Rockchip RK816B Datasheet

Revision 1.5
Oct.2019

Revision History

Date	Revision	Description
2019-10-09	1.5	Update register description
2019-03-05	1.4	Spec update
2018-12-27	1.3	The different with RK816: BUCK DVS.
2017-11-10	1.2	Update RK816-2
2017-5-27	1.1	Update the description
2016-11-04	1.0	Initial release

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Chapter 1 Introduction

1.1 Overview

The RK816B is a complex power management integrated circuit (PMIC) for multi-core system applications powered by Li-ion polymer battery cell, or by a 5V input either form an USB port or form an adapter. The RK816B can provide a complete power management solution with very few external components.

The RK816B provides four configurable synchronous step-down converters, and six LDO regulators. The device also contains a bi-directional charger, the power path management function, and a battery fuel gauge. 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 32KHz output buffer, and real time function. The RK816B supports 32KHz clock generation based on a crystal oscillator.

The switch mode bi-directional charger, together with power path controller integrated in RK816B, allows supplying power form the USB to the loads while it is charging the battery. The charger provides functions such as input current limiting, input voltage limiting, constant temperature charging, trickle current charging, constant current/constant voltage charging, charging termination, dead battery charging, charging over time protection, charging over or under temperature protection, etc. All these functions can be conveniently configured through the I2C digital interface. When the RK816B is powered only by the battery, the bi-directional charger can work on boost mode, it achieves OTG function by supplying power from the battery to the USB.

The charger input current limiting can be set to maximum 2A to accommodate a power adapter as the input supply. When the input current limiting is triggered, the power path controller will distribute the input power in a way that 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 input supply.

A battery fuel gauge is also integrated in the RK816B. Using the proprietary algorithms and the sensed battery current and voltage, the gauge can accurately calculate the battery capacity based on the charging or discharging characteristics of the battery preloaded in the system. The gauge then sends the battery capacity information to the processor through the I2C interface.

The RK816B 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 I2C interface. The inputs of all channels have soft start function, which greatly reduces the inrush current at the start up. 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 buck 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 RK816B is available in a QFN40 5mmx5mm package, with a 0.40mm pin pitch.

1.2 Feature

- Input range: 3.8V ~ 5.5V for USB input； 2.7V~4.5V for BAT input
- Switch mode bi-directional Li-ion battery charger providing charging current up to 2.4A, 2MHz switching frequency for charger and boost
- Power path controller with 4A current path
- Accurate battery fuel gauge
- Real time clock（RTC）
- Low standby current of less than 45uA (at 32KHz clock frequency)
- 2MHz switching frequency for buck converters
- Fast transient response due to the current mode architecture
- Internal frequency compensation and soft start
- Programmable output voltage and power up/power down sequence through I2C interface
- Proprietary circuit architecture achieving high efficiency
- Internal discharge path in off state for bucks and LDOs (configurable through I2C interface)
- Power channels:
  - CH1: Synchronous buck converter, 2A max
  - CH 2: Synchronous buck converter, 2A max
  - CH 3: Synchronous buck converter, 1A max
  - CH 4: Synchronous buck converter, 1A max
  - CH 5: Synchronous boost converter, 0.8A max
  - CH 6, CH7, CH9, CH10, CH11: low drop out voltage regulator, 300mA max
  - CH 8: low noise, high PSRR low drop out voltage regulator, 100mA max
  - CH 12：OTG switch, 0.8A max
- Fixed and programmable power up/power down sequences
- package： 5mm x 5mm QFN40

1.3 Typical Application Diagrams

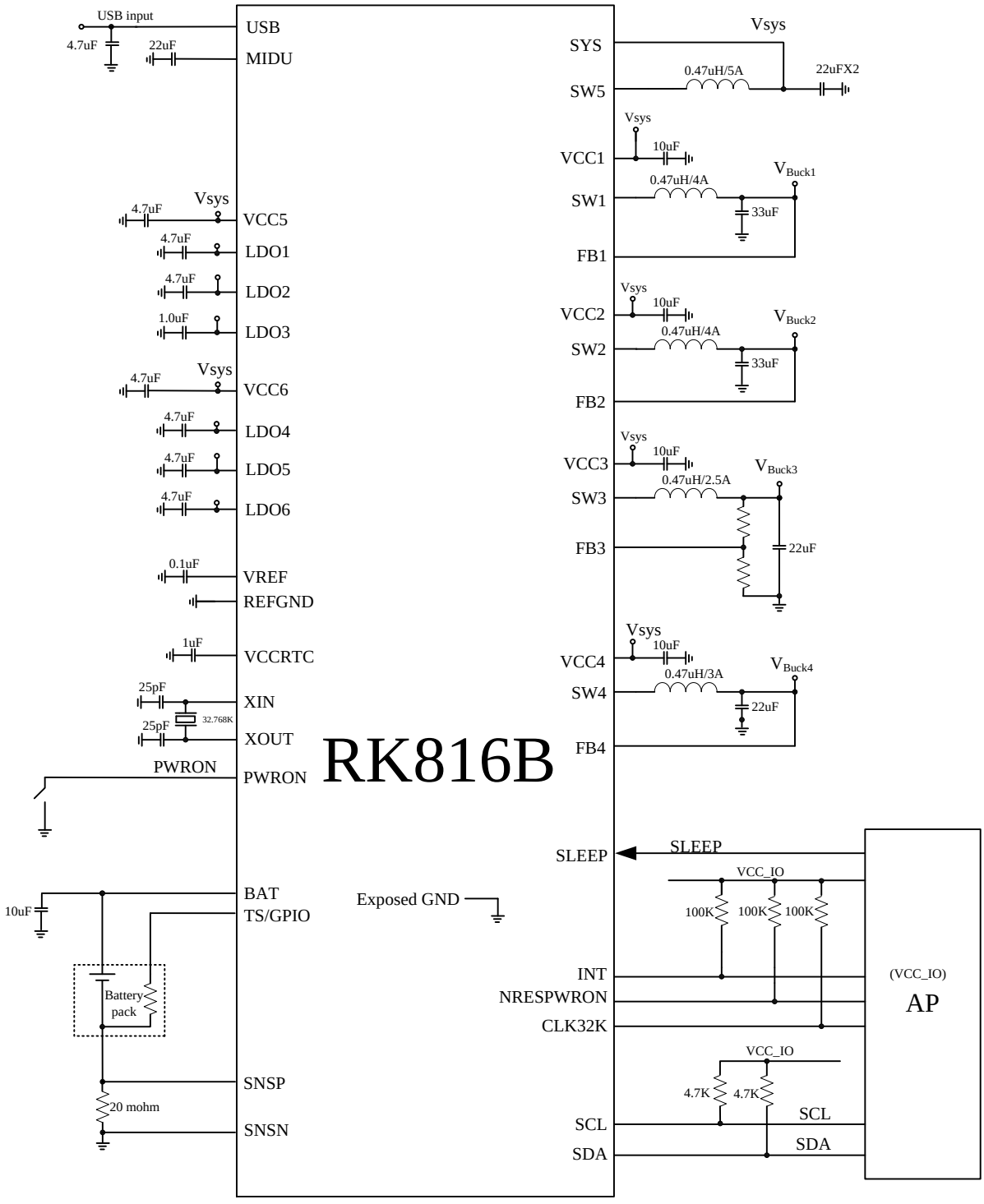


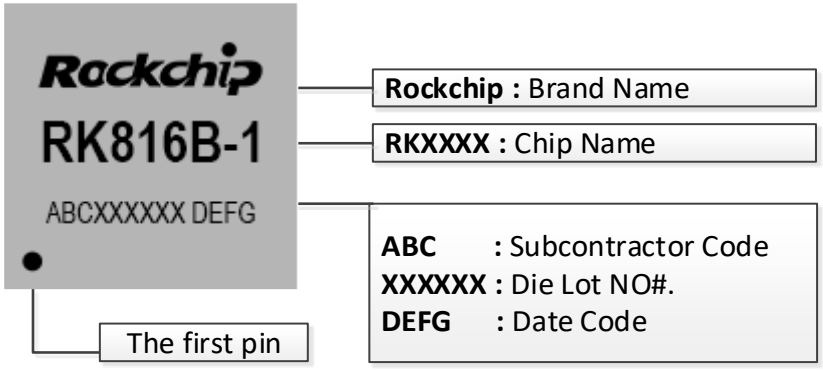
Fig. 1-1 RK816B Typical Application Diagram

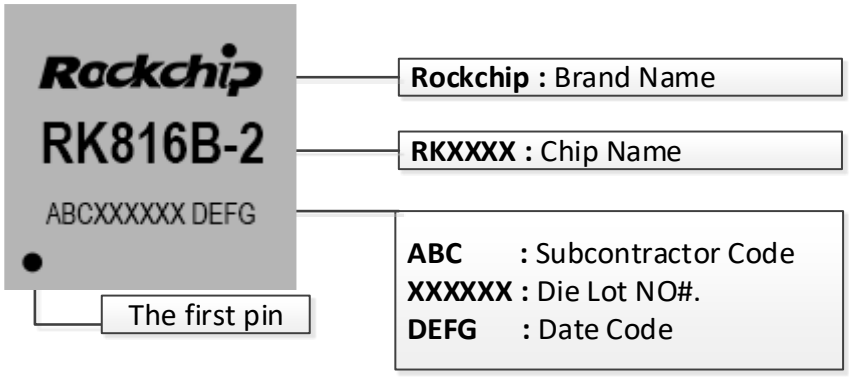
Chapter 2 Package information

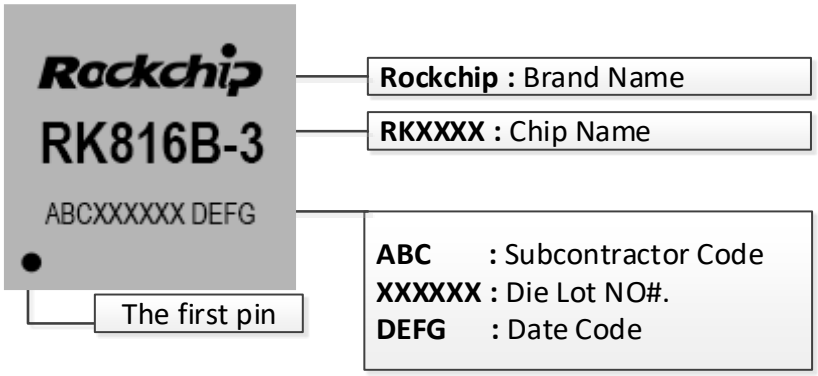
2.1 Ordering information

Orderable Device	RoHS status	Package	Package Qty
RK816B-1	RoHS pass	QFN40(5X5)	2000ea/inner box* 5 inner boxes/outer box
RK816B-2	RoHS pass	QFN40(5X5)	2000ea/inner box* 5 inner boxes/outer box
RK816B-3	RoHS pass	QFN40(5X5)	2000ea/inner box* 5 inner boxes/outer box

2.2 Top Marking







2.3 Dimension

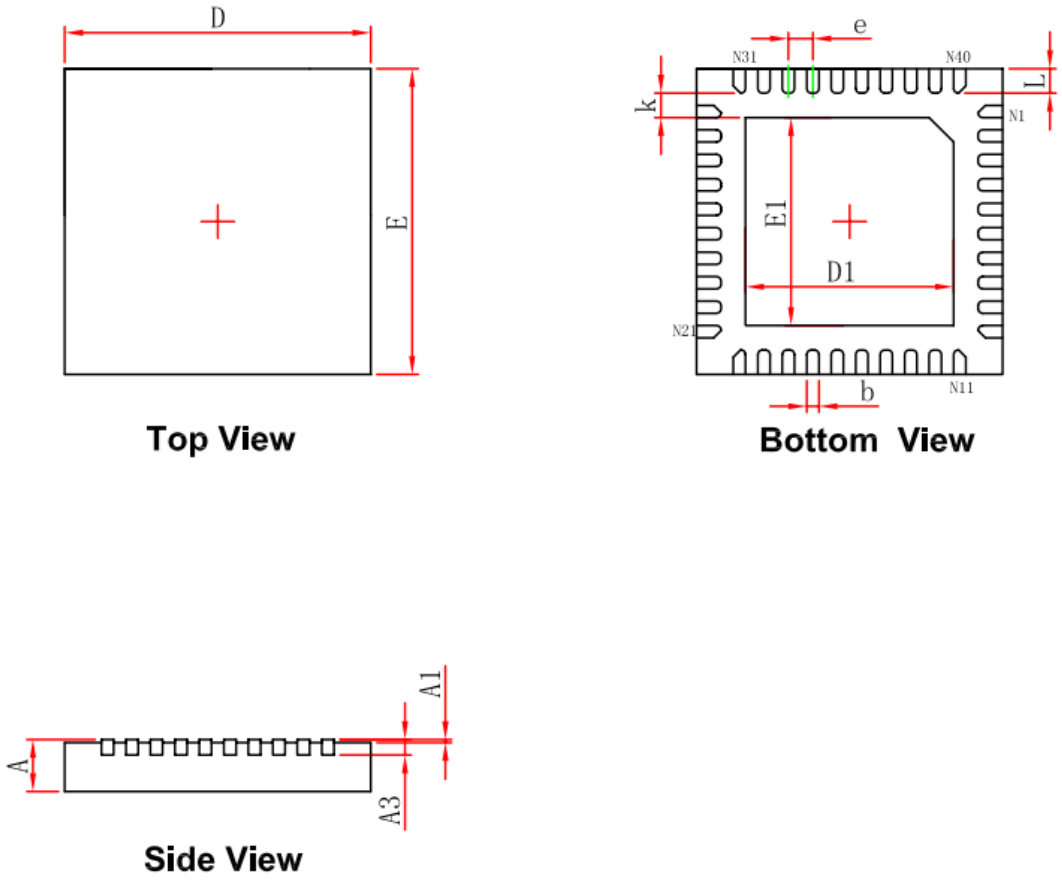


Fig. 2-1 QFN40 5mm X 5mm

DESCRIPTION	SYMBOL	MILLIMETER		
		MIN	NOM	MAX
TOTAL THICKNESS	A	0.70		0.80
STAND OFF	A1	0	0.035	0.05
MATERIAL THICKNESS	A3	-	0.203REF	-

DESCRIPTION	SYMBOL	MILLIMETER		
		MIN	NOM	MAX
PACKAGE SIZE	D	4.924-		5.076-
	E	4.924-		5.076-
EP SIZE	D1	3.300		3.500
	E1	3.300		3.500
LEAD LENGTH	L	0.324		0.476
LEAD PITCH	e	0.400TYP		
LEAD WIDTH	b	0.150		0.250
LEAD TO EXPOSED	k	0.200MIN		

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.*
- *0.15mm of dimension b is recommended in PCB layout.*

2.4 Pin Assignment

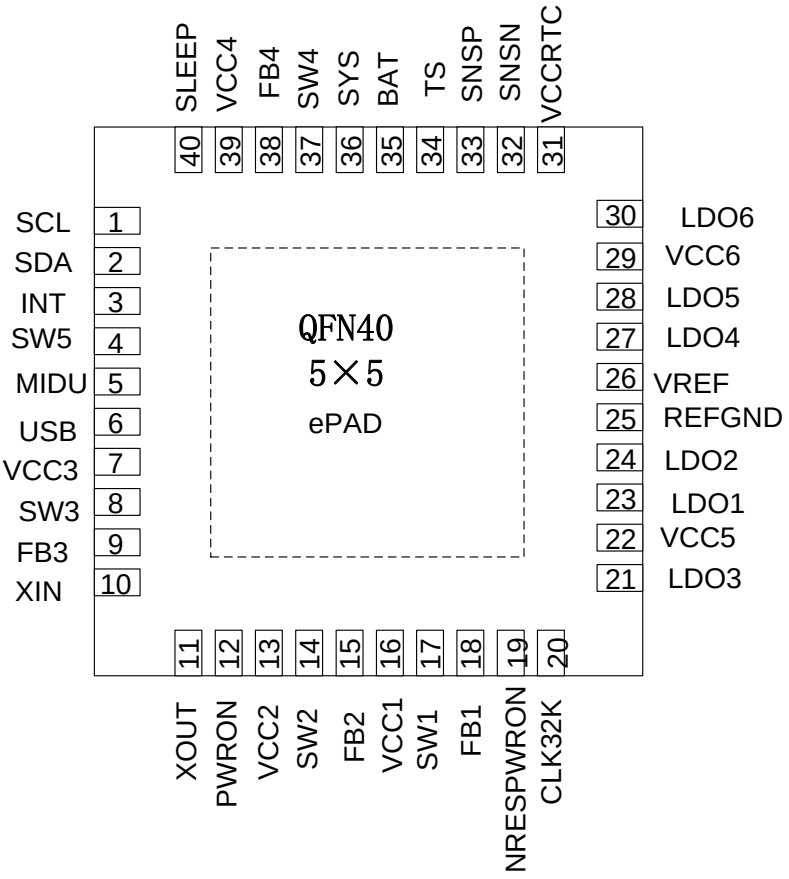


Fig. 2-2 Pin Assignment

2.5 Pinout Number Order

PIN NO	PIN NAME	PIN DESCRIPTION
1	SCL	I2C clock input
2	SDA	I2C data input and output
3	INT	Interrupt request pin.

PIN NO	PIN NAME	PIN DESCRIPTION
4	SW5	Charger switching node / boost switching node
5	MIDU	Middle point of USB power supply / boost output
6	USB	USB power supply
7	VCC3	Power supply of buck3
8	SW3	Switching node of buck3
9	VFB3	Output feedback voltage of buck3
10	XIN	32.768KHz crystal oscillator input
11	XOUT	32.768KHz crystal oscillator output
12	PWRON	Power on or power off enable pin, active low, internal 20k pull high to power supply
13	VCC2	Power supply of buck2
14	SW2	Switching node of buck2
15	VFB2	Output feedback voltage of buck2
16	VCC1	Power supply of buck1
17	SW1	Switching node of buck1
18	VFB1	Output feedback voltage of buck1
19	NRESPWON	Reset pin after power on, active low.
20	CLK32K	32.768KHz clock output, open drain
21	LDO3	LDO3 output
22	VCC5	Power supply of LDO1/2/3
23	LDO1	LDO1 output
24	LDO2	LDO2 output
25	REFGND	Reference ground
26	VREF	Internal reference voltage
27	LDO4	LDO4 output
28	LDO5	LDO5 output
29	VCC6	Power supply of LDO4/5/6
30	LDO6	LDO6 output
31	VCCRTC	Power supply of RTC, decouple it to GND with a 1uF cap
32	SNSN	Battery charging or discharging current sense negative terminal
33	SNSP	Battery charging or discharging current sense postive terminal
34	TS(GPIO1)	Thermistor input. Connect a thermistor from this pin to ground. The thermistor is usually inside the battery pack. (multi-function for GPIO1)
35	BAT	Battery positive terminal
36	SYS	System terminal
37	SW4	Switching node of buck4
38	VFB4	Output feedback voltage of buck4
39	VCC4	Power supply of buck4
40	SLEEP	Sleep mode control input
Exposed pad	Exposed ground	Ground

Chapter 3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Parameter	Min	Max	Units
Voltage range on pins USB，MIDU，SWx	-0.3	**7**	V
Voltage range on pins VCCx, FBx, LDOx, VREF，VCCRTC	-0.3	6.5	V
Voltage range on pin CLK32K, SLEEP	-0.3	6.5	V
Voltage range on pins XIN,XOUT, PWRON	-0.3	$VSYS_{MAX}$+0.3	
Voltage range on pins NRESPWRON, INT, SDA, SCL	-0.3	4	V
Storage temperature range, T_S	-40	150	℃
Operating temperature range, T_J	-40	125	℃
Maximum Soldering Temperature, T_{SOLDER}		300	℃

Note 1. Exposure to the conditions exceeded absolute maximum ratings may cause the permanent damages and affect the reliability and safety of both device and systems using the device. The functional operations cannot be guaranteed beyond specified values in the recommended conditions.

3.2 Recommended Operating Conditions

Parameter	Min	TYP	Max	Units
Voltage range on pins USB	4	5	5.5	V
Voltage range on other pins			5.5	V
Power Dissipation			2.7	W

3.3 DC Characteristics

Test conditions: VUSB =5.0V, TA = 25°C for typical values, unless otherwise noted.

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
USBIN						
USB Operating Range	V_{USB}		4	5	6	V
USB Under Voltage Lockout Threshold		Rising	3.65	3.8	3.95	V
		Falling		3.6		V
USB vs BAT Threshold		Rising		70		mV
		Falling		30		mV
USB Input Current Limit	I_{USB}	Min Current	60	80	100	mA
		Default（OTP）	400	450	500	mA
		Max current		2		A
Maximum USB and BAT Power on Reset Threshold (Rising)	V_{PORH}				2.2	V
Maximum USB and BAT Power on Reset Threshold (Falling)	V_{PORL}		1.2			V
Over Voltage Lock Out Threshold (USB Rising)	$V_{TH(OVLO)}$		5.7	6.0	6.3	V
Over Voltage Lock Out Hysteresis	$V_{HYS(OVLO)}$			0.2		V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
High-Side PMOS Peak Current Limit		0.5A step, Default=3.5A	2		3.5	A
USB Input Quiescent Current	$I_{USBquiet}$	Charger Enable mode			10	mA
CHARGER						
Terminal Battery Voltage	V_{BAT}	$V_{BAT}>V_{RECH}$, $I_{CHG} \le I_{BF}$ Programmable by REG A3<6:4>		4.05		V
				4.1		V
				4.15		V
				4.2		V
				4.25		V
				4.3		V
				4.35		V
	accuracy		-0.5		0.5	%
Recharge Threshold at V_{BAT}	V_{RECH}			V_{BAT} - 0.15		V
Recharge Hysteresis				75		mV
Trickle Charge Threshold	$V_{TRICKLE}$		2.85	3.0	3.15	V
Trickle Charge Hysteresis				200		mV
Trickle Charge Current	$I_{TRICKLE}$			10%		I_{CC}
Dead bat Charge Threshold	V_{DEAD}		1.8	2	2.2	V
Dead bat Charge Hysteresis				200		mV
Dead bat Charge Current	I_{DEAD}			70		mA
Termination Charger Current	I_{BF}	50mA Step, default=200mA	150		300	mA
BAT Leakage Current	I_{BATT}	V_{BAT}=4.2V, SYS float, USB float		20	30	uA
Charge current	I_{CC}	0.2A step, default=1.6A	1		2.4	A
Trickle Charge Time		30 minutes step, default=60 minutes	30		210	Min
Total Charge Time		2 hours step, default=6 hours	4		16	Hour
A/D CONVERTER						
Resolution				12		bits
Input voltage range		Battery voltage	2.5		4.84	V
		USB voltage	3.8		6.16	V
		Current channel	-64		64	mV
		TS	0		2.2	V
Supply current	Active			0.6		mA
SYS INPUT						
SYS Regulation Voltage	V_{SYS}	Auto setting		3.6		V
				4.4		V
BAT to SYS Resistance		I_{SYS}=200mA , V_{BAT}=4.2V		80		mΩ
BAT to SYS Current Limit	I_{BATLIM}	0.5A step, default=3.5A	2		4	A

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
		SYS short		200		mA
BAT to SYS Current Limit accuracy			-10		10	%
SYS voltage range	$V_{SYSINPUT}$		2.7		5.45	V
SYS low alarm voltage, if 3.3V (2.8V~3.5V programmable, step=100mV)	V_{BLO}		3.25	3.3	3.35	V
SYS under voltage threshold(2.7V~3.4V programmable, step=100mV)	V_{BUVL}			2.7		V
SYS under voltage threshold (vin rising)	V_{BUVH}		2.8	2.9	3.0	V
SYS OK voltage threshold （3.3V~3.6V OTP programmable，step=100mV）	V_{BOK}			3.4		V
Stand-by current, V_{DD}=3.6V, device OFF state 32KHz clock running	$I_{Q(STNBY)}$			45		uA
THERMAL PROTECTION						
Thermal Limit Temperature		10 °C step, default=85 °C	85		115	°C
Thermal Shutdown		20 °C step, default=140 °C	140		160	°C
OSCILLATOR						
Switching Frequency CH1,2,3,4(Tj=25℃)	f_{SW}		1.88	2.08	2.28	MHz
LOGIC INPUT						
Input LOW-Level Voltage	V_{IL}				0.4	V
Input HIGH-Level Voltage	V_{IH}		1.1			V
LOGIC OUTPUT						
LOW-Level Output Voltage, 3.0 mA sink current	V_{OL}				1.1	V
HIGH-Level Output Voltage, 3.0 mA source current	V_{OH}		0.4			V
CH1: BUCK1						
Input supply voltage range	V_{INPUT1}		2.7		5.5	V
Voltage Adjustable Range, 6bit	V_{FB1}	0.7125~1.45V(Step=12.5mV)/1.8/2.0/2.2/2.3V	0.7125		2.300	V
Output voltage transition rate （programmable）		BUCK1_RATE=00		3		mV/us
		BUCK1_RATE=01		6		
		BUCK1_RATE=10		12.5		
		BUCK1_RATE=11		25		
Output over voltage lockout (Vout rising)	V_{OV1}			117		%
Preset Voltage, Default(Tj=25℃)	$V_{FB1(Default)}$		1.078	1.100	1.122	V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Preset Voltage, Default(-10℃≦T_j≦+85℃)	$V_{FB1(Default)}$		1.067	1.100	1.133	V
Load Regulation, I_{OUT1} = 200mA to 2A				0.1		%/A
Line Regulation, VCC1 = 3 to 5.5V, I_{OUT1} = 2A				0.1		%/V
Rated output current	I_{MAX1}	Reg2EH<7:6>=<11>		2		A
Switch Current Limit	I_{CL1}	0.5A step, default=3A	2.5		4	A
Operating Quiescent Current, No load, V_{DD}=3.8V（Low Power mode）	I_{Q1}			40		uA
Minimum Switch Current Limit	I_{CLMIN1}	50mA step, default=250mA	150		460	mA
Minimum ON Time	$T_{on1(min)}$			45		ns
Soft-start Time	t_{SS1}	Step=400us, default=400us		400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS1}			250		ohm
CH2：BUCK2						
Input supply voltage range	V_{INPUT2}		2.7		5.5	V
Voltage Adjustable Range, 6bit	V_{FB2}	0.7125~1.45V(Step=12.5mV)/1.8/2.0/2.2/2.3V	0.7125		2.300	V
Output voltage transition rate		BUCK2_RATE=00		3		mV/us
		BUCK2_RATE=01		6		
		BUCK2_RATE=10		12.5		
		BUCK2_RATE=11		25		
Output over voltage lockout (Vout rising)	V_{OV2}			117		%
Preset Voltage, Default(Tj=25℃)	$V_{FB2(Default)}$		1.078	1.100	1.122	V
Preset Voltage, Default(-10℃≦T_j≦+85℃)	$V_{FB2(Default)}$		1.067	1.100	1.133	V
Load Regulation, I_{OUT2} = 200 mA to 2A				0.1		%/A
Line Regulation, VCC2 = 3 to 5.5V, I_{OUT2} = 2A				0.1		%/V
Rated output current	I_{MAX2}	Reg32H<7:6>=<11>		2		A
Switch Current Limit	I_{CL2}	0.5A step, default=3A	2.5		4	A
Operating Quiescent Current, No load, V_{DD}=3.8V（Low Power mode）	I_{Q2}			40		uA
Minimum Switch Current Limit	I_{CLMIN2}	50mA step, default=250mA	150		460	mA
Minimum ON Time	$T_{on2(min}$			45		ns

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
	)					
Soft-start Time	t_{SS2}	Step=400us, default=400us		400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS2}			250		ohm
CH3：BUCK3						
Input supply voltage range	V_{INPUT3}		2.7		5.5	V
Feedback Voltage, Default(Tj=25℃)	$V_{FB3(Default)}$		0.784	0.80	0.816	V
Feedback Voltage, Default(-10℃≦T_j≦+85℃)	$V_{FB3(Default)}$		0.776	0.80	0.824	V
Output over voltage lockout (Vout rising)	V_{OV3}			117		%
Load Regulation, I_{OUT3} = 100mA to 1.0A				0.1		%/A
Line Regulation, VCC3 = 3 to 5.5V, I_{OUT3} = 1A				0.1		%/V
Rated output current	I_{MAX3}	Reg36H<4:3>=<11>		1.0		A
Switch Current Limit	I_{CL3}	0.5A step, default=2A	1.5		3.0	A
Operating Quiescent Current, No load, V_{DD}=3.8V（Low Power mode）	I_{Q3}			40		uA
Minimum Switch Current Limit	I_{CLMIN3}	50mA step, default=150mA	50		400	mA
Minimum ON Time	$T_{on3(min)}$			45		ns
Soft-start Time	t_{SS3}	Step=400us, default=400us		400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS3}			250		ohm
CH4：BUCK4						
Input supply voltage range	V_{INPUT4}		2.7		5.5	V
Voltage Adjustable Range, 4bit	V_{FB4}	Step=100mV	0.8		3.5	V
Feedback Voltage, Default(Tj=25℃)	$V_{FB4(Default)}$		3.234	3.30	3.366	V
Feedback Voltage, Default(-10℃≦T_j≦+85℃)	$V_{FB4(Default)}$		3.201	3.30	3.399	V
Output over voltage lockout (Vout rising)	V_{OV4}			117		%
Load Regulation, I_{OUT4} = 100mA to 1A				0.1		%/A
Line Regulation, VCC4 = 3 to 5.5V, I_{OUT4} = 1A				0.1		%/V
Rated output current	I_{MAX4}	Reg37H<4:3>=<11>		1		A
Switch Current Limit	I_{CL4}	0.5A step, default=2A	1.5		3	A
Operating Quiescent Current, No load,	I_{Q4}			40		uA

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
V_{DD}=3.8V（Low Power mode）						
Minimum Switch Current Limit	I_{CLMIN4}	50mA step, default=150mA	50		400	mA
Minimum ON Time	$T_{on4(min)}$			45		ns
Soft-start Time	t_{SS4}	Step=400us, default=400us		400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS4}			250		Ohm
CH5：BOOST						
Input supply voltage range	V_{INPUT5}		2.7		4.4	V
Output Voltage	V_{FB5}	Step=0.1V,default=5V	4.7		5.4	V
Voltage, Default(Tj=25℃)	$V_{FB5(Default)}$		4.90	5.0	5.10	V
Voltage, Default(-10℃≦T_j≦+85℃)	$V_{FB5(Default)}$		4.75	5.0	5.25	V
Load Regulation, I_{OUT5} = 100mA to 2A				0.2		%/A
Line Regulation, Vin = 3 to 4.2V, I_{OUT5} = 1A				0.1		%/V
Rated output current	I_{MAX5}	Reg2B<4:3>=10		0.8		A
Switch Current Limit	I_{CL5}	default=3A	3			A
Minimum ON Time	$T_{on5(min)}$			70		ns
Soft-start Time	t_{SS5}			400		us
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q5}			250		uA
Auto switch load current between PWM and PFM	$I_{PWM/PFM5}$			50		mA
CH6：LDO1						
Input supply voltage range	V_{INPUT6}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mV)	V_{OUT6}		0.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT6(Default)}$		0.98	1.00	1.02	V
V_{OUT} Output Voltage, Default(Tj= -10~85℃)	$V_{OUT6(Default)}$		0.97	1.00	1.03	V
V_{OUT} Load Regulation, I_{OUT} = 1mA to 300mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN6} = 3 to 5V, I_{OUT6} = 0.3A				0.03		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT6}=1V)	PSRR6			50		dB
Output noise (10Hz to 100kHz, V_{OUT6}=1V)	OUT_{NOISE6}			300		uVrms
Dropout voltage @ 300mA (V_{OUT6}=3.4V)	V_{DROP6}			200		mV
Rated output current	I_{MAX6}			300		mA

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Operating Quiescent Current, No load, V_{CC5}=3.8V（Low Power mode）	I_{Q6}			10		uA
Current Limit, VOUT6 = V_{OUT6}x 0.95	I_{CL6}		350	500		mA
Soft-start Time	t_{SS6}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS6}			400		ohm
CH7：LDO2						
Input supply voltage range	V_{INPUT7}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mV)	V_{OUT7}		0.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT7(Default)}$		1.764	1.800	1.836	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT7(Default)}$		1.746	1.800	1.854	V
V_{OUT} Load Regulation, I_{OUT} = 1mA to 300mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN7}= 3 to 5V, I_{OUT7} = 0.3A				0.03		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT7}=1.8V)	PSRR7			50		dB
Output noise (10Hz to 100kHz, V_{OUT7}=1.8V)	OUT_{NOISE7}			300		uVrms
Dropout voltage @ 300mA (V_{OUT7}=3.4V)	V_{DROP7}			200		mV
Operating Quiescent Current, No load, V_{CC5}=3.8V（Low Power mode）	I_{Q7}			10		uA
Rated output current	I_{MAX7}			300		mA
Current Limit, VOUT7 = V_{OUT7}x 0.95	I_{CL7}		350	500		mA
Soft-start Time	t_{SS7}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS7}			400		Ohm
CH8：LDO3						
Input supply voltage range	V_{INPUT7}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mV)	V_{OUT8}		0.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT8(Default)}$		1.078	1.100	1.122	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	V_{OUT8} (Default)		1.067	1.100	1.133	V
V_{OUT} Load Regulation, I_{OUT} = 1mA to 100mA				0.006		%/mA
V_{OUT} Line Regulation, V_{IN8} = 3 to 5V, I_{OUT8} = 0.1A				0.015		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT8}=1.1V)	PSRR8			70		dB

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Output noise (10Hz to 100kHz, V_{OUT8}=1.1V)	OUT_{NOISE8}			30		uVrms
Dropout voltage @ 100mA (V_{OUT8}=3.4V)	V_{DROP8}			200		mV
Rated output current	I_{MAX8}			100		mA
Operating Quiescent Current, No load, V_{CC5}=3.8V（Low Power mode）	I_{Q8}			30		uA
Current Limit, VOUT8 = V_{OUT8}x 0.95	I_{CL8}		150	200		mA
Soft-start Time	t_{SS8}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS8}			400		Ohm
CH9：LDO4						
Input supply voltage range	V_{INPUT9}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mV)	V_{OUT9}		0.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT9(Default)}$		0.98	1.00	1.02	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT9(Default)}$		0.97	1.00	1.03	V
V_{OUT} Load Regulation, I_{OUT} = 1mA to 300mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN9} = 3 to 5V, I_{OUT9} = 0.3A				0.03		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT9}=1V)	PSRR9			50		dB
Output noise (10Hz to 100kHz, V_{OUT9}=1V)	OUT_{NOISE9}			300		uVrms
Dropout voltage @ 300mA (V_{OUT9}=3.4V)	V_{DROP9}			200		mV
Operating Quiescent Current, No load, V_{CC6}=3.8V（Low Power mode）	I_{Q9}			10		uA
Rated output current	I_{MAX9}			300		mA
Current Limit, VOUT9 = V_{OUT9}x 0.95	I_{CL9}		350	500		mA
Soft-start Time	t_{SS9}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS9}			400		Ohm
CH10：LDO5						
Input supply voltage range	$V_{INPUT10}$		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mv)	V_{OUT10}		0.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT10(Default)}$		2.94	3.00	3.06	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT10(Default)}$		3.91	3.00	3.09	V
V_{OUT} Load Regulation, I_{OUT}				0.003		%/m

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
= 1mA to 300mA						A
V_{OUT} Line Regulation, V_{IN10} = 3 to 5V, I_{OUT10} = 0.3A				0.01		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT10}=3.0V)	PSRR10			50		dB
Output noise (10Hz to 100kHz, V_{OUT10}=3.0V)	$OUT_{NOISE10}$			300		uVrms
Dropout voltage @ 300mA (V_{OUT10}=3.4V)	V_{DROP10}			200		mV
Operating Quiescent Current, No load, V_{CC6}=3.8V（Low Power mode）	I_{Q10}			10		uA
Rated output current	I_{MAX10}			300		mA
Current Limit, VOUT10 = V_{OUT10}x 0.95	I_{CL10}		350	500		mA
Soft-start Time	t_{SS10}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS10}			400		Ohm
CH11：LDO6						
Input supply voltage range	$V_{INPUT11}$		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mv)	V_{OUT11}		0.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT11(Default)}$		2.94	3.00	3.06	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT11(Default)}$		3.91	3.00	3.09	V
V_{OUT} Load Regulation, I_{OUT} = 1mA to 300mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN11} = 3 to 5V, I_{OUT11} = 0.3A				0.015		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT11}=3.0V)	PSRR11			50		dB
Output noise (10Hz to 100kHz, V_{OUT11}=3.0V)	$OUT_{NOISE11}$			300		uVrms
Dropout voltage @ 300mA (V_{OUT11}=3.4V)	V_{DROP11}			200		mV
Operating Quiescent Current, No load, V_{CC6}=3.8V（Low Power mode）	I_{Q11}			10		uA
Rated output current	I_{MAX11}			300		mA
Current Limit, VOUT11 = V_{OUT11}x 0.95	I_{CL11}		350	500		mA
Soft-start Time	t_{SS11}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS11}			400		Ohm
CH12：OTG Switch						
Input supply voltage range	$V_{INPUT12}$		4.7		5.4	V
output current limit	I_{CL12}	default=0.875A	0.875		**2**	A
RTC						
RTC Operating Voltage	V_{IN}		2.5		5.5	V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Range						
CLK32K jitter (open drain) (always on)				100		ns
CLK32K duty cycle			40		60	%
Crystal Recommended						
Nominal frequency	f_{XTAL}			32.768		KHz
Load Capacitance	C1,C2		18	22	28	pF
Crystal Output Capacitance	Cp			0.8	3	pF
Equivalent Series Resistance	Rs			65	75	kΩ
Crystal Max Drive Level Spec	DL				1	uW
I2C INTERFACE (7 bits slave address is: 0011010)						
SCL clock frequency	f_{SCL}				1	MHz

Chapter 4 Function Description

4.1 Function overview

4.1.1 POWER UP/POWER DOWN

The RK816B can be powered by either a battery, or an external power supply through the USB port. When the PMIC is powered by battery only, pressing the PWRON key powers up the PMIC. All the power channels start up at the default output voltages with a press power up sequence, which has 2mS intervals between the channels. When the power up process is done, the NRESPWRON turns to high logic level to inform the processor that all the power rails are up and stable. And now the processor can communicate with the PMIC to re-configure the output voltage of each power channel if needed.

To power down the PMIC, the processor needs to issue a "power down" signal through the I2C interface. Upon receiving the power down signal, the PMIC first saves all the information on the existing states, and then switches the NRESPWRON to low logic level. At this point, the power channels start to be turned off one after another with the power done sequence. If for any reason the processor fails to issue the power down signal, the PMIC can be powered off by "pressing and holding" the PWRON key.

In a case where a battery is the sole power supply and the PMIC is in off state, when an external power supply is plugged into the USB, the PMIC will first check to see if this is a valid power supply. If the power supply from USB is valid, then the power channels are turned on and the battery is charged.

4.1.2 BI-DIRECTIONAL CHARGER

The RK816B has integrated a switch mode bi-directional charger, which provides the functions such as input current limiting, input voltage limiting, constant temperature charging, trickle current charging, constant current/constant voltage charging, charging termination, dead battery charging, charging over time protection, charging over or under temperature protection, etc. All these functions can be conveniently configured through the I2C digital interface.

The input average current limit function allows as large as possible a charging current to be used without having to worry about the input current exceeding the maximum current allowed by the USB port. The input current limits can be configured through I2C interface. For example, when an USB port is used as the input, the input current limit can be configured to either 450mA, or 820mA, to meet the requirements of USB2.0 and USB3.0 respectively.

The charger also has a timer function which sets the maximum charging time for trickle, constant current and constant voltage charging, respectively. If the charging does not complete when a preset maximum charging time is reached, the charging is terminated.

The battery temperature can be monitored through the TS pin. A battery typically has a thermistor inside. The RK816B sources a constant current into the thermistor and senses the voltage across the thermistor through an internal ADC. A safe charging temperature range is preset in the PMIC. The charging can proceed normally if the battery temperature falls within the preset range. If, however, the battery temperature goes either above the upper limit or below the lower limit of the preset range, the charging will pause until the battery temperature goes back in the preset range. If the value of the available thermistor is either too large or too small, a normal resistor can be connected in series or in parallel with the thermistor so that the sensed voltage fits the ADC's input range.

During Charging, Vsys will be set to 3.6V when the battery voltage is below 3.6V. This design is to guarantee that when an external power supply is plugged into the USB port to charge the battery while the battery voltage is low, the Vsys is already at 3.6V, which allows the PMIC to start up quickly without having to wait for the Vsys ramping up.

4.1.3 BOOST AND OTG

When the RK816B is powered only by the battery, the bi-directional charger can work on boost mode, it achieve OTG function by supplying power from the battery to the USB. The synchronous boost converter has 0.8A current capability and is used to power the OTG. The OTG has a built-in current limiting switch, which can effectively protect the boost converter from being damaged if a short circuit occurs at the OTG port.

As the USB input port and the OTG output port share a same pin, when the USB port is being used as a power supply and charging the battery, the OTG switch is forbidden to be turned on. Only when there is no external power supply plugged into the USB port, can the OTG be turned on and serve as a power supply.

The key parameters such as output voltage, and output current limit can be configured through the I2C interface.

4.1.4 POWER PATH MANAGEMENT

A power path management function is integrated in the RK816B, which together with the accurate input current limit function, can provide intelligent power path control. In a power path control process, the PMIC gives the outputs, or the system loads, the highest priority of using the input power. The battery is getting charged only if the input power is greater than the output power required by the system loads. The intelligent power path control function automatically reduces the charging current when the output power required by the loads increases. In an extreme case where the required output power is greater than the input power, the charging current will be cut off and the battery will join the input power supply to provide power to the load. This is how the intelligent power path control works: As the system power loading increases, the PMIC will draw more input current from the power supply to meet the output power requirement while keep the charging current unchanged. If the system power loading continues to increase to the point where the input current limit is reached, then the PMIC will lower the charging current so that enough power still goes to the load. If the system power loading further increases and due to the input current limit, the input power can't meet the output power requirement, then the battery will start to discharge to supply power to the load together with the USB power supply. If for some reason the USB is unplugged, the battery will automatically switched in to take over the USB power supply and provide full power to the load. The wide power path loop bandwidth allows all the above mentioned power path switching transient to be quick and seamless and therefore no overshoot and notch occur at the system and output voltages.

To minimize the loss from the voltage drop along the current path when the battery is charged or discharged, an 80mΩ MOSFET is integrated in the RK816B to serve as a control switch as well as the power switch of the switching mode battery charger.

4.1.5 BATTERY FUEL GAUGE

The RK818 provides an accurate battery fuel gauge. A 12-bit ADC is integrated in the RK816B to collect the information on the battery, such as battery voltage, USB voltage, charging/discharging status, battery temperature, etc. Using the proprietary algorithms and the information collected by the ADC, the battery fuel 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.

4.1.6 BUCK CONVERTERS

The RK816B provides four high current synchronous buck converters, which deliver up to 2A, 2A, 1A and 1A, respectively. An enhanced current mode architecture is used, which improves the transient response significantly. All output voltages can be adjusted dynamically during operation through DVS (Dynamic Voltage Scaling), which guarantees a linear and gradual voltage ramping up and down. A complete set of protection functions, such as short circuit protection, is implemented in the buck converters too.

The inputs of all channels have soft start function, which greatly reduces the inrush current at the start up. 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 buck 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.

4.1.7 LOW DROPOUT REGULATORS

The RK816B also integrates six LDOs, with five LDOs (LDO1, LDO2, LDO4, LDO5 and LDO6) capable of providing up to 300mA and one LDOs (LDO3) providing maximum 100mA. The LDO3 is a low noise, high PSRR LDO which delivers up to 100mA current. The parameters such as output voltage in the different operating modes can be adjusted through the I2C interface.

4.1.8 REAL TIME CLOCK

The RK816B integrates a crystal oscillator buffer and a real time clock (RTC). The buffer works with an external 32.768kHz crystal oscillator. With the RTC function, the PMIC provides second/minute/hour/day/month/year information, alarm wake up as well as time calibration. The RK816B provides one channel of 32.768kHz clock with open drain outputs, which is enabled through I2C interface.

4.2 State Machine Description

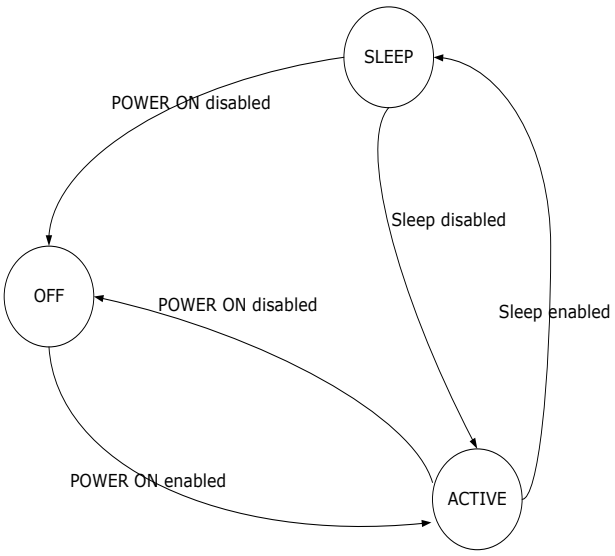


Fig. 4-1 State Machine

4.3 Device Power on Enable Conditions

If none of the device power-on disable conditions is met, the following conditions are available to turn on and/or maintain the ON state of the device:

- PWRON signal is low for a period of time
- USB is plugged in.（PLUG_IN_INT goes to high level）
- RTC set time power on

4.4 Device Power on Disable Conditions

The PMIC will be powered off, or can not be powered on under the following conditions:

- PWRON signal keeps at low lever longer than the long-press delay TDPWRONLP and PWRON_LP_ACT is set to "0"（If it is set to "1", the PMIC will restart automatically after the it is shut down ）The interrupt corresponding to this condition is PWRON_LP_INT in the INT_STS_REG register.
- The die temperature reaches the TSD threshold, in which case the TSD_STS bit in the register THERMAL_REG is set to "1".
- Vsys is lower than UVLO threshold, in which case the VB_UV_STS bit in the register

VB_MON_REG is set to "1".

- Vsys is lower than the low voltage warning threshold which can be set with the VB_LO_SEL bit in the register VB_MON_REG, and the VB_LO_ACT bit is set to "0".
- Vsys is higher than the over voltage protection threshold.
- The DEV_OFF control bit is set to "1". (DEV_OFF is reset when the system is powered off).

4.5 Device Sleep Enable Conditions

- SLEEP signal high level and Reg50<1>=1.
- SLEEP signal low level and Reg50<1>=0.
- Reg4b<1>=1.

4.6 Power Sequence

BOOT(OTP)			**1（RK816B-1）**		**0（RK816B-2）**		**0（RK816B-3）**	
	Output voltage range	**Rate Current**	**Default voltage**	**Power up sequence**	**Default voltage**	**Power up sequence**	**Default voltage**	**Power up sequence**
BUCK1	0.7125V-2.3V（0.7125~1.45V，step 12.5mV)	2A	1.1V	2	1.0V	3	1.1V	2
BUCK2	0.7125V-2.3V（0.7125~1.45V，step 12.5mV)	2A	1.1V	1	2.2V	1	1.1V	1
BUCK3	setting by external resistors	1A	x	3	x	4	x	3
BUCK4	0.8V-3.5V(step 0.1V)	1A	3.3V	1	3.3V	6	3.3V	1
BOOST	4.7-5.4V(step 0.1V)	2A	5V	OFF	5V	OFF	5V	OFF
LDO1	0.8V-3.4V(step 0.1V)	300mA	1.0V	OFF	1.0V	2	1.8V	OFF
LDO2	0.8V-3.4V(step 0.1V)	300mA	1.8V	1	1.8V	5	1.8V	1
LDO3	0.8V-3.4V(step 0.1V)	100mA	1.1V	1	1.0V	2	1.1V	1
LDO4	0.8V-3.4V(step 0.1V)	300mA	1.0V	OFF	3.3V	6	3.3V	OFF
LDO5	0.8V-3.4V(step 0.1V)	300mA	3.0V	4	1.8V	OFF	3.3V	4
LDO6	0.8V-3.4V(step 0.1V)	300mA	3.0V	4	2.8V	OFF	3.3V	4

Table 4-1 Power Start Up Sequence

X: The buck3 voltage is decided by external resistors.

4.6.1 RK816B-1

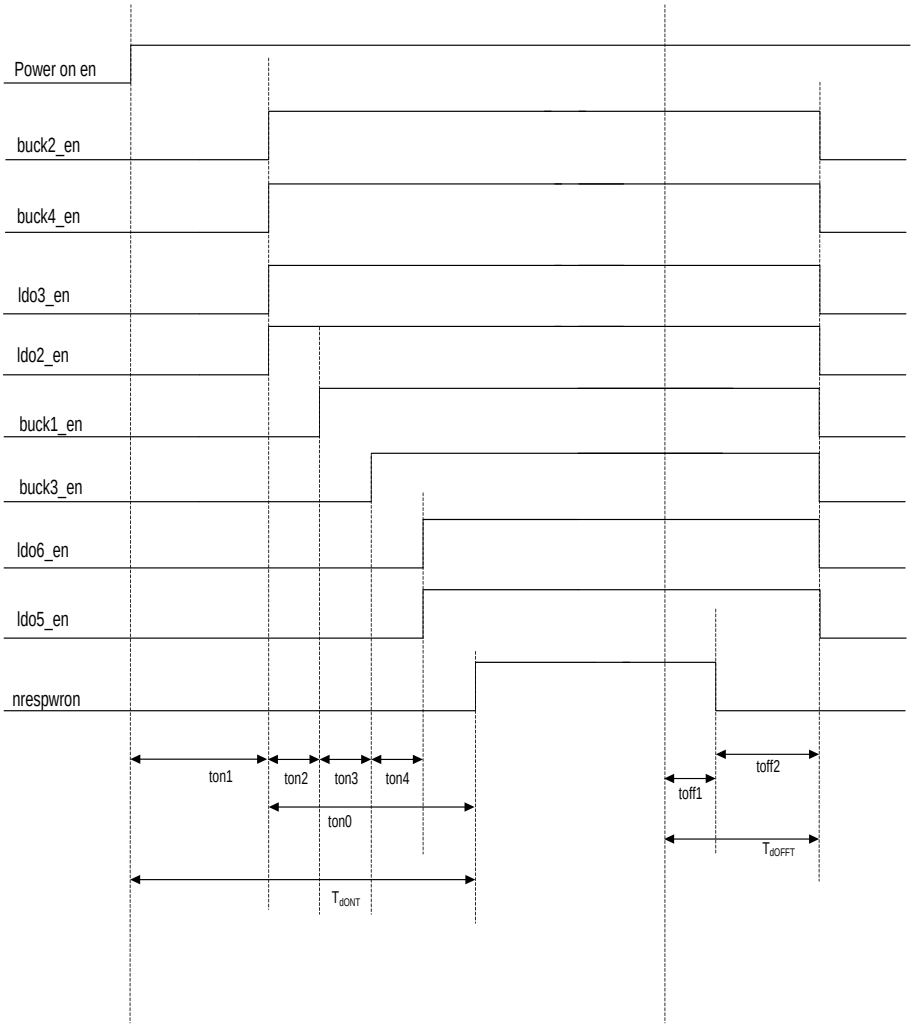


Fig. 4-2 Power On/Off Timing, BOOT1 (RK816B-1)

4.6.2 RK816B-2/3

In this mode, 10 power channels are powered up, among which, the power up sequence and the default voltage of the BUCK1-4, LDO1-6 can be configured through OTP. Again, The default output voltage of the BUCK3 can also be set by the external resistors.

4.6.3 Boot Timing Characteristic

PARAMETERS	DESCRIPTION	MIN	TYP	MAX	UNIT
Ton1	Power on en to 1st channel enable delay		2		ms
Ton2	1st channel enable delay to 2nd channel enable delay		2		ms
Ton3	2nd channel enable to 3rd channel enable delay		2		ms
Ton4	3rd channel enable to 4th channel enable delay		2		ms
Ton0	1st channel enable delay to NRESPWRON rising edge delay		80		ms
toff1	power disable to NRESPWRON falling delay		$1\times t_{CK32K}$		us
Toff2	NRESPWRON falling delay to supplies disable delay		2		ms

Table 4-2 Boot Timing Characteristics

4.7 Power Control Timing

4.7.1 Device Turn On With USB Plug_in

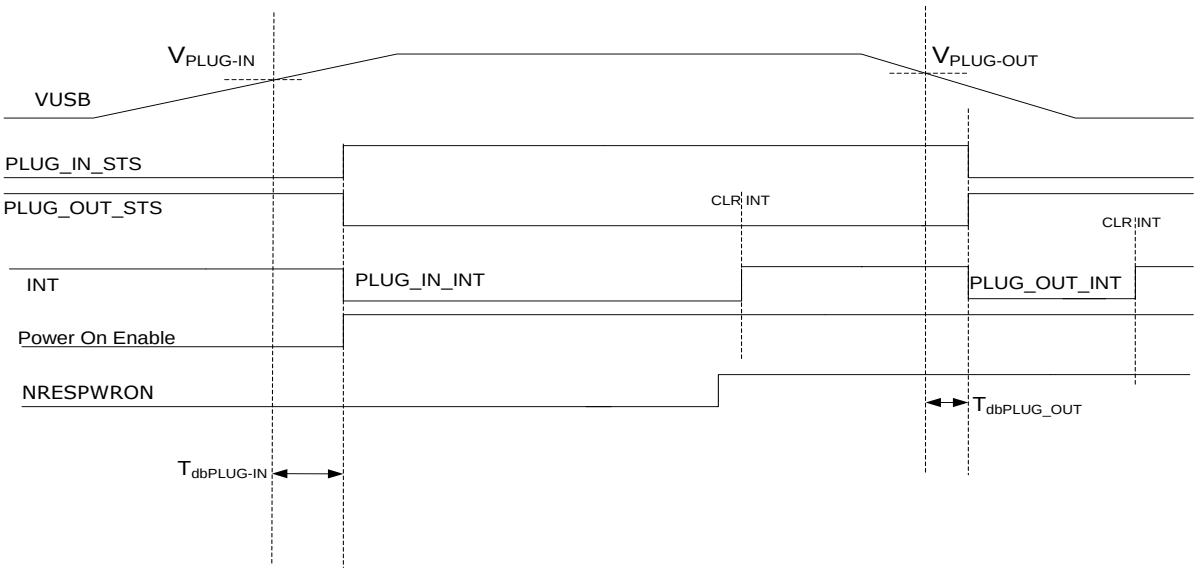


Fig. 4-3 Turn on sequence when USB is plugged in (PLUP_IN_INT triggered power on enable)

4.7.2 Power Control Timing When Powered By BAT

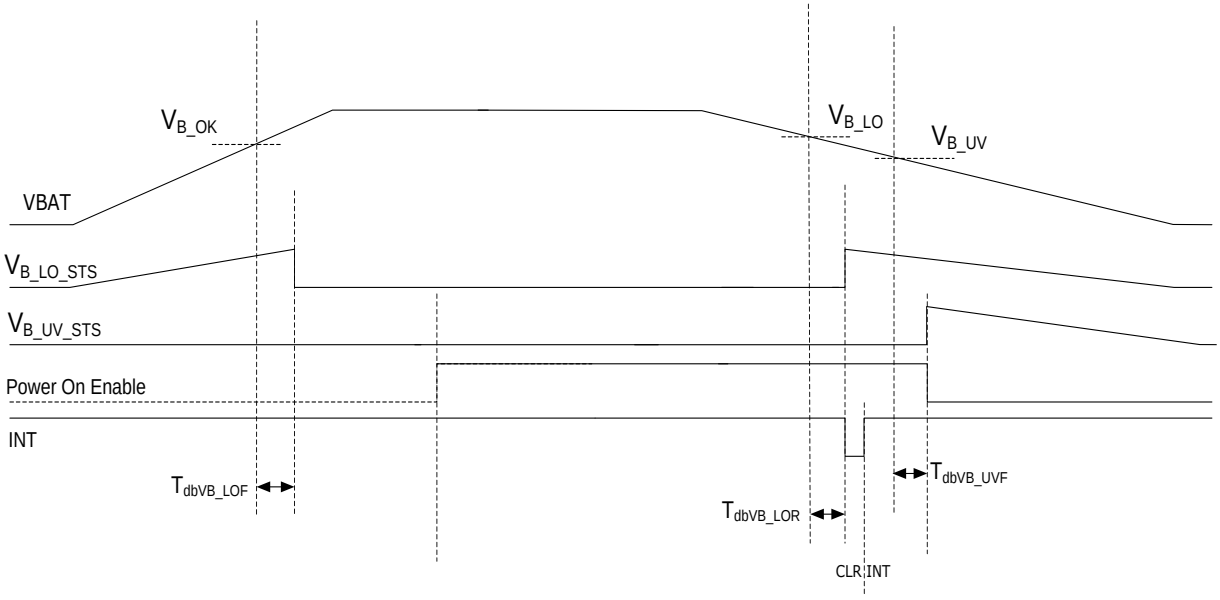


Fig. 4-4 Power Control Timing with VBAT Falling

4.7.3 Timing Characteristics (USB or VBAT Rising,Falling and Plug in)

Parameter	Description	Min	Typ	Max	Unit
T_{dbVB_LOF}	VB_LO falling-edge de-bouncing delay		2		ms
T_{dbVB_LOR}	VB_LO rising-edge de-bouncing delay		2		ms
T_{dbVB_UVF}	VB_UV falling-edge de-bouncing delay		2		ms

Parameter	Description	Min	Typ	Max	Unit
T_{dbPLUG_IN}	USB plug-in de-bouncing delay		100		ms
T_{dbPLUG_OUT}	USB plug-out de-bouncing delay		100		ms

Table 4-3 Timing characteristics of USB and VSYS voltages

4.7.4 Device State Control Through PWRON Signal

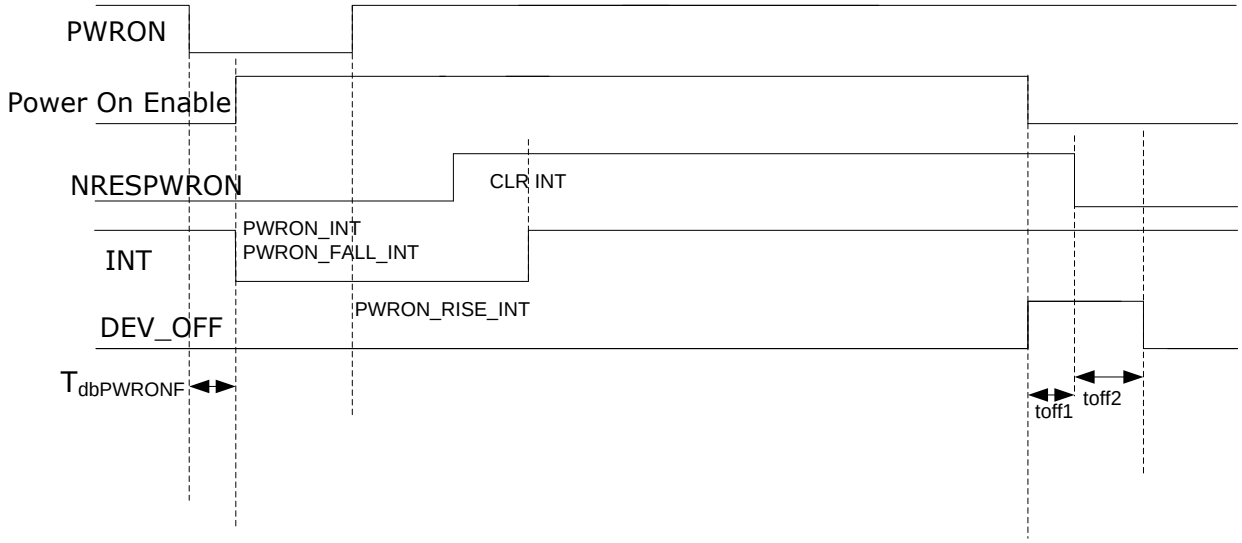


Fig. 4-5 PWRON turn on/DEV_OFF turn off

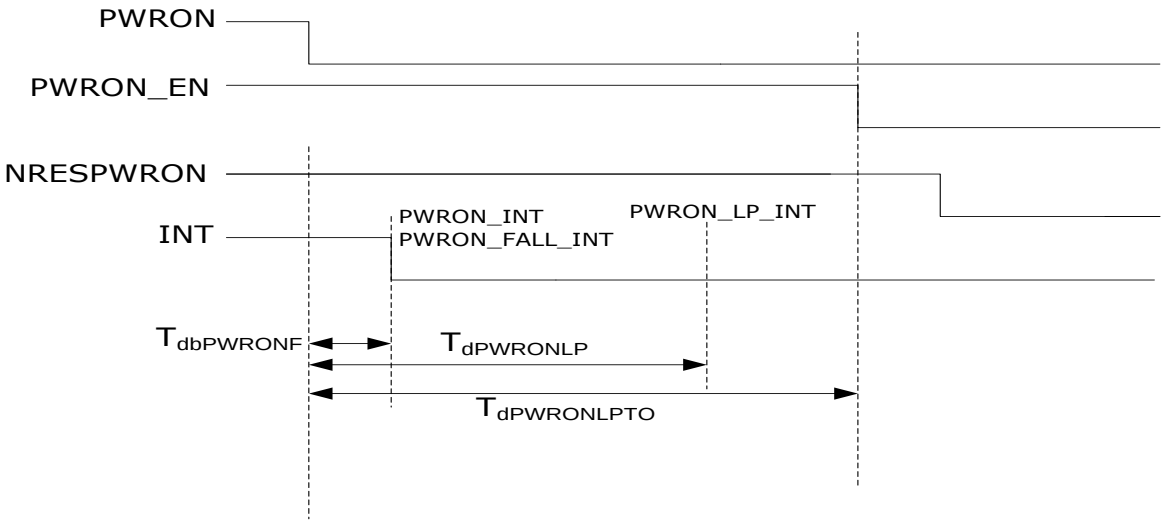


Fig. 4-6 PWRON long press turn off

4.7.5 Timing Characteristics (PWRON, DEV_OFF)

Parameter	Description	Min	Typ	Max	Unit
$T_{dbPWRONF}$	PWRON falling-edge de-bouncing delay		500		ms
$T_{dPWRONLP}$	PWRON long press delay to interrupt (PWRON falling edge to PWRON_LP_INT=1)		1		s
$T_{dPWRONLPTO}$	PWRON long press delay to turn off (PWRON falling edge to NRESPWRON falling edge)		6		s

Table 4-4 Timing Characteristics of PWRON/DEV_OFF

4.7.6 SLEEP State Control

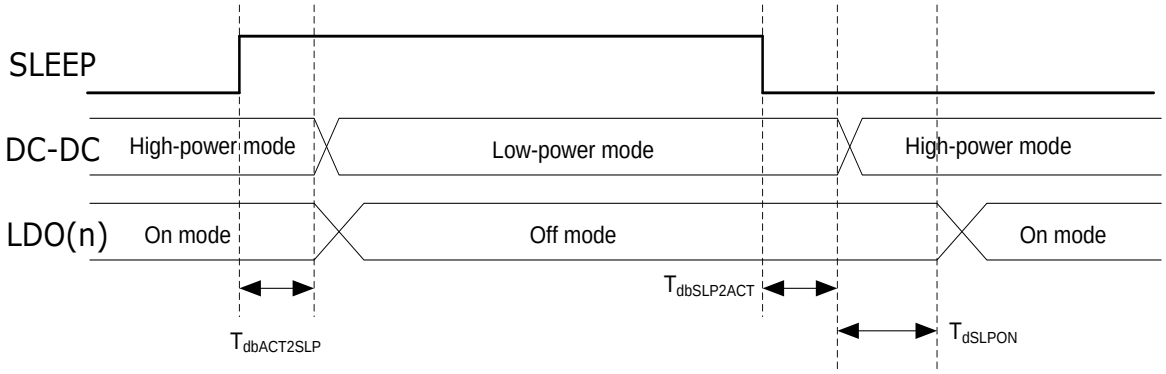


Fig. 4-7 SLEEP/ACTIVE Transition Timing

4.7.7 Timing Characteristics (SLEEP)

Parameter	Description	Min	Typ	Max	Unit
$T_{dbACT2SLP}$	SLEEP falling-edge de-bouncing delay		$3\times t_{ck32k}$		us
$T_{dbSLP2ACT}$	SLEEP rising-edge de-bouncing delay		$3\times t_{ck32k}$		us
T_{dSLPON}	Delay to turn on enable after SLEEP rising-edge de-bouncing		$1\times t_{ck32k}$		us

Table 4-5 Timing Characteristics of SLEEP

Chapter 5 Register Description

5.1 Register Summary

HEX ADDRESS	FUNCTION DESCRIPTION	R/W	DEFAULT
RTC REGISTER			
00	SECONDS_REG	RW	0x00
01	MINUTES_REG	RW	0x50
02	HOURS_REG	RW	0x08
03	DAYS_REG	RW	0x21
04	MONTHS_REG	RW	0x01
05	YEARS_REG	RW	0x15
06	WEEKS_REG	RW	0x03
08	ALARM_SECONDS_REG	RW	0x00
09	ALARM_MINUTES REG	RW	0x00
0A	ALARM_HOURS REG	RW	0x00
0B	ALARM_DAYS_REG	RW	0x01
0C	ALARM_MONTHS_REG	RW	0x01
0D	ALARM_YEARS_REG	RW	0x00
10	RTC_CTRL_REG	RW	0x00
11	RTC_STATUS_REG	RW	0x82
12	RTC_INT_REG	RW	0x00
13	RTC_COMP_LSB_REG	RW	0x00
14	RTC_COMP_MSB_REG	RW	0x00
20	CLK32KOUT_REG	RW	0x01
VERSION REGISTER			
17	CHIP_NAME_REG	RO	0x81
18	CHIP_VER_REG	RO	0x61
19	OTP_VER_REG	RO	0000/otp<3:0>
POWER ON/OFF REGISTER			
21	VB_MON_REG	RW	0x14
22	VB_UV_REG/THERMAL_REG	RW	0x00
47	PWRON_LP_INT_TIME_REG	RW	0x20
48	PWRON_DB_REG	RW	0x40
4B	DEV_CTRL_REG	RW	0x00
AE	ON_SOURCE_REG	RO	0x00
AF	OFF_SOURCE_REG	RO	0x00
POWER CHANNELS ENABLE REGISTER			
23	DCDC_EN_REG1	RW	Boot0:0x0F Boot1:0000/otp<3:0>
24	DCDC_EN_REG2	RW	Boot0:0x00 Boot1:00000/otp<1:0> /0
25	SLP_DCDC_EN_REG	RW	Boot0:0x0F Boot1:0/otp<6:0>
26	SLP_LDO_EN_REG	RW	Boot0:0x36 Boot1:00/otp<5:0>

HEX ADDRESS	FUNCTION DESCRIPTION	R/W	DEFAULT
27	LDO_EN_REG1	RW	Boot0:0x06 Boot1:0000/otp<3:0>
28	LDO_EN_REG2	RW	Boot0:0x03 Boot1:0000/otp<3:0>
BUCK AND LDO CONFIG REGISTER			
2E	BUCK1_CONFIG_REG	RW	0x7A
2F	BUCK1_ON_VSEL_REG	RW	Boot0:0x1F Boot1:00/otp<5:0>
30	BUCK1_SLP_VSEL_REG	RW	Boot0:0x1F Boot1:00/otp<5:0>
32	BUCK2_CONFIG_REG	RW	0x7A
33	BUCK2_ON_VSEL_REG	RW	Boot0:0x1F Boot1:00/otp<5:0>
34	BUCK2_SLP_VSEL_REG	RW	Boot0:0x1F Boot1:00/otp<5:0>
36	BUCK3_CONFIG_REG	RW	0x2A
37	BUCK4_CONFIG_REG	RW	0x2A
38	BUCK4_ON_VSEL_REG	RW	Boot0:0x19 Boot1:000/otp<4:0>
39	BUCK4_SLP_VSEL_REG	RW	Boot0:0x19 Boot1:000/otp<4:0>
3B	LDO1_ON_VSEL_REG	RW	Boot0:0x22 Boot1:001/otp<4:0>
3C	LDO1_SLP_VSEL_REG	RW	Boot0:0x02 Boot1:000/otp<4:0>
3D	LDO2_ON_VSEL_REG	RW	Boot0:0x2A Boot1:001/otp<4:0>
3E	LDO2_SLP_VSEL_REG	RW	Boot0:0x0A Boot1:000/otp<4:0>
3F	LDO3_ON_VSEL_REG	RW	Boot0:0x23 Boot1:001/otp<4:0>
40	LDO3_SLP_VSEL_REG	RW	Boot0:0x03 Boot1:000/otp<4:0>
41	LDO4_ON_VSEL_REG	RW	Boot0:0x22 Boot1:001/otp<4:0>
42	LDO4_SLP_VSEL_REG	RW	Boot0:0x02 Boot1:000/otp<4:0>
43	LDO5_ON_VSEL_REG	RW	Boot0:0x36 Boot1:001/otp<4:0>
44	LDO5_SLP_VSEL_REG	RW	Boot0:0x16 Boot1:000/otp<4:0>
45	LDO6_ON_VSEL_REG	RW	Boot0:0x36 Boot1:001/otp<4:0>
46	LDO6_SLP_VSEL_REG	RW	Boot0:0x16 Boot1:000/otp<4:0>
INTERRUPT REGISTER			
49	INT_STS_REG1	RW	0x00
4A	INT_STS_MSK_REG1	RW	0x00
4C	INT_STS_REG2	RW	0x00
4D	INT_STS_MSK_REG2	RW	0x00
4E	INT_STS_REG3	RW	0x00

HEX ADDRESS	FUNCTION DESCRIPTION	R/W	DEFAULT
4F	INT_STS_MSK_REG3	RW	0x00
50	GPIO_IO_POL_REG	RW	0x26
CHARGER，BOOST AND OTG REGISTER			
2A	OTG_BUCK_LDO_CONFIG_REG	RW	00000/otp<0>/00
2B	CHRG_CONFIG_REG	RW	0x3A
54	BOOST_CON_REG	RW	0x00
54	BOOST_ON_VSEL_REG	RW	0x73
55	BOOST_SLP_VSEL_REG	RW	0x60
9A	CHRG_BOOST_CONFIG_REG	RW	0xC0
A0	SUP_STS_REG	RW	0x0C
A1	USB_CTRL_REG	RW	01000/otp<2:0>
A3	CHRG_CTRL_REG1	RW	0xB3
A4	CHRG_CTRL_REG2	RW	0x52
A5	CHRG_CTRL_REG3	RW	0x82
A6	BAT_CTRL_REG	RW	0xC3
A8	BAT_HTS_TS_REG	RW	0x00
A9	BAT_LTS_TS_REG	RW	0xFF
ADC AND FUEL GAUGE REGISTER			
AC	TS_CTRL_REG	RW	0x83
AD	ADC_CTRL_REG	RW	0x30
B0	GGCON_REG	RW	0x4A
B1	GGSTS_REG	RW	0x40
B2	ZERO_CUR_ADC_REGH	RW	0x00
B3	ZERO_CUR_ADC_REGL	RW	0x00
B4	GASCNT_CAL_REG3	RW	0x00
B5	GASCNT_CAL_REG2	RW	0x00
B6	GASCNT_CAL_REG1	RW	0x00
B7	GASCNT_CAL_REG0	RW	0x00
B8	GASCNT_REG3	RO	0x00
B9	GASCNT_REG2	RO	0x00
BA	GASCNT_REG1	RO	0x00
BB	GASCNT_REG0	RO	0x00
BC	BAT_CUR_REGH	RO	0x00
BD	BAT_CUR_REGL	RO	0x00
BE	TS_ADC_REGH	RO	0x00
BF	TS_ADC_REGL	RO	0x00
C0	USB_ADC_REGH	RO	0x00
C1	USB_ADC_REGL	RO	0x00
C2	BAT_OCV_REGH	RO	0x00

HEX ADDRESS	FUNCTION DESCRIPTION	R/W	DEFAULT
C3	BAT_OCV_REGL	RO	0x00
C4	BAT_VOL_REGH	RO	0x00
C5	BAT_VOL_REGL	RO	0x00
C6	RELAX_ENTRY_THRES_REGH	RW	0x00
C7	RELAX_ENTRY_THRES_REGL	RW	0x60
C8	RELAX_EXIT_THRES_REGH	RW	0x00
C9	RELAX_EXIT_THRES_REGL	RW	0x60
CA	RELAX_VOL1_REGH	RO	0x00
CB	RELAX_VOL1_REGL	RO	0x00
CC	RELAX_VOL2_REGH	RO	0x00
CD	RELAX_VOL2_REGL	RO	0x00
CE	RELAX_CUR1_REGH	RO	0x00
CF	RELAX_CUR1_REGL	RO	0x00
D0	RELAX_CUR2_REGH	RO	0x00
D1	RELAX_CUR2_REGL	RO	0x00
D2	CAL_OFFSET_REGH	RW	0x7F
D3	CAL_OFFSET_REGL	RW	0xFF
D4	NON_ACT_TIMER_CNT_REG	RO	0x00
D5	VCALIB0_REGH	RO	0x00
D6	VCALIB0_REGL	RO	0x00
D7	VCALIB1_REGH	RO	0x00
D8	VCALIB1_REGL	RO	0x00
D9	FCC_GASCNT_REG3	RO	0x00
DA	FCC_GASCNT_REG2	RO	0x00
DB	FCC_GASCNT_REG1	RO	0x00
DC	FCC_GASCNT_REG0	RO	0x00
DD	IOFFSET_REGH	RO	0x00
DE	IOFFSET_REGL	RO	0x00
DF	SLEEP_CON_SAMP_CUR_REG	RW	0x60
DATA REGISTER			
E0	DATA0_REG	RW	0x00
E1	DATA1_REG	RW	0x00
E2	DATA2_REG	RW	0x00
E3	DATA3_REG	RW	0x00
E4	DATA4_REG	RW	0x00
E5	DATA5_REG	RW	0x00
E6	DATA6_REG	RW	0x00
E7	DATA7_REG	RW	0x00
E8	DATA8_REG	RW	0x00
E9	DATA9_REG	RW	0x00

HEX ADDRESS	FUNCTION DESCRIPTION	R/W	DEFAULT
EA	DATA10_REG	RW	0x00
EB	DATA11_REG	RW	0x00
EC	DATA12_REG	RW	0x00
ED	DATA13_REG	RW	0x00
EE	DATA14_REG	RW	0x00
EF	DATA15_REG	RW	0x00
F0	DATA16_REG	RW	0x00
F1	DATA17_REG	RW	0x00
F2	DATA18_REG	RW	0x00

NOTE: Address 60h through 97h are for OTP registers. Customer's accessibility to those addresses is not allowed.

5.2 Register Description

5.2.1 RTC Registers

- **SECONDS_REG : RTC SECOND REGISTER**

Address: 00H				Type: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	SEC1			SEC0			
Default	0	0	0	0	0	0	0	0

	Description
Bit 7	Reserved
Bit 6-4	Set the second digit of the RTC seconds (0-5)
Bit 3-0	Set the first digit of the RTC seconds (0-9)
Note	BCD coding from 00 - 59

- **MINUTES_REG (REG[01]): RTC MIMUTES REGISTER**

ADDRESS: 01H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	MIN1			MIN0			
DEFAULT	0	1	0	1	0	0	0	0

	Description
Bit 7	RESV: Reserved
Bit 6-4	MIN1: Set the second digit of the RTC minutes (0-5)
Bit 3-0	MIN0: Set the first digit of the RTC minutes (0-9)
Note	BCD coding from 00 to 59

- **HOURS_REG (REG[02]): RTC HOUR REGISTER**

ADDRESS**:** 02H				TYPE**:** RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	PM/AM	RESV	HOUR1		HOUR0			

DEFAULT	0	0	0	0	1	0	0	0

Description

Bit 7	PM/AM: Only used in PM-AM mode, 1: PM. 0:AM 1: PM, 0:AM
Bit 6	RESV: Reserved
Bit 5-4	HOUR1: Set the second digit of the RTC hours
Bit 3-0	HOUR0: Set the first digit of the RTC hours
Note	HOUR1/0 BCD coding from 0 to11/23

- **DAYS_REG (REG[03]): RTC DAY REGISTER**

ADDRESS: 03H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	DAY1		DAY0			
DEFAULT	0	0	1	0	0	0	0	1

Description

Bit 7-6	RESV: Reserved
Bit 5-4	DAY1: Set the second digit of the RTC days
Bit 3-0	DAY0: Set the first digit of the RTC days
Note	BCD coding from 0 to 28/29/30/31

- **MONTHS_REG (REG[04]): RTC MONTHS REGISTER**

ADDRESS: 04H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	MONTH1	MONTH0			
DEFAULT	0	0	0	0	0	0	0	1

Description

Bit 7-5	RESV: Reserved
Bit 4	MONTH1: Set the second digit of the RTC months
Bit 3-0	MONTH0: Set the first digit of the RTC months
Note	BCD coding from 01 to 12

- **YEARS_REG (REG[05]): RTC YEARS REGISTER**

ADDRESS: 05H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	YEAR1				YEAR0			
DEFAULT	0	0	0	1	0	1	0	1

Description

Bit 7-5	YEAR1: Set the second digit of the RTC years
Bit 3-0	YEAR0: Set the first digit of the RTC years
Note	BCD coding from 00 to 99

- **WEEKS_REG (REG[06]): RTC WEEKS REGISTER**

ADDRESS: 06H	TYPE: RW

Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	RESV	WEEK		
DEFAULT	0	0	0	0	0	0	1	1

Description

Bit 7-3 RESV: Reserved

Bit 3-0 WEEK: Set the second digit of the RTC weeks

Note BCD coding from 1 to 7

- **ALARM_SECONDS_REG (REG[08]): RTC ALARM SECONDS REGISTER**

ADDRESS: 08H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	ALARM_SEC1			ALARM_SEC0			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 RESV: Reserved

Bit 6-4 ALARM_SEC1: Set the second digit of the RTC alarm seconds

Bit 3-0 ALARM_SEC0: Set the first digit of the RTC alarm seconds

Note BCD coding from 00 to 59

- **ALARM_MINUTES_REG (REG[09]): RTC ALARM MINUTES REGISTER**

ADDRESS: 09H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	ALARM_MIN1			ALARM_MIN0			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 RESV: Reserved

Bit 6-4 ALARM_MIN1: Set the second digit of the RTC alarm minutes

Bit 3-0 ALARM_MIN0: Set the first digit of the RTC alarm minutes

Note BCD coding from 00 to 59

- **ALARM_HOURS_REG (REG[0A]): RTC ALARM HOURS REGISTER**

ADDRESS: 0AH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	ALARM_PM_AM	RESV	ALARM_HOUR1		ALARM_HOUR0			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 ALARM_PM_AM: Set PM or AM: only used in PM-AM mode, 1: PM. 0:AM

Bit 6 RESV: Reserved

Bit 5-4 ALARM_HOUR1: Set the second digit of the RTC alarm hours

Bit 3-0 ALARM_HOUR0: Set the first digit of the RTC alarm hours

Note HOUR1/0 BCD coding from 0 to 11/23

- **ALARM_DAYS_REG (REG[0B]): RTC ALARM DAYS REGISTER**

ADDRESS: 0BH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	ALARM_DAY1		ALARM_DAY0			
DEFAULT	0	0	0	0	0	0	0	1

Description

Bit 7-6 RESV: Reserved

Bit 5-4 Set the second digit of the RTC alarm days

Bit 3-0 Set the first digit of the RTC alarm days

Note BCD coding from 0 to 28/29/30/31

- **ALARM_MONTHS_REG (REG[0C]): RTC ALARM MONTHS REGISTER**

ADDRESS: 0CH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	ALARM_MONTH1	ALARM_MONTH0			
DEFAULT	0	0	0	0	0	0	0	1

Description

Bit 7-5 RESV: Reserved

Bit 4 Set the second digit of the RTC alarm months

Bit 3-0 Set the first digit of the RTC alarm months

Note BCD coding from 01 to 12

- **ALARM_YEARS_REG (REG[0D]): RTC ALARM YEARS REGISTER**

ADDRESS: 0DH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	ALARM_YEAR1				ALARM_YEAR0			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-5 Set the second digit of the RTC alarm years

Bit 3-0 Set the first digit of the RTC alarm years

Note BCD coding from 00 to 99

- **RTC_CTRL_REG (REG[10]): RTC CONTROL REGISTER**

ADDRESS: 10H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RTC_READSEL	GET_TIME	SET_32_COUNTER	TEST_MODE	AMPM_MODE	AUTO_COMP	ROUND_30S (Auto Clr)	STOP_RTC
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 RTC_READ_SEL: 0: Read access directly to dynamic registers.
1: Read access to static shadowed registers.
Bit 6 GET_TIME: Rising transition of this register transfers dynamic registers into static shadowed registers..
Bit 5 SET_32_COUNTER: 1: Set the 32Khz counter with COMP_REG value. It must only be used when the RTC is frozen.
Bit 4 TEST_MODE: 1: Test mode (Auto compensation is enabled when the 32kHz counter reaches at its end)
Bit 3 AMPM_MODE: 0: 24 hours mode.
1: 12 hours mode (PM-AM mode)
Bit 2 AUTO_COMP: 0: No auto compensation RW0.
1: Auto compensation enabled
Bit 1 ROUND_30S: 1: When "1" is written, the time is rounded to the closest minute in the next second, and is self-cleared after rounding.
Bit 0 STOP_RTC: 0: RTC is running，1: RTC is frozen.
RTC_time can only be changed during RTC frozen.

- **RTC_STATUS_REG (REG[11]): RTC STATUS REGISTER**

ADDRESS: 11H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	POWER_UP (Write 1 Clr)	ALARM (Write 1 Clr)	EVENT_1D (Write 1 Clr)	EVENT_1H (Write 1 Clr)	EVENT_1M (Write 1 Clr)	EVENT_1S (Write 1 Clr)	RUN (RO)	RESV
DEFAULT	1	0	0	0	0	0	1	0

Description

Bit 7 POWER_UP: POWER_UP is set by a reset, is cleared by writing one in this bit.
Bit 6 ALARM: Indicates that an alarm interrupt has been generated (bit clear by writing 1) The alarm interrupt keeps its low level, until the micro-controller writes 1 in the ALARM bit of the RTC_STATUS register. The timer interrupt is a low-level pulse (15 μs duration).
Bit 5 EVENT_1D: One day has occurred
Bit 4 EVENT_1H: One hour has occurred
Bit 3 EVENT_1M: One minute has occurred
Bit 2 EVENT_1S :One second has occurred
Bit 1 RUN: 0: RTC is frozen. 1: RTC is running. This bit shows the real state of the RTC
Bit 0 RESV: Reserved

- **RTC_INT_REG (REG[12]): RTC INTERRUPT REGISTER**

ADDRESS: 12H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			INT_SLEEP_MASK_EN	INT_ALARM_EN	INT_TIMER_EN	EVERY	
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-5	RESV: Reserved
Bit 4	INT_SLEEP_MASK_EN: 1: Mask periodic interrupt while the device is in SLEEP mode 0: Normal mode, no interrupt masked.
Bit 3	INT_ALARM_EN: Enable one interrupt when the alarm value is reached 1: Enable 0: Disable
Bit 2	INT_TIMER_EN: Enable periodic interrupt
Bit 1-0	EVERY: 00: every second 01: every minute 10: every hour 11: every day

- **RTC_COMP_LSB_REG (REG[13]): RTC COMPENSATION REGISTER LSB**

ADDRESS: 13H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RTC_COMP_LSB							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit7-0	This register contains the number of 32-kHz periods to be added into the 32KHz counter every hour [LSB]

- **RTC_COMP_MSB_REG (REG[14]): RTC COMPENSATION REGISTER MSB**

ADDRESS: 14H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RTC_COMP_MSB							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit7-0	This register contains the number of 32-kHz periods to be added into the 32KHz counter every hour [MSB]

- **CLK32KOUT_REG (REG[20]): 32KHz CLOCK OUTPUT REGISTER**

ADDRESS: 20H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV							CLK32KOUT_EN
DEFAULT	0	0	0	0	0	0	0	1

	Description
Bit 7-1	Reserved
Bit 0	CLK32KOUT_EN: 1: CLK32K is enabled， 0: CLK32K is disabled

5.2.2 Version Registers

- **CHIP_NAME_REG (REG[17]): CHIP NAME REGISTER**

ADDRESS: 17H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHIP_NAME<11:4>							

DEFAULT	1	0	0	0	0	0	0	1

Description

Bit 7-0 CHIP_NAME<11:4>: Chip name high bits

- **CHIP_VER_REG (REG[18]): CHIP VERSION REGISTER**

ADDRESS: 18H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHIP_NAME<3:0>				CHIP_VER<3:0>			
DEFAULT	0	1	1	0	0	0	0	1

Description

Bit 7-4 CHIP_NAME<3:0>: Chip name low bits

Bit 3-0 CHIP_VER<3:0>: Reserved

- **OTP_VER_REG (REG[19]): OTP VERSION REGISTER**

ADDRESS: 19H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				OTP_VER<3:0>			
DEFAULT	0	0	0	0	OTP			

Description

Bit 7-4 RESV: Reserved

Bit 3-0 OTP_VER<3:0>: OTP version bits

5.2.3 Power On/Off Registers

- **VB_MON_REG (REG[21]): SYSTEM VOLTAGE REGISTER**

ADDRESS: 21H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	PWRON_STS (RO)	PLUG_IN_STS (RO)	VB_UV_STS (RO)	VB_LO_ACT	VB_LO_STS (RO)	VB_LO_SEL		
DEFAULT	0	0	0	1	0	1	0	0

Description

Bit 7 PWRON_STS: PWRON key event occurs
0: PWRON key pressed， 1: No PWRON key pressed

Bit 6 PLUG_IN_STS: charger plug-in event occurs(DC PIN voltage >3.8V)
0: no charger plug in
1: charger plugged in

Bit 5 VB_UV_STS: System under voltage lockout status(shut down system if the bit=1)

Bit 4 VB_LO_ACT: System low voltage action
0: shut down system, 1: insert interrupt

Bit 3 VB_LO_STS: System low voltage status
0: VBAT>VB_LO_SEL, 1: VBAT<VB_LO_SEL

Bit 2-0 VB_LO_SEL: System low voltage threshold
000~111: 2.8V~ 3.5V, step=100mV

- **VB_UV_REG/THERMAL_REG (REG[22]): SYSTEM UNDER VOLTAGE REGISTER/ THERMAL REGISTER**

ADDRESS: 22H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	VB_UV_SEL			TSD_TEMP	HOTDIE_TEMP		HOTDIE_STS (RO)	TSD_STS (RO)
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-5 VB_UV_SEL: System under voltage status
000~111: 2.7V~3.4V, step=100mV

Bit 4 TSD_TEMP: Thermal shutdown temperature threshold
0: 140℃， 1: 160℃

Bit 3-2 HOTDIE_TEMP: Hot-die temperature threshold
00: 85℃， 01: 95℃， 10: 105℃， 11: 115℃

Bit 1 HOTDIE_STS: Hot-die warning
0: No hot-die warning happen， 1: Hot-die warning happen

Bit 0 TSD_STS: Thermal shut down(shut down system if the bit=1)
0: No thermal shut down happen， 1: Thermal shut down happen

- **PWRON_LP_TIME_REG (REG[47]): LONG PRESS INTERRUPT TIME REGISTER**

ADDRESS: 47H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	PWRON_LP_TM_SEL		RESV				
DEFAULT	0	0	1	0	0	0	0	0

Description

Bit 7 RESV: Reserved

Bit 6-5 PWRON_LP_TM_SEL: long press PWRON key interrupt time set bits
00: 0.5S， 01: 1S， 10: 1.5S， 11: 2S

Bit 4-0 RESV: Reserved

- **PWRON_DB_REG (REG[48]): KEY DEBOUNCE TIME REGISTER**

ADDRESS: 48H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	PWRON_DB_SEL		RESV				
DEFAULT	0	1	0	0	0	0	0	0

Description

Bit 7 RESV: Reserved

Bit 6-5 PWRON_DB_SEL: PWRON key de-bounce time set bits
00: 32uS， 01: 10mS， 10: 20mS， 11: 40mS

Bit 4-0 RESV: Reserved

- **DEV_CTRL_REG (REG[4B]): DEVICE CONTROL REGISTER**

ADDRESS: 4BH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	INT_FC_EN	PWRON_LP_ACT	PWRON_LP_OFF_TIME		DEV_OFF_RST	RESV	DEV_SLP	DEV_OFF
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7	INT_FC_EN: interrupt watch dog function enable bit 1: enable（if AP hadn't clear the interrupt, INT pin output waveform effective time is 2S，and then ineffective time is 10mS） 0: disable
Bit 6	Long press action 0：shut down the system， 1: shut down and restart the system
Bit 5-4	PWRON_LP_OFF_TIME: PWRON long press turn off time: 00: 6S， 01: 8S， 10: 10S， 11: 12S
Bit 3	DEV_OFF_RST: Write 1 will activate reset of the digital core.
Bit 2	RESV: Reserved
Bit 1	DEV_SLP: Write 1 allows SLEEP device state (if DEV_OFF = 0 and DEV_OFF_RST = 0). Write '0' will start a SLEEP to ACTIVE device state transition (wake-up event) (if DEV_OFF = 0 and DEV_OFF_RST = 0). This bit is cleared in OFF state.
Bit 0	DEV_OFF: Write 1 will start an ACTIVE to OFF or SLEEP to OFF device state transition (switch-off event). This bit is cleared in OFF state.

- **ON_SOURCE_REG (REG[AE]): ON SOURCE REGISTER**

ADDRESS: AEH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	ON_PWRON	ON_PLUG_IN	ON_RTC	RESTART_RESETB	RESTART_PWRON_LP	RESV		
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7	ON_PWRON: PMIC power up by pressing PWRON
Bit 6	ON_PLUG_IN: PMIC power up by USB plugging in
Bit 5	ON_RTC: PMIC power up by RTC timer
Bit 4	RESTART_RESETB: PMIC restart by pulling down NRESPWRON pin
Bit 3	RESTART_PWRON_LP: PMIC restart by long pressing PWRON
Bit 2-0	RESV: Reserved

- **OFF_SOURCE_REG (REG[AF]): OFF SOURCE REGISTER**

ADDRESS: AFH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	OFF_SYS_OV	OFF_TSD	OFF_SYS_UV	OFF_DEV_OFF	OFF_PWRON_LP	OFF_USB_OV_UV	OFF_SYS_LO

DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7	RESV: Reserved
Bit 6	OFF_SYS_OV: PMIC power off by Vsys over voltage protection
Bit 5	OFF_TSD: PMIC power off due to over temperature protection
Bit 4	OFF_SYS_UV: PMIC power off due to Vsys under voltage protection
Bit 3	OFF_DEV_OFF: PMIC power off due to DEV_OFF bit written
Bit 2	OFF_PWRON_LP: PMIC power off due to long pressing PWRON
Bit 1	OFF_USB_OV_UV: When PMIC is powered by USB only, PMIC power off due to USB over voltage or under voltage.
Bit 0	OFF_SYS_LO: PMIC power off due to Vsys low voltage set by software (If Reg21<4> vb_lo_act=0)

5.2.4 Power Channels Enable Registers

- **DCDC_EN_REG1 (REG[23]): DC-DC ENABLE REGISTER 1**

ADDRESS: 23H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK4_EN_MASK	BUCK3_EN_MASK	BUCK2_EN_MASK	BUCK1_EN_MASK	BUCK4_EN	BUCK3_EN	BUCK2_EN	BUCK1_EN
DEFAULT	0	0	0	0	Boot0:1111；Boot1:OTP			

Description

Bit 7-4	BUCK(n)_EN_MASK: BUCKn enable bit written mask 1：BUCK(n)_EN bit can be written 0：BUCK(n)_EN bit can’t be written
Bit 3-0	BUCK(n)_EN: BUCKn enable bit 1：enable， 0：disable

- **DCDC_EN_REG2 (REG[24]): DC-DC ENABLE REGISTER 2**

ADDRESS: 24H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	OTG_EN_MASK	BOOST_EN_MASK	RESV	RESV	OTG_EN	BOOST_EN	RESV
DEFAULT	0	0	0	0	0	Boot0:00 ； Boot1:OTP		0

Description

Bit 7	RESV: Reserved
Bit 6	OTG_EN_MASK: OTG enable bit written mask 1：OTG_EN bit can be written， 0：OTG_EN bit can’t be written
Bit 5	BOOST_EN_MASK: BOOST enable bit written mask 1：BOOST_EN bit can be written， 0：BOOST_EN bit can’t be written
Bit 4-3	RESV: Reserved
Bit 2	OTG_EN: OTG enable bit 1：enable， 0：disable

Bit 1 BOOST_EN: BOOST enable bit
1：enable， 0：disable
Bit 0 RESV: Reserved

- **SLP_DCDC_EN_REG (REG[25]): DC-DC SLEEP MODE ENABLE REGISTER**

ADDRESS: 25H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	OTG_EN_SLP	BOOST_EN_SLP	RESV	BUCK4_EN_SLP	BUCK3_EN_SLP	BUCK2_EN_SLP	BUCK1_EN_SLP
DEFAULT	0	Boot0:00 ； Boot1:OTP		0	Boot0:1111；Boot1:OTP			

Description

Bit 7 RESV: Reserved
Bit 6 OTG_EN_SLP: OTG enable bit when SLEEP mode
1：enable when SLEEP mode， 0：disable when SLEEP mode
Bit 5 BOOST_EN_SLP: BOOST enable bit when SLEEP mode
1：enable when SLEEP mode， 0：disable when SLEEP mode
Bit 4 RESV: Reserved
Bit 3-0 BUCK(n)_EN_SLP: BUCK(n) enable bit when SLEEP mode
1：enable when SLEEP mode， 0：disable when SLEEP mode

- **SLP_LDO_EN_REG (REG[26]): LDO SLEEP MODE ENABLE REGISTER**

ADDRESS: 26H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV		LDO6_EN_SLP	LDO5_EN_SLP	LDO4_EN_SLP	LDO3_EN_SLP	LDO2_EN_SLP	LDO1_EN_SLP
DEFAULT	0	0	Boot0:110110；Boot1:OTP					

Description

Bit 7-6 RESV: Reserved
Bit 5-0 LDO(n)_EN_SLP: LDO(n) enable bit when SLEEP mode
1：enable when SLEEP mode， 0：disable when SLEEP mode

- **LDO_EN_REG1 (REG[27]): LDO ENABLE REGISTER 1**

ADDRESS: 27H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	LDO4_EN_MASK	LDO3_EN_MASK	LDO2_EN_MASK	LDO1_EN_MASK	LDO4_EN	LDO3_EN	LDO2_EN	LDO1_EN
DEFAULT	0	0	0	0	Boot0:0110；Boot1:OTP			

Description

Bit 7-4 LDO(n)_EN_MASK: LDO(n) enable bit written mask
1： LDO(n)_EN bit can be written
0： LD0(n)_EN bit can’t be written
Bit 3-0 LDO(n)_EN: LDO(n) enable bit

1：enable， 0：disable

- **LDO_EN_REG2 (REG[28]): LDO ENABLE REGISTER 2**

ADDRESS: 28H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	LDO6_EN_MASK	LDO5_EN_MASK	RESV	RESV	LDO6_EN	LDO5_EN
DEFAULT	0	0	0	0	0	0	Boot0:11 ； Boot1:OTP	

Description

Bit 7-6 RESV: Reserved

Bit 5-4 LDO(n)_EN_MASK: LDO(n) enable bit written mask
1： LDO(n)_EN bit can be written
0： LD0(n)_EN bit can’t be written

Bit 3-2 RESV: Reserved

Bit 1-0 LDO(n)_EN: LDO(n) enable bit
1：enable， 0：disable

5.2.5 BUCK And LDO Config Registers

- **BUCK1_CONFIG_REG (REG[2E]): BUCK1 CONFIG REGISTER**

ADDRESS: 2EH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK1_ILMAX		BUCK1_DISCHRG_EN	BUCK1_RATE		BUCK1_ILMIN		
DEFAULT	0	1	1	1	1	0	1	0

Description

Bit 7-6 BUCK1_ILMAX: BUCK1 maximum inductor’s peak current limit
00: 2.5A， 01: 3A， 10: 3.5A， 11: 4A

Bit 5 BUCK1_DISCHRG_EN: BUCK1 discharge resistor enable bit when shut down
0: disable discharge resistor when shut down
1: enable discharge resistor when shut down

Bit 4-3 BUCK1_RATE: BUCK1 voltage change rate when DVS
00: 3mV/uS， 01: 6mV/uS， 10: 12.5mV/uS， 11: 25mV/uS

Bit 2-0 BUCK1_ILMIN: BUCK1 minimum inductor’s peak current
000: 150mA， 001: 200mA， 010: 250mA， 011: 300mA
100: 340mA， 101: 380mA， 110: 420mA， 111: 460mA

- **BUCK1_ON_VSEL_REG (REG[2F]): BUCK1 ON REGISTER**

ADDRESS: 2FH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK1_ON_FPWM	BUCK1_PHASE	BUCK1_ON_VSEL					
DEFAULT	0	0	Boot0:011111；Boot1:OTP					

Description

Bit 7 BUCK1_ON_FPWM:

1: force PWM mode in active mode
0: PWM/PFM auto change mode(default)

Bit 6 BUCK1_PHASE:
0: normal， 1: inverted

Bit 5-0 BUCK1_ON_VSEL: BUCK1 active mode voltage, 0.7125V~1.45V, step=12.5mV
000 000: 0.7125V
000 001: 0.725V
……
111 011: 1.45V

111 100: 1.8V
111 101: 2.0V
111 110: 2.2V
111 111: 2.3V

Note: When new code had been written, users must write register 0x24<7>=1, Otherwise the BUCK1 voltage would NOT change. The same with BUCK2 DVS.

- **BUCK1_SLP_VSEL_REG (REG[30]): BUCK1 SLEEP REGISTER**

ADDRESS: 30H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK1_SLP_FPWM	RESV	BUCK1_SLP_VSEL					
DEFAULT	0	0	Boot0:011111；Boot1:OTP					

Description

Bit 7 BUCK1_SLP_FPWM:
1: force PWM mode in sleep mode
0: PWM/PFM auto change mode(default)

Bit 6 RESV: Reserved

Bit 5-0 BUCK1_SLP_VSEL: BUCK1 sleep mode voltage , 0.7125V~1.45V, step=12.5mV
000 000: 0.7125V
000 001: 0.725V
……
111 011: 1.45V

111 100: 1.8V
111 101: 2.0V
111 110: 2.2V
111 111: 2.3V

Note: When new code had been written, users must write register 0x24<7>=1, Otherwise the BUCK1 voltage would NOT change. The same with BUCK2 DVS.

- **BUCK2_CONFIG_REG (REG[32]): BUCK2 CONFIG REGISTER**

ADDRESS: 32H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK2_ILMAX		BUCK2_DISCHRG_EN	BUCK2_RATE		BUCK2_ILMIN		
DEFAULT	0	1	1	1	1	0	1	0

	Description
Bit 7-6	BUCK2_ILMAX: BUCK2 maximum inductor's peak current limit 00: 2.5A， 01: 3A， 10: 3.5A， 11: 4A
Bit 5	BUCK2_DISCHRG_EN: BUCK2 discharge resistor enable bit when shut down 0: disable discharge resistor when shut down 1: enable discharge resistor when shut down
Bit 4-3	BUCK2_RATE: BUCK2 voltage change rate when DVS 00: 3mV/uS， 01: 6mV/uS， 10: 12.5mV/uS， 11: 25mV/uS
Bit 2-0	BUCK2_ILMIN: BUCK2 minimum inductor's peak current 000: 150mA， 001: 200mA， 010: 250mA， 011: 300mA 100: 340mA， 101: 380mA， 110: 420mA， 111: 460mA

- **BUCK2_ON_VSEL_REG (REG[33]): BUCK2 ON REGISTER**

ADDRESS: 33H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK2_ON_FPWM	BUCK2_PHASE	BUCK2_ON_VSEL					
DEFAULT	0	0	Boot0:011111，Boot1:OTP					

	Description
Bit 7	BUCK2_ON_FPWM: 1: force PWM mode in active mode 0: PWM/PFM auto change mode(default)
Bit 6	BUCK2_PHASE: 0: normal， 1: inverted
Bit 5-0	BUCK2_ON_VSEL: BUCK2 active mode voltage, 0.7125V~1.45V, step=12.5mV 000 000: 0.7125V 000 001: 0.725V …… 111 011: 1.45V 111 100: 1.8V 111 101: 2.0V 111 110: 2.2V 111 111: 2.3V **Note: When new code had been written, users must write register 0x24<7>=1, Otherwise the BUCK1 voltage would NOT change. The same with BUCK1 DVS.**

- **BUCK2_SLP_VSEL_REG (REG[34]): BUCK2 SLEEP REGISTER**

ADDRESS: 34H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK2_SLP_FPWM	RESV	BUCK2_SLP_VSEL					
DEFAULT	0	0	Boot0:011111；Boot1:OTP					

	Description
Bit 7	BUCK2_SLP_FPWM: 1: force PWM mode in sleep mode 0: PWM/PFM auto change mode(default)
Bit 6	RESV: Reserved
Bit 5-0	BUCK2_SLP_VSEL: BUCK2 sleep mode voltage, 0.7125V~1.45V, step=12.5mV 000 000: 0.7125V 000 001: 0.725V …… 111 011: 1.45V 111 100: 1.8V 111 101: 2.0V 111 110: 2.2V 111 111: 2.3V **Note: When new code had been written, users must write register 0x24<7>=1, Otherwise the BUCK1 voltage would NOT change. The same with BUCK1 DVS.**

- **BUCK3_CONFIG_REG (REG[36]): BUCK3 CONFIG REGISTER**

ADDRESS: 36H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK3_ON_FPWM	BUCK3_PHASE	BUCK3_DISCHRG_EN	BUCK3_ILMAX		BUCK3_ILMIN		
DEFAULT	0	0	1	0	1	0	1	0

	Description
Bit 7	BUCK3_ON_FPWM: 1: force PWM mode 0: PWM/PFM auto change mode(default)
Bit 6	BUCK3_PHASE: 0: normal， 1: inverted
Bit 5	BUCK3_DISCHRG_EN: BUCK3 discharge resistor enable bit when shut down 0: disable discharge resistor when shut down 1: enable discharge resistor when shut down
Bit 4-3	BUCK3_ILMAX: BUCK3 maximum inductor’s peak current limit

00: 1.5A， 01: 2A， 10: 2.5A， 11: 3A

Bit 2-0 BUCK3_ILMIN: BUCK3 minimum inductor's peak current
000： 50mA， 001: 100mA， 010: 150mA， 011: 200mA
100: 250mA， 101: 300mA， 110: 350mA， 111: 400mA

- **BUCK4_CONFIG_REG (REG[37]): BUCK4 CONFIG REGISTER**

ADDRESS: 37H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	BUCK4_PHASE	BUCK4_DISCHRG_EN	BUCK4_ILMAX		BUCK4_ILMIN		
DEFAULT	0	0	1	0	1	0	1	0

Description

Bit 7 RESV: Reserved

Bit 6 BUCK4_PHASE:
0: normal， 1: inverted

Bit 5 BUCK4_DISCHRG_EN: BUCK4 discharge resistor enable bit when shut down
0: disable discharge resistor when shut down
1: enable discharge resistor when shut down

Bit 4-3 BUCK4_ILMAX: BUCK4 maximum inductor's peak current limit
00: 2A， 01: 2.5A， 10: 3A， 11: 3.5A

Bit 2-0 BUCK4_ILMIN: BUCK4 minimum inductor's peak current
000: 50mA， 001: 100mA， 010: 150mA， 011: 200mA
100: 250mA， 101: 300mA， 110: 350mA， 111: 400mA

- **BUCK4_ON_VSEL_REG (REG[38]): BUCK4 ON REGISTER**

ADDRESS: 38H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK4_ON_FPWM	RESV		BUCK4_ON_VSEL				
DEFAULT	0	0	0	Boot0:11001；Boot1:OTP				

Description

Bit 7 BUCK4_ON_FPWM:
1: force PWM mode in active mode
0: PWM/PFM auto change mode(default)

Bit 6-5 RESV: Reserved

Bit 4-0 BUCK4_ON_VSEL: BUCK4 active mode voltage, 0.8V~3.5V, step=100mV
00000: 0.8V
00001: 0.9V
……
11001: 3.3V
11010: 3.4V
11011: 3.5V
111xx: 3.5V

- **BUCK4_SLP_VSEL (REG[39]): BUCK4 SLEEP REGISTER**

ADDRESS: 39H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	BUCK4_SLP_FPWM	RESV		BUCK4_SLP_VSEL
DEFAULT	0	0	0	Boot0:11001；Boot1:OTP

Description

Bit 7 BUCK4_SLP_FPWM:
1: force PWM mode in sleep mode
0: PWM/PFM auto change mode(default)
Bit 6-5 RESV: Reserved
Bit 4-0 BUCK4_SLP_VSEL:BUCK4 sleep mode voltage, 0.8V~3.5V, step=100mV
00000: 0.8V
00001: 0.9V
……
11001: 3.3V
11010: 3.4V
11011: 3.5V
111xx: 3.5V

- **LDO1_ON_VSEL_REG (REG[3B]): LDO1 ON REGISTER**

ADDRESS: 3BH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	LDO1_IMAX	LDO1_DISCHRG_EN	LDO1_ON_VSEL				
DEFAULT	0	0	1	Boot0:00010；Boot1:OTP				

Description

Bit 7 RESV: Reserved
Bit 6 LDO1_IMAX: LDO1 current limit
0: normal， 1: 130%*normal
Bit 5 LDO1_DISCHRG_EN: LDO1 discharge resistor enable bit when shut down
0: disable discharge resistor when shut down
1: enable discharge resistor when shut down
Bit 4-0 LDO1_ON_VSEL: LDO1 active mode voltage，0.8V~3.4V， step=0.1V
00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO1_SLP_VSEL_REG (REG[3C]): LDO1 SLEEP REGISTER**

ADDRESS: 3CH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			LDO1_SLP_VSEL				
DEFAULT	0	0	0	Boot0:00010；Boot1:OTP				

Description

Bit 7-5 RESV: Reserved
Bit 4-0 LDO1_SLP_VSEL: LDO1 sleep mode voltage，0.8V~3.4V， step=0.1V

00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO2_ON_VSEL_REG (REG[3D]): LDO2 ON REGISTER**

ADDRESS: 3DH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	LDO2_IMAX	LDO2_DISCHRG_EN	LDO2_ON_VSEL				
DEFAULT	0	0	1	Boot0:01010；Boot1:OTP				

Description

Bit 7 RESV: Reserved
Bit 6 LDO2_IMAX: LDO2 current limit
0: normal， 1: 130%*normal
Bit 5 LDO2_DISCHRG_EN: LDO2 discharge resistor enable bit when shut down
0: disable discharge resistor when shut down
1: enable discharge resistor when shut down
Bit 4-0 LDO2_ON_VSEL: LDO2 active mode voltage，0.8V~3.4V， step=0.1V
00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO2_SLP_VSEL_REG (REG[3E]): LDO2 SLEEP REGISTER**

ADDRESS: 3EH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			LDO2_SLP_VSEL				
DEFAULT	0	0	0	Boot0:01010；Boot1:OTP				

Description

Bit 7-5 RESV: Reserved
Bit 4-0 LDO2_SLP_VSEL: LDO2 sleep mode voltage，0.8V~3.4V， step=0.1V
00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO3_ON_VSEL_REG (REG[3F]): LDO3 ON REGISTER**

ADDRESS: 3FH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	LDO3_IMAX	LDO3_DISCHRG_EN	LDO3_ON_VSEL				
DEFAULT	0	0	1	Boot0:00011；Boot1:OTP				

Description	
Bit 7	RESV: Reserved
Bit 6	LDO3_IMAX: LDO3 current limit 0: normal， 1: 130%*normal
Bit 5	LDO3_DISCHRG_EN: LDO3 discharge resistor enable bit when shut down 0: disable discharge resistor when shut down 1: enable discharge resistor when shut down
Bit 4-0	LDO3_ON_VSEL: LDO3 active mode voltage，0.8V~3.4V， step=0.1V 00000: 0.8V 00001: 0.9V …. 11001: 3.3V 11010: 3.4V

- **LDO3_SLP_VSEL_REG (REG[40]): LDO3 SLEEP REGISTER**

ADDRESS: 40H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			LDO3_SLP_VSEL				
DEFAULT	0	0	0	Boot0:00011；Boot1:OTP				

Description	
Bit 7-5	RESV: Reserved
Bit 4-0	LDO3_SLP_VSEL: LDO3 sleep mode voltage，0.8V~3.4V， step=0.1V 00000: 0.8V 00001: 0.9V …. 11001: 3.3V 11010: 3.4V

- **LDO4_ON_VSEL_REG (REG[41]): LDO4 ON REGISTER**

ADDRESS: 41H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	LDO4_IMAX	LDO4_DISCHRG_EN	LDO4_ON_VSEL				
DEFAULT	0	0	1	Boot0:00010；Boot1:OTP				

Description	
Bit 7	RESV: Reserved
Bit 6	LDO4_IMAX: LDO4 current limit 0: normal， 1: 130%*normal
Bit 5	LDO4_DISCHRG_EN: LDO4 discharge resistor enable bit when shut down 0: disable discharge resistor when shut down 1: enable discharge resistor when shut down
Bit 4-0	LDO4_ON_VSEL: LDO4 active mode voltage，0.8V~3.4V， step=0.1V 00000: 0.8V 00001: 0.9V ….

11001: 3.3V
11010: 3.4V

- **LDO4_SLP_VSEL_REG (REG[42]): LDO4 SLEEP REGISTER**

ADDRESS: 42H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			LDO4_SLP_VSEL				
DEFAULT	0	0	0	Boot0:00010；Boot1:OTP				

Description

Bit 7-5 RESV: Reserved
Bit 4-0 LDO4_SLP_VSEL: LDO4 sleep mode voltage，0.8V~3.4V， step=0.1V
00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO5_ON_VSEL_REG (REG[43]): LDO5 ON REGISTER**

ADDRESS: 43H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	LDO5_IMAX	LDO5_DISCHRG_EN	LDO5_ON_VSEL				
DEFAULT	0	0	1	Boot0:10110；Boot1:OTP				

Description

Bit 7 RESV: Reserved
Bit 6 LDO5_IMAX: LDO4 current limit
0: normal， 1: 130%*normal
Bit 5 LDO5_DISCHRG_EN: LDO5 discharge resistor enable bit when shut down
0: disable discharge resistor when shut down
1: enable discharge resistor when shut down
Bit 4-0 LDO5_ON_VSEL: LDO5 active mode voltage，0.8V~3.4V， step=0.1V
00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO5_SLP_VSEL_REG (REG[44]): LDO5 SLEEP REGISTER**

ADDRESS: 44H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			LDO5_SLP_VSEL				
DEFAULT	0	0	0	Boot0:10110；Boot1:OTP				

Description

Bit 7-5 RESV: Reserved
Bit 4-0 LDO5_SLP_VSEL: LDO5 sleep mode voltage，0.8V~3.4V， step=0.1V

00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO6_ON_VSEL_REG (REG[45]): LDO6 ON REGISTER**

ADDRESS: 45H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	LDO6_IMAX	LDO6_DISCHRG_EN	LDO6_ON_VSEL				
DEFAULT	0	0	1	Boot0:10110；Boot1:OTP				

Description

Bit 7 RESV: Reserved
Bit 6 LDO6_IMAX: LDO6 current limit
0: normal， 1: 130%*normal
Bit 5 LDO6_DISCHRG_EN: LDO6 discharge resistor enable bit when shut down
0: disable discharge resistor when shut down
1: enable discharge resistor when shut down
Bit 4-0 LDO6_ON_VSEL: LDO6 active mode voltage，0.8V~3.4V， step=0.1V
00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

- **LDO6_SLP_VSEL_REG (REG[46]): LDO6 SLEEP REGISTER**

ADDRESS: 46H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			LDO6_SLP_VSEL				
DEFAULT	0	0	0	Boot0:10110；Boot1:OTP				

Description

Bit 7-5 RESV: Reserved
Bit 4-0 LDO6_SLP_VSEL: LDO6 sleep mode voltage，0.8V~3.4V， step=0.1V
00000: 0.8V
00001: 0.9V
….
11001: 3.3V
11010: 3.4V

5.2.6 Interrupt Registers

- **INT_STS_REG1 (REG[49]): INTERRUPT STATUS REGISTER 1**

ADDRESS: 49H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHRG_IN_CLAMP	PWRON_RISE_INT (Write 1	PWRON_FALL_INT (Write 1 clr)	CCCV_T_CNT				

		clr)						
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 CHRG_IN_CLAMP**:** USB input current limit or input voltage limit or constant temperature occur.

Bit 6 PWRON_RISE_INT: PWRON rising event interrupt

Bit 5 PWRON_FALL _INT: PWRON falling event interrupt

Bit 4-0 CCCV_T_CNT**:** Charger CCCV timer counter, the unit is hour.

Note: 1: interrupt occurs, write "1" clear. 0: No interrupt occurs

- **INT_MSK_REG1 (REG[4A]): INTERRUPT MASK REGISTER 1**

ADDRESS: 4AH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	PWRON_RISE_IM	PWRON_FALL_IM	RESV				
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 RESV: Reserved

Bit 6 PWRON_RISE_IM: PWRON rising event interrupt mask

Bit 5 PWRON_FALL_IM: PWRON falling event interrupt mask

Bit 4-0 RESV: Reserved

- **INT_STS_REG2 (REG[4C]): INTERRUPT STATUS REGISTER 2**

ADDRESS: 4CH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	USB_OV_INT(Write 1 clr or RegA3<7>=0 clr	RTC_PERIOD_INT (Write 1 clr)	RTC_ALARM_INT (Write 1 clr)	HOTDIE_INT (Write 1 clr)	PWRON_LP_INT (Write 1 clr)	PWRON_INT (Write 1 clr)	VB_LO_INT (Write 1 clr)	RESV
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 USB_OV_INT: USB over voltage event interrupt.

Bit 6 RTC_PERIOD_INT: RTC period event interrupt

Bit 5 RTC_ALARM_INT: RTC alarm event interrupt

Bit 4 HOTDIE_INT: Hot die event interrupt

Bit 3 PWRON_LP_INT: PWRON PIN long press event interrupt

Bit 2 PWRON_INT: PWRON event interrupt

Bit 1 VB_LO_INT: System low voltage alarm event interrupt

Bit 0 RESV: Reserved

Note: 1: interrupt occurs, write "1" clear. 0: No interrupt occurs

- **INT_MSK_REG2 (REG[4D]): INTERRUPT MASK REGISTER 2**

ADDRESS: 4DH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	USB_OV _IM	RTC_PERIOD_IM	RTC_ALARM_IM	HOTDIE_IM	PWRON_LP_IM	PWRON_IM	VB_LO_IM	RESV
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7	USB_OV_IM: USB over voltage event interrupt mask
Bit 6	RTC_PERIOD_IM: RTC period event interrupt mask
Bit 5	RTC_ALARM_IM: RTC alarm event interrupt mask
Bit 4	HOTDIE_INT: Hot die event interrupt mask
Bit 3	PWRON_LP_IM: PWRON PIN long press event interrupt mask.
Bit 2	PWRON_IM: PWRON event interrupt mask
Bit 1	VB_LO_IM: System low voltage alarm event interrupt status mask
Bit 0	RESV: Reserved

- **INT_STS_REG3 (REG[4E]): INTERRUPT STATUS REGISTER 3**

ADDRESS: 4EH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	DISCHG_ILIM_INT (Write 1 clr)	CHG_CVTLIM_INT (Write 1 clr or RegA3<7>=0 clr)	RESV	CHGTS_INT (Write 1 clr or RegA3<7>=0 clr)	CHGTE_INT (Write 1 clr or RegA3<7>=0 clr)	CHGOK_INT (Write 1 clr or RegA3<7>=0 clr)	PLUG_OUT_INT (Write 1 clr)	PLUG_IN_INT (Write 1 clr)
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7	DISCHG_ILIM_INT: Discharging triggering current limit event interrupt.
Bit 6	CHG_CVTLIM_INT: Charging triggering input voltage limit, or current limit, or temperature protection event interrupt.
Bit 5	RESV: Reserved
Bit 4	CHGTS_INT: TS value exceeding upper or lower limits event interrupt.
Bit 3	CHGTE_INT: Charging overtime event interrupt.
Bit 2	CHGOK_INT: Charging termination event interrupt
Bit 1	PLUG_OUT_INT: charger plug out event interrupt(PLUG_IN_STS falling edge interrupt)
Bit 0	PLUG_IN_INT: charger plug in event interrupt(PLUG_IN_STS rising edge interrupt)
Note:	1: interrupt occurs, write "1" clear. 0: No interrupt occurs

- **INT_STS_MSK_REG2 (REG[4F]): INTERRUPT MASK REGISTER 3**

ADDRESS: 4FH	TYPE: RW

Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	DISCHG_ILIM_IM	CHG_CVTLIM_IM	RESV	CHGTS_IM	CHGTE_IM	CHGOK _IM	PLUG_OUT_IM	PLUG_IN_IM
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 DISCHG_ILIM_IM: Discharging triggering current limit event interrupt mask
Bit 6 CHG_CVTLIM_IM: Charging triggering input voltage limit, or current limit, or temperature protection event interrupt mask.
Bit 5 RESV: Reserved
Bit 4 CHGTS_IM: TS value exceeding upper or lower limits event interrupt mask
Bit 3 CHGTE_IM: Charging overtime event interrupt mask
Bit 2 CHGOK_IM: Charging termination event interrupt mask
Bit 1 PLUG_OUT_IM: Charger plug out event interrupt mask
Bit 0 PLUG_IN_IM: Charger plug in event interrupt mask
Note: 1: interrupt occurs, write "1" clear. 0: No interrupt occurs

- **GPIO_IO_POL_REG (REG[50]): GPIO CONTROL /IO POLARITY REGISTER**

ADDRESS: 50H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV			TS_GPIO_IO	TS_GPIO_DATA	TS_GPIO_FUN	SLP_POL	INT_POL
DEFAULT	0	0	1	0	0	1	1	0

Description

Bit 7-5 RESV: Reserved
Bit 4 TS_GPIO_IO: TS/GPIO1 pin IO definition bit
1: output， 0: input
Bit 3 TS_GPIO_DATA: TS/GPIO1 pin data bit
Bit 2 TS_GPIO_FUN: TS/GPIO1 function selection bit
1: GPIO function， 0: TS function
Bit 1 SLP_POL: SLEEP pin polarity
1: Active high， 0: Active low
Bit 0 INT_POL: INT pin polarity
1: Active high， 0: Active low

5.2.7 Charger，Boost And OTG Config Registers

- **OTG_BUCK_LDO_CONFIG_REG (REG[2A]): OTG, BUCK AND LDO CONFIG REGISTER**

ADDRESS: 2AH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK12_PAR_A	OTG_ILIM		OTG_DISCHRG	RESV	BUCK12_PAR	BUCK_SLP_LP_	LDO_SLP_LP

	LWAYSON_EN			_EN		_EN	EN	_EN
DEFAULT	0	0	0	0	0	OTP	0	0

Description

Bit 7 BUCK12_PAR_ALWAYSON_EN:
1: BUCK1 and BUCK2 work together during light load when in parallel
0: Only BUCK1 work during light load when in parallel

Bit 6-5 OTG_ILIM: OTG current limit set
00: 0.85A (must be 00)

Bit 4 OTG_DISCHRG_EN: OTG discharge resistor enable bit when shut down
1: enable the OTG discharge resistor when shut down， 0: disable

Bit 3 RESV: Reserved

Bit 2 BUCK12_PAR_EN:
1: enable BUCK1 and BUCK2 work in parallel， 0: disable

Bit 1 BUCK_SLP_LP_EN:
1: enable BUCK work in low power mode in sleep mode， 0: disable

Bit 0 LDO_SLP_LP_EN:
1: enable LDO work in low power mode in sleep mode， 0: disable

- **CHRG_CONFIG_REG (REG[2B]): CHARGER CONFIG REGISTER**

ADDRESS: 2BH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	CHRG_PHASE	RESV	CHRG_ILMAX /BOOST_IMAX		CHRG_ILMIN		
DEFAULT	0	0	1	0	1	0	1	0

Description

Bit 7 RESV: Reserved

Bit 6 CHRG_PHASE:
0: normal， 1: reverse

Bit 5 RESV: Reserved

Bit 3-2 CHRG_ILMAX: charger maximum inductor’s peak current limit
00: 2A， 01:2.5A， 10: 3A， 11: 3.5A
BOOST_IMAX: BOOST maximum peak current limit
00:2.5A， 01:3A， 10:4A， 11:5A

Bit 1-0 CHRG_ILMIN: charger minimum inductor’s peak current
000: 200mA， 001:300mA， 010: 400mA， 011: 500mA
100: 650mA， 101:750mA， 110: 850mA， 111: 950mA

- **BOOST_CON_REG(REG[52]): BOOST CONTROL REGISTER**

ADDRESS: 52H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV		CHG_ILMIN_ENB	BST_CLAMPLO_EN	RESV			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-6	RESV: Reserved
Bit 5	CHG_ILMIN_ENB: Charger ILMIN Enable 0：Disable ILMIN; **1：Disable ILMIN （It must be disable）**
Bit 4	BST_CLAMPLO_EN: BOOST Clamp Enable **1: Enable clamp（it must be enable）**； 0:Disable clamp
Bit 3-0	RESV: Reserved

- **BOOST_ON_VSEL_REG (REG[54]): BOOST ON REGISTER**

ADDRESS: 54H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BOOST_ON_VSEL			RESV			BST_IR_LOOP_EN	BST_BURST_EN
DEFAULT	0	1	1	1	0	0	1	1

	Description
Bit 7-5	BOOST_ON_VSEL: BOOST active mode voltage，4.7V~5.4V， step=0.1V 000: 4.7V， 001: 4.8V， 010: 4.9V， 011:5.0V 100: 5.1V， 101: 5.2V， 110: 5.3V， 111:5.4V
Bit 4-2	RESV: Reserved
Bit 1	BOOST_IR_LOOP_EN: BOOST zero current optimization function enable bit 1: enable， 0:disable
Bit 0	BOOST_BURST_EN: BOOST burst mode enable bit 1: enable， 0:disable

- **BOOST_SLP_VSEL_REG (REG[55]): BOOST SLEEP REGISTER**

ADDRESS: 55H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BOOST_SLP_VSEL			RESV				
DEFAULT	0	1	1	0	0	0	0	0

	Description
Bit 7-5	BOOST_SLP_VSEL: BOOST sleep mode voltage，4.7V~5.4V， step=0.1V 000: 4.7V， 001: 4.8V， 010: 4.9V， 011:5.0V 100: 5.1V， 101: 5.2V， 110: 5.3V， 111:5.4V
Bit 4-0	RESV: Reserved

- **CHRG_BOOST_CONFIG_REG (REG[9A]): CHARGER AND BOOST CONFIG REGISTER**

ADDRESS: 9AH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHRG_INCC_ILIM_EN	CHRG_ASYN_EN	BAT_SYS_CMP_DLY		RESV			
DEFAULT	1	1	0	0	0	0	0	0

	Description
Bit 7	CHRG_INCC_ILIM_EN: charger input peak current limit enable bit

1: enable， 0: disable

Bit 6 CHRG_ASYN_EN:

1: enable charger works on asynchronous mode during light load， 0: disable

Bit 5-4 BAT_SYS_CMP_DLY: bat voltage and system voltage comparator delay time

00: 20uS， 10: 10uS， 01: 40uS， 11: 20uS

Bit 3-0 **RESV: Reserved（Do not change the default value）**

- **SUP_STS_REG (REG[A0]): SUPPLY STATUS REGISTER**

ADDRESS: A0H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_EXS (RO)	CHG_STS (RO)			USB_VLIM_EN	USB_ILIM_EN	USB_EXS (RO)	USB_EFF (RO)
DEFAULT	0	0	0	0	1	1	0	0

Description

Bit 7 BAT_EXS: Battery existence monitor

0: No battery, 1: With battery

Bit 6-4 CHG_STS: Charging status

000: No Charging 001:Wakeup current charging 010: Trickle current charging

011: Constant current or constant voltage charging 100: Charging termination

101: USB over voltage 110: Battery temperature fault 111: Charging time fault

Bit 3 USB_VLIM_EN: USB input voltage limit enable control

0: Disable 1: Enable

Bit 2 USB_ILIM_EN: USB input current limit enable control

0: Disable 1: Enable

Bit 1 USB_EXS: USB plug-in monitor

0: No USB plugged in 1: USB plugged in

Bit 0 USB_EFF: USB fault monitor

0: USB fault 1: USB okay

- **USB_CTRL_REG (REG[A1]): USB CONTROL REGISTER**

ADDRESS: A1H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHRG_CT_EN	USB_VLIM_VSEL			RESV	USB_ILIM_SEL		
DEFAULT	0	1	0	0	0	OTP		

Description

Bit 7 CHRG_CT_EN: Charger Thermal fold-back enable

0: Disable 1: Enable

Bit 6-4 USB_VLIM_VSEL: the USB input constant voltage selection

000: 4.0V， 001: 4.1V， 010: 4.2V， 011: 4.3V

100: 4.4V， 101: 4.5V， 110: 4.6V， 111: 4.7V

Bit 3 RESV: Reserved
Bit 2-0 USB_ILIM_SEL: USB input current selection
000: 0.45A， 001: 0.08A， 010: 0.85A， 011: 1A
100: 1.25A， 101: 1.50A， 110: 1.75A， 111: 2A
Note DEFAULT value is set by BOOT

- **CHRG_CTRL_REG1 (REG[A3]): CHARGER CONTROL REGISTER 1**

ADDRESS: A3H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHRG_EN	CHRG_VOL_SEL			RESV	CHRG_CUR_SEL		
DEFAULT	1	0	1	1	0	0	1	1

Description

Bit 7 CHRG_EN: Charger enable
0: Disable 1: Enable
Bit 6-4 CHRG_VOL_SEL: Charging termination voltage selection
000: 4.05V， 001: 4.1V， 010: 4.15V， 011: 4.2V
100: 4.25V， 101: 4.3V， 110,111: 4.35V
Bit 3 RESV: Reserved
Bit 2-0 CHRG_CUR_SEL: Charging current selection
000: 1A， 001: 1.2A， 010: 1.4A， 011: 1.6A
100: 1.8A， 101: 2A， 110: 2.2A， 111: 2.4A

- **CHRG_CTRL_REG2 (REG[A4]): CHARGER CONTROL REGISTER 2**

ADDRESS: A4H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHRG_TERM_SEL		CHRG_TIMER_TRIKL			CHRG_TIMER_CCCV		
DEFAULT	0	1	0	1	0	0	1	0

Description

Bit 7-6 CHRG_TERM_SEL: Charging termination current selection
00:150mA， 01:200mA， 10:300mA， 11:400mA
Bit 5-3 CHRG_TIMER_TRIKL: Trickle current charging time selection
000: 30min， 001: 45min， 010: 60min， 011: 90min
100:120min， 101:150min， 110:180min， 111:210min
Bit 2-0 CHRG_TIMER_CCCV: Constant current/voltage charging timeout threshold selection
000: 4h， 001: 5h， 010: 6h， 011: 8h
100:10h， 101:12h， 110:14h， 111:16h

- **CHRG_CTRL_REG3 (REG[A5]): CHARGER CONTROL REGISTER 3**

ADDRESS: A5H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	SYS_CAN_SD	RESV	CHRG_TERM_ANA_	RESV	CHRG_TIMER_TRIKL	CHRG_TIMER_CCCV_	RESV	

			DIG		_EN	EN		
DEFAULT	1	0	0	0	0	0	1	0

Description

Bit 7 SYS_CAN_SD: Vsys shutdown control with battery as sole power supply
0: Disable， 1: Enable
Bit 6 RESV: Reserved
Bit 5 CHRG_TERM_ANA_DIG: Charging termination flag bit source selection
0: analog， 1: digital
Bit 4 RESV: Reserved
Bit 3 CHRG_TIMER_TRIKL_EN: Trickle current charging timer control
0: Disable， 1: Enable
Bit 2 CHRG_TIMER_CCCV_EN: Constant current/constant voltage timer control
0: Disable， 1: Enable
Bit 1-0 **RESV: Reserved（Do not change the default value）**

- **BAT_CTRL_REG (REG[A6]): BATTERY CONTROL REGISTER**

ADDRESS: A6H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_DIS_ILIM_EN	USB_SYS_EN	RESV			BAT_DISCHRG_ILIM		
DEFAULT	1	1	0	0	0	0	1	1

Description

Bit 7 BAT_DIS_ILIM_EN: Discharging current limit function control
0: Disable， 1: Enable
Bit 6 USB_SYS_EN: USB to system enable control
0: Disable， 1: Enable
Bit 5-3 RESV: Reserved
Bit 2-0 BAT_DISCHRG_ILIM: Discharging current limit selection
000: 2A, 001: 2.5A, 010: 3A, 011: 3.5A, 1xx:4A

- **BAT_HTS_TS_REG (REG[A8]): BATTERY OVER TEMPERATURE THRESHOLD REGISTER**

ADDRESS: A8H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_HTS_TS							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 BAT_HTS_TS: Battery over temperature protection threshold sensed at TS

- **BAT_LTS_TS_REG (REG[A9]): BATTERY UNDER TEMPERATURE THRESHOLD REGISTER**

ADDRESS: A9H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	BAT_LTS_TS							
DEFAULT	1	1	1	1	1	1	1	1

	Description
Bit 7-0	BAT_LTS_TS: Battery low temperature protection threshold sensed at TS

5.2.8 ADC And Fuel Gauge Registers

- **TS_CTRL_REG (REG[AC]): TS CONTROL REGISTER**

ADDRESS: ACH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GG_EN	RESV		TS_FUN	RESV		TS_CUR	
DEFAULT	1	0	0	0	0	0	1	1

	Description
Bit 7	GG_EN: Battery fuel gauge enable control 0: Disable， 1: Enable
Bit 6-5	RESV: Reserved
Bit 4	TS_FUN: TS pin function selection 0: External temperature monitoring（NTC thermistor connected externally） 1:ADC input
Bit 3-2	RESV: Reserved
Bit 1-0	TS_CUR: TS pin output current selection in the temperature monitoring mode 00: 20uA， 01: 40uA, 10: 60uA, 11: 80uA

- **ADC_CTRL_REG (REG[AD]): ADC CONTROL REGISTER**

ADDRESS: ADH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	ADC_VOL_EN	ADC_CUR_EN	ADC_TS_EN	ADC_USB_EN	ADC_PHASE	ADC_CLK_SEL		
DEFAULT	0	0	1	1	0	0	0	0

	Description
Bit 7	ADC_VOL_EN: If GG_EN=0: Battery voltage ADC enable control 0: Disable， 1: Enable
Bit 6	ADC_CUR_EN: If GG_EN=0: Battery current ADC enable control 0: Disable， 1: Enable
Bit 5	ADC_TS_EN: TS ADC enable control 0: Disable， 1: Enable
Bit 4	ADC_USB_EN: USB voltage ADC enable control 0: Disable， 1: Enable
Bit 3	ADC_PHASE: 0: normal， 1: reverse
Bit 2-0	ADC_CLK_SEL: ADC maximum sample time selection 000: 4mS， 001: 8mS， 010: 16mS， 011: 32mS，100: 64mS

101: 128mS, 110: 256mS, 111: 512mS

- **GGCON_REG (REG[B0]): FUEL GAUGE CONTROL REGISTER**

ADDRESS: B0H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CUR_SAMPL_CON_TIMES		ADC_OFF_CAL_INTERV		OCV_SAMPL_INTERV		ADC_CUR_VOL_MODE	CUR_OUT_MODE
DEFAULT	0	1	0	0	1	0	1	0

Description

Bit 7-6 CUR_SAMPL_CON_TIMES: The number of continuous sampling on the battery current ADC
00: 8， 01: 16， 10: 32， 11: 64

Bit 5-4 ADC_OFF_CAL_INTERV<1:0>: ADC's error calibration interval time
00: 8min， 01: 16min， 10: 32min， 11: 48min

Bit 3-2 OCV_SAMPL_INTERV<1:0>: OCV sampling interval time, multiplexing relax voltage sampling interval time.
00: 8min， 01: 16min， 10: 32min， 11: 48min

Bit 1 ADC_CUR_VOL_MODE: Fuel gauge operation mode selection
0:voltage mode， 1:current mode

Bit 0 CUR_OUT_MODE: bat current register data information
0:Average current， 1: Instant current

- **GGSTS_REG (REG[B1]): FUEL GAUGE STATUS REGISTER**

ADDRESS: B1H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	FRAME_SMP_INTERV		FCC_UPD	BAT_CON	RELAX_VOL1_UPD	RELAX_VOL2_UPD	RELAX_STS(RO)	VOL_OUT_MODE
DEFAULT	0	1	0	0	0	0	0	0

Description

Bit 7-6 FRAME_SMP_INTERV: The interval of DATA frame acquisition in the SLEEP mode
00: 0S， 01: 1S， 10: 2S， 11: 3S

Bit 5 FCC_UPD: Flag bit for FCC update
0:NOT， 1:YES (When it is cleared to '0' by users, FCC_GASCNT_REG would be cleared to '0', too.)

Bit 4 BAT_CON: The rising edge detection when the battery is first connected
0:NOT， 1:YES

Bit 3 RELAX_VOL1_UPD: Flag bit for battery voltage1 update in the relaxation state
0:NOT， 1:YES (When it is cleared to '0' by users, RELAX_VOL1_REG and RELAX_CUR1_REG would be cleared to '0', too.)

Bit 2 RELAX_VOL2_UPD: Flag bit for battery voltage2 update in the relaxation state
0:NOT， 1:YES (When it is cleared to '0' by users, RELAX_VOL2_REG and

RELAX_CUR2_REG would be cleared to '0', too.)

Bit 1 RELAX_STS: Flag bit for battery turning to relaxation state
0:NOT in relaxation， 1: in relaxation

Bit 0 VOL_OUT_MODE: bat voltage register data information
0: Average voltage， 1: Instant voltage

- **ZERO_CUR_ADC_REGH (REG[B2]): ZERO CURRENT SENSE HIGH BITS REGISTER**

ADDRESS: B2H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				ZERO_CUR_ADC<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-4 RESV: Reserved
Bit 3-0 ZERO_CUR_ADC<11:8>: Zero current sense value bits<11:8>

- **ZERO_CUR_ADC_REGL (REG[B3]): ZERO CURRENT SENSE LOW BITS REGISTER**

ADDRESS: B3H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	ZERO_CUR_ADC <7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 ZERO_CUR_ADC<7:0>: Zero current sense value bits<7:0>

- **GASCNT_CAL_REG3 (REG[B4]): BAT CAPACITY CALIBRATION REGISTER 3**

ADDRESS: B4H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT_CAL<31:24>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 GASCNT_CAL<31:24>: Calibrated battery capacity value bits <31:24>
Note High bits register must be written first.

- **GASCNT_CAL_REG2 (REG[B5]): BAT CAPACITY CALIBRATION REGISTER 2**

ADDRESS: B5H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT_CAL<23:16>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 GASCNT_CAL<23:16>: Calibrated battery capacity value bits <23:16>

- **GASCNT_CAL_REG1 (REG[B6]): BAT CAPACITY CALIBRATION REGISTER 1**

ADDRESS: B6H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT_CAL<15:8>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	GASCNT_CAL<15:8>: Calibrated battery capacity value bits <15:8>

- **GASCNT_CAL_REG0 (REG[B7]): BAT CAPACITY CALIBRATION REGISTER 0**

ADDRESS: B7H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT_CAL<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	GASCNT_CAL<7:0>: Calibrated battery capacity value bits <7:0>

- **GASCNT_REG3 (REG[B8]): BAT CAPACITY REGISTER 3**

ADDRESS: B8H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT <31:24>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	GASCNT<31:24>: Battery capacity value bits <31:24>
Note	The Battery capacity value <31:0> is signed number, bit <31> is sign bit.

- **GASCNT_REG2 (REG[B9]): BAT CAPACITY REGISTER 2**

ADDRESS: B9H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT <23:16>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	GASCNT<23:16>: Battery capacity value bits <23:16>

- **GASCNT_REG1 (REG[BA]): BAT CAPACITY REGISTER 1**

ADDRESS: BAH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT <15:8>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	GASCNT<15:8>: Battery capacity value bits <15:8>

- **GASCNT_REG0 (REG[BB]): BAT CAPACITY REGISTER 0**

ADDRESS: BBH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GASCNT <7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	GASCNT<7:0>: Battery capacity value bits <7:0>

- **BAT_CUR_REGH (REG[BC]): BAT CURRENT HIGH BITS REGISTER**

ADDRESS: BCH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				BAT_CUR<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	Reserved
Bit 3-0	BAT_CUR<11:8>: Battery current value bits<11:8>
Note	The Battery current value<11:0> is signed number, bit <11> is sign bit. I_{BAT}=(BAT_CUR<11:0>*1800)/(4095*14*R_{Sense}) (unit:mA), R_{Sense} is battery current sense resistance, the unit is mΩ.

- **BAT_CUR_REGL (REG[BD]): BAT CURRENT LOW BITS REGISTER**

ADDRESS: BDH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_CUR<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	BAT_CUR<7:0>: Battery current value bits<7:0>

- **TS_ADC_REGH (REG[BE])：BAT TEMPERATURE HIGH BITS REGISTER**

ADDRESS: BEH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				TS_ADC<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	Reserved
Bit 3-0	TS_ADC<11:8>: TS ADC value bits<11:8>
Note	If NTC resistor ties TS pin to GND, R_{NTC}=(TS_ADC<11:0>*2200)/(4095*I_{TS}) (unit:KΩ), I_{TS} can be programmable by REG AC<1:0>, the unit is 'uA'.

- **TS_ADC_REGHL (REG[BF])：BAT TEMPERATURE LOW BITS REGISTER**

ADDRESS: BFH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	TS_ADC<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 TS_ADC<7:0>: TS ADC value bits<7:0>

- **USB_ADC_REGH (REG[C0])：USB VOLTAGE HIGH BITS REGISTER**

ADDRESS: C0H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				USB_ADC<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-4 Reserved

Bit 3-0 USB_ADC<11:8>: USB voltage value bits<11:8>

Note V_{USB}=2200*2.8*USB_ADC<11:0>/4095 (unit:mV)

- **USB_ADC_REGHL (REG[C1]): USB VOLTAGE LOW BITS REGISTER**

ADDRESS: C1H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	USB_ADC<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 USB_ADC<7:0>: USB voltage value bits<7:0>

- **BAT_OCV_REGH (REG[C2])：BAT OPEN CIRCUIT VOLTAGE HIGH BITS REGISTER**

ADDRESS: C2H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				BAT_OCV<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-4 Reserved

Bit 3-0 BAT_OCV<11:8>: Battery OCV value bits<11:8>

Note V_{ocv}=k*BAT_OCV<11:0>+b (unit:mV), k=(4200-3000)/(VCALIB1<11:0> - VCALIB0<11:0>),
b=4200 - k*VCALIB1<11:0>.

- **BAT_OCV_REGL (REG[C3])：BAT OPEN CIRCUIT VOLTAGE LOW BITS REGISTER**

ADDRESS: C3H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_OCV<7:0>							

DEFAULT	0	0	0	0	0	0	0	0

Description	
Bit 7-0	BAT_OCV<7:0>: Battery OCV voltage value bits<7:0>.

- **BAT_VOL_REGH (REG[C4])：BAT VOLTAGE HIGH BITS REGISTER**

ADDRESS: C4H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				BAT_VOL<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description	
Bit 7-4	Reserved
Bit 3-0	BAT_VOL<11:8>: battery voltage value bits<11:8>.
Note	V_{BAT}=k*BAT_VOL<11:0>+b (unit:mV),k=(4200-3000)/(VCALIB1<11:0> - VCALIB0<11:0>), b=4200 - k*VCALIB1<11:0>.

- **BAT_VOL_REGL (REG[C5])：BAT VOLTAGE LOW BITS REGISTER**

ADDRESS: C5H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_VOL<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description	
Bit 7-0	BAT_VOL<7:0>: battery voltage value bits<7:0>.

- **RELAX_ENTRY_THRES_REGH (REG[C6]): RELAX ENTRY THRESHOLD HIGH BITS REGISTER**

ADDRESS: C6H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				RELAX_ENTRY_THRES<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description	
Bit 7-4	Reserved
Bit 3-0	RELAX_ENTRY_THRES<11:8>: The threshold value bits<11:8> for the battery going into relaxation state
Note	High bits register must be written first.

- **RELAX_ENTRY_THRES_REGL (REG[C7]): RELAX ENTRY THRESHOLD LOW BITS REGISTER**

ADDRESS: C7H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RELAX_ENTRY_THRES<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	RELAX_ENTRY_THRES<7:0>: The threshold value bits<7:0> for the battery going into relaxation state

- **RELAX_EXIT_THRES_REGH (REG[C8]): RELAX EXIT THRESHOLD HIGH BITS REGISTER**

ADDRESS: C8H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				RELAX_EXIT_THRES<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	Reserved
Bit 3-0	RELAX_EXIT_THRES<11:8>: The threshold value bits<11:8> for the battery out of relaxation state
Note	High bits register must be written first.

- **RELAX_EXIT_THRES_REGL (REG[C9]): RELAX EXIT THRESHOLD LOW BITS REGISTER**

ADDRESS: C9H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RELAX_EXIT_THRES<7:0>							
DEFAULT	0	1	1	0	0	0	0	0

	Description
Bit 7-0	RELAX_EXIT_THRES<7:0>: The threshold value bits<7:0> for the battery out of relaxation state

- **RELAX_VOL1_REGH (REG[CA]): RELEX VOLTAGE 1 HIGH BITS REGISTER**

ADDRESS: CAH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				RELAX_VOL1<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	Reserved
Bit 3-0	RELAX_VOL1<11:8>: Voltage1 value bits<11:8> in the relaxation state

- **RELAX_VOL1_REGL (REG[CB]): RELEX VOLTAGE 1 LOW BITS REGISTER**

ADDRESS: CBH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RELAX_VOL1<7:0>							
DEFAULT	0	0	1	1	0	0	0	0

	Description

Bit 7-0 RELAX_VOL1<7:0>: Voltage1 value bits<7:0> in the relaxation state

- **RELAX_VOL2_REGH (REG[CC]): RELEX VOLTAGE 2 HIGH BITS REGISTER**

ADDRESS: CCH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				RELAX_VOL2<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-4 Reserved

Bit 3-0 RELAX_VOL2<11:8>: Voltage2 value bits<11:8> in the relaxation state

- **RELAX_VOL2_REGL (REG[CD]): RELEX VOLTAGE 2 LOW BITS REGISTER**

ADDRESS: CDH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RELAX_VOL2<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 RELAX_VOL2<7:0>: Voltage2 value bits<7:0> in the relaxation state

- **RELAX_CUR1_REGH (REG[CE]): RELEX CURRENT 1 HIGH BITS REGISTER**

ADDRESS: CEH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				RELAX_CUR1<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-4 Reserved

Bit 3-0 RELAX_CUR1<11:8>: Current1 value bits<11:8> in the relaxation state

- **RELAX_CUR1_REGL (REG[CF])：RELEX CURRENT 1 LOW BITS REGISTER**

ADDRESS: CFH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RELAX_CUR1<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 RELAX_CUR1<7:0>: Current1 value bits<7:0> in the relaxation state

- **RELAX_CUR2_REGH (REG[D0])：RELEX CURRENT 2 HIGH BITS REGISTER**

ADDRESS: D0H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				BAT_VOL_R_CALC<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	Reserved
Bit 3-0	RELAX_CUR2<11:8>: Current2 value bits<11:8> in the relaxation state

- **RELAX_CUR2_REGL (REG[D1])：RELEX CURRENT 2 LOW BITS REGISTER**

ADDRESS: D1H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_VOL_R_CALC<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	RELAX_CUR2<7:0>: Current2 value bits<7:0> in the relaxation state

- **CAL_OFFSET_REGH (REG[D2]): ZERO CURRENT CALIBRATION HIGH BITS REGISTER**

ADDRESS: D2H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				CAL_OFFSET_REG<11:8>			
DEFAULT	0	1	1	1	1	1	1	1

	Description
Bit 7-4	Reserved
Bit 3-0	CAL_OFFSET_REG<11:8>: Zero current calibration value bits<11:8>.
Note	High bits register must be written first.

- **CAL_OFFSET_REGL (REG[D3]): ZERO CURRENT CALIBRATION LOW BITS REGISTER**

ADDRESS: D3H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CAL_OFFSET_REG<7:0>							
DEFAULT	1	1	1	1	1	1	1	1

	Description
Bit 7-0	CAL_OFFSET_REG<7:0>: Zero current calibration value bits<7:0>.

- **NON_ACT_TIMER_CNT_REG (REG[D4]): SHUTDOWN TIME REGISTER**

ADDRESS: D4H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	NON_ACT_TIMER_CNT<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	NON_ACT_TIMER_CNT<7:0>: Timer for OFF state（Unit: minute）

- **VCALIB0_REGH (REG[D5]): VOLTAGE 0 CALIBRATION HIGH BITS REGISTER**

ADDRESS: D5H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				VCALIB0<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	Reserved
Bit 3-0	Voltage0 calibration value bits<11:8> for calculating offset error and gain error
Note	The data of VCALIB0<11:0> is the ADC value of 3.0V.

- **VCALIB0_REGL (REG[D6]): VOLTAGE 0 CALIBRATION LOW BITS REGISTER**

ADDRESS: D6H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	VCALIB0<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	Voltage0 calibration value bits<7:0> for calculating offset error and gain error.

- **VCALIB1_REGH (REG[D7]): VOLTAGE 1 CALIBRATION HIGH BITS REGISTER**

ADDRESS: D7H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				VCALIB1<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	Reserved
Bit 3-0	Voltage1 calibration value bits<11:8> for calculating offset error and gain error.
Note	The data of VCALIB1<11:0> is the ADC value of 4.2V.

- **VCALIB1_REGL (REG[D8]): VOLTAGE 1 CALIBRATION LOW BITS REGISTER**

ADDRESS: D8H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	VCALIB1<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	Voltage1 calibration value bits<7:0> for calculating offset error and gain error.

- **FCC_GASCNT_REG3 (REG[D9]): FULL CAPACITY REGISTER 3**

ADDRESS: D9H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	FCC_GASCNT<31:24>							

DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 Full capacity <31:24>

- **FCC_GASCNT_REG2 (REG[D9]): FULL CAPACITY REGISTER 2**

ADDRESS: DAH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	FCC_GASCNT<23:16>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 Full capacity <23:16>

- **FCC_GASCNT_REG1 (REG[DB]): FULL CAPACITY REGISTER 1**

ADDRESS: DBH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	FCC_GASCNT<15:8>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 Full capacity <15:8>

- **FCC_GASCNT_REG0 (REG[DC]): FULL CAPACITY REGISTER 0**

ADDRESS: DCH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	FCC_GASCNT<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 Full capacity <7:0>

- **IOFFSET_REGH (REG[DD]): OFFSET CURRENT HIGH BITS REGISTER**

ADDRESS: DDH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV				IOFFSET<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-4 Reserved

Bit 3-0 Calculated current offset value bits<11:8>

- **IOFFSET_REGL (REG[DE]): OFFSET CURRENT LOW BITS REGISTER**

ADDRESS: DEH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	IOFFSET<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	Calculated current offset value bits<7:0>

- **SLEEP_CON_SAMP_CUR (REG[DF]): SLEEP MODE CONTINUOUS SAMPLE BAT CURRENT THRESHOLD REGISTER**

ADDRESS: DFH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	SLEEP_CON_SAMP_CUR<7:0>							
DEFAULT	0	1	1	0	0	0	0	0

	Description
Bit 7-0	SLEEP_CON_SAMP_CUR<7:0>: In SLEEP mode, if bat current is larger than this threshold, bat current would be taken sample continuously. Or bat current would be taken sample discontinuously.

5.2.9 DATA Registers: DATA(n)_REG (REG[E0]~REG[F2])

Address from [E0] to [F2] are 8-bits data RAM register, it's convenient to be read or written by users.

Chapter 6 Thermal Management

6.1 Overview

For reliability and operability concerns, the absolute maximum junction temperature of RK816B has to be below 125ºC.

Depending on the thermal mechanical design (Smartphone, Tablet, Personal Navigation Device, etc), the system thermal management software and worst case thermal applications, the junction temperature might be exposed to higher values than those specified above.

Therefore, it is recommended to perform thermal simulations at device level (Smartphone, Tablet, Personal Navigation Device, etc) with the measured power of the worst case UC of the device.

6.2 Package Thermal Characteristics

Table 6-1 provides the thermal resistance characteristics for the package used on this device.

Table 6-1 Thermal Resistance Characteristics

PACKAGE (QFN5X5-40)	**POWER(W)**	$\boldsymbol{\theta_{JA}}(℃/\boldsymbol{W})$	$\boldsymbol{\theta_{JB}}(℃/\boldsymbol{W})$	$\boldsymbol{\theta_{JC}}(℃/\boldsymbol{W})$
RK816B	2	36	17	2.3

Note: The testing PCB is based on 4 layers, 114mm x 76 mm, 1.6mm thickness, Ambient temperature is 85°C.

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