AXP223

Datasheet

Revision 1.0

2015.05.25

Version History

Version	Modify Time	Author	Description
V 1.0	2015.05.25		Initial version

Declaration

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Catalog

1. Overview

AXP223 is a highly integrated power management IC(PMIC) targeted at single cell Li-battery(Li-ion or Li-polymer) applications that require multi-channel power conversion outputs. It provides an easy and flexible power management solution for multi-core processors to meet the complex and accurate requirements of power control.

AXP223 integrates an USB3.0-Compatible Flash Charger that supports up to 94% efficiency and 2.1A charge current. Besides, it supports 21 channel power outputs which include 5 channel DC-DC with efficiency up to 95%, and multi-channel 12-Bit ADC which include voltage/current/temperature monitoring. To ensure the security and stability of the power system, AXP223 provides protection circuits such as over-voltage protection(OVP)、under-voltage protection(UVP)、over-current protection(OCP) and over-temperature protection(OTP). Moreover, an unique E-Gauge^{TM} system promises high-accuracy measure and simplifies battery power measurement.

AXP223 provides a fast interface for system to dynamically adjust output voltages and coordinate application processor to enable multiple work-mode conversion to optimize the battery life.

The Intelligent Power Select(IPS^{TM}) circuit of AXP223 could transparently select power path among USB, external adaptor, Li-battery and system load, it also allows application system to work normally when only running at the external input voltage and not the battery.

AXP223 is available in 8mm x 8mm x 0.75mm 68-pin QFN package.

Applications

- Tablet, Smartphone, Smart TV, DVR
- UMPC-like, Student Computer

2. Feature

IPS™

- Input voltage range:2.9~6.3V
- Configurable IPS™ System
- Adaptive USB or AC adaptor voltage/current limit(4.4V/900mA/500mA)

Flash Charger

- Integrated MOSFET charger current up to 2.1A
- Support battery temperature monitoring
- Fully Support USB charger
- High charger accuracy : ±5%
- Support multiple battery such as 4.1V,4.2V,4.22V and 4.24V,etc
- Automatic charge control
- Support LED to indicate charge status
- Automatic charge current adjustment based on system load
- Switch
- DC1SW:internal resister 160mΩ,power source from DCDC1
- CHGLED: internal integrated NMOS up to 100mA buffer strength, drive the motor and charging LED

LDO

- RTC_VCC:30mA, always valid;
- ALDO1: Low noise LDO,0.7~3.3V adjustable,100mV/step, load capacity up to 300mA;
- ALDO2: Low noise LDO,0.7~3.3V adjustable,100mV/step, load capacity up to 300mA;
- ALDO3: Low noise LDO,0.7~3.3V adjustable,100mV/step, load capacity up to 200mA;
- LDO1IO0: Low noise LDO,0.7~3.3V adjustable, 100mV/step, load capacity up to 100mA;
- LDO1IO1: Low noise LDO,0.7~3.3V adjustable, 100mV/step, load capacity up to 100mA;
- DLDO1: 0.7~3.3V adjustable,100mV/step, load capacity up to 400mA;
- DLDO2: 0.7~3.3V adjustable,100mV/step, load capacity up to 200mA;
- DLDO3: 0.7~3.3V adjustable,100mV/step, load capacity up to 200mA;
- DLDO4: 0.7~3.3V adjustable,100mV/step, load capacity up to 100mA;
- ELDO1: 0.7~3.3V adjustable,100mV/step, load capacity up to 400mA;
- ELDO2: 0.7~3.3V adjustable,100mV/step, load capacity up to 200mA;
- ELDO3: 0.7~3.3V adjustable,100mV/step, load capacity up to 200mA;
- DC5LDO: 0.7~1.4V adjustable,100mV/step, load capacity up to 200mA;

DCDC

- DCDC1:1.6~3.4V adjustable, 100mV/step, load capacity up to 1.4A;
- DCDC2:0.6~1.54V adjustable, 20mV/step, load capacity up to 2A,support Voltage Ramp Control(VRC);
- DCDC3: 0.6~1.86V adjustable, 20mV/step, load capacity up to 2A;
- DCDC4: 0.6~1.54V adjustable, 20mV/step, load capacity up to 0.6A;
- DCDC5: 1.0~2.55V adjustable, 50mV/step, load capacity up to 2A;

E-Gauge™

- Integrated dual-mode high accuracy coulomb counter and Fuelgauge system
- Easy mode: high adaptive for the different batteries
- Exact mode: high accuracy gauge for the special batteries(2%)
- Provide the rich power management information including instantaneous power consumption(mA or mW),remaining power(% or mA),charge status(%),remaining battery life and charge time, etc.
- Low power warning and protection
- Provide die temperature information

Host Interface

- Push-Pull Two Wire Interface(P2WI) for communication between the processor and PMIC
- Configurable interrupt management
- Flexible pin function configuration:2 GPIOs can set as IO or LDO function, etc
- Integrated timer
- 12 groups registers for the data storage when system shutdown

System Management

- Soft reset or hard reset
- Support soft shutdown or hard shutdown
- Support the external wakeup power on
- Support PWROK for system reset or shutdown indication
- External power detection(insert/remove/drive strength deficiency)
- All output voltages support soft boot
- Self-protection: OVP,UVP,OCP,OTP

High Integration

- High accuracy reference voltage (5%)
- Integrated MOSFET

3. Pin Map

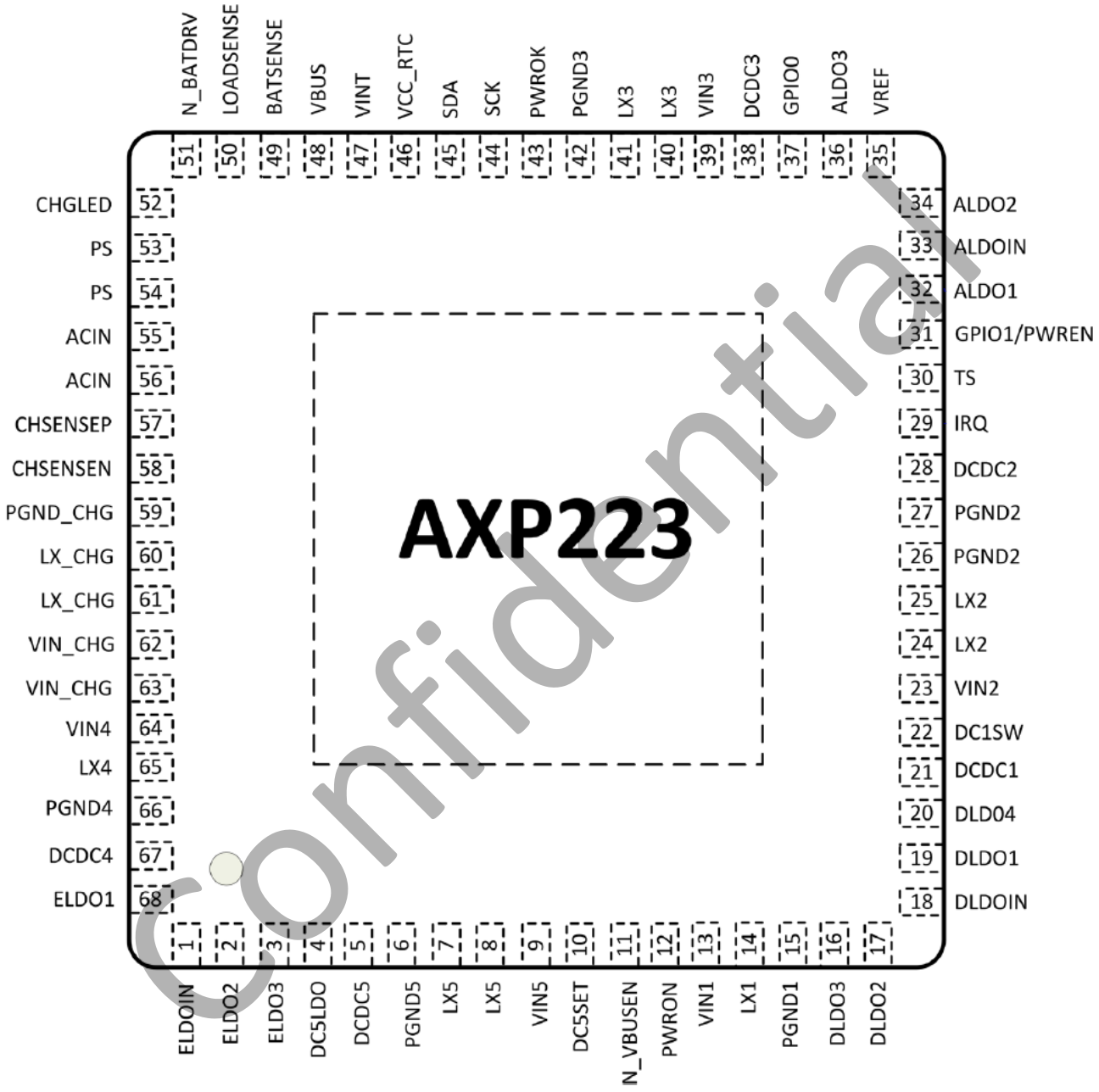
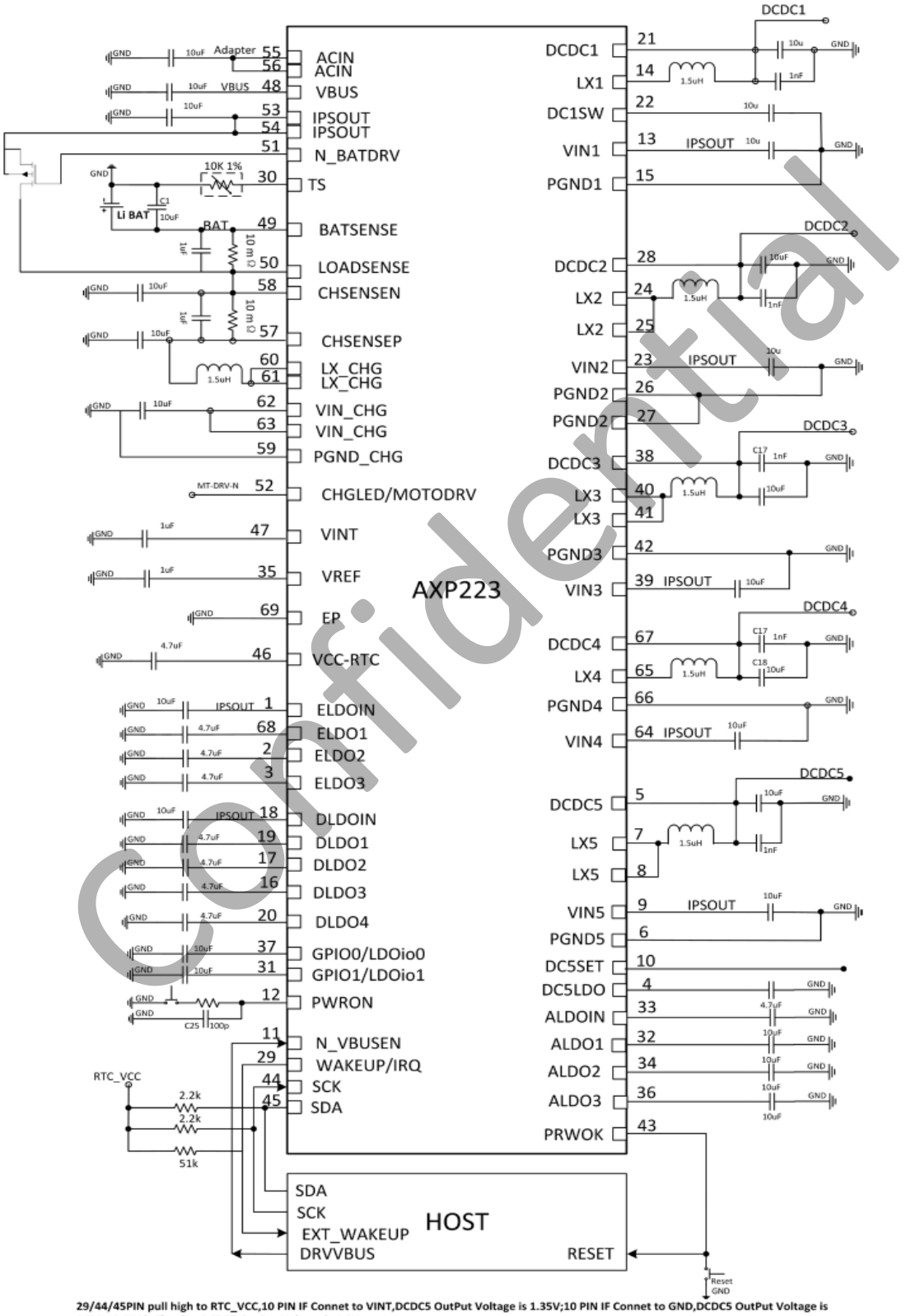


Figure 3-1. AXP223 Pin

4. Typical Application



29/44/45PIN pull high to RTC_VCC,10 PIN IF Connet to VINT,DCDC5 OutPut Voltage is 1.35V;10 PIN IF Connet to GND,DCDC5 OutPut Voltage is 1.5V ;10 PIN is Floating,DCDC5 OutPut Voltage is 1.2V;

5. Absolute Ratings

SYMBOL	DESCRIPTION	VALUE	UNITS
ACIN	Input Voltage	-0.3 ~ 11	V
VBUS	Input Voltage	-0.3 ~ 11	V
Ta	Operating Temperature Range	-20~80	℃
T_J	Junction Temperature Range	-20 ~ 130	℃
Ts	Storage Temperature Range	-40 ~150	℃
T_{LEAD}	Maximum Soldering Temperature (at leads，10sec)	300	℃
V_{ESD}	Maximum ESD stress voltage，Human Body Model	>4000	V
P_D	Internal Power Dissipation	2700	mW

Table 5-1. Absolute ratings

6. Electrical Characteristics

V_{IN} =5V， BAT=3.8V， T_A= 25℃

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
ACIN						
V_{IN}	ACIN Input Voltage		3.8		6.3	V
I_{OUT}	V_{OUT} Current Available Before Loading BAT	500mV Voltage Drop		3000		mA
V_{UVLO}	ACIN Under Voltage Lockout			3.8		V
V_{OUT}	IPS Output Voltage		2.9		5.0	V
R_{ACIN}	Internal Ideal Resistance	PIN to PIN, ACIN to IPSOUT		120		mΩ
VBUS						
V_{IN}	VBUS Input Voltage		3.8		6.3	V
I_{OUT}	V_{OUT} Current Available Before Loading BAT			500	900	mA
V_{UVLO}	VBUS Under Voltage Lockout			3.8		V
V_{OUT}	IPS Output Voltage		2.9		5.0	V
R_{VBUS}	Internal Ideal Resistance	PIN to PIN, VBUS to IPSOUT		170		mΩ
Battery Charger						
V_{TRGT}	BAT Charge Target Voltage		-0.5%	4.2	+0.5%	V
I_{CHRG}	Charge Current			1200	2100	mA
I_{TRKL}	Trickle Charge Current			10%		I_{CHRG} mA
V_{TRKL}	Trickle Charge Threshold Voltage			3.0		V
ΔV_{RECHG}	Recharge Battery Threshold Voltage	Threshold Voltage Relative to V_{TARGET}		-100		mV
T_{TIMER1}	Charger Safety Timer Termination Time	Trickle Mode		50		Min
T_{TIMER2}	Charger Safety Timer Termination Time	CC Mode		480		Min
I_{END}	End of Charge Indication Current Ratio	CV Mode		10%	15%	I_{CHRG} mA
NTC						
V_{TL}	Cold Temperature Fault Threshold Voltage	Charge	0	2.112	3.264	V
		Discharge		3.226		
V_{TH}	Hot Temperature Fault Threshold Voltage	Charge	0	0.397	3.264	V
		Discharge		0.5		
V_{TE}	NTC Disable Threshold Voltage	Falling Threshold Hysteresis		0.2		V

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
Off Mode Current						
I_{BATOFF}	OFF Mode Current	BAT=3.8V		35		μA
Logic						
V_{IL}	Logic Low Input Voltage			0.3		V
V_{IH}	Logic High Input Voltage			1.5		V
P2WI						
V_{CC}	Input Supply Voltage			VCC-RTC		V
f_{SCK}	Clock Operating Frequency				2000	kHZ
t_f	Clock Data Fall Time	2.2Kohm Pull High		60		ns
t_r	Clock Data Rise Time	2.2Kohm Pull High		100		ns
DCDC						
f_{OSC}	Oscillator Frequency	Default		3		MHz
DCDC1						
I_{VIN1}	Input Current	PFM Mode I_{DC1OUT} =0		50		μA
I_{LIM1}	PMOS Switch Current Limit	PWM Mode		2000		mA
I_{DC1OUT}	Available Output Current	PWM Mode		1400		mA
V_{DC1OUT}	Output Voltage	Default	1.6	3.0	3.4	V
DCDC2						
I_{VIN2}	Input Current	PFM Mode I_{DC2OUT} =0		50		μA
I_{LIM2}	PMOS Switch Current Limit	PWM Mode		2800		mA
I_{DC2OUT}	Available Output Current	PWM Mode		2000		mA
V_{DC2OUT}	Output Voltage Range		0.6	1.1	1.54	V
DCDC3						
I_{VIN3}	Input Current	PFM Mode I_{DC3OUT} =0		50		uA
I_{LIM3}	PMOS Switch Current Limit	PWM Mode		2800		mA
I_{DC3OUT}	Available Output Current	PWM Mode		2000		mA
V_{DC3OUT}	Output Voltage Range		0.6	1.1	1.86	V
DCDC4						
I_{VIN4}	Input Current	PFM Mode I_{DC3OUT} =0		45		uA
I_{LIM4}	PMOS Switch Current Limit	PWM Mode		1200		mA
I_{DC4OUT}	Available Output Current	PWM Mode		600		mA
V_{DC4OUT}	Output Voltage Range		0.6	1.1	1.54	V
DCDC5						
I_{VIN5}	Input Current	PFM Mode I_{DC3OUT} =0		45		uA

I_{LIM5}	PMOS Switch Current Limit	PWM Mode		2500		mA
I_{DC5OUT}	Available Output Current	PWM Mode		2000		mA
V_{DC5OUT}	Output Voltage Range		1.0	1.5	2.55	V

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
RTC_VCC						
V_{RTC_VCC}	Output Voltage	I_{RTC_VCC}=1mA	-1%	3.0	1%	V
I_{RTC_VCC}	Output Current			30		mA
ALDO1						
V_{ALDO1}	Output Voltage	I_{ALDO1}=1mA	-1%	3.0	1%	V
I_{ALDO1}	Output Current			300		mA
I_Q	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I_{ALDO1}=60mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V , Io=20mA		31		μV_{RMS}
ALDO2						
V_{ALDO2}	Output Voltage	I_{ALDO2}=1mA	-1%	2.5	1%	V
I_{ALDO2}	Output Current			300		mA
I_Q	Quiescent Current			62		μA
PSRR	Power Supply Rejection Ratio	I_{ALDO2}=10mA,1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V , Io=20mA		31		μV_{RMS}
ALDO3						
V_{ALDO3}	Output Voltage	I_{ALDO3}=1mA	-1%	3.0	1%	V
I_{ALDO3}	Output Current			200		mA
I_Q	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I_{ALDO3}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		43		μV_{RMS}
DLDO1						
V_{DLDO1}	Output Voltage	I_{DLDO1}=1mA	-1%	OFF	1%	V
I_{DLDO1}	Output Current			400		mA
I_Q	Quiescent Current			56		μA
PSRR	Power Supply Rejection Ratio	I_{DLDO1}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
DLDO2						
V_{DLDO2}	Output Voltage	I_{DLDO2}=1mA	-1%	OFF	1%	V
I_{DLDO2}	Output Current			200		mA
I_Q	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I_{DLDO2}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
DLDO3						
V_{DLDO3}	Output Voltage	I_{DLDO3}=1mA	-1%	OFF	1%	V
I_{DLDO3}	Output Current			200		mA
I_Q	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I_{DLDO3}=10mA，1KHz		TBD		dB

e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
DLDO4						
V_{DLDO4}	Output Voltage	I_{DLDO4}=1mA	-1%	OFF	1%	V
I_{DLDO4}	Output Current			100		mA
I_Q	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I_{DLDO4}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
ELDO1						
V_{ELDO1}	Output Voltage	I_{ELDO1}=1mA	-1%	OFF	1%	V
I_{ELDO1}	Output Current			400		mA
I_Q	Quiescent Current			55		μA
PSRR	Power Supply Rejection Ratio	I_{ELDO1}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
ELDO2						
V_{ELDO2}	Output Voltage	I_{ELDO2}=1mA	-1%	OFF	1%	V
I_{ELDO2}	Output Current			200		mA
I_Q	Quiescent Current			55		μA
PSRR	Power Supply Rejection Ratio	I_{ELDO2}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
ELDO3						
V_{ELDO3}	Output Voltage	I_{ELDO3}=1mA	-1%	OFF	1%	V
I_{ELDO3}	Output Current			200		mA
I_Q	Quiescent Current			55		μA
PSRR	Power Supply Rejection Ratio	I_{ELDO3}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
DC5LDO						
V_{DC5LDO}	Output Voltage	I_{DC5LDO}=1mA	-1%	1.1	1%	V
I_{DC5LDO}	Output Current			200		mA
I_Q	Quiescent Current			40		μA
PSRR	Power Supply Rejection Ratio	I_{DC5LDO}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		100		μV_{RMS}
LDOio0						
V_{LDOio0}	Output Voltage	I_{LDOio0}=1mA	-1%	OFF	1%	V
I_{LDOio0}	Output Current			100		mA
I_Q	Quiescent Current			35		μA
PSRR	Power Supply Rejection Ratio	I_{LDOio0}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		40		μV_{RMS}
LDOio1						
V_{LDOio1}	Output Voltage	I_{LDOio1}=1mA	-1%	OFF	1%	V
I_{LDOio1}	Output Current			100		mA
I_Q	Quiescent Current			35		μA
PSRR	Power Supply Rejection Ratio	I_{LDOio1}=10mA，1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3.3V, Io=20mA		40		μV_{RMS}
DC1SW						

R_{DC1SW}	Internal Ideal Resistance	PIN to PIN,DCDC1 , DC1SW		160		mΩ
CHGLED						
R_{DC1SW}	Internal Ideal Resistance	Vin =0.3V		2000		mΩ

7. Pin List

Num	Name	Type	Condition	Description
1	ELDOIN	PI		ELDO Input source
2	ELDO2	O		Output Pin of ELDO2
3	ELDO3	O		Output Pin of ELDO3
4	DC5LDO	O		Output Pin of DC5LDO
5	DCDC5	I		DC-DC5 feedback pin
6	PGND5	G		NMOS Ground for DCDC5
7,8	LX5	IO		Inductor Pin for DCDC5
9	VIN5	PI		DCDC5 input source
10	DC5SET	I		Setting DCDC5 Output Voltage
11	N_VBUSEN	IO	Input	VBUS to IPSOUT Selection GND: IPSOUT selects VBUS High: IPSOUT does not select VBUS
			Output	VBUS to IPSOUT Selection IPSOUT selects VBUS : GND IPSOUT does not select VBUS: High
12	PWRON	I		Power On-Off key input，Internal 100k pull high to VINT
13	VIN1	PI		DCDC1 Input Source
14	LX1	IO		Inductor Pin for DCDC1
15	PGND1	G		NMOS GND for DCDC1
16	DLDO3	O		Output Pin of DLDO3
17	DLDO2	O		Output Pin of DLDO2
18	DLDOIN	PI		DLDO Input Source
19	DLDO1	O		Output Pin of DLDO1
20	DLDO4	O		Output Pin of DLDO4
21	DCDC1	I		DC-DC1 feedback pin
22	DC1SW	O		DCDC1 Switch Output Pin
23	VIN2	PI		DCDC2 Input Source
24,25	LX2	IO		Inductor Pin for DCDC2
26，27	PGND2	G		NMOS Ground for DCDC2
28	DCDC2	I		DC-DC2 Feedback Pin
29	IRQ/WAKEUP	IO		IRQ Output or Wakeup
30	TS	I		Battery Temperature Sensor Input or an External ADC Input
31	GPIO1	IO	REG 92H[2:0]	GPIO1
				Low noise LDO
32	ALDO1	O		Output Pin of ALDO1

Num	Name	Type	Condition	Description
33	ALDOIN	PI		ALDO Input Source
34	ALDO2	O		Output Pin of ALDO2
35	VREF	O		Internal reference voltage
36	ALDO3	O		Output pin of ALDO3
37	GPIO0	IO	REG 90H[2:0]	GPIO0 Low noise LDO
38	DCDC3	I		DC-DC3 feedback pin
39	VIN3	PI		DCDC3 Input Source
40，41	LX3	IO		Inductor Pin for DCDC3
42	PGND3	G		NMOS Ground for DCDC3
43	PWROK	O		Power Good Indication Output
44	SCK	I		Clock pin for serial interface. Normally, it connects a 2.2K resistor to 3.3V I/O power
45	SDA	IO		Data pin for serial interface. Normally, it connects a 2.2K resistor to 3.3V I/O power
46	VCC_RTC	O		Output Pin of VCC_RTC
47	VINT	PO		Internal logic power, 1.8V
48	VBUS	PI		VBUS input
49	BATSENSE	I		PWM Charger Current Sense Resistance Positive Input
50	LOADSENSE	I		PWM Charger Current Sense Resistance Negative Input
51	N_BATDRV	O		BAT to PS extern PMOS driver
52	CHGLED	O		charger status indication
53,54	IPSOUT	PO		System power source
55，56	ACIN	PI		Adapter input
57	CHSENSEP	I		PWM Charger Current Limite Sense Resistance Positive Input
58	CHSENSEN	I		PWM Charger Current Limite Sense Resistance Negative Input
59	PGND_CHG	G		NMOS Ground for PWM Charger
60,61	LX_CHG	IO		Inductor Pin for PWM Charger
62,63	VIN_CHG	I		Charger Input source
64	VIN4	I		DCDC4 input source
65	LX4	IO		Inductor Pin for DCDC4
66	PGND4	G		NMOS Ground for DCDC4
67	DCDC4	I		Feed back to DCDC4
68	ELDO1	O		Output Pin of ELDO1
69	EP	G		Exposed Pad, need to be connected to system ground

8. Block Diagram

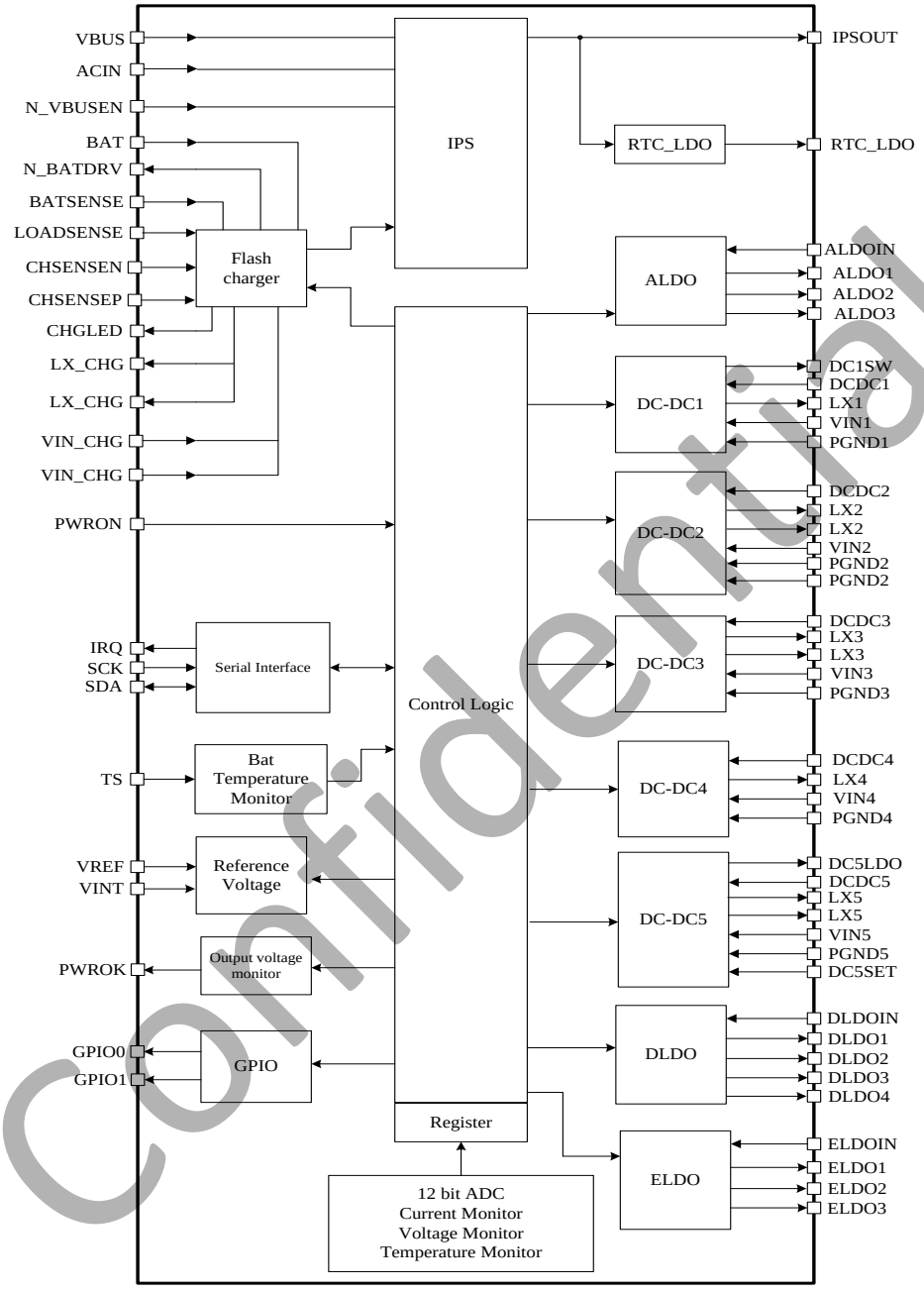


Figure 8-1. Block Diagram

9. Control and Operation

Once AXP223 is powered on, SCK/SDA pin of P2WI will be pulled up to IO Power and then Host can adjust and monitor AXP223 with rich feedback information.

Remarks: “Host” here refers to system processor.
Remarks: “External Power” below includes ACIN and VBUS input.

9.1. Power On/Off & Reset

Power Enable Key (PEK)
The Power Key (PEK) can be connected between PWRON pin and GND of AXP223. AXP223 can automatically identify the four status(Long-press ,Short-press ,Key Down ,Key Up) and then correspond respectively.

Power on
Power on sources include:
(1).ACIN、VBUS Insert
(2).PEK
(3).IRQ Lower-level

AXP223 can be powered on by pressing and holding PEK for a period of time that longer than “ONLEVEL”. In practice, the alarm output signal can be connected to IRQ for AXP223 power on: when the alarm signal is valid (low level), AXP223 will power on.
After power on, DC-DC and LDO will be soft booted in preset timing sequence, and then either Host or PWREN pin can enable/disable corresponding power.

Power Off
When you push-and-hold PEK longer than IRQLEVEL, HOST can write “1” into“REG32H [7]” to inform AXP223 to shutdown, which can disable all power output except VCC-RTC.

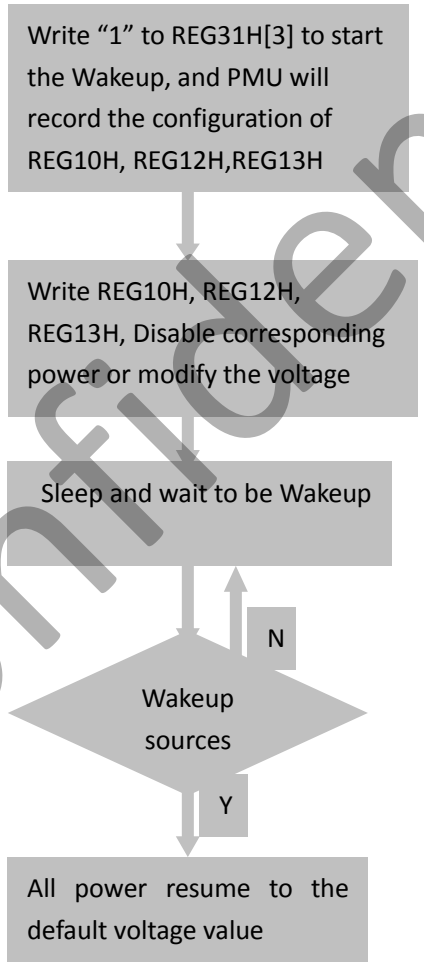
System power-off is initiated whenever the following conditions occur:
1. input voltage is too low(Low-Power Protection)
2. Power output voltage(DCDC) is too low due to overload(Overload Protection)
3. Input voltage is too high(Overvoltage Protection)(See more details in chapter “ Intelligent Power Select”
4. Push PEK longer more than OFFLEVEL(Default 6s), and system will cut off all power output except VCC-RTC (there is no need for an extra RESET key)

Remarks: With the automatic protection mechanism, AXP223 can protect the whole system by preventing components from non-reversible damage due to system abnormality.

Sleep and wakeup
When the running system needs to enter Sleep mode, Maybe one or several power outputs should be disabled or

changed to other voltage. Wakeup can be initiated by the following sources:
(1).ACIN insert/remove (REG40H[6:5] is set to 1)
(2).VBUS insert/remove (REG40H[3:2] is set to 1)
(3).PEK press-and-hold (REG42H[0] is set to 1)
(4).PEK falling edge (REG44H[5] is set to 1)
(5).Battery low power warning level2 (REG43H[1:0] is set to 1)
(6).Detection of rising/falling edge when GPIO[1:0] functions input (REG4CH[1:0],REG90H[7:6] and REG92H[7:6] are set to 1)
(7).Software wakeup (REG31H[5] is set to 1)
(8).IRQ wakeup (REG8FH[7] is set to 1)
These sources will make the all PMU power outputs resume to the default voltage, and all shutdown powers will resume by the power up sequence.

See the control process under sleep and wakeup modes as below:



System Reset and Output Monitoring (PWROK)

The PWROK pin can be used as the reset signal of application system. During AXP223 startup, PWROK outputs low level, which will be pulled high to startup the system after output voltage reaches the regulated value.

When application system works normally, AXP223 will be always monitoring the voltage and load status. If overload or under-voltage occurs, the PWROK will instantly output low level to reset the system and prevent

malfunction or data errors.

9.2. Power Path Management (IPS™)

The input sources of AXP223 include Li- Battery, external power ACIN (such as AC adapter or USB VBUS input). IPS can select the proper power allotting method according to external power and Li-Battery status.

- If only Li- Battery is available, and no external power input, Li- Battery is used for power input;
- If external power is available (VBUS or ACIN), it is preferred in power supply;
- If Li- Battery is available, it will "Seamlessly" switch to Li- Battery once external power is removed;
- When both VBUS and ACIN are available, ACIN will be applied to supply power in priority, and Li- Battery will be charged;
- If the current of ACIN path is not enough, VBUS will be enabled to achieve ACIN/VBUS common power supply;
- If the current is still insufficient, charge current will be reduced to zero, and Battery is used for one of power sources;

Host can set IPS parameters and read the feedback by visiting internal registers in AXP223 via P2WI.

Voltage-Limit/ Current-Limit Mode and Direct Mode

In order not to affect the USB communication, VBUS is always working under VBUS Voltage-Limit mode by default. In this mode, AXP223 ensures that VBUS voltage remains above a configurable reference voltage VHOLD which can meet the USB specification. The default VHOLD is 4.4V, and is adjustable by Reg30H [5:3] register.

If the system need to limit the current obtained from USB VBUS, a current-limit mode is provided (See REG30H [1] register), the current value can be set in REG30H[1:0] as 900mA,500mA, or unlimited.

If the system just utilizes the USB for power supply rather than communication, or the USB power adapter is utilized, AXP223 can be set to "VBUS Direct Mode" by modifying register REG30H[6], and then AXP223 will give priority to the application power demand. When the drive ability of USB Host is insufficient or system power consumption is large so that the VBUS voltage is lower than VHOLD, AXP223 will release IRQ to indicate the weak power supply ability of Host VBUS, which may affect USB communication, and then Host software will follow up.

AXP223's Reaction to External Power Supply Plug-in

AXP223 can automatically detect the plug-in of external powers and judge whether the power is usable or not. The result will be set in the corresponding registers, and IRQ will be released to inform the Host at the same time.

The following table has listed the status bits and meanings of external power registers.

Register Status Bits	Description
REG00H[7]	Indicating the presence of external ACIN
REG00H[6]	Indicating whether the external ACIN is usable or not
REG00H[5]	Indicating the presence of external VBUS
REG00H[4]	Indicating whether the external VBUS is usable or not

REG00H[3]	Indicating whether the VBUS voltage is above V_{HOLD} when used
REG00H[1]	Indicating whether ACIN/VBUS short circuits on PCB or not
REG00H[0]	Indicating whether the system is triggered to startup by ACIN/VBUS or not

The status bit of "indicating whether the VBUS voltage is above V_{HOLD} or not when used" enables the Host to judge when it receives IRQ7(indicating weak supply ability)whether VBUS is pulled low by system load input or the external power itself is below V_{HOLD}, which may facilitate Host software to decide either to keep on working in Voltage-Limit mode or switch to Direct mode.

When to Select VBUS as Input Power

N_VBUSEN and register REG30H[7]、REG30H[2]、REG8F[4] is used to determined whether VBUS be used as power supply.

REG30_[7]	REG8F_[4]	N_VBUSEN	REG30H[2]	Selected or not
0	0	High	0	No
0	0	Low	1	Yes
0	1	High	X	No
0	1	Low	X	Yes
1	X	X	X	Yes

Note:"X" indicates the arbitrary status and the arbitrary value.

Low-Power Protection (Automatic Power off)

A XP223 can set the automatic shutdown voltage V_{OFF} and compare V_{OFF} with ALDOIN. if V_{OFF} is lower than ALDOIN,AXP223 will automatically shutdown, and cut all power outputs except VCC-RTC.

The default value of V_{OFF} can be set in REG31H Bit[2:0].

Over-Voltage Protection

If the external power voltage exceeds 6.3V, AXP223 will release IRQ1/4 for indication. If the external power voltage exceeds 7V, AXP223 will automatically shutdown the system.

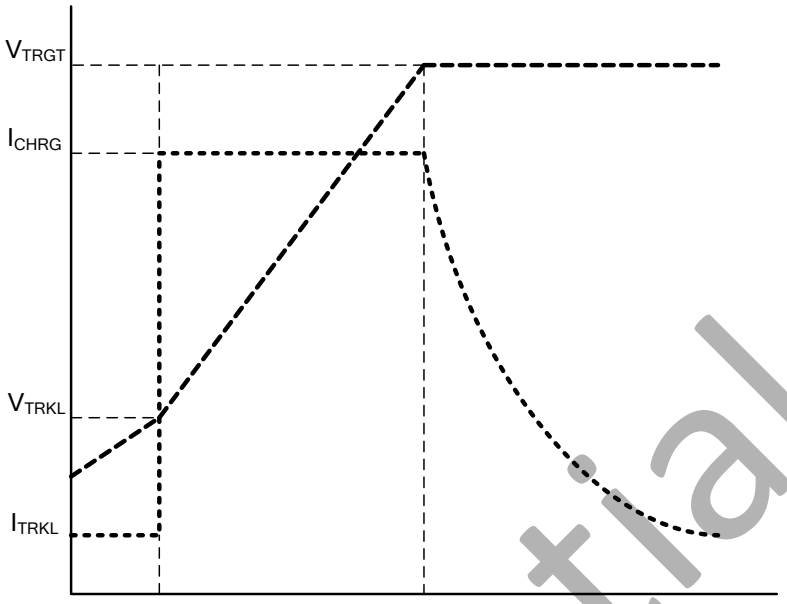
9.3. Adaptive Flash Charger

AXP223 integrates an adaptive current/voltage PWM charger to automatically control the charge cycle, with a built-in safety clock capable of automatic charge termination without processor intervention. This charger features automatic charge current scaling in accordance with the system power consumption, as well as Battery detection, trickle charge and activation. In addition, the built-in temperature detection circuit can automatically stop the charge current when the temperature is too high or too low.

Adaptive Charge Startup

The default state of the charger is "Enable". (It can be programmed via registers. Refer to register REG33H.) When external power is plugged in, AXP223 will automatically start the charge, and send IRQ to Host for indication. At the same time, CHGLED pin will output low level to drive external LED to indicate the charging state.

Charge Voltage/Current



Two Symbolic Voltages

V_{TRGT}=charge target voltage. The V_{TRGT} is 4.2V by default, which can be set by register (Refer to"REG33H[6:5]") . At the same time, AXP223 will automatically adjust the charge target voltage when external power voltage is low.

V_{RCH}=automatic recharge voltage. V_{RCH}=V_{TRGT}-0.1V.

Charge Current

The charge current is 450mA or 1200mA by default, which can be set by REG33H[3:0].

Charge Process

If the Battery voltage is lower than 3.0V, the charger will automatically enter the pre-charge mode, with charge current be 1/10 of the preset value. If the Battery voltage is still below 3.0V 40 minutes later (adjustable, see "REG34H"), charger will automatically enter the Battery activate mode. Refer to " Battery Activate Mode" section for details.

Once the Battery voltage exceeds 3.0V, the charger enters constant current mode. If the charge current is below 65% of the preset value, the system will release IRQ17 to indicate that "drive ability of external power is insufficient, as a result, the charge current is lower than the preset value, which may lead to longer charge time, so stronger power is preferred, or the power-consuming functions should be disabled to shorten the charge time."

When the Battery voltage reaches the $V_{TRGT,}$ the charger will switch from the constant current mode to constant voltage mode, and the charge current will fall.

When the charge current is lower than 10% or 15% (adjustable, see register "REG33H") of the preset value, a charge cycle ends, and AXP223 will release IRQ13 while the CHGLED pin will stop indicating the charging state. When the Battery voltage is below V_{RCH} again, the automatic charge will restart, and IRQ12 will be released.

Battery Activate Mode

At the entering the Battery activate mode from either pre-charge mode or constant current mode (the timer expires), AXP223 will release IRQ10 in both cases to indicate that the Battery may be damaged.

In Battery activate mode, the charger always inputs relatively low current to batteries. AXP223 will exit activate mode and release IRQ11 only if the Battery voltage has reached V_{RCH}.

AXP223 will indicate whether the charger is in Battery activate mode or not in register REG01H.

CHGLED

CHGLED pin is used to indicate charge state and warning. There are four states, namely, charging, not charging, Battery abnormal warning, and external power over-voltage warning. CHGLED is NMOS Open Drain output, so a LED can be directly driven by a current-limit resistor to show the four states. The following table has displayed its two operation modes.

Type A

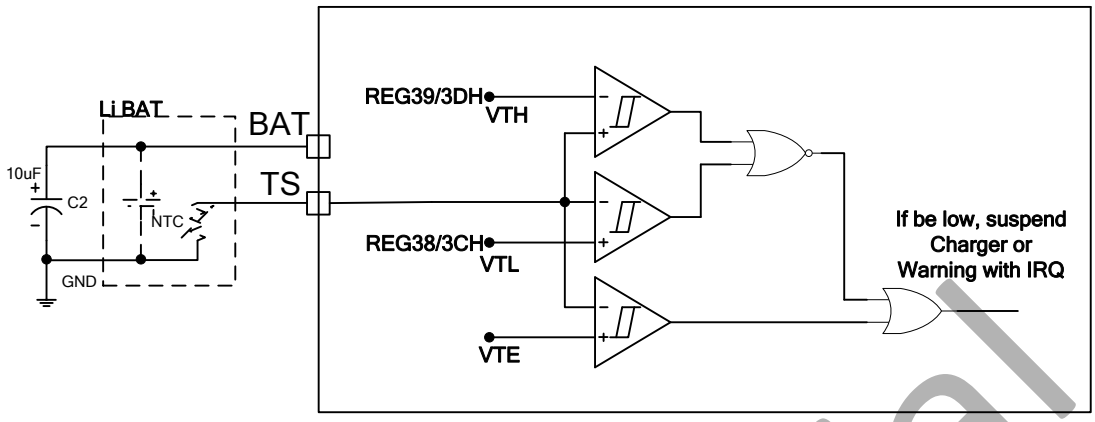
Status	Reaction	Description
Charging	Low level	
Not Charging	High resistance	
Battery abnormality	25% duty 1Hz flicker	The Charger enter Battery activation mode, or Battery temperature is too high/low
Over voltage	25% duty 4Hz flicker	The external input voltage source is too high

Type B

Status	Reaction	Description
Charging	25% duty 1Hz flicker	
Not Charging	High resistance	
Battery abnormality	25% duty 1Hz flicker	The Charger enter Battery activation mode, or Battery temperature is too high/low, or the output voltage is too high
Non Battery	Low level	Non Battery access

Battery Temperature Detection

AXP223 can connect a temperature-sensitive resistor via the TS pin to monitor the Battery temperature when the Battery is charging or discharging. The diagram is shown below.



In the diagram above, VTH/VTL refer to the high temperature threshold and low temperature threshold, which is programmable via registers REG38H/39H/3CH/3DH respectively. VTE=0.2V. The temperature-sensitive resistor is suggested to choose the NTC temperature-sensitive resistor which is 10Kohm and 1% accuracy at 25℃. AXP223 will send constant current via TS pin, and the current can be set as 20uA、40uA、60uA、and 80uA (see register REG84H) to adapt to different NTC resistors. When the current goes through the temperature-sensitive resistor, a test voltage is generated, which will be measured by ADC, and compared with regulated value to release corresponding IRQ or suspend the charge.

If the resistance value of temperature-sensitive resistor is too high or too low, the extra resistors can be serial or parallel to expand the detect ranges.

If the Battery is free from temperature-sensitive resistor, TS pin can be linked to the ground, and in that case, AXP223 will automatically disable the Battery temperature monitoring function.

Battery Detection

AXP223 will automatically detect the Battery presence, record the result in registers (refer to REG01H) and release IRQ8, IRQ9.

The Battery detection can be enabled and disabled by Host. (Refer to register REG32H.)

9.4. Multi-Power Outputs

The following table has listed the multi-power outputs and their functions of AXP223.

Output Path	Type	Default Voltage	Startup Sequence	Application	Load Capacity(Max)
DCDC1	BUCK	3.0V	1	3.0V I/O	1400 mA

DCDC2	BUCK	1.1V	1	1.1V CPU	2000 mA
DCDC3	BUCK	1.1V	1	1.1V GPU	2000 mA
DCDC4	BUCK	1.1V	1	1.1V Core	600mA
DCDC5	BUCK	1.5/DC5SET	1	1.5V DDR3	2000mA
RTC-LDO	LDO	3.0V	1	RTC	30 mA
ALDO1	LDO	3.0V	1	N/A	300 mA
ALDO2	LDO	2.5V	1	N/A	300 mA
ALDO3	LDO	3.0V	1	N/A	200mA
LDO_{IO0}	LDO	OFF	OFF	N/A	100 mA
LDO_{IO1}	LDO	OFF	OFF	N/A	100 mA
DLDO1	LDO	OFF	OFF	N/A	400 mA
DLDO2	LDO	OFF	OFF	N/A	200 mA
DLDO3	LDO	OFF	OFF	N/A	200mA
DLDO4	LDO	OFF	OFF	N/A	100 mA
ELDO1	LDO	OFF	OFF	N/A	400 mA
ELDO2	LDO	OFF	OFF	N/A	200 mA
ELDO3	LDO	OFF	OFF	N/A	200mA
DC5LDO	LDO	1.1V	1	N/A	200mA
DC1SW	Switch	OFF	OFF	N/A	400mA

AXP223 includes five synchronous step-down DC-DCs, fourteen LDOs, two switches, as well as multiple timing and controlling configuration. The work frequency of DC-DC is 3MHz by default, which is adjustable via registers. External small inductors and capacitors can be connected as well. In addition, 5-ch DC-DCs can be set in fixed PWM mode or auto mode (automatically switchable according to the load). See register REG80H.

DC-DC1/2/3/4/5

DCDC1 output voltage range is from 1.6 V to 3.4V, DCDC2/4 output voltage range is range from 0.6V to 1.54V, DCDC3 output voltage range is range from 0.6V to 1.86V, and DCDC5 output voltage range is range from 1.0V to 2.55V which also can be programmed via registers.DCDC5 voltage configuration is depended on the DC5SET pin:

DC5SET Status	Low	Floating	High
DCDC5 Voltage	1.5V	1.2V	1.35V

Small ESR ceramic capacitors above 10uF X7R are recommended to be the DCDC output capacitors; 1.5uH inductor is recommended. The saturation current of inductors used must be larger than 50% of the largest demanded current in the circuit.

VCC-RTC

VCC-RTC is always on to provide constant power for the RTC applications, the maximum value of load current is 30mA.

ALDO1/2/3

Low noise LDO, load current is 300mA/300mA/200mA, it can provide power for the analog circuit.

LDO_{IO0}/LDO_{IO1}

Low noise LDO, load current is 100mA.

DLDO1/DLDO2/DLDO3/DLDO4

DLDO1/DLDO2/DLDO3/DLDO4 are general LDOs, the load currents are respectively 400mA/200mA/200mA/100mA.

ELDO1/ELDO2/ELDO3

ELDO1/ELDO2/ELDO3 are general LDOs, the load currents are respectively 400mA/200mA/200mA.

DC5LDO

The power supply of DC5LDO is DCDC5, the load current is 200mA.

DC1SW

The power supply of DC1SW is DCDC1,its equivalent resistor is 160mOhm.

Soft Start

All DC-DCs and LDOs support soft start to avoid the impact of dramatic current change on the input path during system boot stage.

All DC-DCs do not require external Schottky diodes and resister divider feedback circuits. If a certain DC-DC is unnecessary in application, just float the corresponding LX pins.

9.5. E-Gauge™ system

The multiple 12-bit ADCs in AXP223 can measure Battery voltage, as well as Battery current. AXP223 integrates dual-mode power gauge system. In simple mode, it delivers relatively high compatibility with various batteries; in the high accuracy mode, it is capable of parameter optimization for the certain battery and provides up to 2% accuracy power gauge.

The Enable state controlling and sampling rate of each ADC can be set via register 84H. The sampling results will be saved in corresponding registers, register REG00H[2] is used to indicate the Battery charge/discharge current directions.

Channel	000H	STEP	FFFH
Battery Voltage	0mV	1.1mV	4.5045V
Bat discharge current	0mA	1mA	4.095A
Bat charge current	0mA	1mA	4.095A
Internal temperature	-267.7℃	0.1℃	165.8℃
TS pin input	0mV	0.8mV	3.276V

9.6. Multi-Function Pin Description

GPIO[1:0]

Can be defined as GPIO[1:0], or LDO, etc. Please refer to REG90H-92H Instruction for details

CHGLED

Features charge state indication, over-temperature/over-voltage warning, and motor-drive functions. When REG32H[2] is 0, the maximum load current of this pin is 100mA, and it can drive motors directly when a small motor is connected to 3.3V power with current-limiting resistors connected. When REG32H[2] is 1,the pin is used to indicate the charging status and warning including over-voltage, over-temperature, etc.

9.7. Timer

AXP223 features an internal timer, whose values can be modified via register REG8AH[6:0]. The minimum unit of timer is one minute, and REG8AH[7] will be set after timer timeout.

9.8. Interrupt

Host can communication with AXP223 registers via the P2WI, with speed up to 2MHz, and support continue read/write operation.

When certain events occur, AXP223 will inform Host by pulling down the IRQ interrupt mechanism, and the interrupt state will be stored in interrupt state registers (See registers REG48H, REG49H, REG4AH, REG4BH and REG4CH). The interrupt can be cleared by writing 1 to corresponding state register bit. When there is not interrupt, IRQ output will be pulled high (51K resistance higher through the external). Each interrupt can be masked via interrupt control registers (Refer to registers REG40H, REG41H, REG42H, REG43H, and REG44H).

Bit	IRQ	DESCRIPTION	Bit	IRQ	DESCRIPTION
REG48_[7]	IRQ1	ACIN over voltage	REG4B_[7]	Reserved	
REG48_[6]	IRQ2	ACIN insert	REG4B_[6]		
REG48_[5]	IRQ3	ACIN remove	REG4B_[5]		
REG48_[4]	IRQ4	VBUS over voltage	REG4B_[4]		
REG48_[3]	IRQ5	VBUS insert	REG4B_[3]		
REG48_[2]	IRQ6	VBUS remove	REG4B_[2]		
REG48_[1]	IRQ7	VBUS lower than V_{HOLD}	REG4B_[1]	IRQ19	Battery low level warning1
REG48_[0]	reversed		REG4B_[0]	IRQ20	Battery low level warning2
REG49_[7]	IRQ8	Battery present	REG4C_[7]	IRQ21	Timer finish
REG49_[6]	IRQ9	Battery remove	REG4C_[6]	IRQ22	PEK rising edge

REG49_[5]	IRQ10	Battery active mode	REG4C_[5]	IRQ23	PEK falling edge
REG49_[4]	IRQ11	Exit Battery active mode	REG4C_[4]	Reserved	
REG49_[3]	IRQ12	Charging	REG4C_[3]		
REG49_[2]	IRQ13	Charge finish	REG4C_[2]		
REG49_[1]	IRQ14	Battery over temperature	REG4C_[1]	IRQ24	GPIO1 edge trigger
REG49_[0]	IRQ15	Battery under temperature	REG4C_[0]	IRQ25	GPIO0 edge trigger
REG4A_[7]	IRQ16	IC over temperature			
REG4A_[6]	Reserved				
REG4A_[5]					
REG4A_[4]					
REG4A_[3]					
REG4A_[2]					
REG4A_[1]	IRQ17	PEK short press			
REG4A_[0]	IRQ18	PEK long press			

10. Register

10.1. Control Register List

Address	Description	R/W	Default
00	Status REG	R	
01	Mode and charge status REG	R	
04-0F	Data cache REG	R/W	00H
10	DCDC1/2/3/4/5&ALDO1/2&DC5LDO Control REG	R/W	BFH
12	ELDO1/2/3&DLDO1/2/3/4&DC1SW Control REG	R/W	00H
13	ADLDO3 woke mode REG	R/W	01H
15	DLDO1 Voltage Set REG	R/W	00H
16	DLDO2 Voltage Set REG	R/W	00H
17	DLDO3 Voltage Set REG	R/W	00H
18	DLDO4 Voltage Set REG	R/W	00H
19	ELDO1 Voltage Set REG	R/W	00H
1A	ELDO2 Voltage Set REG	R/W	00H
1B	ELDO3 Voltage Set REG	R/W	00H
1C	DC5LDO Voltage Set REG	R/W	00H
21	DC-DC1 Voltage Set REG	R/W	00H
22	DC-DC2 Voltage Set REG	R/W	00H
23	DC-DC3 Voltage Set REG	R/W	00H
24	DC-DC4 Voltage Set REG	R/W	00H
25	DC-DC5 Voltage Set REG	R/W	00H
27	DC-DC2/3 Ramp control REG	R/W	00H
28	ALDO1 Voltage Set REG	R/W	00H
29	ALDO2 Voltage Set REG	R/W	00H
2A	ALDO3 Voltage Set REG	R/W	00H
30	VBUS-IPSOUT Path control REG	R/W	60H
31	Wakeup,V_{OFF} and power off control REG	R/W	03H
32	Power off, Battery detection and CHGLED REG	R/W	43H
33	Charge control REG1	R/W	C6H
34	Charge control REG2	R/W	45H
35	Charge control REG3	R/W	0EH
36	PEK parameter Set REG	R/W	5DH
37	DCDC converter work frequency REG	R/W	08H
38	Battery charge, under temperature warning Set REG	R/W	A5H
39	Battery charge, over temperature warning Set REG	R/W	1FH
3C	Battery discharge, under temperature warning Set REG	R/W	FCH
3D	Battery discharge, over temperature warning Set REG	R/W	16H

Address	Description	R/W	Default
80	DCDC work mode Set REG	R/W	80H
82	ADC Enable Set REG1	R/W	E0H
84	ADC Sample rate, TS pin Control REG	R/W	32H
85	TS ADC sample rate Set REG	R/W	00H
8A	Timer Set REG	R/W	00H
8C/8D	PWREN Set REG	R/W	00H
8F	Over temperature shutdown control REG	R/W	01H

10.2. GPIO Set Register List

Address	Description	R/W	Default
90	GPIO0 Set REG	R/W	07H
91	GPIO0 LDO mode output voltage Set REG	R/W	1FH
92	GPIO1 control REG	R/W	07H
93	GPIO1 LDO mode output voltage Set REG	R/W	1FH
94	GPIO[1:0] signal REG	R/W	00H
97	GPIO[1:0] pull down Set REG	R/W	00H

10.3. Interrupt Register List

Address	Description	R/W	Default
40	IRQ enable Set REG1	R/W	D8H
41	IRQ enable Set REG2	R/W	FFH
42	IRQ enable Set REG3	R/W	03H
43	IRQ enable Set REG4	R/W	03H
44	IRQ enable Set REG5	R/W	00H
48	IRQ status REG1	R/W	00H
49	IRQ status REG2	R/W	00H
4A	IRQ status REG3	R/W	00H
4B	IRQ status REG4	R/W	00H
4C	IRQ status REG5	R/W	00H

10.4. ADC Data Register List

Address	Description	R/W
56	AXP223 internal temperature monitor ADC Data high 8 bit	R

57	AXP223 internal temperature monitor ADC Data low 4 bit	R
58	TS input ADC Data high 8 bit, monitor Battery temperature by default	R
59	TS input ADC Data low 4 bit, monitor Battery temperature by default	R
78	Battery voltage high 8 bit	R
79	Battery voltage low 4 bit	R
7A	Battery charge current high 8 bit	R
7B	Battery charge current low 5 bit	R
7C	Battery discharge current high 8 bit	R
7D	Battery discharge current low 5 bit	R

Address	Description	R/W	Default
B8	Gauge control register	R/W	C0H
B9	Gauge result(%)	R	64H
E0	Battery full capacity bit[14:8]	R/W	00H
E1	Battery full capacity bit[7:0]	R/W	00H
E6	Battery low level warning set REG	R/W	A0H
E8	Gauge percentage timer interval update set	R/W	00H
E9	Gauge checking timer internal set	R/W	00H
EC	Coulomb percentage checking point set	R/W	00H

Note: Battery full capacity unit :1.456mAH

10.5. Register Description

REG 00H: Power Input Status

Bit	Description	R/W
7	ACIN presence indication 0:ACIN not exist；1:ACIN exists	R
6	Indicating whether ACIN is usable	R
5	VBUS presence indication 0:VBUS not exist；1:VBUS exists	R
4	Indicating whether VBUS is usable	R
3	Indicating whether the VBUS voltage is above V_{HOLD} before used.	R
2	Indicating the Battery current direction 0: the Battery is discharging；1: the Battery is charging	R
1	Indicating whether ACIN and VBUS input short circuit on PCB	R
0	Indicating whether the boot source is ACIN or VBUS 0: Boot source isn't ACIN/VBUS； 1: Boot source is ACIN/VBUS.	R

REG 01H: Power Working Mode and Charge Status Indication

Bit	Description	R/W
7	Indicating whether AXP223 is over-temperature 0: not over-temperature； 1: over-temperature	R
6	Charge indication 0:not charge or charge finished； 1: in charging	R
5	Battery existence indication 0:no Battery connected to AXP202； 1: Battery already connected to AXP202	R
4	Reserved and unchangeable	R
3	Indicating whether the Battery enters the activate mode 0: not enter the activate mode； 1: already entered the activate mode	R
2-0	Reserved and unchangeable	R

REG 04-0FH: Data Buffer

Note: As long as one of the external powers, batteries or backup batteries exists, this data will be reserved and free from the startup and shutdown influence.

REG 10H: DCDC1/2/3/4/5&ALDO1/2&DC5LDO Enable Set

Default: FFH

Bit	Description		R/W	Default
7	ALDO2 Enable Set	0:Off； 1:On	RW	1
6	ALDO1 Enable Set		RW	1
5	DC-DC5 Enable Set		RW	1
4	DC-DC4 Enable Set		RW	1
3	DC-DC3 Enable Set		RW	1
2	DC-DC2 Enable Set		RW	1
1	DC-DC1 Enable Set		RW	1
0	DC5LDO Enable Set		RW	1

Note：X means that decided by the internal memory Set

REG 12H:Power Output Control

Default: 00H

Bit	Description		R/W	Default
7	DC1SW Enable Set	0:Off； 1:On	RW	0
6	DLDO4 Enable Set		RW	0
5	DLDO3 Enable Set		RW	0
4	DLDO2 Enable Set		RW	0
3	DLDO1 Enable Set		RW	0

2	ELDO3 Enable Set		RW	0
1	ELDO2 Enable Set		RW	0
0	ELDO1 Enable Set		RW	0

REG 13H:Power Output Control

Default:81H

Bit	Description		R/W	Default
7	ALDO3 Enable Set	0:Off； 1:On	RW	1
6-0	Reserved and unchangeable		RW	0000001

REG 15H:DLDO1 Output Voltage Set

Default:00H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	DLDO1 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	0
3	DLDO1 Output Voltage Set Bit3		RW	0
2	DLDO1 Output Voltage Set Bit2		RW	0
1	DLDO1 Output Voltage Set Bit1		RW	0
0	DLDO1 Output Voltage Set Bit0		RW	0

REG 16H:DLDO2 Output Voltage Set

Default:00H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	DLDO2 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	0
3	DLDO2 Output Voltage Set Bit3		RW	0
2	DLDO2 Output Voltage Set Bit2		RW	0
1	DLDO2 Output Voltage Set Bit1		RW	0
0	DLDO2 Output Voltage Set Bit0		RW	0

REG 17H:DLDO3 Output Voltage Set

Default:00H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	DLDO3 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	0
3	DLDO3 Output Voltage Set Bit3		RW	0

2	DLDO3 Output Voltage Set Bit2		RW	0
1	DLDO3 Output Voltage Set Bit1		RW	0
0	DLDO3 Output Voltage Set Bit0		RW	0

REG 18H:DLDO4 Output Voltage Set

Default:00H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	DLDO4 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	0
3	DLDO4 Output Voltage Set Bit3		RW	0
2	DLDO4 Output Voltage Set Bit2		RW	0
1	DLDO4 Output Voltage Set Bit1		RW	0
0	DLDO4 Output Voltage Set Bit0		RW	0

REG 19H:ELDO1 Output Voltage Set

Default:00H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	ELDO1 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	0
3	ELDO1 Output Voltage Set Bit3		RW	0
2	ELDO1 Output Voltage Set Bit2		RW	0
1	ELDO1 Output Voltage Set Bit1		RW	0
0	ELDO1 Output Voltage Set Bit0		RW	0

REG 1AH:ELDO2 Output Voltage Set

Default:00H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	ELDO2 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	0
3	ELDO2 Output Voltage Set Bit3		RW	0
2	ELDO2 Output Voltage Set Bit2		RW	0
1	ELDO2 Output Voltage Set Bit1		RW	0
0	ELDO2 Output Voltage Set Bit0		RW	0

REG 1BH:ELDO3 Output Voltage Set

Default:00H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	ELDO3 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	0
3	ELDO3 Output Voltage Set Bit3		RW	0
2	ELDO3 Output Voltage Set Bit2		RW	0
1	ELDO3 Output Voltage Set Bit1		RW	0
0	ELDO3 Output Voltage Set Bit0		RW	0

REG 1CH:DC5LDO Output Voltage Set

Default:04H

Bit	Description		R/W	Default
7-3	Reserved and unchangeable			
2	DC5LDO Output Voltage Set Bit2	0.7-1.4V,100mV/step	RW	1
1	DC5LDO Output Voltage Set Bit1		RW	0
0	DC5LDO Output Voltage Set Bit0		RW	0

REG 21H:DC-DC1 Output Voltage Set

Default:0EH

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	DC-DC1 Output Voltage Set Bit4	1.6-3.4V，100mV/step	RW	0
3	DC-DC1 Output Voltage Set Bit3		RW	1
2	DC-DC2 Output Voltage Set Bit2		RW	1
1	DC-DC2 Output Voltage Set Bit1		RW	1
0	DC-DC2 Output Voltage Set Bit0		RW	0

REG 22H:DC-DC2 Output Voltage Set

Default:19H

Bit	Description		R/W	Default
7-6	Reserved and unchangeable			
5	DC-DC2 Output Voltage Set Bit5	0.6-1.54V，20mV/step	RW	0
4	DC-DC2 Output Voltage Set Bit4		RW	1
3	DC-DC2 Output Voltage Set Bit3		RW	1
2	DC-DC2 Output Voltage Set Bit2		RW	0
1	DC-DC2 Output Voltage Set Bit1		RW	0
0	DC-DC2 Output Voltage Set Bit0		RW	1

REG 23H:DC-DC3 Output Voltage Set

Default:19H

Bit	Description		R/W	Default
7-6	Reserved and unchangeable			
5	DC-DC3 Output Voltage Set Bit5	0.6-1.86V，20mV/step	RW	0
4	DC-DC3 Output Voltage Set Bit4		RW	1
3	DC-DC3 Output Voltage Set Bit3		RW	1
2	DC-DC3 Output Voltage Set Bit2		RW	0
1	DC-DC3 Output Voltage Set Bit1		RW	0
0	DC-DC3 Output Voltage Set Bit0		RW	1

REG 24H:DC-DC4 Output Voltage Set

Default:19H

Bit	Description		R/W	Default
7-6	Reserved and unchangeable			
5	DC-DC4 Output Voltage Set Bit5	0.6-1.54V，20mV/step	RW	0
4	DC-DC4 Output Voltage Set Bit4		RW	1
3	DC-DC4 Output Voltage Set Bit3		RW	1
2	DC-DC4 Output Voltage Set Bit2		RW	0
1	DC-DC4 Output Voltage Set Bit1		RW	0
0	DC-DC4 Output Voltage Set Bit0		RW	1

REG 25H:DC-DC5 Output Voltage Set

Default:0AH

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	DC-DC5 Output Voltage Set Bit4	1.0-2.55V，50mV/step	RW	0
3	DC-DC5 Output Voltage Set Bit3		RW	1
2	DC-DC5 Output Voltage Set Bit2		RW	0
1	DC-DC5 Output Voltage Set Bit1		RW	1
0	DC-DC5 Output Voltage Set Bit0		RW	0

REG 27H:DC-DC2/3 Dynamic Voltage Scaling Parameter Set

Default:00H

Bit	Description	R/W	Default
7-4	Reserved and unchangeable		
3	DC-DC3 VRC Enable Control	RW	0

	0:On； 1:Off			
2	DC-DC2 VRC Enable Control 0:On； 1:Off		RW	0
1	DC-DC3 VRC Voltage ramp Control	0: 20mV/15.625us=1.6mV/us 1: 20mV/31.250us=0.8mV/us	RW	0
0	DC-DC2 VRC Voltage ramp Control	0: 20mV/15.625us=1.6mV/us 1: 20mV/31.250us=0.8mV/us	RW	0

REG 28H:ALDO1 Output Voltage Set

Default:17H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	ALDO1 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	1
3	ALDO1 Output Voltage Set Bit3		RW	0
2	ALDO1 Output Voltage Set Bit2		RW	1
1	ALDO1 Output Voltage Set Bit1		RW	1
0	ALDO1 Output Voltage Set Bit0		RW	1

REG 29H:ALDO2 Output Voltage Set

Default:12H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	ALDO2 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	1
3	ALDO2 Output Voltage Set Bit3		RW	0
2	ALDO2 Output Voltage Set Bit2		RW	0
1	ALDO2 Output Voltage Set Bit1		RW	1
0	ALDO2 Output Voltage Set Bit0		RW	0

REG 2AH:ALDO3 Output Voltage Set

Default:17H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	ALDO3 Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	1
3	ALDO3 Output Voltage Set Bit3		RW	0
2	ALDO3 Output Voltage Set Bit2		RW	1
1	ALDO3 Output Voltage Set Bit1		RW	1
0	ALDO3 Output Voltage Set Bit0		RW	1

REG 30H:VBUS-IPSOUT Path set

Default:60H

Bit	Description		R/W	Default
7	VBUS-IPSOUT Path select Control when VBUS valid 0:decided by N_VBUSEN pin,N_VBUSEN=0,the path is on 1:VBUS-IPSOUT Path is On		RW	0
6	VBUS V_{HOLD} voltage limit set 0:not limited； 1:limited		RW	1
5	V_{HOLD} Set Bit 2	000: 4.0V； 001: 4.1V； 010: 4.2V 011: 4.3V； 100: 4.4V； 101: 4.5V 110: 4.6V； 111: 4.7V	RW	1
4	V_{HOLD} Set Bit 1		RW	0
3	V_{HOLD} Set Bit 0		RW	0
2	DRIVEVBUS as GPO, Output Control 0： Output Low 1： Output High（IPSOUT）		RW	0
1:0	VBUS current limit Control Set 00 -900mA；01-500mA；1x-no current limit		RW	00

REG 31H: Wakeup Control and Voff Voltage Set

Default:03H

Bit	Description		R/W	Default
7	PWROK status when Wakeup 0：do not output low 1：output low		RW	0
6	Soft re-startup Control,write 1 to re-startup,then it self-clear		RW	0
5	Software Wakeup Control,write 1 to restore the output voltage,then it self-clear		RW	0
4	When Wakeup function Enabled,IRQ triggerd PMU Wakeup and IRQ masked or not when Wakeup 0: IRQ triggerd Wakeup，When Wakeup，all IRQ masked 1：IRQ work normal,but not triggered Wakeup			0
3	Wakeup Function Enable Set when Sleep 0： Wakeup function Off 1： Wakeup function On It self-clear after write 1			0
2	V_{OFF} Set Bit2	000-2.6V； 001-2.7V； 010-2.8V； 011-2.9V； 100-3.0V； 101-3.1V； 110-3.2V； 111-3.3V	RW	0
1	V_{OFF} Set Bit1		RW	1
0	V_{OFF} Set Bit0		RW	1

REG 32H: Power off Set、Battery detection and CHGLED Control

Default:43H

Bit	Description	R/W	Default
7	Power off Control	RW	0

	Write 1 to power off all output except RTC and charge module			
6	Battery detection Set : 0:Off； 1:On		RW	1
5-4	CHGLED PIN Set	00: High-Z 01: 25% 0.5Hz toggle 10: 25% 2Hz toggle 11: Output Low	RW	00
3	CHGLED PIN Control Set	0: REGREG 32HBit[5:4] Control 1: Controled by charge module	RW	0
2	Sequence when Power Output Off 0： All Power Output Off at the same time 1： Reverse to the power on sequence		RW	0
1-0	PWROK delay after Power Output ready	00: 8ms； 01: 16ms； 10: 32ms； 11:64ms	RW	11

REG 33H: Charge Control1

Default:C6H

Bit	Description	R/W	Default
7	Charge Enable Control 0:Off， 1:On	RW	1
6:5	Charge Voltage Set 00:4.1V； 01:4.22V； 10:4.2V； 11:4.24V	RW	10
4	Charge end current Set 0: 10% 1: 15%	RW	0
3-0	Charge current Set 0000:300mA； 0001:450mA； 0010:600mA； 0011:750mA； 0100:900mA； 0101:1050mA； 0110:1200mA； 0111:1350mA； 1000:1500mA； 1001:1650mA； 1010:1800mA； 1011:1950mA； 1100:2100mA； 1101:2250mA； 1110:2400mA； 1111:2550mA	RW	0110

REG 34H: Charge Control2

Default:45H

Bit	Description		R/W	Default
7	Pre-Charge timeout Set Bit1	00: 40 min； 01: 50min； 10: 60min； 11: 70min	RW	0
6	Pre-Charge timeout Set Bit0		RW	1
5	Charge Output Off or On when charge finished 0： Off； 1： On		RW	0
4	CHGLED function type 0： A； 1： B		RW	0
3	Reserved and unchangeable		RW	0

2	Charge target voltage change with the charge current or not 0：On 1：Off		RW	1
1	Constant Current timeout set Bit1	00: 6Hours； 01: 8Hours； 10: 10Hours； 11: 12Hours	RW	0
0	Constant Current timeout set Bit0		RW	1

REG 35H: Charge Control3

Default:0EH

Bit	Description	R/W	Default
7:4	Reserved and unchangeable		
3:0	Charge loop current limit Set 0000:300mA； 0001:450mA； 0010:600mA； 0011:750mA； 0100:900mA； 0101:1050mA； 0110:1200mA； 0111:1350mA； 1000:1500mA； 1001:1650mA； 1010:1800mA； 1011:1950mA； 1100:2100mA； 1101:2250mA； 1110:2400mA； 1111:2550mA	RW	1110

REG 36H:PEK Parameter Set

Default:59H

Bit	Description		R/W	Default
7	Power on Time Set Bit1	00: 128mS； 01: 1S； 10: 2S； 11: 3S.	RW	0
6	Power on Time Set Bit0		RW	1
5	Long key Time Set Bit1	00: 1S； 01: 1.5S； 10: 2S； 11: 2.5S.	RW	0
4	Long key Time Set Bit0		RW	1
3	Hardwar Power off function Set when key down time longer than Power off Time 0:Off； 1:On		RW	1
2	Re-startup or not after hardware power off 0:no； 1:yes		RW	0
1	Power off time Set Bit1	00: 4S； 01: 6S； 10: 8S； 11: 10S	RW	0
0	Power off time Set Bit0		RW	1

REG 37H:DC-DC work frequency Set

Default:08H

Bit	Description	R/W	Default
7	DC-DC and charger frequency-spread Set 0：Off 1：On		0
6	DC-DC and charger spread frequency Set 0：50KHz 1：100KHz		0
5	Reserved and unchangeable		0
4	DC-DC 2&3 Poly-phase Function Set		0

	0：Off 1：On			
3	DC-DCSwitch frequency Set Bit 3	5%/step，Default 3MHz	RW	1
2	DC-DCSwitch frequency Set Bit 2		RW	0
1	DC-DCSwitch frequency Set Bit 1		RW	0
0	DC-DCSwitch frequency Set Bit 0		RW	0

REG 38H:VLTF-charge Battery Charge under temperature Set

Default:A5H

Bit	Description		R/W	Default
7-0	Battery under temperature Set when charge，M	M*10H M=A5H:2.112V Range:0V~3.264V	RW	A5H

$V_{LTF\text{-}charge}$ = M *10H * 0.0008V

REG 39H:VHTF-charge Battery Charge over temperature Set

Default:1FH

Bit	Description		R/W	Default
7-0	Battery over temperature Set when charge，N	N*10H N=1FH:0.397V range:0V~3.264V	RW	1FH

$V_{HTF\text{-}charge}$ = N *10H * 0.0008V

REG 3CH:VLTF-discharge Battery under temperature Set

Default:FCH

Bit	Description		R/W	Default
7-0	Battery under temperature Set when discharge，M	M*10H M=FCH:3.226V Range:0V~3.264V	RW	FCH

$V_{LTF\text{-}discharge}$ = M *10H* 0.0008V

REG 3DH:VHTF-discharge Battery over temperature Set

Default:16H

Bit	Description		R/W	Default
7-0	Battery over temperature Set when discharge，N	N*10H N=16H:0.282V Range:0V~3.264V	RW	16H

$V_{LTF\text{-}discharge}$ = N *10H* 0.0008V

REG 80H:DC-DC Work mode

Default:80H

Bit	Description		R/W	Default
7-5	Reserved and unchangeable		RW	100
4	DC-DC5 Work mode Control	0:PFM/PWM auto switch 1:fixed PWM	RW	0
3	DC-DC4 Work mode Control		RW	0
2	DC-DC3 Work mode Control		RW	0
1	DC-DC2 Work mode Control		RW	0
0	DC-DC1 Work mode Control		RW	0

REG 82H:ADC Enable

Default:E0H

Bit	Description		R/W	Default
7	Battery Voltage ADC Enable	0:Off， 1:On	RW	1
6	Battery Current ADC Enable		RW	1
5	Internal temperature ADC Enable		RW	1
4-1	Reserved and unchangeable			
0	TS Pin ADC Enable	0:Off， 1:On	RW	0

REG 84H:ADC Sample rate Set ， TS Pin Control

Default:32H

Bit	Description		R/W	Default
7	ADC Sample rate Set Bit 1	10×2^n Sample rate: 100， 200， 400， 800Hz	RW	0
6	ADC Sample rate Set Bit 0		RW	0
5-4	TS Pin Output Current Set : 00:20uA； 01:40uA； 10:60uA； 11:80uA		RW	11
3	Reserved and unchangeable			
2	TS Pin function 0: Battery temperature detection，1:ADC Input		RW	0
1-0	TS Pin Current Output Set	00:Off 01: Output Current when charging 10:Output Current when ADC sample 11: always On	RW RW	1 0

REG 85H:TS ADC Sample rate set

Default:00H

Bit	Description		R/W	Default
7	TS ADC Sample rate Set 1	10×2^n	RW	0
6	TS ADC Sample rate Set 0	Sample rate :100，200，400，800Hz	RW	0
5-0	Reserved and unchangeable			

REG 8AH:TimerControl

Default:00H

Bit	Description	R/W	Default
7	Timer Timeout status: 1:timeout Write 1 to clear this bit	RW	0
6-0	Timer set，1min/step Write 0 to disable the timer	RW	0000000

REG 8CH:PWREN Control Set 1

Default:00H

Bit	Description		R/W	Default
7	DC-DC1 controlled by PWREN	0：yes 1：no	RW	0
6	DC-DC2 controlled by PWREN		RW	0
5	DC-DC3 controlled by PWREN		RW	0
4	DC-DC4 controlled by PWREN		RW	0
3	DC-DC5 controlled by PWREN		RW	0
2	ALDO1 controlled by PWREN		RW	0
1	ALDO2 controlled by PWREN		RW	0
0	ALDO3 controlled by PWREN		RW	0

REG 8DH:PWRENControl Set 2

Default:00H

Bit	Description		R/W	Default
7	DLDO1 controlled by PWREN	0：yes 1：no	RW	0
6	DLDO2 controlled by PWREN		RW	0
5	DLDO3 controlled by PWREN		RW	0
4	DLDO4 controlled by PWREN		RW	0
3	ELDO1 controlled by PWREN		RW	0
2	ELDO2 controlled by PWREN		RW	0
1	ELDO3 controlled by PWREN		RW	0

0	DC5LDO controlled by PWREN		RW	0

REG 8FH:IC over temperature Power off function Set

Default:01H

Bit	Description	R/W	Default
7	IRQ PIN triggered Power on or Wakeup function Set 0：Off 1：On	RW	0
6	ACIN/VBUS In-short function Set 0：auto detection 1：set by REG8F_[5]	RW	0
5	ACIN/VBUS In-short status and Set 0：not In-short 1：In-short	RW	0
4	N_VBUSEN PIN function Control 0： Output Pin ， as DRIVEVBUS function（Output to enable the OTG 5V Boost module） 1：Input Pin ， Control VBUS Path	RW	0
3	Reserved and unchangeable	RW	0
2	AXP223 internal over temperature Power off function Set 0:do not Power off ； 1: Power off	RW	0
1-0	Reserved and unchangeable	RW	01

REG 90H:GPIO0 function Set

Default:07H

Bit	Description		R/W	Default
7	GPIO0 posedge triggered IRQ/wakeup or not when as input 0：no 1： yes		RW	0
6	GPIO0 negedge triggered IRQ/wakeup or not when as input 0：no 1： yes		RW	0
5-3	Reserved and unchangeable			
2	GPIO0 Pin Function Set Bit 2	000: Output low 001: Output High 010:input Function 011: low noise LDO Function On 100:low noise LDO Function Off 101-111: floating	RW	1
1	GPIO0 Pin Function Set Bit 1		RW	1
0	GPIO0 Pin Function Set Bit 0		RW	1

REG 91H:GPIO0 work as LDO mode and Output voltage Set

Default:1FH

Bit	Description	R/W	Default
7-5	Reserved and unchangeable		

4	GPIO0 LDO Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	1
3	GPIO0 LDO Output Voltage Set Bit3		RW	1
2	GPIO0 LDO Output Voltage Set Bit2		RW	1
1	GPIO0 LDO Output Voltage Set Bit1		RW	1
0	GPIO0 LDO Output Voltage Set Bit0		RW	1

REG 92H:GPIO1 Function Set

Default:07H

Bit	Description		R/W	Default
7	GPIO1 posedge triggered IRQ/wakeup or not when as input 0：no 1： yes		RW	0
6	GPIO1 negedge triggered IRQ/wakeup or not when as input 0：no 1： yes		RW	0
5-3	Reserved and unchangeable			
2	GPIO1 Pin Function Set Bit 2	000: Output low 001: Output High 010: input Function 011: low noise LDO Function On 100:low noise LDO Function Off 101-111: floating	RW	1
1	GPIO1 Pin Function Set Bit 1		RW	1
0	GPIO1 Pin Function Set Bit 0		RW	1

REG 93H:GPIO1 work as LDO mode and Output voltage Set

Default:1FH

Bit	Description		R/W	Default
7-5	Reserved and unchangeable			
4	GPIO1 LDO Output Voltage Set Bit4	0.7-3.3V,100mV/step	RW	1
3	GPIO1 LDO Output Voltage Set Bit3		RW	1
2	GPIO1 LDO Output Voltage Set Bit2		RW	1
1	GPIO1 LDO Output Voltage Set Bit1		RW	1
0	GPIO1 LDO Output Voltage Set Bit0		RW	1

REG 94H:GPIO[1:0] input status

Default:00H

Bit	Description		R/W	Default
7-2				
1	GPIO1 input status	0:Low 1:High	R	0
0	GPIO0input status		R	0

REG 97H:GPIO[1:0] pull down resister Set

Default:00H

Bit	Description		R/W	Default
7-2	Reserved and unchangeable			
1	GPIO1 pull down Control when work as input	0:pull down resistor off 1:pull down resistor on	RW	0
0	GPIO0 pull down Control when work as input		RW	0

REG 40H:IRQ Enable 1

Default:D8H

Bit	Description	R/W	Default
7	ACIN over voltage IRQ Enable	RW	1
6	ACIN insert IRQ Enable	RW	1
5	ACIN remove IRQ Enable	RW	0
4	VBUS over voltage IRQ Enable	RW	1
3	VBUS insert IRQ Enable	RW	1
2	VBUS remove IRQ Enable	RW	0
1	VBUS valid but lower than V_{HOLD}IRQ Enable	RW	0
0	Reserved and unchangeable	RW	0

REG 41H:IRQ Enable 2

Default:FFH

Bit	Description	R/W	Default
7	Battery present IRQ Enable	RW	1
6	Battery remove IRQ Enable	RW	1
5	Battery enter active mode IRQ Enable	RW	1
4	Exit Battery active mode IRQ Enable	RW	1
3	Charging IRQ Enable	RW	1
2	Charge finished IRQ Enable	RW	1
1	Battery over temperature IRQ Enable	RW	1
0	Battery under temperature IRQ Enable	RW	1

REG 42H:IRQ Enable 3

Default:03H

Bit	Description	R/W	Default
7	AXP223 internal over temperature IRQ Enable	RW	0

6-2	Reserved and unchangeable		
1	Short key IRQ Enable	RW	1
0	Long key IRQ Enable	RW	1

REG 43H:IRQ Enable 4

Default:03H

Bit	Description	R/W	Default
7-2	Reserved and unchangeable		
1	Battery energy low warning level 1 IRQ Enable(information)	RW	1
0	Battery energy low warning level 2 IRQ Enable(need to Power off）	RW	1

REG 44H:IRQ Enable 5

Default:00H

Bit	Description	R/W	Default
7	Timer Timeout IRQ Enable	RW	0
6	PEK rising edge IRQ Enable	RW	0
5	PEK falling edge IRQ Enable	RW	0
4-2	Reserved and unchangeable		
1	GPIO1 edge IRQ Enable	RW	0
0	GPIO0 edge IRQ Enable	RW	0

REG 48H:IRQ Status 1

Default:00H

Bit	Description	R/W	Default
7	ACIN over voltage IRQ	RW	0
6	ACIN insert IRQ	RW	0
5	ACIN remove IRQ	RW	0
4	VBUS over voltage IRQ	RW	0
3	VBUS insert IRQ	RW	0
2	VBUS remove IRQ	RW	0
1	VBUS valid but lower than V_{HOLD}IRQ	RW	0
0	Reserved and unchangeable	RW	0

REG 49H:IRQ Status 2

Default:00H

Bit	Description	R/W	Default

7	Battery present IRQ	RW	0
6	Battery remove IRQ	RW	0
5	Battery enter active mode IRQ	RW	0
4	Exit Battery active mode IRQ	RW	0
3	Charging IRQ	RW	0
2	Charge finished IRQ	RW	0
1	Battery over temperature IRQ	RW	0
0	Battery under temperature IRQ	RW	0

REG 4AH:IRQ Status 3

Default:00H

Bit	Description	R/W	Default
7	AXP223 internal over temperature IRQ	RW	0
6-2	Reserved and unchangeable		
1	Short key IRQ	RW	0
0	Long key IRQ	RW	0

REG 4BH:IRQ Status 4

Default:00H

Bit	Description	R/W	Default
7-2	Reserved and unchangeable		
1	Battery energy low warning level 1 IRQ (information)	RW	0
0	Battery energy low warning level 2 IRQ (need to Power off）	RW	0

REG 4CH:IRQ Status 5

Default:00H

Bit	Description	R/W	Default
7	Timer Timeout IRQ status	RW	0
6	PEK rising edge IRQ status	RW	0
5	PEK falling edge IRQ status	RW	0
4-2	Reserved and unchangeable		
1	GPIO1 edge IRQ	RW	0
0	GPIO0 edge IRQ	RW	0

Note: Writing 1 to these bit will clear the IRQ status.

REG B8H:E-Gauge Control

Default:C0H

Bit	Description	R/W	Default
7	Gauge system Enable Control 0：Off 1：On	RW	1
6	Coulomb counter Enable Control 0：Off 1：On	RW	1
5	Battery full capacity calibration Function Enable 0：Off 1：On	RW	0
4	Battery capacity calibration Status 0：do not at calibration status 1： calibrating now	RW	0
3-0	Reserved and unchangeable	RW	0

REG B9H: Battery Gauge result

Default:64H

Bit	Description		R/W	Default
7	Battery result indication 0：be calculated yet 1: calculating now		R	0
6-0	Battery gauge result	0%~100%	R	64

REG E0H: Battery full design capacity Set 1

Default:00H

Bit	Description	R/W	Default
7	Battery full design capacity configed or not 0：not be configed 1:has been configed	RW	0
6-0	Battery full design capacity bit[14:8]	RW	0

Battery full design capacity = Value * 1.456mAh

REG E1H: Battery full design capacity Set 2

Default:00H

Bit	Description	R/W	Default
7-0	Battery full design capacity bit[7:0]	RW	0

REG E6H: Battery low power warning level Set

Default:A0H

Bit	Description	R/W	Default
7:4	Battery low power warning level 1 Set 0000-1111：5%-20%	RW	1010
6-0	Battery low power warning level 2 Set	RW	0000

	0000-1111：0%-15%		

REG E8H: Gauge percentage timer interval update Set

Default:00H

Bit	Description	R/W	Default
7:3	Reserved and unchangeable		
2	000:30s; 001:60s; 010:120s;	RW	0
1	011:164s;100:0s;101:5s	RW	0
0	110:10s;111:20s	RW	0

REG E9H: Gauge checking timer internal Set

Default:00H

Bit	Description	R/W	Default
7	00:60s; 01:120s;	RW	0
6	10:15s; 11:30s	RW	0
5:0	Reserved and unchangeable		

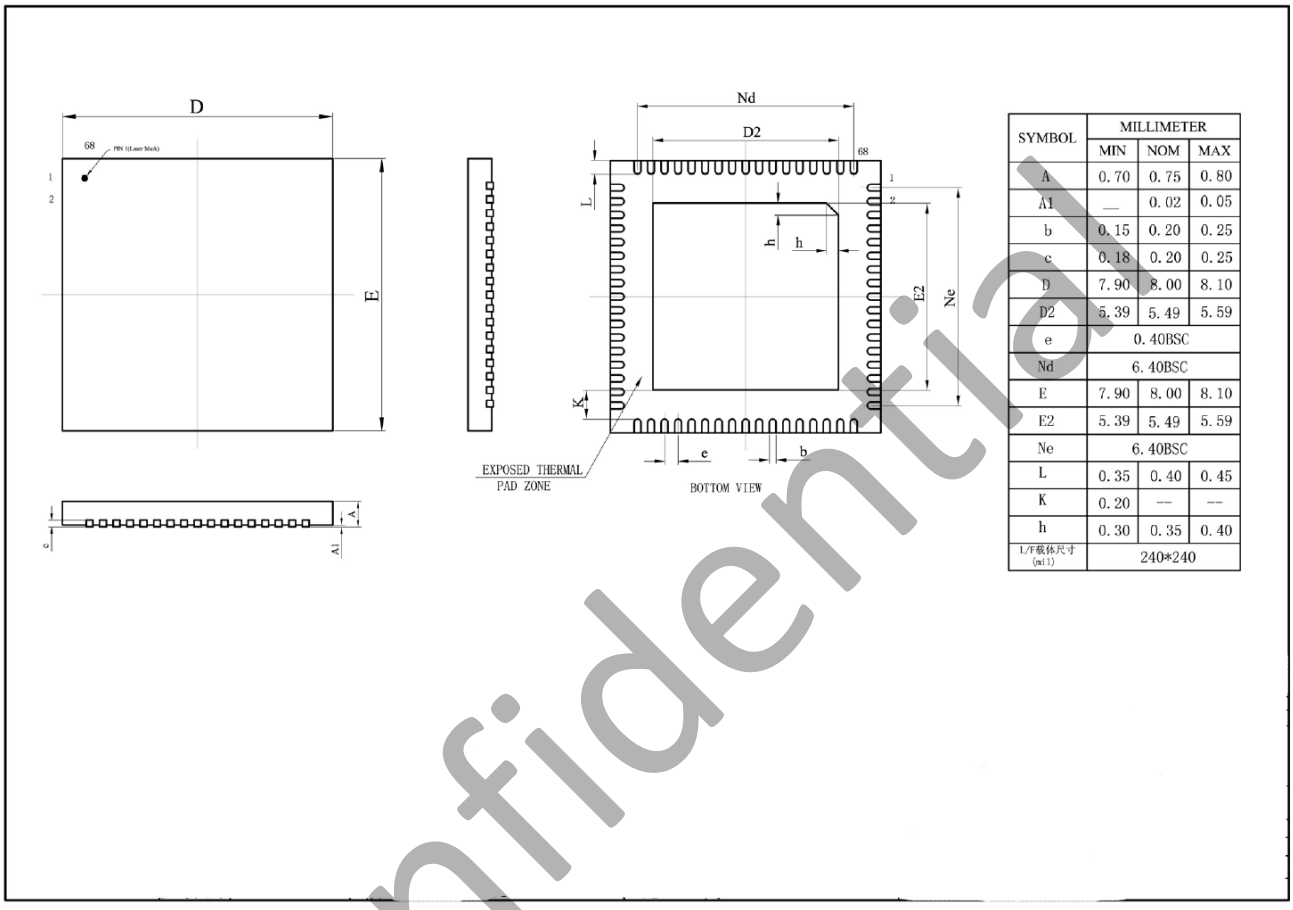
REG ECH: Coulomb percentage checking point Set

Default:00H

Bit	Description	R/W	Default
7:3	Reserved and unchangeable		
2	OCV percentage lower or equal than the following set, start to check:	RW	0
1	000: REG_E6_[3:0] +5; 001: REG_E6_[3:0] + 6;	RW	0
0	010: REG_E6_[3:0] +7; 011: REG_E6_[3:0] + 8; 100: REG_E6_[3:0] + 1; 101: REG_E6_[3:0] + 2; 110: REG_E6_[3:0] + 3; 111: REG_E6_[3:0] + 4;	RW	0

Appendix

Package Dimension for AXP223



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	7.90	8.00	8.10
D2	5.39	5.49	5.59
e	0.40BSC		
Nd	6.40BSC		
E	7.90	8.00	8.10
E2	5.39	5.49	5.59
Ne	6.40BSC		
L	0.35	0.40	0.45
K	0.20	—	—
h	0.30	0.35	0.40
L/F载体尺寸 (mil)	240*240		

