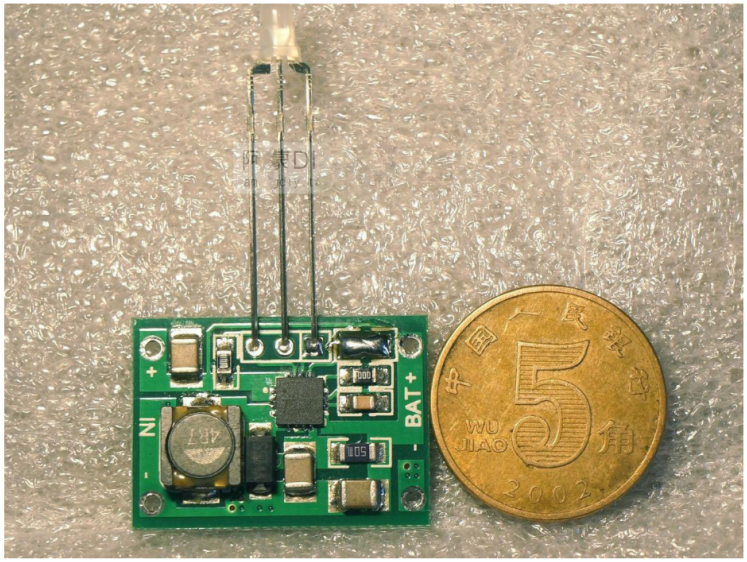
Charge Management Boards (1 Port Play and Charge)



A CMB (Charge Management Board) is a BMS with an integrated charger. This type of board is the holy grail for our purposes. You can identify a CMB from a BMS by the coil on the board and the separate voltage in (Vin) and voltage out (Vout) terminals. A properly engineered CMB will allow for a "1 port play and charge" right out of the box. It's uses a MOSFET to automatically disconnect the battery from the output while charging and provide power from the external power supply to the output instead. Then when the external power is removed the MOSFET automatically reconnects the battery back to the output. **For our purposes I recommend to just use one of these.** The only problem is they are fairly hard to find. I will include a section at the end of known good boards to use.



Stand Alone Charge Boards (1 Port Play and Charge)

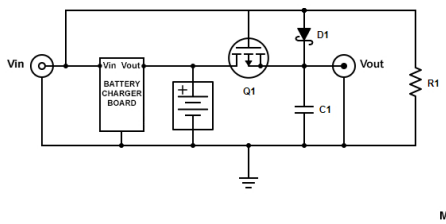


(Pictured)
http://www.ebay.com/itm/2Cells-Sing...le-1-2A-PCB-18650-TP5100-Iphone-/201849640517

The final board to talk about is a stand alone charge board. This is a charger that doesn't have a built in BMS. To safely use one of these you will NEED a PCB/PCM or a BMS to protect your cells and this circuit (pictured below) that I've come up with for a "1 port play and charge" system. This circuit works exactly how the CMB boards work.

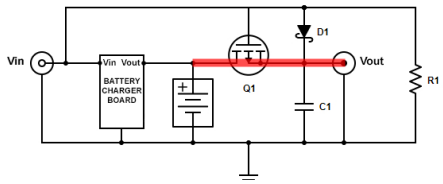
The reason one would use a stand alone charge board over an all in one CMB is that CMB's are fairly hard to find. The other advantage is that there are more options for stand alone charge board's with increased charge current for faster battery charging.

One Port Play and Charge



This circuit relies on a P Channel MOSFET. When the Gate is pulled to ground with the pull-down resistor the MOSFET acts like a closed switch between the Drain and Source. It is in this state when the portable is operating off of battery power. The Schottky diode keeps the power from the battery from going back around to the charger board. Schottky diode's tend to leak a little so the pull-down resistor also has to be adequate enough to handle the leakage.

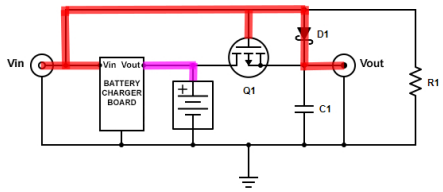
One Port Play and Charge



MICEENO

When the Gate is pulled high by the external power supply from Vin the MOSFET acts like an open switch between Drain and Source. This will disconnect the battery from the portable, allowing it to charge safely and properly, while providing power to the portable from Vin through the Schottky diode. The MOSFET and Schottky diode switch very quickly but a Capacitor is added to smooth the transition.

One Port Play and Charge



MICEENO

I don't have the values of Q1, D1, R1, and C1 listed because I'm waiting on a P Channel MOSFET to arrive to fully test and optimize this circuit. The primary concerns are to do with battery life. When a P Channel MOSFET is acting like a closed switch, there is a small amount of resistance between Drain and Source. This resistance causes heat and power draw. The other component to be concerned with is the Schottky diode. The leak back current will also effect battery life. The test parts I purchased aren't the ones in my final design (which I will post in it's own thread or update here). They are ones that I can get the quickest. The test MOSFET has an Rds(ON) resistance of 0.2 Ohms and the test Schottky diode has a leak current of .002 Amps. The CMBs have a listed below have an Rds(ON) Resistance around 0.050 Ohms, so this is the target in my final design.

Recommended 2s CMBs

http://www.ebay.com/itm/Intelligent...2S-Packs-18650-lithium-Satellite/311721987212

Price: ~$8 Shipped
Model: CX-74-2S (V1.0)
Size: 62x26x6.9mm
Input Charging Voltage: 9-15v
Charging Voltage: 8.40-8.45v
Charging Current: 1A
Over-Discharge Protection Voltage Range: 4.6-5.1v
Short Circuit Protection: Yes
Maximum Operating Current: 2-3A
Disconnects Battery While Charging: Yes
MOSFET Drain-Source Resistance: 0.045 Ohm
Integrated Fuel Gauge: No

Recommended 3s CMBs

http://www.batteryspace.com/CMB-for-11.1V-Li-Ion-Battery-Pack-10A-limit-RoHS-Compliant-with-DC-char.aspx

Datasheet:
http://www.batteryspace.com/prod-specs/4889-CMB-S3A3.pdf

Price: $43.95
Model: CMB-S3A3
Size: 82x82x20mm
Input Charging Voltage: 14-22v
Charging Voltage: 12.6v
Charging Current: 3A
Over-Discharge Protection Voltage: 7.2-9v
Short Circuit Protection: Yes
Maximum Operating Current: 10A
Disconnects Battery While Charging: Yes
MOSFET Drain-Source Resistance: <.050 Ohm
Integrated Fuel Gauge: Yes

Recommended 4s CMBs

http://www.batteryspace.com/CMB-for...ck-10A-limit-RoHS-Compliant-with-DC-char.aspx

Datasheet:
http://www.batteryspace.com/prod-specs/4888-CMB-S4A3.pdf

Price: $49.95
Model: CMB-S4A3
Size: 82x82x20mm
Input Charging Voltage: 18-24v
Charging Voltage: 16.8v
Charging Current: 3A
Over-Discharge Protection Voltage: 9.6-12v
Short Circuit Protection: Yes
Maximum Operating Current: 10A
Disconnects Battery While Charging: Yes
MOSFET Drain-Source Resistance: <.050 Ohm
Integrated Fuel Gauge: Yes

Testing Actual Battery Capacity

The final topic of this thread, which possibly deserves its own thread if enough people get on board, is how to test actual battery capacity. All manufacturers seem to overrate the capacity of their cells. The Chinese fakes are the worst for this.

My testing methodology is what is generally accepted in the E-Bike and EV communities. Which is to use this inexpensive LiPro Balance Charger / Discharger:

http://www.ebay.com/itm/Imax-B6-LCD-Screen-RC-Lipo-NiMh-Li-io-n-LiFe-Battery-LiPro-Balance-Charger/350782413357

First charge all the cells at 0.5C-1C. In the case of unknown C rates I usually charge at .5C of what is printed on the cells. Charge the cells individually to max capacity (4.2v). Then **discharge individually at 1 amp** until empty (3.0v). Record the measured mAh.

Here is a video of a guy testing random cells to show you how the tool works:

https://www.youtube.com/watch?v=xREp4T2hKIM

Tested Cells

Panasonic 3400mah NCR18650B MH12210 (Green)
Plausible Datasheets:
https://na.industrial.panasonic.com/sites/default/pidsa/files/ncr18650b.pdf
https://engineering.tamu.edu/media/4247819/ds-battery-panasonic-18650ncr.pdf
Cell 1 - 2887mah
Cell 2 - 2932mah
Cell 3 - 2887mah
Cell 4 - 2933mah

Spoiler: Notes

LG 3000mah HG2 High Drain LGDBHG21865 (Brown)
Plausible Datasheet:
https://www.nkon.nl/sk/k/hg2.pdf
Cell 1 - 2544mah
Cell 2 - 2556mah
Cell 3 - 2532mah
Cell 4 - 2543mah

LGEAMF11865 LG ICR18650 MF1 2150mAh
Plausible Datasheet:
https://www.imrbatteries.com/content/lg_MF1.pdf
Cell 1/2 - 2229mAh**
Cell 3/4 - 2203mAh**
Cell 5/6 - 2217mAh**
Cell 7/8 - 2241mAh**
Cell 9/10 - 2237mAh**
Cell 11/12 - 2243mAh**
Cell 13/14 - 2242mAh**
Cell 15/16 - 2257mAh**
Cell 17/18 - 2238mAh**
Cell 19/20 - 2226mAh**

Spoiler: **Notes

Tenergy 2200mAh
Plausible Datasheet:
http://www.tenergy.com/core/media/media.nl/id.36145/c.671216/.f?h=384b24cc1d4ad2a6829c
Cell 1/2 – 1966mAh

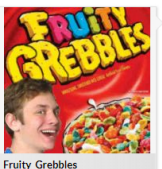
Ultrafire BRC 18650 3000mah
Cell 1 - 862mAh
Cell 2 - 931mAh

EDIT: Added some datasheets as well as other minor changes.

Last edited: Aug 28, 2017

Miceeno, Aug 25, 2017 #1

BocuD, rless, Ampz and 17 others like this.



Fruity_Grebbles
esteemed member

Joined: Jun 21, 2016
Messages: 280
Likes Received: 397
Location: Northern New Jersey

This guide is fantastic. I would love to see it added to the official guide section.

Fruity_Grebbles, Aug 28, 2017 #2

link270, YveltalGriffin and Miceeno like this.

YveltalGriffin
member

> Fruity_Grebbles said: ↑
>
> *This guide is fantastic. I would love to see it added to the official guide section.*

I agree completely. Miceeno, I must say I absolutely love the stuff you've written on batteries recently. It's thorough, well-written, and the best part is that people can read just as much as they want into it. There's a ton of great info here for noobs and pros alike.

YveltalGriffin, Aug 28, 2017 #3

Miceeno and link270 like this.

Joined: Jun 7, 2016
Messages: 125
Likes Received: 136
Location: New Mexico

link270
member

Joined: Jul 4, 2017
Messages: 119
Likes Received: 106

Glad to see a full thread dedicated to this! I would have loved something more clear cut like this when I first started out.

link270, Aug 28, 2017 #4

Miceeno likes this.

lyberty5
member

Joined: Sep 20, 2016
Messages: 37
Likes Received: 94

I'm so glad this guide exists)))

lyberty5, Aug 28, 2017 #5

Miceeno likes this.

GC64
member

Joined: Jul 3, 2016
Messages: 177
Likes Received: 150
Location: Georgia
Portables: 2

I honestly didn't even know people used charge management boards, is there a reason people use charge and play circuits, which require two different plugs, as opposed to CMB's?

GC64, Aug 28, 2017 #6

Miceeno likes this.

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member

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> GC64 said:
> *I honestly didn't even know people used charge management boards, is there a reason people use charge and play circuits, which require two different plugs, as opposed to CMB's?*

My theory is that nobody bothered to look beyond a certain diagram that has existed in this community for years. That's as much as I'm willing to say to keep this from turning out like the last thread.

Miceeno, Aug 28, 2017 #7

Dave Mackintosh, GC64 and DeoNaught like this.

MasterNate
extreme member

Joined: Mar 18, 2017
Messages: 265
Likes Received: 119
Location: The Mitten

Thanks for mentioning BMS. I didnt even know they existed. It would have ruined my batteries if i didnt have it. Thanks Miceeno!!

MasterNate, Aug 28, 2017 #8

Miceeno likes this.

Miceeno
member

Joined: Nov 30, 2016
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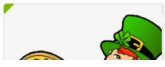
> MasterNate said:
> *Thanks for mentioning BMS. I didnt even know they existed. It would have ruined my batteries if i didnt have it. Thanks Miceeno!!*

If you are using bare cells then a protection board is mandatory. If your battery is a prebuilt pack from a reputable manufacturer then they already built one in. The Tenergy battery I tested has one under the plastic casing on the side the wires come out.

Miceeno, Aug 28, 2017 #9

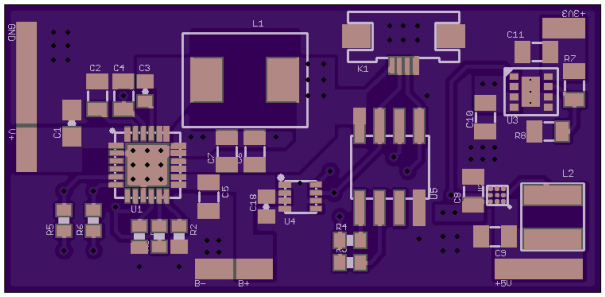


> Miceeno said:
> *My theory is that nobody bothered to look beyond a certain diagram that has existed in this community for years. That's as much as I'm willing to say to keep this from turning out like the last thread.*

Aurelio
The Fixer ᕕ(◁)ᕗ
Staff Member
administrator
legendary member
3rd place contest winner
PortablizeMii team

Joined:	Mar 3, 2016
Messages:	1,642
Likes Received:	2,267
Portables:	2

The reason is actually pretty simple, these all-in-one solutions were not very common when that diagram was made. Even now, these boards are often unreliable and based on very cheap parts, that's why they are so cheap. Moreover, I wouldn't suggest to use that "One port play and charge" circuit. It works (I used it myself while I was working on a GCp few years ago), but it's not the best design (first of all because it doesn't do any validity check on the input source). There are better solution in the work (just like PowerMii), even for the N64.



This design is few months old, I've made few changes, but I had this image handy.

If you want to support the development of my projects, consider becoming one of my patrons: https://www.patreon.com/aureliomannara

ᕕ(◁)ᕗ

Aurelio, Aug 28, 2017 #10

Noah, Matthelv and Miceeno like this.

Miceeno
member

Joined:	Nov 30, 2016
Messages:	89
Likes Received:	153
Portables:	4

> Aurelio said: ↑
>
> *The reason is actually pretty simple, these all-in-one solutions were not very common when that diagram was made. Even now, these boards are often unreliable and based on very cheap parts, that's why they are so cheap. Moreover, I wouldn't suggest to use that "One port play and charge" circuit. It works (I used it myself while I was working on a GCp few years ago), but it's not the best design (first of all because it doesn't do any validity check on the input source). There are better solution in the work (just like PowerMii), even for the N64.*
>
> *View attachment 4010*
>
> *This design is few months old. I've made few changes, but I had this image handy.*

Excellent, lets see something like this available in the store section. The circuit that relies on a MOSFET is an extremely simple solution to the problem of disconnecting batteries when external power is available. Building something with more logic WOULD be a better solution.

Miceeno, Aug 28, 2017 #11

Aurelio
The Fixer ᕕ(◁)ᕗ
Staff Member
administrator
legendary member
3rd place contest winner
PortablizeMii team

Joined:	Mar 3, 2016
Messages:	1,642
Likes Received:	2,267
Portables:	2

> Miceeno said: ↑
>
> *Excellent, lets see something like this available in the store section. The circuit that relies on a MOSFET is an extremely simple solution to the problem of disconnecting batteries when external power is available. Building something with more logic WOULD be a better solution.*

Yeah, definitely. I was just sharing my experience with that same circuit.

If you want to support the development of my projects, consider becoming one of my patrons: https://www.patreon.com/aureliomannara

ᕕ(◁)ᕗ

Aurelio, Aug 28, 2017 #12

Miceeno likes this.

Miceeno
member

Joined:	Nov 30, 2016
Messages:	89
Likes Received:	153
Portables:	4

> Aurelio said: ↑
>
> *Yeah, definitely. I was just sharing my experience with that same circuit.*

Looking at your board, I'm assuming it handles charging and output voltage regulation. This definitely simplifies the power aspect of portablizing especially while trimming out onboard voltage regulation (like on a Wii or a GC). The board in your picture is labeled for 5v and 3.3v so this can handle a large swath of consoles. I like what I'm seeing.

Miceeno, Aug 28, 2017 #13

MasterNate
esteemed member

Joined:	Mar 18, 2017
Messages:	265
Likes Received:	119
Location:	The Mitten

I

> Miceeno said: ↑
>
> *If you are using bare cells then a protection board is mandatory. If your battery is a prebuilt pack from a reputable manufacturer then they already built one in. The Tenergy battery I tested has one under the plastic casing on the side the wires come out.*

I had a protection circuit, just not a battery management system. Since I am using 4 18650s in series, i need a BMS not just a PCB

MasterNate, Aug 28, 2017 #14

> MasterNate said: ↑
>
> *I*

Miceeno
member

Joined: Nov 30, 2016
Messages: 89
Likes Received: 153
Portables: 4

> *I had a protection circuit, just not a battery management system. Since I am using 4 18650s in series, i need a BMS not just a PCB*

I see, a BMS is definitely a better choice. Glad I could help.

Miceeno, Aug 28, 2017 #15

Aurelio
The Fixer ô(◁)▷
Staff Member
administrator
legendary member
3rd place contest winner
PortableMII team

Joined: Mar 3, 2016
Messages: 1,642
Likes Received: 2,267
Portables: 2

> Miceeno said: ↑
>
> *Looking at your board, I'm assuming it handles charging and output voltage regulation. This definitely simplifies the power aspect of portablizing especially while trimming out onboard voltage regulation (like on a Wii or a GC). The board in your picture is labeled for 5v and 3.3v so this can handle a large swath of consoles. I like what I'm seeing.*

This was designed specifically for the N64 (actually starting from what I did for the Wii with PowerMii) as it provides 3.3V and 5V. The same board could be used for something like a RaspberryPI portable, or similar. This has also an integrated fuel gauge.

If you want to support the development of my projects, consider becoming one of my patrons: https://www.patreon.com/aureliomannara

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Aurelio, Aug 28, 2017 #16

link270 and Miceeno like this.

Miceeno
member

Joined: Nov 30, 2016
Messages: 89
Likes Received: 153
Portables: 4

> Aurelio said: ↑
>
> *This was designed specifically for the N64 (actually starting from what I did for the Wii with PowerMii) as it provides 3.3V and 5V. The same board could be used for something like a RaspberryPI portable, or similar. This has also an integrated fuel gauge.*

Beautiful work! I put my name on the PowerMii interest list. I guess I missed this because I focus too much on the glorious N64. A Wii portable has been on my radar for a while and your board will simplify the build.

Miceeno, Aug 28, 2017 #17

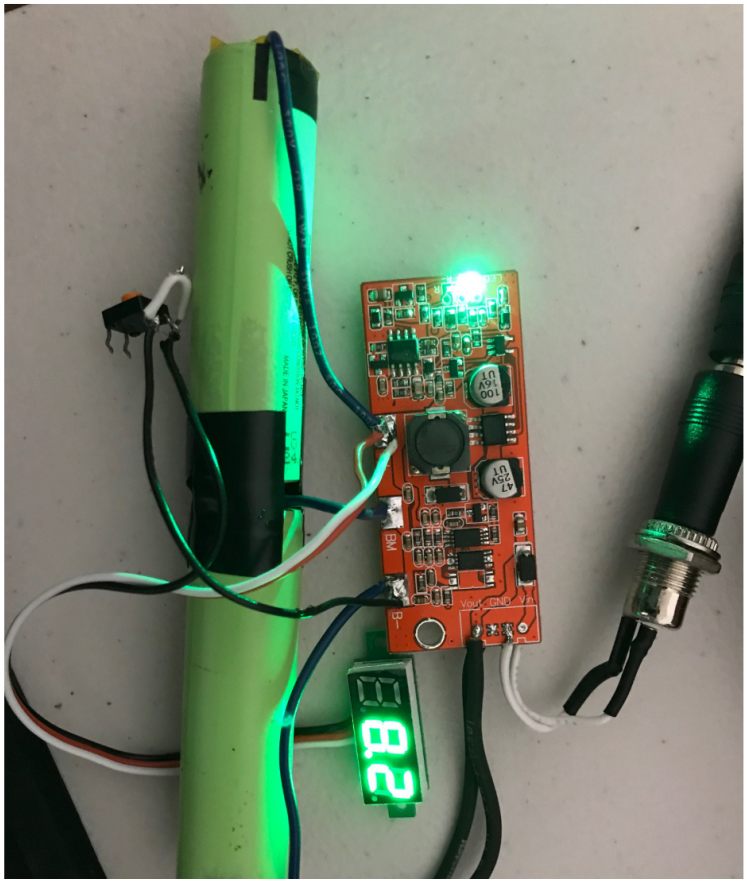
link270 and Aurelio like this.

link270
member

Joined: Jul 4, 2017
Messages: 119
Likes Received: 106

Got one of the red hoard to test out in a portable wii. So far it's working out great! It's got a red and green led on it to show when charging/full. I input 12V 1A to test it and the batteries charged up great and once they got to about 8.35V the led switches to green and the charging cut off. I practiced playing the wii, powering it on and off, and removing the charger from it while it was on and off, etc. and it worked great everything.

It's oretty small for what you get as well. I'm sure the powermii solution will become the go to solution when it comes around, but for now this appears to be an awesome solution and pretty cheap too!



link270, Sep 4, 2017 #18

noh_mercy, Miceeno, cheese and 5 others like this.

Miceeno
member

Joined:	Nov 30, 2016
Messages:	89
Likes Received:	153
Portables:	4

> link270 said: ↑
>
> *Got one of the red hoard to test out in a portable wii. So far it's working out great! It's got a red and green led on it to show when charging/full. I input 12V 1A to test it and the batteries charged up great and once they got to about 8.35V the led switches to green and the charging cut off. I practiced playing the wii, powering it on and off, and removing the charger from it while it was on and off, etc. and it worked great everything.*
>
> *It's oretty small for what you get as well. I'm sure the powermii solution will become the go to solution when it comes around, but for now this appears to be an awesome solution and pretty cheap too!*
>
> *View attachment 4051*

The red board is a good solid board. In another thread I made a post in which I stated that rapidly connecting and disconnecting the 12 volts to Vin caused my N64 to freeze. I have looked into this further and found this statement was false. The freeze was caused by the cartridge shaking in the slot not the switching speed of the MOSFET.

Another thing I really like about the red board is that the power LED has through hole solder points to easily relocate the LED. Which is perfect for our use case.

Something to note, you will need a larger power supply for play and charge because that board charges at 1 amp (drawing 0.75 amps from the 12 volt power supply). In the case of my current N64 portable, the portable draws 1.05 amps (without audio amplifier) from the 12 volt source while playing. And when the batteries are charging the total draw while playing and charging is 1.8 amps. So in my case anything above 2.5 amps will be adequate (assuming the power supply's output is overrated). I don't know what the power draw is on a Wii but I imagine its greater than the N64.

Miceeno, Sep 5, 2017 #19

cheese
the tallest memer in town
Staff Member
administrator
legendary member
PortabilizeMultiteam
Tetris Champion

Joined:	Mar 2, 2016
Messages:	2,245
Likes Received:	2,164
Location:	Florida

> Miceeno said: ↑
>
> *I don't know what the power draw is on a Wii but I imagine its greater than the N64.*

A Wii with custom regs pulls around 10w

> Noah said:
>
> *n65*

portablize.me

cheese, Sep 5, 2017 #20

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