

# **AXP223**

## **Datasheet**

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*PMIC Optimized For Multi-Core High-Performance System*

Revision 1.1

2013.11.28





# Version History

Version	Date	Description
1.0	2013.08.30	First Version
1.1	2013.11.28	Modify some parameters , Supplemental Register

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## Summary

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AXP223 is designed to be a highly-integrated power system management IC , that is optimized for applications requiring single-cell Li-battery (Li-Ion/Polymer) and multiple output DC-DC converters , It is offering an easy-to-use and flexible complete solution which can fully meet the increasingly complexity of accurate power control required by modern application processor system.

AXP223 comprises a USB3.0-Compatible Flash Charger which efficiency up to 94% , Charging current up to 2.1A ; Supports 21-way power output ( Contains five high-current DCDC , high efficiency up to 95% ) , Includes voltage / current / temperature monitoring and other multi-channel 12-Bit ADC ; To guarantee the safty and stability of power system , AXP223 has integrated various protection circuits such as Over voltage Protection(OVP)/Under voltage Protection(UVP) 、 Over temperature protection(OTP)、 Over current protection(OCP) ; Particular E-Gauge™ fuel Gauge system significantly reducing the battery parameters testing process while ensure high-precision measurement.

AXP223 provide a fast interface , allows the system to adjust the output voltage dynamically , and coordinate application processor system to achieve multiple modes of conversion,extend battery using time maximum.

AXP223 Intelligent Power Select, IPS™ circuit can distribue electric energy security transparent in USB and external AC adapter ,Lithium and application system load , and enables applications system working when only external power input but without battery(or battery discharge / damage).

AXP223 is available in 8mm x 8mm x0.75 mm 68-pin QFN package

AXP223 can use on :

- Tacblet , Smart phone, Smart TV , Digital cameras
- Ultra-Mobile PC UMPC / UMPC-like , Entertainment and Education Machine

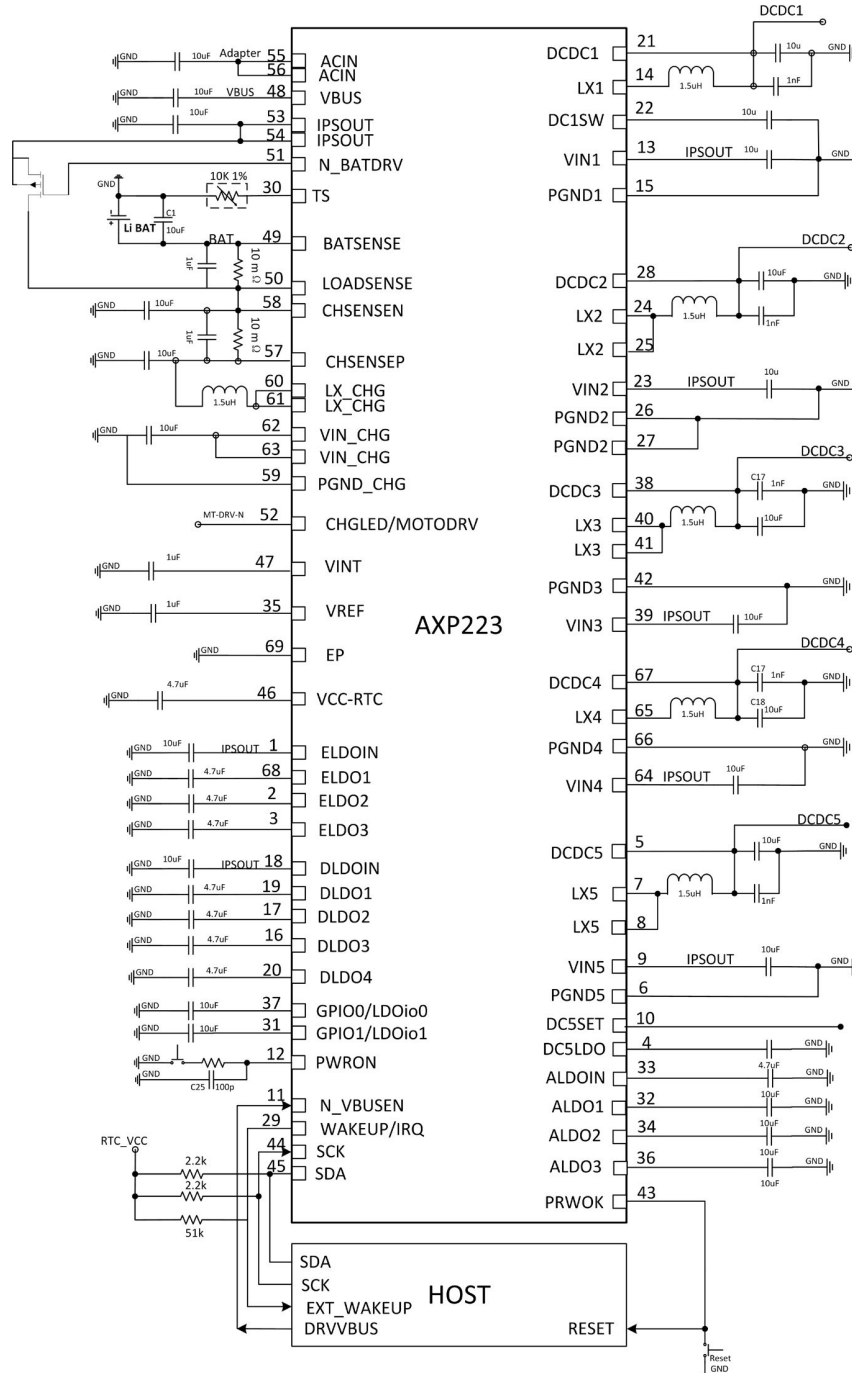
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# Feature

Power Management(IPS™)	<ul style="list-style-type: none"> <li>Wide input voltage : 2.9V~6.3V (AMR:-0.3V~11V)</li> <li>Configurable high efficient IPS system</li> <li>Adaptive USB or AC-adaptor with voltage/current-limit (4.4V/900mA/500mA)</li> </ul>
Fully Integrated Flash Charger	<ul style="list-style-type: none"> <li>Built-in MOSFET max Charge Current up to 2.1A</li> <li>Support Battery Temperature Monitoring</li> <li>Support USB compatible charger</li> <li>High precision Charging , error is less than <math>\pm 0.5\% \pm 0.5\%</math></li> <li>Support Battery of Various Voltage such as 4.1V/4.2V/4.22V/4.24V</li> <li>Automatic Charge Procedure Management</li> <li>Directly drive LED to indicate charge status</li> <li>Automatical scaling of charge current according to the System Load</li> </ul>
14 Low-dropout Linear Regulator (LDO)	<ul style="list-style-type: none"> <li>RTC_VCC : Always on 30mA ,</li> <li>ALDO1/2 : Low noise LDO, voltage from 0.7V~3.3V , 100mV/step, drive capability 300mA</li> <li>ALDO3 : Low noise LDO,voltage from 0.7V~3.3V , 100mV/step, drive capability 200mA</li> <li>LDO<sub>100</sub>/LDO<sub>101</sub> : Low noise LDO, voltage from 0.7V~3.3V ,100mV/step, drive capability 100mA</li> <li>DLDO1/ELDO1 : voltage from 0.7V~3.3V , 100mV/step, drive capability 400mA</li> <li>DLDO2/DLDO3/ELDO2/ELDO3 : voltage from 0.7V~3.3V , 100mV/step , drive capability 200mA</li> <li>DLDO4 : voltage from 0.7V~3.3V , 100mV/step , drive capability 100mA</li> <li>DC5LDO : voltage from 0.7V~1.4V , 100mV/step, drive capability 200mA</li> </ul>
2 Switch	<ul style="list-style-type: none"> <li>DC1SW : Resistance 160mΩ , power from DCDC1</li> <li>CHGLED : Internal integration NMOS with 100mA drive capability , can be used to drive vibration motor and charge LED</li> </ul>
5 Synchronous Buck (DC-DC)	<ul style="list-style-type: none"> <li>DCDC1 : with Voltage from 1.6V~3.4V ,100mV/step, drive capability 1.4A</li> <li>DCDC2 : with Voltage from 0.6V~1.54V ,20mV/step, drive capability 2A, supporting Voltage Ramp Control(VRC)</li> <li>DCDC3 : with Voltage from 0.6V~1.86V ,20mV/step, drive capability 2A</li> <li>DCDC4 : with Voltage from 0.6V~1.54V ,20mV/step, drive capability 0.6A</li> <li>DCDC5 : with Voltage from 1.0V~2.55V ,50mV/step, drive capability 2A</li> </ul>
E-Gauge™ Fuel Gauge system	<ul style="list-style-type: none"> <li>Built-in high-precision dual-mode automatic metering system</li> <li>Provides high adaptability for different battery under easy mode</li> <li>Provide high-precision measurement of specific cells (2%) under high-precision mode</li> <li>Provide Various Power Management data such as Transient Power Consumption(mA or mW) , Remaining Battery Life(% or mAh) , Charge State(%) and Charge Time</li> <li>Two-level Low-Power Warning &amp; Protection</li> <li>Provide AXP223 Die Temperature</li> </ul>
Host Interface	<ul style="list-style-type: none"> <li>Host can exchange data with P2WI/RSB(Push-Pull Two Wire Interface/Reduced Serial Bus)</li> <li>Flexible Interrupts Management</li> <li>Flexible Pin Function Configuration. 2 GPIO can be set as IO, ADC and so on</li> <li>On-chip Configurable Timer</li> <li>12 Registers for Data storage during System Power-off</li> </ul>
System Management	<ul style="list-style-type: none"> <li>Support Soft Reset and Hard Reset</li> <li>Support Soft Power-off and Hard Power-off , Support external Wakeup Triggers</li> <li>PWROK indicating System Reset or Power-off</li> <li>External Power Detection(Plugin/Removal/Inqualified Drive Capability)</li> <li>Support Soft Power-on for Input &amp; Output</li> <li>Overvoltage/Undervoltage Protection (OVP/UVP)</li> <li>Overcurrent Protection (OCP)</li> <li>Over temperature Protection (OTP)</li> </ul>
Highly Integration	<ul style="list-style-type: none"> <li>Internal Reference Voltage with High Accuracy ( 0.5% )</li> <li>On-chip MOSFET</li> </ul>

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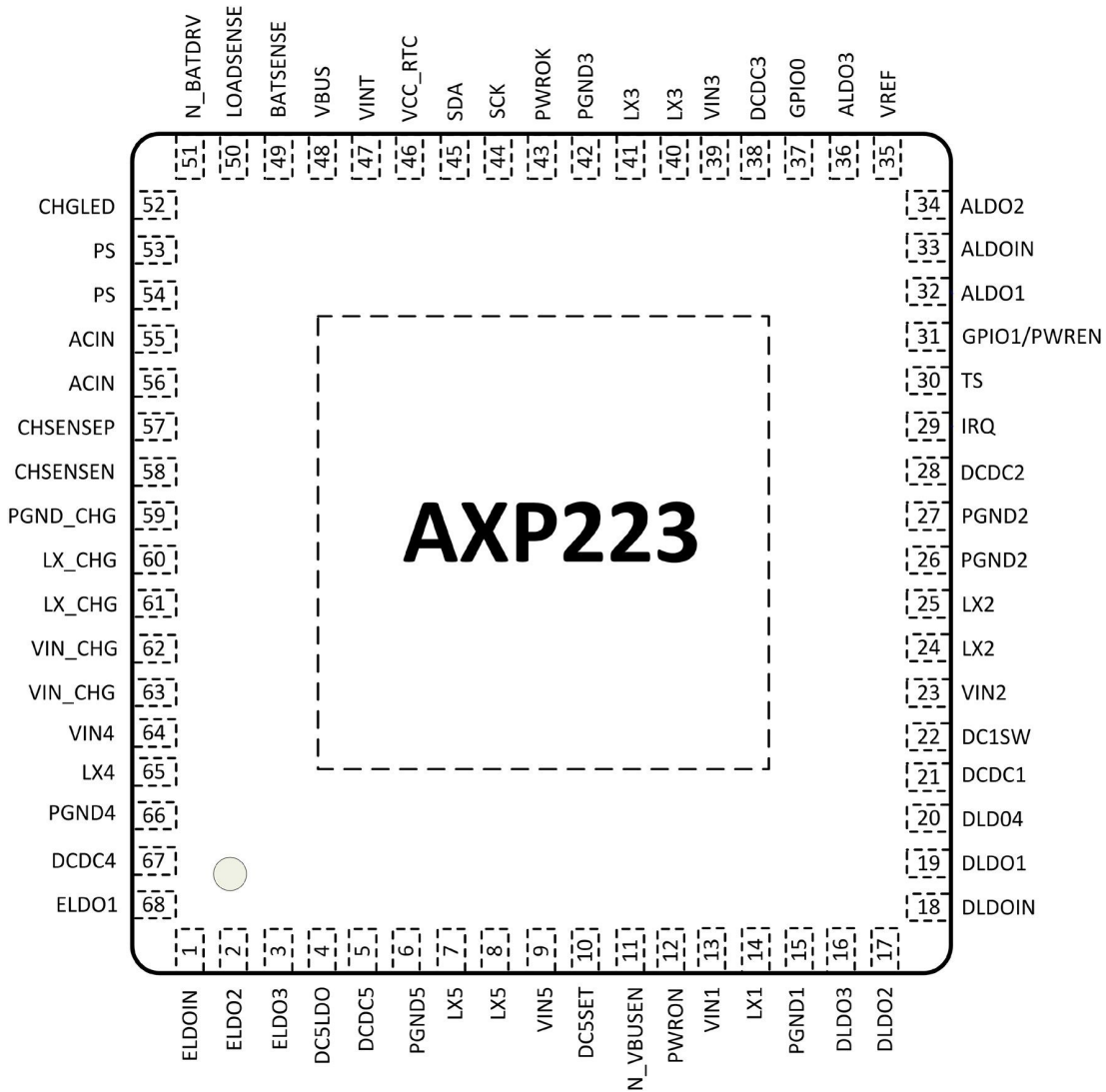
# Typical Application



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;

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# Pin Diagram



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## Pin Description

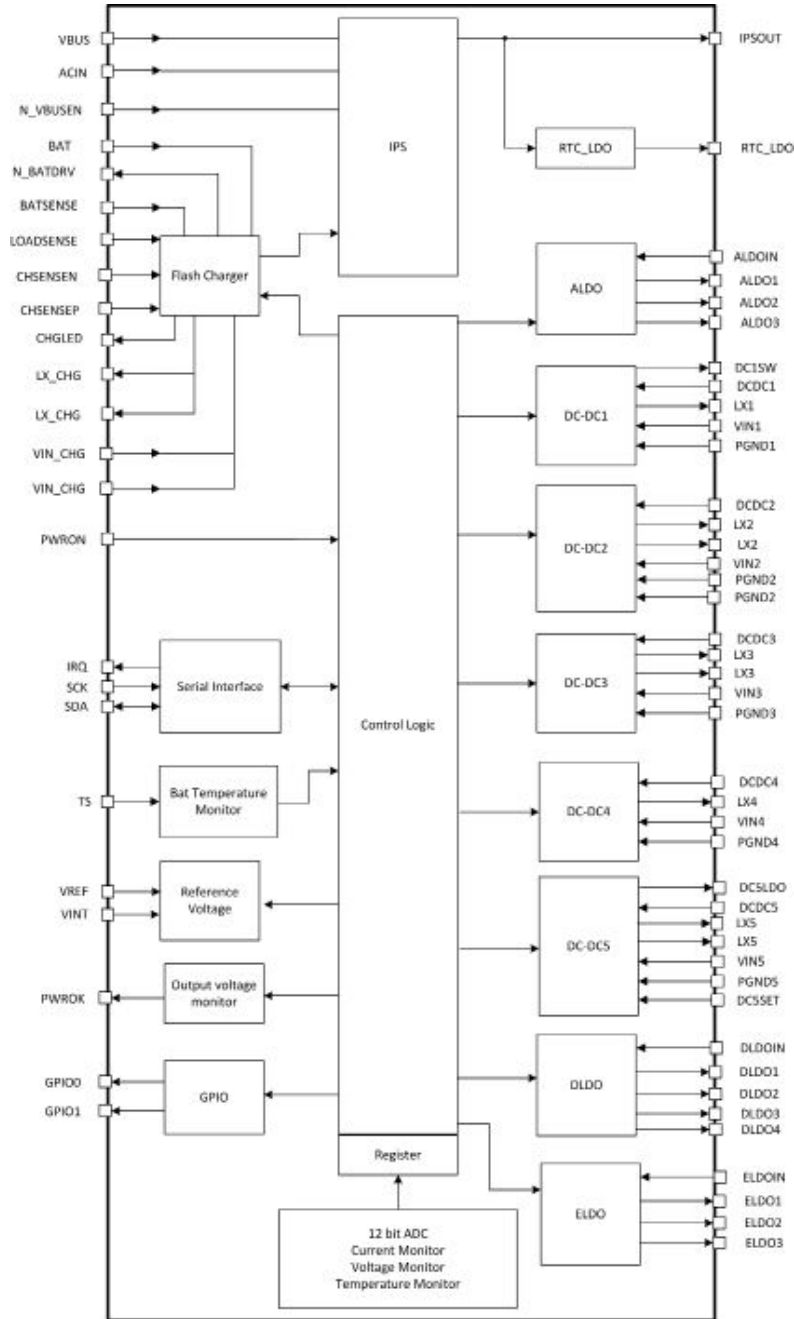
Num	Name	Type	Condition	Function Description
1	ELDOIN	PI		ELDO Input source
2	ELDO2	O		Output Pin of ELDO2
3	ELDO3	O		Output Pin of ELDO3
4	DC5LDO	O		Output Pin of DC5LDO
5	DCDC5	I		DCDC5 feedback pin
6	PGND5	G		NMOS Ground for DCDC5
7,8	LX5	IO		Inductor Pin for DCDC5
9	VIN5	PI		DCDC5 input source
10	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		DCDC1 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		DCDC2 Feedback Pin
29	IRQ/WAKEUP	IO		IRQ Output or Wakeup



Num	Name	Type	Condition	Function Description
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
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		DCDC3 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

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## Functional Block Diagram



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## Absolute Maximum Ratings

Symbol	Description	Value	Units
ACIN	Input Voltage	-0.3 ~ 11	V
VBUS	Input Voltage	-0.3 ~ 11	V
T <sub>a</sub>	Operating Temperature Range	-20 ~ 80	°C
T <sub>j</sub>	Junction Temperature Range	-20~130	°C
T <sub>s</sub>	Storage Temperature Range	-40 ~150	°C
T <sub>LEAD</sub>	Maximum Soldering Temperature (at leads , 10sec)	300	°C
V <sub>ESD</sub>	Maximum ESD stress voltage , Human Body Model	>4000	V
P <sub>D</sub>	Internal Power Dissipation	2700	mW

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## Electrical Characteristics

Symbol	Description	Condition	MIN	TYP	MAX	Units
<b>ACIN</b>						
$V_{IN}$	ACIN Input Voltage		3.8		6.3	V
$I_{OUT}$	$V_{OUT}$ Current Available Before Loading BAT	400mV 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		mOhm

<b>VBUS</b>						
$V_{IN}$	VBUS Input Voltage		3.8		6.3	V
$I_{OUT}$	$V_{OUT}$ Current Available Before Loading BAT	400mV Voltage Drop		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		mOhmΩ

### 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
$\Delta V_{RECHG}$	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	Condition	MIN	TYP	MAX	Units
<b>Off Mode Current</b>						
$I_{BATOFF}$	OFF Mode Current	BAT=3.8V		35		$\mu$ A
<b>Logic</b>						
$V_{IL}$	Logic Low Input Voltage			0.3		V
$V_{IH}$	Logic High Input Voltage			1.5		V
<b>P2WI/RSB</b>						
$V_{CC}$	Input Supply Voltage			VCC-RTC		V
$f_{SCK}$	Clock Operating Frequency				2000	KHZ
$t_f$	Clock Data Fall Time			60		ns
$t_r$	Clock Data Rise Time			100		ns
<b>DCDC</b>						
$f_{OSC}$	Oscillator Frequency	Default		3		MHz
<b>DCDC1</b>						
$I_{VIN1}$	Input Current	PFM Mode $I_{DC1OUT} = 0$		50		$\mu$ A
$I_{LIM1}$	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
<b>DCDC2</b>						
$I_{VIN2}$	Input Current	PFM Mode $I_{DC2OUT} = 0$		50		$\mu$ A
$I_{LIM2}$	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
<b>DCDC3</b>						
$I_{VIN3}$	Input Current	PFM Mode $I_{DC3OUT} = 0$		50		$\mu$ A
$I_{LIM3}$	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
<b>DCDC4</b>						
$I_{VIN4}$	Input Current	PFM Mode $I_{DC4OUT} = 0$		45		$\mu$ A
$I_{LIM4}$	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
<b>DCDC5</b>						
$I_{VIN5}$	Input Current	PFM Mode $I_{DC5OUT} = 0$		45		$\mu$ A
$I_{LIM5}$	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
<b>RTC_VCC</b>						
V <sub>RTC_VCC</sub>	Output Voltage	I <sub>RTC_VCC</sub> =1mA	-1%	3.0	1%	V
I <sub>RTC_VCC</sub>	Output Current			30		mA
<b>ALDO1</b>						
V <sub>ALDO1</sub>	Output Voltage	I <sub>ALDO1</sub> =1mA	-1%	3.0	1%	V
I <sub>ALDO1</sub>	Output Current			300		mA
I <sub>Q</sub>	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I <sub>ALDO1</sub> =60mA,1KHz		TBD		dB
e <sub>N</sub>	Output Noise,20-80KHz	V <sub>o</sub> =3.3V , I <sub>o</sub> =20mA		31		μV <sub>RMS</sub>
<b>ALDO2</b>						
V <sub>ALDO2</sub>	Output Voltage	I <sub>ALDO2</sub> =1mA	-1%	2.5	1%	V
I <sub>ALDO2</sub>	Output Current			300		mA
I <sub>Q</sub>	Quiescent Current			62		μA
PSRR	Power Supply Rejection Ratio	I <sub>ALDO2</sub> =10mA,1KHz		TBD		dB
e <sub>N</sub>	Output Noise,20-80KHz	V <sub>o</sub> =3.3V , I <sub>o</sub> =20mA		31		μV <sub>RMS</sub>
<b>ALDO3</b>						
V <sub>ALDO3</sub>	Output Voltage	I <sub>ALDO3</sub> =1mA	-1%	3.0	1%	V
I <sub>ALDO3</sub>	Output Current			200		mA
I <sub>Q</sub>	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I <sub>ALDO3</sub> =10mA,1KHz		TBD		dB
e <sub>N</sub>	Output Noise,20-80KHz	V <sub>o</sub> =3.3V, I <sub>o</sub> =20mA		43		μV <sub>RMS</sub>
<b>DLDO1</b>						
V <sub>DLDO1</sub>	Output Voltage	I <sub>DLDO1</sub> =1mA	-1%	OFF	1%	V
I <sub>DLDO1</sub>	Output Current			400		mA
I <sub>Q</sub>	Quiescent Current			56		μA
PSRR	Power Supply Rejection Ratio	I <sub>DLDO1</sub> =10mA,1KHz		TBD		dB
e <sub>N</sub>	Output Noise,20-80KHz	V <sub>o</sub> =3.3V, I <sub>o</sub> =20mA		100		μV <sub>RMS</sub>
<b>DLDO2</b>						
V <sub>DLDO2</sub>	Output Voltage	I <sub>DLDO2</sub> =1mA	-1%	OFF	1%	V
I <sub>DLDO2</sub>	Output Current			200		mA
I <sub>Q</sub>	Quiescent Current			60		μA
PSRR	Power Supply Rejection Ratio	I <sub>DLDO2</sub> =10mA,1KHz		TBD		dB
e <sub>N</sub>	Output Noise,20-80KHz	V <sub>o</sub> =3.3V, I <sub>o</sub> =20mA		100		μV <sub>RMS</sub>

Symbol	Description	Conditions	MIN	TYP	MAX	Units
<b>DLDO3</b>						
$V_{DLDO3}$	Output Voltage	$I_{DLDO3}=1mA$	-1%	OFF	1%	V
$I_{DLDO3}$	Output Current			200		mA
$I_Q$	Quiescent Current			60		$\mu A$
PSRR	Power Supply Rejection Ratio	$I_{DLDO3}=10mA, 1KHz$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3V, I_o=20mA$		100		$\mu V_{RMS}$
<b>DLDO4</b>						
$V_{DLDO4}$	Output Voltage	$I_{DLDO4}=1mA$	-1%	OFF	1%	V
$I_{DLDO4}$	Output Current			100		mA
$I_Q$	Quiescent Current			60		$\mu A$
PSRR	Power Supply Rejection Ratio	$I_{DLDO4}=10mA, 1KHz$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3V, I_o=20mA$		100		$\mu V_{RMS}$
<b>ELDO1</b>						
$V_{ELDO1}$	Output Voltage	$I_{ELDO1}=1mA$	-1%	OFF	1%	V
$I_{ELDO1}$	Output Current			400		mA
$I_Q$	Quiescent Current			55		$\mu A$
PSRR	Power Supply Rejection Ratio	$I_{ELDO1}=10mA, 1KHz$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3V, I_o=20mA$		100		$\mu V_{RMS}$
<b>ELDO2</b>						
$V_{ELDO2}$	Output Voltage	$I_{ELDO2}=1mA$	-1%	OFF	1%	V
$I_{ELDO2}$	Output Current			200		mA
$I_Q$	Quiescent Current			55		$\mu A$
PSRR	Power Supply Rejection Ratio	$I_{ELDO2}=10mA, 1KHz$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3V, I_o=20mA$		100		$\mu V_{RMS}$
<b>ELDO3</b>						
$V_{ELDO3}$	Output Voltage	$I_{ELDO3}=1mA$	-1%	OFF	1%	V
$I_{ELDO3}$	Output Current			200		mA
$I_Q$	Quiescent Current			55		$\mu A$
PSRR	Power Supply Rejection Ratio	$I_{ELDO3}=10mA, 1KHz$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3V, I_o=20mA$		100		$\mu V_{RMS}$
<b>DC5LDO</b>						
$V_{DC5LDO}$	Output Voltage	$I_{DC5LDO}=1mA$	-1%	1.1	1%	V

Symbol	Description	Condition	MIN	TYP	MAX	Units
$I_{DC5LDO}$	Output Current			200		mA
$I_Q$	Quiescent Current			40		$\mu$ A
PSRR	Power Supply Rejection Ratio	$I_{DC5LDO}=10\text{mA}, 1\text{KHz}$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3\text{V}, I_o=20\text{mA}$		100		$\mu\text{V}_{\text{RMS}}$
<b>LDOIO0</b>						
$V_{LDOio0}$	Output Voltage	$I_{LDOio0}=1\text{mA}$	-1%	OFF	1%	V
$I_{LDOio0}$	Output Current			100		mA
$I_Q$	Quiescent Current			35		$\mu$ A
PSRR	Power Supply Rejection Ratio	$I_{LDOio0}=10\text{mA}, 1\text{KHz}$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3\text{V}, I_o=20\text{mA}$		40		$\mu\text{V}_{\text{RMS}}$
<b>LDOIO1</b>						
$V_{LDOio1}$	Output Voltage	$I_{LDOio1}=1\text{mA}$	-1%	OFF	1%	V
$I_{LDOio1}$	Output Current			100		mA
$I_Q$	Quiescent Current			35		$\mu$ A
PSRR	Power Supply Rejection Ratio	$I_{LDOio1}=10\text{mA}, 1\text{KHz}$		TBD		dB
$e_N$	Output Noise, 20-80KHz	$V_o=3.3\text{V}, I_o=20\text{mA}$		40		$\mu\text{V}_{\text{RMS}}$
<b>DC1SW</b>						
$R_{DC1SW}$	Internal Ideal Resistance	PIN to PIN, DCDC1, DC1SW		160		mOhm
<b>CHGLED</b>						
$R_{CHGLED}$	Internal Ideal Resistance	$V_{in}=0.3\text{V}$		2		Ohm



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## Control and Operating

Once AXP223 is powered on, SCK/SDA pin of P2WI/RSB will be pulled up to IO Power and then Host(system processor) can adjust and monitor AXP223 ,

Remarks: "External Power" below includes ACIN and VBUS input.

### 9.1. Power On/Off & Reset

#### 9.1.1. Power Enable Key (PEK)

The Power Enable/ Sleep/Wakeup Key can be connected between PWRON pin and GND of AXP223. AXP223 can automatically identify the "Long-press" and "Short-press" and then correspond respectively.

#### 9.1.2. Power On

Power on Source

- ACIN and VBUS
- PEK
- IRQ low level

press PEK can power on AXP223 (press time over ONLEVEL). In application, Host Alarm output signal can be connected to IRQ. Whenever there is a valid Alarm signal ((Low Level)), AXP223 can be powered on..

After power on, DC-DC and LDO will be soft booted in preset timing sequence.

#### 9.1.3. 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 :

- input voltage is too low( Low-Power Protection) ;
- Power output voltage is too low due to overload( Overload Protection) ;
- Input voltage is too high( Overvoltage Protection)( See more details in chapter " Intelligent Power Select" ;
- Push PEK longer more than OFFLEVEL( Default 6S), and system will cut off all power output except VCC-RTC ;

With the automatic protection mechanism, AXP223 can protect whole system by preventing Components from irriversable damage due to system abnormality.

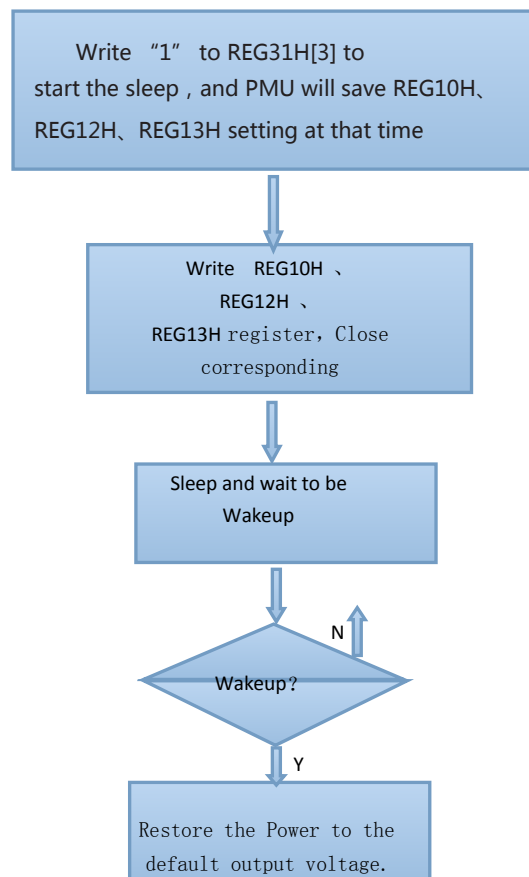
### 9.1.4. Sleep and Wakeup

When the running system needs to enter Sleep mode, REG31H [3] will determine whether one or several power rails should be disabled, Wakeup can be triggered by either signal :

- ACIN plug ( REG40[6:5] should be 1 )
- VBUS plug ( REG40[3:2] should be 1 )
- Push long time PEK ( REG42[0] should be 1 )
- PEK falling edge ( REG44[5] should be 1 )
- Battery low power alarm ( REG43[1:0] should be 1 )
- GPIO[1:0] as a general purpose input when it detects rising and falling edge ( REG4C[1:0] should be 1 , and REG90[7:6]、REF92[7:6] should be 1 )
- Software wakeup , write 1 in REG31[5]
- IRQ wakeup ( REG8F[7] should be 1 )

with all power rails resume to default voltage in default , and power on timing sequence

See control process under sleep and wakeup modes as below :



## 9.1.5. System Reset and Output Monitoring (PWROK)

The PWROK in AXP223 can be used as the reset signal of application system. During AXP223 startup, PWROK outputs low level, which will then be pulled high to startup and reset the system after each 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 drive low to reset the system and prevent data losses.

When application system works normally , drive low PWROK , then AXP223 will reboot , and power on timing sequence

## 9. Power Path management (IPS™)

Power input of AXP223 may come from Li-battery, USB VBUS input, external power ACIN (such as AC adapter). IPS can select proper power 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 ACIN drive capability is not enough, VBUS will be enabled to achieve ACIN/VBUS common power supply ;
- If the drive capacity is still insufficient, charge current will be reduced to zero, and battery is used for power supply ;

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

### 9.2.1 Voltage-Limit/Current Mode and Direct mode

In order not to affect the USB communication, VBUS is always working under 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, adjustable in Reg30H [5:3] register.

If the system has limit on current obtained from USB VBUS, a current-limit mode is provided (See REG30H[1] register), with 900mA/500mA/100mA (Reg30H [0]) selectable.

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 then 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.

### 9.2.2 AXP223’s Reaction to External Power Supply Plugin

AXP223 can automatically detect the plugin of external powers and judge whether the power is usable or not. The result will be set in 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
REG00_[7]	Indicating the presence of external ACIN
REG00_[6]	Indicating whether the external ACIN is usable or not
REG00_[5]	Indicating the presence of external VBUS
REG00_[4]	Indicating whether the external VBUS is usable or not
REG00_[3]	Indicating whether the VBUS voltage is above VHOLD when used
REG00_[1]	Indicating whether ACIN/VBUS short circuits on PCB or not
REG00_[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 VHOLD 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 VHOLD, which may facilitate Host software to decide either to keep on working in Voltage-Limit mode or switch to Direct mode.

### 9.2.3. When to Select VBUS as Input Power

N\_VBUSEN and register REG30H[7]、REG30\_[2]、REG8F\_[4] is used to determined when shall VBUS be used as power supply :

REG30_[7]	REG8F_[4]	N_VBUSEN	REG30H[2]	YES/NO
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 represents any state and any value

### 9.2.4. Low-Power Protection (Automatic Power off)

With AXP223, the value of  $V_{OFF}$ (automatic shutdown voltage) can be set,If the system power is found ALDOIN is lower than  $V_{OFF}$ , AXP223 will automatically enter Shutdown Mode,and disable all other outputs except VCC-RTC.

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

### 9.2.5. 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.

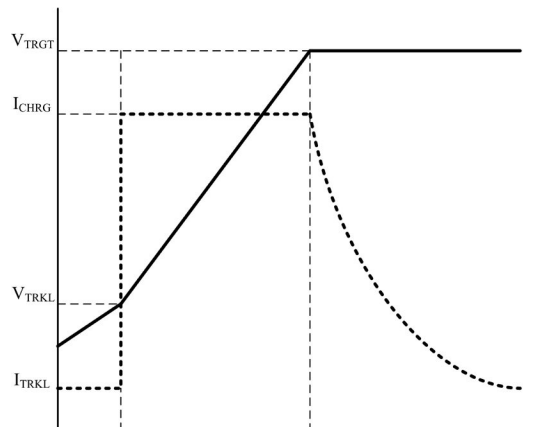
## 9.3. Adaptive Flash Charger

AXP223 integrates a adaptive Flash 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 decrease the charge current when the temperature is too high or too low.

### 9.3.1. 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 firstly judge whether it is chargeable. If the charger is suitable for the power, and the charge function is usable, AXP223 will automatically start the charge, and send IRQ to Host for indication. At the same time, GHGLED pin will output low level to drive external LED to indicate the charging state.

Charge Voltage/Current :



### 9.3.2. 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.  $V_{RCH}=V_{TRGT}-0.1V$ .

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

### 9.3.3. Charge Current

The charge current is 500mA or 1200mA by default, which can be set by REG33H [3:0].

### 9.3.4. 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.

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.

### 9.3.5. Battery Activate Mode

At the entering the battery activate mode from either pre-charge mode or constant current mod(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.

### 9.3.6. CHGLED

CHGLED pin is used to indicate charge state and 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

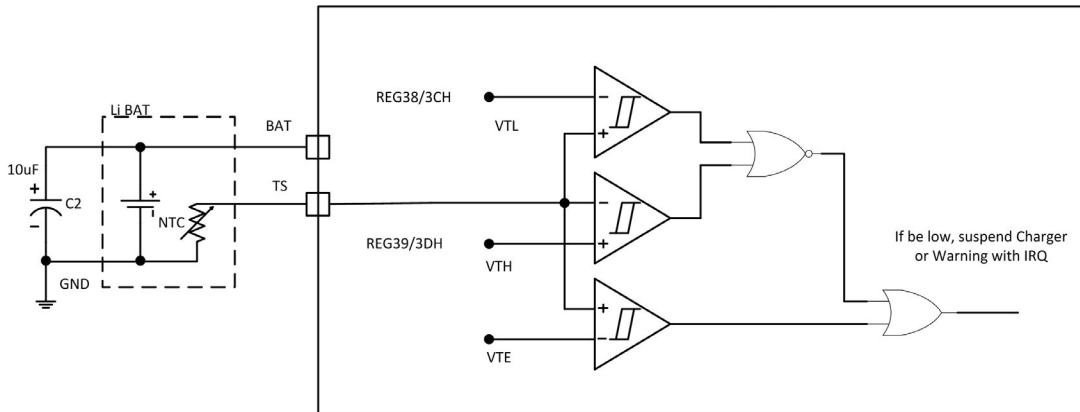
Status	Performance	Remark
Charging	Low Level	
Not Charging	High Resistance	
Battery Abnormal	25% duty 1Hz flicker	The charger enters the battery activate mode, or the battery temperature is too high/low.
Over-Voltage	25% duty 4Hz flicker	External voltage input is too high

#### Type B

Status	Performance	Remark
Charging	25% duty 1Hz flicker	
Not Charging	High Resistance	
Battery Abnormal Over-Voltage	25% duty 1Hz flicker	The charger enters the battery activate mode, or the battery temperature is too high/low. voltage output is too high
No battery	Low Level	No external power is available.

## 9.3.7. 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°C. 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, extra resistors can be serial or parallel connected to expand the detect extent.

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

## 9.3.8 Battery Detection

AXP223 will automatically detect the battery presence, record the result in registers (refer to REG01H) and release IRQ13, IRQ14.

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	Start-up procedure	Application Examples	Drive Ability
DCDC1	BUCK	3.0V	1	3.0V I/O	1400mA
DCDC2	BUCK	1.1V	1	1.1V CPU	2000mA
DCDC3	BUCK	1.1V	1	1.1V GPU	2000mA
DCDC4	BUCK	1.1V	1	1.1V Core	600mA
DCDC5	BUCK	1.5/DC5SET setting	1	1.5V DDR3	2000mA
RTC-LDO	LDO	3.0V	1	RTC	30mA
ALDO1	LDO	3.0	1	N/A	300mA
ALDO2	LDO	2.5V	1	N/A	300mA
ALDO3	LDO	3.0V	1	N/A	200mA
LDO <sub>IO0</sub>	LDO	OFF	OFF	N/A	100mA
LDO <sub>IO1</sub>	LDO	OFF	OFF	N/A	100mA
DLDO1	LDO	OFF	OFF	N/A	400mA
DLDO2	LDO	OFF	OFF	N/A	200mA
DLDO3	LDO	OFF	OFF	N/A	200mA
DLDO4	LDO	OFF	OFF	N/A	100mA
ELDO1	LDO	OFF	OFF	N/A	400mA
ELDO2	LDO	OFF	OFF	N/A	200mA
ELDO3	LDO	OFF	OFF	N/A	200mA
DC5LDO	LDO	1.1V	1	N/A	200mA
DC1SW	Switch	OFF	OFF	N/A	400mA

AXP223 comes with 5 synchronous step-down DC-DCs, 14 LDOs, 2 switch as well as multiple timing and controlling methods. 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 DC-DCs can be set in PWM mode or auto mode (automatically switchable according to the AXP223 load). See register REG80H.

### 9.4.1. DCDC1/2/3/4/5

DCDC1 output voltage ranges from 1.6 V to 3.4V,  
 DCDC2/4 output voltage ranges from 0.6 V to 1.54V  
 DCDC3 output voltage ranges from 0.6 V to 1.86V  
 DCDC5 output voltage ranges from 1.0 V to 2.55V  
 Can be programmed via registers

DCDC5 Voltage setting depends on DC5SET pin Voltage :

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

DCDC output capacitor is recommended to use small ESR ceramic capacitors above 10uF X7R ; recommend 1.5uH inductors , Besides, the inductor saturation current should be larger than 50% of the largest demanded current in power circuitry.



## 9.4.2. VCC-RTC

VCC-RTC always on , Can provide uninterrupted power supply for real-time clock circuit (RTC) of application system , drive ability is 30mA.

## 9.4.3. ALDO1/2/3

ALDO1/2/3 using a low-noise design , can be used to supply power for analog circuits of application system , drive ability is 300mA /300mA /200mA.

## 9.4.4. LDO<sub>IO0</sub> /LDO<sub>IO1</sub>

LDO<sub>IO0</sub>/LDO<sub>IO1</sub> using a low-noise design too , both output drive ability is 100mA.

## 9.4.5. DLDO1/DLDO2/DLDO3/DLDO4

DLDO1/DLDO2/DLDO3/DLDO4 are common low dropout linear regulators , drive ability is 400mA /200mA /200mA/100mA.

## 9.4.6. ELDO1/ELDO2/ELDO3/

ELDO1/ELDO2/ELDO3/ are common low dropout linear regulators , drive ability is 400mA /200mA /200mA/.

## 9.4.7. DC5LDO

Power input of DC5LDO is DCDC5 , drive ability is 200mA.

## 9.4.8. DC1SW

Power input of DC1SW is DCDC1 , equivalent resistance is 160mOhm.

## 9.4.9. Soft Start

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

All DCDC does not require external Schottky diode and resistor divider feedback circuit,if don' t need some DCDC in application , Just let the corresponding LX pin unconnected.

## 9.5. E-Gauge™ Fuel Gauge system

Multiple 12Bit ADC of AXP223 can measuring the battery voltage and current , battery charge and discharge coulometer are internal integration at the same time .Based on this , AXP223 integrated dual-mode fuel gauge system.Under the easy mode , save the exact of the battery parameters needs to initialize , achieve high compatibility with a large number of batteries ; but in precision mode , Optimized parameters of particular battery , achieve measurement accuracy of up to 2%.

Enable control and sampling rate of all ADC can be set visa register REG84H , sample results are stored in the corresponding register , See the ADC data description of register .decide by register REG00H[2] .

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°C	0.1°C	165.8°C
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-96H Instruction for details.

CHGLED

Features charge state indication, over-temperature/over-voltage warning, and Motor-drive , if REG32[2]=0 , the PIN driveability is 100mA , connect micro vibration motor to 3.3V

Power serial links to current limiting resistor , vibration motor can be driven directly.if REG32[2]=1 , the PIN state is charging, over-temperature and over-voltage warning function indicator.

## 9.7. Timer

AXP223 features a internal timer, whose values can be programmed via register REG8AH[6:0]. The minimum time step of timer is minute , timer will be set in REG8AH[7] after timeout.

## 9.8 Interrupt mechanism

Host can visit AXP223 registers via the P2WI/RSB interface, and the highest rate can reach 2MHz. In addition, multi read and write operation is supported.

When certain events occur, AXP223 will inform Host by pulling down the IRQ interrupt mechanism, and the interrupt state will be reserved 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 no 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).

REG	IRQ	Description	REG	IRQ	Description
REG 48_ [7]	IRQ1	ACIN Over voltage	REG 4B_ [7]		
REG 48_ [6]	IRQ2	ACIN plug in	REG 4B_ [6]		
REG 48_ [5]	IRQ3	ACIN removal	REG 4B_ [5]		
REG 48_ [4]	IRQ4	VBUS Over voltage	REG 4B_ [4]		
REG 48_ [3]	IRQ5	VBUS plug in	REG 4B_ [3]		
REG 48_ [2]	IRQ6	VBUS removal	REG 4B_ [2]		
REG 48_ [1]	IRQ7	VBUS voltage lower than $V_{HOLD}$	REG 4B_ [1]	IRQ19	Low power LEVEL1
REG 48_ [0]	Reserved		REG 4B_ [0]	IRQ20	Low power LEVEL2
REG 49_ [7]	IRQ8	Battery plugin	REG 4C_ [7]	IRQ21	Timer Done
REG 49_ [6]	IRQ9	Battery Removal	REG 4C_ [6]	IRQ22	PEK rising edge
REG 49_ [5]	IRQ10	Enter battery activate mode	REG 4C_ [5]	IRQ23	PEK falling edge
REG 49_ [4]	IRQ11	Exit battery activate mode	REG 4C_ [4]		
REG 49_ [3]	IRQ12	charging	REG 4C_ [3]		
REG 49_ [2]	IRQ13	Charge Done	REG 4C_ [2]	Reserved	
REG 49_ [1]	IRQ14	Battery temp too high	REG 4C_ [1]	IRQ24	GPIO1 edge trigger
REG 49_ [0]	IRQ15	Battery temp too low	REG 4C_ [0]	IRQ25	GPIO0 edge trigger
REG 4A_ [7]	IRQ16	Die Temp too high			
REG 4A_ [6]	Reserved				
REG 4A_ [5]	Reserved				
REG 4A_ [4]	Reserved				
REG 4A_ [3]	Reserved				
REG 4A_ [2]	Reserved				
REG 4A_ [1]	IRQ17	PEK short-press			
REG 4A_ [0]	IRQ18	PEK long-press			

# 10

# Register

## 10.1. Register

### 10.1.1. Power Control

Address	Register Description	R/W	Default value
00	Power status register	R	
01	Power mode/ charge state register	R	
04-0F	Data buffer register	R/W	00H
10	DCDC1/2/3/4/5&ALDO1/2&DC5LDO enable and disable control register	R/W	BFH
12	ELDO1/2/3&DLDO1/2/3/4&DC1SW enable and disable control register	R/W	00H
13	ALDO3 ON/OFF control register	R/W	01H
15	DLDO1 voltage setting register	R/W	00H
16	DLDO2 voltage setting register	R/W	00H
17	DLDO3 voltage setting register	R/W	00H
18	DLDO4 voltage setting register	R/W	00H
19	ELDO1 voltage setting register	R/W	00H
1A	ELDO2 voltage setting register	R/W	00H
1B	ELDO3 voltage setting register	R/W	00H
1C	DC5LDO voltage setting register	R/W	00H
21	DCDC1 voltage setting register	R/W	00H
22	DCDC2 voltage setting register	R/W	00H
23	DCDC3 voltage setting register	R/W	00H
24	DCDC4 voltage setting register	R/W	00H
25	DCDC5 voltage setting register	R/W	00H
27	DCDC2/3 voltage ramp parameter setting register	R/W	00H
28	ALDO1 voltage setting register	R/W	00H
29	ALDO2 voltage setting register	R/W	00H
2A	ALDO3 voltage setting register	R/W	00H
30	VBUS-IPSOUT channel setting register	R/W	60H
31	Wakeup control and VOFF shutdown voltage setting register	R/W	03H
32	Shutdown, battery detection, CHGLED control	R/W	43H
33	Charge control register 1	R/W	C6H
34	Charge control register 2	R/W	45H
35	Charge control register 3	R/W	0EH
36	PEK parameter control register	R/W	5DH
37	DCDC converter work frequency setting register	R/W	08H
38	Battery charge under-temperature warning setting register	R/W	A5H

Address	Register Description	R/W	Default value
39	Battery charge over-temperature warning setting	R/W	1FH
3C	Battery discharge under-temperature warning setting	R/W	FCH
3D	Battery discharge over-temperature warning setting	R/W	16H
80	DCDC work mode setting register	R/W	80H
82	ADC enable setting register1	R/W	E0H
84	ADC sample rate setting , TS pin control register	R/W	32H
85	TS ADC sample rate setting register	R/W	00H
8A	Timer control register	R/W	00H
8C/8D	PWREN control register	R/W	00H
8F	Over-temperature shutdown control register	R/W	01H

## 10.1.2. GPIO Control

Address	Register Description	R/W	Default value
90	GPIO0 control register	R/W	07H
91	GPIO0 LDO output voltage setting register	R/W	1FH
92	GPIO1 control register	R/W	07H
93	GPIO1 LDO mode output voltage setting control register	R/W	1FH
94	GPIO[1:0] signal status register	R/W	00H
97	GPIO[1:0] Pull-down control register	R/W	00H

## 10.1.3. Interrupt control

Address	Register Description	R/W	Default value
40	IRQ enable control register 1	R/W	D8H
41	IRQ enable control register 2	R/W	FFH
42	IRQ enable control register 3	R/W	03H
43	IRQ enable control register 4	R/W	03H
44	IRQ enable control register 5	R/W	00H
48	IRQ status register 1	R/W	00H
49	IRQ status register 2	R/W	00H
4A	IRQ status register 3	R/W	00H
4B	IRQ status register 4	R/W	00H
4C	IRQ status register5	R/W	00H

## 10.1.4. ADC Data

Address	Register Description	R/W
56	AXP223 internal temperature monitoring ADC data high 8 bits	R
57	AXP223 internal temperature monitoring ADC data low 4 bits	R
58	TS input ADC data high 8 bits , default monitoring battery	R
59	TS input ADC data low 4 bits , default monitoring battery	R
78	Battery voltage high 8 bits	R

Address	Register Description	R/W
79	Battery voltage low 4 bits	R
7A	Battery charge current high 8 bits	R
7B	Battery charge current low 4 bits	R
7C	Battery discharge current high 8 bits	R
7D	Battery discharge current low 5 bits	R

B8	Fuel Guage control register	R/W	C0H
B9	Fuel Guage result register	R	64H
E0	Total capacity of battery bit[14:8]	R/W	00H
E1	Total capacity of battery bit[7:0]	R/W	00H
E6	Low battery alarm setting register	R/W	A0H
E8H	set the interval update time for Fuel Gauge percentage	R/W	00H
E9H	Fuel Gauge calibration interval setting	R/W	00H
ECH	Coulomb counter percentage of electricity calibration points setting	R/W	00H

Note : The total capacity of battery unit is 1.456MAH

## 10.2. Register Description

### 10.2.1. REG 00H: Power Input Status

Bit	Descripton	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

## 10.2.2. 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 AXP223 ; 1: battery already connected to AXP223	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

## 10.2.3. REG 04-0FH: Data Cache

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.

## 10.2.4. REG 10H: DCDC1/2/3/4/5&ALDO1/2&DC5LDO Power Output Control

Default Value :FFH

Bit	Description	R/W	Default Value
7	ALDO2 enable and disable control	RW	1
6	ALDO1 enable and disable control	RW	1
5	DCDC5 enable and disable control	RW	1
4	DCDC4 enable and disable control	RW	1
3	DCDC3 enable and disable control	RW	1
2	DCDC2 enable and disable control	RW	1
1	DCDC1 enable and disable control	RW	1
0	DCDC0 enable and disable control	RW	1

0: disable; 1: enable

### 10.2.5. REG 12H: Power Output Control

Default Value :00H

Bit	Description	R/W	Default Value
7	DC1SW enable and disable control	RW	0
6	DLDO4 enable and disable control		
5	DLDO3 enable and disable control		
4	DLDO2 enable and disable control		
3	DLDO1 enable and disable control		
2	ELDO3 enable and disable control		
1	ELDO2 enable and disable control		
0	ELDO1 enable and disable control		

### 10.2.6. REG 13H: Power Output Control

Default Value :81H

Bit	Description	R/W	Default Value
7	ALDO3 enable and disable control	RW	1
6-0	Reserved and unchangeable		

### 10.2.7. REG 15H:DLDO1 Output Voltage Setting

Default Value :00H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	DLDO1 output voltage setting Bit4	RW	0
3	DLDO1 output voltage setting Bit3		
2	DLDO1 output voltage setting Bit2		
1	DLDO1 output voltage setting Bit1		
0	DLDO1 output voltage setting Bit0		

### 10.2.8. REG 16H:DLDO2 Output Voltage Setting

Default Value :00H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	DLDO2 output voltage setting Bit4	RW	0
3	DLDO2 output voltage setting Bit3		
2	DLDO2 output voltage setting Bit2		
1	DLDO2 output voltage setting Bit1		
0	DLDO2 output voltage setting Bit0		



## 10.2.9. REG 17H:DLDO3 Output Voltage Setting

Default Value :00H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	DLDO3 output voltage setting Bit4	RW	0
3	DLDO3 output voltage setting Bit3	RW	0
2	DLDO3 output voltage setting Bit2	RW	0
1	DLDO3 output voltage setting Bit1	RW	0
0	DLDO3 output voltage setting Bit0	RW	0

## 10.2.10. REG 18H:DLDO4 Output Voltage Setting

Default Value:00H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	DLDO4 output voltage setting Bit4	RW	0
3	DLDO4 output voltage setting Bit3	RW	0
2	DLDO4 output voltage setting Bit2	RW	0
1	DLDO4 output voltage setting Bit1	RW	0
0	DLDO4 output voltage setting Bit0	RW	0

## 10.2.11. REG 19H:ELDO1 Output Voltage Setting

Default Value :00H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	ELDO1 output voltage setting Bit4	RW	0
3	ELDO1 output voltage setting Bit3	RW	0
2	ELDO1 output voltage setting Bit2	RW	0
1	ELDO1 output voltage setting Bit1	RW	0
0	ELDO1 output voltage setting Bit0	RW	0

### 10.2.12. REG 1AH:ELDO2 Output Voltage Setting

Default Value :00H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	ELDO2 output voltage setting Bit4	RW	0
3	ELDO2 output voltage setting Bit3	RW	0
2	ELDO2 output voltage setting Bit2	RW	0
1	ELDO2 output voltage setting Bit1	RW	0
0	ELDO2 output voltage setting Bit0	RW	0

### 10.2.13. REG 1BH:ELDO3 Output Voltage Setting

Default Value :00H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	ELDO3 output voltage setting Bit4	RW	0
3	ELDO3 output voltage setting Bit3	RW	0
2	ELDO3 output voltage setting Bit2	RW	0
1	ELDO3 output voltage setting Bit1	RW	0
0	ELDO3 output voltage setting Bit0	RW	0

### 10.2.14. REG 1CH:DC5LDO Output Voltage Setting

Default Value :04H

Bit	Description	R/W	Default Value
7-3	Reserved and unchangeable		
2	DC5LDO output voltage setting Bit2	RW	1
1	DC5LDO output voltage setting Bit1	RW	0
0	DC5LDO output voltage setting Bit0	RW	0

### 10.2.15. REG 21H:DCDC1 Output Voltage Setting

Default Value :0EH

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	DCDC1 output voltage setting Bit4	RW	0
3	DCDC1 output voltage setting Bit3	RW	1
2	DCDC1 output voltage setting Bit2	RW	1
1	DCDC1 output voltage setting Bit1	RW	1
0	DCDC1 output voltage setting Bit0	RW	0

**10.2.16. REG 22H:DCDC2 Output Voltage Setting**

Default Value :19H

Bit	Description	R/W	Default Value
7-6	Reserved and unchangeable		
5	DCDC2 output voltage setting Bit5	RW	0
4	DCDC2 output voltage setting Bit4	RW	1
3	DCDC2 output voltage setting Bit3	RW	1
2	DCDC2 output voltage setting Bit2	RW	0
1	DCDC2 output voltage setting Bit1	RW	0
0	DCDC2 output voltage setting Bit0	RW	1

**10.2.17. REG 23H:DCDC3 Output Voltage Setting**

Default Value :19H

Bit	Description	R/W	Default Value
7-6	Reserved and unchangeable		
5	DCDC3 output voltage setting Bit5	RW	0
4	DCDC3 output voltage setting Bit4	RW	1
3	DCDC3 output voltage setting Bit3	RW	1
2	DCDC3 output voltage setting Bit2	RW	0
1	DCDC3 output voltage setting Bit1	RW	0
0	DCDC3 output voltage setting Bit0	RW	1

**10.2.18. REG 24H:DCDC4 Output Voltage Setting**

Default Value :19H

Bit	Description	R/W	Default Value
7-6	Reserved and unchangeable		
5	DCDC4 output voltage setting Bit5	RW	0
4	DCDC4 output voltage setting Bit4	RW	1
3	DCDC4 output voltage setting Bit3	RW	1
2	DCDC4 output voltage setting Bit2	RW	0
1	DCDC4 output voltage setting Bit1	RW	0
0	DCDC4 output voltage setting Bit0	RW	1

### 10.2.19. REG 25H:DCDC5 Output Voltage Setting

Default Value :0AH

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	DCDC5 output voltage setting Bit4	RW	0
3	DCDC5 output voltage setting Bit3	RW	1
2	DCDC5 output voltage setting Bit2	RW	0
1	DCDC5 output voltage setting Bit1	RW	1
0	DCDC5 output voltage setting Bit0	RW	0

1.0-2.55V , 50mV/step

Note: The default voltage depends on DC5SET

### 10.2.20. REG 27H:DCDC2/3 Dynamic Voltage Scaling Parameter Setting

Default Value :00H

Bit	Description	R/W	Default Value
7-4	Reserved and unchangeable		
3	DCDC3 VRC ENABLING CONTROL 0: enable; 1: disable	RW	0
2	DCDC2 VRC ENABLING CONTROL 0: enable; 1: disable	RW	0
1	DCDC3 VRC voltage rising slope control 0: 25mV/15.625us=1.6mV/us 1: 25mV/31.250us=0.8mV/us	RW	0
0	DCDC2 VRC voltage rising slope control 0: 25mV/15.625us=1.6mV/us 1: 25mV/31.250us=0.8mV/us	RW	0

## 10.2.21. REG 28H:ALDO1 Output Voltage Setting

Default Value :17H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	ALDO1 output voltage setting Bit4	RW	1
3	ALDO1 output voltage setting Bit3	RW	0
2	ALDO1 output voltage setting Bit2	RW	1
1	ALDO1 output voltage setting Bit1	RW	1
0	ALDO1 output voltage setting Bit0	RW	1

## 10.2.22. REG 29H:ALDO2 Output Voltage Setting

Default Value :12H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	ALDO2 output voltage setting Bit4	RW	1
3	ALDO2 output voltage setting Bit3	RW	0
2	ALDO2 output voltage setting Bit2	RW	0
1	ALDO2 output voltage setting Bit1	RW	1
0	ALDO2 output voltage setting Bit0	RW	0

## 10.2.23. REG 2AH:ALDO3 Output Voltage Setting

Default Value :17H

Bit	Description	R/W	Default Value
7-5	Reserved and unchangeable		
4	ALDO3 output voltage setting Bit4	RW	1
3	ALDO3 output voltage setting Bit3	RW	0
2	ALDO3 output voltage setting Bit2	RW	1
1	ALDO3 output voltage setting Bit1	RW	1
0	ALDO3 output voltage setting Bit0	RW	1

### 10.2.24 REG 30H:VBUS-IPSOUT Power Path Management

Default Value :60H

Bit	Description	R/W	Default Value
7	The VBUS-IPSOUT path select control signal when VBUS is usable 0: whether to enable the path is decided by N_VBUSEN pin 1:VBUS-IPSOUT can be enabled , regardless of the N_VBUSEN status	RW	0
6	VBUS V <sub>HOLD</sub> voltage-limit control 0: not limit the voltage; 1: limit the voltage	RW	1
5	V <sub>HOLD</sub> Setting Bit 2	RW	1
4	V <sub>HOLD</sub> Setting Bit 1	RW	0
3	V <sub>HOLD</sub> Setting Bit 0	RW	0
2	DRIVEVBUS as the output state control when output 0:low level out put 1:IPS out	RW	0
1-0	VBUS current-limit setting 00:900mA ; 01:500mA; 10:100mA; 11:not limit	RW	00

**10.2.25. REG 31H: Wakeup control and VOFF Power off Voltage Setting**

Default Value :03H

Bit	Description	R/W	Default Value
7	If PWROK is pulled low in the wake process 0:No 1: Yes	RW	0
6	Soft reboot control, write 1 in this bit then PMU will restart, and bit is automatically cleared	RW	0
5	software wake control , write 1 in bit then each output will resume, and bit is automatically cleared	RW	0
4	when enable wakeup function ,if IRQ enable wakeup, if masked in wakeup process 0 : IRQ enable wakeup,and masked in wakeup process 1: IRQ working ,but disable wakeup	RW	0
3	wakeup function enable setting in Sleep mode 0 : disable 1 : enable This bit will be automatically cleared to 0 after writing , so "1 " should be rewritten whenever enters the Sleep mode.	RW	0
2	V <sub>OFF</sub> Set Bit2	RW	0
1	V <sub>OFF</sub> Set Bit1	RW	1
0	V <sub>OFF</sub> Set Bit0	RW	1

**10.2.26. REG 32H: Shutdown Setting, Battery Detection and CHGLED Pin Control**

Default Value :43H

Bit	Description	R/W	Default Value
7	Shutdown Control Writing "1" to this bit will disable the AXP223 output,expect RTC and charging module	RW	0
6	Battery monitoring function setting bit: 0: disable; 1: enable	RW	1
5-4	CHGLED pin function setting	RW	00
3	CHGLED pin control setting	RW	0
2	Output disable timing control	RW	0
1-0	PWROK start delay time compare last power output	RW	11

### 10.2.27. REG 33H: Charging control 1

Default Value :C6H

Bit	Description	R/W	Default Value
7	Charging enable control bit,include Internal and external channel 0: disable , 1:enable	RW	1
6-5	Charging target-voltage setting 00:4.1V; 01:4.22V; 10:4.2V; 11:4.24V	RW	10
4	Charging end-current setting 0: end when the charge current is lower than 10% of the set value 1: end when the charge current is lower than 15% of the set value	RW	0
3-0	Charge current setting 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 ;	RW	0110

### 10.2.28. REG 34H: Charging control 2

Default Value :45H

Bit	Description	R/W	Default Value	
7	Pre-charge timeout setting Bit1	00: 40 min ; 01: 50min ;	RW	0
6	Pre-charge timeout setting Bit0	10: 60min ; 11: 70min	RW	1
5	If close charg output after charge finsih 0 : close ; 1 : open		RW	0
4	CHGLED mode selection 0: Type A 1: Type B		RW	0
3	Reserved and unchangeable			
2	if charging constant follows charging current when value changed 0 : Not follow 1 : Follow		RW	1
1	Constant-current mode timeout setting Bit1	00: 6Hours ; 01: 8Hours ;	RW	0
0	Constant-current mode timeout setting Bit0	10: 10Hours ; 11: 12Hours	RW	1

Note : Type A/B Please refer to "Adaptive Flash Charger" Instruction for details.



**10.2.29. REG 35H: Charging control 3**

Default Value :0EH

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

**10.2.30. REG 36H:PEK Key Parameters Setting**

Default Value :59H

Bit	Description	R/W	Default Value
7	Startup time setting Bit1	RW	0
6	Startup time setting Bit0	RW	1
5	Long-press time setting Bit1	RW	0
4	Long-press time setting Bit0	RW	1
3	Automatic shutdown setting when the key press-time exceeds the shutdown time 0: disable ; 1: enable	RW	1
2	Automatic restart after automatic shutdown when the key press-time exceeds the shutdown time 0: disable ; 1: enable	RW	0
1	Shutdown time setting Bit1	RW	0
0	Shutdown time setting Bit0	RW	1

**10.2.31. REG 37H:DCDC Working Frequency Setting**

Default Value :08H

Bit	Description	R/W	Default Value
7	DCDC and PWM Charger Spread Spectrum function setting 0: disable 1:enable		0
6	DCDC and PWM Charger Spread Spectrum Frequency setting 0: 50KHZ 1:100KHZ		0
5	Reserved and unchangeable		0
4	DCDC 2&2 Poly-Phase function setting 0:disable 1:enable		0
3	DCDC enable/disable frequency setting Bit 3	RW	1
2	DCDC enable/disable frequency setting Bit 2	RW	0
1	DCDC enable/disable frequency setting Bit 1	RW	0
0	DCDC enable/disable frequency setting Bit 0	RW	0

Each level changes by 5%, Default Value1.3MHz

**10.2.32. REG 38H:VLTF-charge Battery Charge Under-temperature Threshold Setting**

Default Value:A5H

Bit	Description	R/W	Default Value
7-0	Battery Under-temperature threshold setting when the battery is charging , M	RW	A5H

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

**10.2.33. REG 39H:VHTF-charge Battery Charge Over-Temperature Threshold Setting**

Default Value :1FH

Bit	Description	R/W	Default Value
7-0	The battery Over-temperature threshold setting when the battery is charging , N	RW	1FH

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

**10.2.34. REG 3CH:VLTF-discharge Battery Discharging Under-Temperature**

**Threshold Setting**

Default Value :FCH

Bit	Description		R/W	Default Value
7-0	The battery Over-temperature threshold setting when the battery is discharging , M	M*10H, when M=FC, corresponding voltage is 3.226V ; corresponding voltage ranges from 0V~3.264V	RW	FCH

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

**10.2.35. REG 3DH:VHTF-discharge Battery Discharging Over-Temperature**

**Threshold Setting**

Default Value :16H

Bit	Description		R/W	Default Value
7-0	The battery Over-temperature threshold setting when the battery is discharging , , N	N*10H, when N=16H, corresponding voltage is 0.282V ; corresponding voltage ranges from 0V~3.264V	RW	16H

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

**10.2.36. REG 80H:DCDC Working Mode Selection**

Default Value :80H

Bit	Description		R/W	Default Value
7-5	Reserved and unchangeable			
4	DCDC4 work mode control	0:PFM/PWM automatic switching 1: fixed PWM	RW	0
3	DCDC3work mode control		RW	0
2	DCDC2 work mode control		RW	0
1	DCDC1 work mode control		RW	0
0	DCDC0 work mode control		RW	0

### 10.2.37. REG 82H:ADC Enable

Default Value :E0H

Bit	Description		R/W	Default Value
7	Battery voltage ADC enable	0: disable, 1: enable	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 function enable	0: disable, 1: enable	RW	0

### 10.2.38. REG 84H:ADC Sample Rate Setting and TS Pin Control

Default Value :32H

Bit	Description		R/W	Default Value
7	ADC sample rate setting Bit 1	10×2 <sup>n</sup> sample rate is 100 , 200 , 400 , 800Hz	RW	0
6	ADC sample rate setting Bit 0		RW	0
5-4	TS pin output current setting: 00:20uA ; 01:40uA ; 10:60uA ; 11:80uA		RW	11
3	Reserved and unchangeable			
2	TS pin function selection 0: battery temperature monitoring function, 1: external independent ADC		RW	0
1-0	TS pin current output method setting	00: disable 01: current output when charging 10: input when the ADC is sampling, reducing the power consumption 11: always enable	RW	1
			RW	0

## 10.2.39. REG 85H:TS ADC Sample Rate Setting

Default Value :00H

Bit	Description		R/W	Default Value
7	TS ADC sample rate setting 1	10×2 <sup>n</sup> sample rate is 100 , 200 , 400 , 800Hz	RW	0
6	TS ADC sample rate setting 0		RW	0
5-0	Reserved and unchangeable			

## 10.2.40. REG 8AH: Timer Control

Default Value :00H

Bit	Description	R/W	Default Value
7	The timer is timeout Write "1" to clear the status.	RW	0
6-0	Set the time , unit: minute Write full 0 to shutdown the timer.	RW	0000000

## 10.2.41. REG 8CH:PWREN Control Setting 1

Default Value :00H

Bit	Description	R/W	Default Value	
7	DCDC1 Whether control by PWREN	0:NO 1:Yes	RW	0
6	DCDC2 Whether control by PWREN		RW	0
5	DCDC3 Whether control by PWREN		RW	0
4	DCDC4 Whether control by PWREN		RW	0
3	DCDC5 Whether control by PWREN		RW	0
2	ALDO1 Whether control by PWREN		RW	0
1	ALDO2 Whether control by PWREN		RW	0
0	ALDO3 Whether control by PWREN		RW	0

### 10.2.42. REG 8DH:PWREN Control Setting 2

Default Value :00H

Bit	Description	R/W	Default Value
7	DLOD1 Whether control by PWREN	RW	0
6	DLOD2 Whether control by PWREN	RW	0
5	DLOD3 Whether control by PWREN	RW	0
4	DLOD4 Whether control by PWREN	RW	0
3	ELOD1 Whether control by PWREN	RW	0
2	ELDO2 Whether control by PWREN	RW	0
1	ELDO3 Whether control by PWREN	RW	0
0	DC5LDO Whether control by PWREN	RW	0

0:NO 1:Yes

## 10.2.43. REG 8FH: Function Setting, Over-temperature Shutdown, etc.

Default Value :01H

Bit	Description	R/W	Default Value
7	IRQ PIN Trigger boot or wake-up settings 0:disable 1:enable	RW	0
6	ACIN/VBUS In-shot Function Setting 0:Automatic detection 1:control by REG8F_[5]	RW	0
5	ACIN/VBUS set by In-short 0:on Not In-short status 1: on In-short status	RW	0
4	N_VBUSEN PIN Function Control 0:output PIN,be DRIVEBUS function( output to drive external OTG boost module) 1:input PIN,be N_VBUSEN function(input control VBUS path)	RW	0
3	Reset IC when press Longtime key 16seconds  0:No Reset 1:Reset	RW	0
2	AXP223 internal over-temperature shutdown setting 0: not shutdown ; 1: shutdown	RW	0
1-0	Reserved and unchangeable	RW	01

#### 10.2.44. REG 90H:GPIO0 Function setting

Default Value :07H

Bit	Description		R/W	Default Value
7	GPIO0 be input function ,rising edge IRQ or Wakeup function 0 : disable 1 : enable		RW	0
6	GPIO0 be input function ,falling edge IRQ or Wakeup function 0 : disable 1 : enable		RW	0
5-3	Reserved and unchangeable			
2	GPIO0 pin function setting Bit 2	000: output low 001: output high	RW	1
1	GPIO0 pin function setting Bit 1	010: general input function 011: enable low noise LDO	RW	1
0	GPIO0 pin function setting Bit 0	100: disable low noise LDO 101-111:floating	RW	1

#### 10.2.45. REG 91H:GPIO0 be LDO Mode and Output High Level Setting

Default Value :1FH

Bit	Description		R/W	Default Value
7-5	Reserved and unchangeable			
4	GPIO0 LDO output voltage setting Bit4	0.7-3.3V,100mV/step	RW	1
3	GPIO0 LDO output voltage setting Bit3		RW	1
2	GPIO0 LDO output voltage setting Bit2		RW	1
1	GPIO0 LDO output voltage setting Bit1		RW	1
0	GPIO0 LDO output voltage setting Bit0		RW	1



**10.2.46. REG 92H:GPIO1 Function Setting**

Default Value :07H

Bit	Description		R/W	Default Value
7	GPIO0 be input function ,rising edge IRQ or Wakeup function 0 : disable 1 : enable		RW	0
6	GPIO0 be input function ,falling edge IRQ or Wakeup function 0 : disable 1 : enable		RW	0
5-3	Reserved and unchangeable			
2	GPIO0 pin function setting Bit 2	000: output low 001: output high 010: general input function 011: enable low noise LDO 100: disable low noise LDO 101-111:floating	RW	1
1	GPIO0 pin function setting Bit 1		RW	1
0	GPIO0 pin function setting Bit 0		RW	1

**10.2.47. REG 93H:GPIO1 be LDO Mode and Output High Level Setting**

Default Value:1FH

Bit	Description		R/W	Default Value
7-5	output voltage setting			
4	GPIO1 LDO output voltage setting Bit4	0.7-3.3V,100mV/step	RW	1
3	GPIO1 LDO output voltage setting Bit3		RW	1
2	GPIO1 LDO output voltage setting Bit2		RW	1
1	GPIO1 LDO output voltage setting Bit1		RW	1
0	GPIO1 LDO output voltage setting Bit0		RW	1

**10.2.48. REG 94H:GPIO[1:0] In put Signal Status Monitoring**

Default Value :00H

Bit	Description		R/W	Default Value
7-2				
1	GPIO1 input status	0: input low level 1: input high level	R	0
0	GPIO0 input status		R	0

**10.2.49. REG 97H:GPIO[1:0] Pull-down setting for input**

Default Value :00H

Bit	Description	R/W	Default Value
7-2	Reserved and unchangeable		
1	GPIO1 Pull-down resistor control	RW	0
0	GPIO0 Pull-down resistor control		

**10.2.50. REG 40H:IRQ Enable 1**

Default Value :D8H

Bit	Description	R/W	Default Value
7	ACIN over-voltage, IRQ enable	RW	1
6	ACIN connected, IRQ enable	RW	1
5	ACIN removed, IRQ enable	RW	0
4	VBUS over-voltage, IRQ enable	RW	1
3	VBUS connected, IRQ enable	RW	1
2	VBUS removed, IRQ enable	RW	0
1	VBUS is available, but lower than $V_{\text{HOLD}}$ IRQ enable	RW	0
0	Reserved and unchangeable	RW	0

**10.2.51. REG 41H:IRQ Enable 2**

Default Value :FFH

Bit	Description	R/W	Default Value
7	Battery connected, IRQ enable	RW	1
6	Battery removed, IRQ enable	RW	1
5	Battery activate mode, IRQ enable	RW	1
4	Exit battery activate mode, IRQ enable	RW	1
3	Be charging, IRQ enable	RW	1
2	Charge finished, IRQ enable	RW	1
1	Battery over-temperature, IRQ enable	RW	1
0	Battery low-temperature, IRQ enable	RW	1

**10.2.52. REG 42H:IRQ Enable 3**

Default Value :03H

Bit	Description	R/W	Default Value
7	AXP223 internal over-temperature, IRQ enable	RW	0
6-2	Reserved and unchangeable		
1	PEK short press, IRQ enable	RW	1
0	PEK long press, IRQ enable	RW	1

**10.2.53. REG 43H:IRQ Enable 4**

Default Value :03H

Bit	Description	R/W	Default Value
7-2	Reserved and unchangeable		
1	Battery level reaches the alarm threshold 1 IRQ enable ( tips )	RW	1
0	Battery level reaches the alarm threshold 2 IRQ enable ( shut down )	RW	1

**10.2.54. REG 44H:IRQ Enable 5**

Default Value :00H

Bit	Description	R/W	Default Value
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 input edge trigger, IRQ enable	RW	0
0	GPIO0 input edge trigger, IRQ enable	RW	0

**10.2.55. REG 48H:IRQ Status 1**

Bit	Description	R/W	Default Value
7	ACIN over-voltage IRQ status	RW	0
6	ACIN connected IRQ status	RW	0
5	ACIN removed IRQ status	RW	0
4	VBUS over-voltage IRQ status	RW	0
3	VBUS connected IRQ status	RW	0
2	VBUS removed IRQ status	RW	0
1	VBUS is available, but lower than $V_{HOLD}$ IRQ status	RW	0
0	Reserved and unchangeable	RW	0

**10.2.56. REG 49H:IRQ Status 2**

Bit	Description	R/W	Default Value
7	Battery connected IRQ status	RW	0
6	Battery removed IRQ status	RW	0
5	Battery activate mode IRQ status	RW	0
4	Exit battery activate mode IRQ status	RW	0
3	Be charging IRQ status	RW	0
2	Charge finished IRQ status	RW	0
1	Battery over-temperature IRQ status	RW	0
0	Battery low-temperature IRQ status	RW	0

**10.2.57. REG 4AH:IRQ Status3**

Bit	Description	R/W	Default Value
7	AXP223 internal over-temperature IRQ status	RW	0
6-2	Reserved and unchangeable		
1	PEK short press IRQ status	RW	0
0	PEK long press, IRQ status	RW	0

**10.2.58. REG 4BH:IRQ Status 4**

Bit	Description	R/W	Default Value
7-2	Reserved and unchangeable		
1	Battery level reaches the alarm threshold IRQ 1 status	RW	0
0	Battery level reaches the alarm threshold IRQ 2 status	RW	0

**10.2.59. REG 4CH:IRQ Status 5**

Bit	Description	R/W	Default Value
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 input edge trigger IRQ status	RW	0
0	GPIO0 input edge trigger IRQ status	RW	0

Note: Writing 1 to all IRQ status register bits will clear corresponding status.

**10.2.60. REG B8H: Fuel Gauge Control**

Default Value C0H

Bit	Description	R/W	Default Value
7	Fuel gauge enable 0:disable 1:enable	RW	1
6	Coulomb Counter enable 0:disable 1:enable	RW	1
5	Total capacity of battery calibration function enable 0:disable 1:enable	RW	0
4	Total capacity of battery calibration function status 0:calibration 1: No calibration	RW	0
3-0	Reserved and unchangeable	RW	0

10.2.61. REG B9H: Indicate Battery level

Default Value 64H

Bit	Description	R/W	Default Value	
7	battery is calculated correctly 0 : No 1 : Yes	R	0	
6-0	Indicate Battery level	0%~100%	R	64

10.2.62. REG E0H: Battery capacity setting 1

Default Value 00H

Bit	Description	R/W	Default Value	
7	battery capacity is configured 0 : No 1 : Yes	RW	0	
6-0	battery capacity setting bit[14:8]	0%~100%	RW	0

Note : battery capacity = Value \* 1.456mAh

### 10.2.63. REG E1H: Battery capacity setting 2

Default Value : 00H

Bit	Description	R/W	Default Value
7-0	battery capacity setting bit[7:0]	RW	0

### 10.2.64. REG E6H: Low battery power alarm threshold settings

Bit	Description	R/W	Default Value
7-4	Low battery power alarm threshold settings 1 0000-1111 : 5%-20%	RW	1010
3-0	Low battery power alarm threshold settings 2 0000-1111 : 5%-15%	RW	0000

Default Value:A0H

### 10.2.65. REG E8H: Interval update time for Fuel Gauge percentage Setting

Default Value:00H

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

**10.2.66. REG E9H: Fuel Gauge calibration interval setting**

Default Value : 00H

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

**10.2.67. REG ECH: Coulomb counter percentage of electricity calibration points setting**

Default Value : 00H

Bit	Description	R/W	Default Value
7:3	Reserved and unchangeable		
2	When OCV power percentage is less than or equal following settings Begin calibration fuel gauge	RW	0
1	000-REG_E6_[3:0] +5 ; 001-REG_E6_[3:0] +6 ; 010-REG_E6_[3:0] +7 ; 011-REG_E6_[3:0] +8 ;	RW	0
0	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

# Package

