SC8813 High Efficiency, Synchronous, Bi-directional Buck Charger Controller with I2C Interface

1 Description

SC8813 is a synchronous buck charger controller with reverse boost discharging function. It supports very wide input and output voltage range, suitable for applications of 1 to 4-cell Li-ion battery.

In charging mode, it steps down the input voltage and effectively charging the batteries as long as the input voltage is higher than battery voltage. SC8813 supports trickle charging, constant current (CC) charging and constant voltage (CV) charging management functions automatically. In discharging mode (reverse boost mode), SC8813 is able to output a boosted voltage up to 36V effectively.

The SC8813 features I2C interface, so the user can easily set the charging/discharging mode and program the input current limit, output current limit and output voltage through I2C. It also supports DP/DM handshaking, the adapter insert detection function, load insert detection function, small current detection. Meantime, it offers a PMOS gate driver for external power path control, an open drain output for general purpose, and also a 10-bit ADC resource. The user can control all these functions through I2C. All these features help simplify the system design and reduce the BOM.

The SC8813 supports under voltage lockout, over voltage protection, over current protection, short circuit warning and over temperature protections to ensure safety under different abnormal conditions.

SC8813 adopts 32 pin QFN 4x4 package.

2 Features

- Charging management for 1 to 4 battery in series, including trickle charging, CC charging, CV charging and charging termination function
- Reverse boost mode operation
- Wide input voltage range (charging mode): VBAT to 36 V
- Wide reverse output range (boost mode): VBAT to 36 V
- I2C Programmable charge current and voltage
- I2C Programmable discharging output voltage
- I2C Programmable input / output current limit
- High efficient buck/boost operation
- DP/DM fast handshaking for charging port
- Adjustable frequency from 150KHz to 450KHz
- 10-bit ADC resources
- Charging status indication
- Event detections, including automatic adapter insert and automatic load insert detection,
- Power path control
- Under voltage protection, and over current protection
- Short circuit indication and thermal shutdown protection
- QFN-32 package

3 Applications

Power Bank
Li-ion Battery Charger
Fast Charge
Smart USB Sockets

4 Device Information

ORDER NUMBER	PACKAGE	BODY SIZE
SC8813QDER	32 pin QFN	4mm x 4mm x 0.75mm

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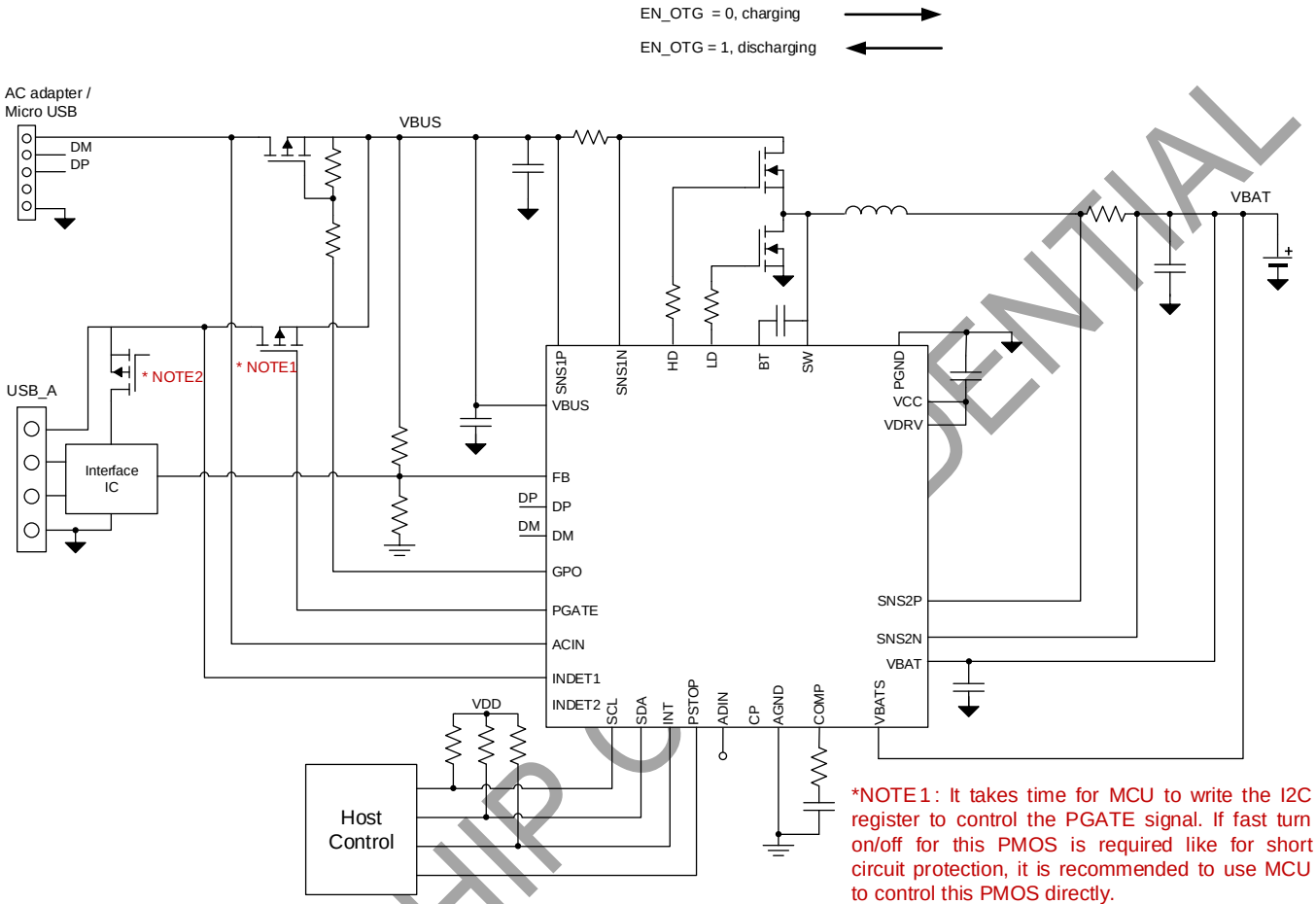
5 Typical Application Circuit



*NOTE 1: It takes time for MCU to write the I2C register to control the PGATE signal. If fast turn on/off for this PMOS is required like for short circuit protection, it is recommended to use MCU to control this PMOS directly.

*NOTE 2: To ensure INDET normal detection, it is recommended that PMOS is used to isolate interface IC from USB-A.

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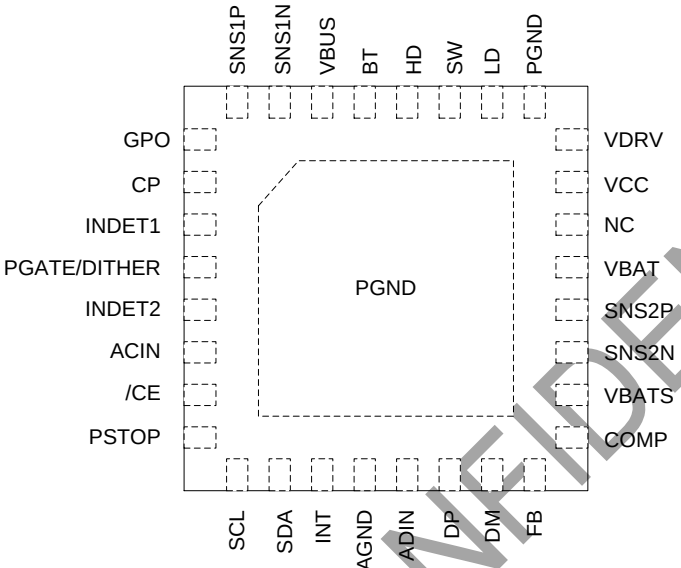
6 Terminal Configuration and Functions

TOP VIEW



TERMINAL		I/O	DESCRIPTION
NUMBER	NAME		
1	GPO	O	Open drain output for general purpose. It is controlled by GPO_CTRL bit. User can use this pin to drive external PMOS with a pull up resistor.
2	CP	O	Driver for external charge pump circuit. **(CHARGE PUMP NOT RECOMMENDED. It is suggested to leave this pin floating, and connect VDRV with VCC. Consult local FAE if charge pump is needed)**
3	INDET1	I	Connect this pin to a USB-A port to detect the load insertion event. When an insertion event is detected, the IC sets INDET1 bit and outputs an INT interrupt pulse to inform MCU.
4	PGATE/DITHER	IO	PMOS gate driver controlled by PGATE bit, used to control the external PMOS on the power path. This pin can be configured through I2C for switching frequency dithering function. Connect a ceramic capacitor (typical 100nF) from this pin to ground when for frequency dither function.
5	INDET2	I	Connect this pin to a USB-A port to detect the load insertion event. When an insertion event is detected, the IC sets INDET2 bit and outputs an INT interrupt pulse to inform MCU.
6	ACIN	I	Connect this pin to AC adapter input node or micro-USB port to detect an AC adapter insertion event. When an insertion event is detected, the IC sets AC_OK bit and outputs an INT interrupt pulse to inform MCU.
7	/CE	I	Chip enable control. Pull this pin to logic low to enable the IC; pull this pin to logic high to disable the IC. This pin is internally pulled low.
8	PSTOP	I	Power stop control. Pull this pin to logic low to enable the power blocks; pull this pin to logic high to disabled the power blocks, and the IC enters into Standby mode. In Standby mode, only the AC adapter and load insert detection functions and the I2C circuits keep working.

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			This pin is internally pulled low.
9	SCL	I	I2C interface clock. Connect SCL to the logic rail through a pull up resistor (typical 10 kΩ). The IC works as a slave, and the I2C address is 0x74H.
10	SDA	I/O	I2C interface data. Connect SDA to the logic rail through a pull up resistor (typical 10 kΩ).
11	INT	O	An open drain output for interrupt signal. The IC sends a logic low pulse at INT pin to inform the host if an interrupt event happens.
12	AGND	I/O	Analog ground. Connect PGND and AGND together at the thermal pad under IC.
13	ADIN	I	ADC input pin. Apply an analog signal (≤ 2.048V) to this pin, the internal 10-bit ADC can convert this analog signal to digital signals, and store the digital values in a register.
14	DP	IO	Positive data line for USB interface. Can be controlled by MCU to implement the handshaking with adapter to realize fast charging.
15	DM	IO	Negative data line for USB interface. Can be controlled by MCU to implement the handshaking with adapter to realize fast charging.
16	FB	I	Feedback node for VBUS voltage. Connect a resistor divider from VBUS to FB to set the VBUS discharging output voltage in external way. The FB reference can also be programmed through I2C.
17	COMP	I	Connect resistor and capacitor at this pin to compensate the control loop.
18	VBATS	I	Sense node for VBAT voltage. Connect to VBAT rail if internal way is selected for VBAT charging termination voltage setting; connect a resistor divider at VBATS if external way is selected.
19	SNS2N	I	Negative input of a current sense amplifier. Connect to one pad of the current sense resistor (typical 10 mΩ) on the power path to sense the current into or out from battery.
20	SNS2P	I	Positive input of a current sense amplifier. Connect to the other pad of the current sense resistor (typical 10 mΩ) on the power path to sense the current into or out from battery.
21	VBAT	I	Power supply to the IC. Connect to the battery positive node. Place a 1 μF capacitor from this pin to PGND as close to the IC as possible.
22	NC		NC pin. Leave this pin floating.
23	VCC	O	Output of an internal 5V linear regulator. Connect a 1 μF capacitor from VCC pin to PGND as close to the IC as possible.
24	VDRV	I	Power supply input for internal driver circuits. One way of getting the power supply is to connect VCC to this pin directly. Another way is to use the CP driver to implement a charge pump between VCC and VDRV pin. **(CHARGE PUMP WAY IS NOT RECOMMENDED. CONSULT LOCAL FAE IF CHARGE PUMP IS USED)**
25	PGND	I/O	Power ground. Connect PGND and AGND together at the PGND thermal pad under IC.
26	LD	O	Gate driver output to the external low side MOSFET.
27	SW	I/O	Switching Node. Connect to the inductor.
28	HD	O	Gate driver output to the external high side MOSFET.
29	BT	I	Connect a 100nF capacitor between BT pin and SW pins to bootstrap a bias voltage for high side MOSFET driver.

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30	VBUS	I	Power supply to the IC. Connect to the VBUS rail. Place a 1 μF capacitor from this pin to PGND as close to the IC as possible.
31	SNS1N	I	Negative input of a current sense amplifier. Connect to one pad of the current sense resistor (typical 10 mΩ) on the power path to sense the current into or out from VBUS.
32	SNS1P	I	Positive input of a current sense amplifier. Connect to one pad of the current sense resistor (typical 10 mΩ) on the power path to sense the current into or out from VBUS.
33	Thermal Pad		PGND thermal pad. Connect PGND and AGND together at the thermal pad under IC.

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