Single Inductor, 3A Battery Charger with 2.4A USB OTG, 0.1us True OVP and Adjustable Fuel Gauge All-in-One Solution

DESCRIPTION

ETA6886 is a switching Li-Ion battery charger capable of delivering up to 3A of charging current to the battery and also capable of delivering up to 2.4A in boost OTG operation. It employs a charge pump to achieve a very fast input OVP, and also includes an externally programmable fuel gauge system for power indication. For charging, it uses a proprietary control scheme that eliminates the current sense resistor for constant current control, thereby improving efficiency and reducing costs. It can also output a 5V voltage in the reversed direction by boosting from the battery. Therefore, it only needs a single inductor to provide power bi-directionally. Together with the build-in Micro-controller functions, such as push-button, auto load detection, and fuel gauging features, ETA6886 is truly an ideal all-in-one solution for battery charging and discharge applications, such as power banks, smart phones, and tablets with only one USB port that can be used for both charging battery and USB OTG function.

ETA6886 is in QFN4x4-28 package.

FEATURES

- Bi-Directional Power conversion with Single Inductor
- Input OVP with 0.1us reaction time
- Input standoff voltage up to 20V
- Switching Charger
- 5V Synchronous Boost
- Up to 95% Efficiency
- Up to 3A Max charging current and 2.4A discharging
- No External Sense resistor
- NTC thermistor input

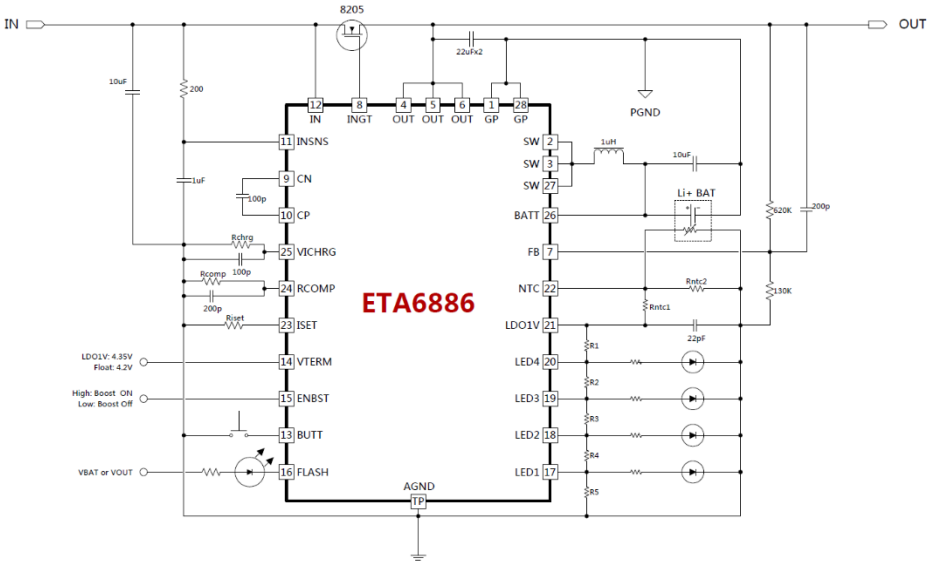
APPLICATIONS

- Power Bank
- Smart Phone / Tablet, MID

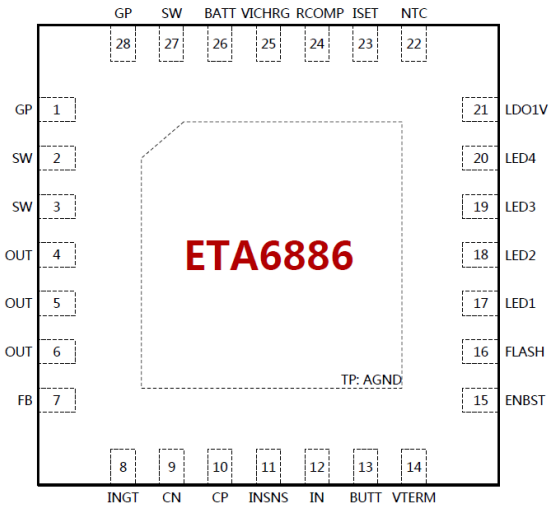
ORDERING INFORMATION

PART	PACKAGE	TOP MARK
ETA6886Q43	QFN4x4-28	ETA6886 YWW2L

TYPICAL APPLICATION



PIN CONFIGURATION



QFN4x4-28

ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

OUT Voltage .....–0.3V to 6V
IN, INGT Voltage .....–0.3V to 20V
All Other Pin Voltage .....V_{OUT}–0.3V to V_{OUT}+0.3
SW,IN,OUT to ground current.....Internally limited
Operating Temperature Range .....–40°C to 85°C
Storage Temperature Range .....–55°C to 150°C

Thermal Resistance	θ_{JC}	θ_{JA}	
QFN4X4-28	2	30	°C/W

Lead Temperature (Soldering, 10ssec) .....260°C
ESD HBM (Human Body Mode) 2KV
ESD MM (Machine Mode) 200V

ELECTRICAL CHACRACTERISTICS

(V_{IN} = 5V, unless otherwise specified. Typical values are at TA = 25oC.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
BUCK MODE					
IN Standoff Voltage				20	V
IN Range		4.5		5.5	V
IN UVLO Voltage	Rising, Hys=500mV		4.5		V
PUMP Hiccup threshold Voltage	Falling.Vin-Vout<300mV Rising,Hys=50mV		300		mV
PUMP Hiccup on time			7		mS
PUMP Hiccup off time			200		mS
PUMP frequence			500		KHZ
PUMP Voltage	Vingt-Vout		3.5		V
INSNS Clamp Voltage			6.4		V
INSNS OVP Voltage	Hys=300mV		6.0		V
IN Operating Current as BUCK	Switcher Enable, Switching		5		mA
	Switcher Enable, No Switching		500		μA
BATTERY CHARGER					
Battery CV Voltage	VTERM=0, I_{BAT} =0mA, default	4.16	4.2	4.24	V
	VTERM=LDO1V, I_{BAT} =0mA, default	4.3	4.35	4.4	V
Charger Restart Threshold	From DONE to Fast Charge		-150		mV
Battery Pre-Condition Voltage	V_{BAT} Rising Hys=200mV		3		V
Pre-Condition Charge Current			200		mA

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Fast Charge Current	R_{ISET} =62KΩ		3		A
Charge Termination Current	R_{VICHRG}=100K,C_{VICHRG}=100pF		200		mA
Charge Termination Blanking time			12		S
BOOST MODE					
BATT Ok Threshold	Rising, HYS=0.5 V		3.2		V
Output Voltage Range		5.0	5.05	5.1	V
Quiescent Current At BATT	Boost On			100	μA
Shutdown Supply Current At BATT	Idle Mode			30	μA
Switching Frequency	VBATT<4.4V	0.8	1.0	1.2	MHz
Iout Current Limit			3		A
Maximum Duty Cycle			90		%
Highside Pmos Rdson	I_{SW} =500mA		55		mΩ
Lowside Nmos Rdson	I_{SW} =500mA		50		mΩ
Short Circuit Hiccup Current			4		A
Short Circuit Hiccup Timer	On Time		25		ms
	Off Time		750		
Load current threshold into sleep mode			30		mA
FLASH, DM, LEDS					
Flash,DM Output Low Voltage	I_{STAT}=10mA			0.15	V
LED Flash Frequency			250		Hz
ISET,FB					
FB	Vhold feedback voltage		0.8		V
ISET Voltage			0.8		V
NTC THERMISTOR MONITOR					
NTC Threshold, Cold	Charger Suspended		52		%ldoIV
NTC Threshold, Hot	Charger Suspended		13		%ldoIV
NTC Threshold Hysteresis			2		%ldoIV
NTC Disable Threshold	Tie NTC to LDOIV				
NTC Input Leakage			0	5	μA
LOGIC INPUT: ENBST, VTERM, BUTT					
Logic Input High		1.2			V
Logic Input Low				0.4	V
THERMAL PROTECTION					
Charging Thermal Regulation threshold			85		°C
Thermal Shutdown	Rising, Hys=30°C		160		°C

PIN DESCRIPTION

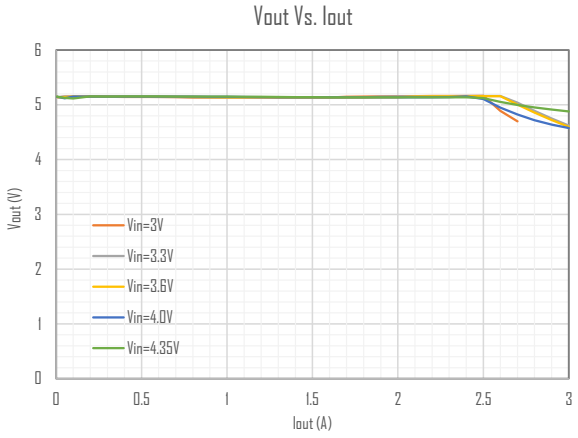
PIN #	NAME	DESCRIPTION
1.28	GP	Power Ground pin
2.3.27	SW	Switching Pin. Connect with an inductor between this pin and BATT.
4,5.6	OUT	USB 5V output during boost and charging input pin during charging. This is a power pin, bypass with 2x22uF MLCC caps to the pin and PGND as close as possible.
7	FB	Input Holding Voltage (V_{HOLD}) feedback pin. A resistor divider from OUT to AGND thru this pin, sets the input voltage at which level the chip tries to keep from further dropping by reducing charge current.
8	INGT	A gate driver pin to control the external NMOS power path.
9	CN	Charging pump Cap's negative terminal
10	CP	Charging pump Cap's positive terminal
11	INSNS	Input sense pin. Internally clamped to 6.4V. Connect a resistor from INSNS to IN, and 1uF cap to Analog ground.
12	IN	Input OVP sense pins. Bypass with a 10uF capacitor from this pin to ground.
13	BUTT	Push Button pin. When the push button is pushed, and input is not present, boost operation is activated. Depending on the loading at OUT, the boost may continue to supply an output voltage or go into sleep mode. When push this button sustain 2S, it will turn on or turn off the flashlight alternatively.
14	VTERM	Battery termination voltage select. VTERM=0, Battery CV voltage=4.2V, VTERM=ldo1V, Battery CV voltage=4.35V. Internally pulled down to AGND
15	ENBST	Manual Force Boost operation pin. When ENBST=1, force Boost Operation. When ENBST=0, force Boost Off.
16	FLASH	Flashlight pin, Connect a LED between BATT and FLASH
17	LED1	Fuel gauge LED1 connection pin
18	LED2	Fuel gauge LED2 connection pin
19	LED3	Fuel gauge LED3 connection pin
20	LED4	Fuel gauge LED4 connection pin
21	LDO1V	Fuel Gauge 1V LDO output pin. Bypass with a 22pF capacitor to Analog ground. Resistor chain from LDO1V, thru LED1-4 to AGND, will set the battery fuel gauge level.
22	NTC	Battery Temperature Monitoring input pin. It sets the valid temperature operating range for both battery charging and discharging.
23	ISET	Buck Charging current setting pin. Connect a resistor between this pin and analog ground to set the current level.
24	RCOMP	Battery serial resistance compensation pin. Connect a resistor and a cap in parallel between this pin and analog ground to set the amount of serial resistance to be compensated. When short to GA, compensation is disabled.

PIN #	NAME	DESCRIPTION
25	VICHRG	Battery EOC (End of Charge) current threshold pin. This pin sets the current threshold when charging enters into EOC stage. Connect a resistor and a cap in parallel from this pin to Analog Ground.
26	BATT	Battery Voltage sense pin. Connect to the battery positive terminal with a separate sensing wire to avoid voltage drop to achieve accurate battery CV charging
TP	AGND	Analog ground pin and Thermal pad

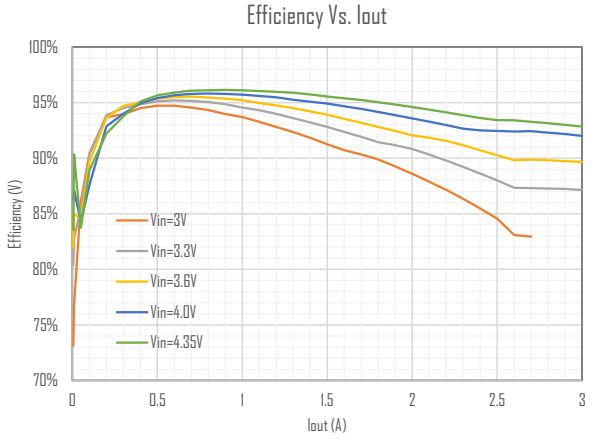
TYPICAL CHARACTERISTICS

(Vin=5V, T_A=25°C, unless otherwise specified)

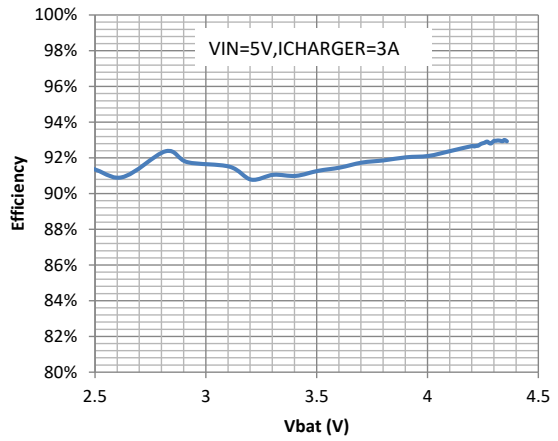
Output current in Boost mode



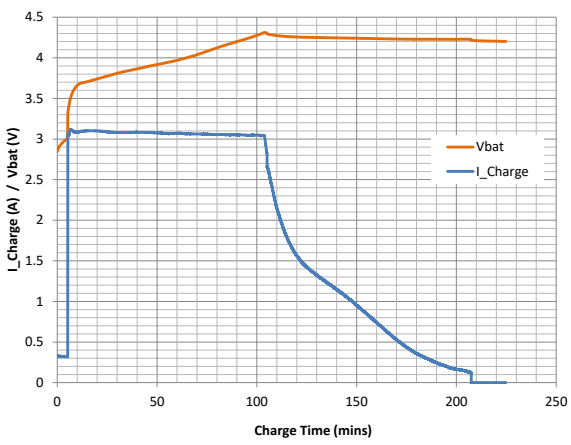
Efficiency in Boost mode



3A Charging Efficiency



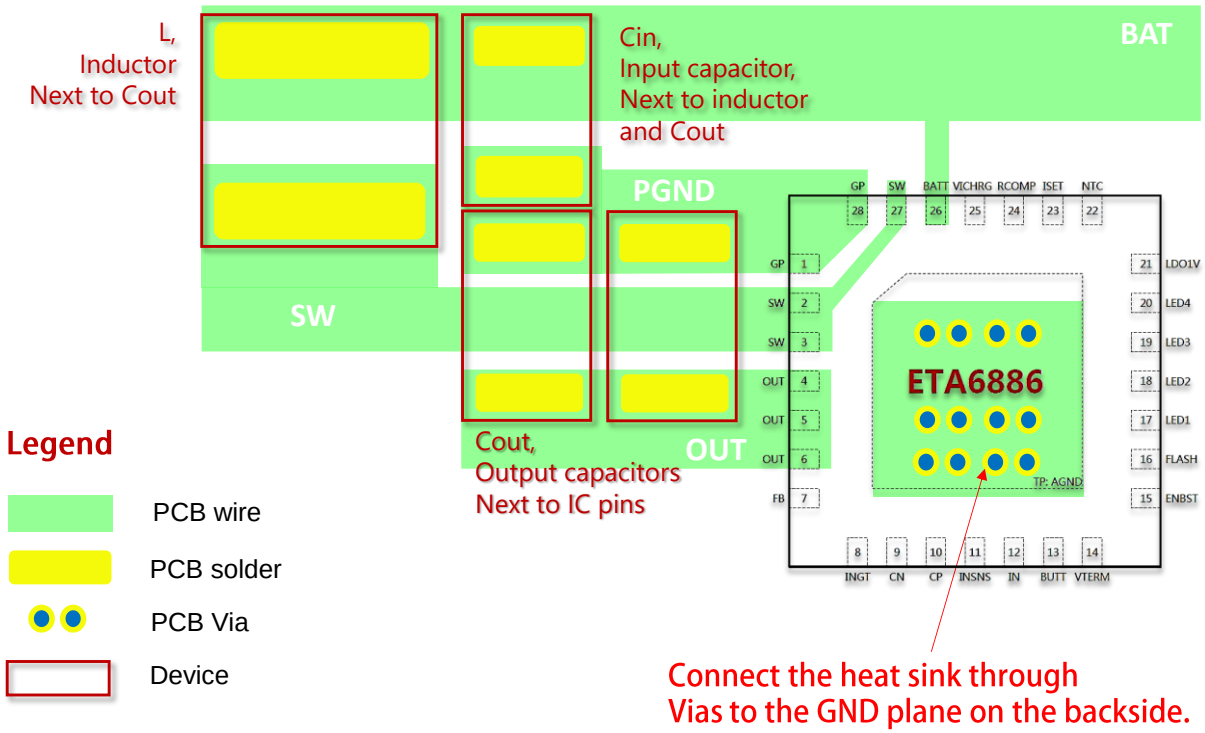
6600mAH Battery Charging Characteristics



Application Support

Please contact local distributor or ETA solutions for detail engineering support.

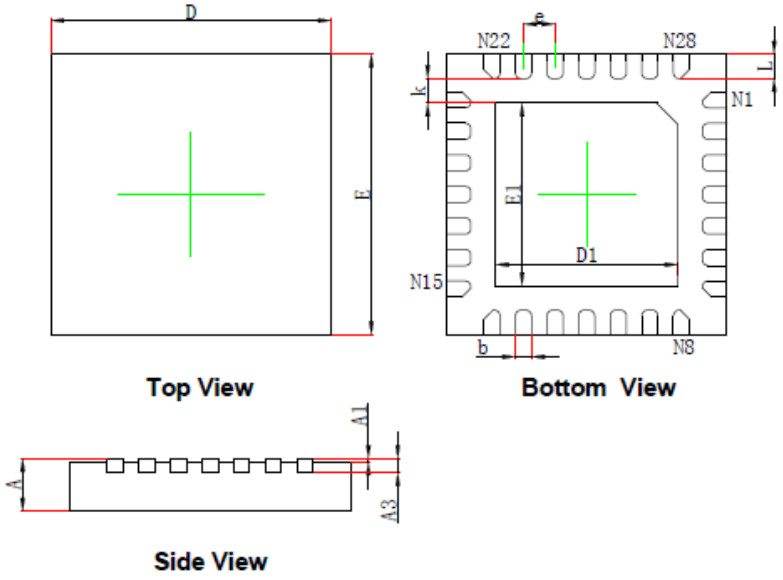
PCB Guidelines



Please try to place the Cout, L, and Cin as suggested by the illustration above. The Cout has to be placed just next to the chip with shortest wire to the OUT and PGND pins. And SW wire goes underneath the Cout and connected by a power inductor just next to the Cout. With the Cin placed beside, a very tight and small power loop is achieved to improve EMI characteristic.

Package Outline

Package: QFN4x4-28



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	3.924	4.076	0.154	0.160
E	3.924	4.076	0.154	0.160
E1	2.500	2.700	0.098	0.106
D1	2.500	2.700	0.098	0.106
k	0.200MIN		0.008MIN	
b	0.180	0.280	0.007	0.011
e	0.450TYP.		0.018TYP.	
L	0.274	0.426	0.011	0.017