DATASHEET

AXP192

Enhanced single Cell Li-Battery and Power System Management IC

X-Powers

Catalog

1. Summary

AXP192 is a highly integrated power system management chip for single-cell lithium batteries (Li-ion or Li-polymer) and applications requiring multiple power conversion outputs, providing an easy-to-use and flexible configuration of a complete power solution that fully meets the relatively complex and precise control requirements of today's increasingly complex application processor systems for power.

The AXP192 integrates an adaptive USB-Compatible charger, 3 Buck DC-DC converter, 4Linear Voltage Regulator (LDO), voltage/current/temperature monitoring and other multi-channel 12-Bit ADCs. To ensure the safety and stability of the power supply system, the AXP192 also incorporates protection circuits for over/under voltage (OVP/UVP), over temperature (OTP), and over current (OCP).

The AXP192's Intelligent Power Select (IPS™) circuitry safely and transparently distributes power between the USB and external AC adapters, the lithium battery, and the application load, and allows the application to function with only external input power and no battery (or an over-discharged/damaged battery).

The AXP192 has triple-input capabilities such as external adapter and USB and battery, and supports rechargeable backup batteries.

AXP192 provides a Two Wire Serial Interface (TWSI) for communication with the host computer, through which the application processor can turn on or off certain power outputs, set their voltages, access internal registers and a variety of measurement data (including Fuel Gauge). The high accuracy (0.5%) of the power measurement data allows consumers to more clearly grasp the power usage status in real time, bringing consumers an unprecedented experience of device power usage.

The AXP192 is available in a 6mm x 6mm 48-pin QFN package.

Application Products

Handheld mobile devices

Intelligent cell phones, PMP/MP4, digital cameras, digital video cameras, handheld navigation devices GPS, PDA, handheld digital radio and television receivers

Mobile Internet Devices MID

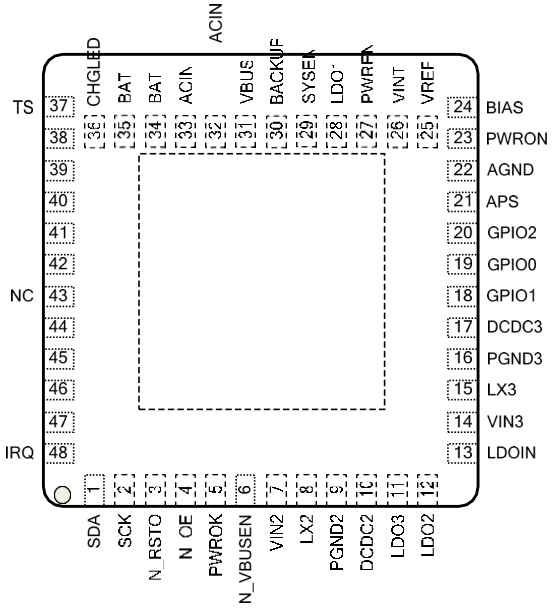
Digital photo frames, portable DVD players, ultra-portable mobile computers UMPC and UMPC-like, learning machines

Application Processor Circuit System

Application Processor systems

Other battery and multi-power application systems

Pin Definition



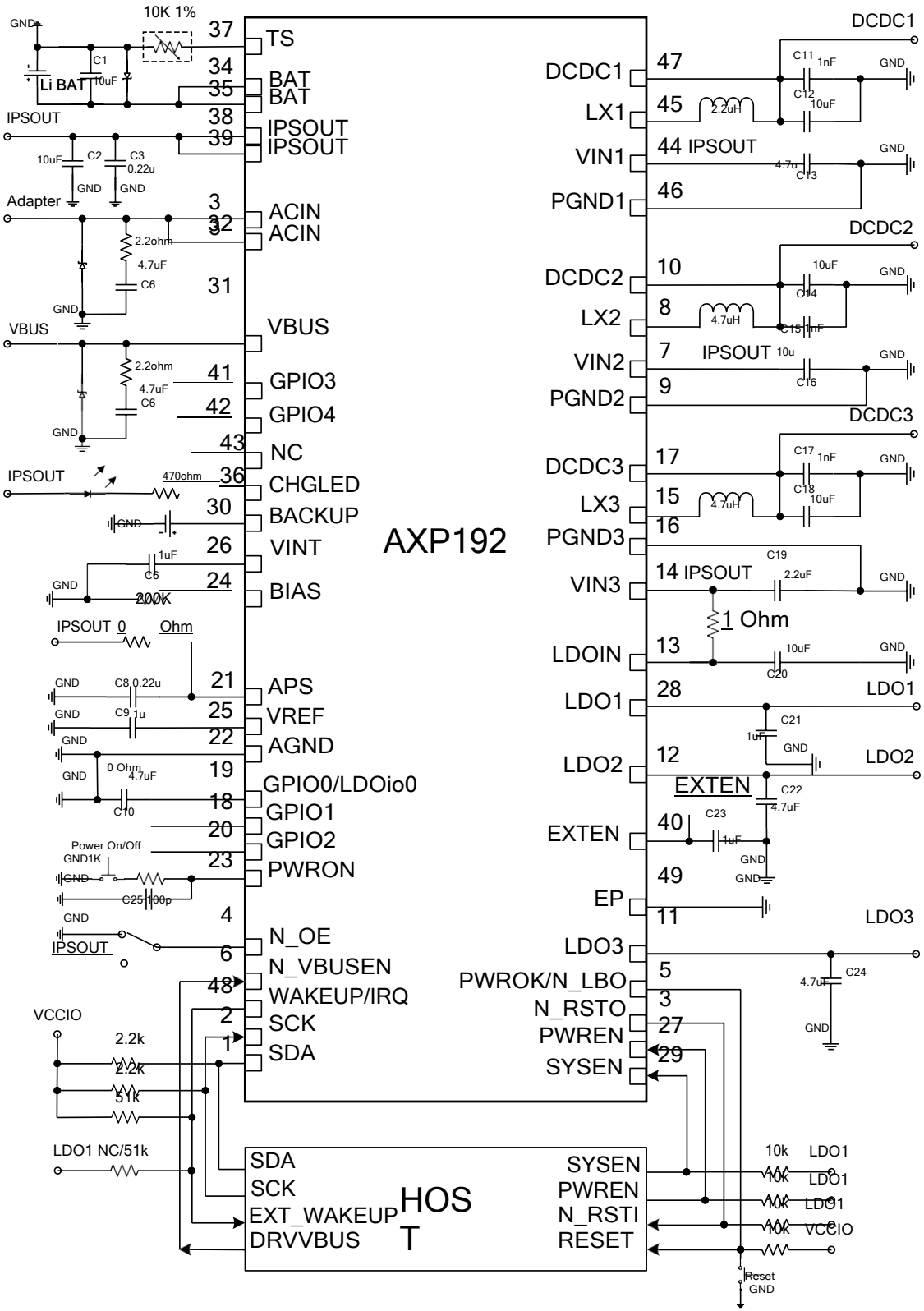
2. Feature

- **Power Management (IPS)**
  - Wide input voltage range. 2.9V~6.3V (AMR: -0.3V~11V)
  - Configurable and efficient Intelligent Power Balance "IPS™" system
  - Adaptive USB or AC adapter voltage and current limiting (4.4V/500mA/100mA)
  - Equivalent internal resistance of the internal ideal diode is less than 100mΩ
- **Fully integrated chargers (Charger)**
  - Built-in MOSFET up to 1.4A maximum charge current
  - Supports battery temperature monitoring
  - Full support for USB charging to meet regulatory requirements
  - High charging accuracy, error less than 0.5%
  - Support 4.1V/4.15V/4.2V/4.36V etc. batteries
  - Automatic charging process control
  - Direct drive LEDs to indicate charging status
  - Automatic adjustment of charging current according to system load conditions
- **Backup Battery**
  - Battery backup can be used to power the RTC module
  - Support backup battery charging, charge current can be set
- **3 Synchronous Buck Converter (DC-DC)**
  - DC-DC1: Adjustable between 0.7V~3.5V, 25mV/step, drive capacity 1.2A
  - DC-DC2: Adjustable between 0.7-2.275V, 25mV/step, drive capacity 1.6A, VRC support
  - DC-DC3: Adjustable between 0.7-3.5V, 25mV/step, drive capacity 0.7A
- **4 Linear Voltage Regulators (LDO)**
  - LDO1: 30mA, always active
  - LDO2: Low noise LDO, 1.8V~3.3V adjustable 100mV/step, drive capacity 200mA
  - LDO3: low noise LDO, 1.8-3.3V adjustable, 100mV/step, drive capacity 200mA
  - LDO_{IO0}: low noise LDO, 1.8-3.3V adjustable, 100mV/step, drive capacity 50mA

  Note: VRC, Voltage Ramp Control.

- **Signal Capture**
  - Built-in Road 16Bit12 ADC
  - Accepts 4external signal inputs
  - Provides current and voltage data for battery and external input power
  - Built-in high-precision coulometer and Fuelgauge system
  - Provides rich power management information, such as instantaneous power consumption (mA or mW), remaining battery power (% or mAh), charge status (%) and remaining battery life or charge time
  - Low power warning and protection
  - Provides chip temperature information
- **Application Processor Interface (Host Interface)**
  - Host can exchange data through the TWSI interface
  - Flexible and configurable interruption management
  - Flexible pin function setting, multiple GPIOs can be set to IO, PWM and other functions respectively
  - Built-in timer
  - Four sets of registers are provided for data storage when the system is shut down
- **System Management**
  - Can be soft reset or hard reset
  - Support soft shutdown or hard shutdown, support external wake-up power on
  - Support output voltage monitoring and self-diagnosis function
  - PWROK for system reset or shutdown indication
  - External power detection (inserted/removed/insufficient drive capability)
  - Soft start supported for all output voltages
  - Over/Under Voltage Protection (OVP/UVP)
  - Overcurrent Protection (OCP)
  - Over Temperature Protection (OTP)
  - Support OTG VBUS power status setting/monitoring
- **Fully Integration**
  - Internally generated high precision reference voltage (0.5%)
  - Built-in MOSFET
  - Customizable timing and output voltage

3. Typical Application



In On/off Manner A,5/48PIN pull high to IO power,29PIN pull high to LDO1,27PIN connect to LDO1 or HOST control signal
In On/off Manner B,5/48PIN pull high to LDO1,27/29PIN connect to HOST control signal

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_J	Operating Temperature Range Operating Temperature	-40 to 130	℃
Ts	Storage Temperature Range 贮存运溫度	-40 to 150	℃
TLEAD	Maximum Soldering Temperature (at leads, 10sec) Solder temperature	300	℃
VESD	Maximum ESD stress voltage, Human Body Model Anti-static ability	>4000	V
P_D	Internal Power Dissipation Internal power consumption tolerance	2100	mW

5. Electrical Characteristics

V_{IN} = 5V, BAT = 3.8V, $_A$T=2 5° C

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
ACIN						
VIN	ACIN Input Voltage		3.8		6.3	V
IOUT	V $_{OUT}$Current Available Before Loading BAT	500mV Voltage Drop		2000		mA
VUVLO	ACIN Under Voltage Lockout			3.8		V
VOUT	IPS Output Voltage		2.9		5.0	V
RACIN	InternalIdealDiodeOn Resistance	PIN to PIN, ACIN to IPSOUT			200	mΩ
VBUS						
VIN	VBUS Input Voltage		3.8		6.3	V
IOUT	V $_{OUT}$Current Available Before Loading BAT	400mV Voltage Drop		500	900	mA
VUVLO	VBUS Under Voltage Lockout			3.8		V
VOUT	IPS Output Voltage		2.9		5.0	V
RVBUS	InternalIdealDiodeOn Resistance	PIN to PIN, VBUS to IPSOUT			300	mΩ
Battery Charger						
VTRGT	BAT Charge Target Voltage		-0.5%	4.2	+0.5%	V
ICHRG	Charge Current			780	1320	mA
ITRKL	Trickle Charge Current			10%		ICHRG

						mA
VTRKL	TrickleChargeThreshold Voltage			3.0		V
ΔVRECHG	RechargeBatteryThreshold Voltage	ThresholdVoltage Relative to VTARGET		-100		mV
TTIMER1	ChargerSafetyTimer Termination Time	Trickle Mode		40		Min
TTIMER2	ChargerSafetyTimer Termination Time	CC Mode		480		Min
IEND	EndofChargeIndication Current Ratio	CV Mode		10%	15%	ICHRG mA
Backup Battery						
VTRGT	Backup Battery Charge Target Voltage		2.5	3.0	3.1	V
ICHRG	Backup Battery Charge Current		50	200	400	uA
IBackup	CurrentwhenuseBackup Battery			10	15	uA
NTC						
VTL	ColdTemperatureFault Threshold Voltage	Charge	0	2.112	3.264	V
		Discharge		3.226		
VTH	Hot Temperature Fault Threshold Voltage	Charge	0	0.397	3.264	V
		Discharge		0.282		
VTE	NTC Disable Threshold Voltage	Falling Threshold Hysteresis		0.2		V
Ideal Diode						
Rds(on)	InternalIdealDiodeOn Resistance(BAT to IPSOUT)				100	mΩ

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
Off Mode Current						
IBATOFF	OFF Mode Current	BAT=3.8V		27		μA
ISUSPEND	USB VBUS suspend Mode current	BAT=3.8V, VBUS=5V. N_VBUSEN=1		86		μA

Logic						
VIL	Logic Low Input Voltage			0.3		V
VIH	Logic High Input Voltage			2		V
TWSI						
VCC	Input Supply Voltage			3.3		V
ADDRESS	TWSI Address			0x68		
fSCK	Clock Operating Frequency			400	1200	kHZ

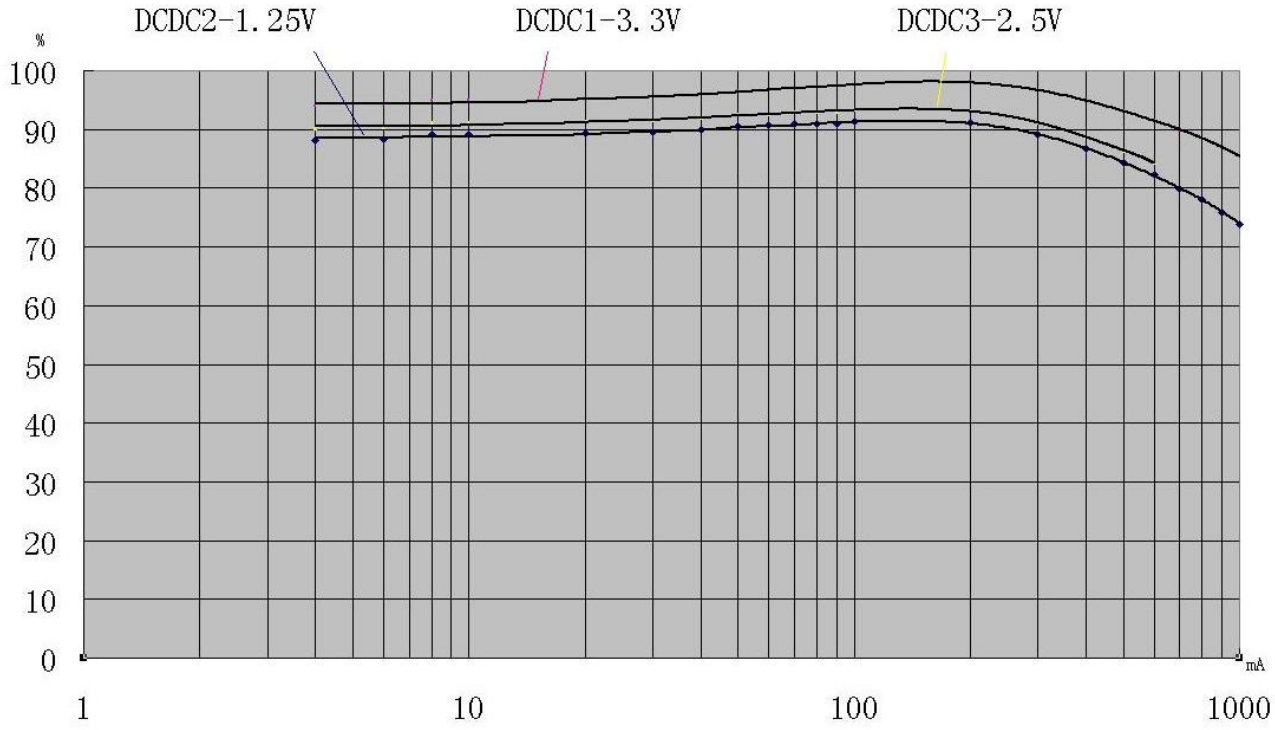
t_f	Clock Data Fall Time	2.2Kohm Pull High		60		ns
t_r	Clock Data Rise Time	2.2Kohm Pull High		100		ns
DCDC						
fOSC	Oscillator Frequency	Default		1.5		MHz
DCDC1						
IVIN1	Input Current	PFM Mode IDC1OUT =0		26		μA
ILIM1	PMOS Switch Current Limit	PWM Mode		1600		mA
IDC1OUT	Available Output Current	PWM Mode		1200		mA
VDC1OUT	Output Voltage	Default	0.7	3.3	3.5	V
DCDC2						
IVIN2	Input Current	PFM Mode IDC2OUT =0		20		μA
ILIM2	PMOS Switch Current Limit	PWM Mode		2300		mA
IDC2OUT	Available Output Current	PWM Mode		1600		mA
VDC2OUT	Output Voltage Range		0.7	1.25	2.275	V
DCDC3						
IVIN3	Input Current	PFM Mode IDC3OUT =0		20		uA
ILIM3	PMOS Switch Current Limit	PWM Mode		1000		mA
IDC3OUT	Available Output Current	PWM Mode		700		mA
VDC3OUT	Output Voltage Range		0.7	2.5	3.5	V

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
LDO1						
VLDO1	Output Voltage	LDO1I=1mA	-1%	1.25 1.8 2.5 3.3	1%	V
ILDO1	Output Current			30		mA
LDO2						
VLDO2	Output Voltage	LDO2I=1mA	-1%	3	1%	V
ILDO2	Output Current			200		mA
I_Q	Quiescent Current			100		μA
PSRR	Power Supply Rejection Ratio	LDO2I=60mA, 1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=3V , Io=150mA		28		μVRMS
LDO3						
VLDO3	Output Voltage	I=1mA$_{LDO3}$	-1%	3.3	1%	V
ILDO3	Output Current			200		mA
I_Q	Quiescent Current			100		μA
PSRR	Power Supply Rejection Ratio	LDO3I=10mA, 1KHz		TBD		dB

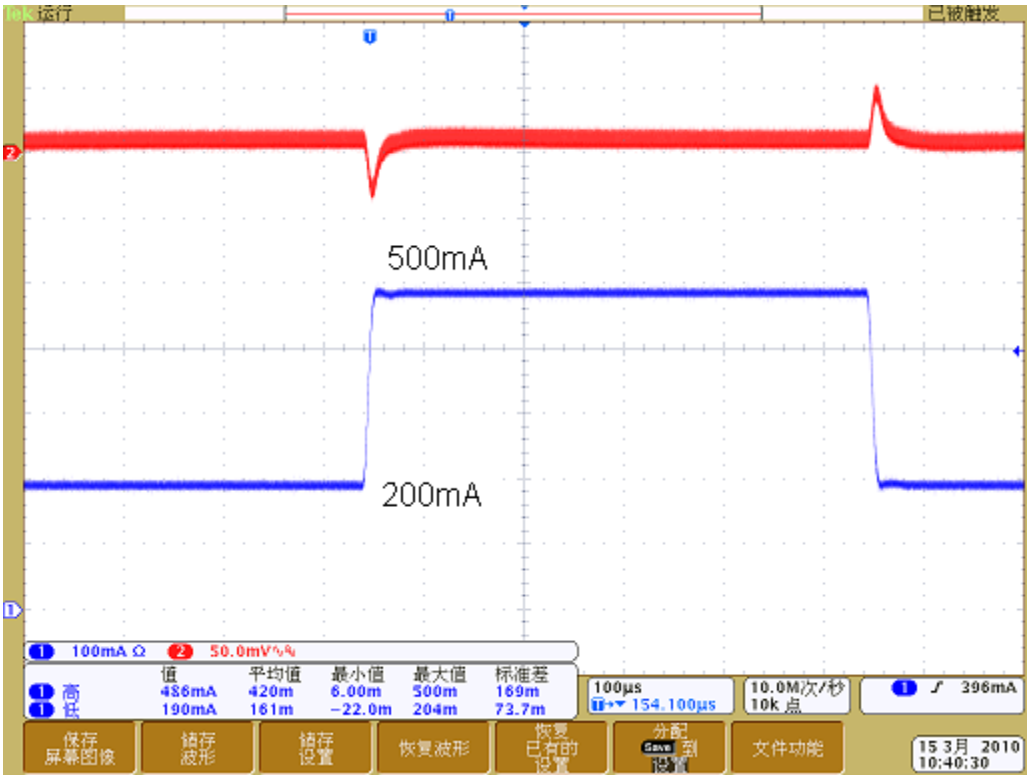
e_N	Output Noise,20-80KHz	Vo=1.8V , Io=150mA		18		μVRMS
LDO_{IO0}						
VLDOIO0	Output Voltage	I LDOIO0=1mA	-1%	3.3	1%	V
ILDOIO0	Output Current			50		mA
I_Q	Quiescent Current			90		μA
PSRR	Power Supply Rejection Ratio	I LDOIO0=10mA, 1KHz		TBD		dB
e_N	Output Noise,20-80KHz	Vo=1.8V, Io=30mA		18		μVRMS

6. Typical Characteristics

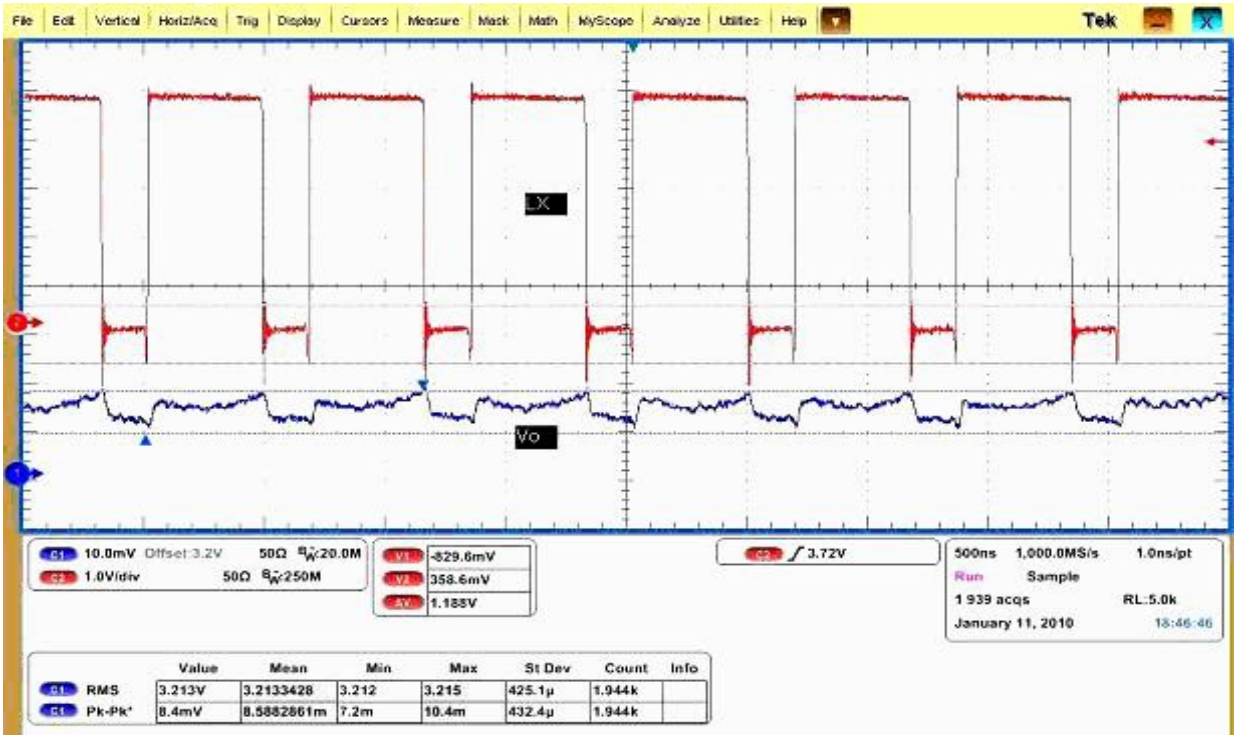
DC-DCEfficiencyvs.Load(3.8Vin)



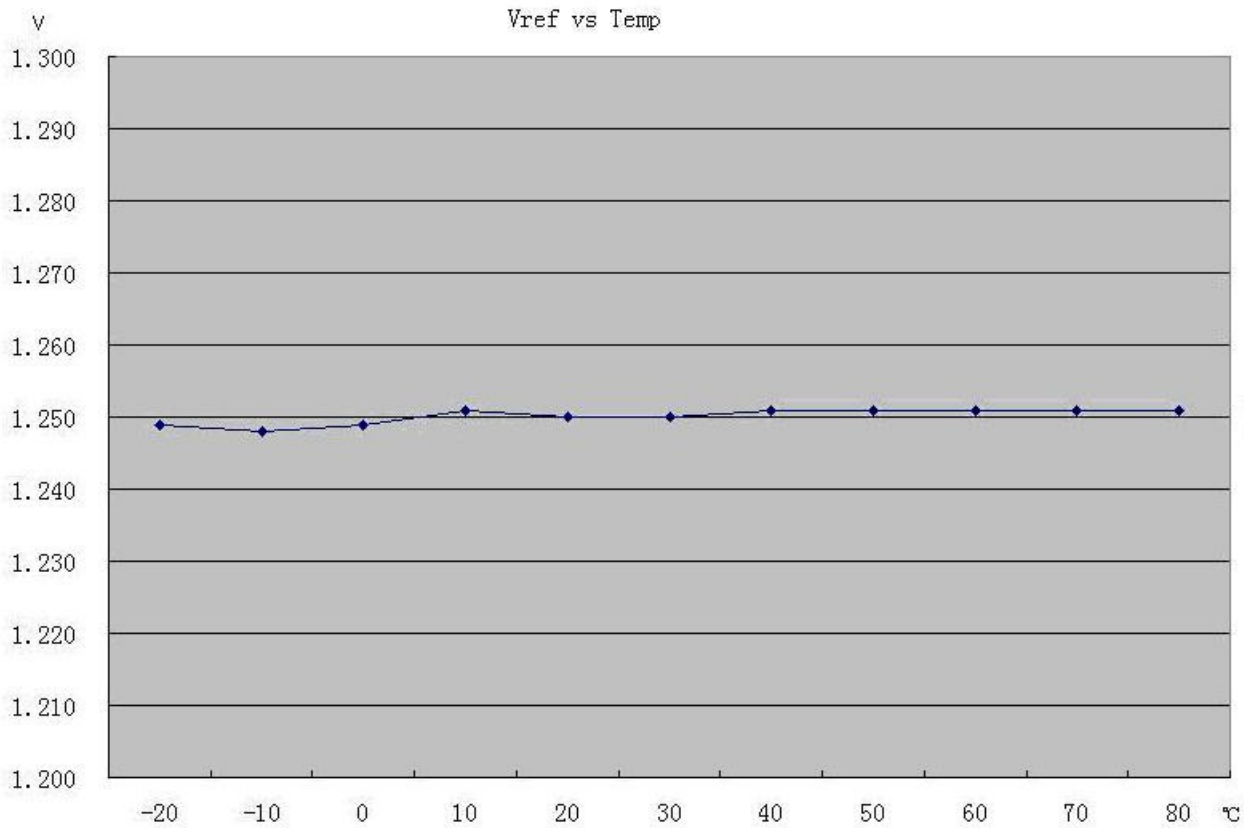
DC-DCLoadTransient(Typical)



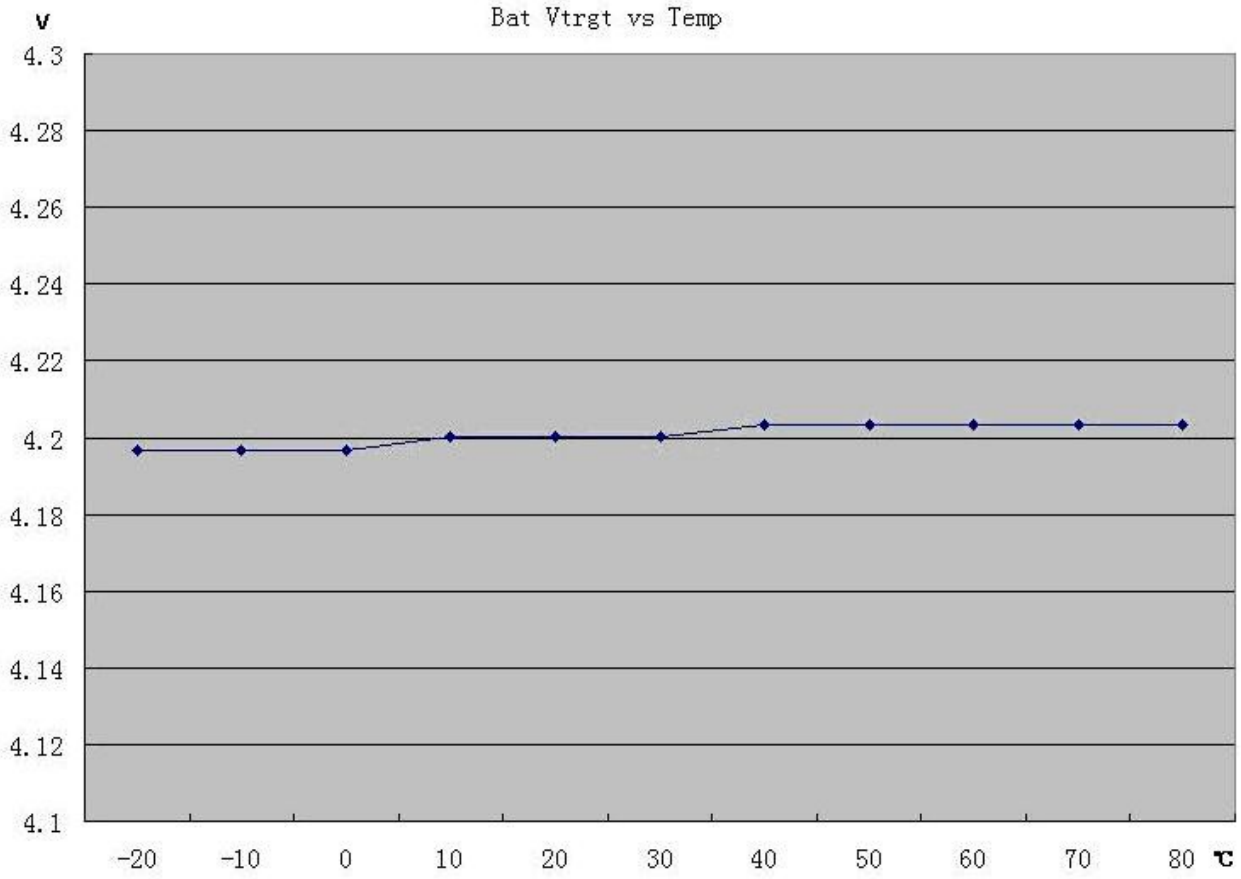
DC-DCRipple



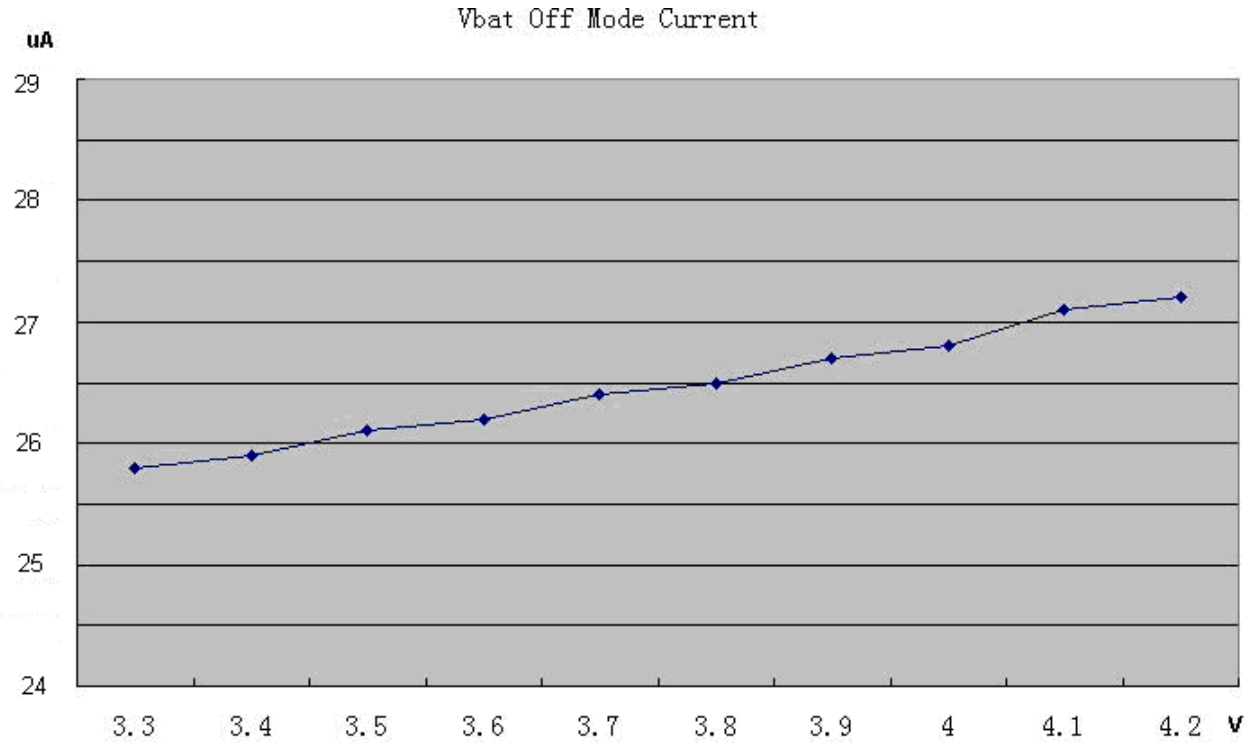
REF VvsTemperature



TRGT **VvsTemperature**



OffModeCurrentvsV_{BAT}

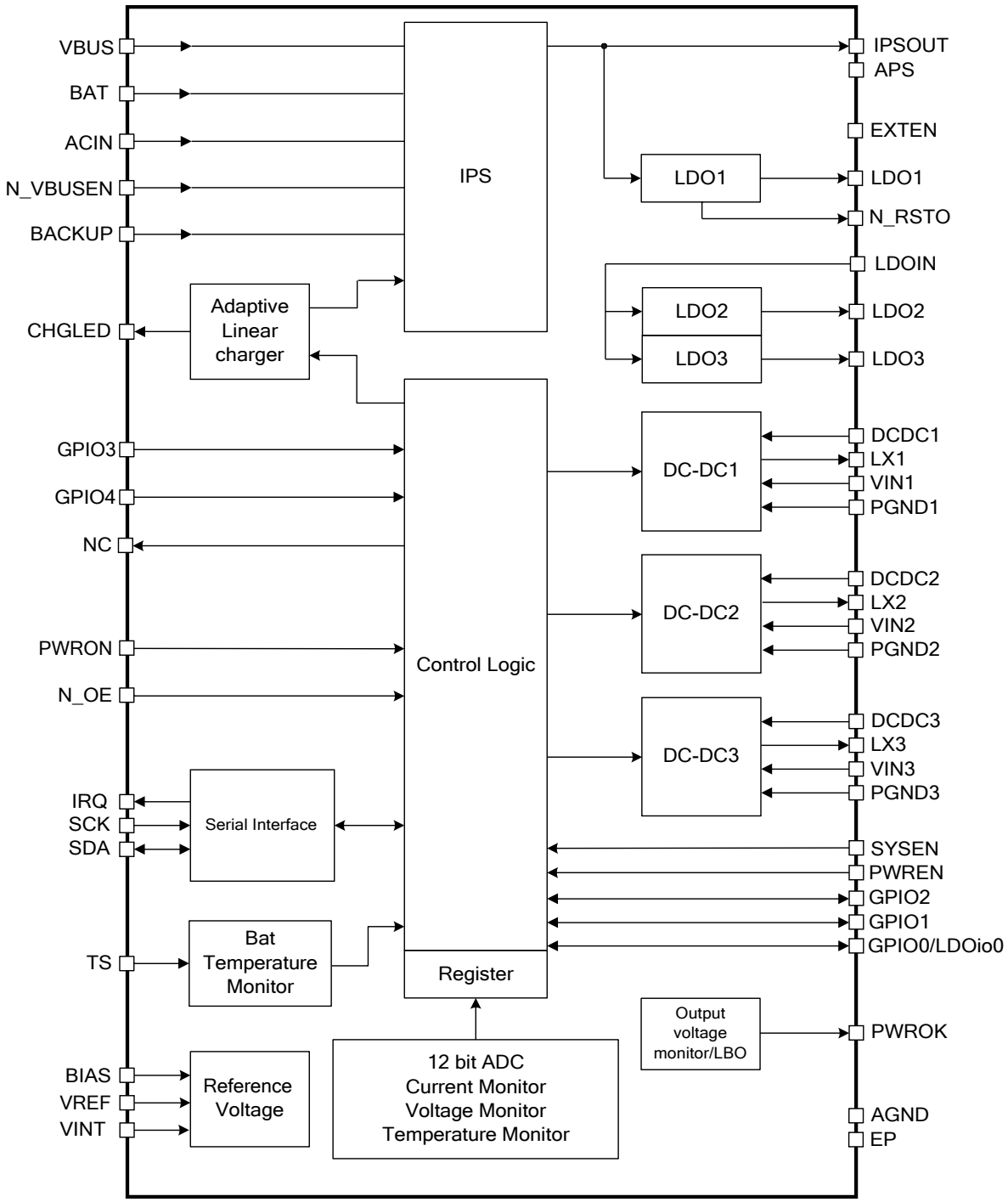


7. Pin Description

Num	Name	Type	Condition	Function Description
1	SDA	IO		Data pin for serial interface,normally it connects 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
3	N_RSTO	IO	REG9EH[7]	LDO1 Reset output
				GPIO[5]
4	N_OE	I		Power output on/off switch GND:on； IPSOUT:off
5	PWROK/	O	SYSEN=LDO1	Power good indication
	N_LBO			Low power detect output
6	N_VBUSEN	I		VBUS to IPSOUT Selection GND:IPSOUT select VBUS High:IPSOUT do not select VBUS
7	VIN2	PI		DCDC2 input source
8	LX2	IO		Inductor Pin for DCDC2
9	PGND2	G		NMOS Ground for DCDC2
10	DCDC2	I		DC-DC2 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
16	PGND3	G		NMOS GND for DCDC3
17	DCDC3	I		Feed back to DCDC3
18	GPIO1	IO	REG 93H[2:0]	GPIO 2
				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
21	APS	PI		Internal Power Input
22	AGND	G		Analog Ground

23	PWRON	I		Power On-Off key input, Internal 100k pull high to APS
24	BIAS	IO		External 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
28	LDO1	O		LDO1 output, for Host RTC block
29	SYSEN	IO		it is the High-voltage Power domain enable signal
30	BACKUP	IO		Backup battery pin
31	VBUS	PI		USB VBUS input
32, , , 33	ACIN	PI		Adapter input
34, , , 35	BAT	IO		Main Battery
36	CHGLED	O		charger status indication
37	TS	I		Battery Temperature sensor input or an external ADC input
38, , , 39	IPSOUT	PO		System power source
40	EXTEN	O		External power module Enable
41	GPIO3	I	REG95H[7]	GPIO3
42	GPIO4	I		GPIO4
43	NC	O		NC
44	VIN1	PI		DCDC1 input source
45	LX1	IO		Inductor Pin for DCDC1
46	PGND1	G		NMOS Ground for DCDC1
47	DCDC1	I		DCDC1 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 (FBD)



9. Control and Operating

When the AXP192 is operating, the TWSI interface SCK/SDA pin is pulled up to the system IO power, then the Host can use this interface to the AXP192
The application can be flexibly adjusted and monitored to obtain rich information about the working status of the application. Note: "Host" refers to the main processor of the application system.

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

9.1 Operating mode and reset (Power On/Off & Reset)

Operating mode button (PEK)

A key can be connected between the PWRON pin of AXP192 and GND as an independent power enable key (PEK)
The AXP192 automatically recognizes "long press" and "short press" of this button and responds accordingly.

Several Power on Source

1ACIN, VBUS, and battery access.
2, N_OE changes from high to low.
3, PEK.

Power On - Mode A

When the SYSEN pin is connected with LDO1, the AXP192 is in switch mode A.

When N_OE is low, the AXP192 is connected when a compliant main power supply (ACIN or VBUS>3.8V, battery voltage above shutdown voltage) is connected.
Will automatically power on (whether or not to automatically power on when external power is connected can be rewritten according to external requirements).

When N_OE is low and the power is off, the power-on action needs to be completed by PEK operation.

A change in N_OE from high to low in the presence of an external power supply or battery will also cause the AXP192 to power up.

AXP192 can be powered on by PEK (key press time over "ONLEVEL"). In practical application, the timing (Alarm) output signal of Host can also be connected to PWRON - in parallel with PEK, when the Alarm signal is active (low), it is equivalent to PEK pressed, and the AXP192 can also be powered on.

After power on, the DC-DC and LDO will be soft-started in a set timing sequence, and the corresponding power supply can be turned on/off by the Host or via the PWREN pin when the boot is complete.

Power Off - Mode A

When PEK "long press" time is longer than IRQLEVEL, Host can write "register REG32H[7]" to 1"" in PEK interrupt service program to notify AXP192 to enter power off state. The AXP192 will turn off all the power outputs except LDO1 when it enters the shutdown state.

The AXP192 will automatically shut down under the following conditions:

1, low input voltage, low power protection.

2, the output voltage of the power supply is too low due to excessive load, overload protection.

3High input voltage and overvoltage protection (see the "Power Path Management" section for details).

4, N_OE changes from low to high without shutting down for a set period of time.

5When PEK is greater than OFFLEVEL (default 6S), the system automatically turns off all outputs except LDO1.

The automatic protection mechanism of AXP192 can avoid irreversible damage of the powered devices when the application system is abnormal, thus protecting the whole system.

Power On - Mode B

When the SYSEN pin is not connected with LDO1, the AXP192 is in switch mode B.

In power-on mode B, each power output is controlled by SYSEN/PWREN. When SYSEN/PWREN is high, its corresponding power path output turns on, otherwise the output will turn off.

Unlike mode A, each power-on source generates only a low pulse on the WAKEUP pin to notify the HOST
Pull up SYSEN/PWREN to power on.

Note: This approach is envisioned for the PXA family and processor applications with similar power management approaches.

Power Off - Mode B

As the shutdown source described in shutdown mode A, each shutdown mode will not immediately shut down the output of AXP192 directly, but generate a low signal on N_LBO pin in order to notify the system to pull down SYSEN/PWREN to enter the shutdown mode; if the system does not pull down SYSEN/PWREN within 2S, AXP192 will shut down automatically; of course, HOST can also directly If the system does not pull down SYSEN/PWREN within 2S, the AXP192 will shut down automatically.

Note: Like Power On Mode B, Power Off Mode B is also envisioned for use in PXA family and processor applications with similar power management methods.

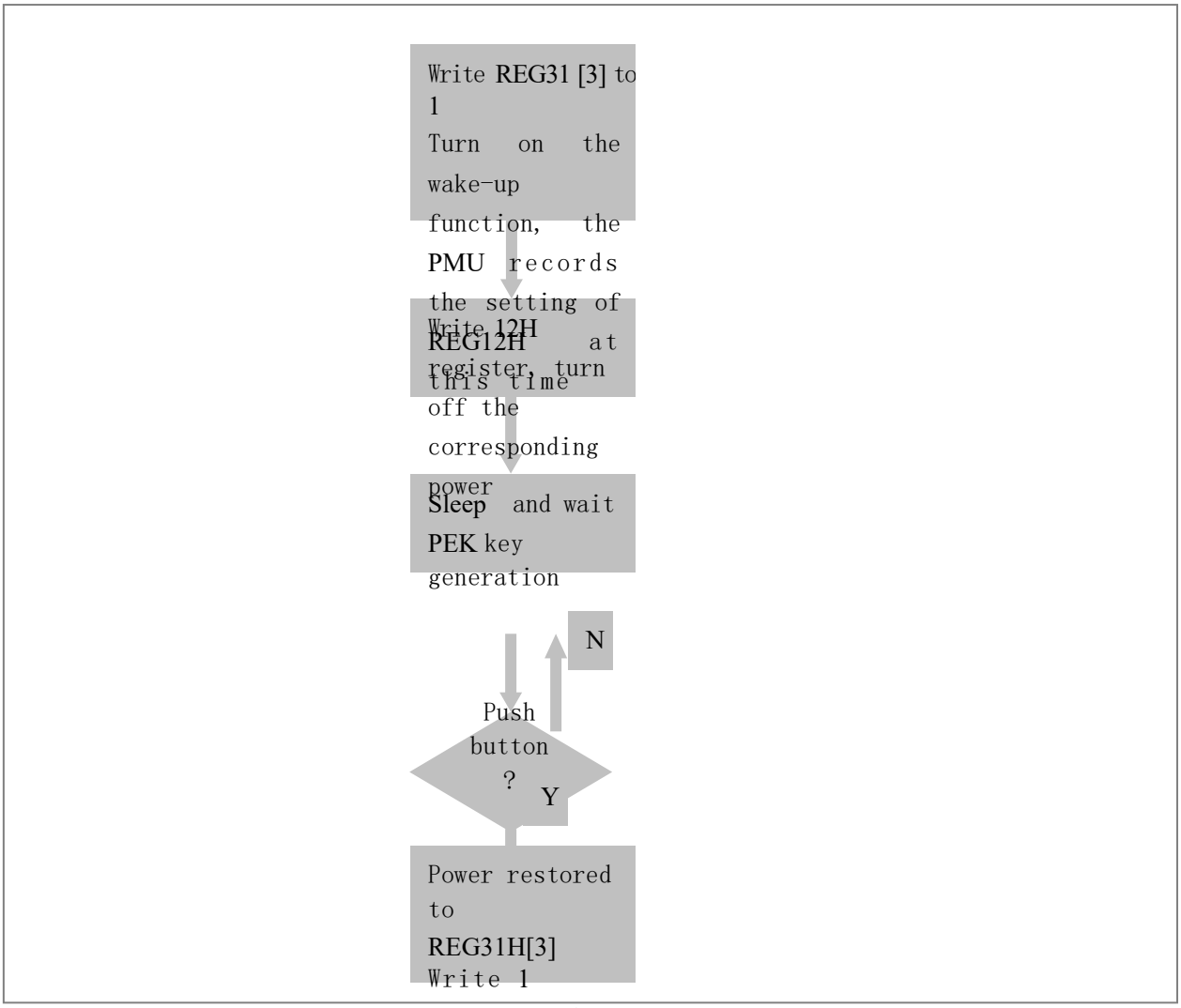
Note:Some processors are divided into two modes: Sleep (Sleep, SYSEN/PWREN one is low, one is high) and Deep Sleep (Deep Sleep, SYSEN/PWREN both are low, all outputs are off except LDO1).

Sleep and wakeup

In the case of MannerA and power on, if the system needs to enter Sleep mode and turn off

one or more of the power, it can be controlled by REG31[3] to decide whether the PEK short press signal triggers wakeup, so that the PMU will restore each output power to the state when REG31[3] is set to 1, and each of the power turned off in turn in accordance with the specified power-up The power supply is turned off in accordance with the specified power-up sequence.

The following is the control flow in Sleep and wakeup modes.



System reset function and output monitoring function (PWROK/N_LBO)

In switch mode A:

AXP192's PWROK can be used as the reset signal of the application system. During the power-on process 192of AXP, PWROK outputs a low level, and when the output voltage of each power supply stabilizes to the preset value, PWROK will be pulled up to achieve the power-on reset of the application system.

During the normal operation of the application system, the AXP192 monitors the voltage and load conditions of each output, and in case of overload or undervoltage, the PWROK immediately outputs a low level to reset the application system to prevent malfunction and possible data errors.

In switch mode B:

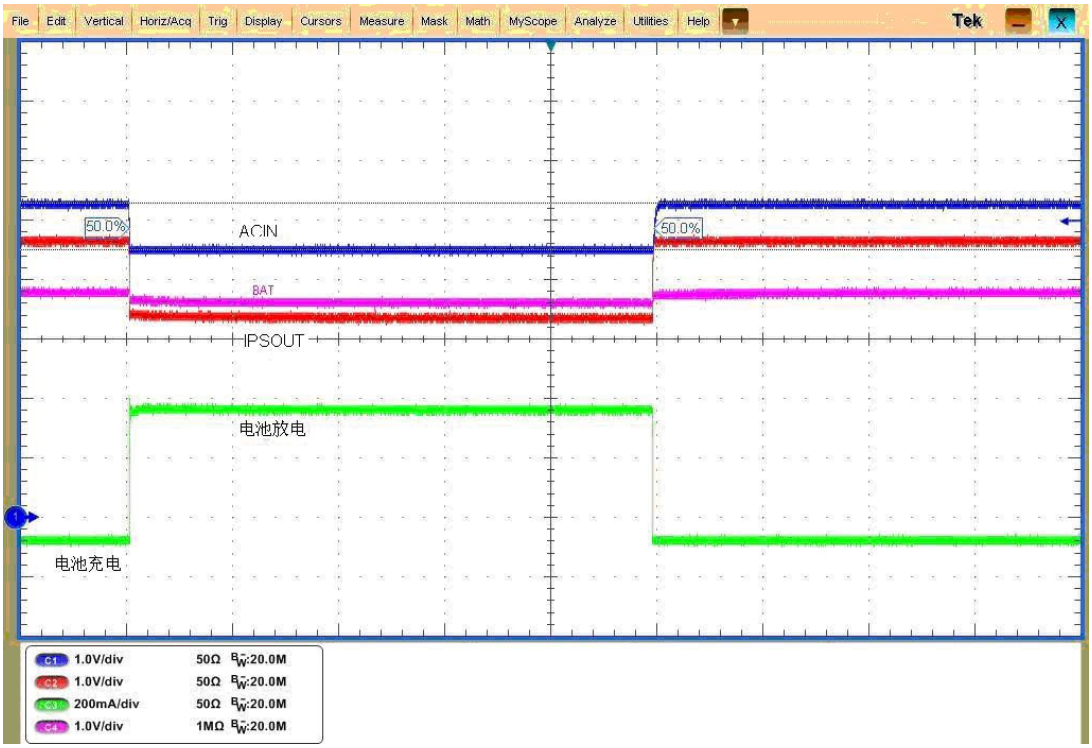
This pin is used as the N_LBO signal, and its low level is used to indicate that the system needs to enter the shutdown mode. The specific function is as described for shutdown

mode B.

9.2 Power path management (IPS)

The power input of AXP192 can come from Li-ion battery BAT, USB VBUS input, external power supply ACIN (e. g. AC Adapter AC Adapter), and IPS selects the suitable power distribution method according to the status of external power supply and Li-ion battery.

- Use of lithium battery power when connected to lithium battery only, with no external power input.
- (a) When an external power supply (VBUS or ACIN) is connected, priority is given to the external power supply.
- Immediate "seamless" switch to lithium battery power when external power is removed when the battery is connected.
- When both VBUS and ACIN are connected at the same time, priority is given to ACIN for power supply and charging of the lithium battery.
- If the ACIN drive capability is not sufficient at this time, the VBUS channel will be opened in time to realize the ACIN/VBUS joint power supply.
- If the drive capacity is still insufficient, the charge current will be reduced until0 the power is replenished by the battery; see the diagram below:



As shown above, when the ACIN load capacity is insufficient, the IPSOUT voltage drops and BAT turns from being charged to discharged with ACIN Together, they work together to provide load current.

The Host can access the internal registers of the AXP192 via TWSI to set the parameters of the IPS and read its feedback.

Voltage limiting/current limiting mode and straight-through mode

In order not to affect the USB communication, the VBUS channel operates in "VBUS voltage limit mode" by default. In this mode, the AXP192 will maintain the VBUS voltage at a settable reference voltage V_{HOLD} to meet the USB specification. V_{HOLD} defaults to 4.4V and can be adjusted in register Reg30H[5:3].

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

If the system only uses USB power supply and does not mind USB communication, or uses USB power adapter, you can set AXP192 to "VBUS direct mode" by modifying register REG30H[6], then AXP192 will give priority to meet the power demand of the application system. When the USB Host drive capability is too weak or the system power consumption is too strong and the VBUS voltage is below V_{HOLD}, the AXP192 will issue IRQ to inform the Host that the VBUS power supply capability is weak, indicating that the USB communication may be affected, and the subsequent action can be decided by the Host software.

Response of AXP192 when external power is plugged in

AXP192 can automatically detect the insertion action of external power supply. When AXP192 detects the external power insertion, it will automatically determine whether the external power is available or not, and set the result in the corresponding register, and issue IRQ to notify Host.

The following table shows the status bits of the external power supply registers and their meanings:

Status bits of the register	Meaning
Register REG00H[7]	Indicates if external adapter power ACIN is present
Register REG00H[6]	Indicates whether the external adapter power supply ACIN is available
Register REG00H[5]	Indicates if external power VBUS is present
Register REG00H[4]	Indicates whether external power VBUS is available
Register REG00H[3]	Indicates whether the voltage of VBUS is higher than V_{HOLD} when the external power supply VBUS is connected.
Register REG00H[1]	Indicates whether the external power supply ACIN/VBUS is shorted on the PCB
Register REG00H[0]	Indicates whether the system is triggered to power on by ACIN/VBUS

The flag bit "Indicate if VBUS voltage is higher than V_{HOLD} when external power supply VBUS is connected" allows Host to determine if VBUS is pulled down because of system load connection or because the external power supply itself is lower than V_{HOLD} when IRQ7 is received (referring to the weak VBUS power supply), thus facilitating Host software to decide whether to continue to work in voltage limit mode or change to pass-through mode.

Whether to use VBUS as input power

Whether AXP192 selects VBUS as input power will be decided by N_VBUSEN and register REG30H[7]:

N_VBUSEN	REG30H[7]	Input	Meaning

		power	
Low	0	VBUS	VBUS is active and no ACIN is available
Low	1	VBUS	VBUS can be used as input power when VBUS is active
High	1	VBUS	
High	0	ACIN/BAT	VBUS is not selected

Low power warning and low power protection (automatic shutdown)

The AXP192 can set two low power warning voltages, $V_{WARNING}$ and auto shutdown voltage V_{OFF}, and compare APS with them. Once APS is found to be lower than $V_{WARNING}$, IRQ19 is issued. if APS is lower than V_{OFF}, AXP192 automatically enters shutdown mode and turns off all outputs except LDO1.

$V_{WARNING}$ can be set to LEVEL1/LEVEL2, when the APS voltage drops below LEVEL2, IRQ30 will be issued, and this IRQ will be cleared automatically when the APS voltage rises to LEVEL1 again.

$V_{WARNING}$ and V_{OFF} default values can be set in registers REG3AH, REG3BH and REG31H Bit[2:0] respectively.

Overvoltage protection

When the external power supply voltage exceeds 6.3 V, the AXP19x emits IRQ1/4 to indicate that the external power supply is over-voltage. When the external power supply exceeds 7 V, the AXP192 Automatic shutdown.

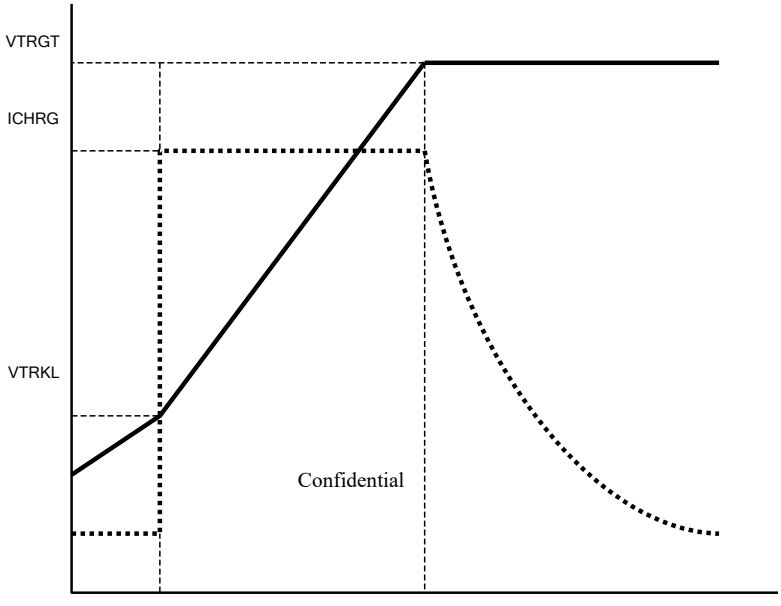
9.3 Adaptive Charger

The AXP192 integrates a constant-current/constant-voltage charger that automatically controls the charge cycle, with a built-in safety clock that automatically stops 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 activation functions, and a built-in temperature detection circuit can automatically reduce the charging current when the temperature is too high or too low.

Start of the adaptive charging process

The charger is in enable state by default (can be turned off by setting the register, see "Register REG33H"). When the external power supply is connected, AXP192 will first judge whether the external power supply is available for charging, when the condition of external power supply is met and the charging function is turned on at this time, AXP192 will automatically start the charging process and send IRQ to Host to indicate the start of charging process. At the same time, the CHGLED pin outputs a low level, which can drive an external light-emitting diode to indicate the charging status.

Charging process voltage and current diagram



ITRKL

Two flag voltages

$V_{TRGTTRGT}$ can be set by register, the default is 4.2V (see "Register REG33H[6:5]"). Meanwhile, when the external power supply voltage is low, AXP192 will automatically adjust the charging target voltage.

V_{RCH}, automatic re-charge voltage. $_{RCH}V=V-0_{TRGT}.1V$.

Charging current

The charging current can be set by register REG33H[3:0], the default value is 450mA or 780mA.

Charging process

If the battery voltage falls below 3.0V, the charger automatically enters pre-charge mode with a charging current of 1/10 of the preset value, and if the battery voltage does not reach 3.0V within minutes40 (this time can be adjusted, see "Register REG34H"), the charger automatically enters battery activation mode. See "Battery Activation Mode" for details.

Once the battery voltage goes above 3.0V, the charger starts to enter constant current mode. If the charging current is less than 65% of the preset value, the system sends IRQ17 to inform that "the external power supply drive capability is insufficient, the charging current does not reach the set value at this time, which will prolong the charging time, if you want to fully charge faster, it is recommended to replace the stronger power supply or turn off the power-consuming function".

When the battery voltage reaches the target voltage V_{TRGT}, the charger moves from constant current mode to constant voltage mode and the charging current is reduced.

When the charging current is lower than 10% or 15% of the preset value (settable, see "Register REG33H"), the charging cycle will end and charging will stop. When the battery voltage falls below V_{RCH} again, it will automatically start re-charging, and IRQ17 will be issued at the same time.

In non-pre-charge mode, if the charge cycle is not completed within minutes480 (this time can be adjusted, see "Register REG34H"), the charger will automatically enter the battery activation mode.

Battery activation mode

Whether going from pre-charge mode or from constant current charge mode to battery activation mode (in case of timer timeout), the AXP192 will issue IRQ10, indicating that the battery may be damaged.

In battery activation mode, the Charger always charges the battery at a low current and exits activation mode if it is able to bring the battery voltage up to V_{RCH}, while emitting

IRQ11.

AXP192 indicates in register REG01H whether the charger is in battery-activated mode.

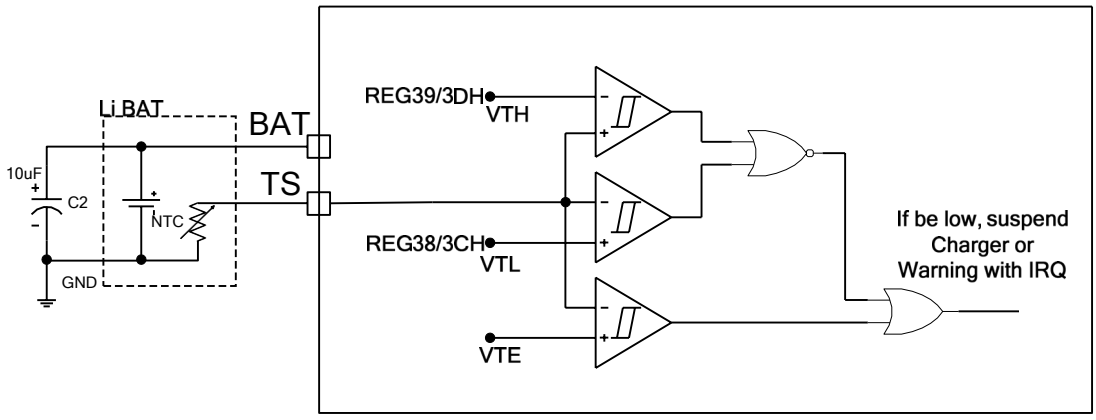
CHGLED

CHGLED pin is used to indicate charging status and alarm, it has four states: charging, not charging, battery abnormal alarm and external power over-voltage alarm. CHGLED is NMOS Open Drain (open drain type) output, it can drive a light-emitting diode directly through a current limiting resistor to indicate these four states. Its performance in each state is shown in the table below:

Status	Performance	Note
Being charged	Low Level	
Not on charge	High resistance	
Battery anomaly	25% duty 1Hz jump	Charger enters battery activation mode, or battery temperature is too high or too low
Overpressure	25% duty 4Hz jump	External power supply input voltage is too high

Battery temperature detection

The AXP192 can be used to monitor the battery temperature during charging/use by connecting a temperature sensitive resistor to the TS pin. The circuit diagram is shown below:



In the above figure, VTH/VTL are the threshold settings for high temperature and low temperature respectively, which can be set by register REG38H/39H/3CH/3DH respectively, VTE=0.2V. It is recommended to use NTC temperature sensitive resistor with 10Kohm at 25℃ and 1% accuracy. AXP192 will send a constant current on TS pin, this current can be set to 20uA, 40uA, 60uA, 80uA. 40uA, 60uA, 80uA four (see register REG84H), to adapt to different NTC resistors. This current flows through the temperature-sensitive resistor and gets a detection voltage, which is measured by AXP192 through ADC and compared with the set value to issue the corresponding IRQ or suspend charging.

If the temperature resistor is too large or too small, you can connect an additional resistor in parallel or in series with its path to extend its detection range. If the

battery does not have a temperature sensitive resistor, you can connect the TS pin to ground, then the AXP192 automatically disables the battery temperature monitoring function.

Battery Testing

AXP192 will automatically detect the presence of battery and identify in the register (see register REG01H) and issue IRQ13, IRQ14. The battery detection function can be turned on or off by Host control (see register REG32H).

9.4 Backup Batttery

The AXP192 supports backup battery use and charging. When no main power (BAT/ACIN/VBUS) is present, the LDO1 input source selects the backup battery and its output is used to maintain the system real-time clock and other parts of the circuitry.

When the main power supply exists, the backup battery can be charged by setting REG35H [7], whose target voltage is 3.0V by default (can be set by REG35H[6:5] setting), the default charging current of 200uA (also through REG35H[1:0] setting).

9.5 Multi-Power Outputs

The AXP192 provides multiple output voltages and functions as listed below:

Output path	Type	Default Voltage	Application examples	Drive Capability
DCDC1	BUCK	Can be set	3.3V I/O	1200 mA
DCDC2	BUCK	Can be set	1.25Vcore	1600 mA
DCDC3	BUCK	Can be set	2.5Vddr	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_{IO0}	LDO	Can be set	Vmic	50 mA

AXP192 includes 3synchronous step-down DC-DC, 4 LDO, various start-up timings and control modes. the operating frequency of DC-DC is 1.5MHz by default, which can be adjusted by setting registers, and small inductors and capacitors can be used in the periphery. 3 Each DC-DC can be set to PWM mode or auto mode (automatically switched by AXP192 according to the size of the load), see "REG80H".

DC-DC1/2/3

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

DCDC1/2/3 output capacitors are recommended to use 10uF X7R or more small ESR ceramic capacitors; when the output voltage is set above 2.5V, 2.2uH inductor is recommended, and below 2.5V, 4.7uH inductor is recommended, where the inductor saturation current should be more than 50% of the maximum demand current of this power path.

The following is a list of recommended inductors and capacitors:

Inductors		
Model	Current specification	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

TDK VLF5014ST-4R7M1R7	1700mA@4.7uH	98mOhm
tdk slf6045t-4r7n2r4-3pf	2400mA@4.7uH	27mOhm
Capacitance		
Model	Temperature Characteristics	tolerances
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 is always on and can provide uninterrupted power to the application's real-time clock circuit (RTC) with a drive capability of 30mA.

LDO2/3

The LDO2/3 features a low-noise design that provides power to the application's analog circuitry with a drive capability of 200mA.

LDO_{IO0}

The LDO_{IO0} also uses a low-noise design with an output drive capability of 50mA.

Soft Start

All DC-DCs and LDOs support soft-start output build-up to avoid sudden changes in current at start-up that can impact the input path.

Self-diagnosis: load monitoring and current limiting protection

All DC-DCs and LDOs have load monitoring and current limiting features that drop each output voltage when the load current exceeds its driving capability to protect the internal circuitry. The AXP192 automatically shuts down when the three DC-DC output voltages fall below 85% of the set voltage. At the same time, the system automatically records which output voltage is too low to cause shutdown (see register REG46H[5:2]) and issues the corresponding IRQ.

All DC-DCs do not require an external Schottky diode and resistive voltage divider feedback circuit. If a DC-DC is not required for an application, simply leave the corresponding LX pin unattended.

9.6 Default Voltage/Timing Setting

AXP192 can be customized for each power supply's default voltage, start-up timing, etc.

Start-up Timing: There are 0-7 levels of 8start-up, where the first level7 indicates that the power is not started by default. The other 0-6 levels indicate that the power is activated in steps 1-7 respectively. At the same time, you can set the start time interval of each step, the selectable range is1 ,4 , 16mS.

Default Voltage Setting: Each DCDC/LDO can be set to a range that includes a choice from the lowest to the highest voltage. See the "Default Configuration Notes" document for more information on this section.

9.7 Signal Capture System

The AXP192's multi-channel 12Bit ADC can measure battery voltage, battery current and external power supply voltage and current in addition to battery voltage, while the internal battery charge/discharge coulometer is integrated. host can calculate battery power more accurately based on these data, in addition to In addition, it can also calculate the real-time power consumption of the system, the remaining battery power, battery charging progress, the remaining battery life and remaining full time and other rich power information.

The enable control and sampling speed of each ADC can be set by registers REG82H, 83H, 84H, and the sampling results are stored in the corresponding registers, see the ADC data class of register description. The input range of GPIO[3:0] can be set by register REG85H. Whether the battery current direction is charging or discharging is indicated by register REG00H[2].

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℃	264.8℃
APS voltage	0mV	1.4mV	5.733V
TS pin input	0mV	0.8mV	3.276V
GPIO0	0/0.7V	0.5mV	2.0475/2.7475V
GPIO1	0/0.7V	0.5mV	2.0475/2.7475V
GPIO2	0/0.7V	0.5mV	2.0475/2.7475V
GPIO3	0/0.7V	0.5mV	2.0475/2.7475V

9.8 Multi-Function Pin Description

GPIO[4:0]

It can be used as GPIO[4:0], ADC Input (monitoring external signals), LDO, PWM, etc. See REG90H-96H description for details.

N_RSTO

LDO1 status monitoring signal (pull-up to LDO1) or GPIO5, see REG9EH description for usage.

CHGLED

Charging status indication, over-temperature and over-voltage alarm functions and GPO functions, see REG32H instructions for usage.

IRQ(WAKEUP)

When the AXP192 is in switch mode A, this pin is used as an IRQ status indication pin, and when an interrupt occurs, its output is pulled low to notify the HOST for interrupt processing and pull-up to the system IO power.

When AXP192 is in switch-on mode B, this pin is used as WAKEUP trigger signal indication to pull up to LDO1, and its specific function is described in switch-on mode B.

PWROK(N_LBO)

The system reset signal (pull-up to the system IO power supply)mode A and the shutdown indication signal (pull-up to the LDO1)switch-off mode B. See "System reset function and output monitoring function" in "9.2 Switch-on and reset".

9.9 Timer

AXP192 contains an internal timer, by setting register REG8AH[6:0] can change the timer value, its minimum resolution of minutes (Minute), the timer timeout will be set REG8AH[7].

9.10 HOST interface and interrupts (TWSI and IRQ)

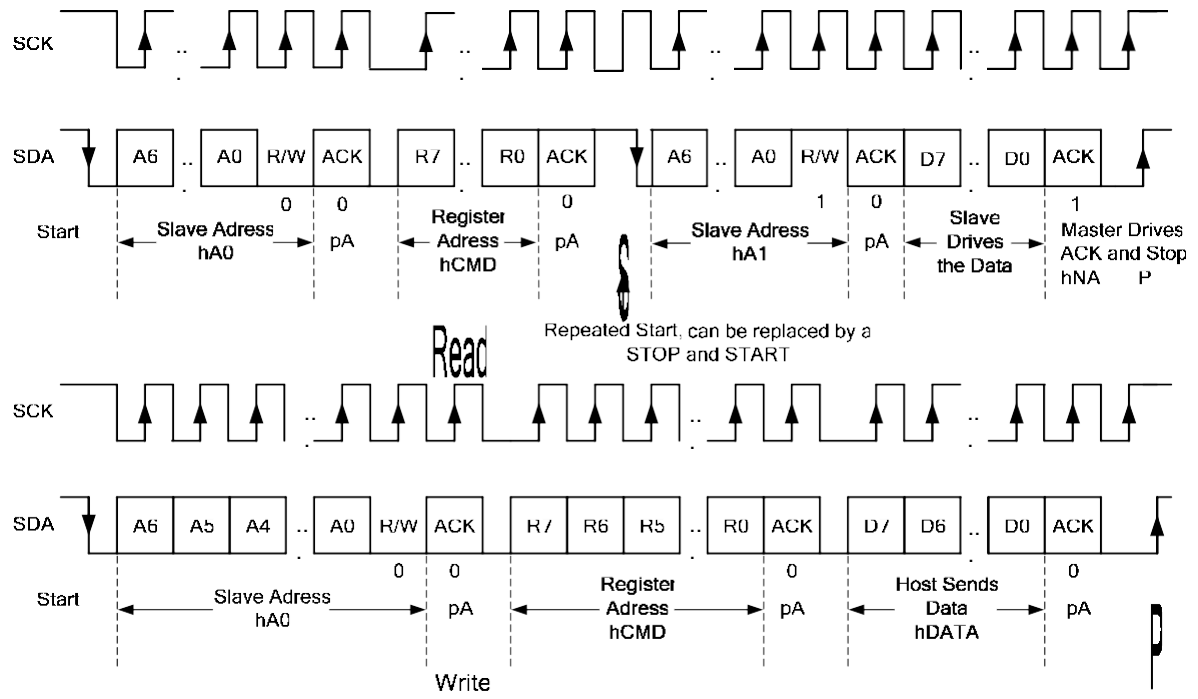


Figure 1: Single Read and Write

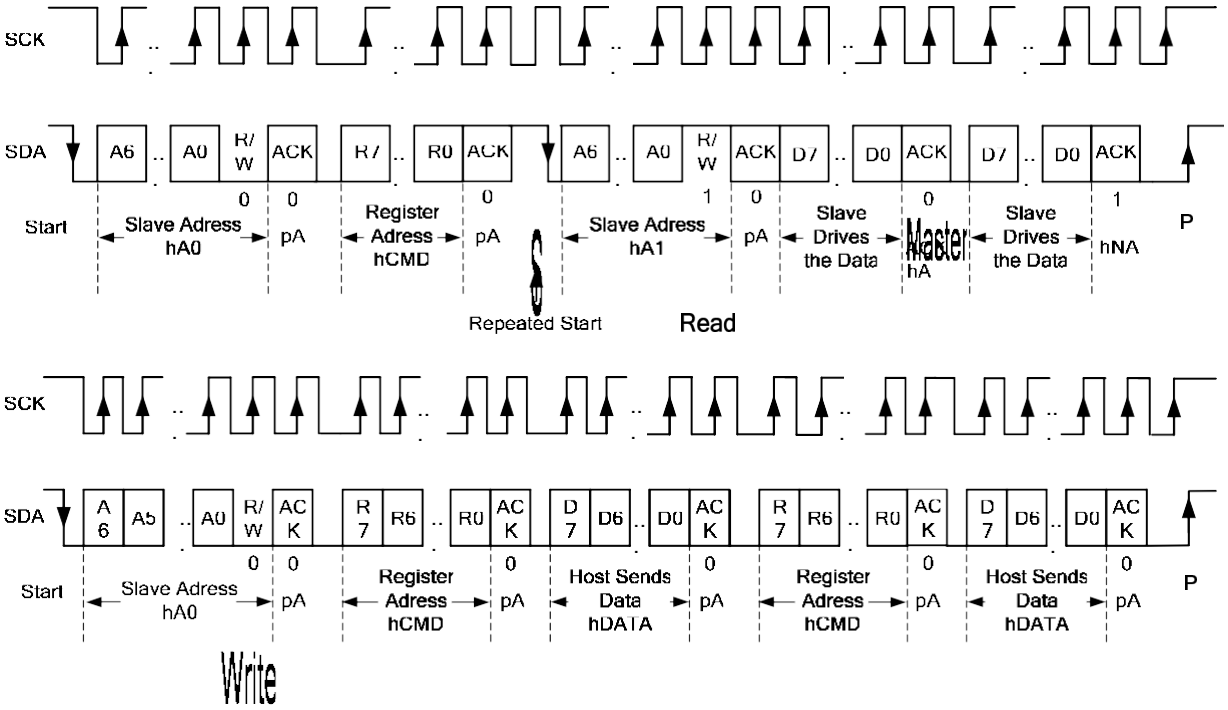


Figure 2: Multi Read and Write

The Host can access the registers of the AXP192 through the TWSI interface with the operation timings shown above, supporting standard 100KHz or

400KHz frequency, up to 1.2MHz, while supporting continuous read/write operation with device addresses 69H (read) and 68H (write).

When some specific events occur, AXP192 alerts Host by pulling down the interrupt mechanism of IRQ, and stores the interrupt status in the interrupt status register (see register REG44H, register REG45H, register REG46H, register REG47H), and writing to the corresponding status register bits 1clears the corresponding interrupt, when there is no interrupt event, IRQ output is pulled high (through the external pull-up 51K resistor). Each interrupt can be masked by the interrupt control register (see register REG40H, register REG41H, register REG42H, register REG43H).

Location	Interruption number	Meaning	Location	Interruption number	Meaning
Register 44H[7]	IRQ1	Power supply ACIN over voltage	Register 46H[7]	IRQ16	IC internal overtemperature
Register 44H[6]	IRQ2	Power supply ACIN plug-in	Register 46H[6]	IRQ17	Insufficient charging current
Register 44H[5]	IRQ3	Power ACIN Remove	Register 46H[5]	IRQ18	DCDC1 voltage is too low
Register 44H[4]	IRQ4	Power Supply VBUS Over Voltage	Register 46H[4]	IRQ19	DCDC2 voltage is too low
Register 44H[3]	IRQ5	Power VBUS plug-in	Register 46H[3]	IRQ20	DCDC3 Voltage too low
Register 44H[2]	IRQ6	Power VBUS Remove	Register 46H[2]	Reserved	
Register 44H[1]	IRQ7	VBUS voltage is less than VHOLD	Register 46H[1]	IRQ22	PEK short press
Register 44H[0]	Reserved		Register 46H[0]	IRQ23	PEK Long press
Register 45H[7]	IRQ8	Battery access	Register 47H[7]	IRQ24	N_OE Power on
Register 45H[6]	IRQ9	Battery Removal	Register 47H[6]	IRQ25	N_OE Shutdown
Register 45H[5]	IRQ10	Enter battery activation mode	Register 47H[5]	IRQ26	VBUS valid
Register 45H[4]	IRQ11	Exit battery activation mode	Register 47H[4]	IRQ27	VBUS Invalid
Register 45H[3]	IRQ12	Being charged	Register 47H[3]	IRQ28	VBUS Session Valid
Register 45H[2]	IRQ13	Charging completed	Register 47H[2]	IRQ29	VBUS Session End
Register 45H[1]	IRQ14	High battery temperature	Register 47H[1]	Reserved	
Register 45H[0]	IRQ15	Battery temperature too	Register 47H[0]	IRQ30	Low Power Warning

		low			

9.11 Registers

Group 11, Power Control Class

Address	Register Description	R/W	Default Value
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 Registers	R/W	XFH
23	DC-DC2 Voltage Setting Register	R/W	16H
25	DC-DC2 Voltage ramp parameter setting register	R/W	00H

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 Pass setting register	R/W	60H
31	V_{OFF} Shutdown voltage setting register	R/W	X3H
32	Power off, 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 charge low temperature alarm setting register	R/W	A5H
39	Battery charge high temperature alarm setting register	R/W	1FH
3A	APS Low Power Level1 Setting Register	R/W	68H
3B	APS Low Power Level2 Setting 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 operating 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 sample 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

Group 12, GPIO control class

Address	Register Description	R/W	Default Value

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

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

Group 13, Interrupt Control Class

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	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

Group 14, ADC Data Class

Address	Register Description	R/W
56	ACIN Voltage ADC Data High Bit8	R
57	ACIN Voltage ADC Data Low Bit4	R
58	ACIN Current ADC Data High Bit8	R
59	ACIN Current ADC data low bit4	R
5A	VBUS Voltage ADC data high 8 bits	R
5B	VBUS voltage ADC data low 4 bits	R
5C	VBUS Current ADC data high 8 bits	R
5D	VBUS Current ADC data low 4 bits	R
5E	AXP192 Internal Temperature Monitoring ADC Data High Bit8	R
5F	AXP192 Internal Temperature Monitoring ADC Data Low Bit4	R
62	TS input ADC data 8 bits higher, battery temperature monitored by default	R

63	TS input ADC data 4 bits lower, battery temperature monitored by default	R
64	GPIO0 Voltage ADC data high 8 bits	R
65	GPIO0 Voltage ADC data low 4 bits	R
66	GPIO1 Voltage ADC data high 8 bits	R
67	GPIO1 Voltage ADC data low 4 bits	R
68	GPIO2 Voltage ADC data high 8 bits	R
69	GPIO2 Voltage ADC data low 4 bits	R
6A	GPIO3 Voltage ADC data high 8 bits	R
6B	GPIO3 Voltage ADC data low 4 bits	R

70	Battery instantaneous power high 8 bits	R
71	Battery instantaneous power in 8 bits	R
72	Low battery instantaneous power 8 bits	R
78	Battery voltage high level8	R
79	Battery voltage low level4	R
7A	Battery charge current high 8 digits	R
7B	Battery charging current 5 bits lower	R
7C	Battery discharge current high 8 digits	R
7D	Battery discharge current 5 bits lower	R
7E	APS Voltage High 8-bit	R
7F	APS Voltage Low 4 bits	R

Note: The battery-powered power is calculated as

Pbat = Register value * Voltage LSB * Current LSB / 1000.

The voltage LSB is 1.1mV, the current LSB is 0.5mA, and the calculation results are in mW.

Address	Register Description	R/W	Default Value
B0	Battery charge coulometer data register [31:24]	R/W	00H
B1	Battery charge coulometer data register [23:16]	R/W	00H
B2	Battery charge coulometer data register [15:8]	R/W	00H
B3	Battery charge coulometer data register [7:0]	R/W	00H
B4	Battery discharge coulometer data register [31:24]	R/W	00H
B5	Battery discharge coulometer data register [23:16]	R/W	00H
B6	Battery discharge coulometer data register [15:8]	R/W	00H
B7	Battery discharge coulometer data register [7:0]	R/W	00H
B8	Coulometer control register	R/W	00H

Coulomb calculation method: C= 65536 * current LSB * (charge coulomb meter value - discharge coulomb meter value) 3600//ADC.

Among them: ADC sampling rate reference REG84H settings; current LSB is 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 exists	R
6	Indicates if ACIN is available	R
5	VBUS presence indication 0:VBUS does not exist;1:VBUS exists	R
4	Indicates whether VBUS is available	R
3	Indicates whether VBUS access is greater than V_{HOLD}	R
2	Indicates the direction of battery current 0:Battery is discharging;1:Battery is being charged	R

1	Indicates if the ACIN and VBUS inputs are shorted at the PCB	R
0	Indicates whether the boot source is ACIN or VBUS 0:Start source is not ACIN/VBUS; 1:Start source is ACIN/VBUS	R

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

Bit	Description	R/W
7	Indicates if the AXP192 is over temperature 0:not overtemperature; 1:overtemperature	R
6	Charging indication 0:Not charging or charging has been completed; 1:Charging	R
5	Battery presence status indication 0:No battery is connected to AXP192; 1:Battery is connected to AXP192	R
4	Reserved, unchangeable	R
3	Indicates whether the battery is in active mode 0:Not in battery activation mode; 1:Already in battery activation mode	R
2	Indicates whether the charging current is less than the desired current 0:Actual charging current is equal to the desired current; 1:Actual charging current is less than the desired current	R
1	AXP192 Switching mode indication 0:Mode A; 1:Mode B	R
0	Reserved, unchangeable	R

REG 02H:USB OTG VBUS status indication

Bit	Description	R/W
7-3	Reserved, unchangeable	
2	Indicates whether VBUS is valid, 1 means valid	R
1	Indicates whether VBUS Session A/B is valid, 1 means valid	R
0	Indicates Session End status, 1 means valid	R

REG 06-0BH:Data cache

Note:This data will be kept as long as one of the external power supply, battery or backup battery is present, and is not affected by switching on and off. Default value is F0/0F/00/FF/00/00H

REG 10H:EXTEN & DC-DC2 output control

Default value:XXH

Bit	Description		R/W	Default Value
7-3	Reserved, unchangeable			
2	EXTEN Switch Control	0:off;1:on	RW	X
1	Reserved, unchangeable			
0	DC-DC2 switching control	0:off;1:on	RW	X

Note: X means by customization, same for the following values of X.

REG 12H: Power output control

Default value:XXH

Bit	Description		R/W	Default Value
7	Reserved, unchangeable		RW	X
6	EXTEN Switch Control	0:off;1:on	RW	X
5	Reserved, unchangeable		RW	X
4	DC-DC2 switching control	0:off;1:on	RW	X
3	LDO3 switching control		RW	X
2	LDO2 Switch Control		RW	X
1	DC-DC3 switching control		RW	X
0	DC-DC1 switching control		RW	X

Note: REG12Hbit6/4 corresponds to REG10Hbit2/0 respectively.

REG 23H:DC-DC2 output voltage setting

Default value:16H

Bit	Description		R/W	Default Value
7-6	Reserved, 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 regulation parameter setting

Default value:00H

Bit	Description		R/W	Default Value
7-3	Reserved, unchangeable			
2	DC-DC2 VRC Enable Control 0:Open; 1:Close		RW	0
1	Reserved, unchangeable		RW	0
0	DC-DC2 VRC Voltage Rise Ramp Control	0: 25mV/15.625us=1.6mV/us 1: 25mV/31.250us=0.8mV/us	RW	0

REG 26H:DC-DC1 output voltage setting

Default value:68H

Bit	Description		R/W	Default Value
7	Reserved, 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

Default value:48H

Bit	Description		R/W	Default Value
7	Reserved, 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

Default value:CFH

Bit	Description		R/W	Default Value
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 pass-through management

Default value:6XH

Bit	Description		R/W	Default Value
7	VBUS when available VBUS-IPSOUT Pass selection control signal 0:The N_VBUSEN pin determines whether to open this path 1:VBUS-IPSOUT pass can be selected to open regardless of the status of N_VBUSEN		RW	0
6	VBUS V voltage $_{HOLD}$limit control 0:No pressure limit; 1:Pressure limit		RW	1
5	V $_{HOLD}$Setting Bit 2	000: 4.0V; 001: 4.1V; 010: 4.2V 011: 4.3V; 100: 4.4V; 101: 4.5V 110: 4.6V; 111: 4.7V	RW	1
4	V $_{HOLD}$Setting Bit 1		RW	0
3	V $_{HOLD}$Setting Bit 0		RW	0
2	Reserved, unchangeable			
1	VBUS current limit control enable signal 0:off;1:on		RW	X
0	VBUS current limit control opens time limit flow selection 0:500mA; 1:100mA		RW	0

REG 31H:V_{OFF} Power Off Voltage Setting

Default value:X3H

Bit	Description	R/W	Default Value

7-4	Reserved, unchangeable		
3	PWRON short press wake-up function enable setting in Sleep mode.		

	0: Short press to wake up function off 1: Short press to wake up function on This bit is automatically cleared0 after it is written, so you need to write it again every time before entering Sleep mode. 1			
2	V_{OFF}Set Bit2	000-2.6V. 001-2.7V. 010-2.8V. 011-2.9V. 100-3.0V. 101-3.1V. 110-3.2V. 111-3.3V	RW	0
1	V_{OFF}Set Bit1		RW	1
0	V_{OFF}Setting Bit0		RW	1

REG 32H: Power off setting, battery detection and CHGLED pin control

Default value:46H

Bit	Description		R/W	Default Value
7	Mode A Lower Shutdown Control Writing this bit will turn 1off the output of AXP192		RW	0
6	Battery monitoring function setting bit: 0:off; 1:on		RW	1
5-4	CHGLED pin function setting	00: High resistance 01: 25% 1Hz blinking 10: 25% 4Hz blinking 11: Output low	RW	00
3	CHGLED pin control settings	0: Controlled by charging function 1: Controlled by register REG 32HBit[5:4]	RW	0
2	Reserved, unchangeable			
1-0	AXP192 Shutdown delay after N_OE goes from low to high Late time	00: 0.5S; 01: 1S. 10: 2S; 11: 3S	RW	10

REG 33H: Charge control 1

Default value:C8H

Bit	Description	R/W	Default Value
7	Charge function enable control bit, including internal and external channels 0:off, 1:on	RW	1
6:5	Charging target voltage setting 00:4.1V; 01:4.15V; 10:4.2V; 11:4.36V	RW	10

4	End-of-charge current setting 0: End charging when charging current is less than 10% of the set value 1: End charging when charging current is less than 15% of setting value	RW	0
3-0	Internal path 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		

REG 34H: Charge control 2

Default value:41H

Bit	Description		R/W	Default Value
7	Pre-charge timeout setting Bit1	00: min30; 01: 40min. 10: 50min; 11: 60min	RW	0
6	Pre-charge timeout setting Bit0		RW	1
5-3	External path charging current setting Range 300-1000mA, 100mA/step, default 300mA		RW	000
2	External path enable setting during charging 0:off;1:on		RW	0
1	Timeout setting in constant current mode Bit1	00: 7Hours; 01: 8Hours. 10: 9Hours; 11: 10Hours	RW	0
0	Timeout setting in constant current mode Bit0		RW	1

REG 35H: Backup battery charging control

Default value:22H

Bit	Description		R/W	Default Value
7	Backup battery charge enable control 0:off;1: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, unchangeable			
1:0	Backup battery charging current setting	00: 50uA; 01: 100uA. 10: 200uA; 11: 400uA	RW	10

REG 36H:PEK key parameter setting

Default value:5DH

Bit	Description		R/W	Default Value
7	Power-on time setting Bit1	00: 128mS; 01: 512mS.	RW	0

6	Power-on time setting Bit0	10: 1S; 11: 2S.	RW	1
5	Long key time setting Bit1	00: 1S; 01: 1.5S.	RW	0
4	Long key time setting Bit0	10: 2S; 11: 2.5S.	RW	1

3	Auto power off function setting when the key time is longer than the power off time 0:off;1:on		RW	1
2	PWROK signal delay after power start is complete 0:32mS; 1:64mS		RW	1
1	Shutdown time setting Bit1	00: 4S; 01: 6S. 10: 8S; 11: 10S.	RW	0
0	Shutdown time setting Bit0		RW	1

REG 37H:DC-DC operating frequency setting

Default value:08H

Bit	Description		R/W	Default Value
7-4	Reserved, unchangeable			
3	DC-DC Switching Frequency Setting Bit 3	Change 5% per level, default 1.5MHz	RW	1
2	DC-DC Switching Frequency Setting Bit 2		RW	0
1	DC-DC Switching Frequency Setting Bit 1		RW	0
0	DC-DC Switching Frequency Setting Bit 0		RW	0

REG 38H:VLTF-charge Battery Charge Low Temperature Threshold Setting

Default value:A5H

Bit	Description		R/W	Default Value
7-0	Battery low temperature threshold setting during charging, M	M*10H, corresponding to 2.112V when M=A5H; can Corresponding voltage 0V~3.264V	RW	A5H

VLTF-charge = M * 10H * 0.0008V

REG 39H:VHTF-charge Battery Charge High Temperature Threshold Setting

Default value:1FH

Bit	Description	R/W	Default Value

7-0	Battery high temperature threshold setting during charging, N	N*10H, when N=1FH, corresponds to 0.397V; can Corresponding voltage 0V~3.264V	RW	1FH

VHTF-charge = N * 10H * 0.0008V

REG 3AH:APS low power level 1

Default value:68H

Bit	Description	R/W	Default Value

7-0	APS Low Power Setting Level 1	RW	68H

REG 3BH:APS low power level 2

Default value:5FH

Bit	Description	R/W	Default Value
7-0	APS Low Power Setting Level 2	RW	5FH

REG3AH, REG3BH corresponding to the APS voltage is set to the following relationship (assuming the register value of n):
Vwarning = 2.8672 + 1.4mV * n * 4

REG 3CH:VLTF-discharge Battery Discharge Low Temperature Threshold Setting

Default value:FCH

Bit	Description		R/W	Default Value
7-0	Battery low temperature threshold setting during discharge, M	M*10H, corresponding to 3.226V when M=FCH; can Corresponding voltage 0V~3.264V	RW	FCH

VLTF-discharge = M * 10H * 0.0008V

REG 3DH:VHTF-discharge Battery Discharge High Temperature Threshold Setting

Default value:16H

Bit	Description		R/W	Default Value
7-0	Battery high temperature threshold setting during discharge, N	N*10H, when N=16H, corresponds to 0.282V; can be used for Response voltage 0V~3.264V	RW	16H

VLTF-discharge = N * 10H * 0.0008V

REG 80H:DC-DC operating mode selection

Default value:E0H

Bit	Description	R/W	Default Value
7-4	Reserved, unchangeable		

3	DC-DC1 Operating mode control	0:PFM/PWM auto switching 1:Fixed PWM	RW	0
2	DC-DC2 operating mode control		RW	0
1	DC-DC3 operating mode control		RW	0
0	Reserved, unchangeable			

REG 82H:ADC Enable 1

Default value:83H

Bit	Description		R/W	Default Value
7	Battery Voltage ADC Enable	0:off, 1: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

Default value:80H

Bit	Description		R/W	Default Value
7	AXP192 Internal Temperature Monitoring ADC Enable	0:off, 1:on	RW	1
6-4	Reserved, unchangeable			
3	GPIO0 ADC function enable	0:off, 1: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 sample rate setting, TS pin control

Default value:32H

Bit	Description		R/W	Default Value
7	ADC Sample Rate Setting Bit 1	25×2^n	RW	0
6	ADC Sample Rate Setting Bit 0	The sampling rate is 25, 50 , , 100and 200Hz respectively	RW	0
5-4	TS pin output current setting: 00:20uA; 01:40uA; 10:60uA; 11:80uA		RW	11
3	Reserved, unchangeable			

2	TS Pin Function Selection 0: Battery temperature monitoring function, 1: External independent ADC input path		RW	0
1-0	TS pin current output method setting	00:Close	RW	1
		01:Output current during charging	RW	0

		10:ADC input when sampling, can save power 11:Always open		

REG 85H:ADC input range

Default value:X0H

Bit	Description		R/W	Default Value
7-4	Reserved, 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

Default value:FFH

Bit	Description	R/W	Default Value
7-0	One LSB is 8mV	RW	FF

REG 87H:GPIO1 ADC IRQ falling edge threshold setting

Default value:00H

Bit	Description	R/W	Default Value
7-0	One LSB is 8mV	RW	00

REG 8AH: Timer control

Default value:00H

Bit	Description	R/W	Default Value

7	Timer timeout Write Clear 1this status	RW	0
6-0	Set the timing time in minutes Write all then turn 0off this timer	RW	0000000

REG 8BH:VBUS pin monitoring SRP function control

Default value:00H

Bit	Description	R/W	Default Value
7-6	Reserved, unchangeable		
5-4	VBUS effective voltage setting 00:4.0V; 01:4.15V; 10:4.45V; 11:4.55V	RW	00
3	VBUS Valid detection function setting:0:off, 1:on	RW	0
2	VBUS Session detection function setting:0:off, 1:on	RW	0
1	Discharge VBUS Discharge Function Setting 0:Turn off the discharge resistor of VBUS; 1:Use the discharge resistor of VBUS	RW	0
0	Charge VBUS charging function setting 0:Disconnect VBUS charging resistor; 1:Use VBUS charging resistor to charge VBUS	RW	0

REG 8FH:Over-temperature shutdown and other function settings

Default value:01H

Bit	Description	R/W	Default Value
7-3	Reserved, unchangeable	RW	0
2	AXP192 Internal over-temperature shutdown function setting 0:No shutdown; 1:Shutdown	RW	0
1-0	Reserved, unchangeable		

REG 90H:GPIO0 function setting

Default value:07H

Bit	Description		R/W	Default Value
7-3	Reserved, unchangeable		RW	0
2	GPIO0 pin function setting Bit 2	000:NMOS open-drain output 001:Universal input function 010:Low noise LDO	RW	1
1	GPIO0 pin function setting Bit 1	011:Reserved 100:ADC input	RW	1

0	GPIO0 pin function setting Bit 0	101:Low output 11X:Float	RW	1

REG 91H:GPIO0 is the output voltage setting when LDO mode

Default value:A0H

Bit	Description	R/W	Default Value
7-4	GPIO0 Output voltage setting in LDO 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, unchangeable		

REG 92H:GPIO1 function setting

Default value:07H

Bit	Description		R/W	Default Value
7-3	Reserved, unchangeable		RW	0
2	GPIO1 pin function setting Bit 2	000:NMOS open-drain output 001:Universal input function 010:PWM1 output, high for VINT, no Pull-down resistor less than 100K can be added 011:Reservation 100:ADC input 101:Low output 11X:Float	RW	1
1	GPIO1 pin function setting Bit 1		RW	1
0	GPIO1 pin function setting Bit 0		RW	1

REG 93H:GPIO2 function setting

Default value:07H

Bit	Description		R/W	Default Value
7-3	Reserved, unchangeable		RW	0
2	GPIO2 pin function setting Bit 2	000:NMOS open-drain output 001:Universal input function 010:PWM2 output, high for VINT,	RW	1

		not		
1	GPIO2 pin function setting Bit 1	Pull-down resistor less than 100K can be added 011:Reserved	RW	1
0	GPIO2 pin function setting Bit 0	100:ADC input 101:Low output 11X:Float	RW	1

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

Default value:00H

Bit	Description		R/W	Default Value
7	Reserved, unchangeable		R	
6	GPIO2 input status	0:Input low level 1:Input high level	R	
5	GPIO1 input status		R	
4	GPIO0 input status		R	
3	Reserved, unchangeable			
2	GPIO2 Output Settings	0:Output low, ground NMOS on 1:Output floating, ground NMOS off	RW	0
1	GPIO1 output setting		RW	0
0	GPIO0 output setting		RW	0

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

Default value:00H

Bit	Description		R/W	Default Value
7	GPIO[4:3] control. 1: GPIO function		RW	0
6-4	Reserved, unchangeable		RW	0
3:2	GPIO4 pin function setting Bit 1-0	00:External charge control 01:NMOS open-drain output port 4 10:Universal input port 4 11:Undefined	RW	00
1:0	GPIO3 pin function set Bit1-0	00:External charge control 01:NMOS open-drain output port 3 10:Universal input port 3 11:ADC input	RW	00

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

Default value:00H

Bit	Description	R/W	Default Value
7-6	Reserved, unchangeable	R	

5	GPIO4 input status	0:Input low level 1:Input high level	R	
4	GPIO3 input status		R	
3-2	Reserved, unchangeable			
1	GPIO4 Output Settings	0:Output low, NMOS on 1:Float, NMOS off	RW	0
0	GPIO3 Output Settings		RW	0

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

Default value:00H

Bit	Description		R/W	Default Value
7-3	Reserved, unchangeable			
2	Pull-down resistor control when GPIO2 is used as an input	0:Close the pull-down resistor 1:Use pull-down resistor	RW	0
1	GPIO1 pull-down resistor control when used as an input		RW	0
0	GPIO0 pull-down resistor control when used as an input		RW	0

REG 98H:PWM1 output frequency setting

Default value:00H

Bit	Description	R/W	Default Value
7-0	PWM1 Output Frequency Setting X	RW	00H

REG 99H:PWM1 duty cycle setting 1

Default value:16H

Bit	Description	R/W	Default Value
7-0	PWM1 Duty Cycle Setting Y1	RW	16H

REG 9AH:PWM1 Duty Cycle Setting 2

Default value:0BH

Bit	Description	R/W	Default Value
7-6	PWM1 Duty Cycle Setting Y2	RW	0BH

REG 9BH:PWM2 output frequency setting

Default value:00H

Bit	Description	R/W	Default Value
7-0	PWM2 Output Frequency Setting X	RW	00H

REG 9CH:PWM2 Duty Cycle Setting 1

Default value:16H

Bit	Description	R/W	Default Value
7-0	PWM2 Duty Cycle Setting Y1	RW	16H

REG 9DH:PWM2 Duty Cycle Setting 2

Default value:0BH

Bit	Description	R/W	Default Value
7-6	PWM2 Duty Cycle Setting Y2	RW	0BH

Note:PWM output frequency = 2.25MHz / (X+1) / Y1 PWM output duty cycle = Y2 / Y1

REG 9EH:N_RSTO (GPIO5) Pin Function Setting

Default value:20H

Bit	Description	R/W	Default Value
7	N_RSTO pin function setting 0:N_RSTO, LDO1 status monitoring; 1:General purpose input/output port 5	RW	0
6	N_RSTO Set5 as general purpose input and output port 0:NMOS open-drain output; 1:general-purpose input function	RW	0
5	N_RSTO setting when used as output port 5 0:Output low, NMOS on; 1:Float, NMOS off	RW	1

4	Status when N_RSTO is input port 5 0:Input low level; 1:Input high level	R	
3-0	Reserved, unchangeable	RW	0000

REG 40H:IRQ enable 1

Default value:D8H

Bit	Description	R/W	Default Value
7	ACIN overvoltage IRQ enable	RW	1
6	ACIN Access IRQ Enable	RW	1
5	ACIN Move Out IRQ Enable	RW	0
4	VBUS overvoltage IRQ enable	RW	1
3	VBUS access to IRQ enable	RW	1
2	VBUS Move Out IRQ Enable	RW	0
1	VBUS available but less than $_{HOLD}$VIRQ enable	RW	0
0	Reserved, unchangeable	RW	0

REG 41H:IRQ enable 2

Default value:FFH

Bit	Description	R/W	Default Value
7	Battery access IRQ enable	RW	1
6	Battery Shift Out 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	Charge Complete IRQ Enable	RW	1
1	Battery Over Temperature IRQ Enable	RW	1
0	Battery Low Temperature IRQ Enable	RW	1

REG 42H:IRQ enable 3

Default value:3BH

Bit	Description	R/W	Default Value
7	AXP192 Internal Over Temperature IRQ Enable	RW	0
6	Charge current less than set current IRQ enable	RW	0
5	DC-DC1 Output voltage is less than the set value IRQ Enable	RW	1

4	DC-DC2 output voltage is less than the set value IRQ Enable	RW	1
3	DC-DC3 Output voltage is less than the set value IRQ Enable	RW	1
2	Reserved, unchangeable		
1	Short key IRQ enable	RW	1

0	Long key IRQ enable	RW	1

REG 43H:IRQ enable 4

Default value:C1H

Bit	Description	R/W	Default Value
7	N_OE Power On IRQ Enable	RW	1
6	N_OE Shutdown IRQ Enable	RW	1
5	VBUS active 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, unchangeable	RW	1
0	APS Low Voltage IRQ Enable	RW	1

REG 4AH:IRQ enable 5

Default value:00H

Bit	Description	R/W	Default Value
7	Timer timeout IRQ enable	RW	0
6-3	Reserved, 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

Default value:00H

Bit	Description	R/W	Default Value
7	ACIN overvoltage IRQ state	RW	0
6	ACIN access to IRQ state	RW	0
5	ACIN Move out of IRQ state	RW	0
4	VBUS overvoltage IRQ state	RW	0
3	VBUS access to IRQ state	RW	0

2	VBUS moves out of IRQ state	RW	0
1	VBUS available but less than $_{HOLD}$VIRQ state	RW	0
0	Reserved, unchangeable	RW	0

REG 45H:IRQ status 2

Default value:00H

Bit	Description	R/W	Default Value
7	Battery access IRQ status	RW	0
6	Battery moved out of IRQ state	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	Charge completion IRQ status	RW	0
1	Battery Over Temperature IRQ Status	RW	0
0	Battery Low Temperature IRQ Status	RW	0

REG 46H:IRQ status 3

Default value:00H

Bit	Description	R/W	Default Value
7	AXP192 Internal Over Temperature IRQ Status	RW	0
6	Charge current is less than the set current IRQ state	RW	0
5	DC-DC1 Output voltage is less than the set value IRQ status	RW	0
4	DC-DC2 Output voltage is less than the set value IRQ status	RW	0
3	DC-DC3 Output voltage is less than the set value IRQ status	RW	0
2	Reserved, unchangeable		
1	Short key IRQ status	RW	0
0	Long key IRQ status	RW	0

REG 47H:IRQ status 4

Default value:00H

Bit	Description	R/W	Default Value
7	N_OE Power On IRQ Status	RW	0
6	N_OE Shutdown IRQ Status	RW	0
5	VBUS valid IRQ state	RW	0

4	VBUS Invalid IRQ state	RW	0
3	VBUS Session A/B IRQ Status	RW	0
2	VBUS Session End IRQ Status	RW	0

1	Reserved, unchangeable	RW	0
0	APS low voltage IRQ state, APS voltage is below the Warning Leve2 post position and above the Warning Level1 After will clear 0	RW	0

REG 4DH:IRQ Status 5

Default value:00H

Bit	Description	R/W	Default Value
7	Timer timeout IRQ status	RW	0
6-3	Reserved, unchangeable	RW	0
2	GPIO2 input edge triggered IRQ state	RW	0
1	GPIO1 input edge triggered IRQ state	RW	0
0	GPIO0 input edge triggered IRQ state	RW	0

Note: All IRQ status registers corresponding to bit writes will 1clear the corresponding status.

REG B8H: Coulometer control

Default value:00H

Bit	Description	R/W	Default Value
7	Coulometer switch control	RW	0
6	Coulometer pause control, writing 1 to this bit will pause the coulometer count and this bit will clear itself	RW	0
5	Clear the coulometer control, writing 1 to this bit will clear the coulometer and this bit will self-clear	RW	0
4-0	Reserved, unchangeable	RW	0

10、Package

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.72	0.82	0.92
A1	—	0.01	0.05
b	0.18	0.22	0.28
c	0.18	0.20	0.23
D	5.90	6.00	6.10
D1		4.10REF	
e		0.40BSC	
Ne		4.40BSC	
E	5.90	6.00	6.10
E1		4.10REF	
L	0.35	0.40	0.45