Quectel Wireless Solutions

Professional Wireless Solution Provider

External Charging IC Application Note

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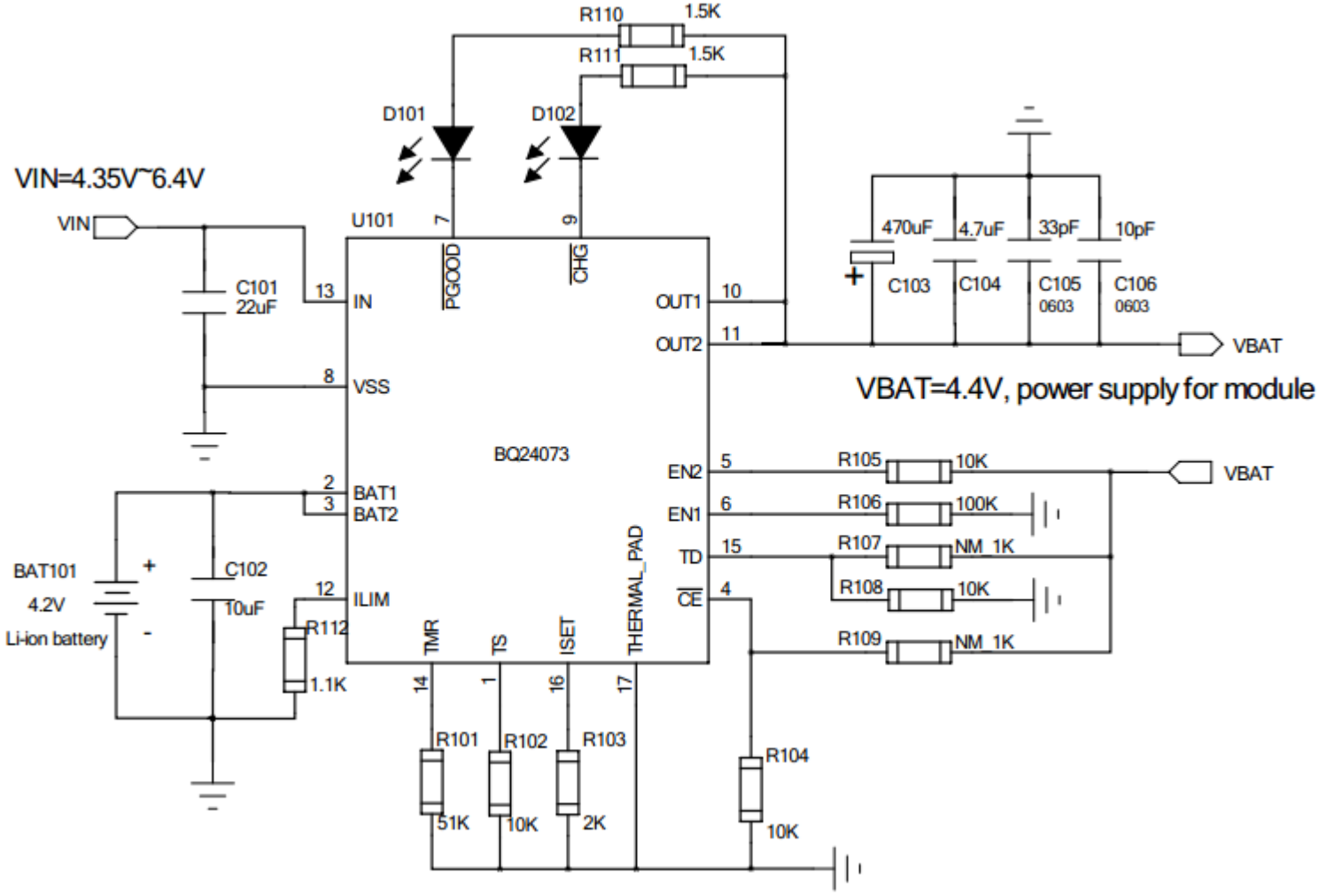
Contents

IC BQ24073

Features

- Compatible USB Charger and AC Adapter
- Li-ion Battery Charger and Power-path Management IC
- Internal LDO Outputs 4.4V
- 28V Input Rating with Overvoltage Protection
- Programmable Input Current Limit up to 1.5A for AC Adapter
- Programmable Pre-Charge and Fast-Charge Safety Timers
- Reverse Current, Short-Circuit and Thermal Protection

Reference circuit for charging application:



IC BQ24073

The BQ24073 powers the system while simultaneously and independently charging the battery, and the output is active whenever a source is connect to IN or BAT.

The device features Dynamic Power Path Management (DPPM) that shares current between the system and battery, and automatically reduces the charging current if the system load increases.

- The input operate voltage (VIN) is from 4.35V to 6.4V. When it exceeds 6.6V for a period long than $t_{DGL(OVP)}$, the internal LDO will shut off and discontinue charging.
- Connect the TS pin to the NTC thermistor to monitor battery temperature and prevent dangerous over-temperature conditions, otherwise, connect a 10kΩ fixed resistor from TS to VSS.
- LED D101 will light when a valid input source is detected.
- LED D102 will light when the battery is charging.

- Use EN1 and EN2 to control the maximum input current and enable USB compliance.

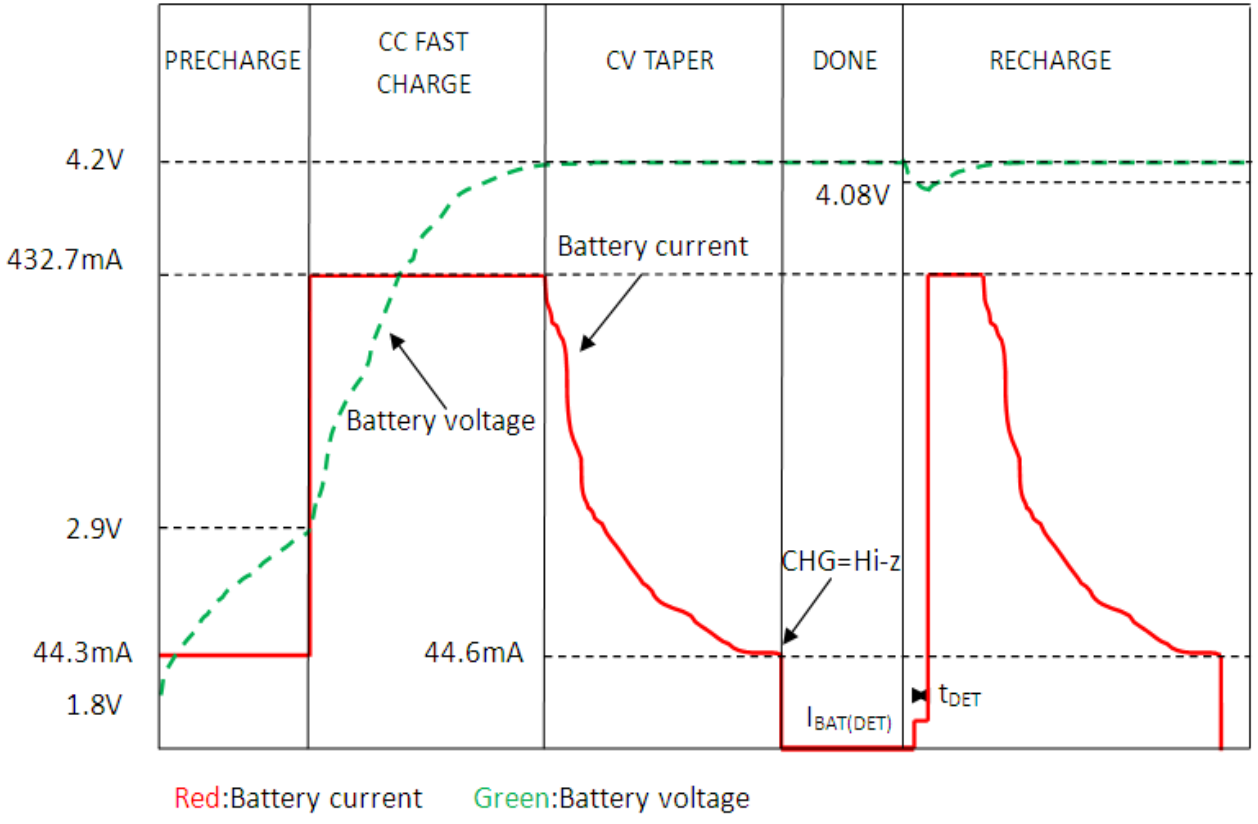
EN1/EN2 Settings

EN2	EN1	Maximum input current into IN pin
0	0	100mA. USB100 mode
0	1	500mA. USB500 mode
1	0	Set by an external resistor from ILIM to VSS ($I_{LIM}=K_{ILIM}/R_{112}$)
1	1	Standby (USB suspend mode)

- Program charge current and pre-charge current with the resistor R103.

  $I_{CHG}=K_{ISET}/R_{103}$, $I_{PRECHG}=K_{PRECHG}/R_{103}$.

Relationship between current and voltage by our test:



Typical Charge Cycle

Charging process:

1. In the beginning, the device checks for a short-circuit on the BAT pin by sourcing $I_{BAT(SC)}$ to the battery and monitoring the voltage. When the BAT voltage exceeds 1.8V, the battery charging continues.

2. In the pre-charge phase, the battery is charged with pre-charge current.

3. Once the battery voltage crosses the 2.9V, the battery is charged with the fast-charge current.

4. As the battery voltage reaches 4.2V, the battery is held at a constant voltage of 4.2V and the charge current tapers off as the battery approaches full charge.

5. When the battery current reaches I_{TERM}, the /CHG pin indicates charging done by going high-impedance.

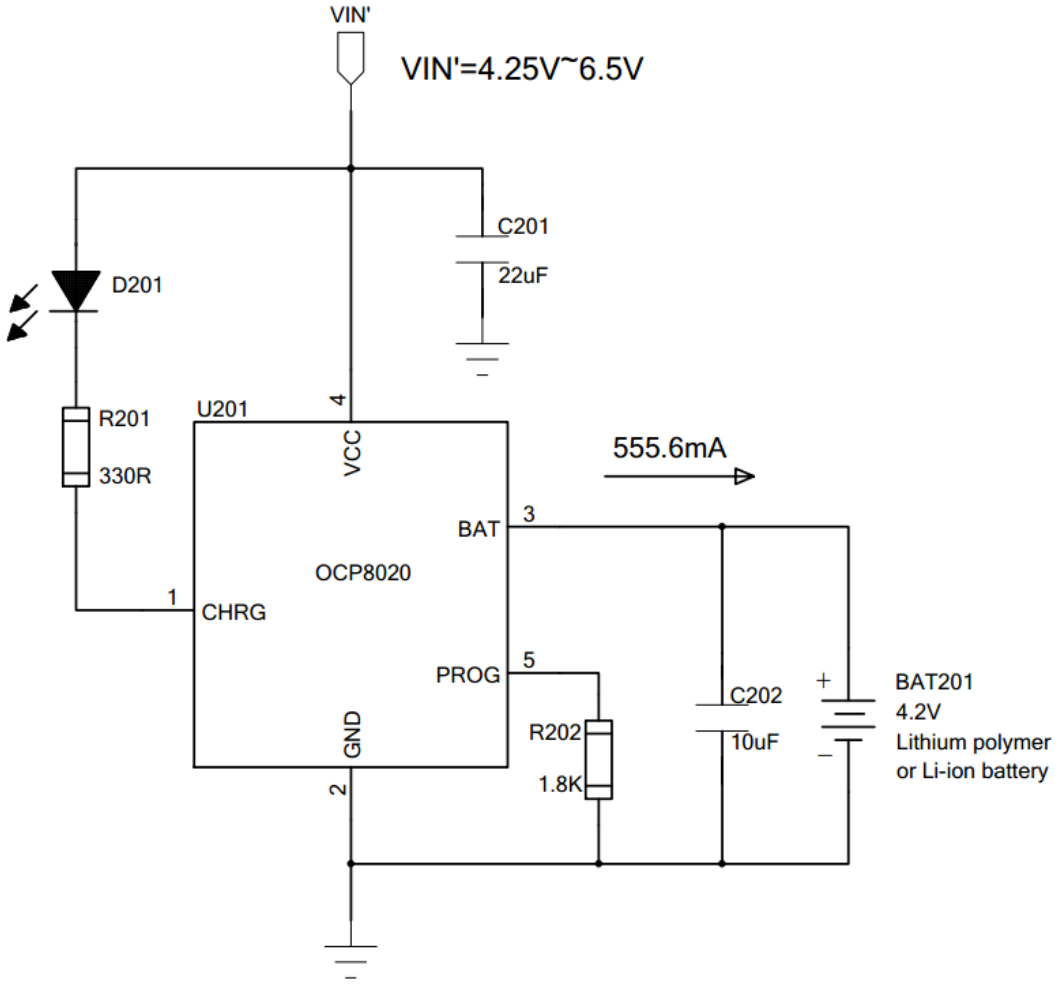
6. Once a charge cycle is completed, the battery voltage is monitored. When the battery voltage falls below 4.08V, the battery detection routine runs. During recharging mode, the system starts from fast-charge phase.

IC OCP8020

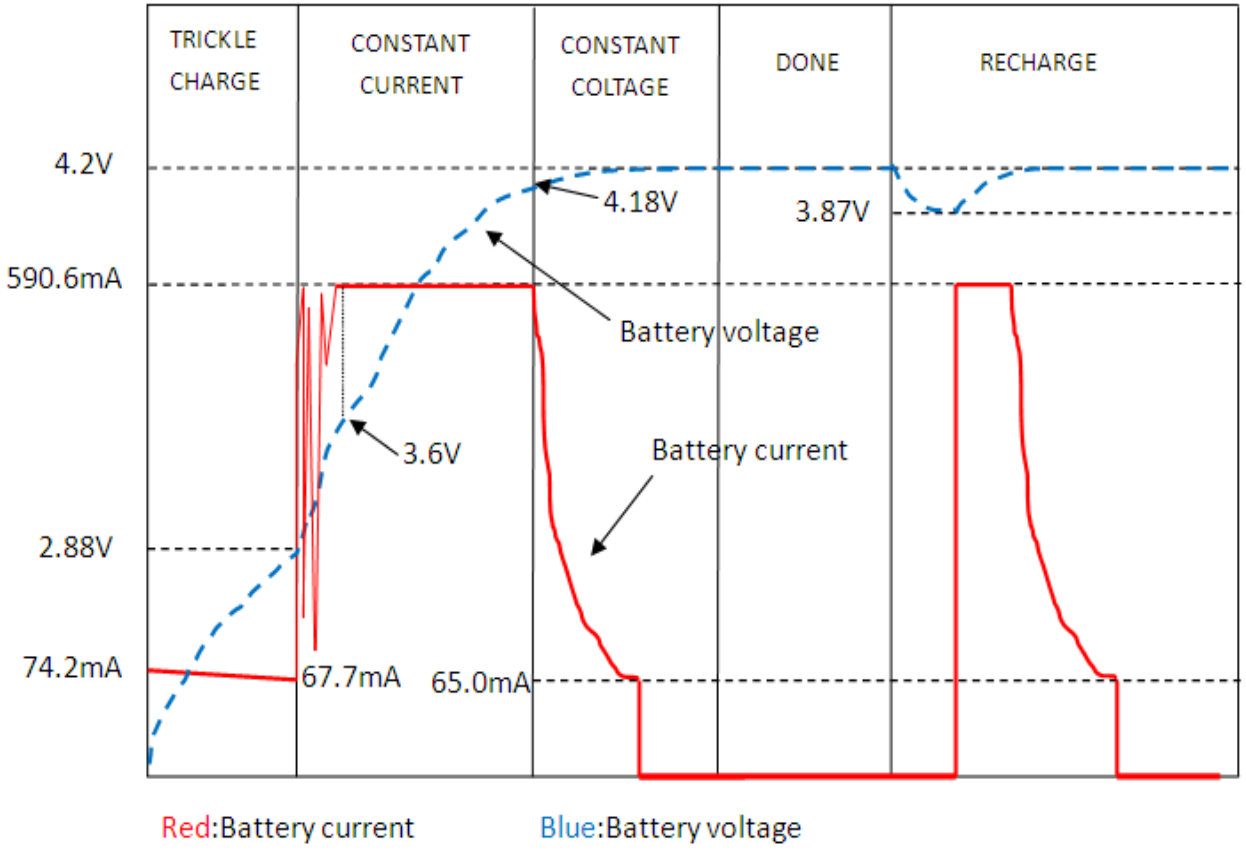
Features

- Compatible USB Charger and AC Adapter
- Programmable Charge Current up to 800mA
- Maximum Input Supply Voltage Support up to 10V
- Press 4.2 Charge Voltage with ±1% Accuracy
- Support both Li-ion and Lithium polymer Battery

Reference circuit for charging application:



Relationship between current and voltage by our test:



Typical Charge Cycle

Charging process:

1. If the BAT pin is less than 2.88V, the charger enters trickle charge mode. In this mode, the charger supplies approximately 1/10 of the programmed charge current to bring the battery voltage up to a safe level for full current charging.

2. When the BAT pin voltage rises above 3.6V, the charger enters constant-current mode, and the programmed charge current is supplied to the battery.

3. When the BAT pin approaches the final float voltage (4.2V), the charger enters constant-voltage mode and the charge current begin to decrease. When the charge current drops to 1/10 of the programmed value, the charge cycle ends.

4. If the battery voltage drops below 3.87V, a recharge cycle will begin.

Note:
Here the current is not stable when the voltage is between 2.88V and 3.6V by our testing, and there are some difference between our test and the conclusions on the datasheet.

IC OCP8020

Some information, described below, is about LTC4054 which is compatible with OCP8020:

	OCP8020	**LTC4054**
Brand	Orient-chip	Linear
Package	SOT23-5	SOT23-5
Input voltage V_{CC} (V)	4.25~6.5 (Max=10)	4.25~6.5 (Max=10)
V_{BAT} (V)	4.2	4.2
I_{CHARG} (mA)	Max=800	Max=800
	P_{PROG}=10K, 110	P_{PROG}=10K, 100
	P_{PROG}=2K, 500	P_{PROG}=2K, 500
$V_{TRICKLE}$ (V)	2.9	2.9
Price ($)	0.15	1.65
Lead time (Week)	4~5	4~6
Battery type	Li-ion and Lithium polymer	Li-ion
Orient-chip website	http://www.orient-chip.com/	
Linear website	http://www.linear.com/	

Below are some reference charger information which are not tested by us. Customer can obtain more details or samples from local vendors.

	SGM4056	**XC6802**
Brand	SGMICRO	TOREX
Package	TDFN-3×3-8L	SOT-89-5, SOT-25, USP-6C
Input voltage V_{CC} (V)	4.5~6.5 (Max=26.5)	4.25~6.0 (Max=6.5)
V_{BAT} (V)	4.18	4.2
I_{CHARG} (mA)	Max=900	Max=800
	Trickle=20% CC (Constant Current)	Trickle=10% CC
	CC=12200K/R_{IREF}	CC=1000K/R_{SEN}
	End=11000K/R_{IMIN}	End=10% CC
$V_{TRICKLE}$ (V)	2.54	2.9
Price ($)	0.16~0.2	0.3
Lead time (Week)	3~5	6~8
Battery type	Li-ion	Li-ion
SGMICRO website	http://www.sg-micro.com	
TOREX website	http://www.torex.co.jp/english/	

CAUTION

Caution:

The TVS component is suggested to add to the front-end of the input pin because of the pulse voltage when plug. The thermal design should be taken into account as well.

THE END

Thank You!

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