Rockchip RK818 Datasheet

Revision 1.0
July.2017

Revision History

Date	Revision	Description
2017-7-24	1.0	Update mark information
2015-5-12	0.3	Update
2015-3-10	0.1	Initial release

Table of Content

Figure Index

Table Index

Warranty Disclaimer

Rockchip Electronics Co., Ltd makes no warranty, representation or guarantee (expressed, implied, statutory, or otherwise) by or with respect to anything in this document, and shall not be liable for any implied warranties of non-infringement, merchantability or fitness for a particular purpose or for any indirect, special or consequential damages.

Information furnished is believed to be accurate and reliable. However, Rockchip Electronics Co., Ltd assumes no responsibility for the consequences of use of such information or for any infringement of patents or other rights of third parties that may result from its use.

Rockchip Electronics Co., Ltd's products are not designed, intended, or authorized for using as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Rockchip Electronics Co., Ltd's product could create a situation where personal injury or death may occur, should buyer purchase or use Rockchip Electronics Co., Ltd's products for any such unintended or unauthorized application, buyers shall indemnify and hold Rockchip Electronics Co., Ltd and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, expenses, and reasonable attorney fees arising out of, either directly or indirectly, any claim of personal injury or death that may be associated with such unintended or unauthorized use, even if such claim alleges that Rockchip Electronics Co., Ltd was negligent regarding the design or manufacture of the part.

Copyright and Patent Right

Information in this document is provided solely to enable system and software implementers to use Rockchip Electronics Co., Ltd 's products. There are no expressed or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Rockchip Electronics Co., Ltd does not convey any license under its patent rights nor the rights of others.
All copyright and patent rights referenced in this document belong to their respective owners and shall be subject to corresponding copyright and patent licensing requirements.

Trademarks

Rockchip and Rockchip™ logo and the name of Rockchip Electronics Co., Ltd's products are trademarks of Rockchip Electronics Co., Ltd. and are exclusively owned by Rockchip Electronics Co., Ltd. References to other companies and their products use trademarks owned by the respective companies and are for reference purpose only.

Confidentiality

The information contained herein (including any attachments) is confidential. The recipient hereby acknowledges the confidentiality of this document, and except for the specific purpose, this document shall not be disclosed to any third party.

Reverse engineering or disassembly is prohibited.

ROCKCHIP ELECTRONICS CO.,LTD. RESERVES THE RIGHT TO MAKE CHANGES IN ITS PRODUCTS OR PRODUCT SPECIFICATIONS WITH THE INTENT TO IMPROVE FUNCTION OR DESIGN AT ANY TIME AND WITHOUT NOTICE AND IS NOT REQUIRED TO UNDATE THIS DOCUMENTATION TO REFLECT SUCH CHANGES.

Chapter 1 Introduction

1.1 Overview

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

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

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

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

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

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

1.2 Feature

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

1.3 Typical Application Diagrams

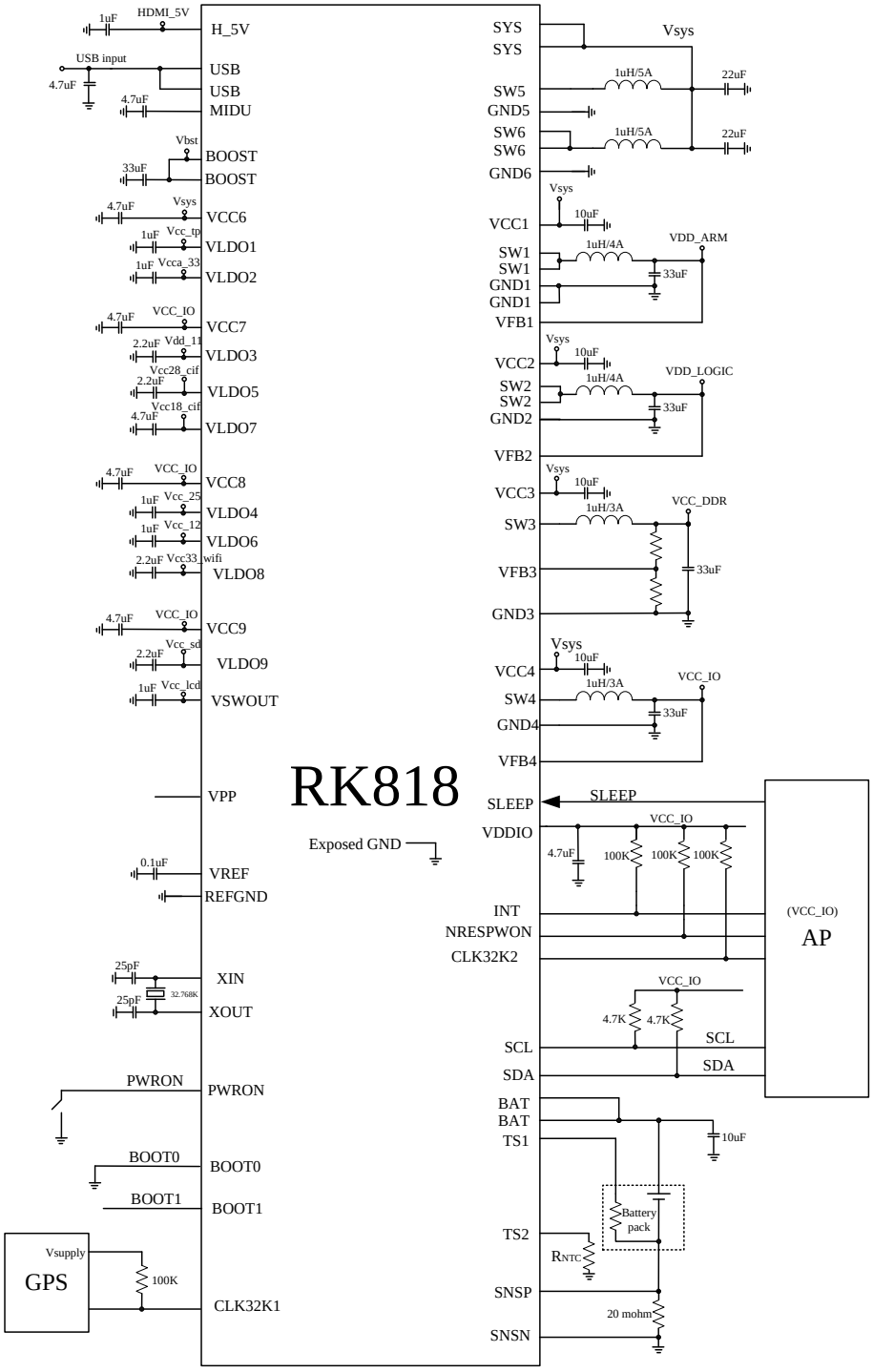


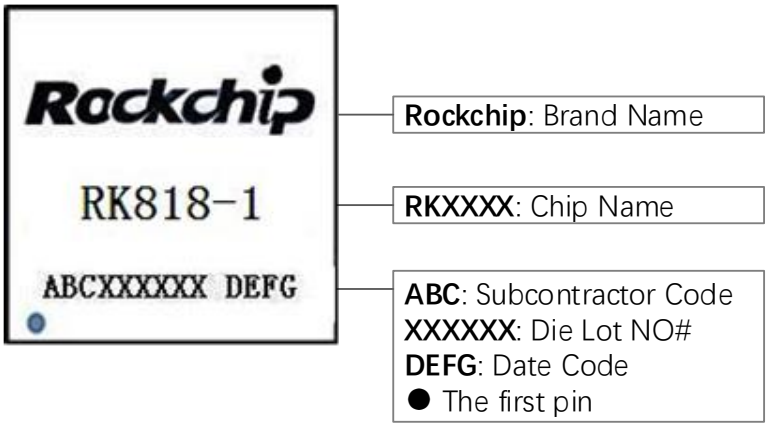
Fig. 1-1 RK818 Typical Application Diagram

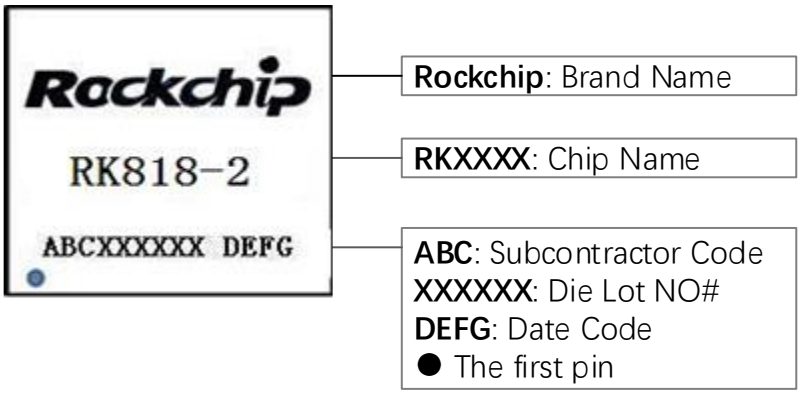
Chapter 2 Package information

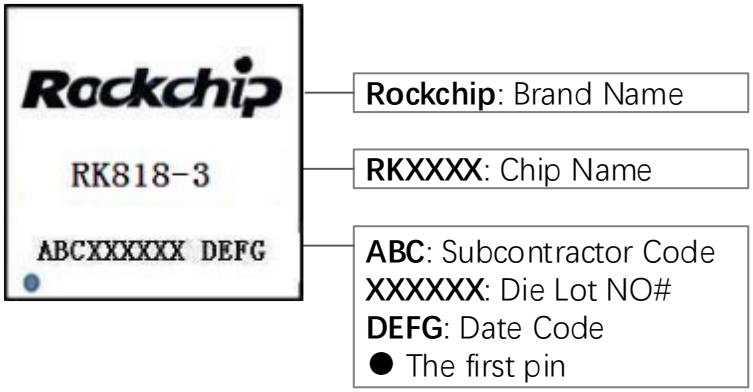
2.1 Ordering information

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

2.2 Top Marking







2.3 Dimension

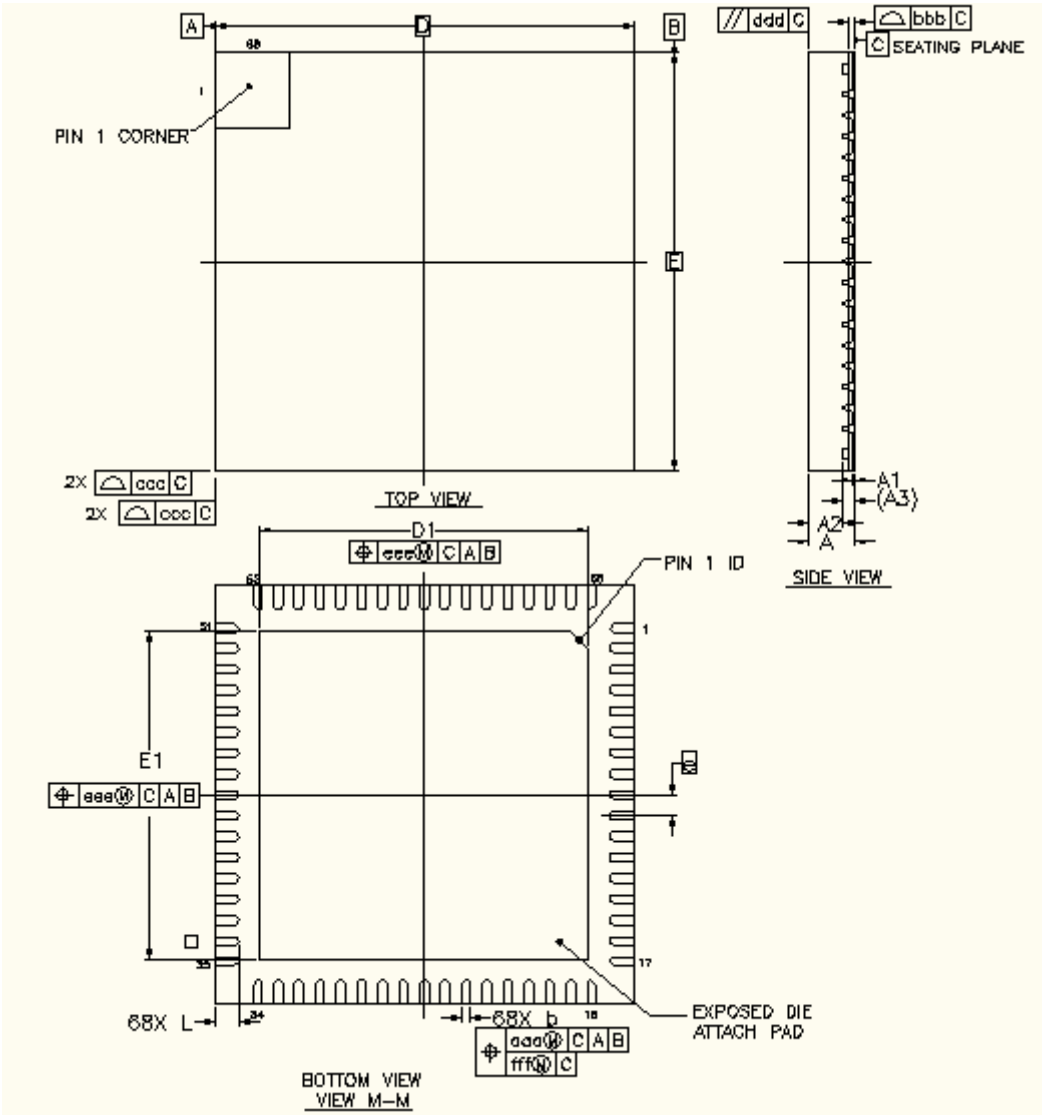


Fig. 2-1 QFN68 7mm X 7mm

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

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

Note:

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

2.4 Pin Assignment

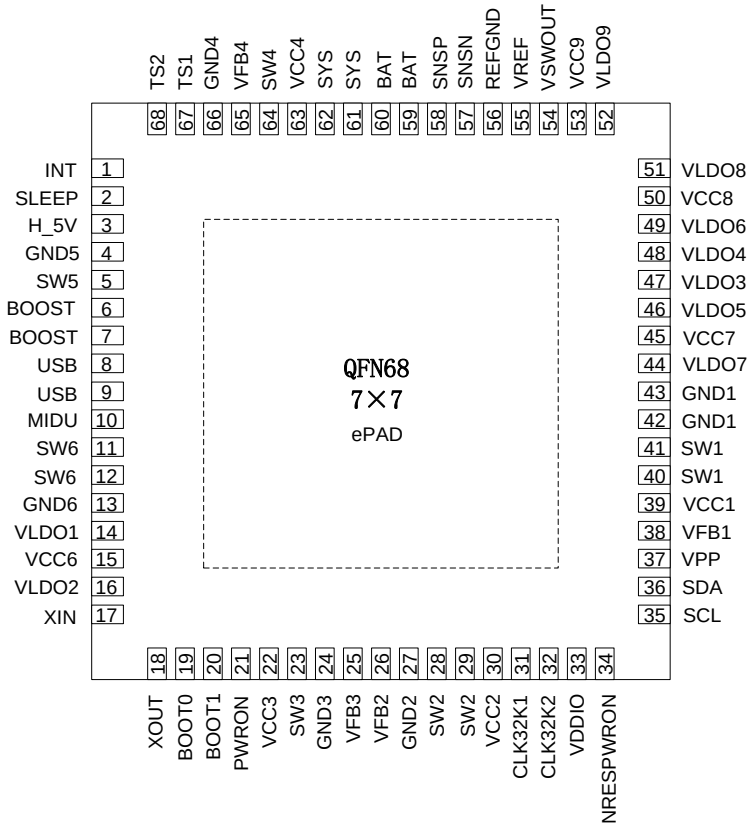


Fig. 2-2 Pin Assignment QFN7x7-68(Pitch=0.35mm)

2.5 Pinout Number Order

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

Pin No	Pin Name	Pin Description
57	SNSN	Bat charging and discharging sense current negative pin
58	SNSP	Bat charging and discharging sense current positive pin
59,60	BAT	Positive battery terminal
61,62	SYS	DC-DC regulator output to power the system load and charge the battery
63	VCC4	Power supply for DCDC4
64	SW4	Switch output of DCDC4
65	VFB4	DCDC4 output voltage feedback input
66	GND4	Power ground for DCDC4
67	TS1	Thermistor1 input. Connect a thermistor from this pin to ground. The thermistor is usually inside the battery pack.
68	TS2	Thermistor2 input. Connect a thermistor from this pin to ground. Or it can be used as analog input pin of internal ADC if the control bit is set to ADC function.
Exposed pad	Exposed ground	It must be connected to ground for thermal and electrical enhancement.

Chapter 3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Parameter	Min	Max	Units
Voltage range on pins USB，MIDU，BOOST，SWx/H_5V	-0.3	6.5	V
Voltage range on pins VCCx, VFBx, VLDOx, VSWOUT, VREF	-0.3	6.5	V
Voltage range on pin CLK32K1,CLK32K2, SLEEP	-0.3	6.5	V
Voltage range on pins XIN,XOUT, BOOT0,BOOT1, PWRON	-0.3	$VSYS_{MAX}$+0.3	
Voltage range on pins NRESPWRON, INT, SDA, SCL	-0.3	4	V
Storage temperature range, T_S	-40	150	□
Operating temperature range, T_J	-40	125	□
Maximum Soldering Temperature, T_{SOLDER}		300	□

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

3.2 Recommended Operating Conditions

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

3.3 DC Characteristics

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

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
USBIN						
USB Operating Range	V_{USB}		4	5	6	V
USB Under Voltage Lockout Threshold		Rising	3.65	3.8	3.95	V
		Falling		3.6		V
USB vs BATT Threshold		Rising		70		mV
		Falling		30		mV
USB Input Current Limit	I_{USB}	Min Current	60	80	100	mA
		Default	400	450	500	mA
		Max current	2.7	3	3.3	A
		step (from 1A to 3A)		200		mA
Maximum USB and BATT Power on Reset Threshold (Rising)	V_{PORH}				2.2	V
Maximum USB and BATT Power on Reset Threshold (Falling)	V_{PORL}		1.2			V
Over Voltage Lock Out Threshold (USB Rising)	$V_{TH(OVLO)}$		5.7	6.0	6.3	V
Over Voltage Lock Out	$V_{HYS\ (OVLO)}$			0.2		V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Hysteresis						
High-Side PMOS Peak Current Limit		0.5A step, Default=4.5A	4		5.5	A
USB Input Quiescent Current	IUSBquiet	Charger Enable mode			10	mA
CHARGING CONTROLLER						
Terminal Battery Voltage	V_{BAT}	VBAT>VRECH, ICHG ≤ IBF		4.05		V
				4.1		V
				4.15		V
				4.2		V
				4.25		V
				4.3		V
				4.35		V
	accuracy		-1		1	%
Recharge Threshold at V_{BATT}	V_{RECH}			V_{BAT} - 0.15		V
Recharge Hysteresis				75		mV
Trickle Charge Threshold	$V_{TRICKLE}$		2.85	3.0	3.15	V
Trickle Charge Hysteresis				200		mV
Trickle Charge Current	$I_{TRICKLE}$			10%		I_{CC}
Dead bat Charge Threshold	V_{DEAD}		1.8	2	2.2	V
Dead bat Charge Hysteresis				200		mV
Dead bat Charge Current	I_{DEAD}			70		mA
Termination Charger Current	I_{BF}	50mA Step, default=150mA	100		250	mA
BAT Leakage Current	I_{BATT}	VBAT=4.2V, SYS float, USB float		20	30	uA
Charge current	I_{CC}	0.2A step, default=2A	1		3	A
Trickle Charge Time		30 minutes step, default=60 minutes	30		210	Min
Total Charge Time		2 hours step,default=6	4		16	Hour
Conversion Efficiency, Constant voltage stage (Vin=5V,Vbat=4.2V) Ibat=3A Ibat=2.5A Ibat=2A Ibat=1.5A Ibat=1A Ibat=500mA Ibat=200mA				 84 87 89 91 94 93 95		%
Conversion Efficiency,				86		%

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Constant voltage stage (Vin=5V,Ibat=2A) Vbat=3.6V Vbat=3.8V Vbat=4.0V Vbat=4.2V				87 88 89		
A/D CONVERTER						
Resolution				12		bits
Input voltage range		Battery voltage	0		4.4	V
		Current channel	-64		64	mV
		TS1/TS2	0		2.2	V
Supply current	Active			0.6		mA
SYS INPUT						
SYS Regulation Voltage	VSYS	Auto setting		3.6		V
				4.4		V
BAT to SYS Resistance		ISYS=200mA , VBAT=4.2V		0.05	0.08	Ω
BAT to SYS Current Limit	IBATLIM	0.5A step,default=5A	3		5	A
		SYS short		200		mA
BAT to SYS Current Limit accuracy			-10		10	%
SYS voltage range	$V_{SYSINPUT}$		2.7		5.45	V
SYS low alarm voltage, if 3.3V (2.8V~3.5V programmable, step=100mV)	V_{BLO}		3.25	3.3	3.35	V
SYS under voltage threshold (vin falling)	V_{BUVL}			2.7		V
SYS under voltage threshold (vin rising)	V_{BUVH}		2.8	2.9	3.0	V
SYS OK voltage threshold （ 3.3V~3.6V OTP programmable , step=100mV）	V_{BOK}			3.4		V
Stand-by current, V_{DD}=3.6V, device OFF state 32KHz clock running	$I_{Q(STNBY)}$			40		uA
THERMAL PROTECTION						
Thermal Limit Temperature		10 °C step, default=85 °C	85		115	°C
Thermal Shutdown		20 °C step, default=140 °C	140		160	°C
OSCILLATOR						
Switching Frequency	f_{SW}		1.8	2	2.2	MHz

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
CH1,2,3,4(Tj=25℃)						
Switching Frequency, CH5(Tj=25℃)	f_{SW}		0.9	1	1.1	MHz
LOGIC INPUT						
Input LOW-Level Voltage (V_{DDIO})	V_{IL}				0.3xV_{DDIO}	V
Input HIGH-Level Voltage (V_{DDIO})	V_{IH}		0.7xV_{DDIO}			V
LOGIC OUTPUT						
LOW-Level Output Voltage, 3.0 mA sink current	V_{OL}				0.4	V
HIGH-Level Output Voltage, 3.0 mA source current	V_{OH}		V_{DDIO}-0.4			V
NRESPWON pin LOW-Level Output Voltage, 3.0mA sink current	$V_{OL(NRES)}$				0.4	V
CLK32KOUT1 pin LOW-Level Output Voltage, 3.0mA sink current	$V_{OL(CLKO1)}$				0.4	V
CLK32KOUT2 pin LOW-Level Output Voltage, 3.0mA sink current	$V_{OL(CLKO2)}$				0.4	
CLK32KOUT2 pin HIGH-Level Output Voltage, 3.0mA source current	$V_{OH(CLKO2)}$		V_{DDIO}-0.4			V
CH1：BUCK DC-DC CONVERTER(BUCK1)						
Input supply voltage range	V_{INPUT1}		2.7		5.5	V
Voltage Adjustable Range, 6bit	V_{FB1}	Step=12.5mV	0.7125		1.500	V
Output voltage transition rate BUCK1_RATE=00 BUCK1_RATE=01 BUCK1_RATE=10 BUCK1_RATE=11				 2 3 4.5 6		 mV/us
Power Good threshold (Vout rising)	V_{PG1}			93		%
Output under voltage lockout(Vout falling)	V_{UV1}			85		%
Output over voltage lockout (Vout rising)	V_{OV1}			117		%
Preset Voltage, Default(Tj=25℃)	$V_{FB1(Default)}$		1.078	1.100	1.122	V
Preset Voltage, Default(-10℃≦ T_j≦+85℃)	$V_{FB1(Default)}$		1.067	1.100	1.133	V
Load Regulation, I_{OUT1} = 200mA to 4A				0.1		%/A

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Line Regulation, VCC1 = 3 to 5.5V, I_{OUT1} = 2A				0.1		%/V
Rated output current	I_{MAX1}	Reg90H<1:0>=<11>		4		A
Switch Current Limit	I_{CL1}	0.4A step, default=3.6A	3.2		4.4	A
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q1}			70		uA
Minimun Switch Current Limit	I_{CLMIN1}	50mA step, default=150mA	50		400	mA
Minimum ON Time	$T_{on1(min)}$			45		ns
Soft-start Time	t_{SS1}	Step=400us, default=400us	400		800	us
C_{OUT} Discharge Switch ON Resistance	R_{DIS2}			250		ohm
Conversion Efficiency (Vin=3.8V,Vout=1.1V) Iout=4A Iout=3.5A Iout=3A Iout=2.5A Iout=2A Iout=1.5A Iout=1 A Iout=500mA Iout=100 mA Iout=10 mA				 65 68 71 75 79 83 86 89 80 81		 % % % % % % % % % %
CH2：BUCK DC-DC CONVERTER (BUCK2)						
Input supply voltage range	V_{INPUT2}		2.7		5.5	V
Voltage Adjustable Range, 6bit	V_{FB2}	Step=12.5mV	0.7125		1.500	V
Output voltage transition rate BUCK2_RATE=00 BUCK2_RATE=01 BUCK2_RATE=10 BUCK2_RATE=11				 2 3 4.5 6		 mV/us mV/us mV/us mV/us
Power Good threshold (Vout rising)	V_{PG2}			93		%
Output under voltage lockout (Vout falling)	V_{UV2}			85		%
Output over voltage lockout (Vout rising)	V_{OV2}			117		%
Preset Voltage, Default(Tj=25℃)	$V_{FB2(Default)}$		1.078	1.100	1.122	V
Preset Voltage, Default(-10℃≦ T_j≦+85℃)	$V_{FB2(Default)}$		1.067	1.100	1.133	V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Load Regulation, I_{OUT2} = 200 mA to 4A				0.1		%/A
Line Regulation, VCC2 = 3 to 5.5V, I_{OUT2} = 2A				0.1		%/V
Rated output current	I_{MAX2}	Reg90H<3:2>=<11>		4		A
Switch Current Limit	I_{CL2}	0.4A step, default=3.6A	3.2		4.4	A
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q2}			70		uA
Minimun Switch Current Limit	I_{CLMIN2}	50mA step, default=150mA	50		400	mA
Minimum ON Time	$T_{on2(min)}$			45		ns
Soft-start Time	t_{SS2}	Step=400us, default=400us	400		800	us
C_{OUT} Discharge Switch ON Resistance	R_{DIS2}			250		ohm
Conversion Efficiency (Vin=3.8V,Vout=1.1V) Iout=4A Iout=3.5A Iout=3A Iout=2.5A Iout=2A Iout=1.5A Iout=1 A Iout=500mA Iout=100 mA Iout=10 mA				62 65 69 73 76 81 85 89 85 83		%
CH3：BUCK DC-DC CONVERTER (BUCK3)						
Input supply voltage range	V_{INPUT3}		2.7		5.5	V
Feedback Voltage, Default(Tj=25℃)	$V_{FB3(Default)}$		0.98	1.00	1.02	V
Feedback Voltage, Default(-10℃≦T_j≦+85℃)	$V_{FB3(Default)}$		0.97	1.00	1.03	V
Power Good threshold (Vout rising)	V_{PG3}			93		%
Output under voltage lockout (Vout falling)	V_{UV3}			85		%
Output over voltage lockout (Vout rising)	V_{OV3}			117		%
Load Regulation, I_{OUT3} = 100mA to 2.5A				0.1		%/A
Line Regulation, VCC3 = 3 to 5.5V, I_{OUT3} = 2A				0.1		%/V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Rated output current	I_{MAX3}	Reg90H<5:4>=<11>		2.5		A
Switch Current Limit	I_{CL3}	0.5A step, default=2.5A	2		3.5	A
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q3}			70		uA
Minimum Switch Current Limit	I_{CLMIN3}	50mA step, default=150mA	50		400	mA
Minimum ON Time	$T_{on3(min)}$			45		ns
Soft-start Time	t_{SS3}	Step=400us, default=400us	400		800	us
C_{OUT} Discharge Switch ON Resistance	R_{DIS3}			250		ohm
Conversion Efficiency (Vin=3.8V,Vout=1.5V) Iout=2.5A Iout=2A Iout=1.5A Iout=1 A Iout=500mA Iout=100 mA Iout=10 mA				70 75 80 84 88 84 83		%
CH4：BUCK DC-DC CONVERTER (BUCK4)						
Input supply voltage range	V_{INPUT4}		2.7		5.5	V
Voltage Adjustable Range, 4bit	V_{FB4}	Step=100mV	1.8		3.6	V
Feedback Voltage, Default(Tj=25℃)	$V_{FB4(Default)}$		2.94	3.00	3.06	V
Feedback Voltage, Default(-10℃≦T_j≦+85℃)	$V_{FB4(Default)}$		-2.91	3.00	3.09	V
Power Good threshold (Vout rising)	V_{PG4}			93		%
Output under voltage lockout (Vout falling)	V_{UV4}			85		%
Output over voltage lockout (Vout rising)	V_{OV4}			117		%
Load Regulation, I_{OUT4} = 100mA to 2.5A				0.1		%/A
Line Regulation, VCC4 = 3 to 5.5V, I_{OUT4} = 2A				0.1		%/V
Rated output current	I_{MAX4}	Reg90H<7:6>=<11>		2.5		A
Switch Current Limit	I_{CL4}	0.5A step, default=3A	2.5		4	A
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q4}			70		uA

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Minimun Switch Current Limit	I_{CLMIN4}	50mA step, default=150mA	50		400	mA
Minimum ON Time	$T_{on4(min)}$			45		ns
Soft-start Time	t_{SS4}	Step=400us, default=400us		400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS4}			250		Ohm
Conversion Efficiency, (DCR<50mohm) Vin=3.8V,Vout=3V Iout=2.5A Iout=2A Iout=1.5A Iout=1 A Iout=500mA Iout=100mA Iout=10mA				 81 84 87 91 94 88 75		%
CH5：BOOST DC-DC CONVERTER (BOOST)						
Input supply voltage range	V_{INPUT5}		2.7		4.4	V
Output Voltage	V_{FB5}	Step=0.1v,default=5v	4.7		5.4	V
Voltage, Default(Tj=25℃)	$V_{FB5(Default)}$		4.90	5.0	5.10	V
Voltage, Default(-10 ℃ ≦ T_j ≦ +85℃)	$V_{FB5(Default)}$		4.75	5.0	5.25	V
Power Good threshold (Vout rising)	V_{PG5}			90		%
Output under voltage lockout (Vout falling)	V_{UV5}			85		%
Load Regulation, I_{OUT5} = 100mA to 2.5A				0.2		%/A
Line Regulation, Vin = 3 to 4.2V, I_{OUT5} = 1.5A				0.1		%/V
Rated output current	I_{MAX5}	Reg3A<4:3>=11		2.5		A
Switch Current Limit	I_{CL5}	0.5A step, default=4.5A	4		5.5	A
Minimum ON Time	$T_{on5(min)}$			70		ns
Soft-start Time	t_{SS5}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS5}			250		ohm
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q5}			250		uA
Auto switch load current between PWM and PFM	$I_{PWM/PFM5}$			50		mA
Conversion Efficiency, (DCR<50mohm)				80		%

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Vin=3.8V,Vout=5V Iout=2.5A Iout=2A Iout=1.5A Iout=800mA Iout=500mA Iout=100mA Iout=10mA				85 89 93 94 90 71		
CH6 ：LDO1						
Input supply voltage range	V_{INPUT6}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 4bit(step=100mv)	V_{OUT6}		1.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT6(Default)}$		3.234	3.300	3.366	V
V_{OUT} Output Voltage, Default(Tj= -10~85℃)	$V_{OUT6(Default)}$		3.201	3.300	3.399	V
Power Good threshold (Vout rising)	V_{PG6}			93		%
Output under voltage lockout (Vout falling)	V_{UV6}			85		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 150mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN6} = 3 to 5V, I_{OUT6} = 0.1A				0.03		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT6}=3.3V)	PSRR6			50		dB
Output noise (10Hz to 100kHz, V_{OUT6}=3.3V)	OUT_{NOISE6}			300		uVrms
Dropout voltage @ 150mA (V_{OUT6}=3.3V)	V_{DROP6}			200		mV
Rated output current	I_{MAX6}			150		mA
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q6}			28		uA
Current Limit, VOUT6 = V_{OUT6} x 0.95	I_{CL6}		250	300		mA
Soft-start Time	t_{SS6}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS6}			400		ohm
CH7：LDO2						
Input supply voltage range	V_{INPUT7}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 4bit(step=100mv)	V_{OUT7}		1.8		3.4	V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT7(Default)}$		3.234	3.300	3.366	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT7(Default)}$		3.201	3.300	3.399	V
Power Good threshold (Vout rising)	V_{PG7}			93		%
Output under voltage lockout (Vout falling)	V_{UV7}			85		%
Output over voltage lockout (Vout rising)	V_{OV7}			125		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 150mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN7}= 3 to 5V, I_{OUT7} = 0.1A				0.03		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT7}=3.3V)	PSRR7			50		dB
Output noise (10Hz to 100kHz, V_{OUT7}=3.3V)	OUT_{NOISE7}			300		uVrms
Dropout voltage @ 150mA (V_{OUT7}=3.3V)	V_{DROP7}			200		mV
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q7}			28		uA
Rated output current	I_{MAX7}			150		mA
Current Limit, VOUT7 = V_{OUT7} x 0.95	I_{CL7}		250	300		mA
Soft-start Time	t_{SS7}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS7}			400		Ohm
CH8 ： LDO3						
Input supply voltage range	V_{INPUT7}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 4bit (0.8V~2V, step=100mV, 2V~ 2.5V step=500mV)	V_{OUT8}		0.8		2.5	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT8(Default)}$		1.078	1.100	1.122	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	V_{OUT8} (Default)		1.067	1.100	1.133	V
Power Good threshold (Vout rising)	V_{PG8}			93		%
Output under voltage lockout (Vout falling)	V_{UV8}			85		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 150mA				0.006		%/mA
V_{OUT} Line Regulation, V_{IN8} = 3				0.015		%/V

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
to 5V, I_{OUT8} = 0.05A						
Power Supply Reject Ratio (f = 10kHz, V_{OUT8}=1.1V)	PSRR8			70		dB
Output noise (10Hz to 100kHz, V_{OUT8}=1.1V)	OUT_{NOISE8}			30		uVrms
Dropout voltage @ 100mA (V_{OUT8}=2.5V)	V_{DROP8}			200		mV
Rated output current	I_{MAX8}			100		mA
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q8}			52		uA
Current Limit, VOUT8 = V_{OUT8} x 0.95	I_{CL8}		150	200		mA
Soft-start Time	t_{SS8}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS8}			400		Ohm
CH9： LDO4						
Input supply voltage range	V_{INPUT9}		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 4bit(step=100mv)	V_{OUT9}		1.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT9(Default)}$		2.450	2.500	2.550	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT9(Default)}$		2.425	2.500	2.575	V
Power Good threshold (Vout rising)	V_{PG9}			93		%
Output under voltage lockout (Vout falling)	V_{UV9}			85		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 150mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN9} = 3 to 5V, I_{OUT9} = 0.15A				0.03		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT9}=3.3V)	PSRR9			50		dB
Output noise (10Hz to 100kHz, V_{OUT9}=3.3V)	OUT_{NOISE9}			300		uVrms
Dropout voltage @ 150mA (V_{OUT9}=3.3V)	V_{DROP9}			200		mV
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q9}			28		uA
Rated output current	I_{MAX9}			150		mA
Current Limit, VOUT9 = V_{OUT9} x 0.95	I_{CL9}		250	300		mA
Soft-start Time	t_{SS9}			400		us
C_{OUT} Discharge Switch ON	R_{DIS9}			400		Ohm

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Resistance						
CH10 ：LDO5						
Input supply voltage range	$V_{INPUT10}$		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 4bit(step=100mv)	V_{OUT10}		1.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT10(Default)}$		2.744	2.800	2.856	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT10(Default)}$		2.716	2.800	2.884	V
Power Good threshold (Vout rising)	V_{PG10}			93		%
Output under voltage lockout (Vout falling)	V_{UV10}			85		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 300mA				0.003		%/mA
V_{OUT} Line Regulation, V_{IN10} = 3 to 5V, I_{OUT10} = 0.3A				0.01		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT10}=3.3V)	PSRR10			52		dB
Output noise (10Hz to 100kHz, V_{OUT10}=3.3V)	$OUT_{NOISE10}$			300		uVrms
Dropout voltage @ 300mA (V_{OUT10}=2.8V)	V_{DROP10}			200		mV
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q10}			28		uA
Rated output current	I_{MAX10}			300		mA
Current Limit, VOUT10 = V_{OUT10} x 0.95	I_{CL10}		350	500		mA
Soft-start Time	t_{SS10}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS10}			400		Ohm
CH11：LDO6						
Input supply voltage range	$V_{INPUT11}$		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mv)	V_{OUT11}		0.8		2.5	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT11(Default)}$		1.176	1.200	1.224	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT11(Default)}$		1.164	1.200	1.236	V
Power Good threshold (Vout rising)	V_{PG11}			93		%
Output under voltage lockout (Vout falling)	V_{UV11}			85		%

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
V_{OUT} Load Regulation, I_{OUT} = 1mA to 150mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN11} = 3 to 5V, I_{OUT11} = 0.1A				0.015		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT11}=3.3V)	PSRR11			70		dB
Output noise (10Hz to 100kHz, V_{OUT11}=3.3V)	$OUT_{NOISE11}$			30		uVrms
Dropout voltage @ 150mA (V_{OUT11}=2.5V)	V_{DROP11}			200		mV
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q11}			52		uA
Rated output current	I_{MAX11}			150		mA
Current Limit, VOUT11 = V_{OUT11} x 0.95	I_{CL11}		200	300		mA
Soft-start Time	t_{SS11}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS11}			400		Ohm
CH12：LDO7						
Input supply voltage rangef	$V_{INPUT12}$		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 5bit(step=100mv)	V_{OUT12}		0.8		2.5	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT12(Default)}$		1.764	1.800	1.836	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT12(Default)}$		-1.736	1.800	1.854	V
Power Good threshold (Vout rising)	V_{PG12}			93		%
Output under voltage lockout (Vout falling)	V_{UV12}			85		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 300mA				0.005		%/mA
V_{OUT} Line Regulation, V_{IN12} = 3 to 5V, I_{OUT12} = 0.3A				0.015		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT12}=3.3V)	PSRR12			65		dB
Output noise (10Hz to 100kHz, V_{OUT12}=3.3V)	$OUT_{NOISE12}$			50		uVrms
Dropout voltage @ 300mA (V_{OUT12}=2.5V)	V_{DROP12}			200		mV
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q12}			48		uA
Rated output current	I_{MAX12}			300		mA
Current Limit, VOUT12 =	I_{CL12}		400	400		mA

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
V_{OUT12} x 0.95						
Soft-start Time	t_{SS12}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS12}			250		Ohm
CH13 ： LDO8						
Input supply voltage range	$V_{INPUT13}$		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 4bit(step=100mv)	V_{OUT13}		1.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT13(Default)}$		3.234	3.300	3.366	V
V_{OUT} Output Voltage, Default(Tj=-10~85℃)	$V_{OUT13(Default)}$		3.201	3.300	3.399	V
Power Good threshold (Vout rising)	V_{PG13}			93		%
Output under voltage lockout (Vout falling)	V_{UV13}			85		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 150mA				0.003		%/mA
V_{OUT} Line Regulation, V_{IN13} = 3 to 5V, I_{OUT6} = 0.15A				0.01		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT13}=3.3V)	PSRR13			50		dB
Output noise (10Hz to 100kHz, V_{OUT13}=3.3V)	$OUT_{NOISE13}$			300		uVrms
Dropout voltage @ 300mA (V_{OUT13}=2.8V)	V_{DROP13}			200		mV
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q13}			30		uA
Rated output current	I_{MAX13}			400		mA
Current Limit, VOUT13 = V_{OUT13} x 0.95	I_{CL13}		500	600		mA
Soft-start Time	t_{SS13}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS13}			400		Ohm
CH14 ： LDO9						
Input supply voltage range	$V_{INPUT14}$		2.7		5.5	V
V_{OUT} Output Voltage Adjustable Range, 4bit(step=100mv)	V_{OUT14}		1.8		3.4	V
V_{OUT} Output Voltage, Default(Tj=25℃)	$V_{OUT14(Default)}$		3.234	3.300	3.366	V
V_{OUT} Output Voltage, Default (Tj=-10~85℃)	$V_{OUT14Default)}$		3.201	3.300	3.399	V
Power Good threshold (Vout	V_{PG14}			93		%

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
rising)						
Output under voltage lockout (Vout falling)	V_{UV14}			85		%
V_{OUT} Load Regulation, I_{OUT} = 1mA to 150mA				0.003		%/mA
V_{OUT} Line Regulation, V_{IN14} = 3 to 5V, I_{OUT14} = 0.15A				0.01		%/V
Power Supply Reject Ratio (f = 10kHz, V_{OUT14}=3.3V)	PSRR14			50		dB
Output noise (10Hz to 100kHz, V_{OUT13}=3.3V)	$OUT_{NOISE14}$			300		uVrms
Dropout voltage @ 300mA (V_{OUT13}=2.8V)	V_{DROP14}			200		mV
Operating Quiescent Current, No load, V_{DD}=3.8V	I_{Q14}			30		uA
Rated output current	I_{MAX14}			300		mA
Current Limit, VOUT14 = V_{OUT14} x 0.95	I_{CL14}		400	500		mA
Soft-start Time	t_{SS14}			400		us
C_{OUT} Discharge Switch ON Resistance	R_{DIS14}			400		Ohm
CH15 :SWITCH						
Input supply voltage range	$V_{INPUT15}$		2.7		5.5	V
Rated output current	I_{MAX15}			300		mA
On resistance(Vgs=3V)				150		mohm
Current Limit	I_{CL15}		400	500		mA
C_{OUT} Discharge Switch ON Resistance	R_{DIS15}			400		Ohm
CH16：H_5V (HDMI_5V)						
Input supply voltage range	$V_{INPUT16}$		4.7		5.4	V
Rated output current	I_{MAX16}			80		mA
CH17：OTG Switch						
Input supply voltage range	$V_{INPUT17}$		4.7		5.4	V
Rated output current	I_{MAX17}			800		mA
output current limit	I_{CL17}	0.1A step, default=0.8A	0.7		**1**	A
Real Time Clock (RTC)						
RTC Operating Voltage Range	V_{IN}		2.5		5.5	V
RTC Supply Current	I_Q			5	10	uA
CLK32OUT1 jitter (open drain) (always on)				100		ns
CLK32OUT1 duty cycle			40		60	%

PARAMETERS	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
CLK32OUT2 jitter (open drain)				100		ns
CLK32OUT2 duty cycle			40		60	%
I2C Interface (The 7-bits slave address is: 0011100)						
SCL clock frequency	f_{SCL}				400	kHz
SCL high time	t_{HIGH}		0.6			us
SCL low time	t_{LOW}		1.3			us
Data setup time	$t_{SU,DAT}$		0.1			us
Data hold time	$t_{HD,DAT1}$		0.3			us
Setup time for repeated start	$t_{SU,STA}$		0.6			us
HOLD time for start/repeated start	$t_{HD,STA}$		0.6			us
Bus free time between a stop and condition	t_{BUF}		1.3			us
Rise time of SCL/SDA	t_r		20 + $0.1C_B$		300	ns
Fall width of SCL/SDA	t_f		20 + $0.1C_B$		300	ns
Pulse width of suppressed spike	t_{SP}		0		50	ns
Capacitive load for each of bus line	C_{B2}				400	pF

Chapter 4 Function Description

4.1 Function overview

4.1.1 POWER UP/POWER DOWN

The RK818 can be powered by either a battery, or an external power supply through the USB port. When the PMIC is powered by a battery only, pressing the PWRON key powers up the PMIC. All the power channels start up at the default output voltages with a preset 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 I^2C 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 down 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 the USB is valid, then the power channels are turned on and the battery is charged.

4.1.2 SWITCHING CHARGER

The RK818 has integrated a switch mode charger, which provides the functions like trickle current charging, constant current charging, constant voltage charging, charging termination, automatic recharging, battery temperature monitoring, charging timer and thermal feedback protection. The values of constant current and constant voltage charging can be set through I^2C 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 I^2C interface. For example, when an USB port is used as the input, the input current limit can be configured to either 450mA, or 850mA, 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 TS1 pin. A battery typically has a thermistor inside. The RK818 sinks a constant current into the thermistor and senses the voltage across the thermistor through an internal ADC. A safe charging temperature range is preset in the PMIC. The charging can proceed normally if the battery temperature falls within the preset range. If, however, the battery temperature goes either above the upper limit or below the lower limit of the preset range, the charging will pause until the battery temperature goes back in the preset range. If the value of the available thermistor is either too large or too small, a normal resistor can be connected in series or in parallel with the thermistor so that the sensed voltage fits the ADC's input range.

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

4.1.3 POWER PATH MANAGEMENT

A power path management function is integrated in the RK818, 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 not 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, a 50mΩ MOSFET is integrated in the RK818 to serve as a control switch as well as the power switch of the switching mode battery charger.

4.1.4 THERMAL FOLDBACK

Generally speaking, the higher the operating junction temperature is, the shorter the chip's life time. Therefore, keeping the operating junction temperature as low as possible is one of the keys in reliability design. The RK818 provides a thermal feedback protection function for charging process. When the die temperature reaches a preset value, the PMIC will lower the charging current so as to keep the die temperature within an appropriate range. The life time of the PMIC equipped with this function can be reliably prolonged and no over-heat damage will occur.

4.1.5 BATTERY FUEL GAUGE

The RK818 provides an accurate battery fuel gauge. A 12-bit ADC is integrated in the RK818 to collect the information on the battery, such as battery 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 I^2C interface.

4.1.6 BUCK CONVERTERS

The RK818 provides four high current synchronous buck converters, which deliver up to 4A, 4A, 2.5A and 2.5A, 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 key parameters such as operating mode, output voltage, DVS change rate, and output current limit can be configured through the I^2C interface.

4.1.7 BOOST CONVERTER

The synchronous boost converter has 2.5A current capability and is used to power the

OTG and the HTMI5V. 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 operating mode, output voltage, and output current limit can be configured through the I^2C interface.

4.1.8 LOW DROPOUT REGULATORS (LDOS)

The RK818 also integrates nine LDOs and one low R_{dson} switch, with four LDOs (Ch6, Ch7, Ch9 and Ch11) capable of providing up to 150mA and three LDOs (CH10, CH12 and CH14) providing maximum 300mA. The LDO on Ch8 is a low noise, high PSRR LDO which delivers up to 100mA current and the LDO on Ch14 has 400mA current capability. The parameters such as output voltage in the different operating modes can be adjusted through the I^2C interface.

4.1.9 REAL TIME CLOCK (RTC)

The RK818 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 RK818 provides two channels of 32.768kHz clocks with open drain outputs, where one channel is constantly on and the other is enabled through I^2C interface.

4.2 State Machine Description

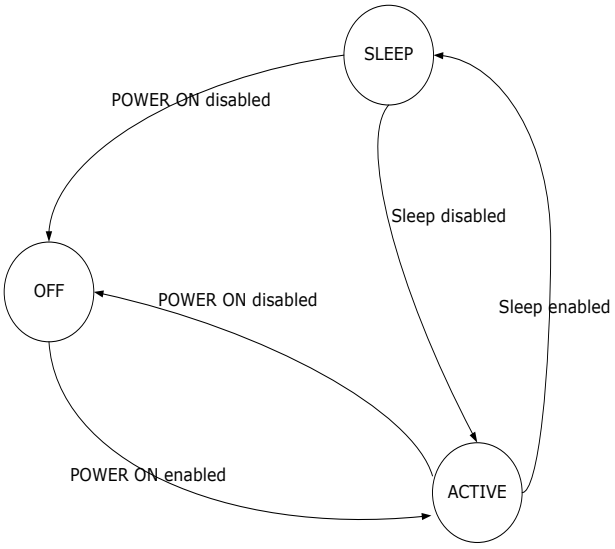


Fig. 4-1 State Machine

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).
- The temperature sensed at TS2 is either too high or too low. (To use TS2, a thermistor on a device to be monitored should be connected between TS2 and GND, and the ADC_TS2_EN bit in the register ADC_CTRL_REG must be set to "enable". When the sensed voltage at TS2, which is saved in the register TS2_ADC_REG, is greater than the value in BAT_LTS_TS2_REG or smaller than the value in BAT_HTS_TS2_REG, the PMIC will be 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

AP	RK3188/RK3168/ RK3188M/RK3168M/RK3028A/RK3028/RK2928		Partial Customized otp/ BUCK1~4, LDO3/LDO4/ LDO5/LDO7		RK3066		RK3288/RK3368		Sofia-3GR		RK3399	
BOOT	11		10		01		00 RK818-1		RK818-2		RK818-3	
	Typ Vout	Sequence	Typ Vout	Sequence	Typ Vout	Sequence	Typ Vout	Sequence	Typ Vout	Sequence	Typ Vout	Sequence
BUCK1	1.1V	3	OTP	OTP	1.2V	3	1.1V	3	1.0V	12	0.9V	6
BUCK2	1.1V	1	OTP	OTP	1.2V	1	1.1V	1	1.0V	12	0.9V	4
BUCK3	x	4	x	OTP	x	4	x	3	x	13	x	5
BUCK4	3.0V	1	OTP	OTP	3.0V	1	3.3V	4	3.3V	14	1.8V	3
LDO1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1.8V	11	OFF	OFF
LDO2	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
LDO3	1.1V	1	OTP	OTP	1.1V	1	1.0V	2	1.8V	15	OFF	OFF
LDO4	2.5V	2	OTP	OTP	2.5V	2	OFF	OFF	1.8V	1	3.3V	1
LDO5	3V	1	OTP	OTP	3.0V	2	1.8V	4	1.8V	11	3.0V	7
LDO6	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1.5V	2
LDO7	1.8V	2	OTP	OTP	1.8V	2	1.8V	3	1.1V	15	OFF	OFF
LDO8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3.0V	14	3.3V	8
LDO9	3.0V	4	3.0V	5	3.0V	4	3.3V	10	1.8V	15	3.0V	9
SWITCH	OFF	OFF	OFF	OFF	OFF	OFF	5V	10	OFF	OFF	5V	10
OTG	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
HDMI_5V	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Table 4-1 Power Start Up Sequence

X: The buck3 voltage is decided by external resistors.

4.5.1 BOOT1=1, BOOT0 = 1

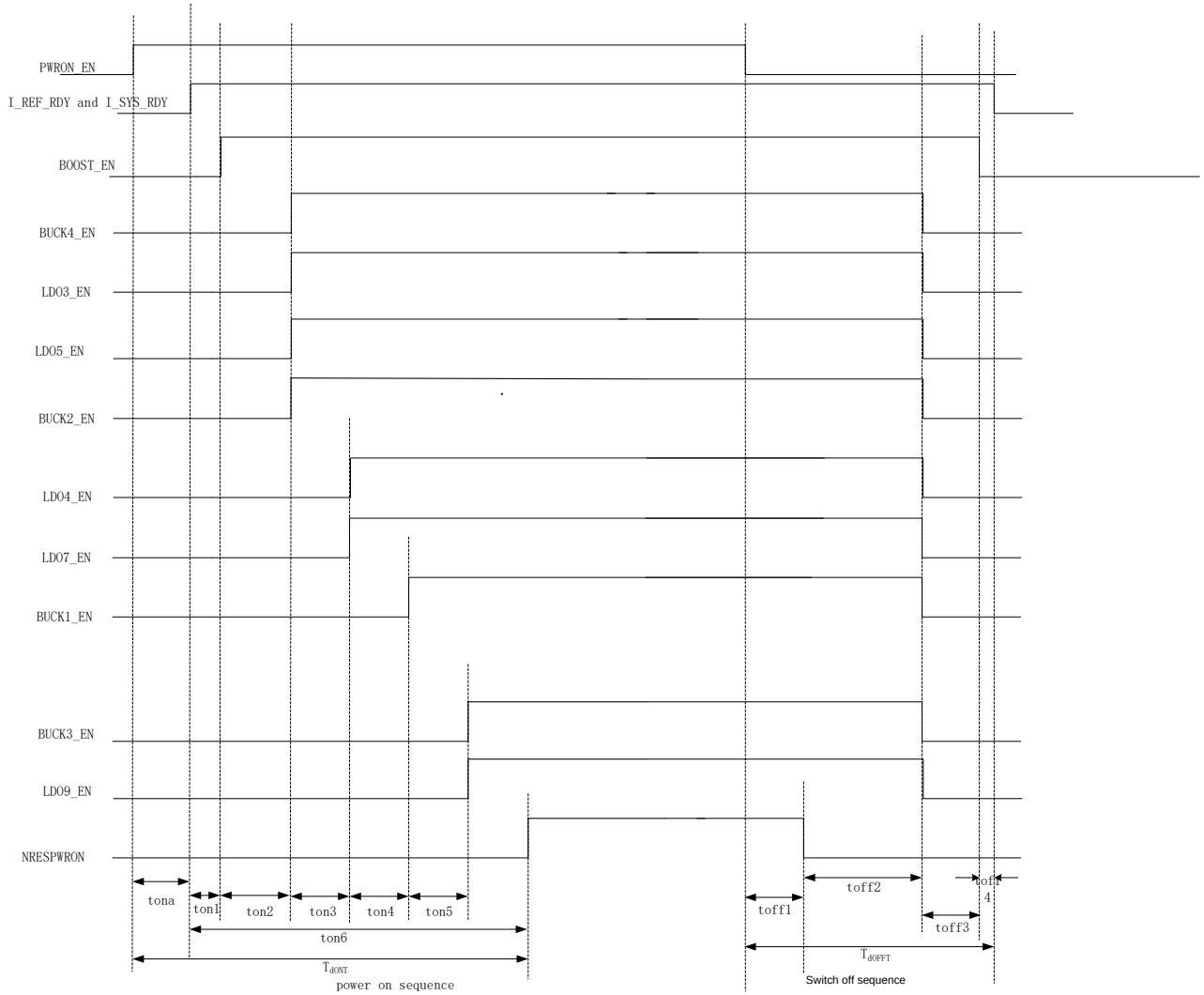


Fig. 4-2 Power On/Off Timing, BOOT1=1, BOOT0=1

4.5.2 BOOT1=0, BOOT0=1

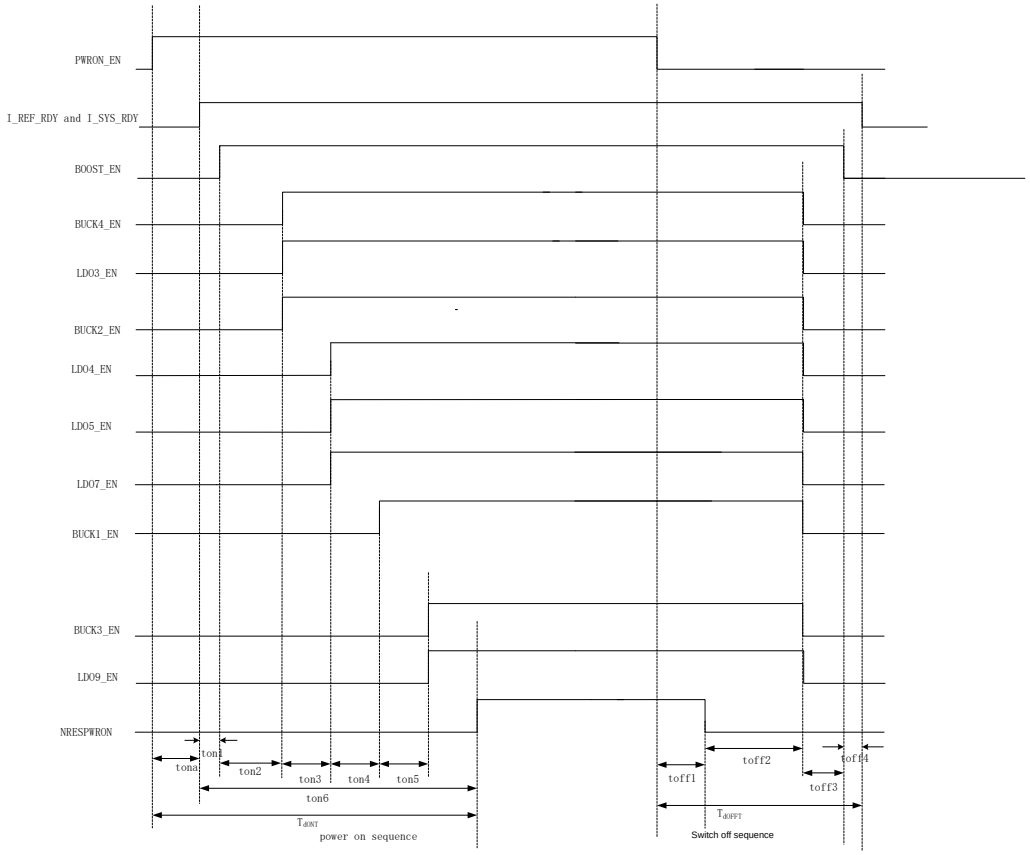


Fig. 4-3 Power On/Off Timing, BOOT1=0, BOOT0=1

4.5.3 BOOT1=1, BOOT0=0

In the "10" mode, 9 power channels are powered up, which are BUCK1- BUCK4, LDO3-LDO5 and LDO7. The power up sequence and the default output voltage of these 9 channels can be configured through OTP. The default output voltage of the BUCK3 can also be set by the external resistors. The default output voltage of the LDO9 is 3V, and the startup sequency of the LDO9 is 9th.

4.5.4 BOOT1=0, BOOT0=0

In the mode of "00", 14 power channels are powered up, among which, the power up sequence and the default voltage of the BUCK1-4, LDO1-9 and the SWITCH can be configured through OTP. Again, The default output voltage of the BUCK3 can also be set by the external resistors. The voltage of the SWITCH is the same as the input supply.

4.5.5 Boot Timing Characteristic

PARAMETERS	DESCRIPTION	MIN	TYP	MAX	UNIT
T_{ona}	power on enable to system ready and reference ready delay				us
Ton1	Reference and system ready to boost enable delay		$66\times t_{CK32K}$		us
Ton2	Boost enable delay to 1st channel enable delay		$66\times t_{CK32K}$		us
Ton3	1st channel enable to 2st channel enable delay		$66\times t_{CK32K}$		us
Ton4	2nd channel enable to 3rd channel enable delay		$66\times t_{CK32K}$		us
Ton5	3rd channel enable to 4th channel enable delay		$66\times t_{CK32K}$		us
Ton6	1st channel enable to NRESPWRON rising edge delay		82		ms

PARAMETERS	DESCRIPTION	MIN	TYP	MAX	UNIT
toff1	PWRON disable to NRESPWRON falling delay		$1\times t_{CK32K}$		us
Toff2	NRESPWRON falling delay to supplies disable delay		2		ms
Toff3	Other supplies disable to boost disable		2		ms
Toff4	Supplies disable to house-keeping disable delay		$1\times t_{CK32K}$		us

Table 4-2 Boot Timing Characteristics

4.7 Power Control Timing

4.6.1 Device Turn On With USB Plug_in

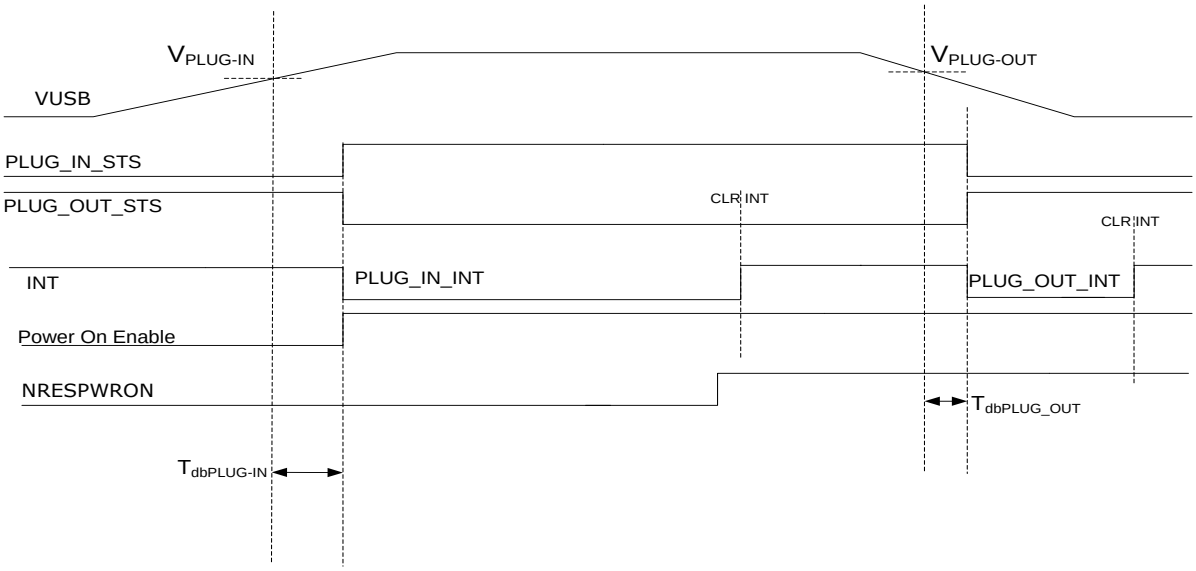


Fig. 4-3 Turn on sequence when USB is plugged in (PLUP_IN_INT triggered power on enable)

4.6.2 Power Control Timing When Powered By BAT

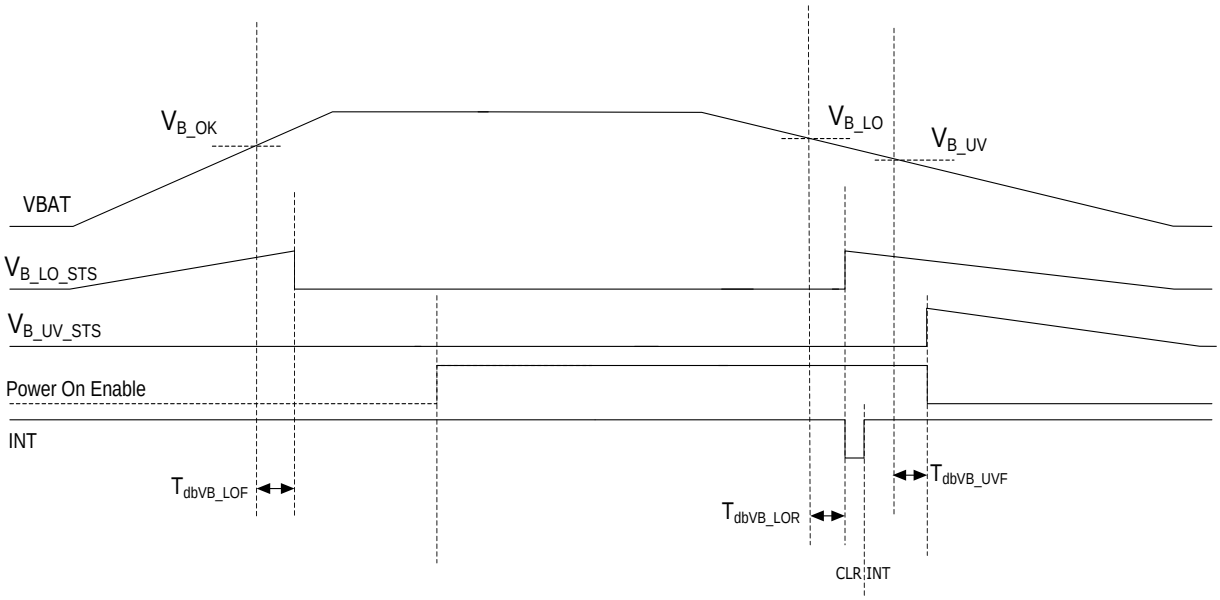


Fig. 4-4 Power Control Timing with VBAT Falling

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

Parameter	Description	Min	Typ	Max	Unit
T_{dbVB_LOF}	VB_LO falling-edge de-bouncing delay		2		ms
T_{dbVB_LOR}	VB_LO rising-edge de-bouncing delay		2		ms
T_{dbVB_UVF}	VB_UV falling-edge de-bouncing delay		2		ms
T_{dbPLUG_IN}	USB plug-in de-bouncing delay		100		ms
T_{dbPLUG_OUT}	USB plug-out de-bouncing delay		100		ms

Table 4-3 Timing characteristics of USB and VSYS voltages

4.6.4 Device State Control Through PWRON Signal

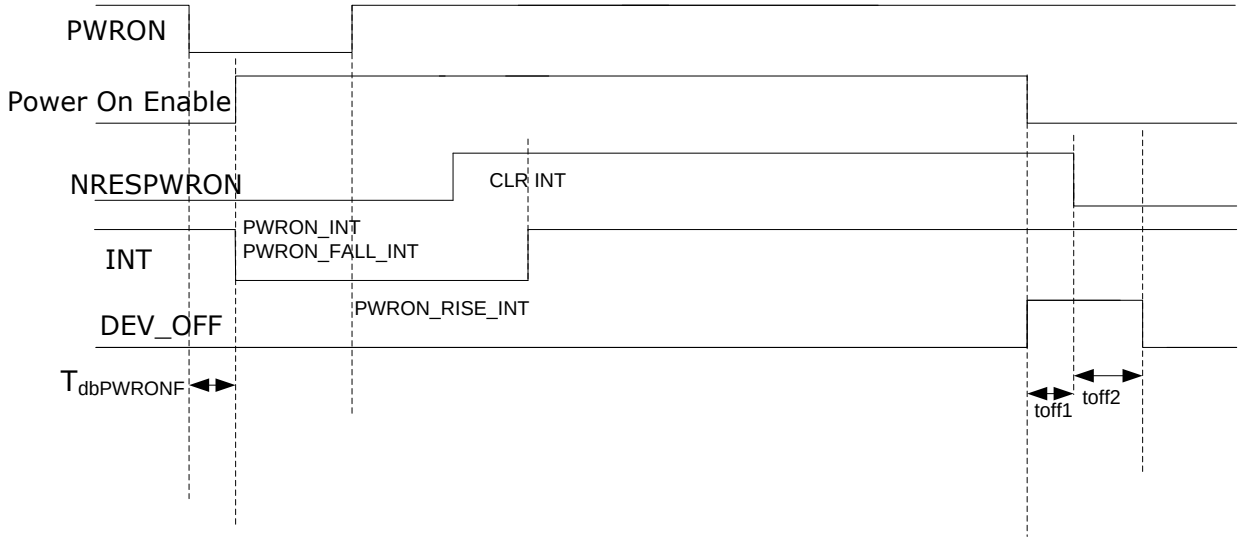


Fig. 4-5 PWRON turn on/DEV_OFF turn off

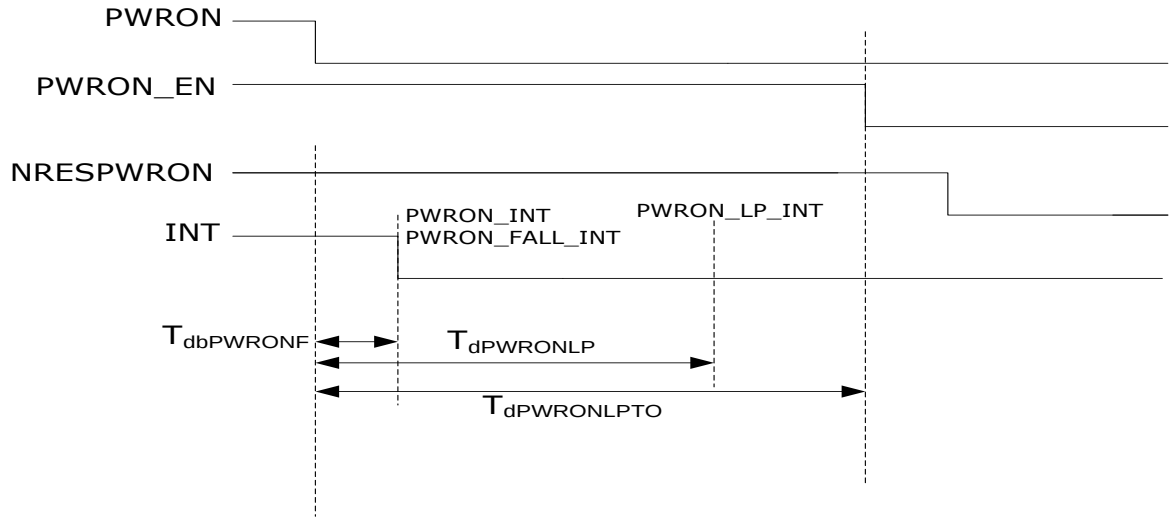


Fig. 4-6 PWRON long press turn off

4.6.5 Timing Characteristics (PWRON, DEV_OFF)

Parameter	Description	Min	Typ	Max	Unit
$T_{dbPWRONF}$	PWRON falling-edge de-bouncing delay		500		ms
$T_{dPWRONLP}$	PWRON long press delay to interrupt (PWRON falling edge to		1		s

Parameter	Description	Min	Typ	Max	Unit
	PWRON_LP_INT=1)				
$T_{dPWRONLPTO}$	PWRON long press delay to turn off (PWRON falling edge to NRESPWRON falling edge)		6		s

Table 4-4 Timing Characteristics of PWRON/DEV_OFF

4.6.6 SLEEP State Control

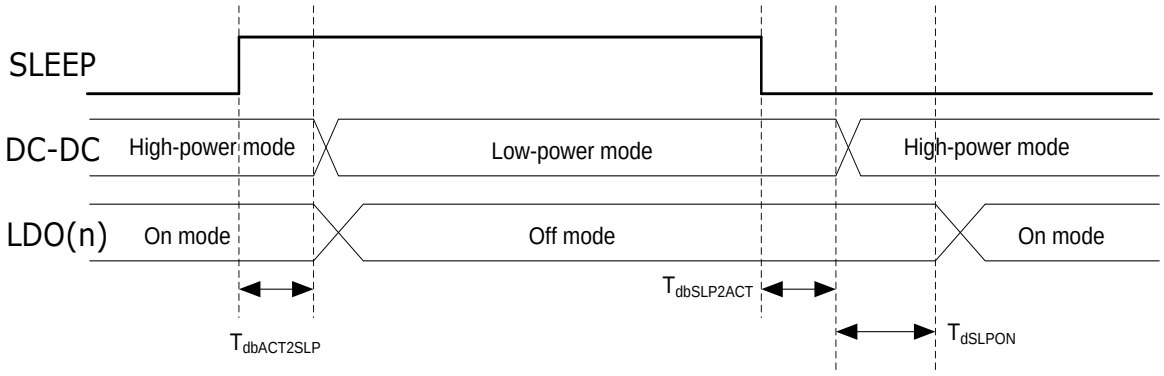


Fig. 4-7 SLEEP/ACTIVE Transition Timing

4.6.7 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/RESET
RTC REGISTERS			
00	SECONDS REG	RW	00
01	MINUTES REG	RW	50
02	HOURS REG	RW	08
03	DAYS_REG	RW	21
04	MONTHS_REG	RW	01
05	YEARS_REG	RW	13
06	WEEKS_REG	RW	01
08	ALARM_SECONDS_REG	RW	00
09	ALARM_MINUTES REG	RW	00
0A	ALARM_HOURS REG	RW	00
0B	ALARM_DAYS_REG	RW	01
0C	ALARM_MONTHS_REG	RW	01
0D	ALARM_YEARS_REG	RW	00
10	RTC_CTRL_REG	RW	00
11	RTC_STATUS_REG	RW	82
12	RTC_INT_REG	RW	00
13	RTC_COMP_LSB_REG	RW	00
14	RTC_COMP_MSB_REG	RW	00
RESERVED REGISTERS			
0E	RESERVED	RW	00
0F	RESERVED	RW	00
15	RESERVED	RW	00
16	RESERVED	RW	00
17	RESERVED	RW	00
18	RESERVED	RW	00
MISC REGISTERS			
20	CLK32KOUT_REG	RW	00
21	VB_MON_REG	RW	06
22	THERMAL_REG	RW	00
POWER CHANNEL CONTROL/MONITOR REGISTERS			
23	DCDC_EN_REG	RW	boot
24	LDO_EN_REG	RW	boot
25	SLEEP_SET_OFF_REG1	RW	00
26	SLEEP_SET_OFF_REG2	RW	00
27	DCDC_UV_STS_REG	RO	00
28	DCDC_UV_ACT_REG	RW	1F
29	LDO_UV_STS_REG	RO	00
2A	LDO_UV_ACT_REG	RW	FF
2B	DCDC_PG_REG	RO	00

HEX ADDRESS	FUNCTION DESCRIPTION	r/W	DEFAULT/RESET
2C	LDO_PG_REG	RO	00
2D	VOUT_MON_TDB_REG	RW	02
POWER CHANNEL CONFIGIRATION REGISTERS			
2E	BUCK1_CONFIG_REG	RW	01
2F	BUCK1_ON_VSEL	RW	boot
30	BUCK1_SLP_VSEL	RW	00
31	BUCK1_DVS_VSEL	RW	00
32	BUCK2_CONFIG_REG	RW	01
33	BUCK2_ON_VSEL	RW	boot
34	BUCK2_SLP_VSEL	RW	00
35	BUCK2_DVS_VSEL	RW	00
36	BUCK3_CONFIG_REG	RW	01
37	BUCK4_CONFIG_REG	RW	00
38	BUCK4_ON_VSEL	RW	boot
39	BUCK4_SLP_VSEL_REG	RW	00
3A	BOOST_CONFIG_REG	RW	09
3B	LDO1_ON_VSEL_REG	RW	boot
3C	LDO1_SLP_VSEL_REG	RW	00
3D	LDO2_ON_VSEL_REG	RW	boot
3E	LDO2_SLP_VSEL_REG	RW	00
3F	LDO3_ON_VSEL_REG	RW	boot
40	LDO3_SLP_VSEL_REG	RW	00
41	LDO4_ON_VSEL_REG	RW	boot
42	LDO4_SLP_VSEL_REG	RW	00
43	LDO5_ON_VSEL_REG	RW	boot
44	LDO5_SLP_VSEL_REG	RW	00
45	LDO6_ON_VSEL_REG	RW	boot
46	LDO6_SLP_VSEL_REG	RW	00
47	LDO7_ON_VSEL_REG	RW	boot
48	LDO7_SLP_VSEL_REG	RW	00
49	LDO8_ON_VSEL_REG	RW	boot
4A	LDO8_SLP_VSEL_REG	RW	00
4B	DEVCTRL_REG	RW	00
INTERRUPT REGISTERS			
4C	INT_STS_REG1	RW	00
4D	INT_STS_MSK_REG1	RW	00
4E	INT_STS_REG2	RW	00
4F	INT_STS_MSK_REG2	RW	00
50	IO_POL_REG	RW	06
BOOST/OTG/DCDC CURRENT LIMIT REGISTERS			
52	H5V_EN_REG	RW	00
53	SLEEP_SET_OFF_REG3	RW	00
54	BOOST_LDO9_ON_VSEL_REG	RW	

HEX ADDRESS	FUNCTION DESCRIPTION	r/W	DEFAULT/RESET
55	BOOST_LDO9_SLP_VSEL_REG	RW	60
56	BOOST_CTRL_REG	RW	00
90	DCDC_ILMAX	RW	55
CHARGING CONTROL REGISTERS			
9A	CHRG_COMP_REG	RW	00
A0	SUP_STS_REG	RW	0C
A1	USB_CTRL_REG	RW	
A3	CHRG_CTRL_REG1	RW	B5
A4	CHRG_CTRL_REG2	RW	4A
A5	CHRG_CTRL_REG3	RW	02
A6	OTG_ILIM_REG BAT_CTRL_REG	RW	8C
A8	BAT_HTS_TS1_REG	RW	00
A9	BAT_LTS_TS1_REG	RW	FF
AA	BAT_HTS_TS2_REG	RW	00
AB	BAT_LTS_TS2_REG	RW	FF
AC	TS_CTRL_REG	RW	8F
AD	ADC_CTRL_REG	RW	00
AE	ON_SOURCE	RO	00
AF	OFF_SOURCE	RO	00
BATTERY FUEL GAUSE REGISTER			
B0	GGCON	RW	4A
B1	GGSTS	RW	40
B2	FRAME_SMP_INTERV_REG	RW	01
B3	AUTO_SLP_CUR_THR_REG	RW	40
B4	GASCNT_CAL_REG3	RW	00
B5	GASCNT_CAL_REG2	RW	00
B6	GASCNT_CAL_REG1	RW	00
B7	GASCNT_CAL_REG0	RW	00
B8	GASCNT3	R	00
B9	GASCNT2	R	00
BA	GASCNT1	R	00
BB	GASCNT0	R	00
BC	BAT_CUR_AVG_REGH	R	00
BD	BAT_CUR_AVG_REGL	R	00
BE	TS1_ADC_REGH	R	00
BF	TS1_ADC_REGL	R	00
C0	TS2_ADC_REGH	R	00
C1	TS2_ADC_REGL	R	00
C2	BAT_OCV_REGH	R	00

HEX ADDRESS	FUNCTION DESCRIPTION	r/W	DEFAULT/RESET
C3	BAT_OCV_REGL	R	00
C4	BAT_VOL_REGH	R	00
C5	BAT_VOL_REGL	R	00
C6	RELAX_ENTRY_THRES_REGH	RW	00
C7	RELAX_ENTRY_THRES_REGL	RW	60
C8	RELAX_EXIT_THRES_REGH	RW	00
C9	RELAX_EXIT_THRES_REGL	RW	60
CA	RELAX_VOL1_REGH	R	00
CB	RELAX_VOL1_REGL	R	00
CC	RELAX_VOL2_REGH	R	00
CD	RELAX_VOL2_REGL	R	00
CE	BAT_CUR_R_CALC_REGH	R	00
CF	BAT_CUR_R_CALC_REGL	R	00
D0	BAT_VOL_R_CALC_REGH	R	00
D1	BAT_VOL_R_CALC_REGL	R	00
D2	CAL_OFFSET_REGH	RW	7F
D3	CAL_OFFSET_REGL	RW	FF
D4	NON_ACT_TIMER_CNT_REGL	R	00
D5	VCALIB0_REGH	R	00
D6	VCALIB0_REGL	R	00
D7	VCALIB1_REGH	R	00
D8	VCALIB1_REGL	R	00
DD	IOFFSET_REGH	R	00
DE	IOFFSET_REGL	R	00
DATA REGISTERS			
DF	DATA0	RW	00
E0	DATA1	RW	00
E1	DATA2	RW	00
E2	DATA3	RW	00
E3	DATA4	RW	00
E4	DATA5	RW	00
E5	DATA6	RW	00
E6	DATA7	RW	00
E7	DATA8	RW	00
E8	DATA9	RW	00
E9	DATA10	RW	00
EA	DATA11	RW	00
EB	DATA12	RW	00
EC	DATA13	RW	00

HEX ADDRESS	FUNCTION DESCRIPTION	r/W	DEFAULT/RESET
ED	DATA14	RW	00
EE	DATA15	RW	00
EF	DATA16	RW	00
F0	DATA17	RW	00
F1	DATA18	RW	00
F2	DATA19	RW	00

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

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

- **DAYS_REG : 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	Reserved
Bit 5-4	Set the second digit of the RTC days
Bit 3-0	Set the first digit of the RTC days
Note	BCD coding from 0 to 28/29/30/31

- **MONTHS_REG : RTC MONTH REGISTER**

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

Description

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

- **YEARS_REG : RTC YEAR REGISTER**

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

Description

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

- **WEEKS_REG : RTC WEEK REGISTER**

ADDRESS: 06H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	RESV	WEEK		
DEFAULT	0	0	0	0	0	0	0	1

	Description
Bit 7-3	Reserved
Bit 3-0	Set the second digit of the RTC weeks
Note	BCD coding from 1 to 7

- **ALARM_SECONDS_REG : RTC ALARM SECOND 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	Reserved
Bit 6-4	Set the second digit of the RTC alarm seconds
Bit 3-0	Set the first digit of the RTC alarm seconds
Note	BCD coding from 00 to 59

- **ALARM_MINUTES_REG : RTC ALARM MINUTE 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	Reserved
Bit 6-4	Set the second digit of the RTC alarm minutes
Bit 3-0	Set the first digit of the RTC alarm minutes
Note	BCD coding from 00 to 59

- **ALARM_HOURS_REG : RTC ALARM HOUR REGISTER**

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

	Description
Bit 7	Set PM) or AM: only used in PM-AM mode, 1: PM. 0:AM.
Bit 6	Reserved
Bit 5-4	Set the second digit of the RTC alarm hours
Bit 3-0	Set the first digit of the RTC alarm hours
Note	HOUR1/0 BCD coding from 0 to 11/23

- **ALARM_DAYS_REG : RTC ALAR DAY 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 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 : RTC ALARM MONTH 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 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 : RTC ALARM YEAR 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 : RTC CONTROL REGISTER**

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

Description

Bit 7 RTC_READ_SEL: 0: Read access directly to dynamic registers.
1: Read access to static shadowed registers.

Bit 6 GET_TIME: Rising transition of this register transfers dynamic registers into static shadowed registers..

Bit 5 SET_32_COUNTER: 1: Set the 32Khz counter with COMP_REG value. It must only be used when the RTC is frozen.

Bit 4 TEST_MODE: 1: Test mode (Auto compensation is enabled when the 32kHz counter reaches at its end)

Bit 3 AMPM_MODE: 0: 24 hours mode.
1: 12 hours mode (PM-AM mode)

Bit 2 AUTO_COMP: 0: No auto compensation RW0.
1: Auto compensation enabled

Bit 1 ROUND_30S: 1: When "1" is written, the time is rounded to the closest minute in the next second, and is self-cleared after rounding.

Bit 0 STOP_RTC: 0: RTC is running.
1: RTC is frozen.
RTC_time can only be changed during RTC frozen.

- **RTC_STATUS_REG : 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 secondr has occurred

Bit 1 RUN: 0: RTC is frozen. 1: RTC is running. This bit shows the real state of the RTC

Bit 0 RESEVERED

- **RTC_INT_REG : RTC INTERRUPT REGISTER**

ADDRESS: 12H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	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 RESEVERED

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 : RTC COMPENSATION LSB REGISTER**

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 : RTC COMPENSATION MSB REGISTER**

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]

5.2.2 MISC REGISTERS

- **CLK32KOUT_REG : RTC 32KHz CLOCK OUTPUT REGISTER**

ADDRESS: 20H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESERVED						CLK32KOUT2_FUN	CLK32KOUT2_EN
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-2 RESERVED

Bit 1 CLK32KOUT2_FUN: CLK32KOUT2 pin functional definition
0：32.768K clock output

1：Recovery function

Bit 0 CLK32KOUT2_EN: If CLK32KOUT2_FUN=0，then
1: CLK32KOUT2 is enabled
0: CLK32KOUT2 is disabled

- **VB_MON_REG : BATTERY VOLTAGE MONITOR REGISTER**

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

Description

Bit 7 RESERVED

Bit 6 PLUG_IN_STS: charger plug-in event occurs(DC PIN voltage >3.8V)
0: no charger plug in
1: charger pluged in
This bit is read only

Bit 5 VB_UV_STS: Battery under voltage lockout status(shut down system if the bit=1)
This bit is read only

Bit 4 VB_LO_ACT: VBAT low action
0: shut down system
1: insert interrupt

Bit 3 VB_LO_STS: Battery low voltage status
0: VBAT>VB_LO_SEL
1: VBAT<VB_LO_SEL
This bit is read only

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

- **THERMAL_REG : THERMAL CONTROL REGISTER**

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

Description

Bit 7-5 Reserved

Bit 4 TSD_TEMP: Thermal shutdown temperture threshold
0: 140℃;
1: 160℃

Bit 3-2 HOTDIE_TEMP: Hot-die temperature threshold

00：85℃；01：95℃；10：105℃；11：115℃；

Bit 1 HOTDIE_STS: Hot-die warning
This bit is read only bit.

Bit 0 TSD-STS: Thermal shut down

5.2.3 POWER CHANNEL CONTROL/MONITOR REGISTERS

- **DCDC_EN_REG : DC-DC CONVERTER ENABLE REGISTER**

ADDRESS: 23H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	OTG_EN	SWITCH_EN	LDO9_EN	BOOST_EN	BUCK4_EN	BUCK3_EN	BUCK2_EN	BUCK1_EN
DEFAULT	Boot							

Description

Bit 7 OTG_EN，OTG enable
1： Enable
0： Disable
DEFAULT value is set by boot.

Bit 6 SWITCH_EN: SWITCH enable
1: Enable
0: Disable
DEFAULT 由 bootSet.

Bit 5 LDO9_EN: LDO9 enable
1: Enable
0: Disable
DEFAULT value is set by boot.

Bit 4 BOOST_EN: BOOST enable
1: Enable
0: Disable
The default value is set by boot.

Bit 3-0 BUCK(n)_EN: BUCKn enable
1: Enable
0: Disable
The default value is set by boot.

- **LDO_EN_REG : LDO ENABLE REGISTER**

ADDRESS: 24H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	LDO8_EN	LDO7_EN	LDO6_EN	LDO5_EN	LDO4_EN	LDO3_EN	LDO2_EN	LDO1_EN
DEFAULT	Boot							

Description

Bit 7-0 LDOn: LDO(n) enable
1: Enable

0: Disable
The default value is set by boot.

- **SLEEP_SET_OFF_REG1 : SLEEP SET OFF REGISTER #1**

ADDRESS: 25H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	OTG_SLP_SET_OFF	SWITCH_SLP_SET_OFF	LDO9_SLP_SET_OFF	BOOST_SLP_SET_OFF	BUCK4_SLP_SET_OFF	BUCK3_SLP_SET_OFF	BUCK2_SLP_SET_OFF	BUCK1_SLP_SET_OFF
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 1: OTG is set off in sleep mode
0: No effect.
Bit 6 1: Switch is set off in sleep mode
0: No effect.
Bit 5 1: LDO9 is set off in sleep mode
0: No effect.
Bit 4 1: The boost converter is set off in sleep mode
0: No effect.
Bit 3 1: Buck4 is set off in sleep mode
0: No effect.
Bit 2 1: Buck3 is set off in sleep mode
0: No effect.
Bit 1 1: Buck2 is set off in sleep mode
0: No effect.
Bit 0 1: Buck1 is set off in sleep mode
0: No effect.

- **SLEEP_SET_OFF_REG2 : SLEEP SET OFF REGISTER #2**

ADDRESS: 26H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	LDO8_SLP_SET_OFF	LDO7_SLP_SET_OFF	LDO6_SLP_SET_OFF	LDO5_SLP_SET_OFF	LDO4_SLP_SET_OFF	LDO3_SLP_SET_OFF	LDO2_SLP_SET_OFF	LDO1_SLP_SET_OFF
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 1: LDO8 is set off in sleep mode
0: No effect.
Bit 6 1: LDO7 is set off in sleep mode
0: No effect.
Bit 5 1: LDO6 is set off in sleep mode
0: No effect.

Bit 4 1: LDO5 is set off in sleep mode
0: No effect.
Bit 3 1: LDO4 is set off in sleep mode
0: No effect.
Bit 2 1: LDO3 is set off in sleep mode
0: No effect.
Bit 1 1: LDO2 is set off in sleep mode
0: No effect.
Bit 0 1: LDO1 is set off in sleep mode
0: No effect.

- **DCDC_UV_STS_REG : DC-DC UNDER VOLTAGE STATUS REGISTER**

ADDRESS: 27H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	OTG_UV_STS	H5V_UV_STS	LDO9_UV_STS	BOOST_UV_STS	BUCK4_UV_STS	BUCK3_UV_STS	BUCK2_UV_STS	BUCK1_UV_STS
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 OTG_UV_STS: OTG under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 6 H5V_UV_STS: H5V under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 5 LDO9_UV_STS: LDO9 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 4 BOOST_UV_STS: BOOST under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 3 BUCK4_UV_STS: BUCK4 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 2 BUCK3_UV_STS: BUCK3 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 1 BUCK2_UV_STS: BUCK2 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 0 BUCK1_UV_STS: BUCK1 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal

- **DCDC_UV_ACT_REG : DC-DC UNDER VOLTAGE ACTION REGISTER**

ADDRESS: 28H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	OTG_UV_ACT	H5V_UV_ACT	LDO9_UV_ACT	BOOST_UV_ACT	BUCK4_UV_ACT	BUCK3_UV_ACT	BUCK2_UV_ACT	BUCK1_UV_ACT
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 OTG_UV_ACT: OTG under voltage action.
1: Restart OTG
0: No effect

Bit 6 H5V_UV_ACT: H5V under voltage action.
1: Restart H5V
0: No effect

Bit 5 LDO9_UV_ACT: LDO9 under voltage action.
1: Restart LDO9
0: No effect

Bit 4 BOOST_UV_ACT: BOOST under voltage action.
1: shut down converter(this shut down action will also reset the BOOST_EN bit to 0)
0: No effect

Bit 3 BUCK4_UV_ACT: BUCK4 under voltage action.
1: Restart BUCK4
0: No effect

Bit 2 BUCK3_UV_ACT: BUCK3 under voltage action.
1: Restart BUCK3
0: No effect

Bit 1 BUCK2_UV_ACT: BUCK2 under voltage action.
1: Restart BUCK2
0: No effect

Bit 0 BUCK1_UV_ACT: BUCK1 under voltage action.
1: Restart BUCK1
0: No effect

- **LDO_UV_STS_REG : LDO UNDER VOLTAGE S TATUS REGISTER**

ADDRESS: 29H				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	LDO8_UV_STS	LDO7_UV_STS	LDO6_UV_STS	LDO5_UV_STS	LDO4_UV_STS	LDO3_UV_STS	LDO2_UV_STS	LDO1_UV_STS
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 LDO8_UV_STS: LDO8 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal

Bit 6 LDO7_UV_STS: LDO7 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 5 LDO6_UV_STS: LDO6 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 4 LDO5_UV_STS: LDO5 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 3 LDO4_UV_STS: LDO4 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 2 LDO3_UV_STS: LDO3 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 1 LDO2_UV_STS: LDO2 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal
Bit 0 LDO1_UV_STS: LDO1 under voltage flag.
1: Output voltage drop below 85% of nominal voltage
0: Normal

- **LDO_UV_ACT_REG : LDO UNVER VOLTAGE ACTION REGISTER**

ADDRESS: 2AH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	LDO8_UV_ACT	LDO7_UV_ACT	LDO6_UV_ACT	LDO5_UV_ACT	LDO4_UV_ACT	LDO3_UV_ACT	LDO2_UV_ACT	LDO1_UV_ACT
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 LDO8_UV_ACT: LDO8 under voltage action
1: Restart LDO8
0: No effect
Bit 6 LDO7_UV_ACT: LDO7 under voltage action
1: Restart LDO7
0: No effect
Bit 5 LDO6_UV_ACT: LDO6 under voltage action
1: Restart LDO6
0: No effect
Bit 4 LDO5_UV_ACT: LDO5 under voltage action
1: Restart LDO5
0: No effect
Bit 3 LDO4_UV_ACT: LDO4 under voltage action
1: Restart LDO4
0: No effect
Bit 2 LDO3_UV_ACT: LDO3 under voltage action

1: Restart LDO3
0: No effect

Bit 1 LDO2_UV_ACT: LDO2 under voltage action
1: Restart LDO2
0: No effect

Bit 0 LDO1_UV_ACT: LDO1 under voltage action
1: Restart LDO1
0: No effect

- **DCDC_PG_REG : DC-DC POWER GOOD STATUS REGISTER**

ADDRESS: 2BH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	OTG_PG_STS	H5V_PG_STS	LDO9_PG_STS	BOOST_PG_STS	BUCK4_PG_STS	BUCK3_PG_STS	BUCK2_PG_STS	BUCK1_PG_STS
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 OTG_PG_STS: OTG power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 6 H5V_PG_STS: H5V power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 5 LDO9_PG_STS: LDO9 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 4 BOOST_PG_STS: BOOST power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 3 BUCK4_PG_STS : BUCK4 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 2 BUCK3_PG_STS : BUCK3 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 1 BUCK2_PG_STS : BUCK2 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 0 BUCK1_PG_STS : BUCK1 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

- **LDO_PG_REG : LDO POWER GOOD STATUS REGISTER**

ADDRESS: 2CH				TYPE: RO				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	LDO8_PG_STS	LDO7_PG_STS	LDO6_PG_STS	LDO5_PG_STS	LDO4_PG_STS	LDO3_PG_STS	LDO2_PG_STS	LDO1_PG_STS
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 LDO8_PG_STS : LDO8 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 6 LDO7_PG_STS : LDO7 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 5 LDO6_PG_STS : LDO6 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 4 LDO5_PG_STS : LDO5 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 3 LDO4_PG_STS : LDO4 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 2 LDO3_PG_STS : LDO3 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 1 LDO2_PG_STS : LDO2 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

Bit 0 LDO1_PG_STS : LDO1 power good flag.
1: Power good, Vout>90% of setting voltage
0: Power not good, Vout<90% of setting voltage

- **VOUT_MON_TDB_REG : VOUT DEBOUNCE MONITOR REGISTER**

ADDRESS: 2DH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	RESV	RESV	VOUT_MON_TDB	
DEFAULT	0	0	0	0	0	0	1	0

Description

Bit 7-2 Reserved

Bit 1-0 VOUT_MON_TDB: Vout monitor debouncing time(UV_STS rising edge and PG_STS rising edge debounce time)
00: 62us
01: 124us(default)
10: 186us
11: 248us

5.2.4 POWER CHANNEL CONFIGURATION REGISTER

- **BUCK1_CONFIG_REG : BUCK1 CONFIGURATION REGISTER**

ADDRESS: 2EH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	BUCK1_PHASE	RESV	BUCK1_RATE		BUCK1_ILMIN		
DEFAULT	0	0	0	1	1	0	1	0

Description

Bit 7 Reserved

Bit 6 BUCK1_PHASE,
0: Normal,
1: Inverted

Bit 5 Reserved

Bit 4-3 BUCK1_RATE: Voltage change rate after DVS
00: 2mv/us
01: 3mv/us
10: 4.5mv/us
11: 6mv/us

Bit 2-0 BUCK1_ILMIN:
000: 50mA, 001: 100mA, 010: 150mA, 011: 200mA
100: 250mA, 101: 300mA, 110: 350mA, 111: 400mA

- **BUCK1_ON_VSEL : BUCK1 ACTIVE MODE REGISTER**

ADDRESS: 2FH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK1_ON_FPWM	RESV	BUCK1_ON_VSEL					
DEFAULT	0	0	Boot					

Description

Bit 7 BUCK1_ON_FPWM:
1: Forced PWM mode in active mode.
0: PWM/PFM auto change mode.(default)

Bit 6 Reserved

Bit 5-0 BUCK1_ON_VSEL: BUCK1 active mode voltage selection,
0.7125V~1.5V ,step=12.5mV
000 000: 0.7125V
000 001: 0.725V
.....
111 111: 1.5V
The default value is set by boot.

- **BUCK1_SLP_VSEL : BUCK1 SLEEP MODE 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	0	0	0	0	0	0

Description

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

Bit 6 Reserved

Bit 5-0 BUCK1_SLP_VSEL: BUCK1 sleep mode voltage selection, 0.7125V~1.5V , step=12.5mV

000 000: 0.7125V
000 001: 0.725V
……
111 111: 1.5V

- **BUCK2_CONFIG_REG : BUCK2 CONFIGURATION REGISTER**

ADDRESS: 32H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	BUCK2_PHASE	RESV	BUCK2_RATE		BUCK2_ILMIN		
DEFAULT	0	0	0	1	1	0	1	0

Description

Bit 7 Reserved

Bit 6 BUCK2_PHASE,
0: Normal,
1: Inverted

Bit 5 Reserved

Bit 4-3 BUCK2_RATE: Voltage change rate after DVS.
00: 2mv/us
01: 3mv/us
10: 4.5mv/us
11: 6mv/us

Bit 2-0 BUCK2_ILMIN:
000: 50mA， 001: 100mA， 010: 150mA， 011: 200mA
100: 250mA， 101: 300mA， 110: 350mA， 111: 400mA

- **BUCK2_ON_VSEL : BUCK2 ACTIVE MODE REGISTER**

ADDRESS: 33H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK2_ON_FPWM	RESV	BUCK2_ON_VSEL					
DEFAULT	0	0	Boot					

	Description
Bit 7	BUCK2_ON_FPWM 1: Forced PWM mode in active mode. 0: PWM/PFM auto change mode.(default)
Bit 6	Reserved
Bit 5-0	BUCK2_ON_VSEL: BUCK2 active mode voltage selection, 0.7125V~1.5V , step=12.5mV 000 000: 0.7125V 000 001: 0.725V …… 111 111: 1.5V The default value is set by boot.

- **BUCK2_SLP_VSEL : BUCK2 SLEEP MODE 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	0	0	0	0	0	0

	Description
Bit 7	BUCK2_SLP_FPWM: 1: Forced PWM mode in sleep mode. 0: PWM/PFM auto change mode.(default)
Bit 6	Reserved
Bit 5-0	BUCK2_SLP_VSEL: BUCK1 sleep mode voltage selection, 0.7125V~1.5V , step=12.5mV 000 000: 0.7125V 000 001: 0.725V …… 111 111: 1.5V

- **BUCK3_CONFIG_REG : BUCK3 CONFIGURATION REGISTER**

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

	Description
Bit 7	BUCK3_ON_FPWM: 1: Forced PWM mode in active mode.

0: PWM/PFM auto change mode.(default)

Bit 6 BUCK3_PHASE,
0: Normal,
1: Inverted

Bit 5-3 Reserved

Bit 2-0 BUCK3_ILMIN:
000: 50mA， 001: 100mA， 010: 150mA， 011: 200mA
100: 250mA， 101: 300mA， 110: 350mA， 111: 400mA

- **BUCK4_CONFIG_REG : BUCK4 CONFIGURATION REGISTER**

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

Description

Bit 7 RESERVED

Bit 6 BUCK4_PHASE,
0: Normal,
1: Inverted

Bit 2-0 BUCK4_ILMIN:
000: 50mA， 001: 100mA， 010: 150mA， 011: 200mA
100: 250mA， 101: 300mA， 110: 350mA， 111: 400mA

- **BUCK4_ON_VSEL : BUCK4 ACTIVE MODE REGISTER**

ADDRESS: 38H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK4_ON_FPWM	RESV	RESV	BUCK4_ON_VSEL				
DEFAULT	0	0	0	Boot				

Description

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

Bit 6-4 RESERVED

Bit 3-0 BUCK4_ON_VSEL: BUCK4 active mode voltage selection, 1.8V~3.3V , step=100Mv

00000: 1.8V
00001: 1.9V
……
01110: 3.2V
01111: 3.3V
10000: 3.4V

10001: 3.5V
10010: 3.6V
The default value is set by boot.

- **BUCK4_SLP_VSEL : BUCK4 SLEEP MODE REGISTER**

ADDRESS: 39H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK4_SLP_FPWM	RESV	RESV	BUCK4_SLP_VSEL				
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 BUCK4_SLP_FPWM:
1: Forced PWM mode in sleep mode.
0: PWM/PFM auto change mode.(default)
Bit 6-5 Reserved
Bit 4-0 BUCK4_SLP_VSEL: BUCK4 sleep mode voltage selection, 1.8V~3.3V , step=100Mv

00000: 1.8V
00001: 1.9V
……
01110: 3.2V
01111: 3.3V
10000: 3.4V
10001: 3.5V
10010: 3.6V

- **BOOST_CONFIG_REG : BOOST CONFIGURATIN REGISTER**

ADDRESS: 3AH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	BOOST_ANTI_RING	BOOST_PHASE	BOOST_ILMAX		BOOST_ILMIN		
DEFAULT	0	0	0	0	1	0	1	0

Description

Bit 7 RESERVED
Bit 6 BOOST_ANTI_RING: BOOST anti-ring enable
0: Disable
1: Enable
Bit 5 BOOST_PHASE,
0: Normal
1: Inverted
Bit 4-3 BOOST_ILMAX:
00: 4A,

01: 4.5A,
10: 5A,
11: 5.5A

Bit 2-0 BOOST_ILMIN:
000: 75mA， 001: 100mA， 010: 125mA，011: 150mA
100: 175mA， 101: 200mA， 110: 225mA， 111: 250mA

- **LDO1_ON_VSEL_REG : LDO1 ACTIVE MODE VOLTAGE REGISTER**

ADDRESS: 3BH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO1_ON_VSEL				
DEFAULT	0	0	0	Boot				

Description

Bit 7-5 RESERVED

Bit 4-0 LDO1_ON_VSEL: LDO1 active mode voltage selection, 1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V
The default value is set by boot.

- **LDO1_SLP_VSEL_REG : LDO1 SLEEP MODE VOLTAGE SELECT REGISTER**

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

Description

Bit 7-5 Reserved

Bit 4-0 LDO1_SLP_VSEL: LDO1 SLEEP mode voltage selection. 1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V

- **LDO2_ON_VSEL_REG : LDO2 ACTIVE MODE VOLTAGE SELECT REGISTER**

ADDRESS: 3DH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	RESV	RESV	RESV	LDO2_ON_VSEL
DEFAULT	0	0	0	Boot

Description

Bit 7-5 RESERVED

Bit 4-0 LDO2_ON_VSEL: LDO2 active mode voltage selection. 1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V
DEFAULT value is set by boot.

- **LDO2_SLP_VSEL_REG : LDO2 SLEEP MODE VOLTAGE SELECT REGISTER**

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

Description

Bit 7-5 RESERVED

Bit 4-0 LDO2_SLP_VSEL: LDO2 sleep mode voltage selection.
1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V

- **LDO3_ON_VSEL_REG : LDO3 ACTIVE MODE VOLTAGE SELECT REGISTER**

ADDRESS: 3FH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	LDO3_ON_VSEL			
DEFAULT	0	0	0	0	Boot			

Description

Bit 7-4 RESERVED

Bit 4-3 LDO3_ON_VSEL: LDO3 active mode voltage selection.
0.8V~2.5V, step=0.1V
0000: 0.8V
0001: 0.9V

….
1100: 2.0V
1101: 2.2V
1111: 2.5V
DEFAULT value is set by boot.

- **LDO3_SLP_VSEL_REG : LDO3 SLEEP MODE VOLTAGE SELECT REGISTER**

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

	Description
Bit 7-4	RESERVED
Bit 3-0	LDO3_SLP_VSEL: LDO3 sleep mode voltage selection. 0.8V~2.5V, step=0.1V 0000: 0.8V 0001: 0.9V …. 1100: 2.0V 1101: 2.2V 1111: 2.5V DEFAULT value is set by boot.

- **LDO4_ON_VSEL_REG : LDO4 ACTIVE MODE VOLTAGE SELECT**

ADDRESS: 41H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO4_ON_VSEL				
DEFAULT	0	0	0	Boot				

	Description
Bit 7-5	RESERVED
Bit 4-0	LDO4_ON_VSEL: LDO4 active mode voltage selection. 1.8V~3.4V, step=0.1V 00000: 1.8V 00001: 1.9V …. 01110: 3.2V 01111: 3.3V 10000: 3.4V DEFAULT value is set by boot.

- **LDO4_SLP_VSEL_REG : LDO4 SLEEP MODE VOLTAGE SELECT REGISTER**

ADDRESS: 42H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	RESV	RESV	RESV	LDO4_SLP_VSEL				
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-5 RESERVED

Bit 4-0 LDO2_SLP_VSEL: LDO2 sleep mode voltage selection.
1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V

- **LDO5_ON_VSEL_REG : LDO5 ACTIVE MODE VOLTAGE SELECT REGISTER**

ADDRESS: 43H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO5_ON_VSEL				
DEFAULT	0	0	0	Boot				

Description

Bit 7-5 RESERVED

Bit 4-0 LDO5_ON_VSEL: LDO5 active mode voltage selection.
1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V
DEFAULT is set by boot.

- **LDO5_SLP_VSEL_REG : LDO5 SLEEP MODE VOLTAGE SELECT REGISTER**

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

Description

Bit 7-5 RESERVED

Bit 4-0 LDO5_SLP_VSEL: LDO5 sleep mode voltage selection.
1.8V~3.4V, step=0.1V
00000: 1.8V

00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V

- **LDO6_ON_VSEL_REG : LDO6 ACTIVE MODE VOLTAGE SELECT REGISTER**

ADDRESS: 45H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO6_ON_VSEL				
DEFAULT	0	0	0	Boot				

	Description
Bit 7-5	RESERVED
Bit 4-0	LDO6_ON_VSEL: LDO6 active mode voltage selection. 0.8V~2.5V, step=0.1V 00000: 0.8V 00001: 0.9V …… 10000: 2.4V 10001: 2.5V DEFAULT is set by boot.

- **LDO6_SLP_VSEL_REG : LDO6 SLEEP MODE VOLTAGE SELECT REGISTER**

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

	Description
Bit 7-5	RESERVED
Bit 4-0	LDO6_SLP_VSEL: LDO6 sleep mode voltage selection. 0.8V~2.5V, step=0.1V 00000: 0.8V 00001: 0.9V …… 10000: 2.4V 10001: 2.5V

- **LDO7_ON_VSEL_REG : LDO7 ACTIVE MODE VOLTAGE SELECT REGISTER**

ADDRESS: 47H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO7_ON_VSEL				
DEFAULT	0	0	0	Boot				

	Description
Bit 7-5	RESERVED
Bit 4-0	LDO7_ON_VSEL: LDO7 active mode voltage selection. 0.8V~2.5V, step=0.1V 00000: 0.8V 00001: 0.9V …… 10000: 2.4V 10001: 2.5V DEFAULT is set by boot.

- **LDO7_SLP_VSEL_REG : LDO7 SLEEP MODE VOLTAGE SELECT REGISTER**

ADDRESS: 48H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO7_SLP_VSEL				
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-5	RESERVED
Bit 4-0	LDO7_SLP_VSEL: LDO7 sleep mode voltage selection. 0.8V~2.5V, step=0.1V 00000: 0.8V 00001: 0.9V …… 10000: 2.4V 10001: 2.5V

- **LDO8_ON_VSEL_REG : LDO8 ACTIVE MODE VOLTAGE SELECT REGISTER**

ADDRESS: 49H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO8_ON_VSEL				
DEFAULT	0	0	0	Boot				

	Description
Bit 7-5	RESERVED
Bit 4-0	LDO8_ON_VSEL: LDO8 active mode voltage selection. 1.8V~3.4V, step=0.1V 00000: 1.8V 00001: 1.9V …. 01110: 3.2V 01111: 3.3V 10000: 3.4V DEFAULT is set by boot.

- **LDO8_SLP_VSEL_REG : LDO8 SLEEP MODE VOLTAGE SELECT REGISTER**

ADDRESS: 4AH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	LDO8_SLP_VSEL				
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-5 RESERVED

Bit 4-0 LDO8_SLP_VSEL: LDO8 sleep mode voltage selection.
1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V

- **DEV CTRL_REG : DEVICE CONTROL REGISTER**

ADDRESS: 4BH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	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 RESERVED

Bit 6 Long Press Action Selection
0：Power off
1： Power off and restart

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 start an ACTIVE to OFF or SLEEP to OFF device state transition (switch-off event) and activate reset of the digital core.

Bit 2 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.

5.2.5 INTERRUPT REGISTER

- **INT_STS_REG1 : INTERRUPT STATUS REGISTER #1**

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)	VOUT_LO_INT (Write 1 clr)
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 status.
Bit 3	PWRON_LP_INT: PWRON PIN long press event interrupt status.
Bit 2	PWRON_INT: PWRON event interrupt status.
Bit 1	VB_LO_INT: Battery under voltage alarm event interrupt status.
Bit 0	VOUT_LO_INT: VOUT under voltage alarm event interrupt status
Note:	1: Interrupt asserted, write "1" to clear 0: No interrupt

- **INT_MSK_REG1 : INTERRUPT MASK REGISTER #1**

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

	Description
Bit 7	USB_OV_INT_IM: USB over voltage event interrupt mask.
Bit 6	RTC_PERIOD_INT: RTC period event interrupt mask.
Bit 5	RTC_ALARM_INT: RTC alarm event interrupt mask.
Bit 4	HOTDIE_INT: Hot die event interrupt status mask.
Bit 3	PWRON_LP_INT: PWRON PIN long press event interrupt status mask.
Bit 2	PWRON_INT: PWRON event interrupt status mask.
Bit 1	VB_LO_INT: Battery under voltage alarm event interrupt status mask.
Bit 0	VOUT_LO_IM: Vout under voltage alarm event interrupt status mask
Note:	1: Mask the specified interrupt

0: Do not mask the specified interrupt

- **INT_STS_REG2 : INTERRUPT STATUS REGISTER#2**

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)	TS2_INT (Write 1 clr)	CHGTS1_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	TS2_INT: TS2 value exceeding upper or lower limits event interrupt.
Bit 4	CHGTS1_INT: TS1 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:	Write "1" to clear.

- **INT_STS_MSK_REG2 : INTERRUPT MASK REGISTER#2**

ADDRESS: 4FH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	DISCHG_ILIM_INT_IM	CHG_CVTLIM_INT_IM	TS2_INT_IM	CHGTS1_INT_IM	CHGTE_INT_IM	CHGOK_INT_IM	PLUG_OUT_INT_IM	PLUG_IN_INT_IM
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7	DISCHG_ILIM_INT_IM：Discharging triggering current limit event interrupt mask 1: Mask the interrupt 0: Do not mask the interrupt
Bit 6	CHG_CVTLIM_INT_IM：Charging triggering input voltage limit, or current limit, or temperature protection event interrupt mask. 1: Mask the interrupt 0: Do not mask the interrupt
Bit 5	

TS2_INT_IM：TS2 value exceeding upper or lower limits event interrupt mask

Bit 4 1: Mask the interrupt
0: Do not mask the interrupt
CHGTS1_INT_IM:TS1 value exceeding upper or lower limits event interrupt mask.

Bit 3 1: Mask the interrupt
0: Do not mask the interrupt
CHGTE_INT_IM：Charging overtime event interrupt mask

Bit 2 1: Mask the interrupt
0: Do not mask the interrupt
CHGOK_INT_IM：Charging termination event interrupt mask.
1: Mask the interrupt
0: Do not mask the interrupt

Bit 1 PLUG_OUT_INT_IM: Charger plug out event interrupt mask.
1: Mask the interrupt
0: Do not mask the interrupt

Bit 0 PLUG_IN_INT_IM: Charger plug in event interrupt mask
1: Mask the interrupt
0: Do not mask the interrupt

- **IO_POL_REG : IO POLARITY REGISTER**

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

Description

Bit 7-1 RESERVED

Bit 0 INT_POL: INT pin polarity
0: active low
1: active high

5.2.6 BOOST/OTG/DCDC REGISTER

- **H5V_EN_REG:**

ADDRESS: 52H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	RESV	BST_UHV_ST	REF_RDY_CTRL	H5V_EN
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-3 RESERVED

Bit 2 BST_UHV_ST: Boost over load enable
0: Enable
1: Disable

Bit 1 REF_RDY_CTRL: ref_rdy control
0: After PMIC is powered up, if vref is lower than a preset value, then ref_rdy can be switched to logic low level.
1: After PMIC is powered up, if vref is lower than a preset value, then RED_rdy must be kept at logic high level.

Bit 0 H5V_EN: HDMI 5V enable control
1: Enable
0: Disable

- **SLEEP_SEL_OFF_REG3:**

ADDRESS: 53H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	RESV	RESV	RESV	H5V_SLP_SET_OFF
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-1 RESERVED

Bit 0 1: HDMI 5V disabled in the SLEEP mode
0: HDMI 5V enabled in the SLEEP mode

- **BOOST_LDO9_ON_VSEL_REG:**

ADDRESS: 54H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BOOST_ON_VSEL			LDO9_ON_VSEL				
DEFAULT	由 BOOT 设定							

Description

Bit 7-5 BOOST_ON_VSEL<2:0>: BOOST active mode voltage selection
000: 4.7V 001: 4.8V
010: 4.9V 011: 5V
100: 5.1V 101: 5.2V
110: 5.3V 111: 5.4V

Bit 4-0 LDO9_ON_VSEL: LDO9 active mode voltage selection
1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V
Default value is set by boot.

- **BOOST_LDO9_SLP_VSEL_REG:**

ADDRESS: 55H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	BOOST_SLP_VSEL			LDO9_SLP_VSEL				
DEFAULT	0	1	1	0	0	0	0	0

Description

Bit 7-5 BOOST_SLP_VSEL<2:0>: BOOST SLEEP mode voltage selection
000: 4.7V 001: 4.8V
010: 4.9V 011: 5V
100: 5.1V 101: 5.2V
110: 5.3V 111: 5.4V

Bit 4-0 LDO9_SLP_VSEL: LDO9 SLEEP mode voltage selection
1.8V~3.4V, step=0.1V
00000: 1.8V
00001: 1.9V
….
01110: 3.2V
01111: 3.3V
10000: 3.4V

- **BOOST_CTRL_REG: BOOST CONTROL REGISTER**

ADDRESS: 56H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	BST_HV_ST	BST_SWITCH_VT	BST_SWITCH_VT_HYS	BST_SWITCH_EN	RESV	RESV	RESV
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7 RESERVED

Bit 6 BST_HV_ST: boost startup with heavy load
0: disable
1: enable

Bit 5 BST_SWITCH_VT: Switching threshold from Boost mode to Switch mode.
0: 3.8V
1: 3.9V

Bit 4 BST_SWITCH_VT_HYS: Hysteresis of switching threshold from Boost mode to Switch mode.
0: 200mV 1: 300mV

Bit 3 BST_SWITCH_EN: Boost operating in the switch mode enable control.
0: Disable
1: Enable

Bit 2:0 RESERVED

- **DCDC_ILMAX: DCDC inductor peak current register**

ADDRESS: 56H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BUCK4_ILMAX		BUCK3_ILMAX		BUCK2_ILMAX		BUCK1_ILMAX	

DEFAULT	0	1	0	1	0	1	0	1

Description

Bit 7:6 BUCK4_ILMAX:BUCK4 inductor peak current bit
00: 2.5A 01:3A 10:3.5A 11:4A

Bit 5:4 BUCK3_ILMAX:BUCK3 inductor peak current bit
00: 2A 01:2.5A 10:3A 11:3.5A

Bit 3:2 BUCK2_ILMAX:BUCK2 inductor peak current bit
00: 3.2A 01:3.6A 10:4A 11:5A

Bit 1:0 BUCK1_ILMAX:BUCK1 inductor peak current bit
00: 3.2A 01:3.6A 10:4A 11:5A

5.2.7 CHARGER SET REGISTER

- **CHRG_COMP_REG:**

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

Description

Bit 7-6 RESERVED
Bit 5-4 BAT_SYS_CMP_DLY: Delay time for the voltage comparator between BAT and SYS.
00: 20uS
10: 10uS
01: 40uS
11: 20uS
Bit 3-2 CHRG_IRVS: Setting the charger reverse current.
Bit 1-0 CHRG_OUTCV_COMP: Setting the charger output voltage loop compensation

- **SUP_STS_REG:**

ADDRESS: A0H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_EXS (Read only)	CHG_STS (Read only)			RESV	USB_ILIM_EN	USB_EXS (Read only)	USB_EFF (Read only)
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 RESV: Reserved

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:**

ADDRESS: A1H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	CHRG_CT_EN	USB_CHG_SD_VSEL			USB_ILIM_SEL			
DEFAULT	OTP							

Description

Bit 7 CHRG_CT_EN: Constant temperature charging enbale
0:disable
1:enable

Bit 6-4 USB_CHG_SD_VSEL: the USB low voltage shutdown charger voltage selection
000: 2.78V, 001:2.85V, 010: 2.92V, 011: 2.99V
100: 3.06V, 101: 3.13V, 110: 3.19V, 111: 3.26V

Bit 3-0 USB_ILIM_SEL: USB input current selection
0000: 0.45A, 0001: 0.08A, 0010: 0.85A, 0011: 1A,
0100: 1.25A, 0101: 1.5A, 0110: 1.75A, 0111: 2A,
1000: 2.25A, 1001: 2.5A, 1010: 2.75A, 1011: 3A,
11xx:3A

DEFAULT value is set by BOOT

- **CHRG_CTRL_REG1: CHARGE CONTROL REGISTER1**

ADDRESS: A3H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	CHRG_EN	CHRG_VOL_SEL			CHRG_CUR_SEL			
DEFAULT	1	0	1	1	0	1	0	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 3-0 CHRG_CUR_SEL: Charging current selection
0000:1A， 0001:1.2A， 0010:1.4A， 0011:1.6A
0100:1.8A， 0101:2A， 0110:2.2A， 0111:2.4A
1000:2.6A， 1001:2.8A， 1010--1111:3A

- **CHRG_CTRL_REG2: CHARGER CONTROL REGISTER2**

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	0	1	0	1	0

Description

Bit 7-6 CHRG_TERM_SEL: Charging termination current selection
00:100mA， 01:150mA， 10:200mA， 11:250mA

Bit 5-3 CHRG_TIMER_TRIKL: Trickle current charging time selection
000:30min. 001:60min， 010:90min， 011:120min，
100:150min， 101:180min， 110，111:210min

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: CHARGING CONTROL REGISTER3**

ADDRESS: A5H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	SYS_CAN_SD	TS2_SD_EN	CHRG_TERM_ANA_DIG	CHRG_PHASE	CHRG_TIMER_TRIKL_EN	CHRG_TIMER_CCCV_EN	RESV	
DEFAULT	0	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 TS2_SD_EN: PMIC EN bit control when TS2 is over either upper or lower limit
0: Disable the EN bit
1: Enable the EN bit

Bit 5 CHRG_TERM_ANA_DIG: Charging termination flag bit source selection
0: Analog
1: Digital

Bit 4 CHRG_PHASE: Charger timer reverse mode control
0: Normal
1: Reverse

Bit 3 CHRG_TIMER_TRIKL_EN: Trickle current charging timer control
0: Enable
1: Disable

Bit 2 CHRG_TIMER_CCCV_EN: Constant current/constant voltage timer control
0: Disable
1: Enable

Bit 1-0 Reserved

- **OTG_ILIM_REG/BAT_CTRL_REG: OTG/BATTERY CURRENT LIMIT REGISTER**

ADDRESS: A6H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_DIS_ILIM_EN	H5V_IPKLIM_SEL	OTG_IPKLIM_SEL	OTG_ILIM_SEL		BAT_DISCHRG_ILIM		
DEFAULT	1	0	0	0	1	1	0	0

Description

Bit 7 BAT_DIS_ILIM_EN: Discharging current limit function control
0: Disable
1: Enable

Bit 6 H5V_IPKLIM_SEL: HDMI 5V peak current limit selection
0: 100mA
1: 115mA

Bit 5 OTG_IPKLIM_SEL: OTG peak current limit selection
0:125%*OTG_ILIM_SEL
1:150%*OTG_ILIM_SEL

Bit 4-3 OTG_ILIM_SEL:OTG current limit selection
00:700mA, 01:800mA, 10:900mA, 11:1A

Bit 2-0 BAT_DISCHRG_ILIM: Discharging current limit selection
000:3A, 001:3.5A, 010:4A, 011 4.5A, 1xx:5A

- **BAT_HTS_TS1_REG: TS1 HT PROTECTION THRESHOLD REGISTER**

ADDRESS: A8H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_HTS_TS1							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	BAT_HTS_TS1: Battery over temperature protection threshold sensed at TS1.

- **BAT_LTS_TS1_REG: TS1 LT PROTECTION REGISTER**

ADDRESS: A9H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_LTS_TS1							
DEFAULT	1	1	1	1	1	1	1	1

	Description
Bit 7-0	BAT_LTS_TS1: Battery low temperature protection threshold sensed at TS1.

- **BAT_HTS_TS2_REG: TS2 HT PROTECTION REGISTER**

ADDRESS: AAH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_HTS_TS2							
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-0	BAT_HTS_TS2: Battery over temperature protection threshold sensed at TS2

- **BAT_LTS_TS2_REG: TS2 LT PROTECTION REGISTER**

ADDRESS: ABH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	BAT_LTS_TS2							
DEFAULT	1	1	1	1	1	1	1	1

	Description
Bit 7-0	BAT_LTS_TS2: Battery low temperature protection threshold sensed at TS2.

- **TS_CTRL_REG: TS PIN CONTROL REGISTER**

ADDRESS: ACH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	GG_EN	TS2_TE (Read only)	TS2_FUN	TS1_FUN	TS2_CUR		TS1_CUR	
DEFAULT	1	0	0	0	1	1	1	1

	Description
Bit 7	GG_EN: Battery fuel gauge enable control 0: Disable

1: Enable

Bit 6 TS2_TE: Flag for TS2 value out of higher or lower limit
0: Out of limit
1: In the limit

Bit 5 TS2_FUN: TS2 pin function selection
0: External temperature monitoring（NTC thermistor connected externally）
1: ADC input

Bit 4 TS1_FUN: TS1pin function selection
0: External temperature monitoring（NTC thermistor connected externally）
1:ADC input

Bit 3-2 TS2_CUR: TS2 pin output current selection in the temperature monitoring mode
00:20uA, 01:40uA, 10:60uA, 11:80uA

Bit 1-0 TS1_CUR: TS1 pin output current selection in the temperature monitoring mode
00:20uA, 01:40uA, 10:60uA, 11:80uA

- **ADC_CTRL_REG: ADC CONTROL REGISTER**

ADDRESS: ADH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	ADC_VOL_EN	ADC_CUR_EN	ADC_TS1_EN	ADC_TS2_EN	ADC_PHASE	ADC_CLK_SEL		
DEFAULT	0	0	0	0	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_TS1_EN: TS1 ADC enable control
0: Disable
1: Enable

Bit 4 ADC_TS2_EN: TS2 ADC enable control
0: Disable
1: Enable

Bit 3 ADC_PHASE: ADC's clock phase
0: Normal
1: Reverse

Bit 2-0 ADC_CLK_SEL: ADC clock frequency selection
000: 2Meg， 001: 1Meg， 010: 500K， 011: 250K，100: 125K
101: 64K, 110: 32K, 111: 16K

- **ON_SOURCE_REG: POWER UP SOURCE REGISTER**

ADDRESS: AEH				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	ON_PWRON	ON_PLUG_IN	ON_RTC	RESTART_RESETB	RESTART_PWRON_LP	RESTART_RECOVERY	RESV	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	RESTART_RECOVERY: PMIC restart by long pressing PWRON to trigger Recovery
Bit 1-0	RESERVED

- **OFF_SOURCE_REG: POWER OFF SOURCE REGISTER**

ADDRESS: AFH				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	OFF_REF_DN	OFF_SYS_OV	OFF_TSD	OFF_SYS_UV	OFF_DEV_OFF	OFF_PWRON_LP	OFF_TS2	OFF_SYS_LO
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7	OFF_REF_DN: PMIC power off due to Vref off the range during normal operation
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_TS2: PMIC power off due to TS2 value over the high or low limit
Bit 0	OFF_SYS_LO: PMIC power off due to Vsys low voltage set by software (If Reg21<4> vb_lo_act=0)

5.2.8 BATTERY FUEL GAUGE CONFIGURATION REGISTER

- **GGCON_REG: FUEL GAUGE CONFIGURATION 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	ADC_RES_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 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	ADC_RES_MODE: Battery internal resistance calculation control 0: Disable 1: Enable

- **GGSTS_REG: FUEL GAUGE STATUS REGISTER**

ADDRESS: B1H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RES_CUR_AVG_SEL<1:0>		BAT_CON	RELAX_VOL1_UPD	RELAX_VOL2_UPD	RELAX_STS(RO)	IV_AVG_UPD_STS
DEFAULT	0	1	0	0	0	0	0	0

	Description
Bit 7	RESERVED
Bit 6-5	RES_CUR_AVG_SEL<1:0>: The fraction of the current ripple for internal resistance calculation 00: 1/2, 01:1/4, 10:1/8, 11:1/16
Bit 4	BAT_CON: The rising edge detection when the battery is first connected 0: Not detected 1: Detected
Bit 3	RELAX_VOL1_UPD:Flag bit for battery voltage1 update in the relaxation state. 0:NOT 1:YES
Bit 2	RELAX_VOL2_UPD: Flag bit for battery voltage1 update in the relaxation state 0:NOT 1:YES
Bit 1	RELAX_STS: Flag bit for battery turning to relaxation state 0: Not in relaxation 1: in relaxation
Bit 0	IV_AVG_UPD_STS: Flag bit for the internal resistance successfully sensed 0: Not sensed 1: Sensed

1.1.1.1 **FRAME_SMP_INTERV_REG:**

ADDRESS: B2H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	AUTO_SLP_EN	FRAME_SMP_INTERV_REG<4:0>				
DEFAULT	0	0	0	0	0	0	0	1

Description

Bit 7-6	RESERVED
Bit 5	AUTO_SLP_EN: Automatically switching to SLEEP mode control 0： Disable 1： Enable
Bit4-Bit0	FRAME_SMP_INTERV_REG<4:0>: The interval of DATA frame acquisition in the SLEEP mode

- **AUTO_SLP_CUR_THR_REG: CURRENT THRESHOLD REGISTER**

ADDRESS: B3H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	AUTO_SLP_CUR_THR_REG<7:0>							
DEFAULT	0	1	0	0	0	0	0	0

Description

Bit 7-0	AUTO_SLP_CUR_THR_REG<7:0>：Current threshold for automatically switching to Sleep mode

- **GASCNT_CAL_REG3: BAT CAPACITY CALIBRATION REGISTER3**

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	The register B4 must be written first, and then B5, B6…B7 must be written last.

- **GASCNT_CAL_REG2: BAT CAPACITY CALIBRATION REGISTER2**

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: BAT CAPACITY CALIBRATION REGISTER1**

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: BAT CAPACITY CALIBRATION REGISTER0**

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: BAT CAPACITY REGISTER3**

ADDRESS: B8H				TYPE: R				
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>

- **GASCNT_REG2: BAT CAPACITY REGISTER2**

ADDRESS: B9H				TYPE: R				
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: BAT CAPACITY REGISTER1**

ADDRESS: BAH				TYPE: R				
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: BAT CAPACITY REGISTER0**

ADDRESS: BBH				TYPE: R				
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: BAT CURRENT HIGH BITS REGISTER**

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

	Description
Bit 7-4	RESERVED
Bit 3-0	BAT_CUR_AVG<11:8>: Battery average current value bits<11:8>

- **BAT_CUR_AVG_REGL: BAT CURRENT LOW BITS REGISTER**

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

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

- **TS1_ADC_REGH：TS1 ADC HIGH BITS REGISTER**

ADDRESS: BEH				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	TS1_ADC<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

	Description
Bit 7-4	RESERVED
Bit 3-0	TS1_ADC<11:8>: TS1 ADC value bits<11:8>

- **TS1_ADC_REGHL：TS1 ADC LOW BITS REGISTER**

ADDRESS: BFH				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

SYMBOL	TS1_ADC<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 TS1_ADC<7:0>: TS1 ADC value bits<7:0>

- **TS2_ADC_REGH：TS2 ADC HIGH BITS REGISTER**

ADDRESS: C0H				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	RESV	TS2_ADC<11:8>			
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-4 RESERVED

Bit 3-0 TS2_ADC<11:8>: TS2 ADC value bits<15:8>.

- **TS2_ADC_REGHL: TS2 ADC LOW BITS REGISTER**

ADDRESS: C1H				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	TS2_ADC<7:0>							
DEFAULT	0	0	0	0	0	0	0	0

Description

Bit 7-0 TS2_ADC<7:0>: TS2 ADC value bits<7:0>

- **BAT_OCV_REGH：BAT OVER VOLTAGE HIGH BITS REGISTER**

ADDRESS: C2H				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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>

- **BAT_OCV_REGL：BAT OVER TEMP LOW BITS REGISTER**

ADDRESS: C3H				TYPE: R				
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：BAT VOLTAGE HIGH BITS REGISTER**

ADDRESS: C4H				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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>: Real time battery voltage value bits<11:8>.

- **BAT_VOL_REGL：BAT VOLTAGE LOW BITS REGISTER**

ADDRESS: C5H				TYPE: R				
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>: Real time battery voltage value bits<7:0>.

- **RELAX_ENTRY_THRES_REGH**

ADDRESS: C6H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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<15:8> for the battery going into relaxation state

- **RELAX_ENTRY_THRES_REGL**

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**

ADDRESS: C8H	TYPE: RW

Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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<15:8> for the battery out of relaxation state

- **RELAX_EXIT_THRES_REGL**

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**

ADDRESS: CAH				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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**

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

Description

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

- **RELAX_VOL2_REGH**

ADDRESS: CCH				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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**

ADDRESS: CDH				TYPE: R				
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

- **BAT_CUR_R_CALC_REGH:BAT CURRENT HIGH BITS REGISTER**

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

	Description
Bit 7-4	RESERVED
Bit 3-0	BAT_CUR_R_CALC<11:8>: Battery stable current value bits<11:8> for the internal resistance calculation.

- **BAT_CUR_R_CALC_REGL：BAT CURRENT LOW BITS REGISTER**

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

	Description
Bit 7-0	BAT_CUR_R_CALC<7:0>: Battery stable current value bits<7:0> for the internal resistance calculation.

- **BAT_VOL_R_CALC_REGH：BAT VOLTAGE HIGH BITS REGISTER**

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

	Description
Bit 7-4	RESERVED
Bit 3-0	BAT_VOL_R_CALC<11:8>: Battery stable voltage value bits<11:8> for the internal resistance calculation.

- **BAT_VOL_R_CALC_REGL：BAT VOLTAGE LOW BITS REGISTER**

ADDRESS: D1H				TYPE: R				
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	BAT_VOL_R_CALC<7:0>: Battery stable voltage value bits<7:0> for the internal resistance calculation.

- **CAL_OFFSET_REGH: OFFSET HIGH BITS REGISTER**

ADDRESS: D2H				TYPE: RW				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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>: PCB current offset value bits<11:8>.
Note	The register D2 must be written first, and D3 must be written last.

- **CAL_OFFSET_REGL: OFFSET 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>: PCB current offset value bits<7:0>.

- **NON_ACT_TIMER_CNT_REGL:**

ADDRESS: D4H				TYPE: R				
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 SLEEP or OFF state（Unit: minute）

- **VCALIB0_REGH: VOLTAGE0 CALIBRATION HIGH BITS REGISTER**

ADDRESS: D5H				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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.

- **VCALIB0_REGL: VOLTAGE0 CALIBRATION LOW BITS REGISTER**

ADDRESS: D6H				TYPE: R				
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: VOLTAGE1 CALIBRATION HIGH BITS REGISTER**

ADDRESS: D7H				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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.

- **VCALIB1_REGL: VOLTAGE1 CALIBRATION LOW BITS REGISTER**

ADDRESS: D8H				TYPE: R				
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- Voltage1 calibration value bits<7:0> for calculating offset error and gain error.

- **IOFFSET_REGH: CURRENT OFFSET HIGH BITS REGISTER**

ADDRESS: DDH				TYPE: R				
Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SYMBOL	RESV	RESV	RESV	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: CURRENT OFFSET LOW BITS REGISTER**

ADDRESS: DEH				TYPE: R				
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>

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

Address from [DF] 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 RK818 has to be below 125ºC.

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

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

6.2 Package Thermal Characteristics

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

Table 6-1 Thermal Resistance Characteristics

PACKAGE (QFN7X7-68)	**POWER(W)**	$\boldsymbol{\theta_{JA}}(℃/\boldsymbol{W})$	$\boldsymbol{\theta_{JB}}(℃/\boldsymbol{W})$	$\boldsymbol{\theta_{JC}}(℃/\boldsymbol{W})$
RK818	2	21.99	12	6.58

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