USB Type-C Lithium Battery Charger Module

Technical Datasheet

Product Overview

Compact USB Type-C charging module with integrated 5V boost converter and battery management system for single-cell lithium batteries. Features automatic charge termination and simultaneous charge/discharge capability.

Key Features

- **USB Type-C Input Interface** - Universal compatibility with modern USB power sources
- **High Current Charging** - 2.4A ± 5% charging current for faster charge times
- **Selectable Charge Voltage** - 4.2V/4.35V options for standard and high-capacity cells
- **Automatic Charge Termination** - Stops charging when current drops below 50mA
- **Intelligent Charge Cycling** - Automatically restarts charging when battery voltage drops below 4.1V
- **Pre-charge Function** - 180mA pre-charge current for deeply discharged batteries (<2.8V)
- **Ultra-low Quiescent Current** - <30μA standby current minimizes battery drain
- **High Efficiency Boost Converter** - 92.5-95.9% efficiency across load range
- **Simultaneous Charge & Discharge** - Supports power path management with external key connection
- **Low Output Ripple** - 100mV ripple for clean 5V output
- **Compact Form Factor** - 25mm × 20mm PCB size

Electrical Specifications

Input Characteristics

Parameter	Min	Typical	Max	Unit
Input Voltage	5.0	5.0	5.5	V
Input Interface	-	USB Type-C	-	-

Output Characteristics

Parameter	Min	Typical	Max	Unit
Output Voltage	5.0	-	5.15	V
Output Current	-	2.0	-	A
Output Voltage Ripple	-	100	-	mV
Quiescent Current	-	-	30	µA

Battery Charging

Parameter	Value	Unit	Notes
Charging Current	2.4 ± 5%	A	Maximum charging current
Charging Cut-off Voltage	4.2/4.35 ± 0.5%	V	Selectable for standard/high-cap cells
Charge Termination Current	≤100	mA	Actual shutdown at <50mA
Pre-charge Current	180	mA	When Vbat < 2.8V
Charge Restart Voltage	4.1	V	When battery voltage drops
Deep Discharge Threshold	2.8	V	Triggers pre-charge mode

Boost Converter Efficiency

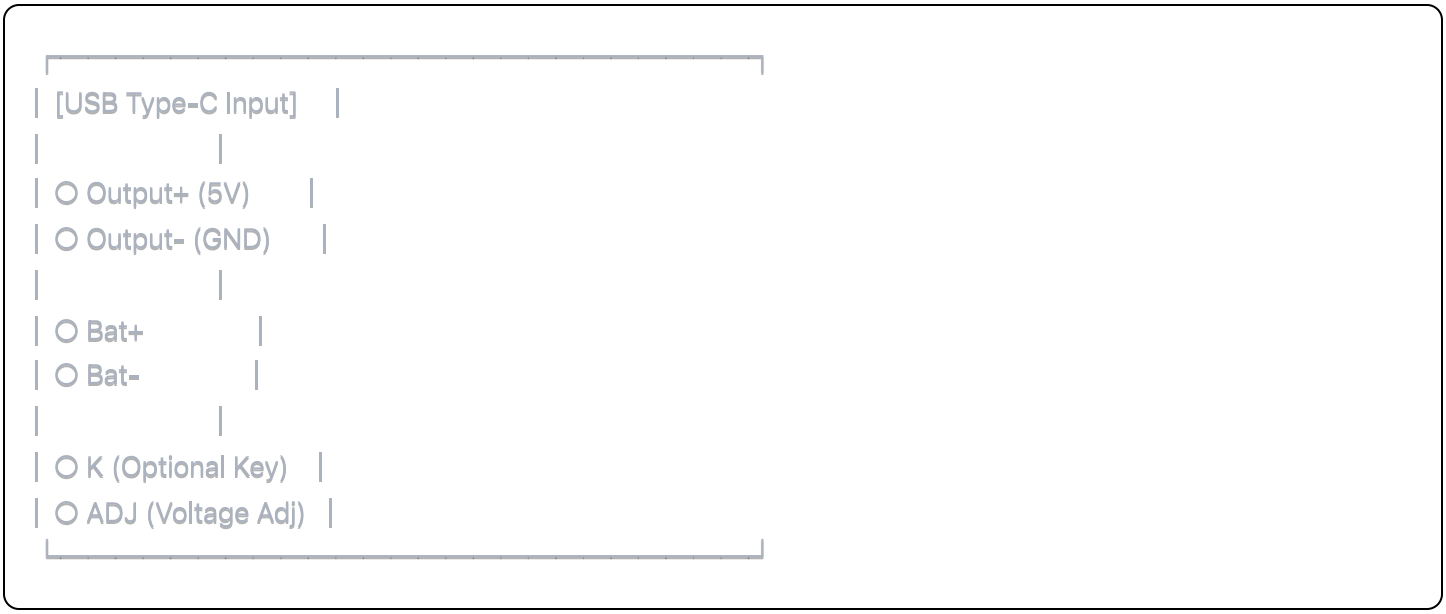
Input (V)	Input (A)	Output (V)	Output (A)	Efficiency
3.837	0.685	5.039	0.5	95.90%
3.758	1.427	5.138	1.0	95.80%
3.673	2.225	5.146	1.5	94.50%
3.580	3.086	5.112	2.0	92.50%

Physical Specifications

Parameter	Value	Unit
PCB Dimensions	25 × 20	mm
Module Weight	4	g
Package Dimensions	90 × 60 × 20	mm
Package Weight	5	g
Mounting	Surface mount	-

Pin Configuration

Connector Layout



Pin Descriptions

Pin	Label	Function	Notes
1	Type-C	Power Input	5-5.5V DC input port
2	Out+	Output Positive	5V-5.15V regulated output positive pole
3	Out-	Output Negative	Output negative pole/ground
4	Bat+	Battery Positive	Connect to Li-ion positive terminal
5	Bat-	Battery Negative	Connect to Li-ion negative terminal
6	K	External Key Pad	Optional - for discharge control
7	ADJ	Voltage Regulation	Battery charging voltage adjustment

Functional Description

Charging Cycle

1. **Initial Detection**: Module detects battery voltage upon connection
2. **Pre-charge Mode**: If Vbat < 2.8V, applies 180mA pre-charge current
3. **Constant Current**: Main charging phase at 2.4A (±5%)
4. **Constant Voltage**: Maintains terminal voltage (4.2V or 4.35V selectable) while current tapers
5. **Termination**: Charging stops when current falls below 50mA
6. **Standby**: Monitors battery voltage, restarts if drops below 4.1V

Charging Voltage Selection

The module supports two charging cut-off voltages:

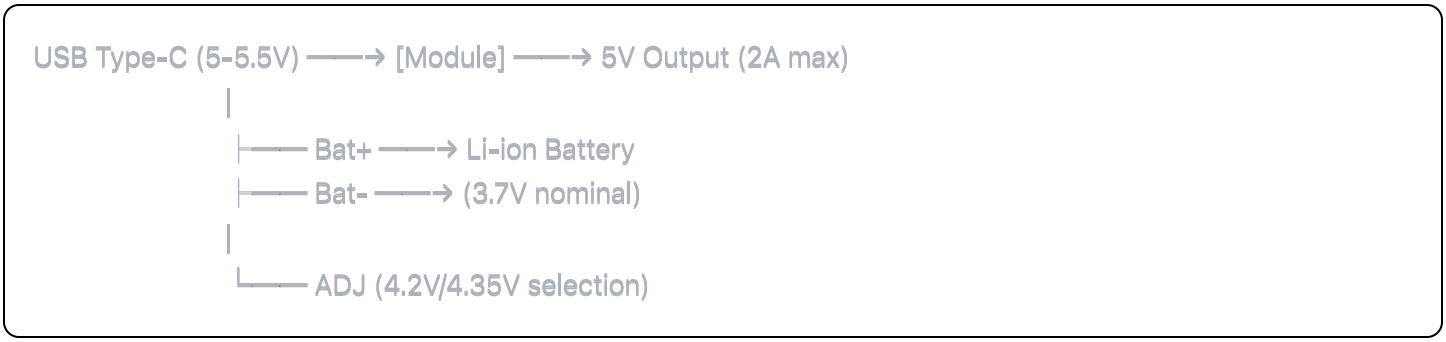
- **4.2V ± 0.5%**: Standard Li-ion cells
- **4.35V ± 0.5%**: High-capacity Li-ion cells
- Voltage selection via onboard regulation adjustment

Power Path Management

The module supports simultaneous charging and discharging through the K (Key) pad connection with the output negative pole, enabling uninterrupted power supply to connected loads while charging.

Application Notes

Typical Application Circuit



Battery Compatibility

- Compatible with single-cell lithium-ion batteries (3.7V nominal)
- Supports standard 18650, polymer, and other rechargeable lithium formats
- 4.2V setting: Standard Li-ion/Li-Po cells
- 4.35V setting: High-capacity Li-ion cells (verify cell compatibility)
- Female connectors accommodate various battery terminal types

Safety Considerations

- Module includes over-discharge protection (<2.8V)
- Automatic charge termination prevents overcharging
- Pre-charge mode protects deeply discharged cells
- Ensure proper polarity connection to prevent damage

Recommended Operating Conditions

Parameter	Min	Max	Unit
Operating Temperature	0	45	°C
Storage Temperature	-20	60	°C
Input Voltage	5.0	5.5	V
Battery Voltage Range (4.2V mode)	2.8	4.2	V
Battery Voltage Range (4.35V mode)	2.8	4.35	V

Module Components (Visible)

- Boost converter inductor (marked "2R2" - 2.2µH)
- Power management IC
- Input/output capacitors
- Current sense resistors
- Protection components
- Voltage adjustment circuitry

Performance Characteristics

Efficiency vs Load

The boost converter maintains high efficiency across the entire load range:

- Light load (0.5A): 95.9% efficiency
- Medium load (1.0A): 95.8% efficiency
- Heavy load (1.5A): 94.5% efficiency
- Maximum load (2.0A): 92.5% efficiency

Output Regulation

- Voltage regulation: 5.0-5.15V with automatic loss compensation
- Load regulation maintains stable output across 0-2A range
- Ripple voltage: 100mV maximum

Notes

- This is a third-party interpretation based on product images and feature descriptions
- Specifications are derived from visible markings and provided feature list

- For safety-critical applications, verify all parameters through testing
- Module appears to use integrated charge management IC (specific part number not visible)
- Material: Electronic components on multicolor PCB
- Loss compensation feature maintains stable 5V output under varying loads

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Document Version: 2.0
Updated with detailed specifications from product documentation
Based on product images and manufacturer specifications