

Single Inductor, 3A Switch Mode Battery Charger with 2.5A USB OTG

DESCRIPTION

ETA6085 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 2.5A in boost OTG operation, with extremely high efficiency in both charging mode and OTG mode. For charging, it uses a proprietary control scheme that eliminates the current sense resistor for conventional constant current control, maximizing efficiency, reducing charging time and reducing costs. It can also output a 5V voltage in the reversed direction by boosting from the battery. It only needs a single inductor to provide power bi-directionally. ETA6085 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.

ETA6085 is suitable for charging a 4.2V Li-ion battery.

ETA6085 is in QFN3x3-20 FC package.

FEATURES

- ◆ Bi-Directional Power conversion with Single Inductor
- ◆ Switching Charger
- ◆ 5V Synchronous Boost
- ◆ Up to 95% Efficiency
- ◆ Up to 3A Max charging current and 2.5A discharging
- ◆ No-Battery detection
- ◆ No External Sense resistor
- ◆ NTC thermistor input

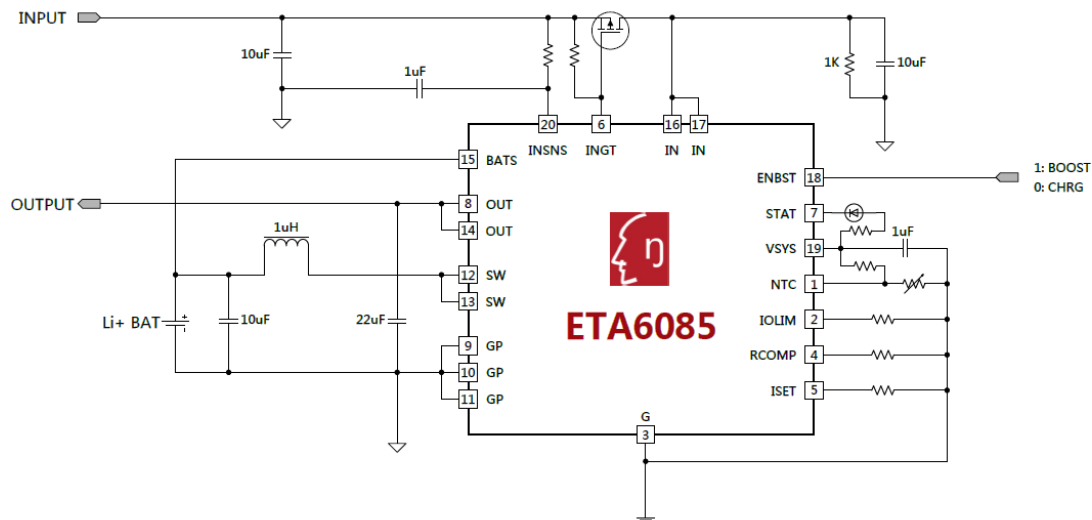
APPLICATIONS

- ◆ Tablet, MID
- ◆ Smart Phone
- ◆ Power Bank

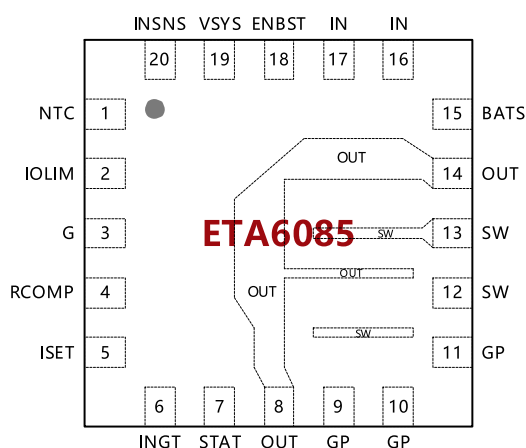
ORDERING INFORMATION

PART	PACKAGE	TOP MARK
ETA6085F3W	QFN3x3-20	ETA6085 YWW2L

TYPICAL APPLICATION



PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS

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

IN,OUT Voltage	-0.3V to 6V
INGT Voltage	-0.3V to 20V
All Other Pin Voltage	$V_{IN} - 0.3V$ to $V_{IN} + 0.3V$
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_{JA}	
QFN3x3-20.....	30.....°C/W
Lead Temperature (Soldering, 10ssec)	260°C
ESD HBM (Human Body Mode)	2KV
ESD MM (Machine Mode)	200V

ELECTRICAL CHARACTERISTICS

($V_{IN} = 5V$, unless otherwise specified. Typical values are at $T_A = 25^\circ C$.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
BUCK MODE					
IN Range		4.5		5.5	V
IN UVLO Voltage	Rising, Hys=500mV		4.5		V
IN to OUT MOSFET $R_{DS(on)}$			40		m Ω
IN to OUT Input current limit	Default		5		A
IN to OUT Hiccup threshold when OUT Short		10			A
INSNS Clamp Voltage			6.4		V
INSNS OVP Voltage	Hys=450mV		6.05		V
INGT Output driving capability	I(INGT)=1mA		0.065	0.2	V
OUT to IN reversed leakage current			10		μA
OUT to IN reversed Voltage threshold			150		mV
IN Quiescent current (Without BUCK)			50		μA
OUT Operating Current as BUCK	Switcher Enable, Switching		5		mA
	Switcher Enable, No Switching		500		μA
BATTERY CHARGER					
Battery CV Voltage	$I_{BAT} = 0mA$, default	4.16	4.2	4.24	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	$R_{ISET} = 62K\Omega$ $I_{charge} = 145700V/R_{ISET}$	2.1	2.35	2.6	A
Charge Termination Current			200		mA
Charge Termination Blanking time			10		S
Pre-Condition Timer			1		hour
Fast-Charge Timer			24		hour
BOOST MODE					
BATT Ok Threshold	Rising, HYS=0.5 V		3.2		V
Output Voltage Range		5.0	5.05	5.1	V
Shutdown Supply Current At BATT			10	15	μ A
Switching Frequency	$V_{IN} < 4.3V$	0.8	1.0	1.2	MHz
Inductor Current Limit	$R_{IOLIM} = 200K$		4		A
Maximum Duty Cycle			90		%
Highside Pmos R _{dson}	$I_{sw} = 500mA$		40		m Ω
Lowside Nmos R _{dson}	$I_{sw} = 500mA$		40		m Ω
Short Circuit Hiccup Current			3.5		A
Short Circuit Hiccup Timer	On Time		5		ms
	Off Time		200		
IDLIM, ISET					
IDLIM Voltage			0.8		V
ISET Voltage			0.8		V
VSYS					
VSYS Voltage	$V_{IN} = 5V$ ($I_{sys} = 10mA$)		3.2		V
	V_{IN} not connected, $V_{BATT} = 3.6V$ ($I_{sys} = 10mA$)		3.54		V
VSYS Max I _{out}	When Short to GND		50	100	mA
			50	100	mA
VSYS Reversed Leakage Current			0	10	μ A
NTC THERMISTOR MONITOR					
NTC Threshold, Cold	Charger Suspended		52		% V_{sys}
NTC Threshold, Hot	Charger Suspended		13		% V_{sys}
NTC Threshold Hysteresis			2		% V_{sys}
NTC Disable Threshold	Tie NTC to VSYS				
NTC Input Leakage			0	5	μ A
LOGIC INPUT ENBST, VTERM					
Logic Input High		1.2			V
Logic Input Low				0.6	V
THERMAL PROTECTION					
Charging Thermal Regulation threshold			85		$^{\circ}$ C

Thermal Shutdown	Rising, Hys=30°C	160	°C
------------------	------------------	-----	----

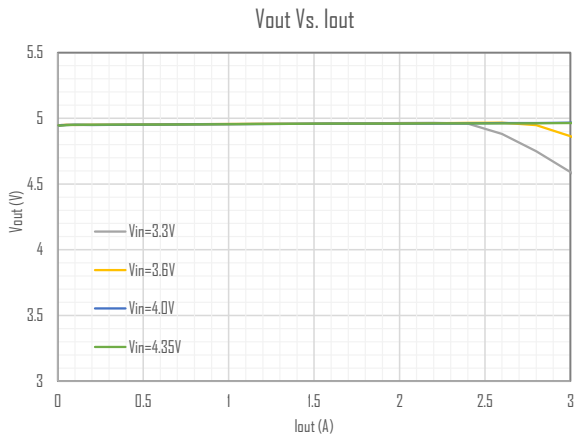
PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	NTC	Battery Temperature Monitoring input pin. It sets the valid temperature operating range for both battery charging and discharging.
2	IDLIM	Boost inductor current limit setting pin. Connect a resistor between this pin and analog ground to set the current level.
3	G	Analog Ground pin.
4	RCOMP	Charge Termination Voltage adjust pin for Battery impedance compensation. Connect a resistor between this pin and analog ground to set the amount of voltage compensation. When floating, adjustment voltage is 0mV.
5	ISET	Buck Charging current setting pin. Connect a resistor between this pin and analog ground to set the current level.
6	INGT	External high voltage OVP MOSFET gate drive pin. This pin can be used to control an external MOSFET for OVP purpose. This pin can sustain Voltage up to 20V.
7	STAT	Charge status indication pin. When in charging, STAT is pulled low. And STAT become high-impedance when charging is completed.
8,14	OUT	USB 5V output during boost and Current limited input pin during charging. This is a power pin, by pass with 2x22uF ceramic caps closed to the pin and PGND.
9,10,11	GP	Power Ground pin
12,13	SW	Switching Pin. Connect with an inductor between this pin and BATT.
15	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
16,17	IN	DC input pins. Bypass with a 22uF capacitor from this pin to ground.
18	ENBST	Manual Force Boost operation pin. This function is enabled when MODE pin is forced high. When ENBST=1, force Boost Operation. When ENBST=0, Boost Operation is disabled.
19	VSYS	System voltage supply pin. It can supply up to 30mA. It gets power from IN when IN is present and from BATT when there is no IN power connected.
20	INSNS	Input sense pin. Internally clamped to 6.4V. Connect a resistor from INSNS to IN, and 1uF cap to Analog ground.

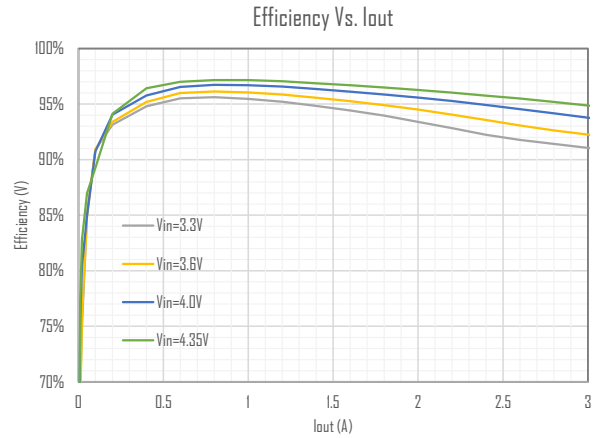
TYPICAL CHARACTERISTICS

($V_{in}=5V$, $T_A=25^{\circ}C$, unless otherwise specified)

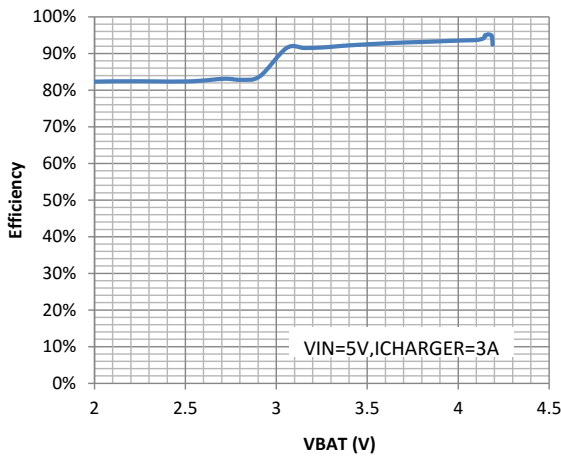
Output current in Boost mode



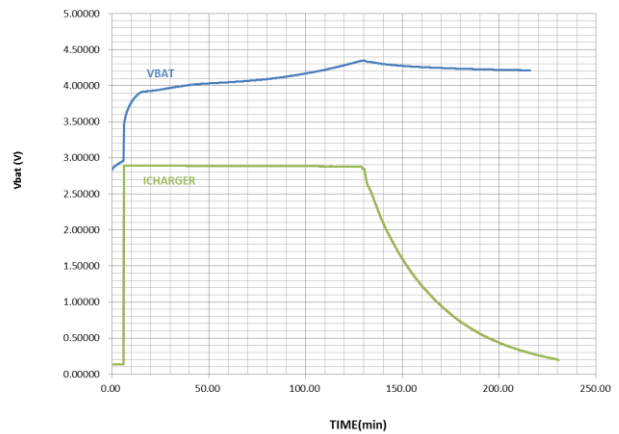
Efficiency in Boost mode



3A Charging Efficiency



8000mAH Battery Charging Characteristics



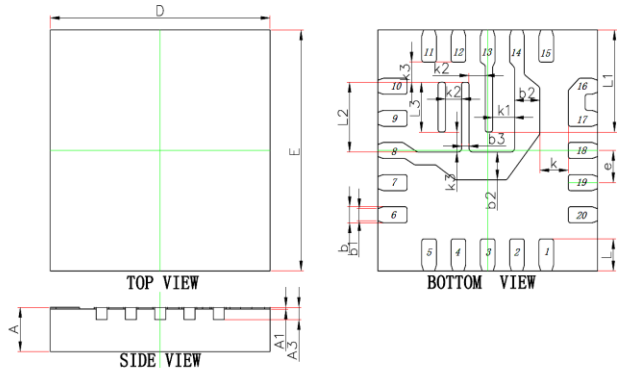
APPLICATION SUPPORT

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

PACKAGE OUTLINE

QFN3x3-20

Note: The backside exposed inner leads or pads of ETA6085 are for internal leadframe connection. Please **DONOT** draw a heat dissipation pad underneath the IC when doing the PCB layout for ETA6085, as the exposed heat dissipation pad on PCB will short the leads of ETA6085. Only connecting leads located at the outer ring is good enough for the best performance of ETA6085. Please contact ETA application engineer in case of any question or confusion.



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.152 REF.		0.006 REF.	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
b	0.150	0.250	0.006	0.010
b1	0.150 REF.		0.006 REF.	
b2	0.295	0.395	0.012	0.016
b3	0.050	0.150	0.002	0.006
e	0.400 BSC.		0.016 BSC.	
L	0.324	0.476	0.013	0.019
L1	1.194	1.346	0.047	0.053
L2	0.794	0.946	0.031	0.037
L3	0.544	0.696	0.021	0.027
k	0.388 REF.		0.015 REF.	
k1	0.300 REF.		0.012 REF.	
k2	0.222 REF.		0.009 REF.	
k3	0.250 REF.		0.010 REF.	

A recommended PCB pad layout is shown below for reference.

