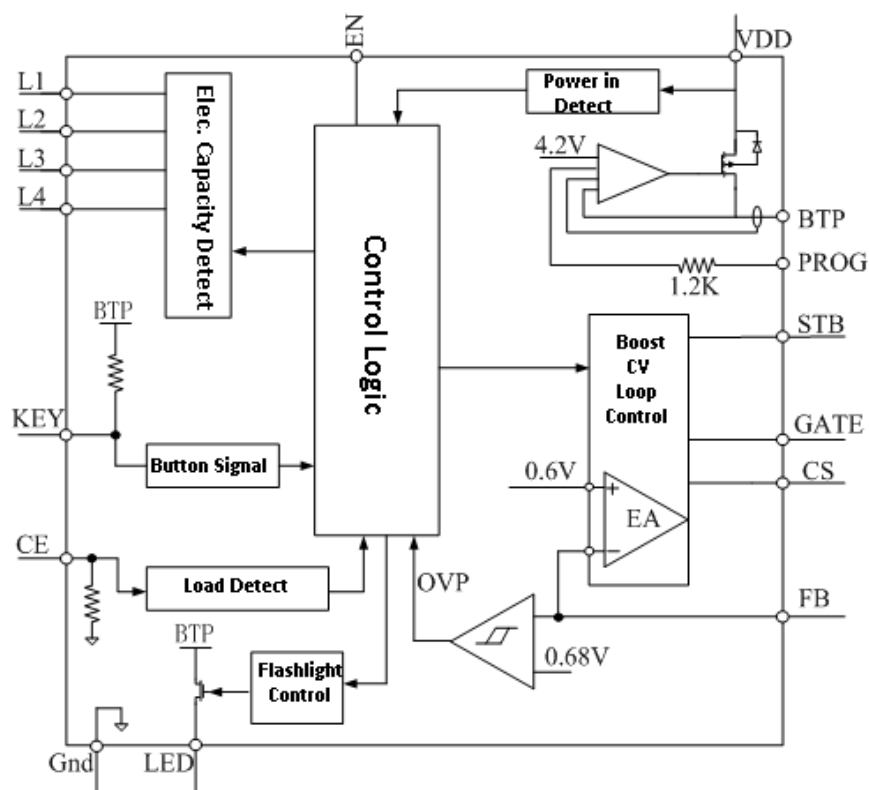


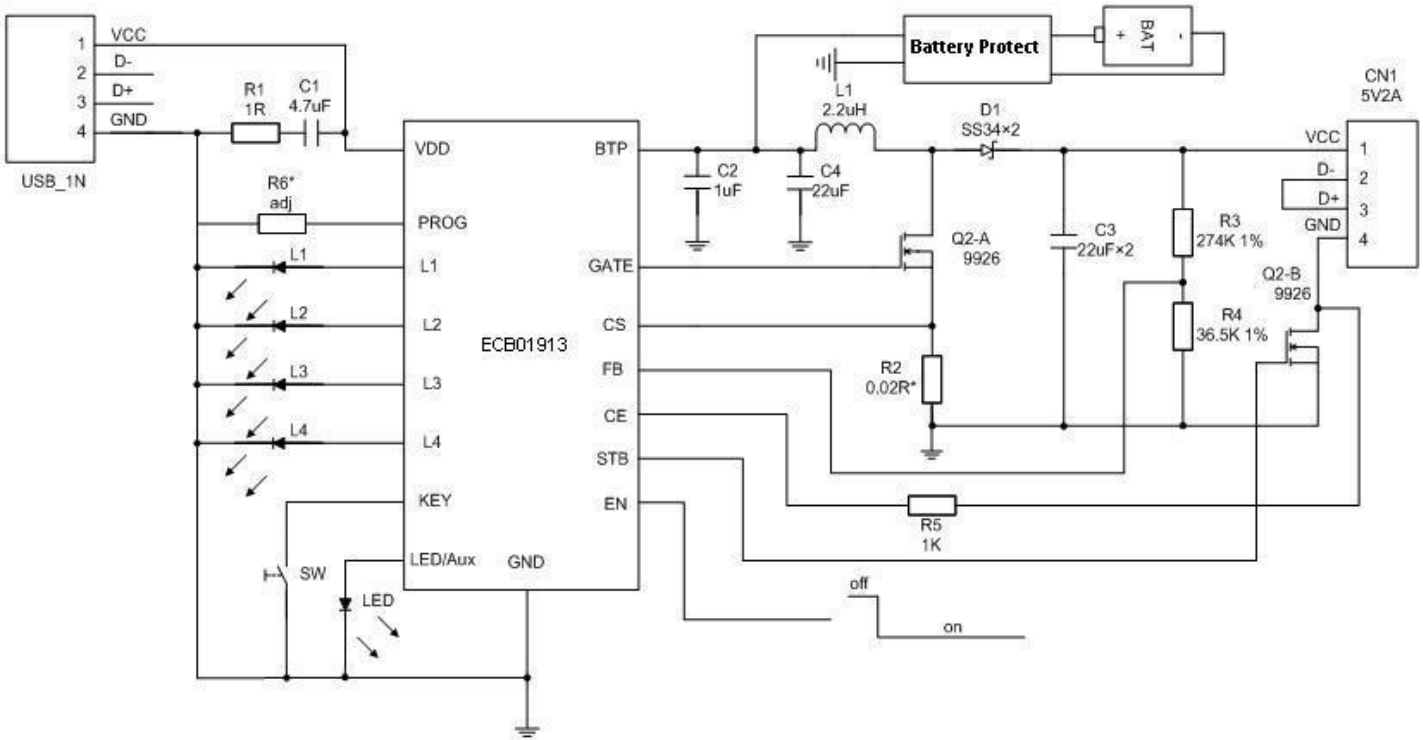
## Features

- ◆ Internally embedded 1A Max. charge mode, charging current adjustable when under 1A ;
- ◆ OVP function when charge , charge terminated when charge voltage over 6.2V ;
- ◆ Trickle/CC/CV three charging stages , fully charges voltage of 4.22V adjustable 0 V Battery chargeable
- ◆ Thermo charging protection function, charging current starts to decline from 120 degree Celsius, could lower down to zero output.
- ◆ Fixed switching frequency @ 650KHZ in discharge, Power MOSFET driven externally and moderately to reach flexible application
- ◆ Internal 0.6V reference Voltage, adjustable output voltage; Internal 0.68V OVP threshold output current adjustable
- ◆ Meet dual start up modes of button and triggered by EN pin
- ◆ Constant Output Power function with OCP (Over Current) and SCP (Short Circuit Protection)
- ◆ Boost function allowed during charge period, indicating LED remains charging status and capacity
- ◆ boost starts when loading being sense, fall into sleeping mode when loading removed or under 50mA
- ◆ 4 indicating LED controlled to show capacity precisely
- ◆ Can be defined as a Li- ion battery charger specifically
- ◆ Direct drive Flashlight LED with max. 50mA without external resistors required
- ◆ Battery over- charge and over- discharge protection

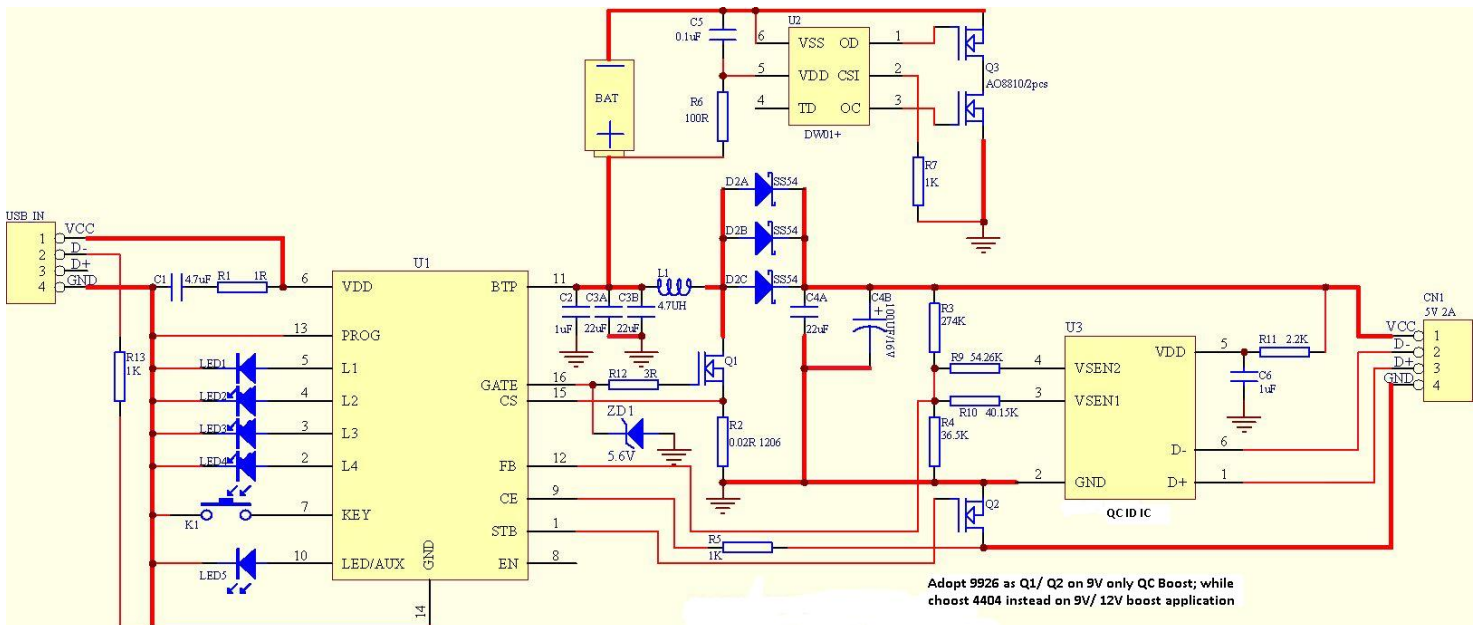
## Internal Function Block



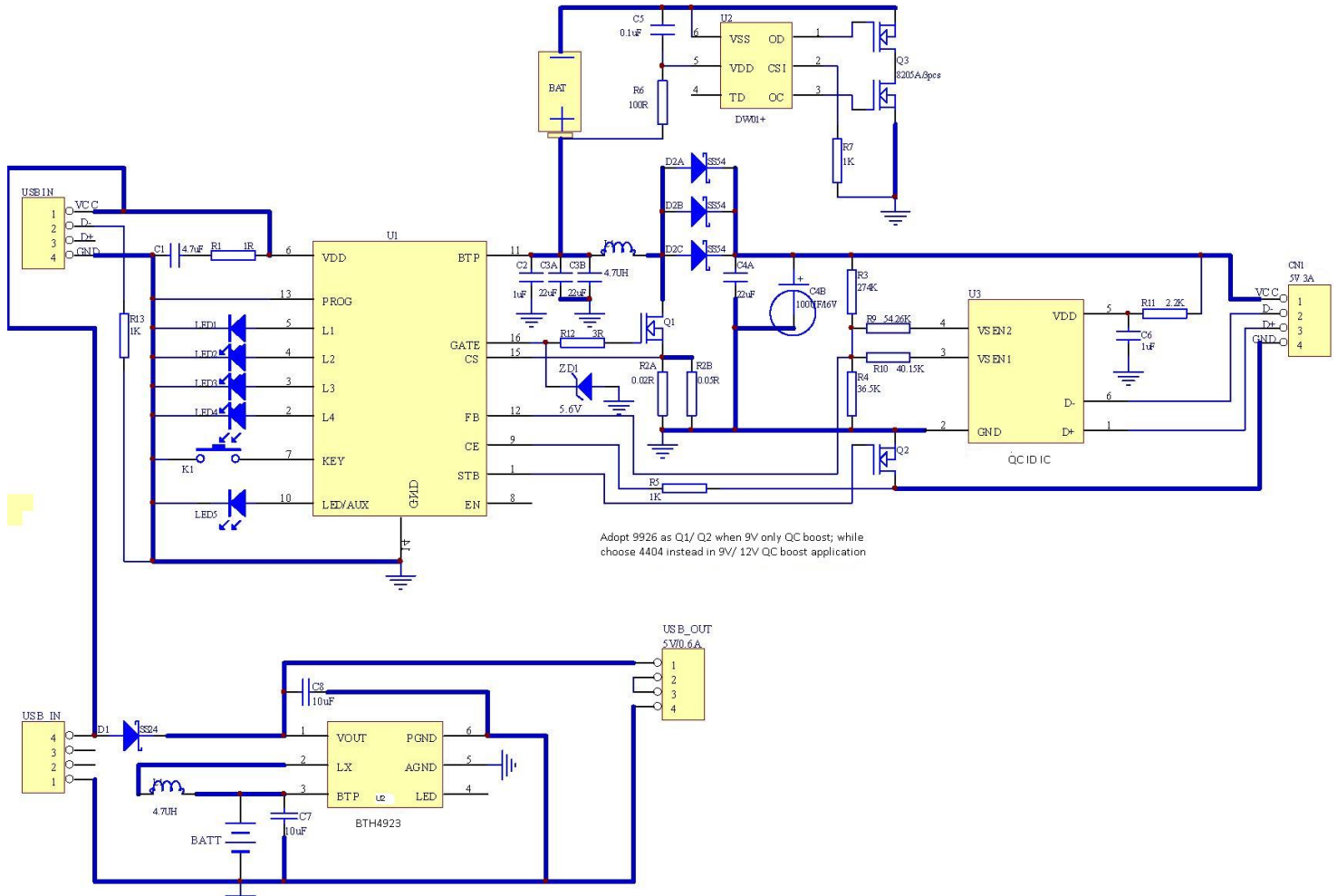
Typical Application A : Single Port Single Chip application



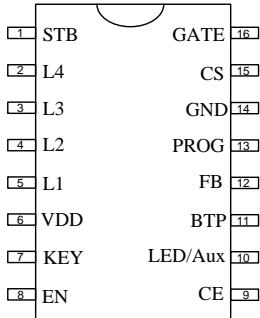
Typical Application B: Single Port W/ QC application



Typical Application A: Dual Ports w/ QC application



## Pin Configuration



Symbol	Pin #	Description
STB	1	Stand- by Control
L4	2	LED Indicator # 4
L3	3	LED Indicator # 3
L2	4	LED Indicator # 2
L1	5	LED Indicator # 1
VDD	6	VDD 5V in
KEY	7	To Button
EN	8	Boost Enable
CE	9	Loading Sensing
LED/Aux	10	Flash LED/ Auxiliary
BTP	11	To Battery +
FB	12	Output basis of boost
PROG	13	Charging current programming Pin
GND	14	Ground
CS	15	Inductor peak current sensing Pin when Boost
GATE	16	Ext. Gate driving Pin when Boost

## Ordering Information

ECB01913 XX X

M1 : SOP-16L

R : Tape Reel

Part No.	Package type	Marking	Remark
ECB01913M1R	SOP-16L	ECB01913 LLLLL YYWW	1. LLLLL : The last five numbers of LOT. 2. YY : Year code ; Year 2014=14 3. WW : Week code ; 01~52



QC 2.0 compliant Portable Power Bank Single Chip IC

DC Parameter

( Unless specified, all parameters measured under room Temp. and set GND potential as 0 potential )

Symbol	Characteristics	Test Condition	Unit	Min	Typ	Max
Systematic Parameter						
V <sub>IN</sub>	Input Voltage Range		V	4.5	5	5.5
V <sub>bat</sub>	Battery Voltage		V	2.8		4.35
I <sub>sleep</sub>	Sleep Mode Current	BTP=3.2- 4.2V	uA			50
Charge Parameter						
V <sub>IN</sub> Drop out Monitor	V <sub>IN</sub> (Low to High)	V <sub>IN</sub> >BAT	mV		100	
	V <sub>IN</sub> (High to Low)	V <sub>IN</sub> >BAT	mV		30	
V <sub>float</sub>	Floating Gate voltage		V	4.18	4.22	4.26
I <sub>bat</sub>	BAT reverse current		uA		±0.5	±5
V <sub>TRKL</sub>	Trickling turns to CCM Volt	V <sub>BAT</sub> low to high	V		2.8	
V <sub>TRHYS</sub>	Trickling charge hysteresis Volt.		mV		100	
V <sub>UV</sub>	Vcc under voltage lock- out	Vcc low to high	V		3.7	
V <sub>UVHYS</sub>	Vcc under voltage lock- out hysteresis		mV		200	
V <sub>RECHG</sub>	Recharge Voltage threshold		V		4.1	
V <sub>prog1</sub>	PROG Volt. when Trickling		V		0.1	
V <sub>prog2</sub>	PROG Volt. when large Current		V		1	
FLED	LED Flicker Freq. when Charge		Hz		1	
V <sub>OVP</sub>	OVP when Charge		V	6.0	6.2	6.4

Symbol	Characteristics	Test Condition	Unit	Min	Typ	Max
Discharge Parameter						
V <sub>EN</sub>	Enable On Volt.		V	0		1.5
FB	Ref. Volt. of Boost system		mV	582	600	618
INOLOADOFF	Zero load detect current threshold		mA	25	50	75
TNOLOADOFF	Off Delay time for boost when zero load		S	12	16	20
F <sub>sw</sub>	Switching Freq.		KHZ	520	650	780
D <sub>max</sub>	Max. duty Cycle		%	78	90	95
TN_DRIVE	N GATE driving time (load=1nF)	Rise Time	nS		10	
		Fall Time	nS		8.5	
V <sub>ocp</sub>	Peak Current threshold Volt.	BTP=3.6V	mV	115	120	125
	Constant Power Output current bias	BTP=3.2-4.2V	%	-10	0	10
T <sub>ss</sub>	Soft star time		mS		2	
OVP	OVP starts threshold Volt.		mV	660	680	700
OVP_HYS	OVP threshold Hysteresis Volt		mV	615	635	654
T <sub>d_OVP</sub>	OVP turn off delay		uS		30	
V <sub>SD1</sub>	Boost shut down Voltage when low power capacity	V <sub>BAT</sub> high to low	V		2.8	
V <sub>UVLO_R</sub>	UVLO Recovery Volt.	V <sub>BAT</sub> low to high	V		3.00	
I <sub>auto_off</sub>	Loading current of Auto- off	BAT=2.8-4.2V L=2.2uH	mA	25	50	75
OTP	Over Temp. Protection		degC		150	
OTP_HYS	OTP Hysteresis		degC		30	

## Function and Characteristics

### Charge Management Portion

- (1) Fully charged Volt. set @ typical 4.22V
- (2) Max. charging current can reach 1A; When under 1A required, thru Rch resistor on PROG Pin to GND While  $I_{ch} = 1200 / (R_{ch} + 1200) (A)$
- (3) Pre- charge function when  $V_{BAT}$  under 2.8V (Current =  $I_{ch} * 10\%$ )
- (4) 0V Battery chargeable
- (5) Three stage charge function: Tickling / Constant Current/ Constant Voltage
- (6) Thermo Charging protection, charge current starts to decline from 120°C, and down to 0 when 150°C

### Boost( Discharge Management Portion)

- (1) Switching Freq. @ 650KHZ to drive external N- MOS and adjust output voltage and current
- (2) After loading current < 50mA being sensed for 16 Seconds, ECB01913 would turn into Stand- by mode
- (3) Automatic loading detect function , user could wake up system with button or EN Pin when design
- (4) Constant Power design , OCP point lower down along with battery voltage. When output current surpasses OCP point, output voltage declines to maintain stable output power until output voltage turns to be as low as battery voltage, which system would judge as over current or short- circuit state to shut down
- (5) Boost reference voltage @ 0.6V, with suitable dividing resistors to alter output voltage, equation is-  $V_{out} = 0.6 \times (1 + R3/R4)$  , With OVP function , when output voltage surpasses  $V_{ovp} = 0.68 \times (1 + R3/R4)$ , boost function would be interrupted ; Also, the peak boost voltage must under 9V
- (6) 3.2V Indicator LED1 starts to flicker when  $V_{bat} < 3.2V$ ;  
A. When boost not being triggered and  $V_{bat} < 3.0V$ , button won't effect, and LED1 would flicker for 8 seconds. ;  
B. When boost not being triggered and  $V_{bat} > 3.0V$ , Boost function can be waken with button until  $V_{bat}$  falls under 2.8V, discharge output would be turned off, at this moment, LED1 still flickers for 8 seconds.
- (7) Max. output current can be decided by R2, when  $V_{bat}$  is 3.6V, output current can be calculated by :  $I_{out} = 0.04 / R2$  , When  $V_{bat}$  is higher or lower than 3.6V, output current tolerance is < 15% In normal case of application, user can set  $R2 = 0.04$  Ohm to gain 1A output current , and By setting  $R2 = 0.02$  Ohm to gain 2A output current
- (8) Boost/ Discharge allowed while internal battery being charged, and LEDs indication follows rules of charging state shown below in "Charge/ Discharge Indicating LED Intro."

### Charge/ Discharge Indicating LED Intro.

- (1) Charge/ Discharge indicating LEDs Marquee is shown in below chart
- (2) When discharging, if  $V_{bat}$  falls under 2.8V, system would be shut down ; when  $V_{bat}$  raises from low to high and before reaching 3.0V, boost action would not be ignited by inserting any loads or clicking button, and LED1 would flicker for 8 seconds to remind low battery voltage
- (3) In sleeping mode, by clicking button to check status, LEDs would flicker for 8 seconds in accordance With actual battery condition in the following methods—



Operating Mode *	Internal Battery Status	L1	L2	L3	L4
(Boost)Discharge	BAT<3.2V	Flicker	off	off	off
	3.2≤BAT<3.45V	on	off	off	off
	3.45≤BAT<3.65V	on	on	off	off
	3.65≤BAT<3.80V	on	on	on	off
	3.80≤BAT	on	on	on	on
Charge	3.65≤BAT	Surge	Surge	Surge	Surge
	3.65≤BAT<3.80V	on	Surge	Surge	Surge
	3.80≤BAT<4.00V	on	on	Surge	Surge
	4.00≤BAT<4.22V	on	on	on	Surge
	4.22=BAT	on	on	on	on
Stand- by	-	off	off	off	off

\* Flicker Frequency of LED during Discharge period is 2 HZ, with duty cycle of 50%

\* Surge of 4 LEDs during Charge period is exposed of 1 HZ, with 250mS on- state each

#### Specified in Li-ion Battery charging and Power Capacity Indication

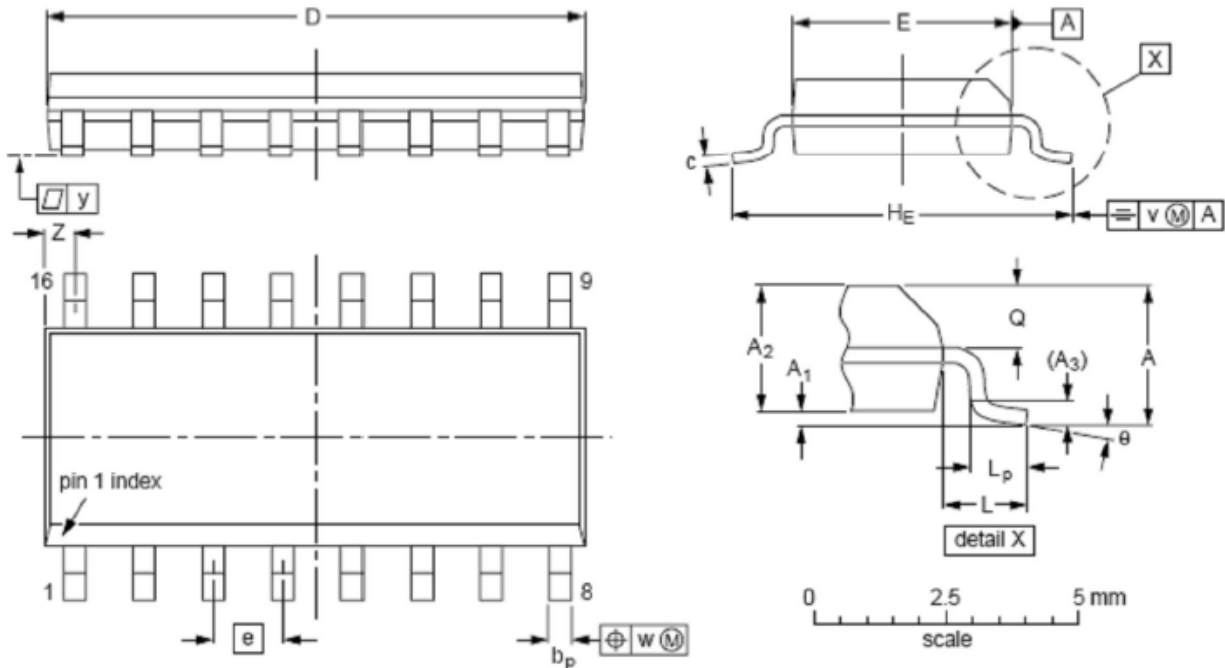
1. When connect LED/ Aux pin with BAT, ECB01913 turns into single LED indicating mode, which is only applied to charge Li- ion battery and under voltage indication. Single LED flickers when charging, and is ON state when battery fully charged. User can either choose EN Pin or KEY Pin to ignite Boost function, but other LEDs won't show boost status
2. In this mode, when any of protection modes occur, user is demanded to reset manually for safety concerns.

#### Flashlight Control

- (1) Double click button can turn on Flash; Turning off by another action of double click
- (2) No external resistors required to control white light LED with max. output of 50mA

#### EN PIN control function

- (1) Boost function being triggered when EN in low level ;
- (2) Boost function stops when EN set floating or being pulled high level
- (3) Min loading current sensing function being stopped in this phase, and Boost action remains

**Package Information**

**DIMENSIONS** (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	ε
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.039	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	