

# ***Rockchip RK816B Datasheet***

**Revision 1.6  
Oct.2021**

**Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description</b>
2021-10-27	1.6	Update RK816B-6 sequence and CHRG_TERM_SEL(RegA4) 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

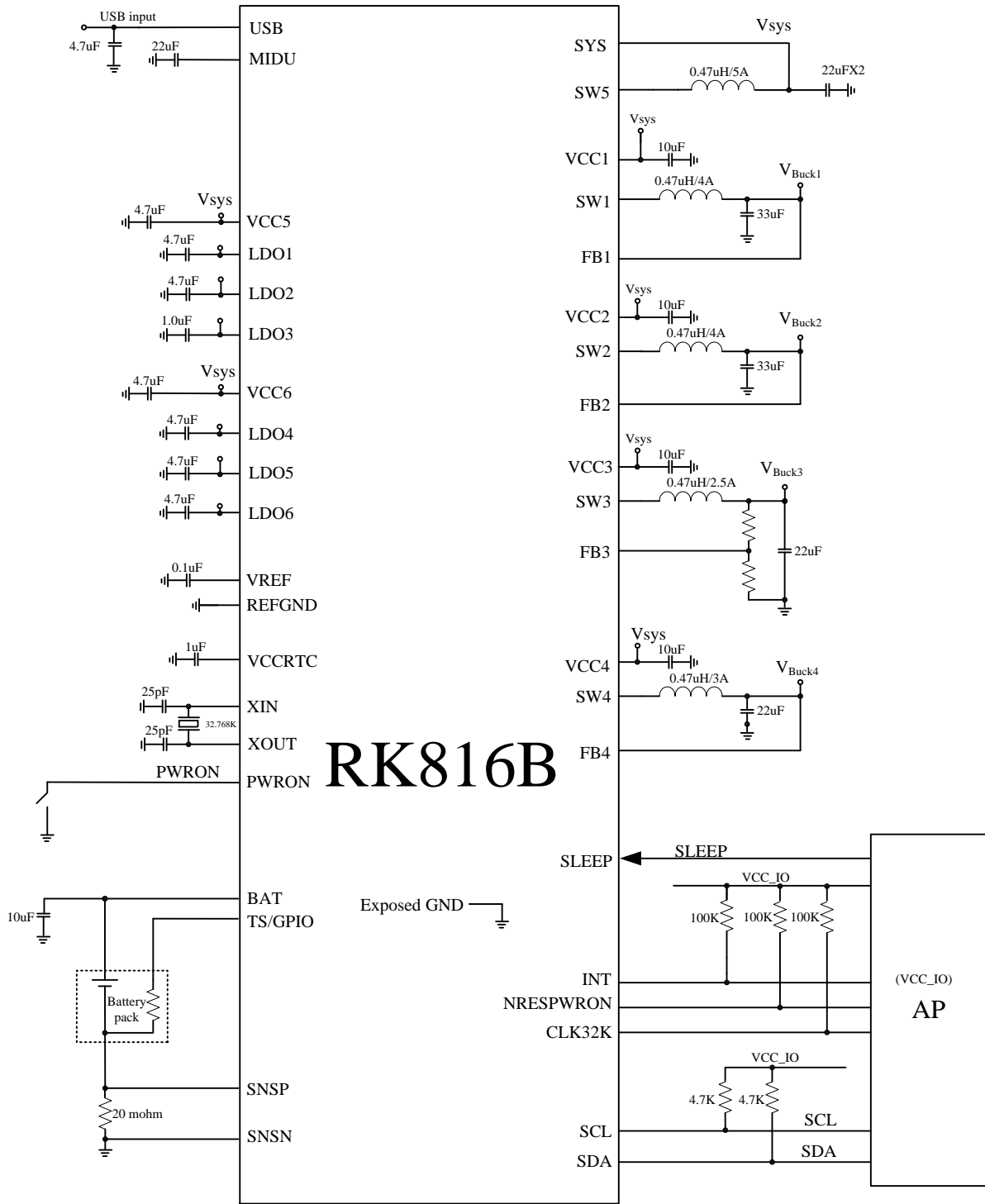


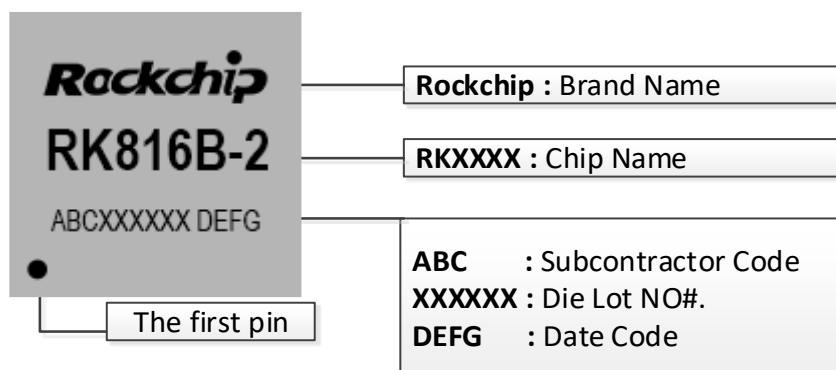
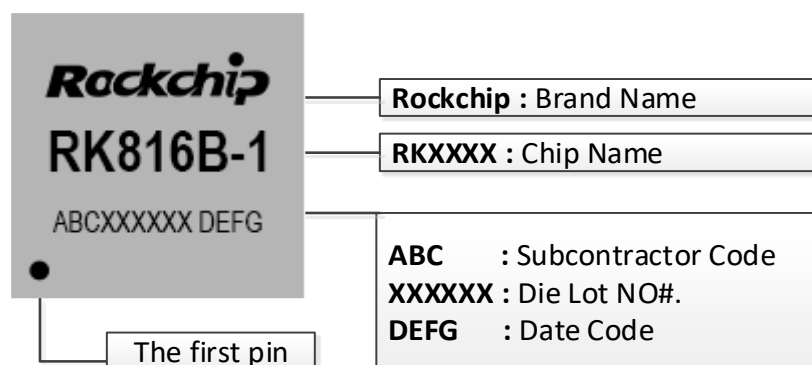
Fig. 1-1 RK816B Typical Application Diagram

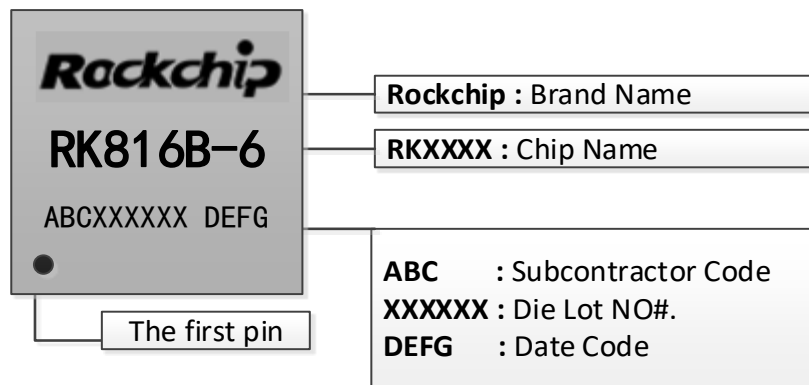
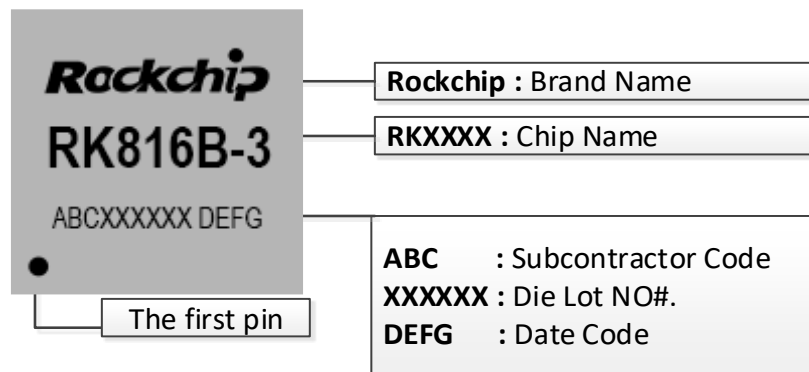
## Chapter 2 Package information

### 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
RK816B-6	RoHS pass	QFN40(5X5)	2000ea/inner box* 5 inner boxes/outer box

### 2.2 Top Marking





### 2.3 Dimension

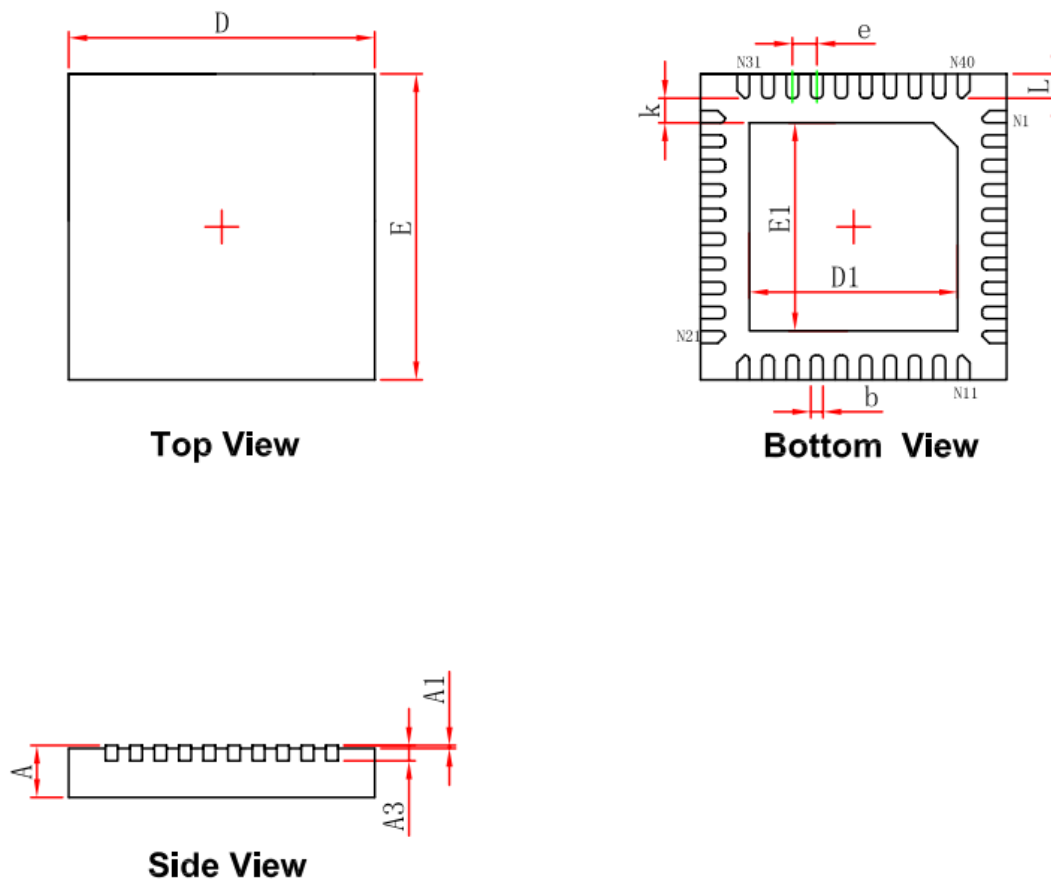


Fig. 2-1 QFN40 5mm X 5mm

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

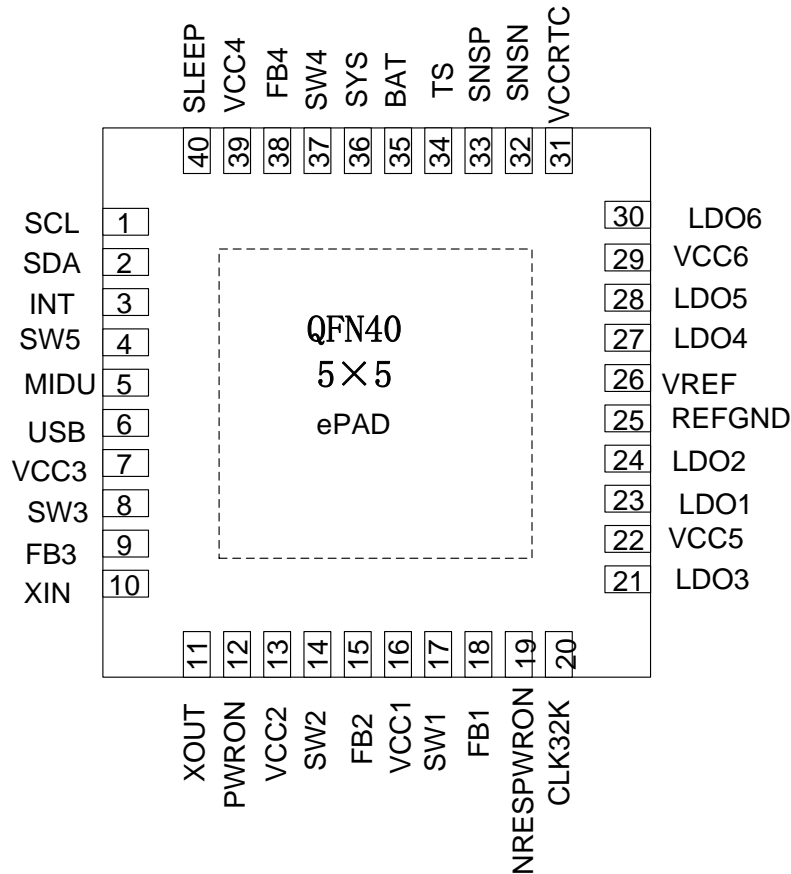


Fig. 2-2 Pin Assignment

## 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.
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

PIN NO	PIN NAME	PIN DESCRIPTION
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 positive 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 <sub>MAX</sub> +0.3	
Voltage range on pins NRESPWRON, INT, SDA, SCL	-0.3	4	V
Storage temperature range, T <sub>s</sub>	-40	150	°C
Operating temperature range, T <sub>j</sub>	-40	125	°C
Maximum Soldering Temperature, T <sub>SOLDER</sub>		300	°C

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: V<sub>USB</sub> = 5.0V, T<sub>A</sub> = 25°C for typical values, unless otherwise noted.

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
<b>USBIN</b>						
USB Operating Range	V <sub>USB</sub>		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 <sub>USB</sub>	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 <sub>PORH</sub>				2.2	V
Maximum USB and BAT Power on Reset Threshold (Falling)	V <sub>PORL</sub>		1.2			V
Over Voltage Lock Out Threshold (USB Rising)	V <sub>TH(OVL0)</sub>		5.7	6.0	6.3	V
Over Voltage Lock Out Hysteresis	V <sub>HYS(OVLO)</sub>			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	IUSBquiet	Charger Enable mode			10	mA
<b>CHARGER</b>						
Terminal Battery Voltage	V <sub>BAT</sub>	VBAT>VRECH, ICHG ≤ IBF Programmable by REG A3<6:4>		4.05		V
				4.1		V
				4.15		V
				4.2		V
				4.25		V
				4.3		V
	accuracy		-0.5		0.5	%
Recharge Threshold at V <sub>BAT</sub>	V <sub>RECH</sub>			V <sub>BAT</sub> - 0.15		V
Recharge Hysteresis				75		mV
Trickle Charge Threshold	V <sub>TRICKLE</sub>		2.85	3.0	3.15	V
Trickle Charge Hysteresis				200		mV
Trickle Charge Current	I <sub>TRICKLE</sub>			10%		I <sub>CC</sub>
Dead bat Charge Threshold	V <sub>DEAD</sub>		1.8	2	2.2	V
Dead bat Charge Hysteresis				200		mV
Dead bat Charge Current	I <sub>DEAD</sub>			70		mA
Termination Charger Current	I <sub>BF</sub>	50mA Step, default=200mA	150		300	mA
BAT Leakage Current	I <sub>BATT</sub>	VBAT=4.2V, SYS float, USB float		20	30	uA
Charge current	I <sub>CC</sub>	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
<b>A/D CONVERTER</b>						
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
<b>SYS INPUT</b>						
SYS Regulation Voltage	V <sub>SYS</sub>	Auto setting		3.6		V
				4.4		V
BAT to SYS Resistance		I <sub>SYS</sub> =200mA , VBAT=4.2V		80		mΩ
BAT to SYS Current Limit	I <sub>BATLIM</sub>	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 <sub>SYSINPU</sub> T		2.7		5.45	V
SYS low alarm voltage, if 3.3V (2.8V~3.5V programmable, step=100mV)	V <sub>BLO</sub>		3.25	3.3	3.35	V
SYS under voltage threshold(2.7V~3.4V programmable, step=100mV)	V <sub>BUVL</sub>			2.7		V
SYS under voltage threshold (vin rising)	V <sub>BUVH</sub>		2.8	2.9	3.0	V
SYS OK voltage threshold (3.3V~3.6V OTP programmable, step=100mV)	V <sub>BOK</sub>			3.4		V
Stand-by current, V <sub>DD</sub> =3.6V, device OFF state 32KHz clock running	I <sub>Q(STNBY)</sub>			45		uA
<b>THERMAL PROTECTION</b>						
Thermal Limit Temperature		10 °C step, default=85 °C	85		115	°C
Thermal Shutdown		20 °C step, default=140 °C	140		160	°C
<b>OSCILLATOR</b>						
Switching Frequency CH1,2,3,4( Tj=25°C )	f <sub>SW</sub>		1.88	2.08	2.28	MHz
<b>LOGIC INPUT</b>						
Input LOW-Level Voltage	V <sub>IL</sub>				0.4	V
Input HIGH-Level Voltage	V <sub>IH</sub>		1.1			V
<b>LOGIC OUTPUT</b>						
LOW-Level Output Voltage, 3.0 mA sink current	V <sub>OL</sub>				1.1	V
HIGH-Level Output Voltage, 3.0 mA source current	V <sub>OH</sub>		0.4			V
<b>CH1: BUCK1</b>						
Input supply voltage range	V <sub>INPUT1</sub>		2.7		5.5	V
Voltage Adjustable Range, 6bit	V <sub>FB1</sub>	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/u s
		BUCK1_RATE=01		6		
		BUCK1_RATE=10		12.5		
		BUCK1_RATE=11		25		
Output over voltage lockout (Vout rising)	V <sub>OV1</sub>			117		%
Preset Voltage, Default( Tj=25°C )	V <sub>FB1(Def</sub> ault)		1.078	1.100	1.122	V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Preset Voltage, Default(-10°C ≤ T <sub>j</sub> ≤ +85°C)	V <sub>FB1</sub> (Default)		1.067	1.100	1.133	V
Load Regulation, I <sub>OUT1</sub> = 200mA to 2A				0.1		%/A
Line Regulation, VCC1 = 3 to 5.5V, I <sub>OUT1</sub> = 2A				0.1		%/V
Rated output current	I <sub>MAX1</sub>	Reg2EH<7:6>=<11>		2		A
Switch Current Limit	I <sub>CL1</sub>	0.5A step, default=3A	2.5		4	A
Operating Quiescent Current, No load, V <sub>DD</sub> =3.8V (Low Power mode)	I <sub>Q1</sub>			40		uA
Minimum Switch Current Limit	I <sub>CLMIN1</sub>	50mA step, default=250mA	150		460	mA
Minimum ON Time	T <sub>on1</sub> (min)			45		ns
Soft-start Time	t <sub>SS1</sub>	Step=400us, default=400us		400		us
C <sub>OUT</sub> Discharge Switch ON Resistance	R <sub>DIS1</sub>			250		ohm
<b>CH2: BUCK2</b>						
Input supply voltage range	V <sub>INPUT2</sub>		2.7		5.5	V
Voltage Adjustable Range, 6bit	V <sub>FB2</sub>	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 (V <sub>out</sub> rising)	V <sub>OV2</sub>			117		%
Preset Voltage, Default( T <sub>j</sub> =25°C )	V <sub>FB2</sub> (Default)		1.078	1.100	1.122	V
Preset Voltage, Default(-10°C ≤ T <sub>j</sub> ≤ +85°C)	V <sub>FB2</sub> (Default)		1.067	1.100	1.133	V
Load Regulation, I <sub>OUT2</sub> = 200 mA to 2A				0.1		%/A
Line Regulation, VCC2 = 3 to 5.5V, I <sub>OUT2</sub> = 2A				0.1		%/V
Rated output current	I <sub>MAX2</sub>	Reg32H<7:6>=<11>		2		A
Switch Current Limit	I <sub>CL2</sub>	0.5A step, default=3A	2.5		4	A
Operating Quiescent Current, No load, V <sub>DD</sub> =3.8V (Low Power mode)	I <sub>Q2</sub>			40		uA
Minimum Switch Current Limit	I <sub>CLMIN2</sub>	50mA step, default=250mA	150		460	mA
Minimum ON Time	T <sub>on2</sub> (min)			45		ns

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Soft-start Time	t <sub>SS2</sub>	Step=400us, default=400us		400		us
C <sub>OUT</sub> Discharge Switch ON Resistance	R <sub>DIS2</sub>			250		ohm
<b>CH3: BUCK3</b>						
Input supply voltage range	V <sub>INPUT3</sub>		2.7		5.5	V
Feedback Voltage, Default( T <sub>j</sub> =25°C )	V <sub>FB3</sub> (Default)		0.784	0.80	0.816	V
Feedback Voltage, Default(-10°C ≤ T <sub>j</sub> ≤ +85°C)	V <sub>FB3</sub> (Default)		0.776	0.80	0.824	V
Output over voltage lockout (V <sub>out</sub> rising)	V <sub>OV3</sub>			117		%
Load Regulation, I <sub>OUT3</sub> = 100mA to 1.0A				0.1		%/A
Line Regulation, V <sub>CC3</sub> = 3 to 5.5V, I <sub>OUT3</sub> = 1A				0.1		%/V
Rated output current	I <sub>MAX3</sub>	Reg36H<4:3>=<11>		1.0		A
Switch Current Limit	I <sub>CL3</sub>	0.5A step, default=2A	1.5		3.0	A
Operating Quiescent Current, No load, V <sub>DD</sub> =3.8V (Low Power mode)	I <sub>Q3</sub>			40		uA
Minimum Switch Current Limit	I <sub>CLMIN3</sub>	50mA step, default=150mA	50		400	mA
Minimum ON Time	T <sub>on3</sub> (min)			45		ns
Soft-start Time	t <sub>SS3</sub>	Step=400us, default=400us		400		us
C <sub>OUT</sub> Discharge Switch ON Resistance	R <sub>DIS3</sub>			250		ohm
<b>CH4: BUCK4</b>						
Input supply voltage range	V <sub>INPUT4</sub>		2.7		5.5	V
Voltage Adjustable Range, 4bit	V <sub>FB4</sub>	Step=100mV	0.8		3.5	V
Feedback Voltage, Default( T <sub>j</sub> =25°C )	V <sub>FB4</sub> (Default)		3.234	3.30	3.366	V
Feedback Voltage, Default(-10°C ≤ T <sub>j</sub> ≤ +85°C)	V <sub>FB4</sub> (Default)		3.201	3.30	3.399	V
Output over voltage lockout (V <sub>out</sub> rising)	V <sub>OV4</sub>			117		%
Load Regulation, I <sub>OUT4</sub> = 100mA to 1A				0.1		%/A
Line Regulation, V <sub>CC4</sub> = 3 to 5.5V, I <sub>OUT4</sub> = 1A				0.1		%/V
Rated output current	I <sub>MAX4</sub>	Reg37H<4:3>=<11>		1		A
Switch Current Limit	I <sub>CL4</sub>	0.5A step, default=2A	1.5		3	A
Operating Quiescent Current, No load,	I <sub>Q4</sub>			40		uA

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

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Operating Quiescent Current, No load, $V_{CC5}=3.8V$ (Low Power mode)	$I_{Q6}$			10		$\mu A$
Current Limit, $V_{OUT6} = V_{OUT6X} 0.95$	$I_{CL6}$		350	500		mA
Soft-start Time	$t_{SS6}$			400		$\mu s$
$C_{OUT}$ Discharge Switch ON Resistance	$R_{DIS6}$			400		ohm
<b>CH7: LDO2</b>						
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( $T_j=25^{\circ}C$ )	$V_{OUT7(D\ default)}$		1.764	1.800	1.836	V
$V_{OUT}$ Output Voltage, Default( $T_j=-10\sim 85^{\circ}C$ )	$V_{OUT7(D\ default)}$		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		$\mu V_{rms}$
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		$\mu A$
Rated output current	$I_{MAX7}$			300		mA
Current Limit, $V_{OUT7} = V_{OUT7X} 0.95$	$I_{CL7}$		350	500		mA
Soft-start Time	$t_{SS7}$			400		$\mu s$
$C_{OUT}$ Discharge Switch ON Resistance	$R_{DIS7}$			400		Ohm
<b>CH8: LDO3</b>						
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( $T_j=25^{\circ}C$ )	$V_{OUT8(D\ default)}$		1.078	1.100	1.122	V
$V_{OUT}$ Output Voltage, Default( $T_j=-10\sim 85^{\circ}C$ )	$V_{OUT8}$ (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		$\mu V_{rms}$
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		$\mu A$
Current Limit, $V_{OUT8} = V_{OUT8X} 0.95$	$I_{CL8}$		150	200		mA
Soft-start Time	$t_{SS8}$			400		$\mu s$
$C_{OUT}$ Discharge Switch ON Resistance	$R_{DIS8}$			400		Ohm
<b>CH9: LDO4</b>						
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( $T_j=25^{\circ}C$ )	$V_{OUT9(D_{default})}$		0.98	1.00	1.02	V
$V_{OUT}$ Output Voltage, Default( $T_j=-10\sim 85^{\circ}C$ )	$V_{OUT9(D_{default})}$		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		$\mu V_{rms}$
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		$\mu A$
Rated output current	$I_{MAX9}$			300		mA
Current Limit, $V_{OUT9} = V_{OUT9X} 0.95$	$I_{CL9}$		350	500		mA
Soft-start Time	$t_{SS9}$			400		$\mu s$
$C_{OUT}$ Discharge Switch ON Resistance	$R_{DIS9}$			400		Ohm
<b>CH10: LDO5</b>						
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( $T_j=25^{\circ}C$ )	$V_{OUT10( Default)}$		2.94	3.00	3.06	V
$V_{OUT}$ Output Voltage, Default( $T_j=-10\sim 85^{\circ}C$ )	$V_{OUT10( Default)}$		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 <sub>OUT</sub> Line Regulation, V <sub>IN10</sub> = 3 to 5V, I <sub>OUT10</sub> = 0.3A				0.01		%/V
Power Supply Reject Ratio (f = 10kHz, V <sub>OUT10</sub> =3.0V)	PSRR10			50		dB
Output noise (10Hz to 100kHz, V <sub>OUT10</sub> =3.0V)	OUT <sub>NOISE10</sub>			300		uVrms
Dropout voltage @ 300mA (V <sub>OUT10</sub> =3.4V)	V <sub>DROP10</sub>			200		mV
Operating Quiescent Current, No load, V <sub>CC6</sub> =3.8V (Low Power mode)	I <sub>Q10</sub>			10		uA
Rated output current	I <sub>MAX10</sub>			300		mA
Current Limit, V <sub>OUT10</sub> = V <sub>OUT10X</sub> 0.95	I <sub>CL10</sub>		350	500		mA
Soft-start Time	t <sub>SS10</sub>			400		us
C <sub>OUT</sub> Discharge Switch ON Resistance	R <sub>DIS10</sub>			400		Ohm
<b>CH11: LDO6</b>						
Input supply voltage range	V <sub>INPUT11</sub>		2.7		5.5	V
V <sub>OUT</sub> Output Voltage Adjustable Range, 5bit(step=100mv)	V <sub>OUT11</sub>		0.8		3.4	V
V <sub>OUT</sub> Output Voltage, Default( T <sub>j</sub> =25°C )	V <sub>OUT11</sub> (Default)		2.94	3.00	3.06	V
V <sub>OUT</sub> Output Voltage, Default( T <sub>j</sub> =-10~85°C )	V <sub>OUT11</sub> (Default)		3.91	3.00	3.09	V
V <sub>OUT</sub> Load Regulation, I <sub>OUT</sub> = 1mA to 300mA				0.005		%/mA
V <sub>OUT</sub> Line Regulation, V <sub>IN11</sub> = 3 to 5V, I <sub>OUT11</sub> = 0.3A				0.015		%/V
Power Supply Reject Ratio (f = 10kHz, V <sub>OUT11</sub> =3.0V)	PSRR11			50		dB
Output noise (10Hz to 100kHz, V <sub>OUT11</sub> =3.0V)	OUT <sub>NOISE11</sub>			300		uVrms
Dropout voltage @ 300mA (V <sub>OUT11</sub> =3.4V)	V <sub>DROP11</sub>			200		mV
Operating Quiescent Current, No load, V <sub>CC6</sub> =3.8V (Low Power mode)	I <sub>Q11</sub>			10		uA
Rated output current	I <sub>MAX11</sub>			300		mA
Current Limit, V <sub>OUT11</sub> = V <sub>OUT11X</sub> 0.95	I <sub>CL11</sub>		350	500		mA
Soft-start Time	t <sub>SS11</sub>			400		us
C <sub>OUT</sub> Discharge Switch ON Resistance	R <sub>DIS11</sub>			400		Ohm
<b>CH12: OTG Switch</b>						
Input supply voltage range	V <sub>INPUT12</sub>		4.7		5.4	V
output current limit	I <sub>CL12</sub>	default=0.875A	0.875		2	A
<b>RTC</b>						
RTC Operating Voltage	V <sub>IN</sub>		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	%
<b>Crystal Recommended</b>						
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	k $\Omega$
Crystal Max Drive Level Spec	DL				1	$\mu$ W
<b>I2C INTERFACE (7 bits slave address is: 0011010)</b>						
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, V<sub>sys</sub> 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 V<sub>sys</sub> is already at 3.6V, which allows the PMIC to start up quickly without having to wait for the V<sub>sys</sub> 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

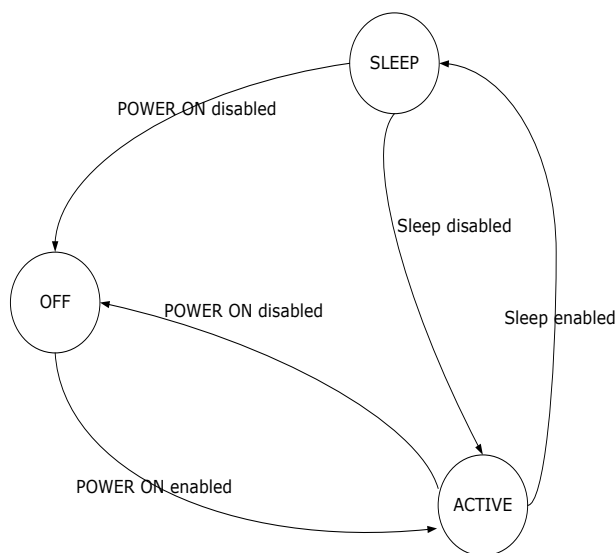


Fig. 4-1 State Machine

## 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

BOOT(OTP)			0 (RK816B-6)	
	Output voltage range	Rate Current	Default voltage	Power up sequence
BUCK1	0.7125V-2.3V (0.7125~1.45V, step 12.5mV)	2A	0.9V	2
BUCK2	0.7125V-2.3V (0.7125~1.45V, step 12.5mV)	2A	0.9V	1
BUCK3	setting by external resistors	1A	x	3
BUCK4	0.8V-3.5V(step 0.1V)	1A	3.3V	4
BOOST	4.7-5.4V(step 0.1V)	2A	5V	OFF
LDO1	0.8V-3.4V(step 0.1V)	300mA	1.8V	OFF
LDO2	0.8V-3.4V(step 0.1V)	300mA	1.8V	2
LDO3	0.8V-3.4V(step 0.1V)	100mA	0.9V	1
LDO4	0.8V-3.4V(step 0.1V)	300mA	3.3V	OFF
LDO5	0.8V-3.4V(step 0.1V)	300mA	3.3V	4
LDO6	0.8V-3.4V(step 0.1V)	300mA	3.3V	4

Table 4-1 Power Start Up Sequence

X: The buck3 voltage is decided by external resistors.

4.6.1 RK816B-1

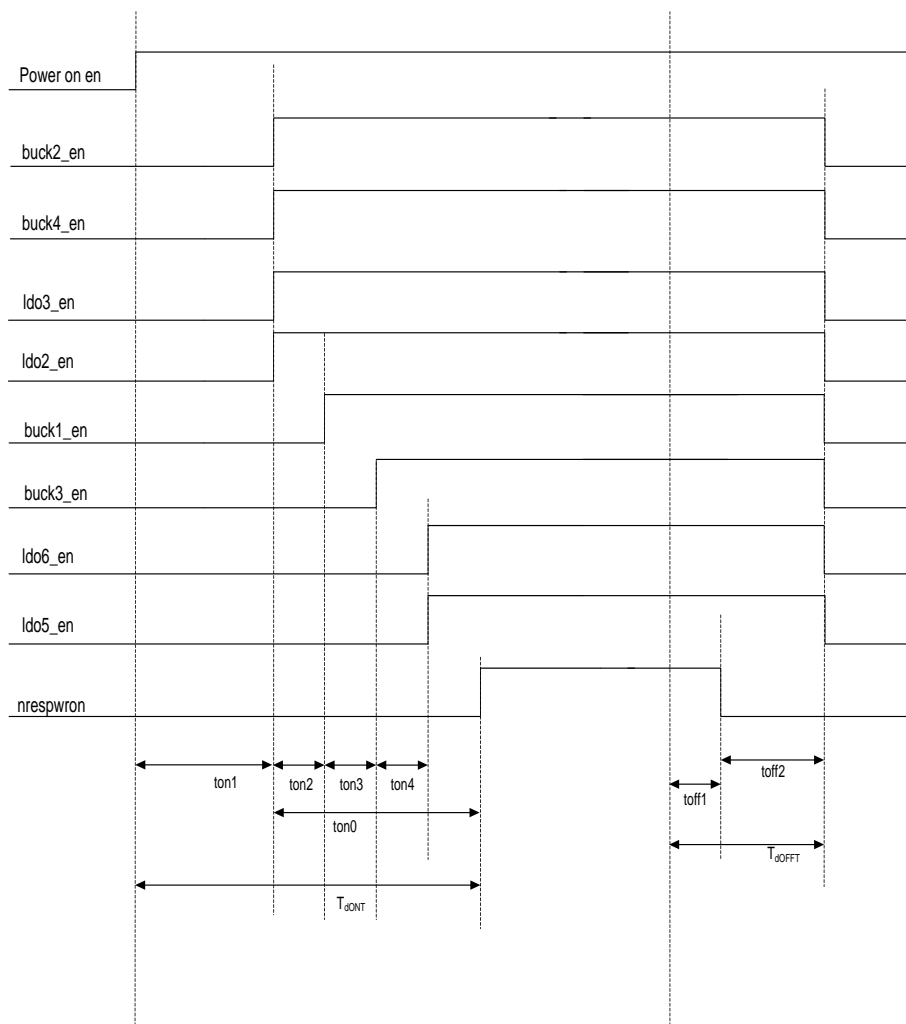


Fig. 4-2 Power On/Off Timing, BOOT1 (RK816B-1)

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 × t <sub>CK32K</sub>		us
Toff2	NRESPWRON falling delay to		2		ms

	supplies disable delay				
--	------------------------	--	--	--	--

Table 4-2 Boot Timing Characteristics

## 4.7 Power Control Timing

### 4.7.1 Device Turn On With USB Plug\_in

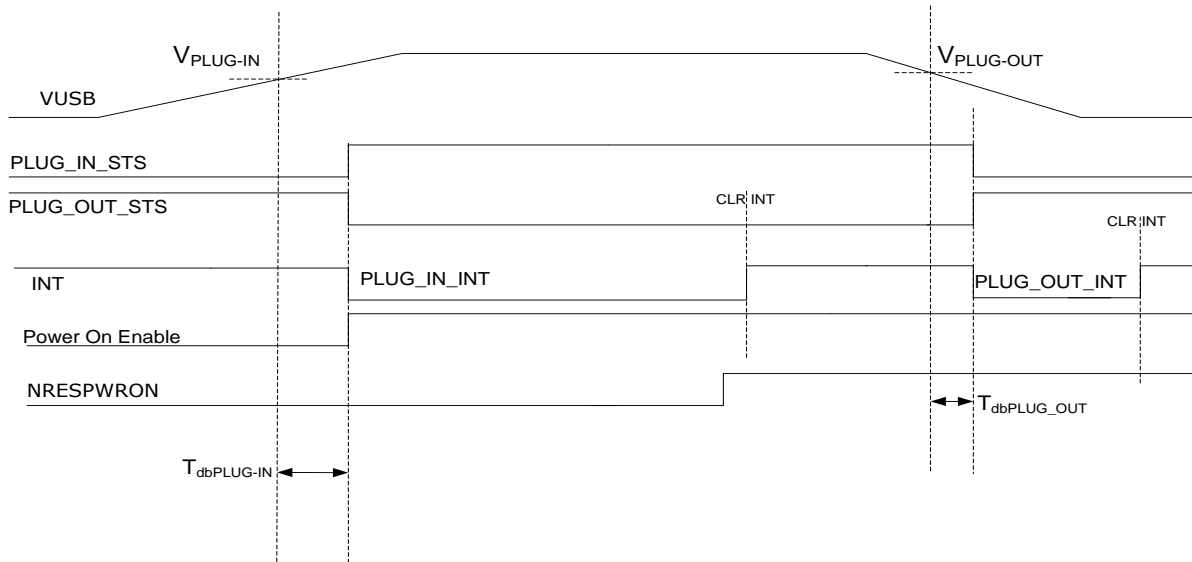


Fig. 4-3 Turn on sequence when USB is plugged in (PLUP\_IN\_INT triggered power on enable)

### 4.7.2 Power Control Timing When Powered By BAT

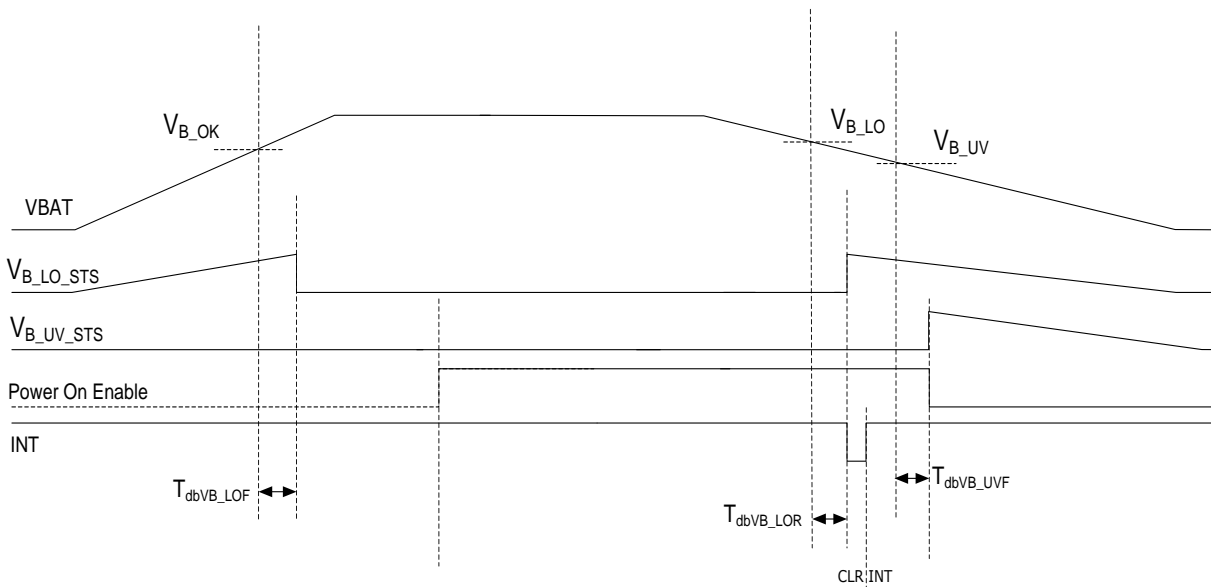


Fig. 4-4 Power Control Timing with VBAT Falling

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

Parameter	Description	Min	Typ	Max	Unit
T <sub>dbVB_LOF</sub>	VB_LO falling-edge de-bouncing delay		2		ms
T <sub>dbVB_LOR</sub>	VB_LO rising-edge de-bouncing delay		2		ms

Parameter	Description	Min	Typ	Max	Unit
T <sub>dbVB_UVF</sub>	VB_UV falling-edge de-bouncing delay		2		ms
T <sub>dbPLUG_IN</sub>	USB plug-in de-bouncing delay		100		ms
T <sub>dbPLUG_OUT</sub>	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

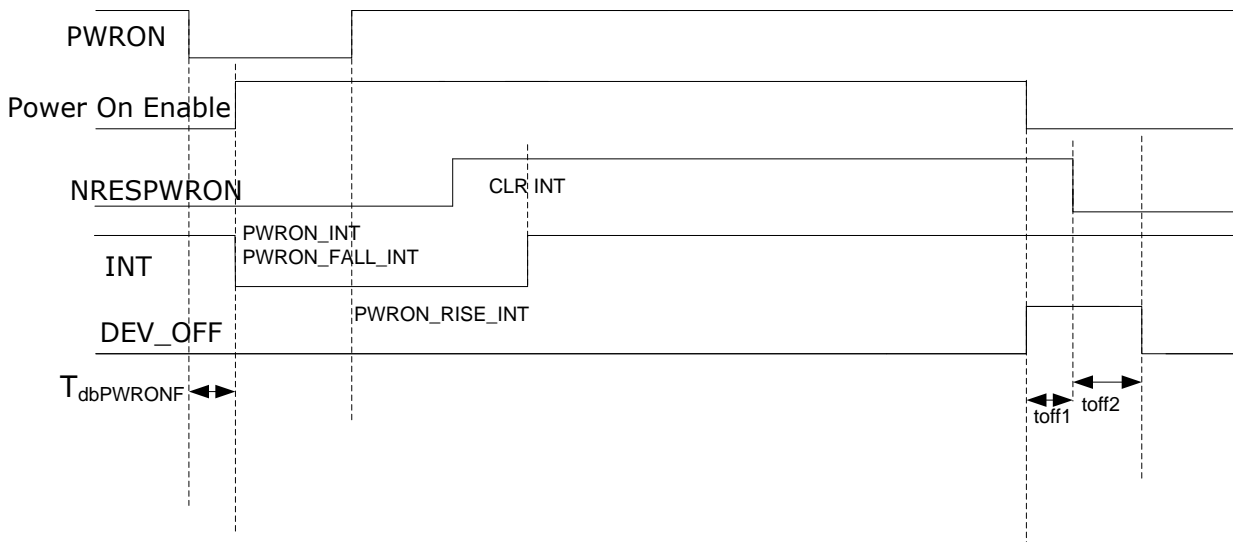


Fig. 4-5 PWRON turn on/DEV\_OFF turn off

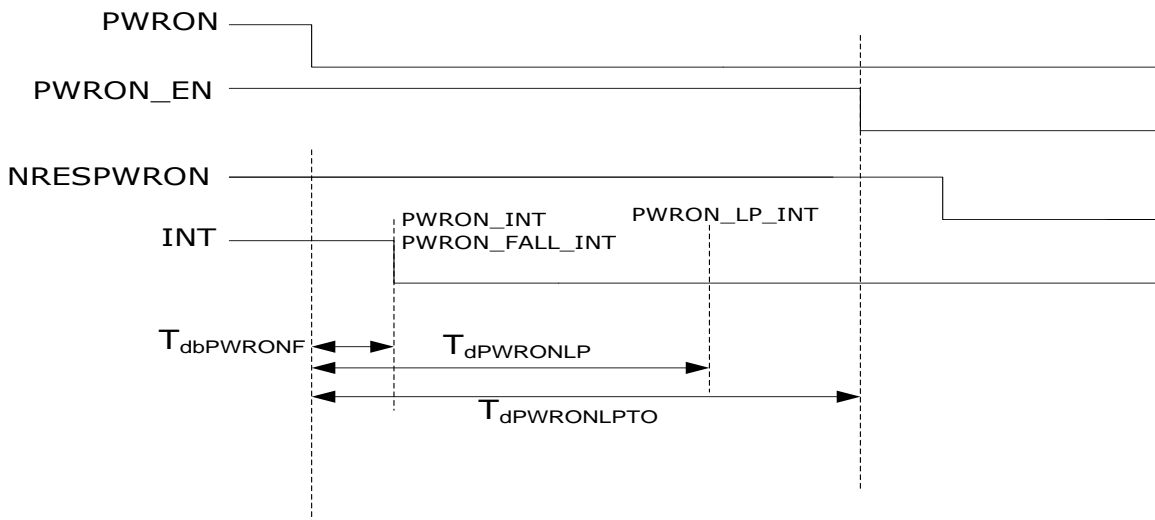


Fig. 4-6 PWRON long press turn off

#### 4.7.5 Timing Characteristics (PWRON, DEV\_OFF)

Parameter	Description	Min	Typ	Max	Unit
T <sub>dbPWRONF</sub>	PWRON falling-edge de-bouncing delay		500		ms
T <sub>dpWRONLNP</sub>	PWRON long press delay to interrupt (PWRON falling edge to PWRON_LP_INT=1)		1		s
T <sub>dpWRONLPTO</sub>	PWRON long press delay to turn off (PWRON falling edge to NRESPWRON)		6		s

	falling edge)			
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Table 4-4 Timing Characteristics of PWRON/DEV\_OFF

4.7.6 SLEEP State Control

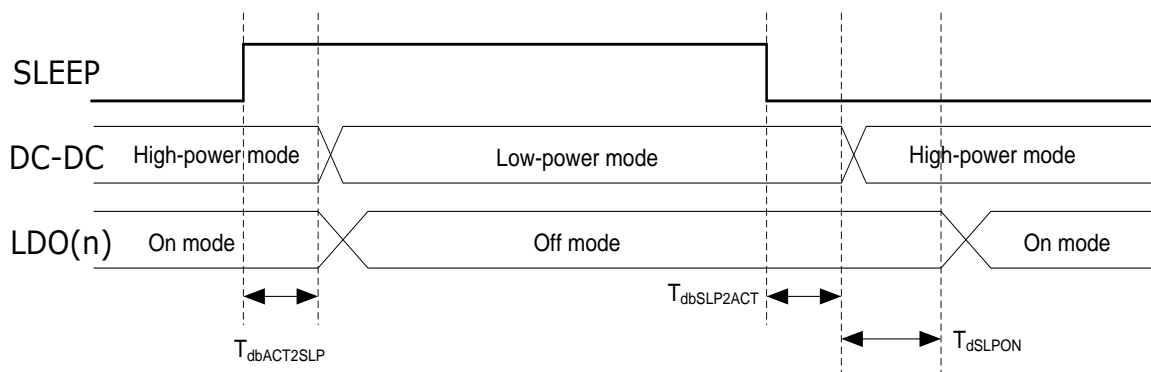


Fig. 4-7 SLEEP/ACTIVE Transition Timing

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
<b>RTC REGISTER</b>			
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
<b>VERSION REGISTER</b>			
17	CHIP_NAME_REG	RO	0x81
18	CHIP_VER_REG	RO	0x61
19	OTP_VER_REG	RO	0000/otp<3:0>
<b>POWER ON/OFF REGISTER</b>			
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
<b>POWER CHANNELS ENABLE REGISTER</b>			
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>
<b>BUCK AND LDO CONFIG REGISTER</b>			
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>
<b>INTERRUPT REGISTER</b>			
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
<b>CHARGER, BOOST AND OTG REGISTER</b>			
2A	OTG_BUCK_LDO_CONFIG_REG	RW	0000/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
<b>ADC AND FUEL GAUGE REGISTER</b>			
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
<b>DATA REGISTER</b>			
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 MINUTES 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	MONTH 1	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				
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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_A M	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_REA DSEL	GET_T IME	SET_32_ COUNTE R	TEST_ MODE	AMPM _MOD E	AUTO _CO MP	ROUND_3 OS (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_I N_ST S (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_ST S (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\_ST S: 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_M ASK	BUCK3 _EN_M ASK	BUCK2 _EN_M ASK	BUCK1 _EN_M ASK	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_E N_MA SK	BOOS T_EN_ MASK	RESV	RESV	OTG_EN	BOOST _EN	RESV
DEFAULT	0	0	0	0	0	Boot0:00 ;		0
						Boot1:OTP		

**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: LDO(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: LDO(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_ON_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_DIS CHRG_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_O N_FPWM	BUCK2_P HASE	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_DISCHR G_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_IM AX	LDO2_DIS CHRG_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_IM AX	LDO3_DIS CHRG_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_IM AX	LDO5_DIS CHRG_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_IM AX	LDO6_DIS CHRG_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_C LAMP	PWRON_R ISE_INT (Write 1	PWRON_FAL L_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_INT	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\_MSK\_REG3 (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_IO	TS_GPIO_IO_DATA	TS_GPIO_FUNC	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\_FUNC: 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

	LWAYS N_EN			_EN		_EN	EN	_EN
DEFAULT	0	0	0	0	0	OTP	0	0

**Description**

- Bit 7 BUCK12\_PAR\_ALWAYS\_ON\_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_P HASE	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_ ILMI N_EN B	BST_CL AMPLO_ 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_L OOP_EN	BST_BU RST_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_IN CC_ILIM _EN	CHRG_ASY N_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_V LIM_E N	USB_I LIM_E N	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  
Analog mode : 00:150mA, 01:200mA, 10:300mA, 11:400mA  
Digital mode : 00:100mA, 01:150mA, 10:200mA, 11:250mA
- 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_C	RESV	CHRG_TE	RESV	CHRG_TIM	CHRG_TIM	RESV	

	AN_SD		RM_ANA_DIG		ER_TRIKL_EN	ER_CCCV_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_V OL_EN	ADC_CU R_EN	ADC_TS_ EN	ADC_U SB_EN	ADC_PH ASE	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),  $k=(4200-3000)/(V_{CALIB1}<11:0> - V_{CALIB0}<11:0>)$ ,  
 $b=4200 - k*V_{CALIB1}<11:0>$ .

● **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), $k=(4200-3000)/(V_{CALIB1}<11:0> - V_{CALIB0}<11:0>)$ ,  
 $b=4200 - k*V_{CALIB1}<11:0>$ .

● **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
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**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 125°C.

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

<b>PACKAGE (QFN5X5-40)</b>	<b>POWER(W)</b>	$\theta_{JA}$ (°C/W)	$\theta_{JB}$ (°C/W)	$\theta_{JC}$ (°C/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.*