

## GENERAL DESCRIPTION

The N3857 is a low cost, fully integrated, single cell Lithium-Ion battery charger management controller and works with various types of AC adapter or DC voltage source.

The N3857 is designed to operate as a linear low dropout regulator. The battery is charged in CC / CV (constant current /constant voltage) profile, This device is built in a pre-charge function when the battery voltage is below 3.0V .The pre-charge mode is set to limit power dissipation due to the over-discharged battery. The current of both pre-charge and fast charge mode is programmable with an external resistor, and the maximum fast charge current is up to 1A. The output voltage to the battery is also adjustable by external resistors.

The N3857 features on its charge current with thermal foldback to guarantee a safe operation. A LED pin output is also provided which is capable of source and sink 10mA to drive two LEDs for indicating the charging status.

## FEATURES

- Fully integrated charger for Lithium-Ion
- Very low dropout operation
- Programmable fast charge, pre-charge current
- Adjustable output voltage to battery
- Up to 1A continuous charge current
- Charge current with thermal foldback
- 1% voltage accuracy
- No external blocking diode required
- 1uA battery drain current
- Input voltage up to 9V
- 2 LEDs indicating charging status
- Few external components
- Very low cost solution
- SOP-8 and DIP-8 Package

## APPLICATIONS

- Cellular phones
- PDA's
- Stand-alone chargers

## ABSOLUTE MAXIMUM RATINGS

	SYMBOL	LIMITS	UNITS
Power supply voltage	VCC	-0.3 ~ 20	V
Output Voltage	VO	-0.3 ~ 20	V
Power Dissipation at Ta =50 °C, SOP/DIP	PTOT	1000/1200	mW
Charge Current , if (VIN – VO)<0.9V	IFAST	1	A
ESD Rating ----- Human Body Mode Machine Model		3K 250	V
Operating Junction Temperature	Tj	- 25 ~ 150	
Storage Temperature	TSTG	- 55 ~ 150	
Lead Temperture(Soldering) 10S	TLEAD	300	

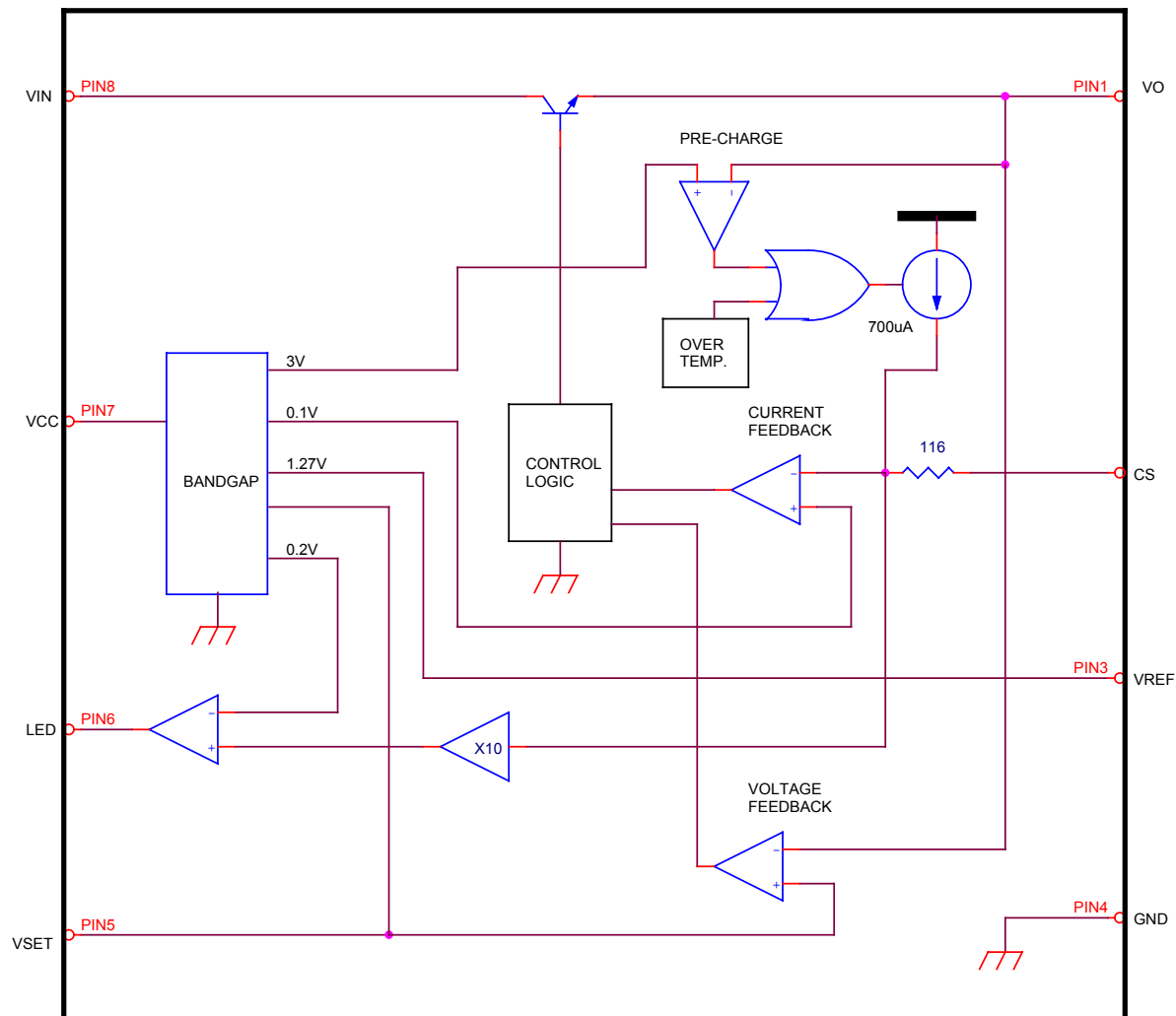
**THERMAL DATA**

PARAMETER	SYMBOL	SOP- 8	DIP-8	UNIT
Thermal Resistance Junction to Ambient	$\theta_{ja}$	53	45	/W
Thermal Resistance Junction to Case	$\theta_{jc}$	23	15	/W

**ELECTRICAL SPECIFICATIONS**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Voltage Range	VCC		6	7	14	V
Input voltage Range	VIN		4.3	-	9	V
Dropout Voltage	VIN – VO			0.1		V
Operating Supply Current	Icc	Vcc=6V		11		mA
Battery Leakage Current	Ileak				1	uA
Reference Voltage	VREF		1.26	1.27	1.28	V
Output Voltage setting	VSET	R13=19.1K,R14=8.2K	4.16	4.20	4.24	V
Battery Pre-charge Current	IPRE	Rcs=0.2	95	115	130	mA
Battery Fast Charge Current	IFAST	Rcs=0.2 , VBATT=3.8V	500	525	550	mA
Max. Fast Charge Current	IFAST(MAX)	(VIN-VO)<0.9V			1	A
LED Indicate Full Charge		Rcs=0.2	130	140	150	mA
IFAST Regulated Voltage	Vcs		0.103	0.105	0.107	V
Battery Pre-charge Threshold			2.95	3.00	3.15	V
Over Temperature Threshold			130	140	150	°C

## BLOCK DIAGRAM



## APPLICATION INFORMATION

## PRE-CHARGE MODE

If battery voltage is below 3V, the pre-charge mode is automatically enabled, this function is used to limit the power dissipation of battery and the N3857 device whenever the battery is over-discharged. When battery begins to charge in this mode, the voltage of the battery will rise and reach the 3V limit, the N3857 will change to the fast charge mode . The pre-charge

current value is selected by external current sense resistor, the pre-charge current is given by :

$$I_{PRE} = \frac{V_{CS} - 116 \times 700\mu A}{R_{CS}}$$

### **FAST CHARGE MODE**

The fast charge mode operates while the battery voltage is above 3V, and the battery is not fully charged. The fast charge current can be set to maximum of 700mA, and the fast charge current value is selected by external current sense resistor, the fast charge current is given by :

$$I_{FAST} = \frac{V_{CS}}{R_{CS}}$$

### **LED INDICATE THE CHARGING STATUS**

The LED pin output is capable of source and sink 10mA current to drive 2 LEDs for showing present charging status. As the battery begins to charge, the LED pin will source a 10mA current to drive charge LED indicator. When the charge control switched into the constant voltage mode from the fast charge mode, the output voltage ( $V_O$ ) is regulated, but the charge current will be fallen down gradually. While charge current is below the limit, the LED pin will sink a 10mA current to drive full LED indicator, the current limit of LED exchange is given by :

$$I_{LIMIT} \approx \frac{0.02}{R_{CS}}$$

### **ADJUST THE OUTPUT VOLTAGE TO THE BATTERY**

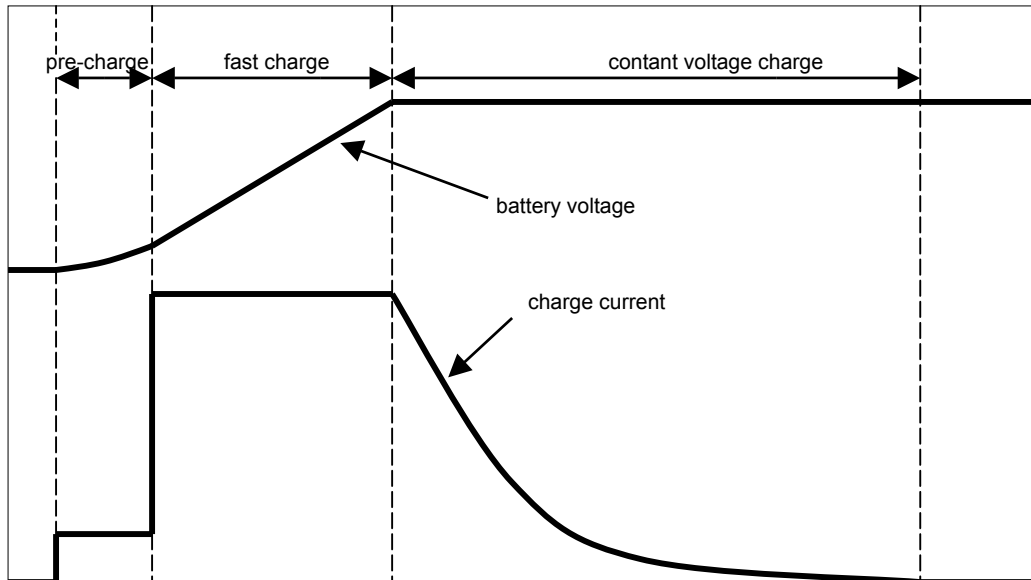
The battery voltage is adjusted by external resistors R13 and R14, the resistor R13 connects to VSET pin and VREF pin, the resistor R14 connects to VREF pin and GND pin to generate VSET voltage , the  $V_O$  voltage is given by :

$$V_O = V_{SET} = V_{REF} \times \left( 1 + \frac{R_{13}}{R_{14}} \right)$$

### **OVER CURRENT AND OVER TEMPERATURE PROTECTION**

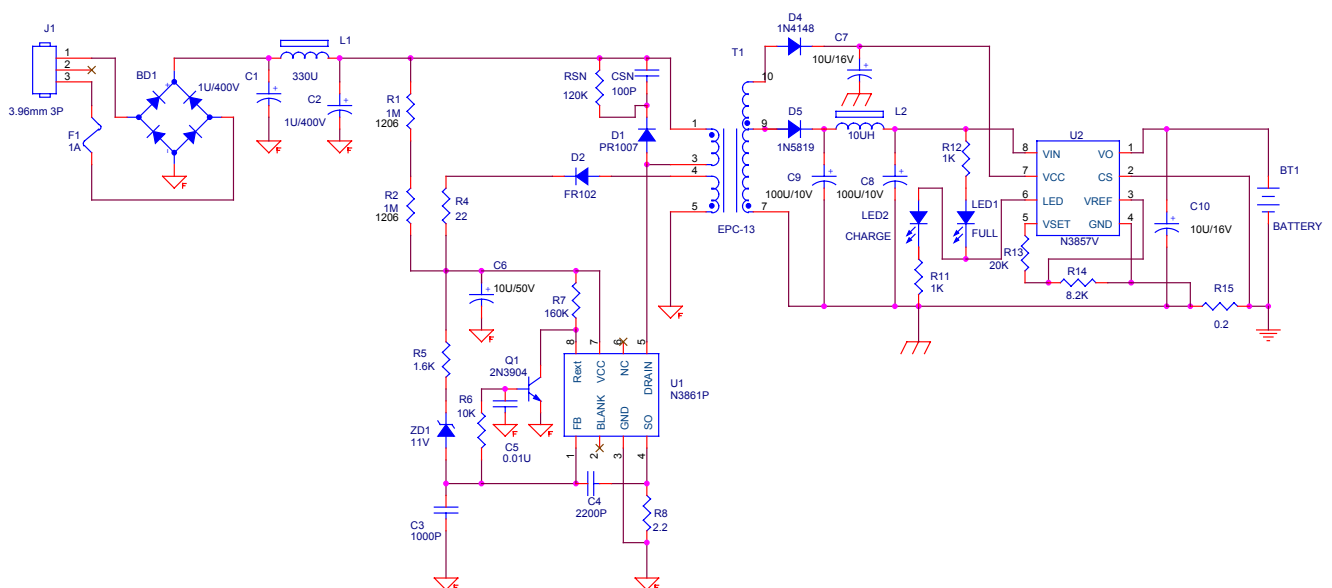
The N3857 is built in over current and over temperature protection, both of these functions protect the device in an event of a short circuit condition, while the protection happened, the charge current will force to switch to the pre-charge current level.

## BATTERY CHARGE PROCEDURE

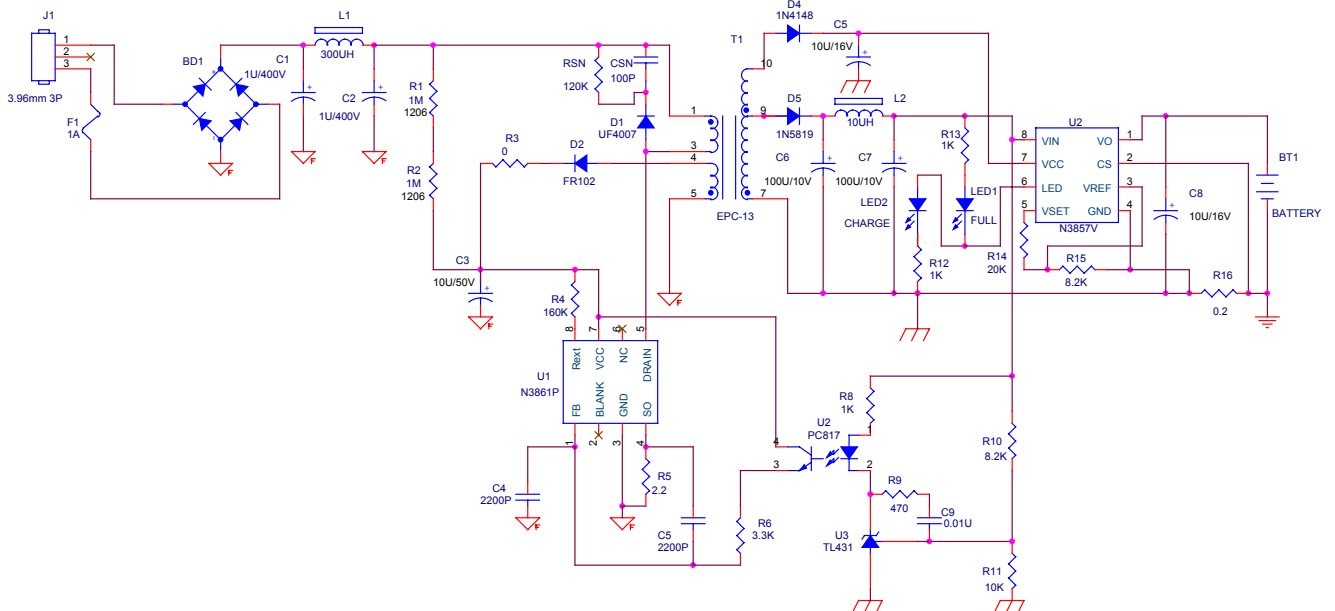


## TYPICAL APPLICATION

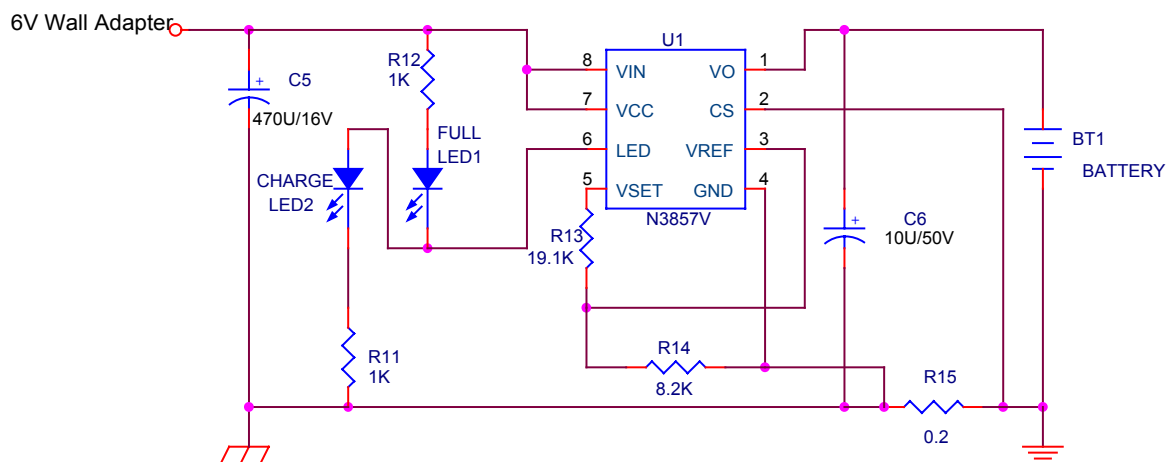
### 1. 4.3V/500mA CHARGER FOR PRIMARY FEEDBACK APPLICATION(NO LOAD< 0.3W AT 230VAC)



## 2. 4.3V/500mA CHARGER FOR SECONDARY FEEDBACK APPLICATION(NO LOAD <0.3W AT 230VAC)

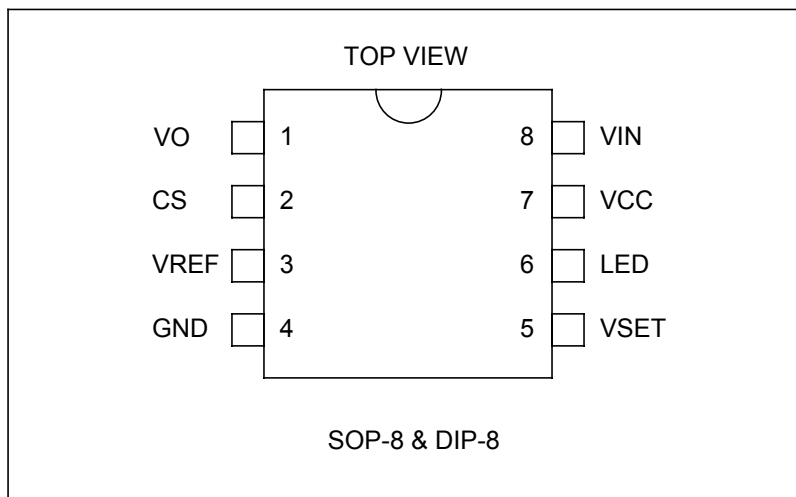


## 3. WALL ADAPTER APPLICATION



**DEVICE SELECTION GUIDE**

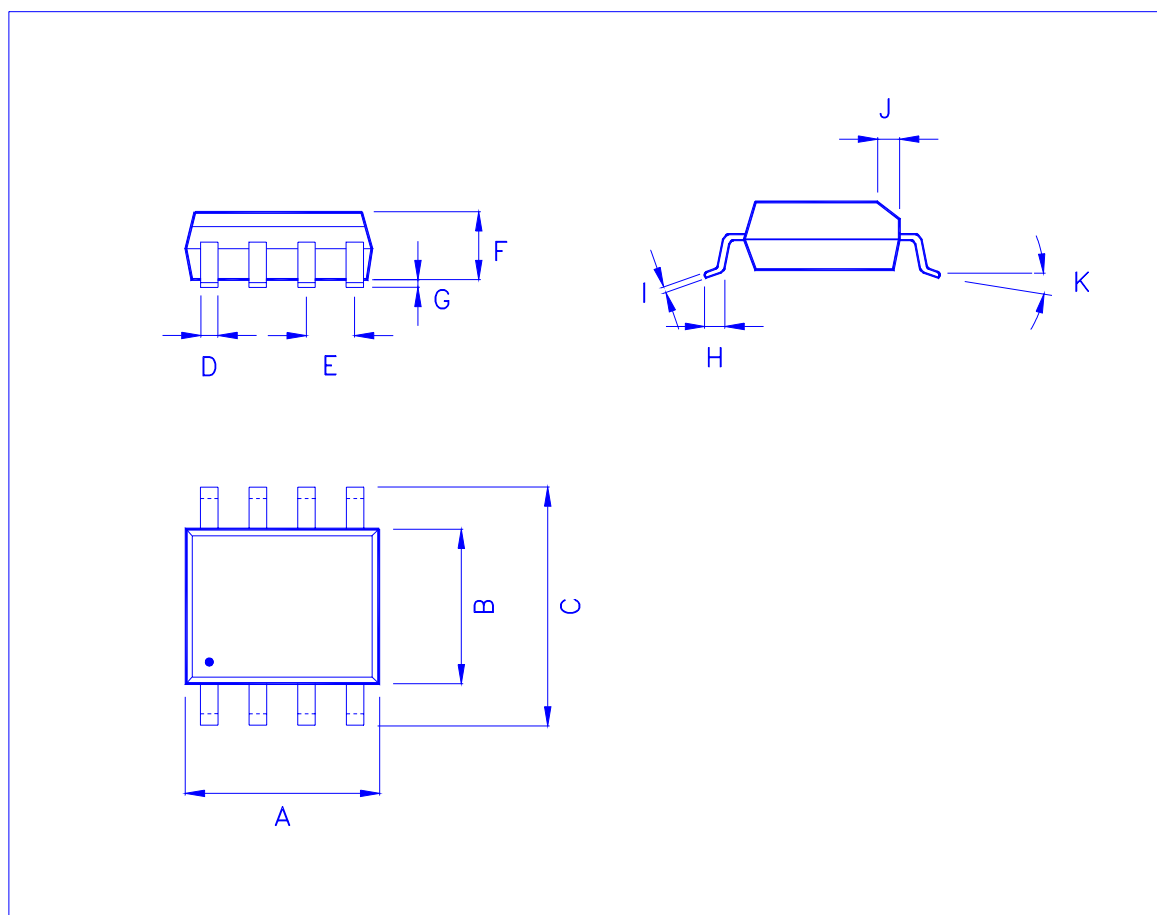
DIP-8	SOP-8
N3857P	N3857V

**PIN CONFIGURATIONS**

**PIN FUNCTIONS**

NO	FUNCTION	DESCRIPTION
1	VO	The output pin of this IC , it connects to the plus(+) pin of the battery .
2	CS	The current sense input pin of this IC, it connects to the current sense resistor for setting fast charge current.
3	VREF	The reference voltage output pin, it connects to the resistor R13 and R14 to generate VSET voltage.
4	GND	GND pin
5	VSET	The input of voltage error amplifier, set the voltage to adjust the output voltage ( pin1) by the external resistors R13 and R14 .
6	LED	The charge status indicated pin, it is capable of sink and source 10mA current for driving the LEDs ,this pin source a high level to indicate the present charge status, then sink a low level to indicate the full charge status.
7	VCC	The supply voltage for control circuit
8	VIN	The charge voltage source input

**SOP-8 (D) MECHANICAL DATA**

Dimension	mm			Dimension	mm		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.8		5.0	H	0.4		1.27
B	3.8		4.0	I	0.18		0.25
C	5.8		6.2	J		0.22	
D	0.33		0.51	K	0°		8°
E		1.27		L			
F			1.75	M			
G	0.1		0.3	N			





## DIP-8 MECHANICAL DATA

Dimension	mm			Dimension	mm		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	8.8		9.6	H	7.95		9.75
B	6.2		7.0	I			
C	0.35	0.45	0.55	J			
D		2.54		K			
E	0.5		0.8	L			
F	3.05	3.28	3.56	M			
G	7.48	7.62	8.13	N			

