Single Inductor, 5A Battery Charger with 3A USB OTG, 0.1us True OVP

DESCRIPTION

ETA6986 is a switching Li-Ion battery charger capable of delivering up to 5A of charging current to the battery and also capable of delivering up to 3A in boost OTG operation. It employs a charge pump to achieve a very fast input OVP, a 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. ETA6986 is truly an ideal solution controlled by MCU 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.

ETA6986 is in a tiny QFN3x3-20 package.

FEATURES

- Bi-Directional Power conversion with Single Inductor
- Input OVP with 0.1us reaction time
- Input standoff voltage up to 20V
- Switching Charger up to 5A
- 5V Synchronous Boost up to 3A
- Up to 95% Efficiency
- NTC thermistor input

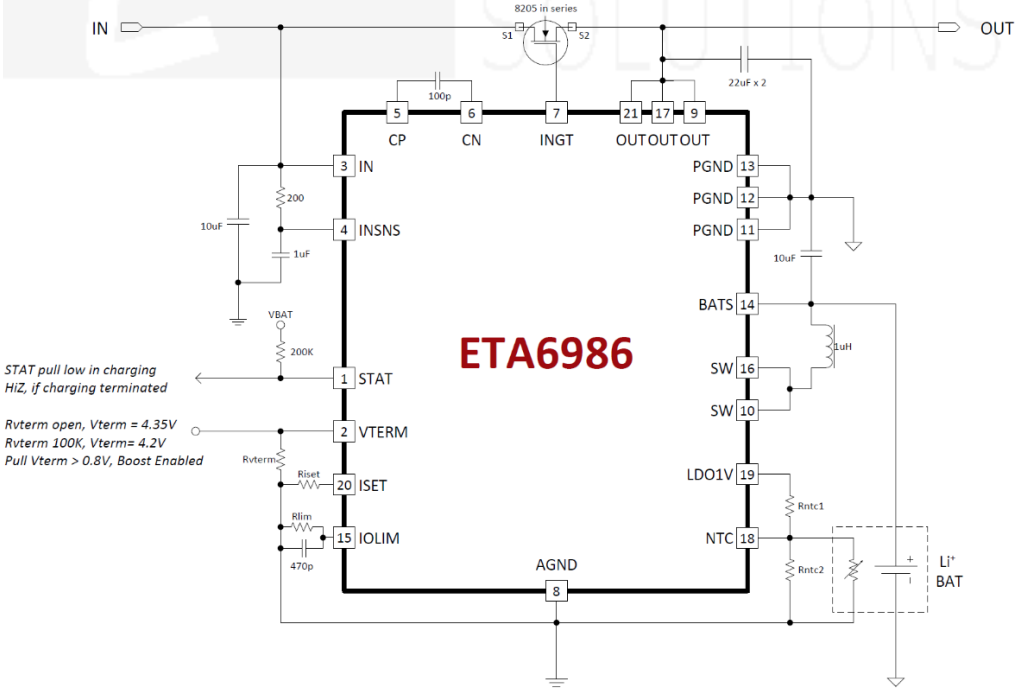
APPLICATIONS

- Power Bank
- Smart Phone / Tablet, MID

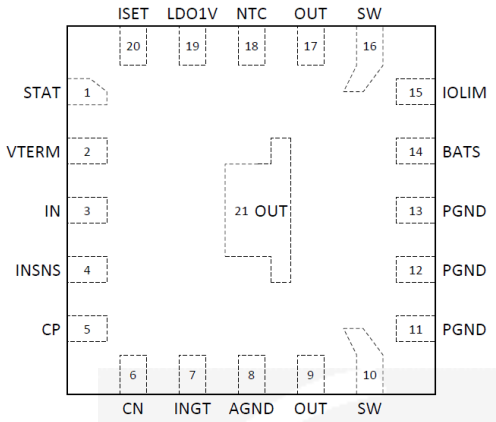
ORDERING INFORMATION

PART	PACKAGE	TOP MARK
ETA6986F3W	QFN3x3-20	ETA6986 YWW2L

TYPICAL APPLICATION



PIN CONFIGURATION



QFN3x3-20

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}	
QFN3X3-20	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	R_{VTERM}=50K, I_{BAT} =0mA, default	4.16	4.2	4.24	V
	R_{VTERM}=open, 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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Pre-Condition Charge Current			200		mA
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			3.5		A
Maximum Duty Cycle			90		%
Highside Pmos Rdson	I_{SW} =500mA		45		mΩ
Lowside Nmos Rdson	I_{SW} =500mA		40		mΩ
Short Circuit Hiccup Current			4		A
Short Circuit Hiccup Timer	On Time		25		ms
	Off Time		750		
ISET,Vhold					
Vhold	Vout start to reduce charging current		4.65		V
ISET Voltage			0.8		V
NTC THERMISTOR MONITOR					
NTC Threshold, Cold	Charger Suspended		52		%ldo1V
NTC Threshold, Hot	Charger Suspended		13		%ldo1V
NTC Threshold Hysteresis			2		%ldo1V
NTC Disable Threshold	Tie NTC to LDO1V				
NTC Input Leakage			0	5	μA
LOGIC INPUT: VTERM for Boost Enabling					
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

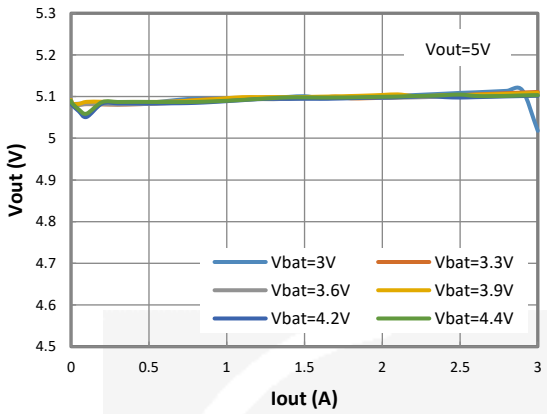
PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	STAT	Charging status pin. Pull low when charge in progress and HiZ when charge finishes.
2	VTERM	Multi-functional pin. In charge mode (Vin is available), pulling VTERM pin below 0.2V sets the chip to have charge terminated at 4.2V and leaving it float (VTERM is set 0.3V internally if left float) sets the chip to have charge terminated at 4.35V. And if Vin is absent, pulling VTERM high will enable the boost mode that the chip works as step-up converter to make output maintaining a 5V voltage.
3	IN	Input OVP sense pins. Bypass with a 10uF capacitor from this pin to ground.
4	INSNS	Input sense pin. Internally clamped to 6.4V. Connect a resistor from INSNS to IN, and 1uF cap to Analog ground.
5	CP	Charging pump Cap's positive terminal
6	CN	Charging pump Cap's negative terminal
7	INGT	A gate driver pin to control the external NMOS power path.
8	AGND	Analog ground pin
9, 17, 21	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.
10, 16	SW	Switching Pin. Connect with an inductor between this pin and BATT.
11, 12, 13	PGND	Power Ground pin
14	BATS	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
15	IOLIM	Output current limit pin. This pin sets the output current limit in Boost mode. Connect a resistor (Rlim) and a cap (470pF) in parallel from this pin to Analog Ground.
18	NTC	Battery Temperature Monitoring input pin. It sets the valid temperature operating range for both battery charging and discharging.
19	LDO1V	1V LDO output pin setting up a voltage reference for NTC resistor network. Bypass with a 22pF capacitor to Analog ground.
20	ISET	Buck Charging current setting pin. Connect a resistor between this pin and analog ground to set the current level.

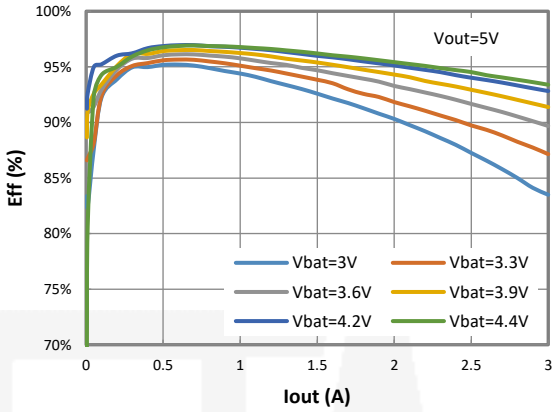
TYPICAL CHARACTERISTICS

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

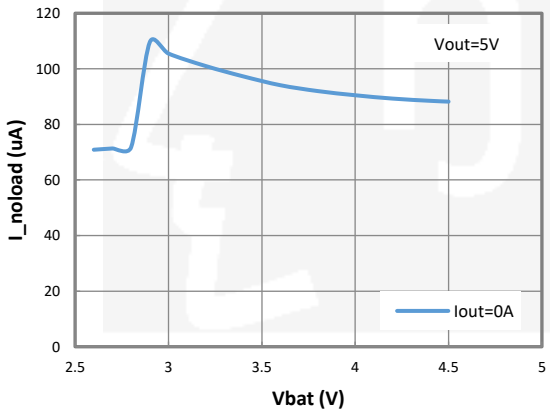
Boost Mode Vout Vs Iout



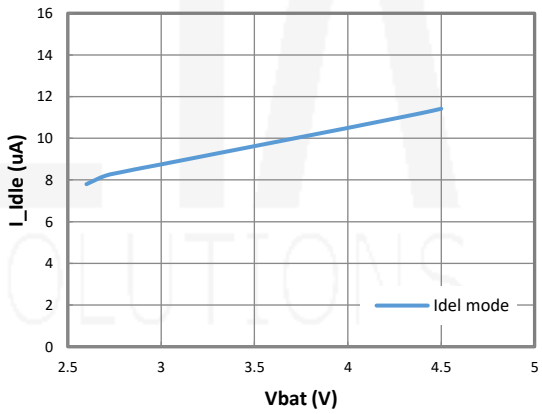
Boost Mode Eff Vs Iout



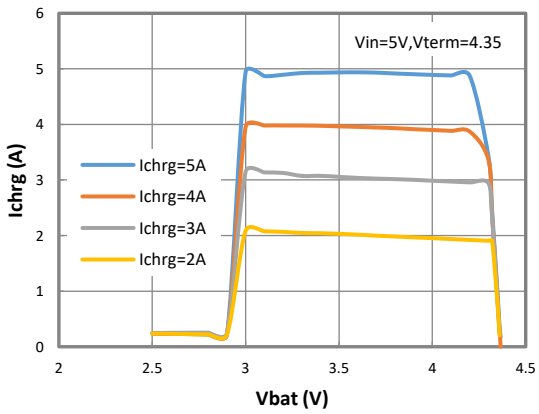
Boost Mode I_noload Vs Vbat



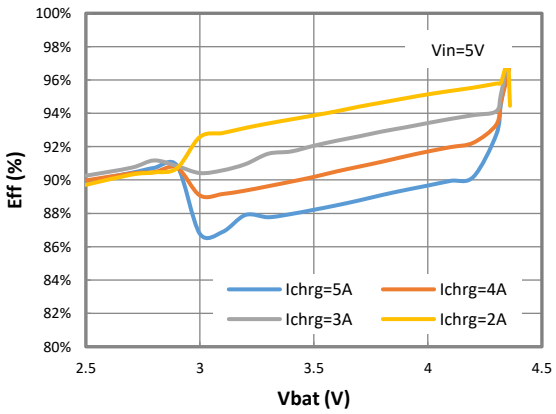
I_Idle Vs Vin



Charge Mode Ichrg Vs Vbat



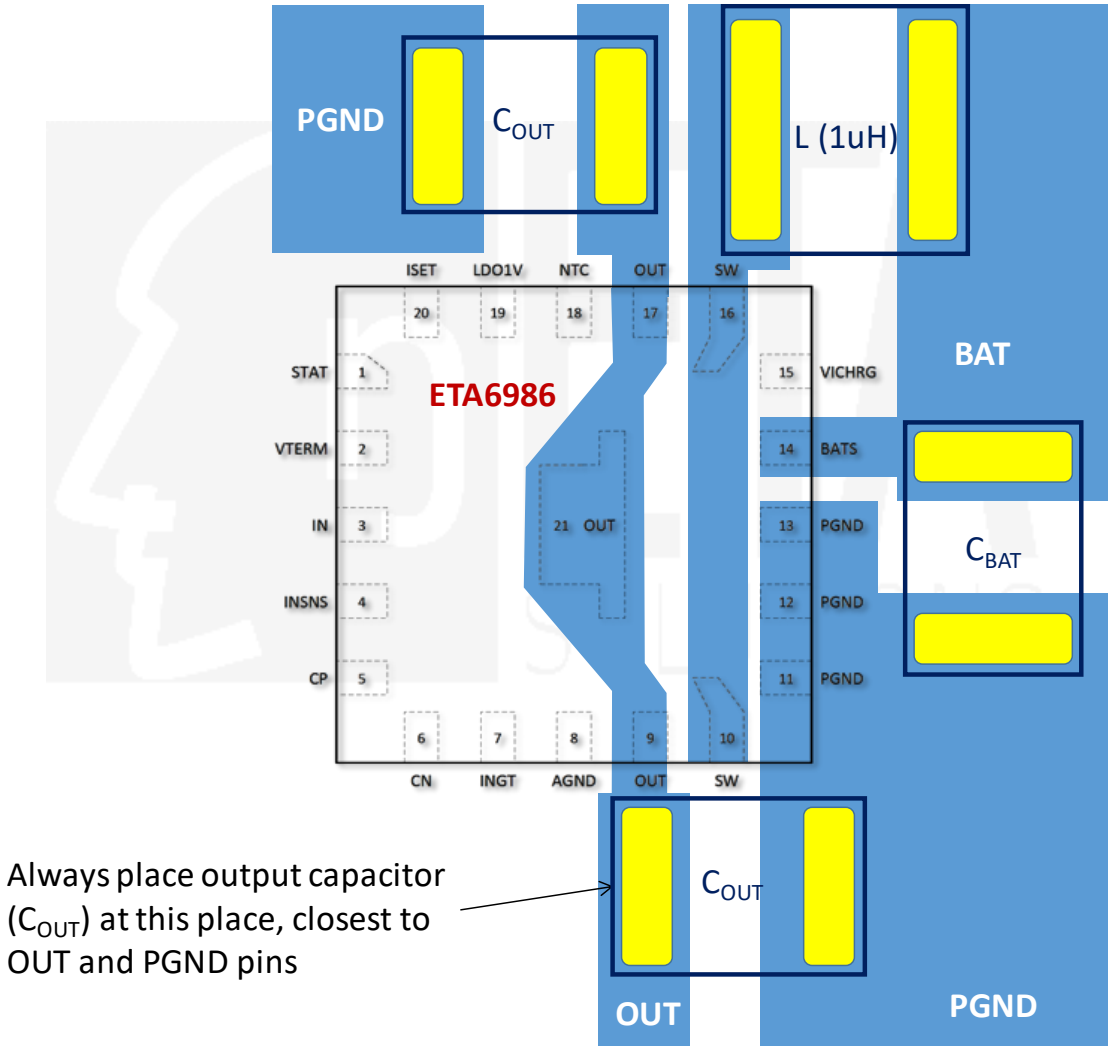
CHRG Mode Eff Vs Vbat



Application Support

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

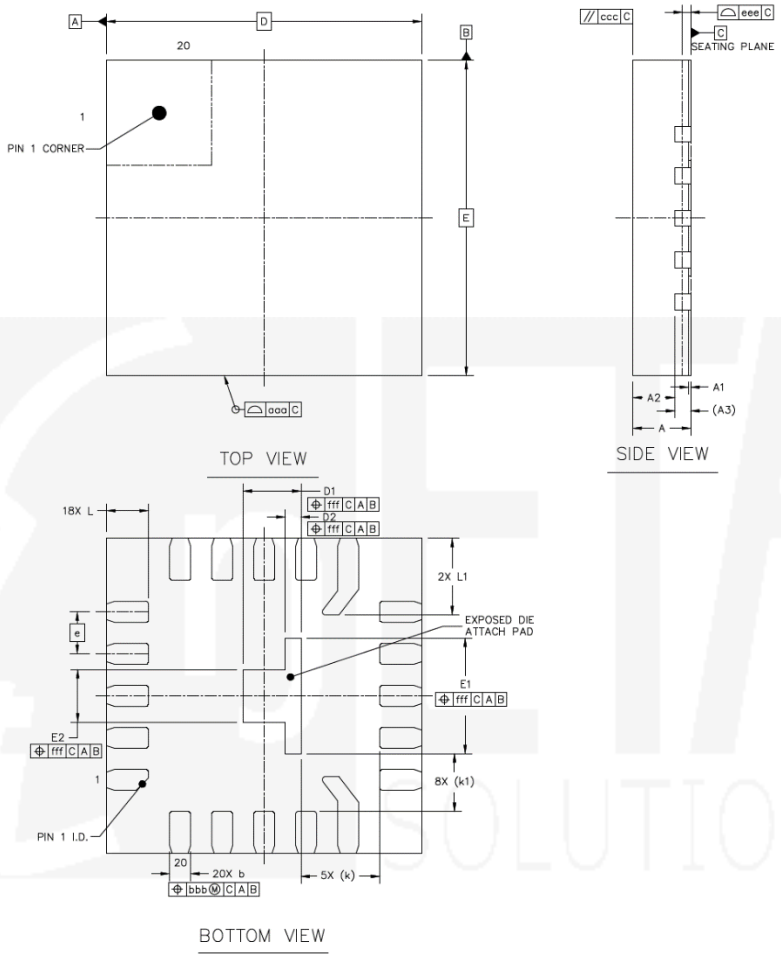
PCB Guidelines



Please try to place the Cout, L, and Cbat 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 chip and connected by a power inductor just next to the Cout. With the Cin placed beside and the shortest SW trace, a very tight and small power loop is achieved, so as to improve EMI characteristics.

Package Outline

Package: QFN3x3-20



		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.5	0.55	0.6
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.4	---
L/F THICKNESS		A3		0.152 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		3 BSC	
	Y	E		3 BSC	
LEAD PITCH		e		0.4 BSC	
EP SIZE	X	D1	0.45	0.55	0.65
		D2	0.05	0.15	0.25
	Y	E1	1	1.1	1.2
		E2	0.4	0.5	0.6
LEAD LENGTH		L	0.3	0.4	0.5
		L1	0.63	0.73	0.83
LEAD TO EXPOSED PAD EDGE		k		0.75 REF	
		k1		0.55 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.08	
LEAD OFFSET		bbb		0.1	