Switch Mode Single Li-Ion Battery Charger

■ General Description

The XT2064 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 XT2064 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
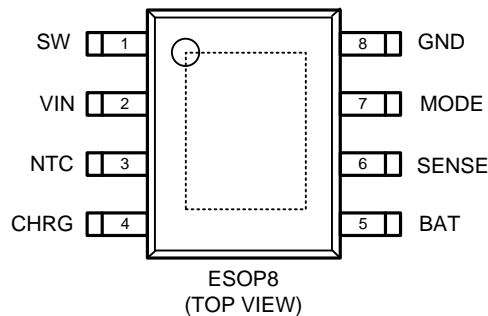- Various Chargers
- Pads

■ Package Information

ESOP8
(TOP VIEW)

Fig1 package information

■ Pin Function Description

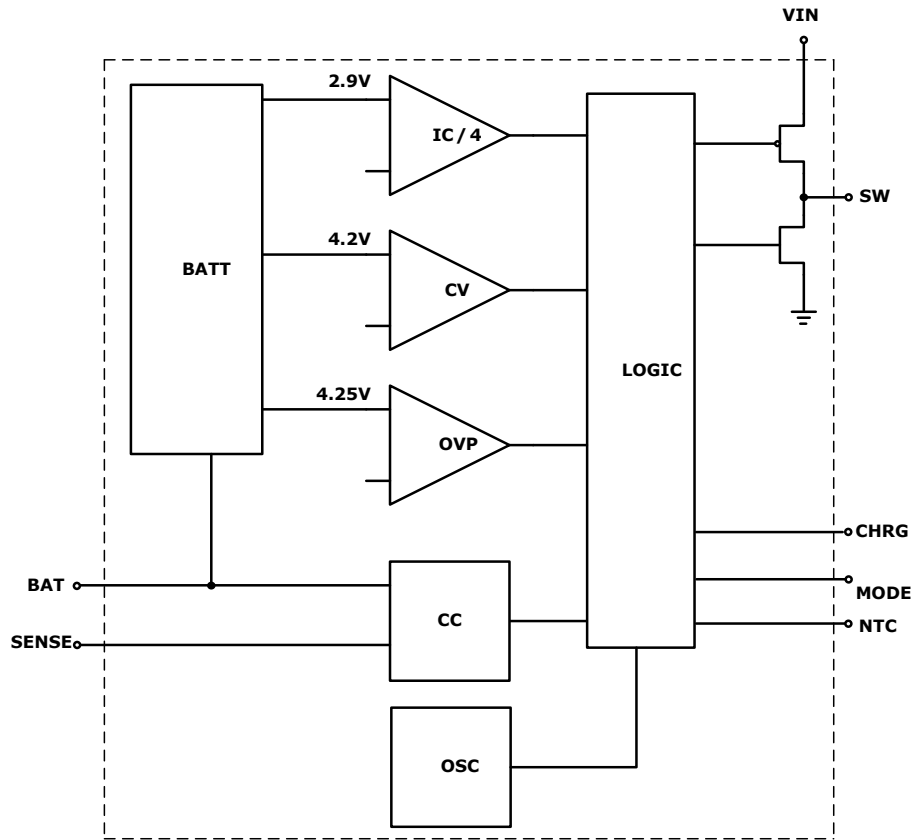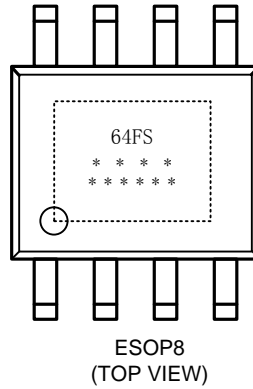| Pin Name	Pin No. ESOP8	Description
VIN	2	Power input
NTC	3	Battery temperature detection input. To disable the temperature qualification function, ground the NTC pin.
CHRG	4	Charge status output
BAT	5	Battery sense input
SENSE	6	Current sense input
MODE	7	Charge current program, "L" represents the programming current, then "H" represents the programming current 0.6 times. Default "L".
GND	8	Ground
SW	1	Charging current output

■ Block Diagram

Fig2　block diagram

■ Ordering Information

XT2064 ①②③

Designator	Description	Symbol	Description
①	Feedback Mode	F	Fixed output
②	Package	S	ESOP8
③	Device Orientation	R	Embossed tape: Standard feed
		L	Embossed tape: Reverse feed

■ Marking Rule

64FS
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ESOP8
(TOP VIEW)

Designator	Description
64FS	XT2064◆◆◆
F	固定输出
S	Package: ESOP8
****	Represents the assembly lot No

■ Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating	Unit
Input Voltage	VIN	V_{SS}-0.3～V_{SS}+6	V
SW Voltage	Vsw	V_{SS}-0.3～VIN+0.3	
BAT Voltage	Vbat	Vss-0.3～6	
SENSE Voltage	Vsense	V_{SS}-0.3～6	
CHAG Voltage	Vchrg	V_{SS}-0.3～6	
MODE Voltage	Vms	V_{SS}-0.3～6	
NTC Voltage	Vntc	V_{SS}-0.3～6	
FB Voltage	Vfb	V_{SS}-0.3～6	
SW switching current	Isw	±2.5	A
Work peripheral temperature	Topa	-40～+85	°C
Storage Temperature	Tstr	-65～+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
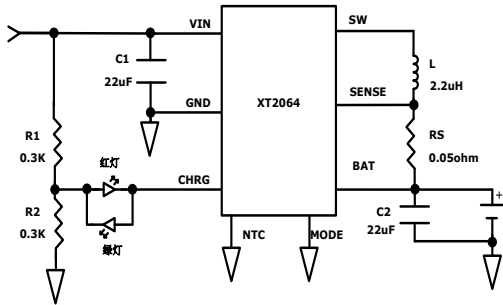
■ Electrical Characteristics

Test Condition: VIN=5V，RS=0.05ohm，TA=25℃(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_{BAT}	VIN>4.35V	4.16	4.2	4.25	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, VBAT>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}	VBAT>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}	VBAT - 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}	VMODE=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	℃	1
Hysteresis of temperature protection	ΔT_{SD}	-	20	25	30	℃	1

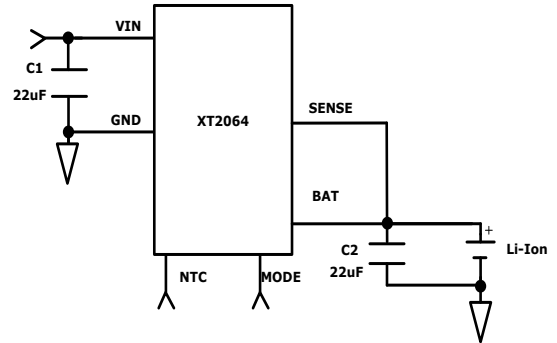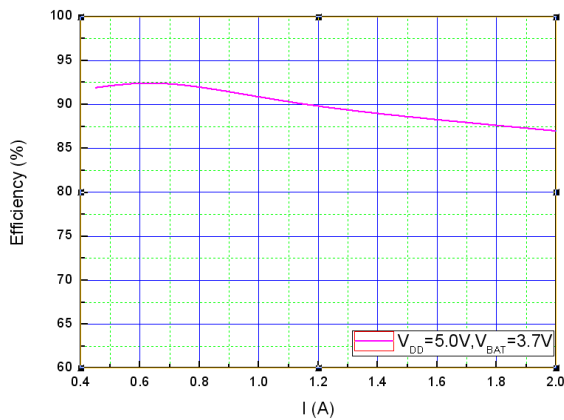## ■ Test Circuit

● Test Circuit 1

● Test Circuit 2

Fig3　test circuit

■ Typical Characteristic Curve

VIN=5V, charge current 2A

Charging current and charging efficiency
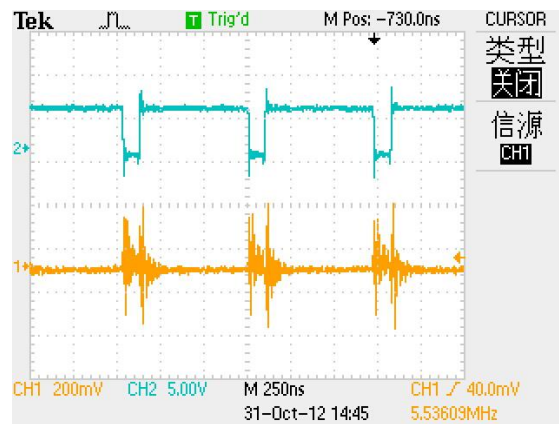

SW wave and output ripple

Fig4　typical characteristic curve
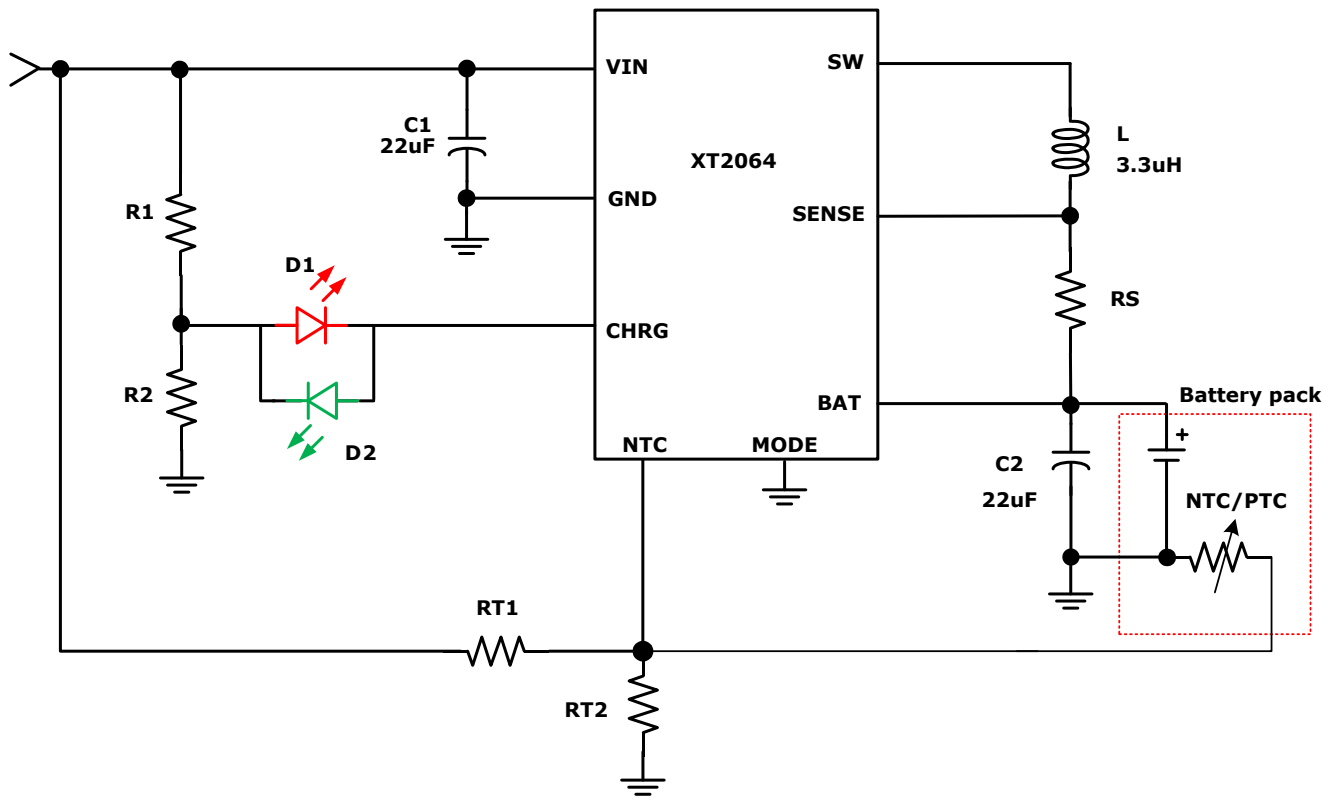
■ Typical Applications

Fig5　typical application

■ Operation

XT2064 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 BAT 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: IBAT=100mV/RS

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 BAT 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, IBAT=100mV/RS; When MODE is high, the charging current is automatically reduced to 60mV/RS. XT2064 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

XT2064 built-in temperature compensation circuit, when the internal temperature reaches 100℃, the maximum charging

current will fall with increasing temperature, reducing the possibility of thermal breakdown. When the temperature rises to 153℃, the chip enters the temperature protection, stopping charge cycle.

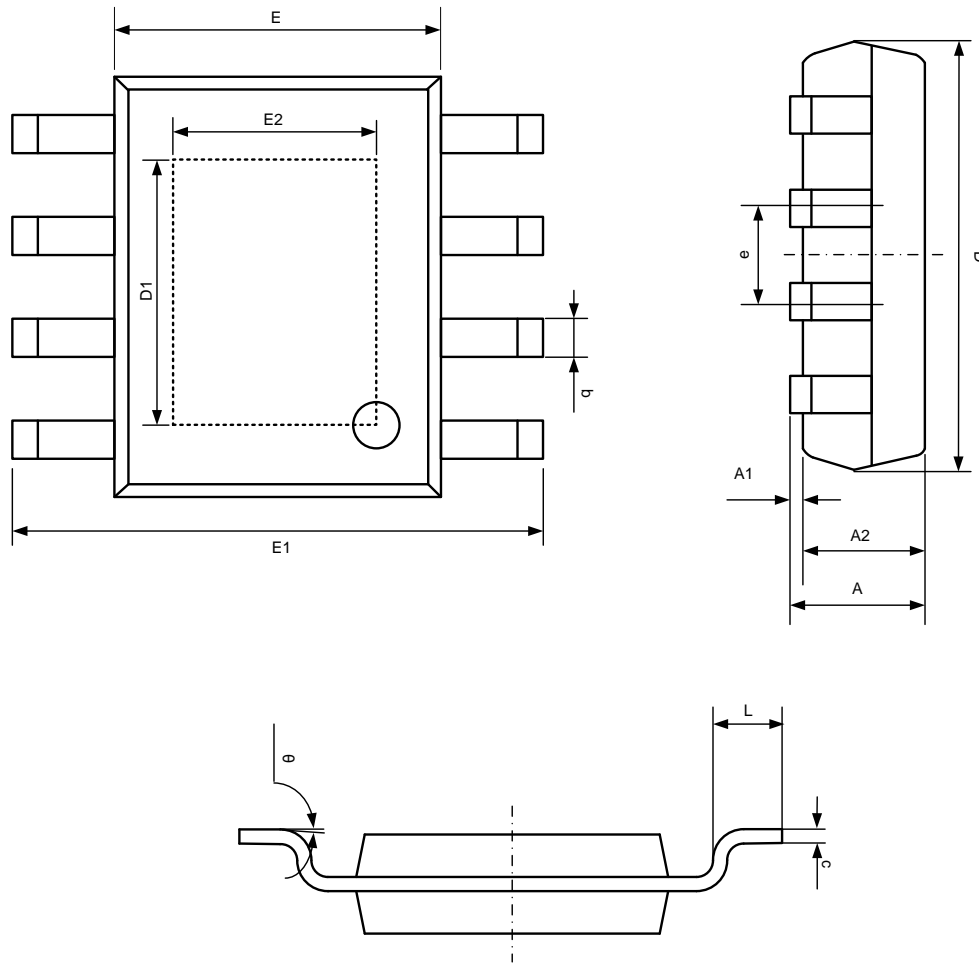For 4.2V Li-Ion battery, just connect BAT and FB pin.

➢ 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*VIN/R1.

E.g., VIN = 5V, taking R1 = R2 = 330Ω, LED current is 7.5mA.

■ Package Information

- ESOP8

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.002	0.006
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.420	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°