

DATASHEET

# AXP192

Enhanced single Cell Li-Battery and Power System Management IC

**X-Powers**

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### 1. Summary (Summary)

AXP192 It is a highly integrated power system management chip for single-cell lithium batteries (lithium ion or lithium polymer) and requires multiple power conversion. The output application provides a simple and easy-to-use complete power solution that can be flexibly configured to fully meet the current increasingly complex application processing. The power supply system requires relatively complex and precise control of the power supply.

AXP192 Internally integrated an adaptive USB-Compatible Charger, 3 Buck converter ( Buck DC-DC converter) , 4 Linear regulator ( LDO) , Voltage/current/temperature monitoring and other multiple channels 12-Bit ADC . To ensure the safety and stability of the power supply system, AXP192 Also integrated over/under voltage ( OVP/UVP) , Overtemperature ( OTP) , Overcurrent ( OCP) And other protection circuits.

AXP192 Of smart power balance ( Intelligent Power Select, IPS™) The circuit can be in USB And external AC adapter, lithium battery. Safe and transparent distribution of electric energy between the battery and the application system load, and when there is only an external input power supply and no battery (or battery over-discharge). The application system can also work normally under the circumstances.

AXP192 Has an external adapter and USB And three input capabilities such as battery, support rechargeable backup battery.

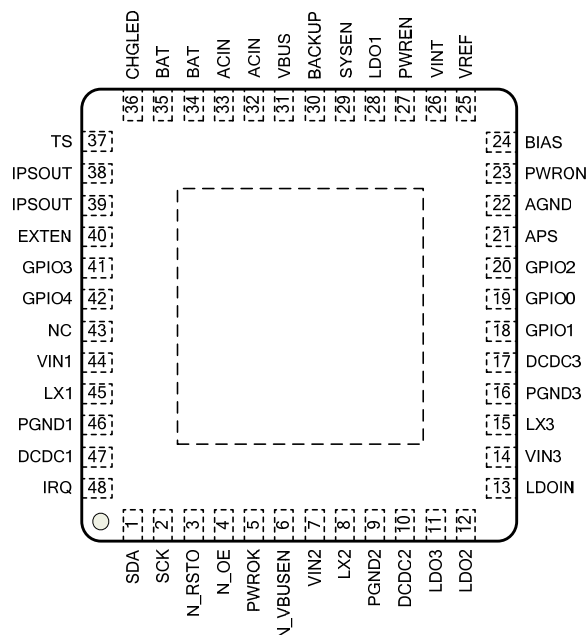
AXP192 Provides a two-wire serial communication interface to communicate with the host: Two Wire Serial Interface (TWSI) , The application processor can. This interface can be used to turn on or turn off certain power outputs, set their voltages, access internal registers and various measurement data (including Fuel Gauge) . High precision ( 0.5% ) Power measurement data to facilitate consumers to grasp the status of power. Unprecedented equipment power usage experience.

AXP192 provide 6mm x 6mm 48-pin QFN Package.

### Application products

- Handheld mobile device
- Smart mobile phone, PMP/MP4, number
- Code camera, digital video camera, handheld guide
- Aviation equipment GPS, PDA, Hand-held numbers
- Broadcast television receiver
- Mobile internet device MID
- Digital photo frame, portable DVD player,
- Ultra-portable mobile computer UMPC and
- UMPC-like ,leaning machine
- Application processor circuit system
- Application Processor systems
- Other battery and multi-power application systems

### Pin definition



## 2. Feature

- **Power management ( IPS )**
  - o Wide input voltage range:  
2.9V~6.3V (AMR :- 0.3V~11V)
  - o Configurable and efficient smart power balance "IPS™" system
  - o Adaptive USB Or AC adapter voltage limit and current limit  
(4.4V/500mA/100mA)
  - o The equivalent internal resistance of the internal ideal diode is less than 100mΩ
- **Fully integrated charger ( Charger )**
  - o Built-in MOSFET The maximum charging current can reach 1.4A
  - o Support battery temperature monitoring
  - o Full support USB Charging, meet the specification
  - o The charging accuracy is high, the error is less than 0.5%
  - o stand by 4.1V/4.15V/4.2V/4.36V And other batteries
  - o Automatic charging process control
  - o Can be driven directly led Indicate charging status
  - o Automatically adjust the charging current according to the system load
- **spare battery ( Backup Battery )**
  - o Can use spare battery to RTC Module power supply
  - o Support backup battery charging, charging current can be set
- **3 Synchronous buck converter ( DC-DC )**
  - o DC-DC1 : Available at 0.7V~3.5V Adjust between,  
25mV/step, Drive capability 1.2A
  - o DC-DC2 : Available at 0.7-2.275V Adjust between,  
25mV/step, Drive capability 1.6A, stand by VRC
  - o DC-DC3 : Available at 0.7-3.5V Adjust between,  
25mV/step, Drive capability 0.7A
- **4 Linear regulator ( LDO )**
  - o LDO1 : 30mA , Always valid
  - o LDO2 : Low noise LDO , 1.8V~3.3V adjustable,  
100mV/step, Drive capability 200mA
  - o LDO3 : Low noise LDO, 1.8-3.3V adjustable,  
100mV/step, Drive capability 200mA
  - o LDO<sub>100</sub> : Low noise LDO, 1.8-3.3V adjustable,  
100mV/step, Drive capability 50mA

Note: VRC , Voltage Ramp Control , Voltage ramp  
Rate control.
- **Signal acquisition system ( Signal Capture )**
  - o Built-in 16 road 12 Bit ADC
  - o accept 4 External signal input
  - o Provide battery and external input power supply current and voltage  
according to
  - o Built-in high-precision coulomb counting Fuelgauge system
  - o Provide rich power management information, such as instantaneous power consumption  
(mA or mW) , Remaining battery power (% or mAh) ,  
Charge status (%) and remaining battery time or charge  
Electricity time etc.
  - o Low battery warning and protection
  - o Provide chip temperature information
- **Application processor interface ( Host Interface )**
  - o Host able to pass TWSI Interface for data exchange
  - o Configurable interrupt management
  - o Flexible pin function setting, multiple channels GPIO Separable  
Set as IO , PWM Other functions
  - o Built-in timer
  - o Provides four sets of registers, which can be used for system shutdown  
Data preservation
- **System Management( SystemManagement )**
  - o Can be soft reset or hard reset
  - o Support soft shutdown or hard shutdown, support external wake-up  
machine
  - o Support output voltage monitoring, self-diagnosis function
  - o PWROK Used for system reset or shutdown indication
  - o External power detection (insertion/removal/ insufficient drive capability)
  - o All output voltages support soft start
  - o Over/under voltage protection ( OVP/UVP)
  - o Overcurrent protection ( OCP)
  - o Over temperature protection ( OTP)
  - o stand by OTG VBUS Power status setting/monitoring
- **High integration ( Fully Integration )**
  - o Internally generated high-precision reference voltage ( 0.5% )
  - o Built-in MOSFET
  - o Customizable timing and output voltage



## 4. Absolute Maximum Ratings

Symbol	Description	Value	Units
ACIN	Input Voltage Input voltage	-0.3 to 11	V
VBUS	Input Voltage Input voltage	-0.3 to 11	V
T <sub>J</sub>	Operating Temperature Range Operating temperature	-40 to 130	°C
T <sub>s</sub>	Storage Temperature Range Storage and transportation temperature	-40 to 150	°C
T <sub>LEAD</sub>	Maximum Soldering Temperature (at leads , 10sec) Soldering temperature	300	°C
V <sub>ESD</sub>	Maximum ESD stress voltage , Human Body Model Antistatic ability	> 4000	V
P <sub>D</sub>	Internal Power Dissipation Internal power consumption tolerance	2100	mW

## 5. Electrical Characteristics (Electrical Characteristics)

V<sub>IN</sub> = 5V , BAT=3.8V , T<sub>A</sub>= 25°C

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
<b>ACIN</b>						
V <sub>IN</sub>	ACIN Input Voltage		3.8		6.3	V
I <sub>OUT</sub>	V <sub>OUT</sub> Current Available Before Loading BAT	500mV Voltage Drop		2000		mA
V <sub>UVLO</sub>	ACIN Under Voltage Lockout IPS			3.8		V
V <sub>OUT</sub>	Output Voltage		2.9		5.0	V
R <sub>ACIN</sub>	Internal Ideal Diode On PIN to PIN, ACIN to Resistance	IPSOULT			200	mΩ
<b>VBUS</b>						
V <sub>IN</sub>	VBUS Input Voltage		3.8		6.3	V
I <sub>OUT</sub>	V <sub>OUT</sub> Current Available Before Loading BAT	400mV Voltage Drop		500	900	mA
V <sub>UVLO</sub>	VBUS Under Voltage Lockout IPS			3.8		V
V <sub>OUT</sub>	Output Voltage		2.9		5.0	V
R <sub>VBUS</sub>	Internal Ideal Diode On PIN to PIN, VBUS to Resistance	IPSOULT			300	mΩ
<b>Battery Charger</b>						
V <sub>TRGT</sub>	BAT Charge Target Voltage Charge		<u>-0.5%</u>	4.2	<u>+0.5%</u>	V
I <sub>CHRG</sub>	Current			780	<u>1320</u>	mA
I <sub>TRKL</sub>	Trickle Charge Current			<u>10%</u>		I <sub>CHRG</sub>

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								mA
V <sub>TRKL</sub>	Trickle Charge Threshold Voltage				3.0			V
ΔV <sub>RECHG</sub>	Recharge Battery Threshold Voltage	Threshold Voltage Relative to V <sub>TARGET</sub>			-100			mV
T <sub>TIMER1</sub>	Charger Safety Timer Termination Time	Trickle Mode			40			Min
T <sub>TIMER2</sub>	Charger Safety Timer Termination Time	CC Mode			480			Min
I <sub>END</sub>	End of Charge Indication Current Ratio	CV Mode			10%	15%		I <sub>CHRG</sub> mA
<b>Backup Battery</b>								
V <sub>TRGT</sub>	Backup Battery Charge Target Voltage				2.5	3.0	3.1	V
I <sub>CHRG</sub>	Backup Battery Charge Current				50	200	400	uA
I <sub>Backup</sub>	when use Backup Battery					10	15	uA
<b>NTC</b>								
V <sub>TL</sub>	Cold Temperature Fault Charge Threshold Voltage	Charge		0	<u>2.112</u>		3.264	V
		Discharge			<u>3.226</u>			
V <sub>TH</sub>	Hot Temperature Fault Charge Voltage	Charge		0	<u>0.397</u>		3.264	V
		Discharge			<u>0.282</u>			
V <sub>TE</sub>	NTC Disable Threshold Voltage		Falling Threshold Hysteresis		0.2			V
<b>Ideal Diode</b>								
R <sub>ds(on)</sub>	Internal Ideal Diode On Resistance(BAT to IPSOUT)						100	mΩ

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Off Mode Current</b>						
I <sub>BATOFF</sub>	OFF Mode Current	BAT=3.8V		27		μA
I <sub>SUSPEND</sub>	USB VBUS suspend Mode current	BAT=3.8V , VBUS=5V , N_VBUSEN=1		86		μA
<b>Logic</b>						
V <sub>IL</sub>	Logic Low Input Voltage	Logic		0.3		V
V <sub>IH</sub>	High Input Voltage			2		V
<b>TWSI</b>						
V <sub>CC</sub>	Input Supply Voltage			3.3		V
ADDRESS	TWSI Address			0x68		
f <sub>SCK</sub>	Clock Operating Frequency			400	1200	KHZ

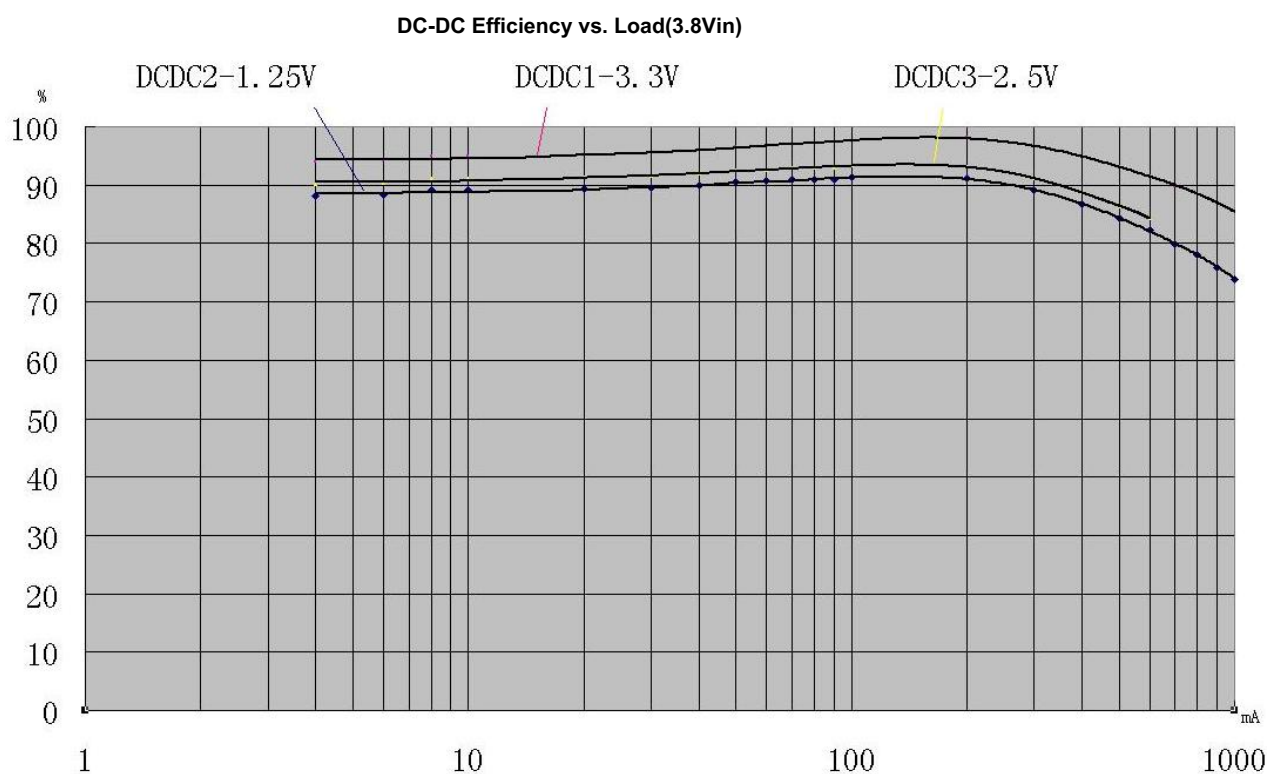
t <sub>f</sub>	Clock Data Fall Time Clock	2.2Kohm Pull High		60		ns
t <sub>r</sub>	Data Rise Time	2.2Kohm Pull High		100		ns
<b>DCDC</b>						
f <sub>osc</sub>	Oscillator Frequency	Default		1.5		MHz
<b>DCDC1</b>						
I <sub>VIN1</sub>	Input Current	PFMMode I <sub>DC1OUT</sub> = 0		26		μA
I <sub>LIM1</sub>	PMOS Switch Current Limit	PWMMode		1600		mA
I <sub>DC1OUT</sub>	Available Output Current	PWMMode		1200		mA
V <sub>DC1OUT</sub>	Output Voltage	Default	0.7	3.3	3.5	V
<b>DCDC2</b>						
I <sub>VIN2</sub>	Input Current	PFMMode I <sub>DC2OUT</sub> = 0		20		μA
I <sub>LIM2</sub>	PMOS Switch Current Limit	PWMMode		2300		mA
I <sub>DC2OUT</sub>	Available Output Current	PWMMode		1600		mA
V <sub>DC2OUT</sub>	Output Voltage Range		0.7	1.25	2.275	V
<b>DCDC3</b>						
I <sub>VIN3</sub>	Input Current	PFMMode I <sub>DC3OUT</sub> = 0		20		μA
I <sub>LIM3</sub>	PMOS Switch Current Limit	PWMMode		1000		mA
I <sub>DC3OUT</sub>	Available Output Current	PWMMode		700		mA
V <sub>DC3OUT</sub>	Output Voltage Range		0.7	2.5	3.5	V

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
<b>LDO1</b>						
V <sub>LDO1</sub>	Output Voltage	I <sub>LDO1</sub> = 1mA	- 1%	1.25 1.8 2.5 3.3	1%	V
I <sub>LDO1</sub>	Output Current			30		mA
<b>LDO2</b>						
V <sub>LDO2</sub>	Output Voltage	I <sub>LDO2</sub> = 1mA	- 1%	3	1%	V
I <sub>LDO2</sub>	Output Current			200		mA
I <sub>Q</sub>	Quiescent Current			100		μA
PSRR	Power Supply Rejection Ratio Output	I <sub>LDO2</sub> = 60mA , 1KHz		TBD		dB
e <sub>N</sub>	Noise, 20-80KHz	V <sub>o</sub> =3V, I <sub>o</sub> =150mA		28		μV <sub>RMS</sub>
<b>LDO3</b>						
V <sub>LDO3</sub>	Output Voltage	I <sub>LDO3</sub> = 1mA	- 1%	3.3	1%	V
I <sub>LDO3</sub>	Output Current			200		mA
I <sub>Q</sub>	Quiescent Current			100		μA
PSRR	Power Supply Rejection Ratio	I <sub>LDO3</sub> = 10mA , 1KHz		TBD		dB



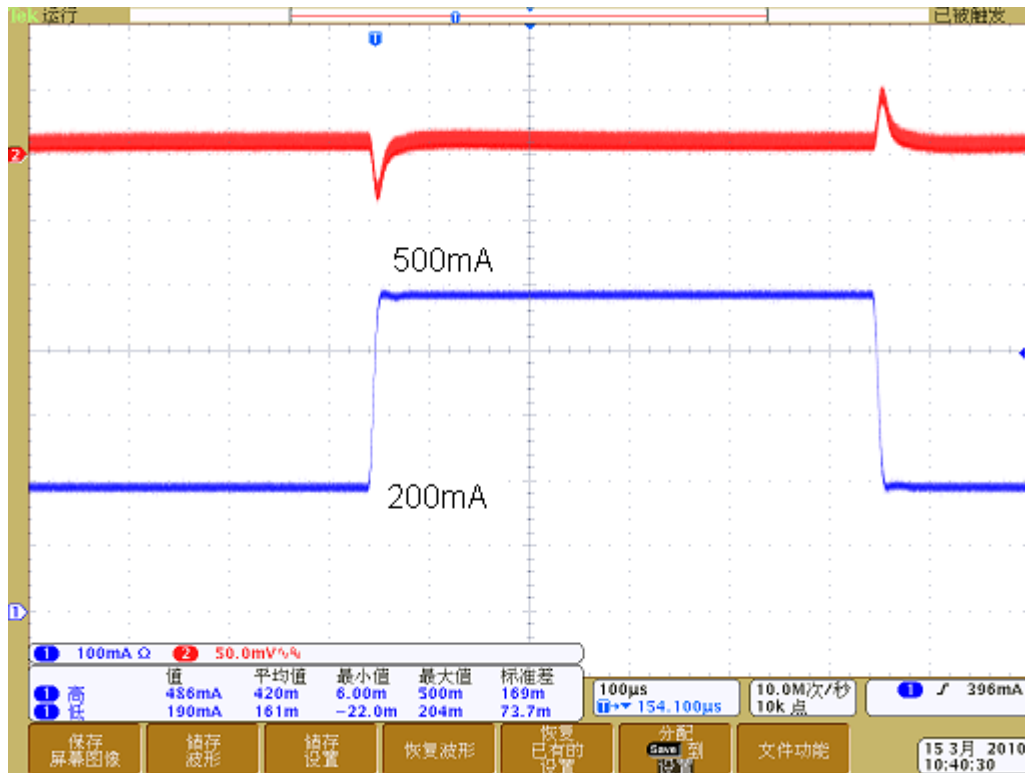
e <sub>N</sub>	Output Noise,20-80KHz	V <sub>o</sub> =1.8V, I <sub>o</sub> =150mA		18		μV <sub>RMS</sub>
<b>LDO<sub>IO0</sub></b>						
V <sub>LDOIO0</sub>	Output Voltage	I <sub>LDOIO0</sub> = 1mA	- 1%	3.3	1%	V
I <sub>LDOIO0</sub>	Output Current			50		mA
I <sub>Q</sub>	Quiescent Current			90		μA
PSRR	Power Supply Rejection Ratio Output	I <sub>LDOIO0</sub> = 10mA , 1KHz		TBD		dB
e <sub>N</sub>	Noise, 20-80KHz	V <sub>o</sub> =1.8V, I <sub>o</sub> =30mA		18		μV <sub>RMS</sub>

## 6. Typical Characteristics

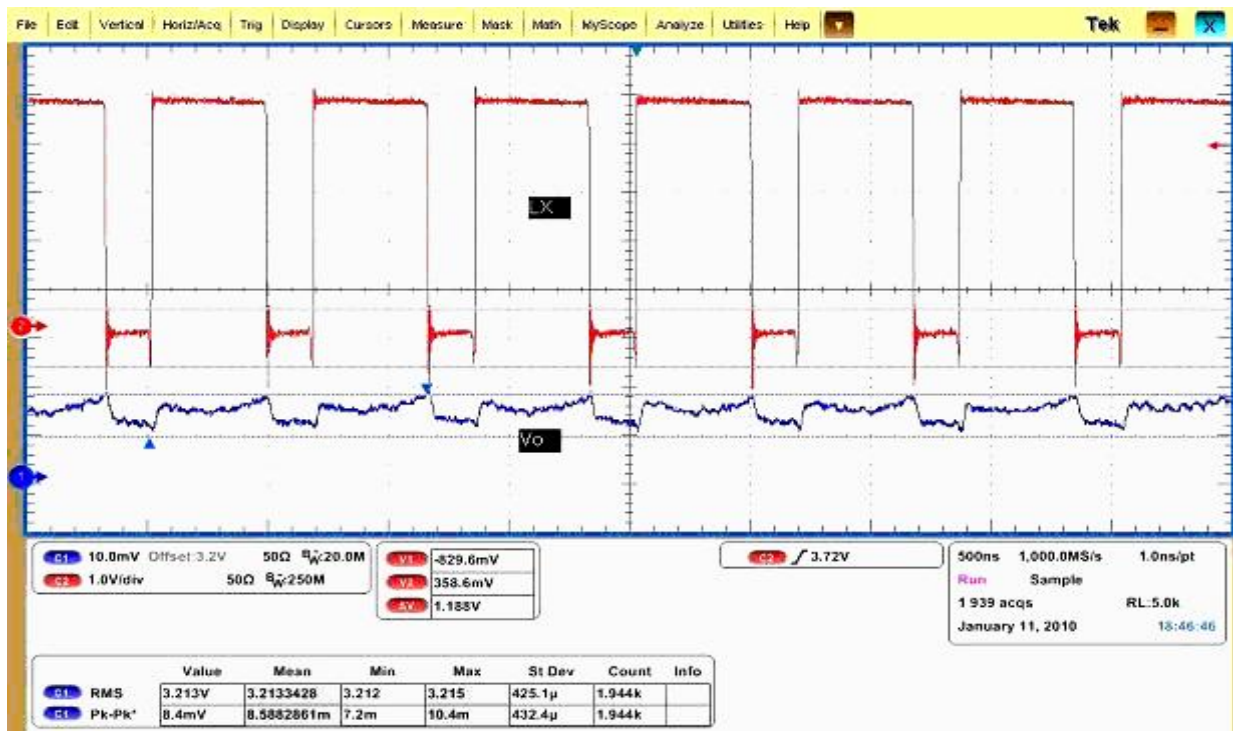


**DC-DC Load Transient(Typical)**

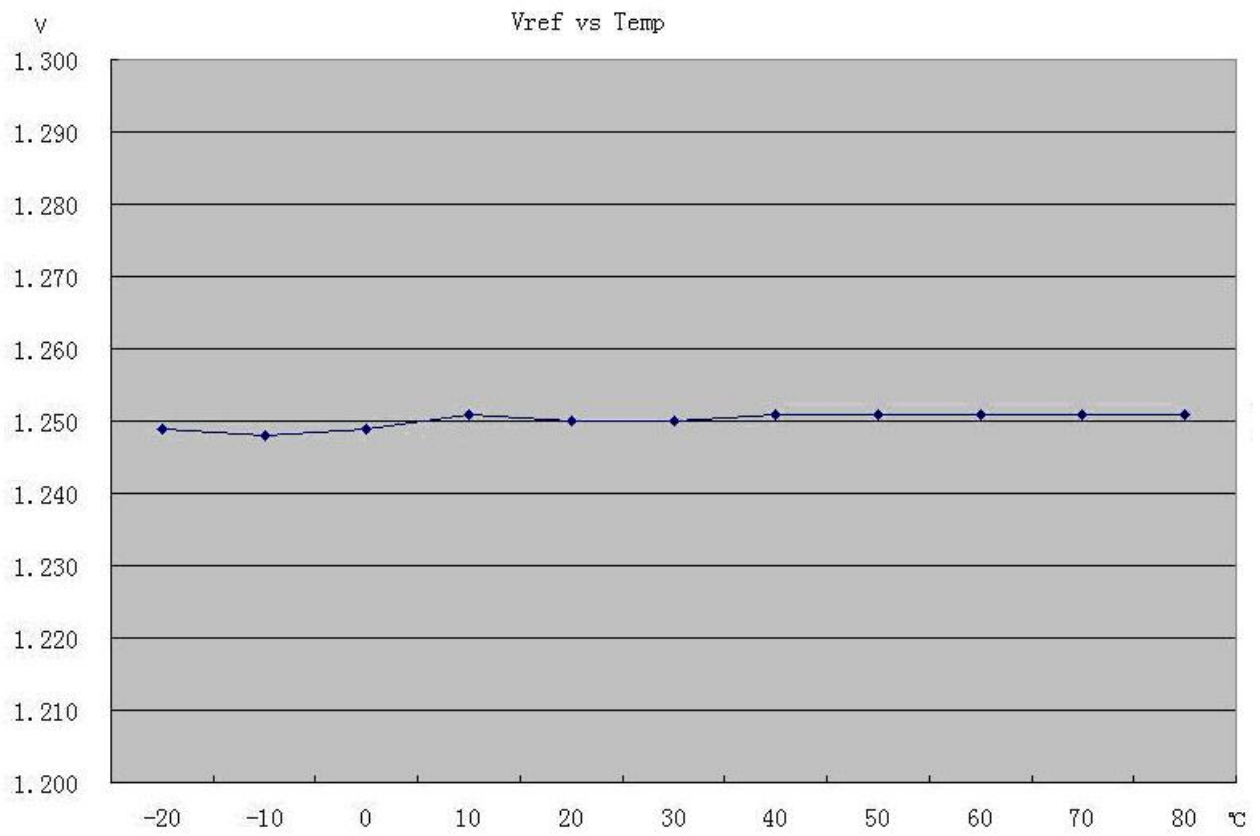
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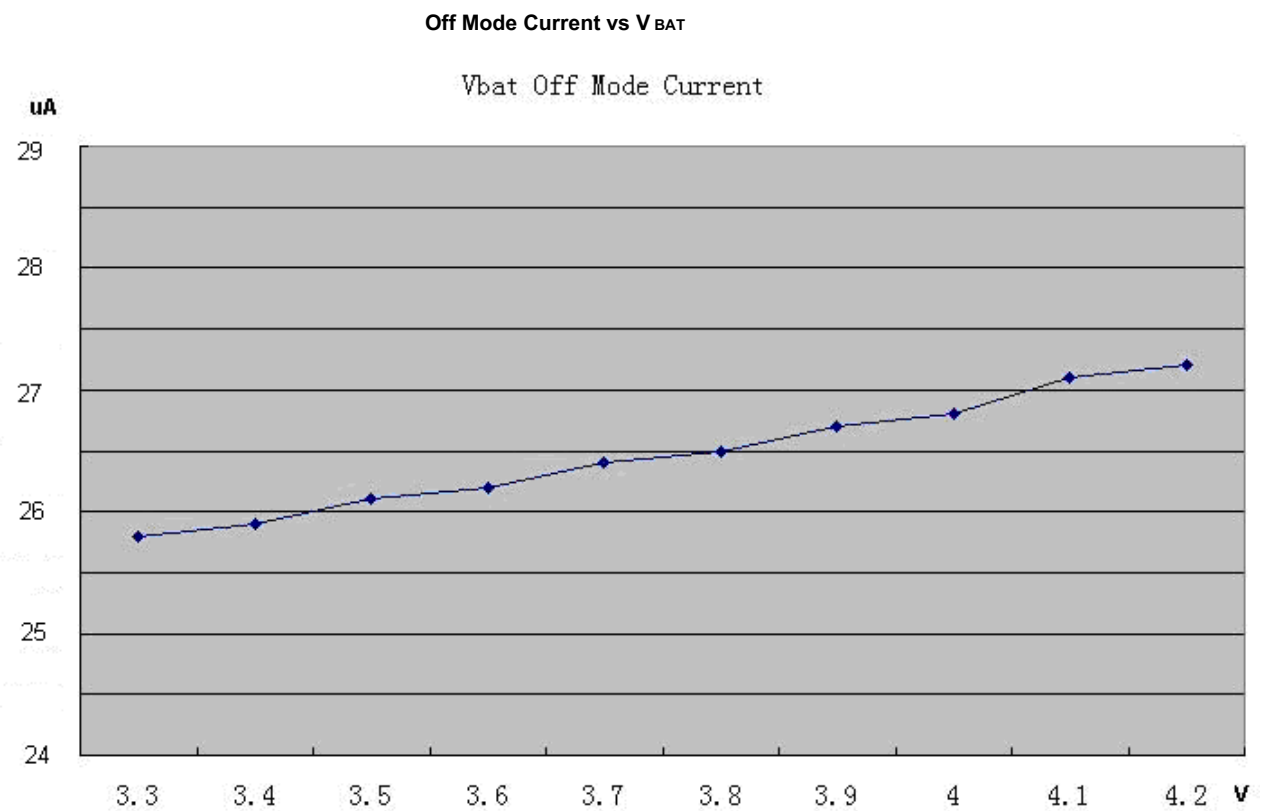
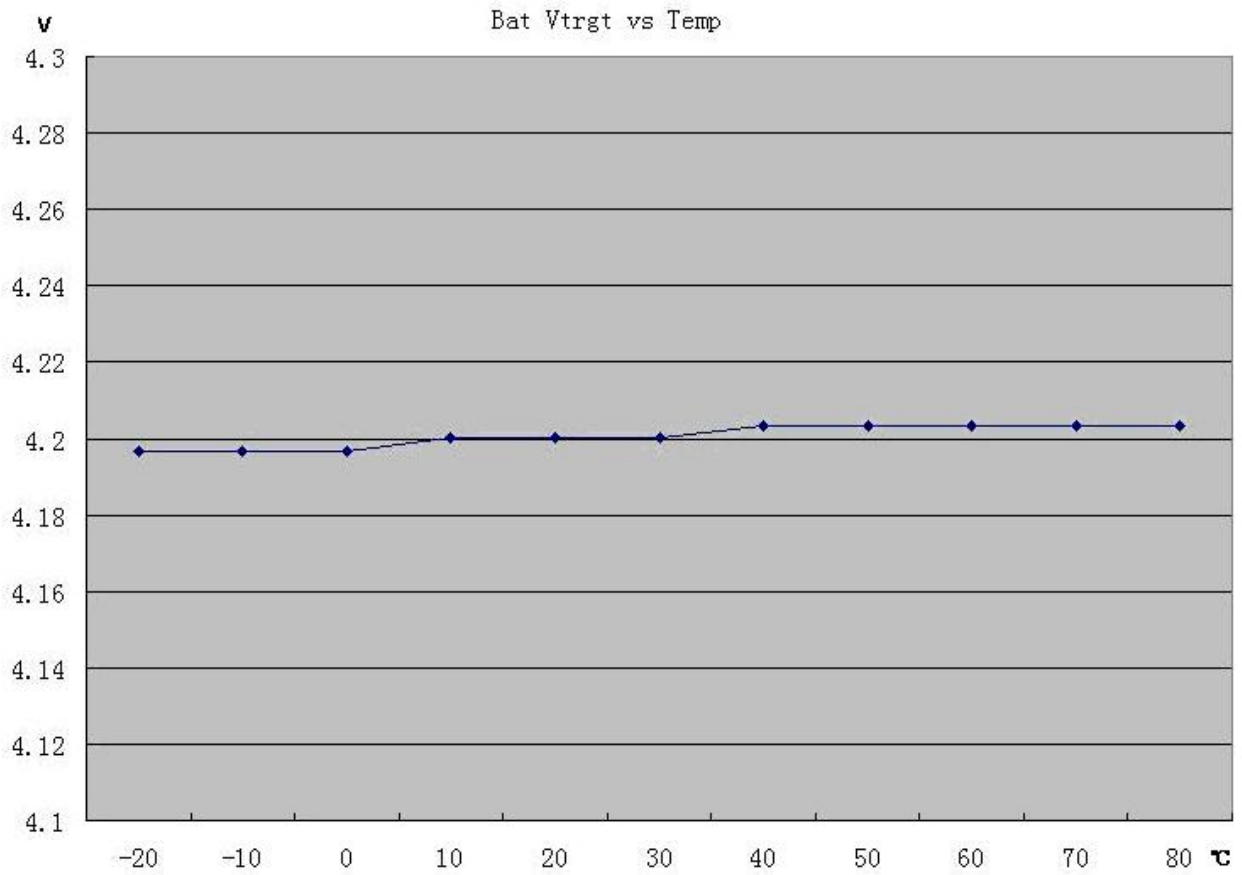
## DC-DC Ripple



## V<sub>REF</sub> vs Temperature



V TRGT vs Temperature



## 7. Pin Description

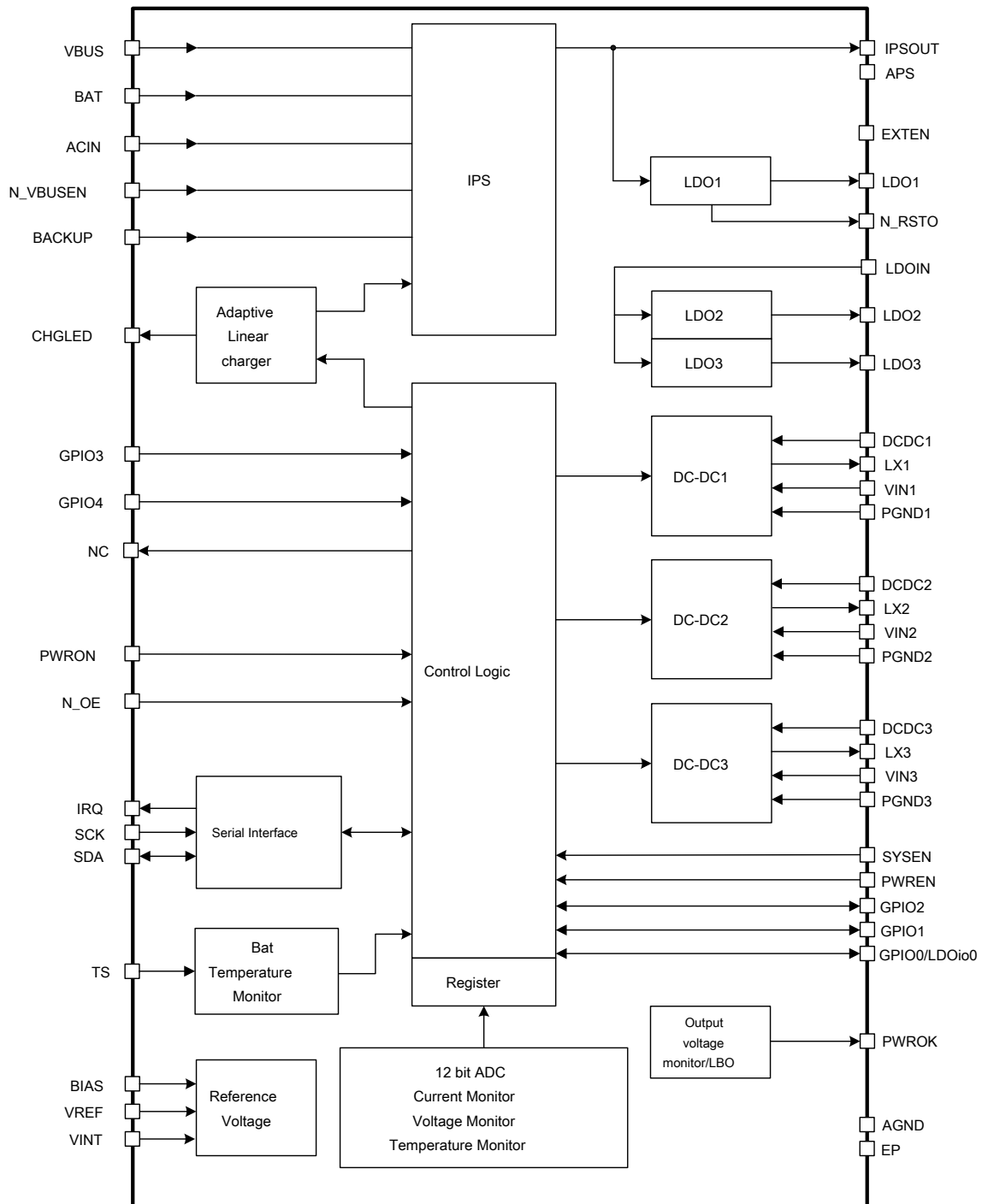
<u>Num</u>	<u>Name</u>	<u>Type</u>	<u>Condition</u>	<u>Function Description</u>
1	SDA	IO		Data pin for serial interface, normally it connect a 2.2K resistor to 3.3V/I/O power
2	SCK	I		it is the Clock pin for serial interface, normally it connect a 2.2K resistor to 3.3V/I/O power LDO1
3	N_RSTO	IO	REG9EH[7]	Reset output
				GPIO[5]
4	N_OE	I		Power output on/off switch GND:on ; IPSOUT:off
5	PWROK/ N_LBO	O	<u>SYSEN=LDO1</u>	Power good indication
				Low power detect output VBUS to
6	N_VBUSEN	I		IPSOUT Selection GND:IPSOUT select VBUS High:IPSOUT do not select VBUS DCDC2
7	VIN2	PI		input source
8	LX2	IO		Inductor Pin for DCDC2 NMOS
9	PGND2	G		Ground for DCDC2 DC-DC2
10	DCDC2	I		feedback pin
11	LDO3	O		Output Pin of LDO3
12	LDO2	O		Output Pin of LDO2
13	LDOIN	PI		Input to LDO2 and LDO3
14	VIN3	PI		DCDC3 input source
15	LX3	IO		Inductor Pin for DCDC3 NMOS
16	PGND3	G		GND for DCDC3 Feed back to
17	DCDC3	I		DCDC3 GPIO 2
18	GPIO1	IO	REG 93H[2:0]	PWM 2
				ADC Input
19	GPIO0	IO	REG 90H[2:0]	GPIO 0
				Low noise LDO
				ADC Input
20	GPIO2	IO	REG 92H[2:0]	GPIO 1
				PWM 1
				ADC Input
twenty one	APS	PI		Internal Power Input
twenty two	AGND	G		Analog Ground

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twenty three	PWRON	I		Power On-Off key input , Internal 100k pull high to APS External
twenty four	BIAS	IO		200Kohm 1% resistor
25	VREF	O		Internal reference voltage
26	VINT	PO		Internal logic power, 2.5V
27	PWREN	IO		it is the Low-voltage Power domain enable signal LDO1
28	LDO1	O		output , for Host RTC block
29	SYSEN	IO		it is the High-voltage Power domain enable signal Backup
30	BACKUP	IO		battery pin
31	VBUS	PI		USB VBUS input
<u>32 , 33</u>	ACIN	PI		Adapter input
<u>34 , 35</u>	BAT	IO		Main Battery
36	CHGLED	O		charger status indication
37	TS	I		Battery Temperature sensor input or an external ADC input System power
<u>38 , 39</u>	IPSOUT	PO		source
40	EXTEN	O		External power module Enable GPIO3
41	GPIO3	I	REG95H[7]	
42	GPIO4	I		GPIO4
43	NC	O		NC
44	VIN1	PI		DCDC1 input source
45	LX1	IO		Inductor Pin for DCDC1 NMOS
46	PGND1	G		Ground for DCDC1 DCDC1
47	DCDC1	I		feedback pin
48	IRQ/ WAKEUP	IO		IRQ output or wakeup
49	EP	G		Exposed Pad, need to connect to system ground

### 8. Functional Block Diagram



### 9. Control and Operating

when AXP192 in working, TWI interface SCK/SDA Pull up the pin to the system IO Power, then Host You can use this interface to AXP192

Flexible adjustment and monitoring of the working status, and obtain abundant information.

Note:" Host "Refers to the main processor of the application system.

Note: The "external power supply" referred to below includes ACIN and VBUS enter.

#### 9.1 Work Mode and Reset (Power On/Off & Reset)

##### Working mode button (PEK)

AXP192 of PWRON Pin to GND A button can be connected between it as an independent switch button Power Enable Key(PEK)

Or sleep/wake button. AXP192 It can automatically recognize the "long press" and "short press" of this button and respond accordingly.

##### Several boot sources (Power on Source)

- 1 , ACIN , VBUS And battery access.
- 2 , N\_OE From high to low.
- 3 , PEK .

##### Power On—Method A

when SYSEN Pin and LDO1 When connected together, AXP192 In switch mode A .

N\_OE When it is low, when the required main power supply ( ACIN or VBUS>3.8V , The battery voltage is higher than the shutdown voltage) when connected, AXP192 It will automatically turn on (whether to turn on automatically when external power is connected can be rewritten according to external requirements)

While in N\_OE Is low and in the shutdown state, the startup action needs to pass PEK Operation to complete.

In the presence of an external power supply or battery, N\_OE The change from high to low will also cause AXP192 Turn on.

AXP192 Can be made by PEK( Pressing time exceeds " ONLEVEL ") Turn on. In practical applications, Host Timing( Alarm) Output letter Number can also be connected to PWRON -versus PEK in parallel, Alarm When the signal is valid (low level), it is equivalent to PEK You can also press AXP192 Turn on.

After booting, DC-DC with LDO It will be soft-started according to the set sequence sequence. Host Or through PWREN The pin turns on/off the corresponding power.

##### Power Off—Method A

PEK "Long press" time is greater than IRQLEVEL When PEK In the interrupt service routine, Host "Register REG32H[7] " Write " 1 "To notify AXP192 Enter the shutdown state. AXP192 It will be turned off when entering the shutdown state LDO1 All power output except for.



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In the following cases, AXP192 It will automatically shut down:

- 1 , The input voltage is too low, low power protection;
- 2 , The output voltage of the power supply is too low due to excessive load, and overload protection;
- 3 , Input voltage is too high, overvoltage protection (see the "Power Path Management" chapter for details);
- 4 , N\_OE Change from low to high without shutting down within the set time;
- 5 , PEK more than the OFFLEVEL Time (default 6S) The system automatically shuts down except LDO1 Output other than

AXP192 The automatic protection mechanism can avoid irreversible damage to the power supply device when the application system is abnormal, thereby protecting the entire system.

### Power On—Method B

when SYSEN Pin not and LDO1 When connected together, AXP192 In switch mode B .

In boot mode B , Each power output is controlled by SYSEN/PWREN Control when SYSEN/PWREN When it is high, its corresponding power path output is turned on, otherwise the output will be turned off.

And way A The difference is that when each boot source occurs only WAKEUP A low-level pulse is generated on the pin to notify HOST Pull up SYSEN/PWREN Turn on.

Note: This method is envisaged for PXA In processor applications with similar series and power management methods.

### Power Off—Method B

Such as shutdown method A The described shutdown source, each shutdown method will not immediately shut down directly AXP192 The output of N\_LBO A low level signal is generated on the pin to notify the system to pull down SYSEN/PWREN Enter shutdown mode; if 2S The system is not pulled down within SYSEN/PWREN ,then AXP192 Automatic shutdown; of course HOST Can also be directly pulled down SYSEN/PWREN Enter the corresponding shutdown mode.

Note: as the boot method B , Shutdown method B Also envisioned for PXA In processor applications with similar series and power management methods.

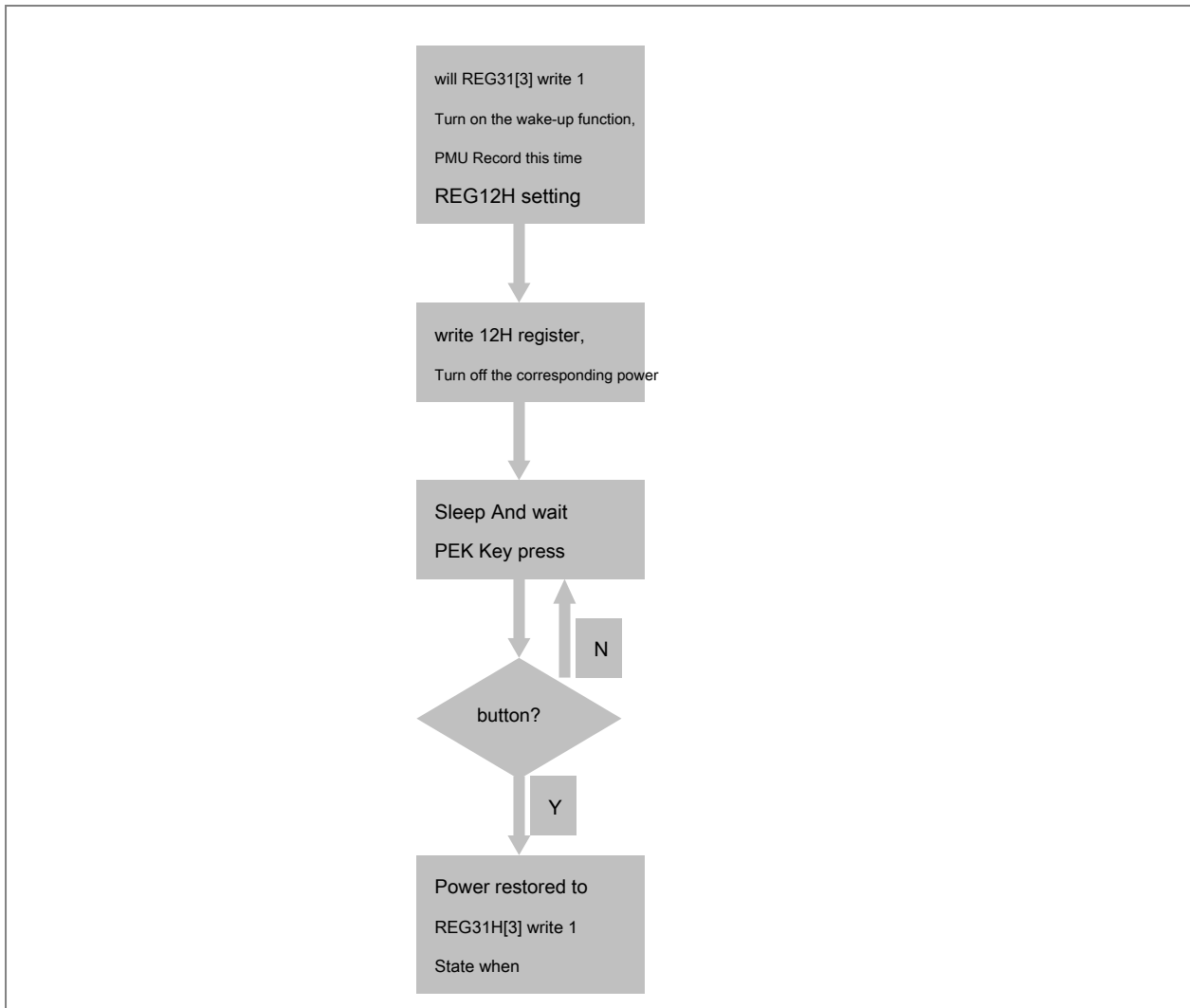
Note: Some processors are divided into sleep ( Sleep , SYSEN/PWREN One way is low, one way is high) and deep sleep ( Deep Sleep , SYSEN/PWREN Are all low, except LDO1 All external outputs are closed) two modes.

### Sleep and wakeup

in MannerA And when the system is turned on, if the system needs to enter Sleep Mode, and turn off one or several of the power supplies, you can REG31[3] Controlled by PEK Short press signal trigger wakeup ,Let PMU Restore each output power to REG31[3]

Be placed 1 The power supply of each channel is turned off in sequence according to the specified power-on sequence.

As follows Sleep with wakeup Its control flow in mode.



### System reset function and output monitoring function (PWROK/N\_LBO)

In switch mode A under:

AXP192 of PWROK Can be used as a reset signal for the application system. in AXP192 During the boot process, PWROK Output low level. When the output voltage of each power supply stabilizes and reaches the preset value, PWROK Will be pulled high to realize the power-on reset of the application system.

In the normal working process of the application system, AXP192 Always monitor the voltage and load status of each output, and when the load is over or under power Under pressure, PWROK Output low level immediately to reset the application system to prevent malfunction and possible data errors.

In switch mode B under:

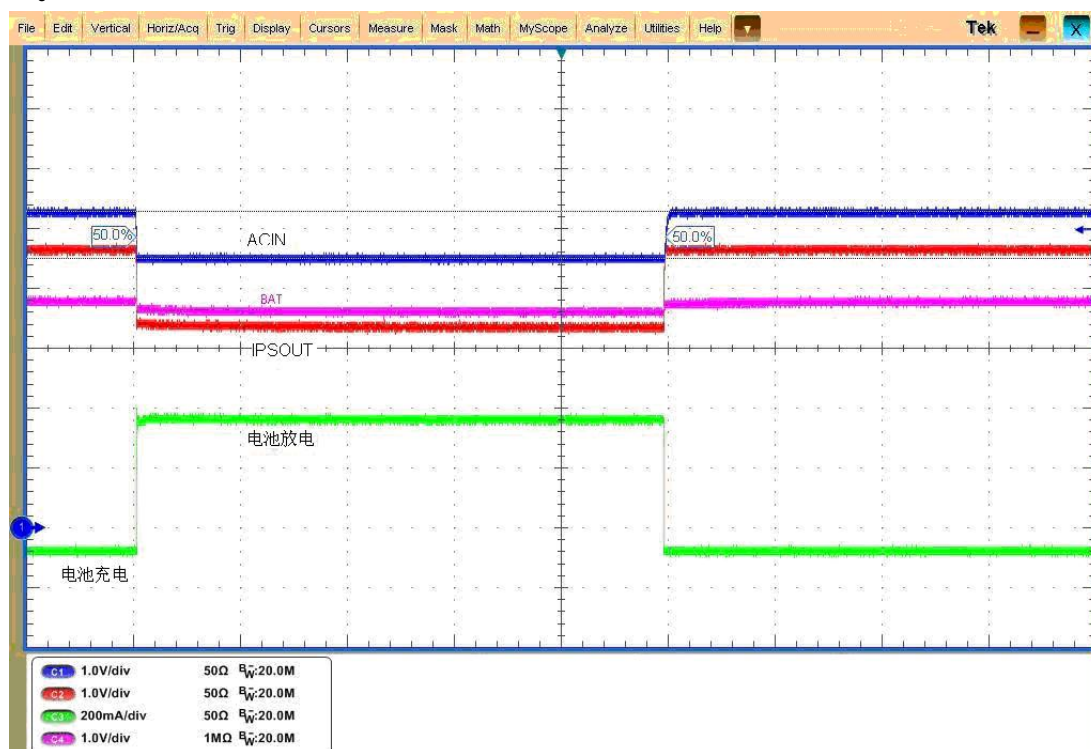
This pin acts as N\_LBO Signal, its low level is used to indicate that the system needs to enter shutdown mode. Specific functions are like shutdown B Describe Narrated.

### 9.2 Power Path Management (IPS)

AXP192 The power input can come from a lithium battery BAT , USB VBUS Input, external power supply ACIN( Such as AC adapter AC Adapter) , IPS According to the external power supply and the status of the lithium battery, select the appropriate power distribution method.

- O When only the lithium battery is connected and there is no external power input, the lithium battery is used for power supply;
- O When the external power supply is connected ( VBUS or ACIN) , Give priority to using external power supply;
- O When the battery is connected, when the external power supply is removed, it will immediately switch to lithium battery power supply "seamlessly"
- O when VBUS with ACIN When both are connected at the same time, the priority is used ACIN Power supply and charge the lithium battery;
- O If this time ACIN When the drive capacity is insufficient, it will be turned on at the right time VBUS Access ACIN/VBUS Common power supply;
- O If the drive capacity is still insufficient, the charging current will be reduced until 0 , And then use the battery to supplement the power supply;

See the figure below:



As shown in the figure above, when ACIN When the load capacity is insufficient, IPSOUT Voltage drop, BAT From being charged to discharging and ACIN Together to provide load current.

Host able to pass TWSI access AXP192 Internal register to set IPS Parameters and read the feedback information.

#### Voltage limit/current limit mode and pass-through mode

In order not to affect USB communication, VBUS By default, the channel works in " VBUS Pressure limiting mode". In this mode, AXP192 Will VBUS The voltage is maintained at a settable reference voltage  $V_{HOLD}$  Above to meet USB specification.  $V_{HOLD}$  The default is 4.4V , Available in the register Reg30H[5:3] Adjustment.

If the system is USB VBUS There is a limit on the amount of current drawn, and a current limit mode is available for selection (see register REG30H[1]) , Current limit value is optional 500mA/100mA( register Reg30H[0]) .

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If the system just uses USB Power and don't mind USB Communication, or use USB Power adapter, you can modify the register REG30H[6] will AXP192 Set to "VBUS Pass-through mode" when AXP192 Will give priority to meeting the power demand of the application system. when USB Host The driving ability is too weak or the system consumes too much power. VBUS Voltage is lower than  $V_{HOLD}$ , AXP192 Will issue IRQ<sub>7</sub> ,inform Host VBUS Power supply is weak, indicating USB Communication may be affected, and subsequent actions can be Host Software decision.

### The response of AXP192 when the external power supply is plugged in

AXP192 Can automatically detect the plug-in action of the external power supply. when AXP192 After detecting that the external power supply is inserted, it will automatically determine the external Whether the source is available, and set the result in the corresponding register, and issue IRQ<sub>7</sub> ,Notice Host .

The register status bits and meanings of the external power supply are shown in the following table:

Register status bit	meaning
register REG00H[7]	Indicates external adapter power ACIN does it exist
register REG00H[6]	Indicates external adapter power ACIN it's usable or not
register REG00H[5]	Indicates external power supply VBUS does it exist
register REG00H[4]	Indicates external power supply VBUS it's usable or not
register REG00H[3]	Indicate access to external power VBUS Time, VBUS Is the voltage higher than $V_{HOLD}$
register REG00H[1]	Indicates external power supply ACIN/VBUS Whether in PCB Short on
register REG00H[0]	Indicates whether the system is ACIN/VBUS Trigger boot

"Indicating access to external power VBUS Time, VBUS Is the voltage higher than  $V_{HOLD}$  "This flag bit allows Host On receipt IRQ<sub>7</sub>

Time (refers to VBUS Weak power supply), judge VBUS Is it pulled down because the system load is connected or because the external power supply itself is lower than the voltage  $V_{HOLD}$  To facilitate Host The software decides whether to continue working in the pressure limiting mode or change to the through mode.

### Whether to use VBUS as input power

AXP192 Whether to choose VBUS As input power, it will be N\_VBUSEN And register REG30H[7] To decide:

N_VBUSEN	REG30H[7]	Input power	meaning
Low	0	VBUS	VBUS Effective and none ACIN Choose when VBUS Yes when valid VBUS As input power
Low	1	VBUS	
High	1	VBUS	
High	0	ACIN/BAT	Not used VBUS

### Low battery warning and low battery protection (automatic shutdown)

AXP192 Two levels of low battery warning voltage can be set  $V_{WARNING}$  And automatic shutdown voltage  $V_{OFF}$  And will APS Compare with it. Once found APS Below  $V_{WARNING}$  , Just issue IRQ<sub>19</sub> . in case APS Below  $V_{OFF}$  , AXP192 Automatically enter the shutdown mode, turn off the LDO1 All outputs except for.

$V_{WARNING}$  Can be set LEVEL1/LEVEL2 , when APS Voltage drop below LEVEL2 Post IRQ<sub>30</sub> , APS The voltage rises again to LEVEL1 Automatically clear this after IRQ<sub>7</sub> .

$V_{WARNING}$  with  $V_{OFF}$  The default value can be in the register REG3AH , REG3BH with REG31H Bit[2:0] Set up.

### Overvoltage protection

When the external power supply voltage exceeds 6.3V Time, APX19x issue IRQ1/4 , Prompting the external power supply is overvoltage. When the external power supply exceeds 7V , AXP192 Automatic shut-down.

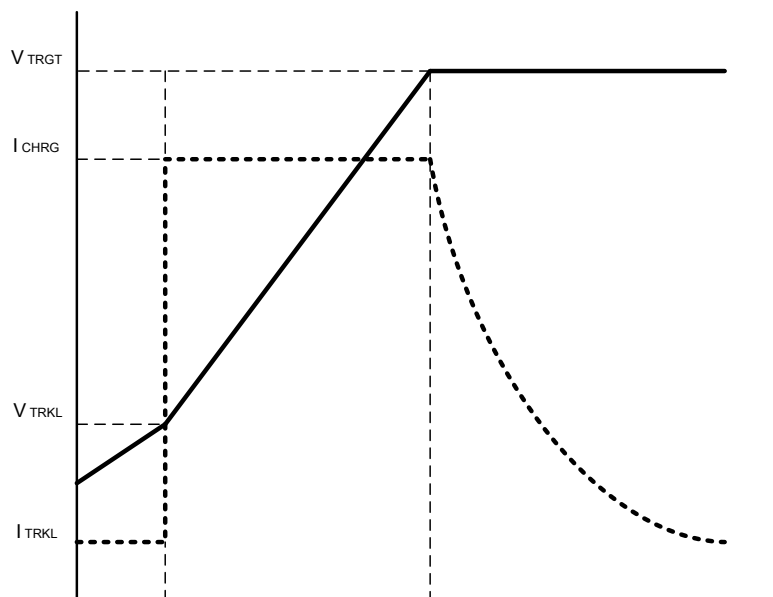
## 9.3 Adaptive Charger (Adaptive Charger)

AXP192 Integrated a constant current/constant voltage charger, which can automatically control the charging cycle, and the built-in safety clock can automatically stop charging Without processor intervention. This charger can automatically adjust the charging current according to the power consumption of the system. It also has battery detection, trickle charging and Activate the function, the built-in temperature detection circuit can automatically reduce the charging current when the temperature is too high or too low.

### Start of adaptive charging process

The charger is enabled by default (can be turned off by setting the register, see "Register REG33H "). When the external power supply is connected Rear, AXP192 First determine whether the external power supply can be used for charging. When the conditions for the external power supply are met, and the charging function is turned on at this time then AXP192 Automatically start the charging process, Host issue IRQ , Indicating that the charging process has started. Simultaneously, CHGLED The pin outputs a low level, which can drive an external LED to indicate the charging status.

### Schematic diagram of voltage and current during charging



### Two sign voltages

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$V_{TRGT}$  , Charging target voltage.  $V_{TRGT}$  Can be set by register, the default is 4.2V( See "register REG33H[6:5] "). At the same time, when the external power supply voltage is low, AXP192 The charging target voltage is automatically adjusted.

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

### recharging current

The charging current can pass through the register REG33H[3:0] Setting, the default value is 450mA or 780mA .

### Charging process

If the battery voltage is lower than 3.0V , The charger automatically enters the pre-charge mode, the charging current is the preset value 1/10 . in case 40 Within minutes (this time can be adjusted, see "register REG34H ") , the battery voltage still cannot reach 3.0V , The charger automatically enters the battery activation mode.

See "Battery Activation Mode" for details.

Once the battery voltage is higher 3.0V , The charger starts to enter the constant current mode. If the charging current is less than the preset value 65% When the system issues IRQ17 This informs "the drive capacity of the external power supply is insufficient, and the charging current does not reach the set value at this time, which will extend the charging time. Fully charge faster, it is recommended to replace with a stronger power supply or turn off the power-intensive functions.

When the battery voltage reaches the target voltage  $V_{TRGT}$  Then, the charger enters the constant voltage mode from the constant current mode, and the charging current decreases.

When the charging current is lower than the preset value 10% or 15% Time (can be set, see "register REG33H ") , the charging cycle ends and charging stops  
At the end of charging, AXP192 Will issue IRQ18 , CHGLED The pin stops indicating the charging status. When the battery voltage drops below  $V_{RCH}$  , It will automatically start recharging and send out IRQ17 .

In non-precharge mode, if 480 Within minutes (this time can be adjusted, see "register REG34H ") , the charging cycle is not over, the charger will automatically enter the battery activation mode.

### Battery activation mode

Whether from the pre-charge mode or from the constant current charging mode to the battery activation mode (when the timer expires), AXP192 Will issue IRQ10 , Indicating that the battery may be damaged.

In battery activation mode, Charger Always charge the battery with a small current, if the battery voltage can reach  $V_{RCH}$  , Then exit  
Activate the mode and issue at the same time IRQ11 .

AXP192 In register REG01H Indicates whether the charger is in battery activation mode.

### CHGLED

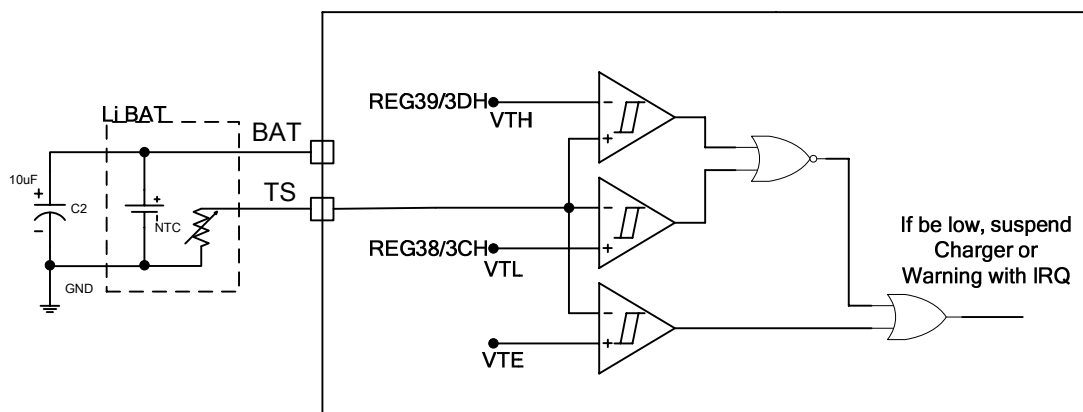
CHGLED The pin is used to indicate the charging status and alarm. It has four states: charging, not charging, battery abnormal alarm and external Power overvoltage alarm. CHGLED Yes NMOS Open Drain( Open-drain type) output, can directly drive a light-emitting diode through a current-limiting resistor to display these four states. Its performance in each state is shown in the following table:

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status	which performed	Comment
Charging low		
Not charging high	resistance	
Abnormal battery	25% duty 1Hz Jumping the charger	into the battery activation mode, or the battery temperature is too high, too low and
overvoltage	25% duty 4Hz The external power	input voltage is too high

### Battery temperature detection

During charging/use, AXP192 Can be passed on TS An external temperature-sensitive resistor is connected to the pin to monitor the battery temperature. The circuit diagram is as follows:



In the picture above, VTH/VTL Set the thresholds for high temperature and low temperature respectively, which can be set through registers respectively REG38H/39H/3CH/3DH Settings, VTE=0.2V . Recommended temperature-sensitive resistor selection 25 At °C 10Kohm , Accuracy 1% of NTC Temperature sensitive resistor. AXP192 will be TS Send on pin Constant current, this current can be set to 20uA , 40uA , 60uA , 80uA Four (see register REG84H) To adapt to different NTC resistance. This current flows through the temperature-sensitive resistor to obtain a detection voltage, AXP192 by ADC Measure the voltage value and compare it with the set value, thus Send out the corresponding IRQ Or suspend charging.

If the resistance of the temperature-sensitive resistor is too large or too small, an additional resistor can be connected in parallel or in series with its path to expand its detection range.

If the battery does not have a temperature-sensitive resistor, you can put TS The pin is connected to ground, at this time AXP192 Automatically disable the battery temperature monitoring function.

### Battery detection

AXP192 It will automatically detect the presence of the battery and mark it in the register (see register REG01H) And issue IRQ13 , IRQ14 .

The battery detection function can be Host Control on or off (see register REG32H) .

### 9.4 Backup Battery

AXP192 Support the use and charging of backup batteries, when there is no main power supply ( BAT/ACIN/VBUS) When it exists, LDO1 The input source selects a backup battery, and its output is used to maintain the system's real-time clock and other circuits.

When the main power is present, you can set REG35H[7] To charge the backup battery, its target voltage defaults to 3.0V( accessible REG35H[6:5] Settings), the default charging current is 200uA( Can also pass REG35H[1:0] Settings).

### 9.5 Multi-Power Outputs

AXP192 The list of multiple output voltages and functions provided is as follows:

Output path	Types of	Default voltage	Application examples	Drive capability
DCDC1	BUCK	Can be set	3.3V I/O	1200 mA
DCDC2	BUCK	Can be set	1.25V core	1600 mA
DCDC3	BUCK	Can be set	2.5V ddr	700 mA
LDO1	LDO	Can be set	RTC	30 mA
LDO2	LDO	Can be set	Analog/FM	200 mA
LDO3	LDO	Can be set	1.8V HDMI	200 mA
LDO I00	LDO	Can be set	Vmic	50 mA

AXP192 contain 3 Synchronous step-down DC-DC , 4 road LDO , A variety of start sequence and control methods. DC-DC The default operating frequency is 1.5MHz , Can be adjusted by setting the register, and the peripheral can use small inductance and capacitance components. 3 A DC-DC Can be set to PWM Mode or automatic mode (by AXP192 Automatically switch according to the size of the load), see "register REG80H ".

#### DC-DC1/2/3

DCDC1/3 The output voltage range is 0.7-3.5V , DCDC2 The output voltage is 0.7-2.275V , Can be set by register (see "Register REG23H 26H 27H 29H ").

DCDC1/2/3 Recommended output capacitor 10uF X7R Above small ESR Ceramic capacitor; when the output voltage is set to 2.5V It is recommended to use 2.2uH Inductance, in 2.5V It is recommended to use 4.7uH Inductance, where the saturation current of the inductor must be greater than the maximum demand current of the power path 50% the above.

The following is a list of recommended inductors and capacitors:

inductance		
model	Current specifications	DC internal resistance
Murata LQH55PN2R2NR0	2100mA@2.2uH	30mOhm
Murata LQH55PN4R7NR0	1400mA@4.7uH	60mOhm
Murata LQH44PN2R2MP0	2000mA@2.2uH	49mOhm
Murata LQH44PN4R7MP0	1700mA@2.2uH	80mOhm
TDK VLF5010ST-2R2M2R3	2700mA@2.2uH	41mOhm



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TDK VLF5014ST-4R7M1R7	1700mA@4.7uH	98mOhm
TDK SLF6045T-4R7N2R4-3PF	2400mA@4.7uH	27mOhm
<b>capacitance</b>		
<b>model</b>	<b>Temperature characteristics</b>	<b>Tolerance</b>
TDK C2012X5R0J475K	X5R/X7R	10%@4.7uF
TDK C2012X5R0J106K	X5R/X7R	10%@10uF
Murata GRM31E71A475K	X7R	10%@4.7uF
Murata GRM21E71A106K	X7R	10%@10uF
Murata GRM31E71A106K	X7R	10%@10uF

### LDO1

LDO1 Always on, can be the real-time clock circuit of the application system ( RTC) Provide uninterrupted power supply, its driving capability is 30mA .

### LDO2/3

LDO2/3 Using a low-noise design, it can provide power for the analog circuit of the application system, and its driving capability is 200mA .

### LDO<sub>100</sub>

LDO<sub>100</sub> A low-noise design is also adopted, and the output drive capability is 50mA .

### Soft Start

all DC-DC with LDO Both support the soft-start output establishment method to avoid the impact of the sudden change of current on the input path during startup.

### Self-diagnosis: load monitoring and current limit protection

all DC-DC with LDO There are load monitoring and current limiting functions. When the load current exceeds its driving capacity, each output voltage will drop to protect the internal circuit. Three DC-DC The output voltage is lower than the set voltage 85% Time, AXP192 Automatic shut-down. At the same time, the system automatically records which output voltage is too low caused the shutdown (see register REG46H[5:2]) And issue the corresponding IRQ .

all DC-DC No external Schottky diode and resistor divider feedback circuit are required. If you don't need to use a DC-DC , Only need to correspond LX The pin can be left floating.

## 9.6 Default Voltage/Timing Setting

AXP192 The default voltage and startup sequence of each power supply can be customized.

Start-up sequence: included 8 Level start, namely 0-7 , Of which 7 Level means that this power supply will not be activated by default after power-on. other 0-6 The levels respectively indicate the first 1-7 Step to start this power supply. At the same time, the start time interval of each step can be set, and the optional range is 1 , 4 , 16mS .

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Default voltage setting: each way DCDC/LDO The settable range includes the selection from the lowest voltage to the highest voltage.

For this part, please refer to the "Default Configuration Instructions" document.

### 9.7 Signal Capture

The general battery power monitor usually estimates the battery power by measuring the battery voltage, and AXP192 Multipath 12Bit ADC In addition to measuring battery voltage, it can also measure battery current and external power supply voltage and current. At the same time, it integrates a battery charging and discharging library.

Count. Host The battery power can be calculated more accurately based on these data. In addition, the real-time power consumption of the system can also be calculated.

Rich power information such as remaining battery power, battery charging progress, remaining battery usage time and remaining full charge time.

Each way ADC The enable control and sampling speed can be through the register REG82H , 83H , 84H To set, the sampling results are stored in the

Please refer to the register description ADC Data category. among them GPIO[3:0] Input range can be through register REG85H Set up.

The battery current direction is charged or discharged by the register REG00H[2] To instruct.

Channel	000H	STEP	FFFH
Battery Voltage	0mV	1.1mV	4.5045V
Bat discharge current	0mA	0.5mA	4.095A
Bat charge current	0mA	0.5mA	4.095A
ACIN volatge	0mV	1.7mV	6.9615V
ACIN current	0mA	0.625mA	2.5594A
VBUS voltage	0mV	1.7mV	6.9615V
VBUS current	0mA	0.375mA	1.5356A
Internal temperature	-144.7 °C	0.1 °C	264.8 °C
APS voltage	0mV	1.4mV	5.733V
TS pin input	0mV	0.8mV	3.276V
GPIO0	0/0.7V	0.5mV	<u>2.0475/2.7475V</u>
GPIO1	0/0.7V	0.5mV	<u>2.0475/2.7475V</u>
GPIO2	0/0.7V	0.5mV	<u>2.0475/2.7475V</u>
GPIO3	0/0.7V	0.5mV	2.0475/2.7475V

### 9.8 Multi-Function Pin Description

#### GPIO[4:0]

can be used as GPIO[4:0] , ADC Input (Monitoring of external signals), LDO , PWM Etc., see REG90H-96H Description.

#### N\_RSTO

LDO1 Status monitoring signal (pull up to LDO1 ) Or GPIO5 , See how to use REG9EH Description.

### CHGLED

Charge status indication, over-temperature and over-voltage alarm functions, and GPO Function, use method see REG32H Description.

### IRQ(WAKEUP)

when AXP192 In switch mode A When, this pin is used as IRQ Status indicator pin, when an interrupt occurs, its output is pulled low  
know HOST Perform interrupt processing and pull up to the system IO power supply.

when AXP192 In switch mode B When, this pin is used as WAKEUP Trigger signal indication, pull up to LDO1 , Please refer to the boot mode for specific functions B Description.

### PWROK(N\_LBO)

In the switch mode A, it is the system reset signal (pull up to the system IO power) , In switch mode B, it is the shutdown indicator signal (upper Pull to LDO1), refer to "System Reset Function and Output Monitoring Function" in "9.2 Power On/Off and Reset".

## 9.9 Timer (Timer)

AXP192 Contains an internal timer, by setting the register REG8AH[6:0] The timer value can be changed, the minimum resolution is minutes  
bell( Minute) , Set when the timer expires REG8AH[7] .

9.10 HOST interface and interrupt (TWSI and IRQ)

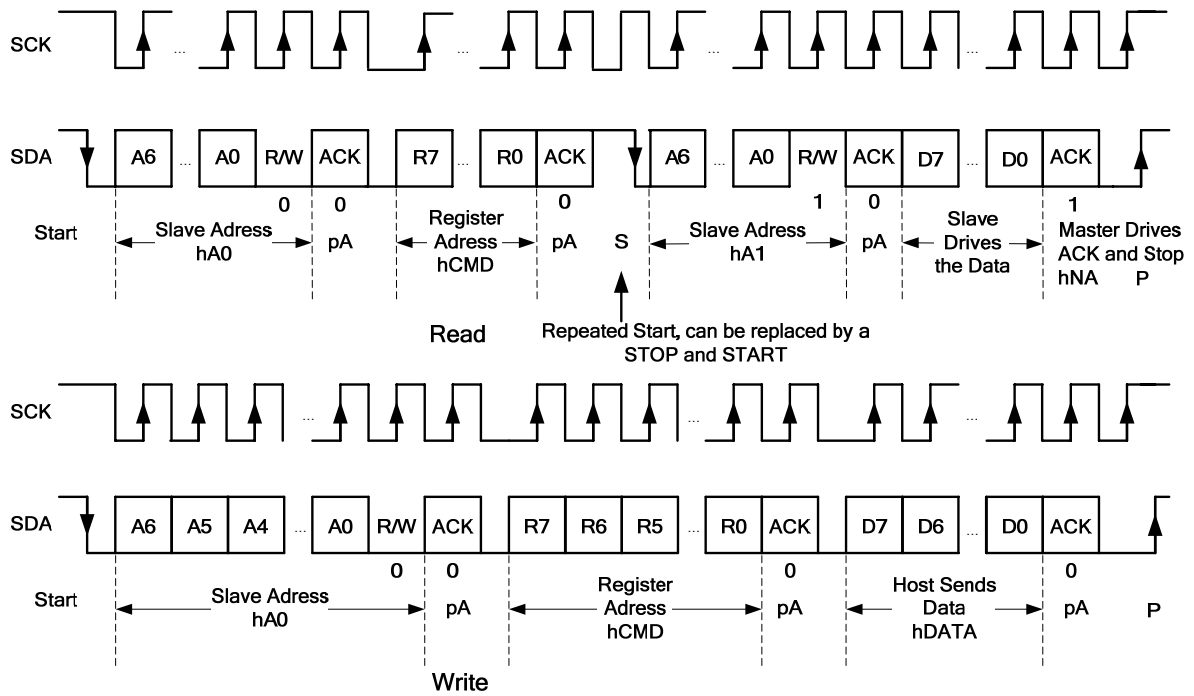


Figure 1: Single Read and Write

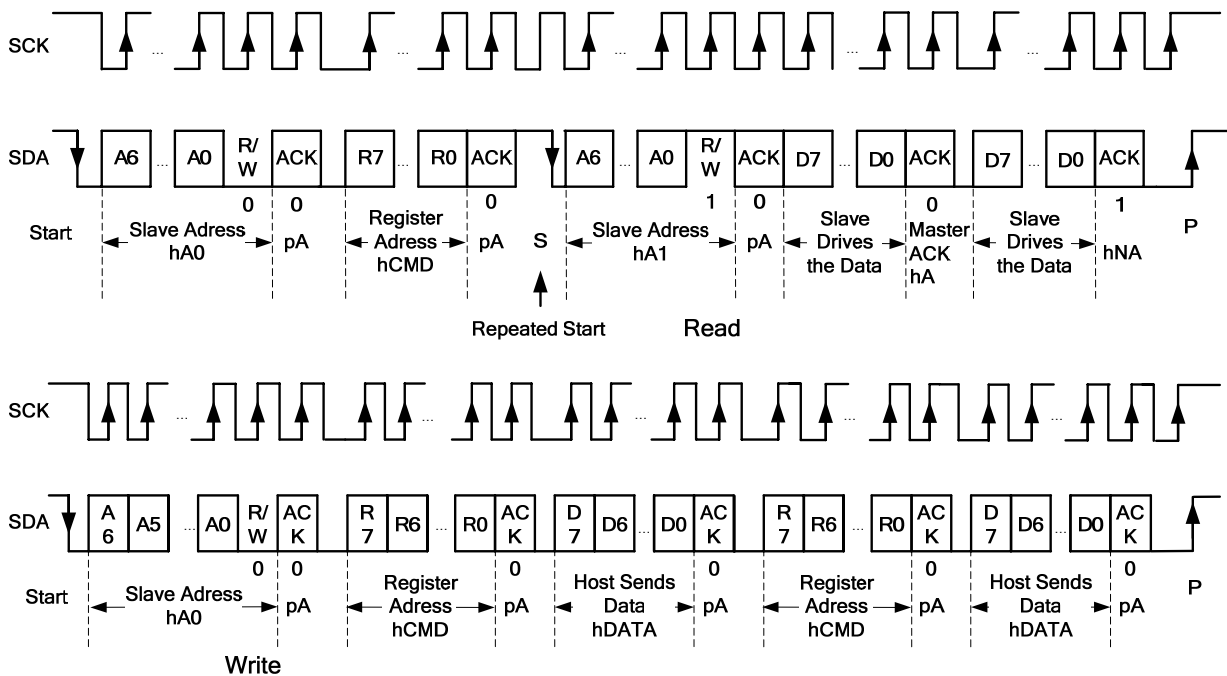


Figure 2: Multi Read and Write

Host able to pass TWSI Interface access AXP192 The operation sequence of the register is shown in the figure above, which supports standard 100KHz or

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400KHz Frequency, the highest speed can reach 1.2MHz , Support continuous read/write operation at the same time, the device address is 69H( Read) and 68H( write).

When certain events occur, AXP192 By pulling down IRQ To remind Host , And save the interrupt status in the interrupt status register (see register REG44H ,register REG45H ,register REG46H ,register REG47H) , Write to the corresponding status register bit 1 Then clear the corresponding interrupt, when there is no interrupt event, IRQ Output pull high (through external pull up 51K resistance). Each interrupt can be masked by the interrupt control register (see register REG40H ,register REG41H ,register REG42H ,register REG43H) .

position	Interrupt number	meaning	position	Interrupt number	meaning
register 44H[7]	IRQ1	power supply ACIN Overpressure	register 46H[7]	<u>IRQ16</u>	IC Internal overtemperature
register 44H[6]	IRQ2	power supply ACIN insert	register 46H[6]	<u>IRQ17</u>	Insufficient charging current
register 44H[5]	IRQ3	power supply ACIN Remove	register 46H[5]	<u>IRQ18</u>	DCDC1 Voltage is too low
register 44H[4]	IRQ4	power supply VBUS Overpressure	register 46H[4]	<u>IRQ19</u>	DCDC2 Voltage is too low
register 44H[3]	IRQ5	power supply VBUS insert	register 46H[3]	IRQ20	DCDC3 Voltage is too low
register 44H[2]	IRQ6	power supply VBUS Remove	register 46H[2]	Keep	
register 44H[1]	IRQ7	VBUS Voltage is less than V HOLD	register 46H[1]	IRQ22	PEK dog
register 44H[0]	Keep		register 46H[0]	<u>IRQ23</u>	PEK Press
register 45H[7]	IRQ8	Battery access	register 47H[7]	<u>IRQ24</u>	N_OE Boot up
register 45H[6]	IRQ9	Battery removal	register 47H[6]	<u>IRQ25</u>	N_OE Shutdown
register 45H[5]	<u>IRQ10</u>	Enter battery activation mode	register 47H[5]	<u>IRQ26</u>	VBUS effective
register 45H[4]	<u>IRQ11</u>	Exit battery activation mode	register 47H[4]	<u>IRQ27</u>	VBUS invalid
register 45H[3]	<u>IRQ12</u>	Charging	register 47H[3]	<u>IRQ28</u>	VBUS Session Valid
register 45H[2]	<u>IRQ13</u>	finished charging	register 47H[2]	IRQ29	VBUS Session End
register 45H[1]	<u>IRQ14</u>	Battery temperature is too high	register 47H[1]	Keep	
register 45H[0]	<u>IRQ15</u>	Battery temperature is too low	register 47H[0]	<u>IRQ30</u>	Low battery warning

## 9.11 Registers

First 1 Group, power control class

address	Register description	R/W	Defaults
00	Power status register	R	
01	Power mode/charge status register	R	
04	OTG VBUS Status register	R	
06-0B	Data buffer register 0-5	R/W	F0/0F/00/FF/ 00/00
10	EXTEN & DC-DC2 Switch control register	R/W	X5H
12	DC-DC1/3 & LDO2/3 Switch control register	R/W	XFH
twenty three	DC-DC2 Voltage setting register	R/W	16H
25	DC-DC2 Voltage slope parameter setting register	R/W	00H

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26	DC-DC1 Voltage setting register	R/W	68H
27	DC-DC3 Voltage setting register	R/W	48H
28	LDO2/3 Voltage setting register	R/W	CFH
30	VBUS-IPSOUT Path setting register	R/W	60H
31	V <sub>OFF</sub> Shutdown voltage setting register	R/W	X3H
32	Shutdown, battery detection, CHGLED Control register	R/W	46H
33	Charge control register 1	R/W	C8H
34	Charge control register 2	R/W	41H
35	Backup battery charge control register	R/W	22H
36	PEK Parameter setting register	R/W	5DH
37	DCDC Converter operating frequency setting register	R/W	08H
38	Battery charging low temperature alarm setting register	R/W	A5H
39	Battery charging high temperature alarm setting register	R/W	1FH
3A	APS Low power Level1 Set register	R/W	68H
3B	APS Low power Level2 Set register	R/W	5FH
3C	Battery discharge low temperature alarm setting register	R/W	FCH
3D	Battery discharge high temperature alarm setting register	R/W	16H
80	DCDC Working mode setting register	R/W	E0H
82	ADC Enable setting register 1	R/W	83H
83	ADC Enable setting register 2	R/W	80H
84	ADC Sampling rate setting, TS pin Control register	R/W	32H
85	GPIO [3:0] Input range setting register	R/W	X0H
86	GPIO1 ADC IRQ Rising edge threshold setting	R/W	FFH
87	GPIO1 ADC IRQ Falling edge threshold setting	R/W	00H
8A	Timer control register	R/W	00H
8B	VBUS Monitoring setting register	R/W	00H
8F	Over-temperature shutdown control register	R/W	01H

First 2 group, GPIO Control class

address	Register description	R/W	Defaults
90	GPIO0 Control register	R/W	07H
91	GPIO0 LDO Mode output voltage setting register	R/W	A0H
92	GPIO1 Control register	R/W	07H
93	GPIO2 Control register	R/W	07H
94	GPIO[2:0] Signal status register	R/W	00H
95	GPIO[4:3] Function control register	R/W	00H
96	GPIO[4:3] Signal status register	R/W	00H
97	GPIO[2:0] Pull-down control register	R/W	00H
98	PWM1 Frequency setting register	R/W	00H
99	PWM1 Duty cycle setting register 1	R/W	16H
9A	PWM1 Duty cycle setting register 2	R/W	0BH

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9B	PWM2 Frequency setting register	R/W	00H
9C	PWM2 Duty cycle setting register 1	R/W	16H
9D	PWM2 Duty cycle setting register 2	R/W	0BH
9E	N_RSTO (GPIO5) Control register	R/W	20H

First 3 Group, interrupt control class

address	Register description	R/W	Defaults
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	3BH
43	IRQ Enable control register 4	R/W	C1H
4A	IRQ Enable control register 5	R/W	00H
44	IRQ Status register 1	R/W	00H
45	IRQ Status register 2	R/W	00H
46	IRQ Status register 3	R/W	00H
47	IRQ Status register 4	R/W	00H
4D	IRQ Status register 5	R/W	00H

First 4 group, ADC Data type

address	Register description	R/W
56	ACIN Voltage ADC High data 8 Bit	R
57	ACIN Voltage ADC Low data 4 Bit	R
58	ACIN Current ADC High data 8 Bit	R
59	ACIN Current ADC Low data 4 Bit	R
5A	VBUS Voltage ADC High data 8 Bit	R
5B	VBUS Voltage ADC Low data 4 Bit	R
5C	VBUS Current ADC High data 8 Bit	R
5D	VBUS Current ADC Low data 4 Bit	R
5E	AXP192 Internal temperature monitoring ADC High data 8 Bit	R
5F	AXP192 Internal temperature monitoring ADC Low data 4 Bit	R
62	TS enter ADC High data 8 Bit, monitor battery temperature by default	R
63	TS enter ADC Low data 4 Bit, monitor battery temperature by default	R
64	GPIO0 Voltage ADC High data 8 Bit	R
65	GPIO0 Voltage ADC Low data 4 Bit	R
66	GPIO1 Voltage ADC High data 8 Bit	R
67	GPIO1 Voltage ADC Low data 4 Bit	R
68	GPIO2 Voltage ADC High data 8 Bit	R
69	GPIO2 Voltage ADC Low data 4 Bit	R
6A	GPIO3 Voltage ADC High data 8 Bit	R
6B	GPIO3 Voltage ADC Low data 4 Bit	R

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70	High battery instantaneous power 8 Bit	R
71	Battery instantaneous power 8 Bit	R
72	Low battery instantaneous power 8 Bit	R
78	High battery voltage 8 Bit	R
79	Battery voltage is low 4 Bit	R
7A	High battery charging current 8 Bit	R
7B	Low battery charging current 5 Bit	R
7C	High battery discharge current 8 Bit	R
7D	Low battery discharge current 5 Bit	R
7E	APS High voltage 8 Bit	R
7F	APS Low voltage 4 Bit	R

Note: The calculation method of battery power is

$$P_{bat} = \text{Register value} * \text{voltage LSB} * \text{Current LSB} / 1000 .$$

Among them, the voltage LSB for 1.1mV , Current LSB for 0.5mA , The calculation result unit is mW .

address	Register description	R/W	Defaults
B0	Battery charging coulomb counter data register [ 31:24]	R/W	00H
B1	Battery charging coulomb counter data register [ 23:16]	R/W	00H
B2	Battery charging coulomb counter data register [ 15:8]	R/W	00H
B3	Battery charging coulomb counter data register [ 7:0]	R/W	00H
B4	Battery discharge coulomb counter data register [ 31:24]	R/W	00H
B5	Battery discharge coulomb counter data register [ 23:16]	R/W	00H
B6	Battery discharge coulomb counter data register [ 15:8]	R/W	00H
B7	Battery discharge coulomb counter data register [ 7:0]	R/W	00H
B8	Coulomb counter control register	R/W	00H

Coulomb calculation method:  $C = 65536 * \text{Current LSB} * (\text{Charge Coulomb Count} - \text{Discharge Coulomb Count}) / 3600 / \text{ADC Sampling Rate}$ .

among them: ADC Sample rate reference REG84H Setting; current LSB for 0.5mA ; The calculation result unit is mAh .

REG 00H: Input power status

Bit	description	R/W
7	ACIN Presence indication 0: ACIN does not exist; 1: ACIN exist	R
6	Instructions ACIN it's usable or not	R
5	VBUS Presence indication 0: VBUS does not exist; 1:VBUS exist	R
4	Instructions VBUS it's usable or not	R
3	Instructions VBUS Is the access greater than before use $V_{\text{HOLD}}$	R
2	Indicates the direction of battery current 0: The battery is discharging; 1: The battery is charged	R



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1	Instructions ACIN with VBUS Is the input in PCB Shorted	R
0	Indicates whether the startup source is ACIN or VBUS 0: Start source non ACIN/VBUS ; 1: Startup source is ACIN/VBUS	R

REG 01H: Power supply working mode and charging status indication

Bit	description	R/W
7	Instructions AXP192 Overheated 0: Not overheated 1: Over temperature	R
6	Charging instructions 0: Not charging or charging completed; 1: Charging	R
5	Battery presence status indicator 0: No battery connected to AXP192 ; 1: The battery is connected to AXP192	R
4	Reserved and unchangeable	R
3	Indicates whether the battery is in active mode 0: Did not enter the battery activation mode; 1: Battery activation mode entered	R
2	Indicates whether the charging current is less than the expected current 0: The actual charging current is equal to the expected current; 1: The actual charging current is less than the expected current	R
1	AXP192 Switch mode indication 0: the way A ; 1: the way B	R
0	Reserved and unchangeable	R

REG 02H: USB OTG VBUS status indication

Bit	description	R/W
7-3	Reserved and unchangeable	
2	Instructions VBUS is it effective, 1 Means effective	R
1	Instructions VBUS Session A/B is it effective, 1 Indicates valid instructions Session	R
0	End status, 1 Means effective	R

REG 06-0BH: Data cache

Note: As long as one of the external power supply, battery or backup battery exists, this data will be kept, and will not be affected by the switch.

The default value is F0/0F/00/FF/00/00H

## REG 10H: EXTEN & DC-DC2 output control

Defaults: XXH

Bit	description		R/W	Defaults
7-3	Reserved and unchangeable			
2	EXTEN Switch control	0: shut down; 1: turn on	RW	X
1	Reserved and unchangeable			
0	DC-DC2 Switch control	0: shut down; 1: turn on	RW	X

Note: X Indicates that it depends on the customization situation, the following values are X The part is the same.

## REG 12H: Power output control

Defaults: XXH

Bit	description		R/W	Defaults
7	Reserved and unchangeable		RW	X
6	EXTEN Switch control	0: shut down; 1: turn on	RW	X
5	Reserved and unchangeable		RW	X
4	DC-DC2 Switch control	0: shut down; 1: turn on	RW	X
3	LDO3 Switch control		RW	X
2	LDO2 Switch control		RW	X
1	DC-DC3 Switch control		RW	X
0	DC-DC1 Switch control		RW	X

Note: REG12Hbit6/4 Correspond respectively REG10Hbit2/0 .

## REG 23H: DC-DC2 output voltage setting

Defaults: 16H

Bit	description		R/W	Defaults
7-6	Reserved and unchangeable			
5	DC-DC2 Output voltage setting Bit5	0.7-2.275V , 25mV/step	RW	X
4	DC-DC2 Output voltage setting Bit4		RW	X
3	DC-DC2 Output voltage setting Bit3		RW	X
2	DC-DC2 Output voltage setting Bit2		RW	X
1	DC-DC2 Output voltage setting Bit1		RW	X
0	DC-DC2 Output voltage setting Bit0		RW	X

REG 25H: DC-DC2 dynamic voltage adjustment parameter setting

Defaults: 00H

Bit	description		R/W	Defaults
7-3	Reserved and unchangeable			
2	DC-DC2 VRC Enable control 0: turn on; 1: shut down		RW	0
1	Reserved and unchangeable		RW	0
0	DC-DC2 VRC Voltage rise slope control	0: 25mV/15.625us=1.6mV/us 1: 25mV/31.250us=0.8mV/us	RW	0

REG 26H: DC-DC1 output voltage setting

Defaults: 68H

Bit	description		R/W	Defaults
7	Reserved and unchangeable			
6	DC-DC1 Output voltage setting Bit6	0.7-3.5V , 25mV/step	RW	X
5	DC-DC1 Output voltage setting Bit5		RW	X
4	DC-DC1 Output voltage setting Bit4		RW	X
3	DC-DC1 Output voltage setting Bit3		RW	X
2	DC-DC1 Output voltage setting Bit2		RW	X
1	DC-DC1 Output voltage setting Bit1		RW	X
0	DC-DC1 Output voltage setting Bit0		RW	X

REG 27H: DC-DC3 output voltage setting

Defaults: 48H

Bit	description		R/W	Defaults
7	Reserved and unchangeable			
6	DC-DC3 Output voltage setting Bit6	0.7-3.5V , 25mV/step	RW	X
5	DC-DC3 Output voltage setting Bit5		RW	X
4	DC-DC3 Output voltage setting Bit4		RW	X
3	DC-DC3 Output voltage setting Bit3		RW	X
2	DC-DC3 Output voltage setting Bit2		RW	X
1	DC-DC3 Output voltage setting Bit1		RW	X
0	DC-DC3 Output voltage setting Bit0		RW	X

REG 28H: LDO2/3 output voltage setting

Defaults: CFH

Bit	description		R/W	Defaults
7	LDO2 Output voltage setting Bit3	1.8-3.3V , 100mV/step	RW	X
6	LDO2 Output voltage setting Bit2		RW	X
5	LDO2 Output voltage setting Bit1		RW	X
4	LDO2 Output voltage setting Bit0		RW	X
3	LDO3 Output voltage setting Bit3	1.8-3.3V , 100mV/step	RW	X
2	LDO3 Output voltage setting Bit2		RW	X
1	LDO3 Output voltage setting Bit1		RW	X
0	LDO3 Output voltage setting Bit0		RW	X

REG 30H: VBUS-IPSOUT channel management

Defaults: 6XH

Bit	description		R/W	Defaults
7	VBUS When available VBUS-IPSOUT Path selection control signal 0: by N_VBUSEN pin Decide whether to open this channel 1:VBUS-IPSOUT Access can be selected to open, regardless of N_VBUSEN status		RW	0
6	VBUS V <sub>HOLD</sub> Pressure limiting control 0: Unlimited pressure 1: Pressure limiting		RW	1
5	V <sub>HOLD</sub> Set up 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 <sub>HOLD</sub> Set up Bit 1		RW	0
3	V <sub>HOLD</sub> Set up Bit 0		RW	0
2	Reserved and unchangeable			
1	VBUS Current limit control enable signal 0: shut down; 1: turn on		RW	X
0	VBUS Current limit control open time limit current selection 0: 500mA ; 1:100mA		RW	0

REG 31H:V<sub>OFF</sub> Shutdown voltage setting

Defaults: X3H

Bit	description		R/W	Defaults
7-4	Reserved and unchangeable			
3	Sleep Mode PWRON Short press to wake up function enable setting:			

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	0 : Short press to turn off the wake-up function 1 : Short press to turn on the wake-up function this bit Automatically clear after writing 0 , So every time you enter Sleep Need to write again before mode 1		
2	V <sub>OFF</sub> Set up Bit2	000-2.6V ; 001-2.7V ; 010-2.8V ;	RW 0
1	V <sub>OFF</sub> Set up Bit1	011-2.9V ; 100-3.0V ; 101-3.1V ;	RW 1
0	V <sub>OFF</sub> Set up Bit0	110-3.2V ; 111-3.3V	RW 1

REG 32H: shutdown settings, battery detection and CHGLED pin control

Defaults: 46H

Bit	description	R/W	Defaults
7	the way A Shutdown control Write this bit 1 Will close AXP192 The output battery monitoring	RW	0
6	function setting bit: 0: shut down; 1: turn on	RW	1
5-4	CHGLED Pin function setting 00: High resistance 01: 25% 1Hz Flashing 10: 25% 4Hz Flashing 11: Output low level	RW	00
3	CHGLED Pin control settings 0: Controlled by charging function 1: By register REG 32HBit[5:4] control	RW	0
2	Reserved and unchangeable		
1-0	N_OE From low to high AXP192 Shutdown delay Late time 00: 0.5S ; 01: 1S ; 10: 2S ; 11: 3S	RW	10

REG 33H: charge control 1

Defaults: C8H

Bit	description	R/W	Defaults
7	Charge function enable control bit, including internal channel and external channel 0: shut down, 1: turn on	RW	1
6:5	Charging target voltage setting 00:4.1V ; 01:4.15V ; 10: 4.2V ; 11:4.36V	RW	10
4	Charging end current setting 0: Charging current is less than 10% End charging when set value 1: Charging current is less than 15% End charging when set value	RW	0
3-0	Internal channel charging current setting 0000: 100mA ; 0001: 190mA ; 0010: 280mA ; 0011: 360mA ; 0100: 450mA ; 0101: 550mA ; 0110: 630mA ; 0111: 700mA ;	RW	1000

	1000: 780mA ; 1001: 880mA ; 1010: 960mA ; 1011: 1000mA ; 1100: 1080mA ; 1101:1160mA ; 1110:1240mA ; 1111:1320mA		
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REG 34H: Charge control 2

Defaults: 41H

Bit	description		R/W	Defaults
7	Precharge timeout setting Bit1	00: 30 min ; 01: 40min ;	RW	0
6	Precharge timeout setting Bit0	10: 50min ; 11: 60min	RW	1
5-3	External channel charging current setting range 300-1000mA , 100mA/step , Defaults 300mA		RW	000
2	External channel enable setting during charging 0: shut down; 1: turn on		RW	0
1	Timeout setting in constant current mode Bit1	00: 7Hours ; 01: 8Hours ;	RW	0
0	Timeout setting in constant current mode Bit0	10: 9Hours ; 11: 10Hours	RW	1

REG 35H: Backup battery charging control

Defaults: 22H

Bit	description		R/W	Defaults
7	Backup battery charging enable control 0: shut down; 1: turn on		RW	0
6:5	Backup battery charging target voltage setting 00: 3.1V ; 01:3.0V ; 10: 3.0V ; 11: 2.5V		RW	01
4-2	Reserved and unchangeable			
1:0	Backup battery charging current setting	00: 50uA ; 01: 100uA ; 10: 200uA ; 11: 400uA	RW	10

REG 36H: PEK key parameter setting

Defaults: 5DH

Bit	description		R/W	Defaults
7	Boot time setting Bit1	00: 128mS ; 01: 512mS ;	RW	0
6	Boot time setting Bit0	10: 1S ; 11: 2S.	RW	1
5	Long press time setting Bit1	00: 1S ; 01: 1.5S ;	RW	0
4	Long press time setting Bit0	10: 2S ; 11: 2.5S.	RW	1

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3	Automatic shutdown function setting when the key duration is longer than the shutdown duration 0: shut down; 1: turn on	RW	1
2	After the power is started PWROK Signal delay 0:32mS ; 1:64mS	RW	1
1	Shutdown duration setting Bit1	00: 4S ; 01: 6S ; 10: 8S ; 11: 10S.	0
0	Shutdown duration setting Bit0		1

REG 37H: DC-DC working frequency setting

Defaults: 08H

Bit	description	R/W	Defaults
7-4	Reserved and unchangeable		
3	DC-DC Switching frequency setting Bit 3	Change every level 5% ,Defaults 1.5MHz	1
2	DC-DC Switching frequency setting Bit 2		0
1	DC-DC Switching frequency setting Bit 1		0
0	DC-DC Switching frequency setting Bit 0		0

REG 38H:V<sub>LTF-charge</sub> Battery charging low temperature threshold setting

Defaults: A5H

Bit	description	R/W	Defaults
7-0	Battery low temperature threshold setting when charging, M	RW	A5H
	M*10H , when M=A5H Time corresponding 2.112V ;can Corresponding voltage 0V~3.264V		

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

REG 39H:V<sub>HTF-charge</sub> Battery charging high temperature threshold setting

Defaults: 1FH

Bit	description	R/W	Defaults
7-0	The battery high temperature threshold setting when charging, NN	RW	1FH
	NN*10H , when N=1FH ,correspond 0.397V ;can Corresponding voltage 0V~3.264V		

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

REG 3AH: APS low battery level 1

Defaults: 68H

Bit	description	R/W	Defaults
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7-0	APS Low battery setting level 1	RW	68H
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REG 3BH: APS low battery level 2

Defaults: 5FH

Bit	description	R/W	Defaults
7-0	APS Low battery setting level 2	RW	5FH

REG3AH , REG3BH corresponding APS The voltage is set to the following relationship (assuming the register value is n):

$$V_{warning} = 2.8672 + 1.4mV * n * 4$$

REG 3CH:  $V_{LTF-discharge}$  Battery discharge low temperature threshold setting

Defaults: FCH

Bit	description	R/W	Defaults
7-0	The battery low temperature threshold setting when discharging, $M * 10H$ , when M=FCH Time corresponding 3.226V ;can Corresponding voltage 0V~3.264V	RW	FCH

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

REG 3DH:  $V_{HTF-discharge}$  Battery discharge high temperature threshold setting

Defaults: 16H

Bit	description	R/W	Defaults
7-0	The battery high temperature threshold setting during discharge, $N * 10H$ , when N=16H ,correspond 0.282V ; Yes Should voltage 0V~3.264V	RW	16H

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

REG 80H: DC-DC working mode selection

Defaults: E0H

Bit	description	R/W	Defaults
<u>7-4</u>	Reserved and unchangeable		
3	DC-DC1 Working mode control	RW	0
2	DC-DC2 Working mode control		
1	DC-DC3 Working mode control		
0	Reserved and unchangeable		

0: PFM/PWM Automatic switching  
1: fixed PWM



## REG 82H: ADC enable 1

Defaults: 83H

Bit	description		R/W	Defaults
7	battery voltage ADC Enable	0: shut down, 1: turn on	RW	1
6	Battery current ADC Enable		RW	0
5	ACIN Voltage ADC Enable		RW	0
4	ACIN Current ADC Enable		RW	0
3	VBUS Voltage ADC Enable		RW	0
2	VBUS Current ADC Enable		RW	0
1	APS Voltage ADC Enable		RW	1
0	TS Pin ADC Function enable		RW	1

## REG 83H: ADC enable 2

Defaults: 80H

Bit	description		R/W	Defaults
7	AXP192 Internal temperature monitoring ADC Enable	0: shut down, 1: turn on	RW	1
<del>6-4</del>	Reserved and unchangeable			
3	GPIO0 ADC Function enable	0: shut down, 1: turn on	RW	0
2	GPIO1 ADC Function enable		RW	0
1	GPIO2 ADC Function enable		RW	0
0	GPIO[3] ADC Function enable		RW	0

## REG 84H: ADC sampling rate setting, TS pin control

Defaults: 32H

Bit	description		R/W	Defaults
7	ADC Sampling rate setting Bit 1 ADC Sampling	25×2 <sup>n</sup> The sampling rates are 25 , 50 , 100 , 200Hz	RW	0
6	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: Externally independent ADC Input path		RW	0
1-0	TS Pin current output mode setting	00: shut down	RW	1
		01: Output current when charging	RW	0

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		10: ADC Input during sampling to save power 11: Always on	
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### REG 85H: ADC input range

Defaults: X0H

Bit	description		R/W	Defaults
7-4	Reserved and unchangeable			
3	GPIO3 ADC Input range	0:0-2.0475V 1:0.7-2.7475V	RW	0
2	GPIO2 ADC Input range		RW	0
1	GPIO1 ADC Input range		RW	0
0	GPIO0 ADC Input range		RW	0

### REG 86H: GPIO1 ADC IRQ rising edge threshold setting

Defaults: FFH

Bit	description	R/W	Defaults
7-0	One LSB for 8mV	RW	FF

### REG 87H: GPIO1 ADC IRQ falling edge threshold setting

Defaults: 00H

Bit	description	R/W	Defaults
7-0	One LSB for 8mV	RW	00

### REG 8AH: Timer control

Defaults: 00H

Bit	description	R/W	Defaults
7	Timer expired write 1 Clear this state	RW	0
6-0	Set the timing time in minutes Write all 0 Turn off this timer	RW	000000

REG 8BH: VBUS pin monitoring SRP function control

Defaults: 00H

Bit	description	R/W	Defaults
7-6	Reserved and unchangeable		
5-4	VBUS Effective voltage setting 00:4.0V ; 01:4.15V ; 10: 4.45V ; 11:4.55V VBUS Valid Detection	RW	00
3	function settings: 0: shut down, 1: turn on	RW	0
2	VBUS Session Detection function settings: 0: shut down, 1: turn on	RW	0
1	Discharge VBUS Discharge function setting 0: shut down VBUS The discharge resistance; 1: use VBUS Discharge resistance	RW	0
0	Charge VBUS Charging function settings 0: disconnect VBUS Charging resistance 1: use VBUS Charging resistor to VBUS Recharge	RW	0

REG 8FH: Function settings such as over temperature shutdown

Defaults: 01H

Bit	description	R/W	Defaults
7-3	Reserved and unchangeable	RW	0
2	AXP192 Internal over-temperature shutdown function setting 0: Not shut down 1: Shutdown	RW	0
1-0	Reserved and unchangeable		

REG 90H: GPIO0 function setting

Defaults: 07H

Bit	description	R/W	Defaults
7-3	Reserved and unchangeable	RW	0
2	GPIO0 Pin function setting Bit 2	RW	1
1	GPIO0 Pin function setting Bit 1		
0	GPIO0 Pin function setting Bit 0		

000: NMOS Open drain output  
 001: Universal input function  
 010: Low noise LDO  
 011: Keep  
 100: ADC enter  
 101: Low output  
 11X: Floating

REG 91H: Output voltage setting when GPIO0 is in LDO mode

Defaults: A0H

Bit	description	R/W	Defaults
7-4	GPIO0 LDO Output voltage setting in mode 0000: 1.8V ; 0001: 1.9V ; 0010: 2.0V ; 0011: 2.1V ; 0100: 2.2V ; 0101: 2.3V ; 0110: 2.4V ; 0111: 2.5V ; 1000: 2.6V ; 1001: 2.7V ; 1010: 2.8V ; 1011: 2.9V ; 1100: 3.0V ; 1101: 3.1V ; 1110: 3.2V ; 1111: 3.3V	RW	1010
3-0	Reserved and unchangeable		

REG 92H: GPIO1 function setting

Defaults: 07H

Bit	description	R/W	Defaults
7-3	Reserved and unchangeable	RW	0
2	GPIO1 Pin function setting Bit 2 000: NMOS Open drain output 001: Universal input function 010: PWM1 Output, high level is VINT ,Do not	RW	1
1	GPIO1 Pin function setting Bit 1 Can be less than 100K Pull-down resistor 011: Keep	RW	1
0	GPIO1 Pin function setting Bit 0 100: ADC enter 101: Low output 11X: Floating	RW	1

REG 93H: GPIO2 function setting

Defaults: 07H

Bit	description	R/W	Defaults
7-3	Reserved and unchangeable	RW	0
2	GPIO2 Pin function setting Bit 2 000: NMOS Open drain output 001: Universal input function 010: PWM2 Output, high level is VINT ,Do not	RW	1
1	GPIO2 Pin function setting Bit 1 Can be less than 100K Pull-down resistor 011: Keep	RW	1
0	GPIO2 Pin function setting Bit 0 100: ADC enter 101: Low output 11X: Floating	RW	1

REG 94H: GPIO[2:0] signal state setting and monitoring

Defaults: 00H

Bit	description		R/W	Defaults
7	Reserved and unchangeable		R	
6	GPIO2 Input state	0: Input low level 1: Input high level	R	
5	GPIO1 Input state		R	
4	GPIO0 Input state		R	
3	Reserved and unchangeable			
2	GPIO2 Output settings	0: Output low level, ground NMOS turn on 1: Output floating, grounded NMOS shut down	RW	0
1	GPIO1 Output settings		RW	0
0	GPIO0 Output settings		RW	0

REG 95H: GPIO[4:3] pin function setting

Defaults: 00H

Bit	description		R/W	Defaults
7	GPIO[4:3] control: 1 : GPIO Features		RW	0
6-4	Reserved and unchangeable		RW	0
3:2	GPIO4 Pin function setting Bit 1-0	00: External charging control 01: NMOS Open drain output port 4 10: Universal input port 4 11: Undefined	RW	00
1:0	GPIO3 Pin function setting Bit 1-0	00: External charging control 01: NMOS Open drain output port 3 10: Universal input port 3 11: ADC enter	RW	00

REG 96H: GPIO[4:3] signal state setting and monitoring

Defaults: 00H

Bit	description		R/W	Defaults
7-6	Reserved and unchangeable		R	

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5	GPIO4 Input state	0: Input low level	R	
4	GPIO3 Input state	1: Input high level	R	
3-2	Reserved and unchangeable			
1	GPIO4 Output settings	0: Output low level, NMOS turn on	RW	0
0	GPIO3 Output settings	1: Floating, NMOS shut down	RW	0

REG 97H: GPIO[2:0] as the pull-down setting when input

Defaults: 00H

Bit	description	R/W	Defaults
7-3	Reserved and unchangeable		
2	GPIO2 Pull-down resistance control when used as input 0: Turn off the pull-down resistor	RW	0
1	GPIO1 Pull-down resistance control when used as input 1: Use pull-down resistor	RW	0
0	GPIO0 Pull-down resistance control when used as input	RW	0

REG 98H: PWM1 output frequency setting

Defaults: 00H

Bit	description	R/W	Defaults
7-0	PWM1 Output frequency setting X	RW	00H

REG 99H: PWM1 duty cycle setting 1

Defaults: 16H

Bit	description	R/W	Defaults
7-0	PWM1 Duty cycle setting Y1	RW	16H

REG 9AH: PWM1 duty cycle setting 2

Defaults: 0BH

Bit	description	R/W	Defaults
7-6	PWM1 Duty cycle setting Y2	RW	0BH

REG 9BH: PWM2 output frequency setting

Defaults: 00H

Bit	description	R/W	Defaults
7-0	PWM2 Output frequency setting X	RW	00H

REG 9CH: PWM2 duty cycle setting 1

Defaults: 16H

Bit	description	R/W	Defaults
7-0	PWM2 Duty cycle setting Y1	RW	16H

REG 9DH: PWM2 duty cycle setting 2

Defaults: 0BH

Bit	description	R/W	Defaults
7-6	PWM2 Duty cycle setting Y2	RW	0BH

Note: PWM Output frequency =  $2.25\text{MHz} / (X+1) / Y1$  PWM Output  
 duty cycle =  $Y2 / Y1$

REG 9EH: N\_RSTO (GPIO5) pin function setting

Defaults: 20H

Bit	description	R/W	Defaults
7	N_RSTO Pin function setting 0: N_RSTO , LDO1 Condition monitoring; 1: Universal input and output port 5	RW	0
6	N_RSTO As a general purpose input and output port 5 Set up 0: NMOS Open-drain output; 1: Universal input function	RW	0
5	N_RSTO As output port 5 Time setting 0: Output low level, NMOS turn on; 1: Floating, NMOS shut down	RW	1
4	N_RSTO As input port 5 State when 0: Input low level; 1: Input high level	R	
3-0	Reserved and unchangeable	RW	0000

### REG 40H: IRQ enable 1

Defaults: D8H

Bit	description	R/W	Defaults
7	ACIN Overpressure IRQ Enable	RW	1
6	ACIN Access IRQ Enable	RW	1
5	ACIN Move out IRQ Enable	RW	0
4	VBUS Overpressure IRQ Enable	RW	1
3	VBUS Access IRQ Enable	RW	1
2	VBUS Move out IRQ Enable	RW	0
1	VBUS Available but less than V <sub>HOLD</sub> IRQ Enable	RW	0
0	Reserved and unchangeable	RW	0

### REG 41H: IRQ enable 2

Defaults: FFH

Bit	description	R/W	Defaults
7	Battery access IRQ Enable	RW	1
6	Battery removed IRQ Enable	RW	1
5	Battery activation mode IRQ Enable	RW	1
4	Exit battery activation mode IRQ Enable	RW	1
3	Charging IRQ Enable	RW	1
2	finished charging IRQ Enable	RW	1
1	Battery over temperature IRQ Enable	RW	1
0	Low battery IRQ Enable	RW	1

### REG 42H: IRQ enable 3

Defaults: 3BH

Bit	description	R/W	Defaults
7	AXP192 Internal overtemperature IRQ Enable	RW	0
6	The charging current is less than the set current IRQ Enable	RW	0
5	DC-DC1 The output voltage is less than the set value IRQ Enable	RW	1
4	DC-DC2 The output voltage is less than the set value IRQ Enable	RW	1
3	DC-DC3 The output voltage is less than the set value IRQ Enable	RW	1
2	Reserved and unchangeable		
1	Short key IRQ Enable	RW	1



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0	Long key IRQ Enable	RW	1
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REG 43H: IRQ enable 4

Defaults: C1H

Bit	description	R/W	Defaults
7	N_OE Boot up IRQ Enable	RW	1
6	N_OE Shutdown IRQ Enable	RW	1
5	VBUS effective IRQ Enable	RW	0
4	VBUS invalid IRQ Enable	RW	0
3	VBUS Session A/B IRQ Enable	RW	0
2	VBUS Session End IRQ Enable	RW	0
1	Reserved and unchangeable	RW	1
0	APS Low pressure IRQ Enable	RW	1

REG 4AH: IRQ enable 5

Defaults: 00H

Bit	description	R/W	Defaults
7	Timer expired IRQ Enable	RW	0
6-3	Reserved and unchangeable	RW	0
2	GPIO2 Input edge trigger IRQ Enable	RW	0
1	GPIO1 Input edge trigger IRQ Enable	RW	0
0	GPIO0 Input edge trigger IRQ Enable	RW	0

REG 44H: IRQ status 1

Defaults: 00H

Bit	description	R/W	Defaults
7	ACIN Overpressure IRQ status	RW	0
6	ACIN Access IRQ status	RW	0
5	ACIN Move out IRQ status	RW	0
4	VBUS Overpressure IRQ status	RW	0
3	VBUS Access IRQ status	RW	0
2	VBUS Move out IRQ status	RW	0
1	VBUS Available but less than V <sub>HOLD</sub> IRQ status	RW	0
0	Reserved and unchangeable	RW	0

### REG 45H: IRQ status 2

Defaults: 00H

Bit	description	R/W	Defaults
7	Battery access IRQ status	RW	0
6	Battery removed IRQ status	RW	0
5	Battery activation mode IRQ status	RW	0
4	Exit battery activation mode IRQ status	RW	0
3	Charging IRQ status	RW	0
2	finished charging IRQ status	RW	0
1	Battery over temperature IRQ status	RW	0
0	Low battery IRQ status	RW	0

### REG 46H: IRQ status 3

Defaults: 00H

Bit	description	R/W	Defaults
7	AXP192 Internal overtemperature IRQ status	RW	0
6	The charging current is less than the set current IRQ status	RW	0
5	DC-DC1 The output voltage is less than the set value IRQ status	RW	0
4	DC-DC2 The output voltage is less than the set value IRQ status	RW	0
3	DC-DC3 The output voltage is less than the set value IRQ status	RW	0
2	Reserved and unchangeable		
1	Short key IRQ status	RW	0
0	Long key IRQ status	RW	0

### REG 47H: IRQ status 4

Defaults: 00H

Bit	description	R/W	Defaults
7	N_OE Boot up IRQ status	RW	0
6	N_OE Shutdown IRQ status	RW	0
5	VBUS effective IRQ status	RW	0
4	VBUS invalid IRQ status	RW	0
3	VBUS Session A/B IRQ status	RW	0
2	VBUS Session End IRQ status	RW	0

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1	Reserved and unchangeable	RW	0
0	APS Low pressure IRQ status, APS Voltage is lower than Warning Leve2 Post-position, over Warning Level1  Will be cleared later 0	RW	0

### REG 4DH: IRQ status 5

Defaults: 00H

Bit	description	R/W	Defaults
7	Timer expired IRQ status	RW	0
6-3	Reserved and unchangeable	RW	0
2	GPIO2 Input edge trigger IRQ status	RW	0
1	GPIO1 Input edge trigger IRQ status	RW	0
0	GPIO0 Input edge trigger IRQ status	RW	0

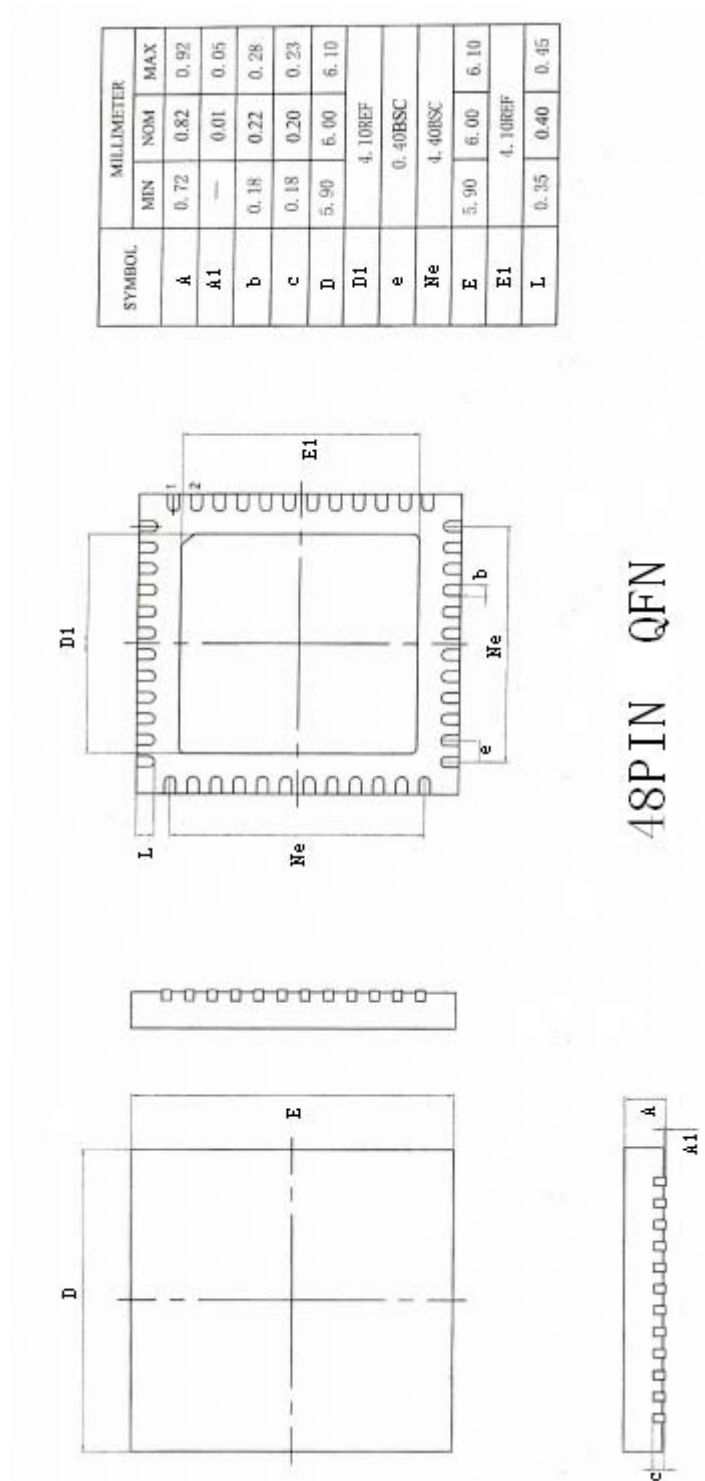
Note: all IRQ Write the corresponding bit of the status register 1 The corresponding status will be cleared.

### REG B8H: Coulomb counter control

Defaults: 00H

Bit	description	R/W	Defaults
7	Coulomb counter switch control	RW	0
6	Coulomb counter pause control, write this bit 1 The coulomb counting will be suspended, and this bit will be	RW	0
5	self-cleared to clear the coulomb counter control. Write this bit 1 The coulomb counter will be cleared, and at the	RW	0
4-0	same time this bit will be self-cleared and retained and cannot be changed	RW	0

10. Package (Package)



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