PGCPSU

the tiny, powerful & affordable LiPo power supply

HHTronik

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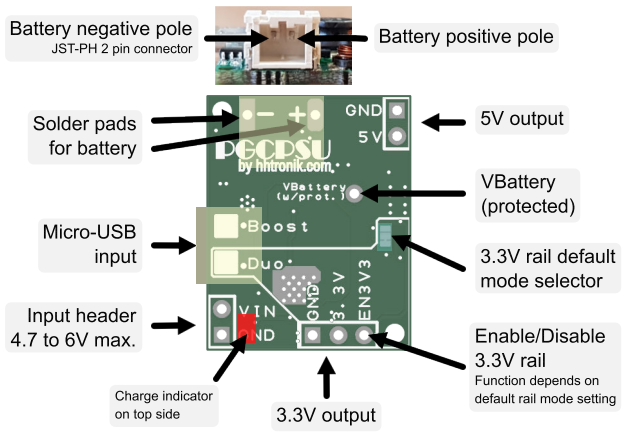
The *PGCPSU* is a compact, low-cost and efficient power supply module to use with single cell Li-Po or Li-Ion batteries. It integrates battery protection and charging functions as well as DC/DC converters to provide stable 5V or 5V and 3.3V supply rails depending on the product variant.

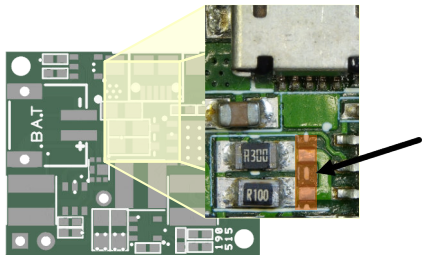
Features

- Compact outline: 25x20mm
- User settable charge current (up to 1900mA)
- 5V rail providing at least 350mA
- (optional) 3.3V rail providing at least 400mA
- Low quiescent current (typ. > 100uA)
- High efficiency switching mode converters
- Good line and load regulation
- Micro-USB or 2.54mm pin header input for charging
- Inbuilt battery protection
- Fault tolerant output rails

Connections



Charge current selection

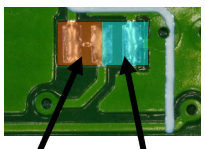


Cut area to set charge current
R300 + R100: ~1866mA
R300: ~1400mA
R100: ~466mA

Reconnect with a dab of solder when needed.

EN3V3 pin mode

By default the 3.3V rail will be enabled. The user can select the behavior of the EN3V3 pin by switching the potential the pull up/down resistor is attached to, by using the solder pad switch depicted on the right.



Default Off
Pull EN3V3 pin High to enable 3.3V rail
Cut small copper trace first between the „default on" pads first

Default On
Pull EN3V3 pin Low to disable 3.3V rail

Product variants	
BOOST	5V output rail
DUO	5V and 3.3V output rails

Input characteristics				
Parameter	Min.	Typ.	Max.	Units
Voltage range	4.7	5.0	6.0	V
Current draw			2.1	A

Battery charging and protection characteristics				
Parameter	Min.	Typ.	Max.	Units
Float voltage	4.158	4.2	4.242	V
Charge start threshold	4.092	4.14	4.182	V
Trickle charge threshold		2.9		V
Charge current (1)			1900	mA
Overcharge detection	4.25	4.3	4.35	V
Overcharge release	4.05	4.10	4.15	V
Over-discharge detection	2.3	2.4	2.5	V
Over-discharge release	2.9	3.0	3.1	V
Over-current detection	2.7	3.0	3.9	A

(1) the actual charge current depends on the user's selection, input power supply capabilities and thermals. The select-able charge currents are: ~1866mA, 1400mA and 466mA. Details below.

5V rail characteristics (PGCPSU BOOST and DUO)				
Parameter	Min.	Typ.	Max.	Units
Output voltage accuracy		2		%
Line regulation (1)		0.5	1	%
Load regulation		0.5		%
Quiescent current		35	90	uA
Output current (2)	350		650	mA

(1) line regulation at I_{load} = 10mA
(2) output current capability depends on battery charge. By design the 5V rail can supply 350mA from a stable 2.5V input. On the DUO variant, the 3.3V rail loads the 5V converter, thus reducing the „available" power for consumers on the 5V rail.

3.3V rail characteristics (PGCPSU DUO only)				
Parameter	Min.	Typ.	Max.	Units
Output voltage accuracy		2		%
Line regulation (1)		0.1	0.4	%
Load regulation		0.5		%
Quiescent current (2)		38	74	uA
Output current (3)	400		800	mA

(1) line regulation at Iload = 10mA
(2) includes additional load on 5V rail
(3) output current capability depends on battery charge and other loads on the 5V rail. Above indications are only valid on an otherwise not-loaded 5V rail.

Mechanical characteristics				
Parameter	Min.	Typ.	Max.	Units
Length		25.0		mm
Width		20.0	21.5	mm
Height		7.2	7.4	mm
Weight		3.2		g
Mount hole diameter		1.8		mm

Charging

Note: make sure the connected battery can safely handle the set charge current. Charging a lithium cell at higher than specified rates can damage the cell and cause fire or explosion! Check the specification of the lithium battery prior to charging!

When the battery voltage is below the charge start threshold the charge circuit will start a CC/CV charge cycle, charging at the set current until V_{float} is reached, then entering CV mode until the current falls below ~15% of the set current.

When the battery voltage is below 2.9V the charger enter trickle charge mode, applying only ~20% of the set charge current until the trickle charge threshold is reached.

When the input voltage drops below the nominal minimum of 4.7V the charge will continue at reduced rate. The charge will end when $V_{battery} = V_{in}$ - 200mV is reached.

Note: depending on the set charge current the PGCPSU and the battery cell can heat up significantly. While thermal protection is built into all chips on board, the user has to provide enough cooling and make sure every surrounding piece of equipment can safely handle the thermal dissipation. If required an additional heatsink can be added to the board by using the exposed via area below the charger IC. The exposed pas is not connected to any potential and should be left floating. Ideally the user should use a non-conductive thermal pad to create a good thermal bond with the board.

Battery protection

The module includes multiple facilities designed to protect itself and the connected battery from damage. These protections include following conditions:

1. Reverse polarity battery connection
2. Over-discharge
3. Over-charge
4. Over-current and short-circuit

Fault recovery is automatic when fault condition is removed.

Note: the reverse polarity protection only applies to the battery connection. Applying reverse voltage to the charger input terminals of the PGCPSU the board may cause damage to the board's circuitry.

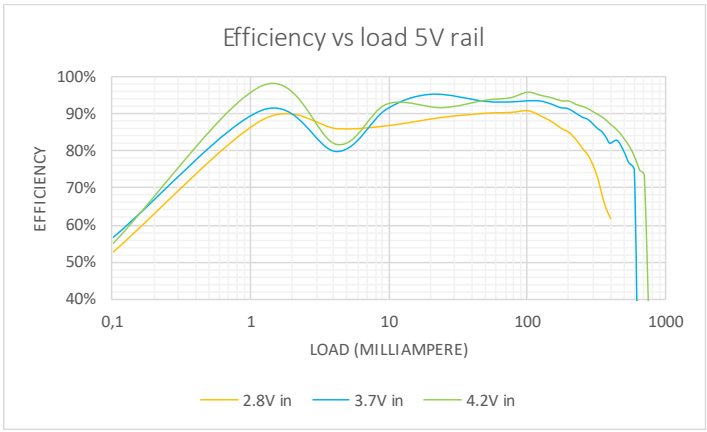
Power supply rails operation

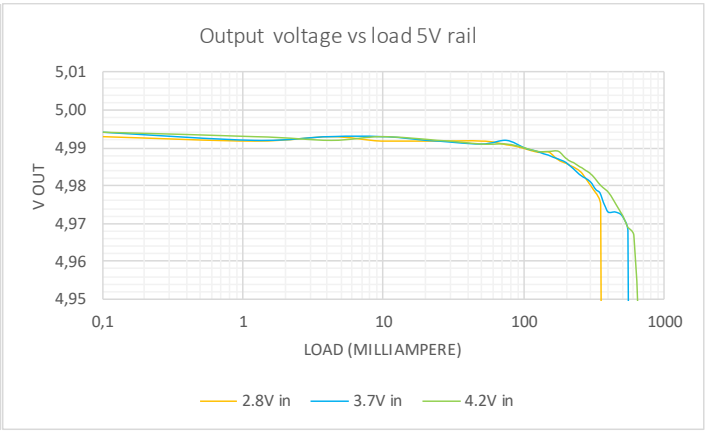
Depending on the product variant, a 5V rail or both a 5V and 3.3V rails are provided. In the case of PGCPSU DUO the converters are connected in series, meaning that applying load to either rail will take from the available power budget of the other rail.

Note: because of the space constraints, the output reservoir capacitance is reduced to a usable minimum. It can be necessary to increase the capacitance if the connected load generates frequent load transients.

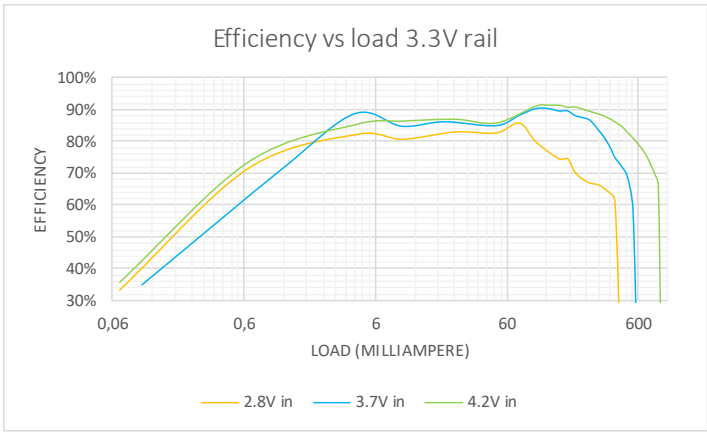
On PCGPSU DUO the user can switch the 3.3V rail by driving the **EN3V3** pin. The solder-bridge switch on the PCB allows to select the mode of operation of the **EN3V3** pin by selecting its default state.

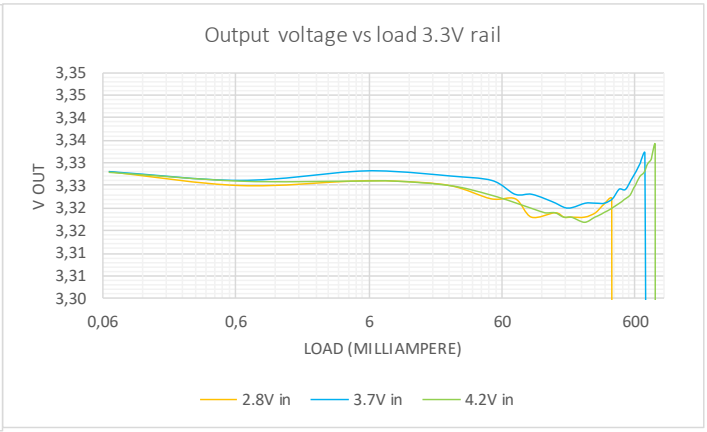
Efficiency and regulation 5V rail





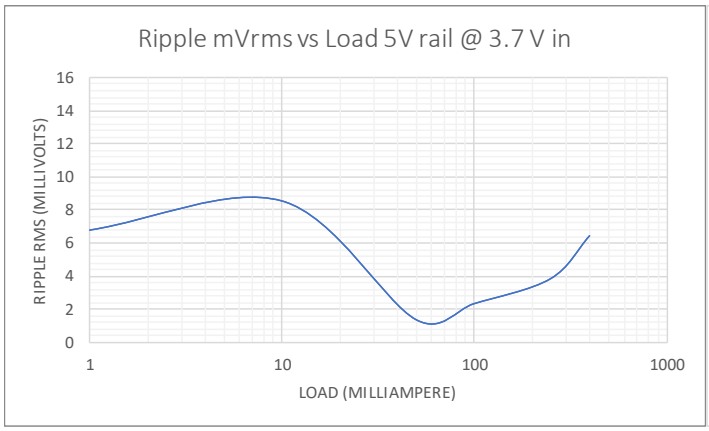
Efficiency and regulation 3.3V rail

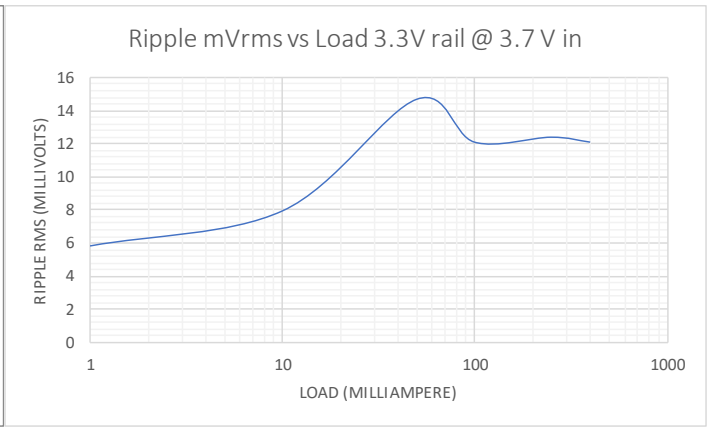


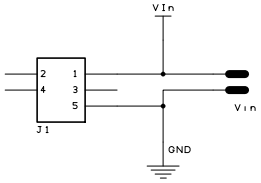


Ripple vs. Load

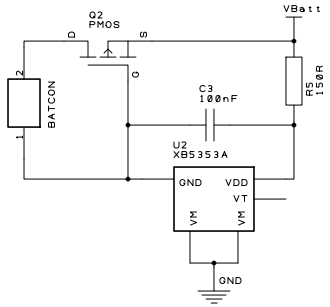
Note: measured at 20MHz bandwidth using a 1x probe.



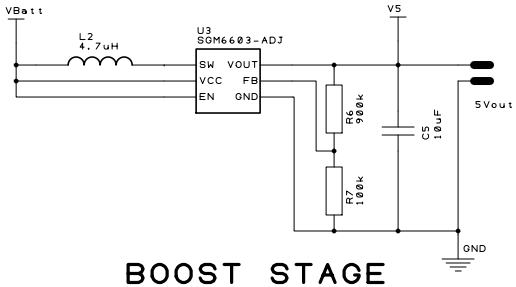




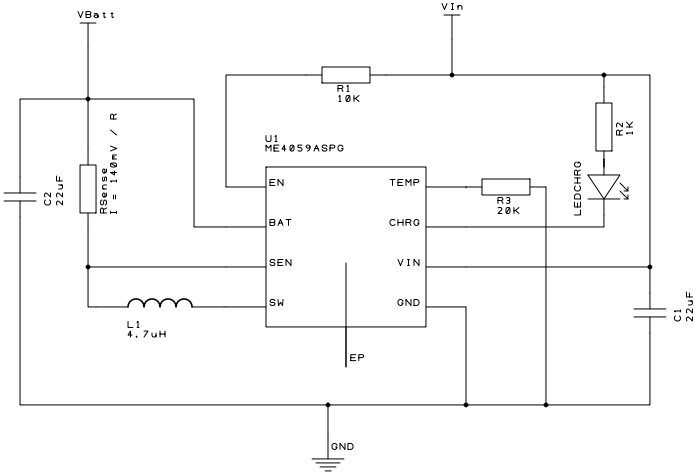
INPUT SECTION



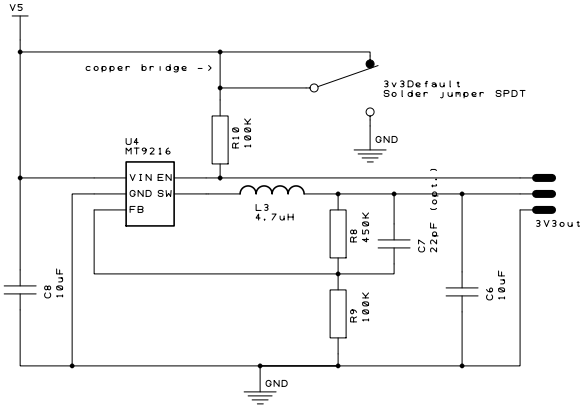
CELL PROTECTION



BOOST STAGE



CHARGE CIRCUIT



BUCK STAGE

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