

Switch Mode Single Li-Ion Battery Charger

■ General Description

The XT2063 is a constant current, constant voltage Li-Ion battery charger that uses a current mode PWM step down switching architecture. Using DC-DC control mode, the charge current is set by an external resistor, up to 2A. With a 1.5MHz switching frequency, the XT2063 provides small, simple and efficient solution to fast charge single cell Li-Ion battery.

When the input voltage is lower than 4.35V, the chip enters the SLEEP MODE, the power consumption will be reduced to 60μA. Built-in temperature protection and load short-circuit protection ensure high reliability of the IC. There are two LED can display various charging states.

■ Features

- Constant current mode DC-DC PWM control
- Constant voltage LDO control
- 1.5MHz switching frequency
- Anti reverse connection
- Automaitc sleep mode for low power consumption
- Automatic recharge

■ Applications

- Mobile Phone
- Digital Camera
- Portable Devices
- Various Chargers
- Pads

■ Package Information

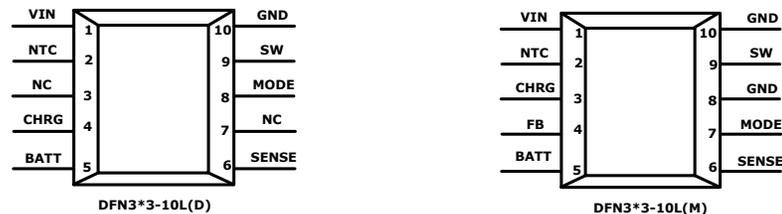


Fig1 package information

■ Pin Function Description

Pin Name	Pin No.		Description
	DFN-10L(D)	DFN-10L(M)	
VIN	1	1	Power input
NTC	2	2	Battery temperature detection input. To disable the temperature qualification function, ground the NTC pin.
CHRG	4	3	Charge status output
BATT	5	5	Battery sense input
FB	-	4	External feedback input, to fine-tuning the output voltage.
SENSE	6	6	Current sense input
MODE	8	7	Charge current program, "L" represents the programming current, then "H" represents the programming current 0.6 times. Default "L".
GND	10	8、10	Ground
SW	9	9	Charging current output

■ Block Diagram

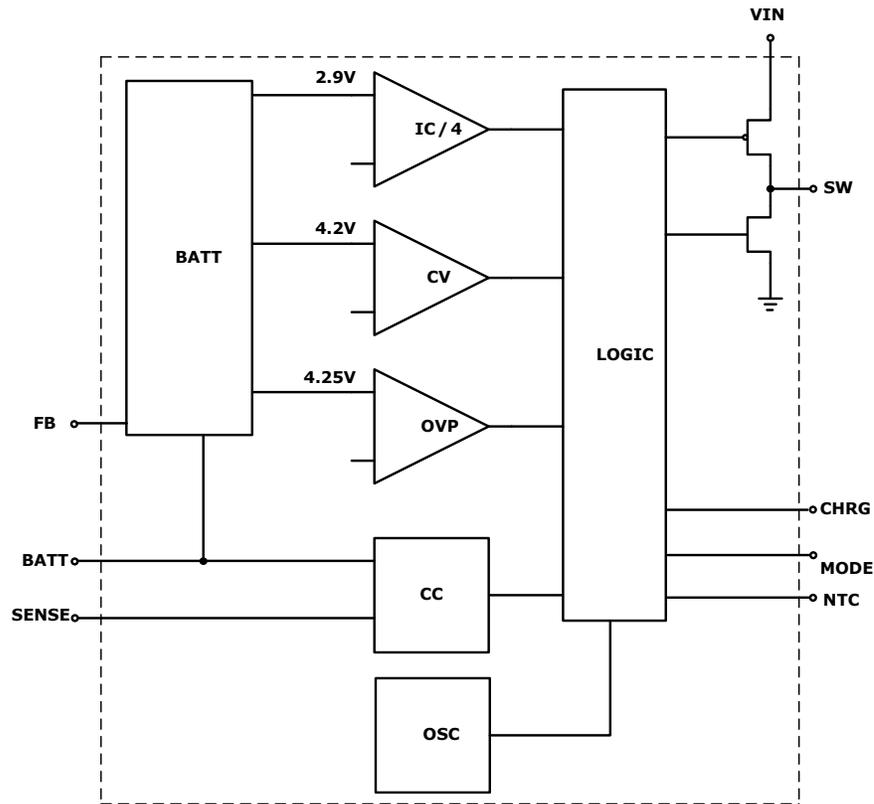


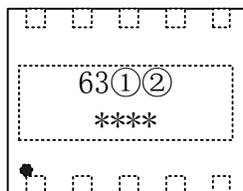
Fig2 block diagram

■ Ordering Information

XT2063 ①②③④

Designator	Description	Symbol	Description
①	Feedback Mode	A	External feedback
		F	Fixed output
②	Output Voltage	D	External FB
		1	Fixed 4.2
③	Package	D	DFN3*3-10L(D)
		M	DFN3*3-10L(M)
④	Device Orientation	R	Embossed tape: Standard feed
		L	Embossed tape: Reverse feed

■ Marking Rule



① Represents Feedback Mode

Designator	Feedback Mode	Product Name
A	External feedback	XT2063A◆◆◆
F	Fixed output	XT2063F◆◆◆

② Represents Package

Designator	Package
D	DFN3*3-10L(D)
M	DFN3*3-10L(M)

Note: The second line of **** represents the assembly lot No.

■ Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating	Unit
Input Voltage	VIN	$V_{SS}-0.3 \sim V_{SS}+6$	V
SW Voltage	Vsw	$V_{SS}-0.3 \sim VIN+0.3$	
BATT Voltage	Vbat	$V_{SS}-0.3 \sim 6$	
SENSE Voltage	Vsense	$V_{SS}-0.3 \sim 6$	
CHAG Voltage	Vchrg	$V_{SS}-0.3 \sim 6$	
MODE Voltage	Vms	$V_{SS}-0.3 \sim 6$	
NTC Voltage	Vntc	$V_{SS}-0.3 \sim 6$	
FB Voltage	Vfb	$V_{SS}-0.3 \sim 6$	
SW switching current	Isw	± 2.5	A
Work peripheral temperature	Topa	$-40 \sim +85$	°C
Storage Temperature	Tstr	$-65 \sim +125$	
ESD HBM	V _{ESD}	4000	V

Note: Absolute maximum ratings are under any conditions cannot exceed the rating. In case exceed this rating; the product could suffer physical damage

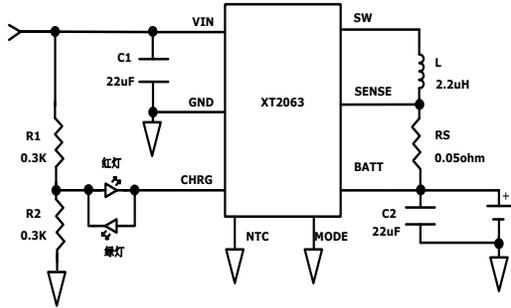
■ Electrical Characteristics

Test Condition: VIN=5V, RS=0.05ohm, TA=25°C (Unless Otherwise Specified)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Test Circuit
Input voltage	V _{IN}	-	4.35	5	6	V	1
Battery regulated output voltage	V _{BATT}	VIN>4.35V	4.16	4.2	4.242	V	1
Input current	I _Q	Standby Mode VIN<4.35V	50	60	70	μA	2
	I _{STB}	End of Charge	0.83	0.92	1.2	mA	2
Battery terminal current	I _R	leakage current, VBATT>VIN	0	0.01	0.1	μA	2
	I _B	End of charge	5	6.5	8	μA	2
Constant current	I _{CHARGE}	RS=50mohm, V _{MH} ="1"	1.8	2	2.2	A	1
		RS=50mohm, V _{ML} ="0"	1.08	1.2	1.32	A	1
Termination current threshold	I _{END}	VBATT>4.2V	50	65	80	mA	1
Trickle Charge threshold voltage	V _{TR}	-	2.8	2.92	3	V	1
Recharge Battery threshold Voltage	ΔV _{REG}	VBATT - VRECHARGE	90	130	170	mV	1
Oscillator Frequency	F _{OSC}	RL=100mA	1.35	1.5	1.65	MHz	1
MODE LOW	V _{ML}	-	-	-	0.8	V	2
MODE HIGH	V _{MH}	-	1.2	-	-	V	2
MODE current	I _{MODE}	V _{MODE} =5V	6	7.5	9	μA	2
Low-voltage lockout voltage	V _{UVLO}	VIN adjusted from low to high	4.3	4.35	4.45	V	2
NTC pin threshold voltage (hot)	V _{HOT}	VIN=5V	1.57	1.67	1.77	V	2
NTC pin threshold voltage (cold)	V _{COLD}	VIN=5V	3.23	3.33	3.43	V	2
Over temperature Protection	T _{SD}	-	143	153	163	°C	1
Hysteresis of temperature protection	ΔT _{SD}	-	20	25	30	°C	1

Test Circuit

Test Circuit 1



Test Circuit 2

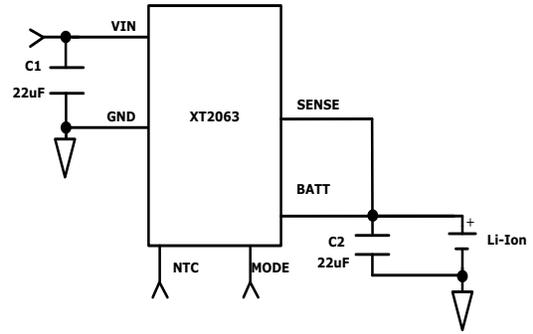
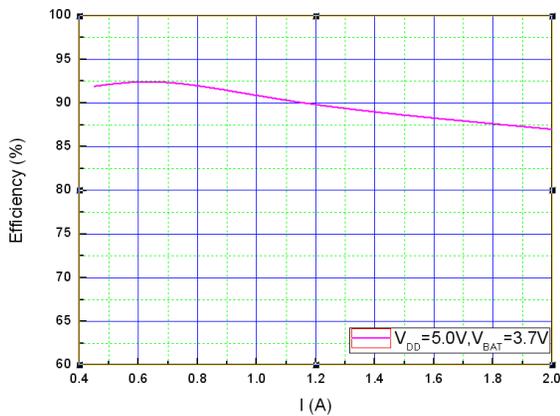


Fig3 test circuit

Typical Characteristic Curve

VIN=5V, charge current 2A

Charging current and charging efficiency



SW wave and output ripple

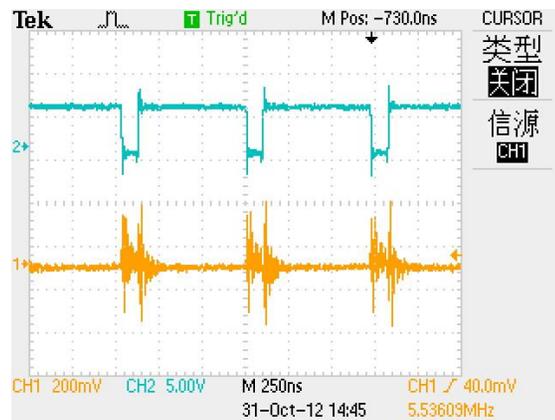


Fig4 typical characteristic curve

Typical Applications

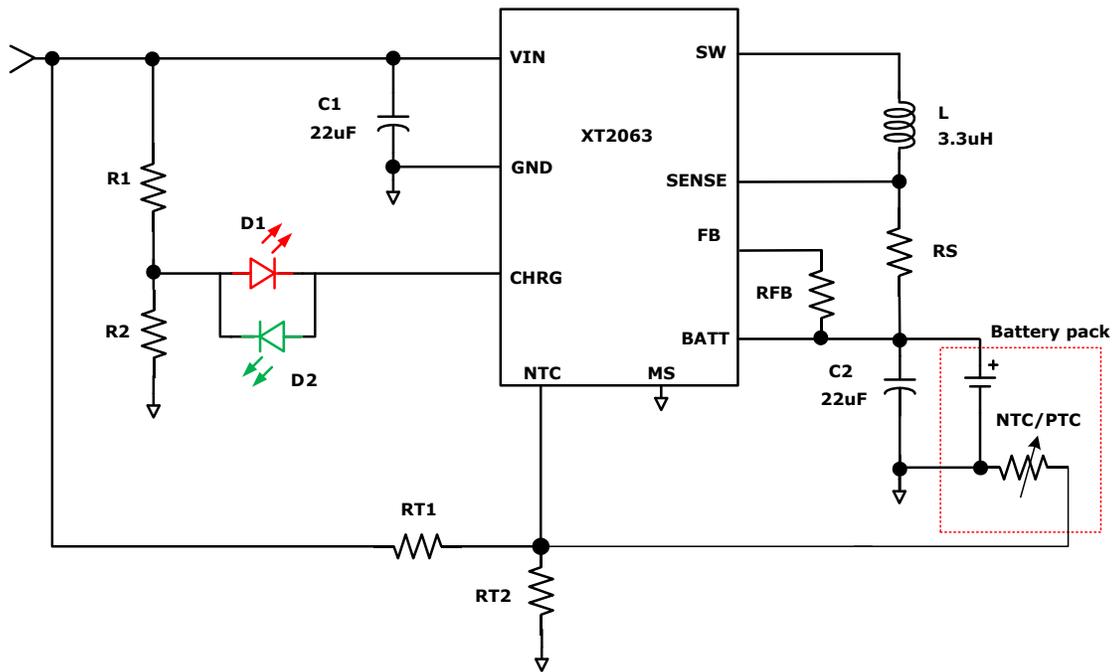


Fig5 typical application

Operation

XT2063 is a constant current, constant voltage Li-Ion battery charger that uses a current mode PWM step-down switching architecture. The charge current is set by an external sense resistor (RS) between the SENSE and BATT pins.

When the input voltage is below the UVLO level (4.35V), the chip enters SLEEP MODE, then the chip power consumption reduce to 60μA or less. When the input voltage rises above the UVLO voltage, the charger enters charging mode. If the battery voltage is lower than the trickle charge threshold voltage (2.9V), the charger enters trickle charge mode, and the trickle charge set to 25 % of the maximum charge current. When the battery voltage exceeds the trickle charge threshold, the charger enters constant current charging mode, then the charging current is defined by the internal 100mV reference and external sense resistor to decide, calculated as follows: $I_{BATT} = 100mV / R_S$

When the battery voltage is close to the target value 4.2V, the charge current drops and the chip enters constant voltage charging mode LDO. When the charge current drops to 65mA, the chip stops charging, the green LED turns on. If the battery does not leave BATT terminal and the battery voltage drops to 4.07V, the chip will automatically enter RECHARGE state, and restart the charge cycle.

➤ Current Setting

When MODE is low, $I_{BATT} = 100mV / R_S$; When MODE is high, the charging current is automatically reduced to 60mV/ R_S . XT2063 can determine the allowable maximum current according to the input voltage, when the input voltage is less than 4.6V, the charge current is reduced to 500mA.

➤ Temperature Protection

XT2063 built-in temperature compensation circuit, when the internal temperature reaches 100°C, the maximum charging current will fall with increasing temperature, reducing the possibility of thermal breakdown. When the temperature rises to 153°C, the chip enters the temperature protection, stopping charge cycle.

➤ BATT Voltage Trimming

XT2063 can fine-tuning the battery regulated float voltage, with a small resistor between BATT and FB pin, the target voltage VBATT can be calculated as follows:

$$R_{FB} = (V_{BATT} - 4.2) \times 200 \text{ (k}\Omega\text{)}$$

For example, choose $R_{FB} = 30\text{k}\Omega$, battery regulated output voltage is 4.35V.

For 4.2V Li-Ion battery, just connect BATT and FB pin.

➤ Charging Status

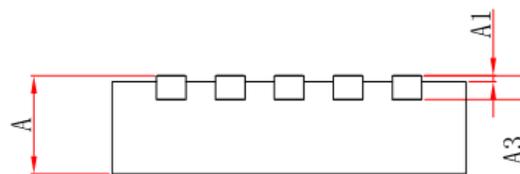
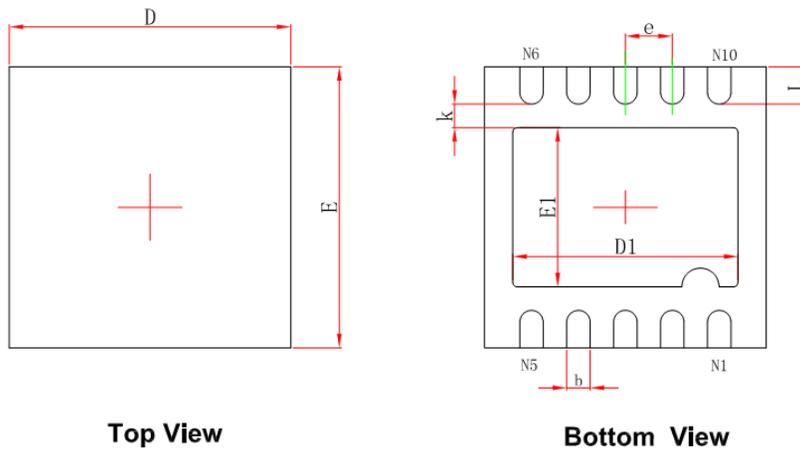
Operating States	Error	Charge	Full	No Load
Red LED (D1)	Always off	Always bright	Always off	Flashing
Green LED (D2)	Always off	Always off	Always bright	Always bright

The lamp brightness is determined by R1, R2 resistance, the current of D1 (or D2) is $0.5 \times V_{IN} / R1$.

E.g., $V_{IN} = 5\text{V}$, taking $R1 = R2 = 330\Omega$, LED current is 7.5mA.

■ Package Information

- DFN3*3-10L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.300	0.500	0.012	0.020