

Introduction

1.1 Overview

The RK818 is a complex power-management integrated circuit (PMIC) for multi-core system applications powered by a Li-ion or a Li-ion polymer battery cell, or by a 5V input either from an USB port or from an adaptor. The RK818 can provide a complete power management solution with very few external components.

The RK818 provides four configurable synchronous step-down converters and one synchronous step-up converter with current capability up to 4A and 2.5A, respectively. The device also contains 9 LDO regulators, one linear switch, one switch-mode charger, a battery fuel gauge, and the power path management function. Power-up/power-down controller is configurable and can support any customized power-up/power-down sequences (OTP based). A real-time clock (RTC) is also integrated to provide a 32-kHz output buffer, and real time function. The RK818 supports 32-kHz clock generation based on a crystal oscillator.

The switch-mode charger, together with the power path controller integrated in the RK818, allows supplying power to the loads while it is charging the battery. The charger provides functions such as input current limiting, trickle current charging, constant current (CC)/constant voltage (CV) charging, charging termination, charging over time protection, etc. All these functions can be conveniently configured through the I2C digital interface. The input current limit can be set to maximum 3A to accommodate a power adaptor as the input supply. When an input current limiting is triggered, the power path controller will distribute the input power in a way that the loads have the higher priority than the battery to take the input power. The difference between the input and output power will be used to charge the battery. In a case that the output power required by the loads exceeds the input power, the power path controller will automatically turn on the battery switch so that the battery can supply extra power to the loads together with the input supply. A "battery fuel gauge" is also integrated in the RK818. Using the proprietary algorithms and the sensed battery current and voltage, the gauge can accurately calculate the battery capacity based on the charging/discharging characteristics of the battery preloaded in the system. The gauge then sends the battery capacity information to the processor through the I2C interface. Other functions that the charger provides includes tiny current charging for an over discharged battery, or so called "dead battery", battery temperature monitoring, safe charging timer and over temperature shut down.

The RK818 can dynamically adjust the output voltage of each DC-DC converter, as required by the processor based on the processor's operation status so as to maximize the system efficiency. The output voltages of most channels can be configured through the I2C interface. The inputs of all channels have soft start function, which greatly reduces the inrush current at the startup. The frequency compensations of all the control loops are implemented internally to eliminate external compensation components.

The 2MHz switching frequency allows small size inductors to be used for both buck and boost converters. Also, as all the power switches are integrated on chip, no external power switches and Schottky diodes are needed, which reduces the system cost significantly.

The RK818 is available in a QFN68 7.0 mm x 7.0 mm package, with a 0.35-mm pin pitch.

1.2 Feature

- Input range: 3.8V - 6V for USB input; 2.7V - 4.5V for BAT input
- Switch mode Li-ion battery charger providing charging current up to 3A.
- Power path controller with 5A current path.
- Accurate battery fuel gauge.
- Real time clock (RTC)
- Low standby current of less than 40uA (at 32KHz clock frequency)
- 2MHz switching frequency for the buck converters
- 1MHz switching frequency for the boost converter
- Fast transient response due to the current mode architecture
- Internal frequency compensation and soft start
- Programmable output voltage and power up/down sequence through I2C interface
- Proprietary circuit architecture achieving high efficiency
- Internal discharge path in off state for BUCs and LDOs
- Power channels:
 - Ch1: Synchronous buck converter, 4A max
 - Ch2: Synchronous buck converter, 4A max
 - Ch3: Synchronous buck converter, 2.5A max
 - Ch4: Synchronous buck converter, 2.5A max
 - Ch5: Synchronous boost converter, 2.5A max
 - Ch6—7, Ch9 and Ch11: LDOs, 150mA max
 - Ch8: Low noise, high PSRR LDO ,100mA max
 - Ch10, 12,14: LDOs, 300mA max
 - Ch13: LDO, 400mA max
 - Ch15: Low $R_{ds(on)}$ switch, 0.15ohm ($V_{gs}=3V$)
 - Ch16: HDMI5V switch, 80mA max
 - Ch17: OTG switch, 800mA max
- Fixed and programmable power up/down sequences
- Package: 7mmx7mm QFN68

1.3 Typical Application Diagrams

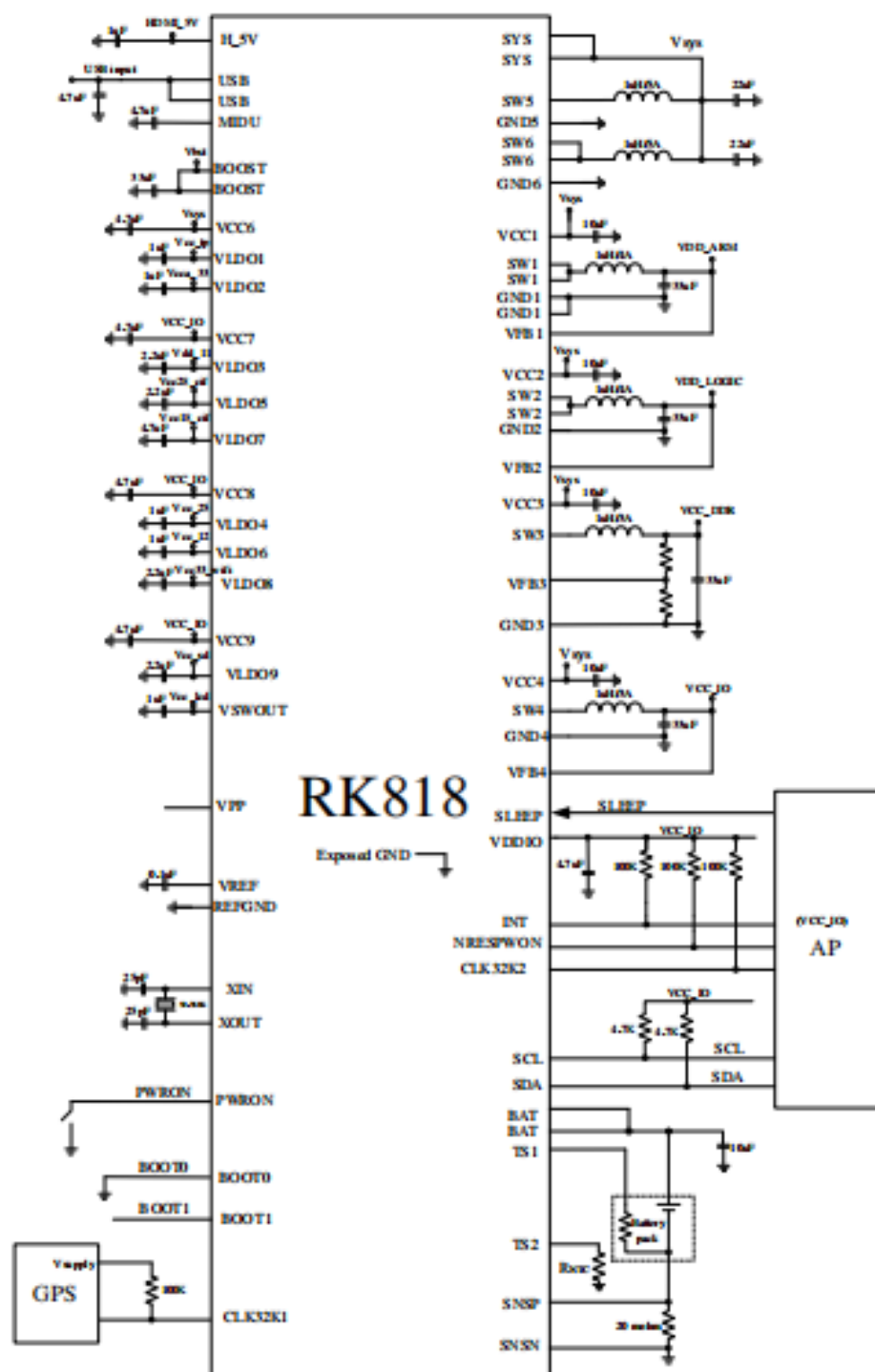


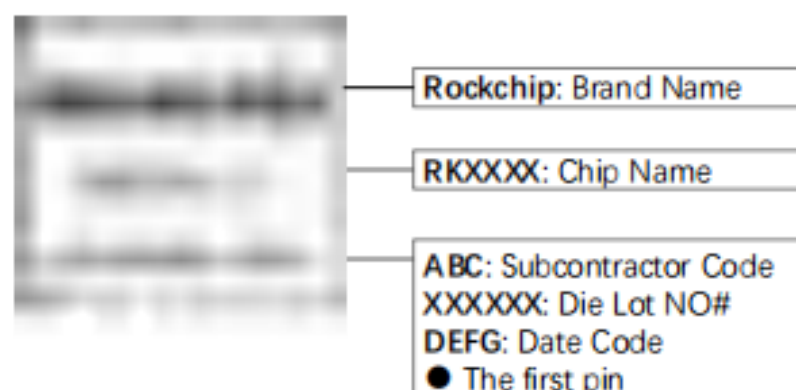
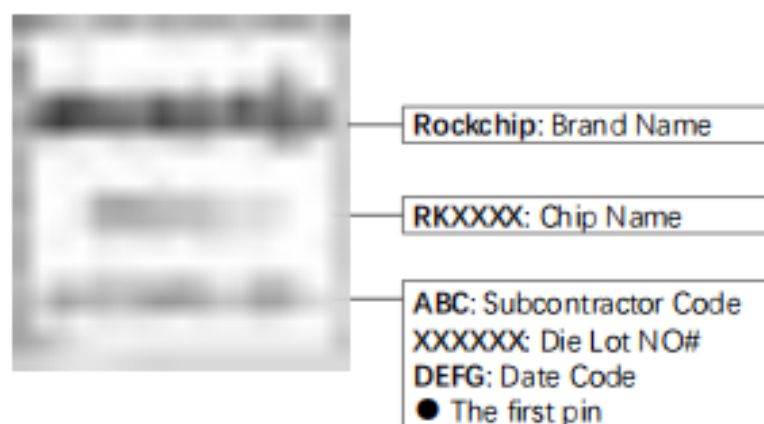
Fig. 1-1 RK818 Typical Application Diagram

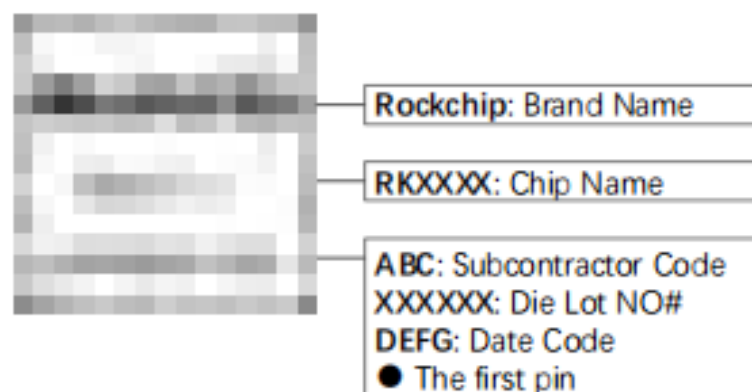
Package information

2.1 Ordering information

Orderable Device	RoHS status	Package	Package Qty	Device special feature
RK818-1	RoHS pass	QFN68(7X7)	2600ea/inner box* 6 inner boxes/outer box	For RK3288/RK3368
RK818-2	RoHS pass	QFN68(7X7)	2600ea/inner box* 6 inner boxes/outer box	For Sofia-3GR
RK818-3	RoHS pass	QFN68(7X7)	2600ea/inner box* 6 inner boxes/outer box	For RK3399

2.2 Top Marking





2.3 Dimension

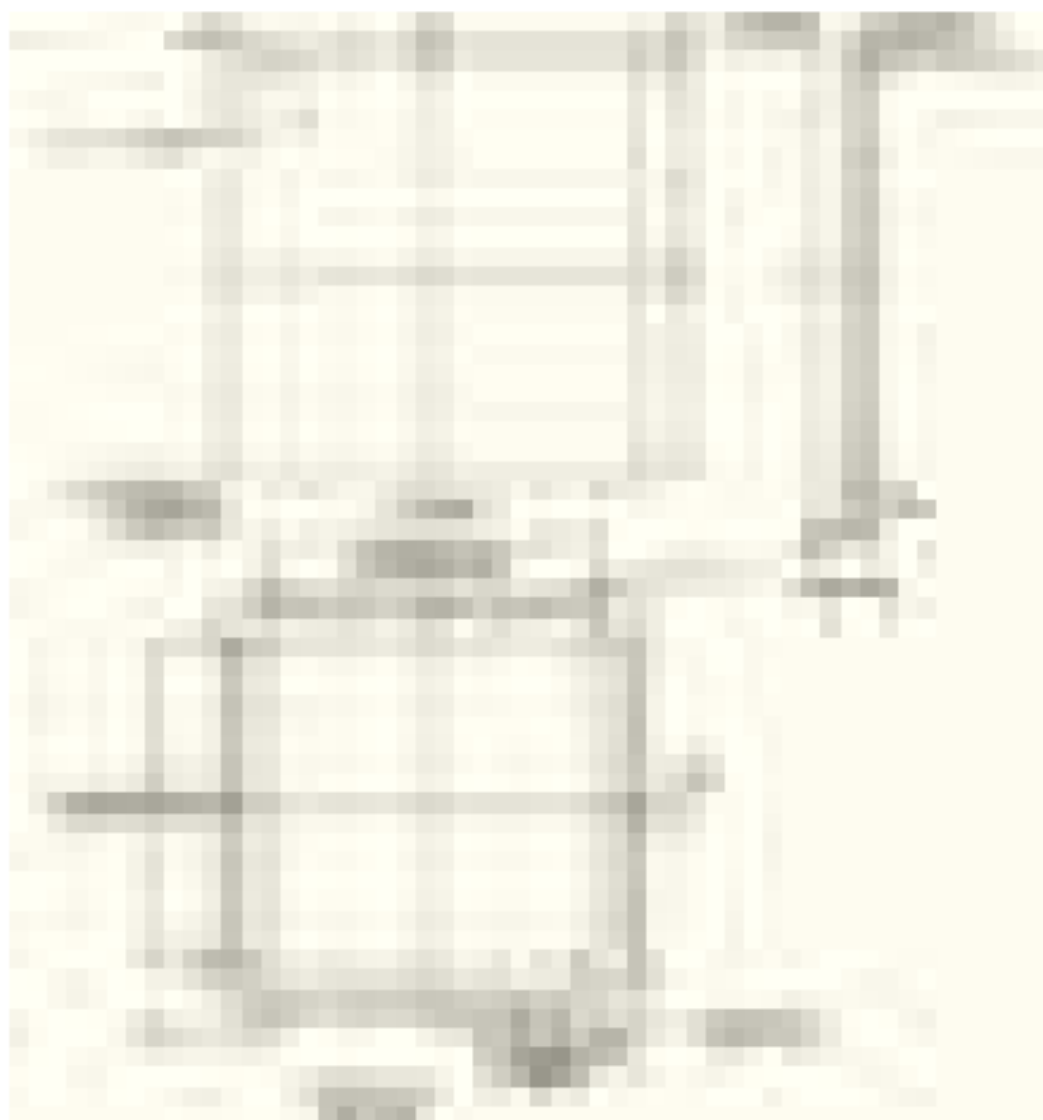


Fig. 2-1 QFN68 7mm X 7mm

DESCRIPTION	SYMBOL	MILLIMETER		
		MIN	NOM	MAX
TOTAL THICKNESS	A	0.70	0.75	0.80

DESCRIPTION	SYMBOL	MILLIMETER		
		MIN	NOM	MAX
STAND OFF	A1	0	0.035	0.05
MOLD THICKNESS	A2	-	0.55	0.57
MATERIAL THICKNESS	A3	-	0.203 _{REF}	-
PACKAGE SIZE	D	-	7 _{BSC}	-
	E	-	7 _{BSC}	-
EP SIZE	D1	5.39	5.49	5.59
	E1	5.39	5.49	5.59
LEAD LENGTH	L	0.30	0.4	0.50
LEAD PITCH	e	0.35 _{BSC}		
LEAD WIDTH	b	0.1	0.15	0.2
LEAD POSITION OFFSET	aaa	0.07		
LEAD COPLANARITY	bbb	0.08		
PACKAGE EDGE PROFILE	ccc	0.10		
MOLD FLATNESS	ddd	0.10		
EP POSITION OFFSET	eee	0.10		
	fff	0.05		

Note:

- Coplanarity applies to leads, corner leads and die attach pad.
- Dimension b applies to metalized terminal and is measured between 0.15mm and 0.30mm from the terminal tip. If the terminal has the optional radius on the other end of the terminal, the dimension b should not be measure in that radius area.

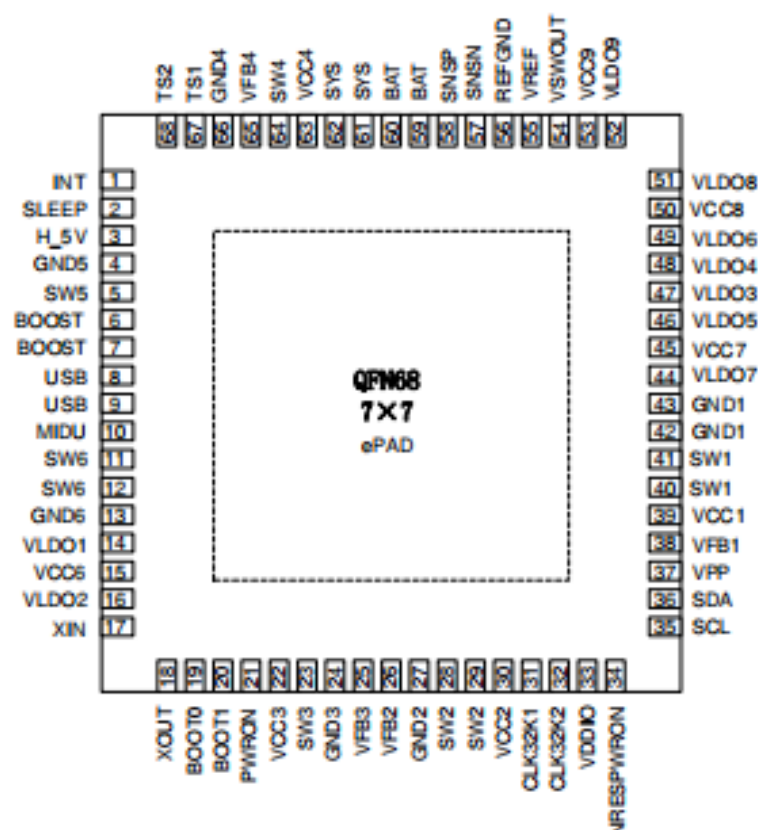
2.4 Pin Assignment

Fig. 2-2 Pin Assignment QFN7x7-68(Pitch=0.35mm)

2.5 Pinout Number Order

Pin No	Pin Name	Pin Description
1	INT	Interrupt request pin. Active low.
2	SLEEP	Input pin for switching state between sleep and non-sleep state.
3	H_5V	5v supply output for HDMI
4	GND5	Power ground
5	SW5	Switch output
6,7	BOOST	BOOST output
8,9	USB	Power input from USB
10	MIDU	Middle point of USB power supply
11,12	SW6	Switch output
13	GND6	Power ground
14	VLDO1	LDO1 output
15	VCC6	Power supply for LDO
16	VLDO2	LDO2 output
17	XIN	32.768KHz crystal oscillator input
18	XOUT	32.768KHz crystal oscillator output
19	BOOT0	Boot sequence selection, low bit
20	BOOT1	Boot sequence selection, high bit
21	PWRON	Power on or power off enable pin, active low, internal 100K pull high to power supply
22	VCC3	Power supply for DCDC3
23	SW3	Switch output of DCDC3
24	GND3	Power ground for DCDC3
25	VFB3	feedback voltage for DCDC3
26	VFB2	DCDC2 output voltage feedback input
27	GND2	Power ground for DCDC2
28,29	SW2	Switch output of DCDC2
30	VCC2	Power supply for DCDC2
31	CLK32K1	32.768K clock1 output, open drain,
32	CLK32K2	32.768K clock2 output, open drain,
33	VDDIO	Power supply for IO
34	NRESPWON	Reset pin after power on, active low
35	SCL	Clock input of I2C
36	SDA	Data input/output of I2C
37	VPP	Power supply for testing, floating in the application
38	VFB1	DCDC1 output voltage feedback input
39	VCC1	Power supply for DCDC1
40,41	SW1	Switch output of DCDC1
42,43	GND1	Power ground for DCDC1
44	VLDO7	LDO7 output
45	VCC7	Power supply for LDO
46	VLDO5	LDO5 output
47	VLDO3	LDO3 output
48	VLDO4	LDO4 output
49	VLDO6	LDO6 output
50	VCC8	Power supply for switch
51	VLDO8	LDO8 output
52	VLDO9	LDO9 output
53	VCC9	Power supply for LDO
54	VSWOUT	Switch output
55	VREF	Internal reference voltage
56	REFGND	Reference ground