Translated version of AXP209 Datasheet v1.0_cn.pdf

X-Powers
DATASHEET
Enhanced single Cell Li-Battery and Power System Management IC
AXP209

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1. Overview (Summary)

AXP209 management chip is a highly integrated power system for single-cell lithium battery (lithium-ion or lithium polymer) and require multiple power conversion
Application of the output can be flexibly configured to provide easy-to-use and complete power solutions fully meet the increasingly complex application processing

Precise control requirements of the control system for the power supply.

AXP209 integrates an adaptive USB-Compatible the PWM charger, 2-way step-down converter (Buck DC-DC converter), 5-channel linear regulator device (LDO) voltage / current / temperature multi-channel 12-Bit ADC, 4 configurable GPIO. Sustaining

Card power system security the stable, AXP209 integrated over / under voltage (OVP / UVP), over temperature (OTP), overcurrent protection (OCP) circuit.

Wisdom energy balance in AXP209 (Intelligent Power Select, IPS ™) circuit in the USB and external AC adapter, lithium battery

Safe and transparent distribution of electric energy between the pool and the application of the system load and the only external input power without batteries (or battery over discharge / damage)

Can also be the case so that the application of the system to work properly.

AXP209 external adapter and USB and battery capacity of three-input, support rechargeable backup battery.

AXP209 provides a two-wire serial communication interface: Two Wire Serial the Interface (TWSI), application processor through the pick

Mouth open or shut down some of the power output, set the voltage, the access to the internal registers and a variety of measurement data (including Fuel Gauge). High

Accuracy (1%, mainly decided by the the BIAS resistor 1% accuracy) power measurement data to facilitate consumers more clearly the real-time power usage like

Conditions, giving consumers an unprecedented level of equipment energy use experience.

AXP209 6mm x 6mm 48-pin QFN package.

Applications

Handheld mobile devices

Smart mobile phone, PMP/MP4, the number of

Digital camera, a digital camera, a handheld guide

Navigational GPS, PDA, handheld digital

Radio and television receivers

Mobile Internet Devices xPad, MID

Digital photo frames, portable DVD player,

Ultra mobile PC UMPC and

UMPC-like, learning machine

Application processor circuit system

Application Processor systems

Other battery and power applications

Pin Definition

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2. Features (Feature)

• Power Management **(IPS)**

o Wide input voltage range:

2.9V6.3V (AMR:-0.3V11V)

o Configurable efficient wisdom energy balance "IPS ™" system

o the adaptive USB (support USB3.0) or AC adapter

Pressure limiting current limit (4.4V/900mA/500mA/100mA)

o battery path equivalent resistance of less than 75mΩ

• Fully integrated **PWM** charger **(PWM Charger)**

o maximum charging current of up to 1.8A

o support the battery temperature monitoring

o Full support for USB charging (including 3.0) compliant

Claim

o charging high precision, an error of less than 0.5%

o support 4.1V/4.15V/4.2V/4.36V other battery

o Automatic charging process control

o can directly drive LEDs indicate the charging status

o charging current is adjusted automatically according to the load on the system

• battery backup **(Backup Battery)**

o acceptable backup battery input supply RTC module

o support for charging a spare battery charging current can be set

• **2-channel** synchronous buck converter **(DC-DC)**

o DC-DC2: can be adjusted between 0.7-2.275V

25mV/step, drive capability 1.6A, support VRC

o DC-DC3: can be adjusted between 0.7-3.5V,

25mV/step, drive capacity 1.2A

• **5** linear regulators **(LDO)**

o LDO1: 30mA, always effective

the o LDO2: low noise LDO, 1.8V3.3V adjustable

100mV/step, drive capability of 200mA

o LDO3 :0.7-3 .5 V adjustable, 25mV/step, flooding

Dynamic capacity 200mA

the o LDO4: low noise LDO, 1.8V3.3V adjustable

100mV/step, drive capability of 200mA

o LDO5: low-noise LDO, 1.8-3.3V adjustable

100mV/step, drive capability 50mA

• Timer **(Timer)**

o 7bit Timer, Timing Range 1127 minutes

o Timer interrupt output

Note: VRC, Voltage Ramp Control voltage ramp

Rate control.

• signal acquisition system **(Signal Capture)**

o Built-in 12 Bit ADC, 12-way

o accept two additional external signal input

number of current and voltage o battery and external input power

According to

o Built-in high-precision Coulomb Counter and Fuelgauge of system

o Provide rich power management information, such as instantaneous power consumption

(MA or mW), and the remaining battery capacity (% or mAh)

The state of charge (%) and the remaining battery time or charge

Electric time

o two low-battery warning and protection

o provide chip temperature data

• Application Processor Interface **(Host Interface)**

o Host by TWSI interface for data exchange

o interrupt can be flexibly configured and Sleep Management

o flexible pin feature set, multiple GPIO respectively

IO, ADC functions

o Built-in configurable timer

o provide 12 sets of registers can be used for system shutdown

Data is saved

• System Management **(System Management)**

o support soft reset and hard reset

o Support soft-off and hard shutdown

o Support for external trigger source wake

o support the output voltage monitoring, self-diagnostic function

o output PWROK, the used for system reset or shutdown instructions

o external power detection (insert / remove / drive capacity)

o All input and output support soft-start

o over / under-voltage protection (OVP / UVP)

o overcurrent protection (OCP)

o overtemperature protection (OTP)

o Support OTG VBUS power state setting / monitoring

• High integration **(Fully Integration)**

o Internal precision reference voltage (0.5%)

o Built-in MOSFET

o timing and the output voltage can be customized

• decryption module **(Decryption)**

o 128bit OTP password storage

o dynamic real-time decryption algorithm

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3. Typical applications (Typical Application)

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4. Limit parameter (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
°C
Ts
Storage Temperature Range Storage Temperature
-40 To 150
°C
T
LEAD
Maximum Soldering Temperature (at leads, 10sec)
Soldering temperature
300
°C
V
ESD
Maximum ESD stress voltage, Human Body Model

Antistatic ability > 4000 V

PD Internal Power Dissipation / Internal power consumption tolerance 2100 mW

5. Electrical Characteristics (Electrical Characteristics)

V_{IN} = 5V, BAT = 3.8V, T_A = 25 °C

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
ACIN						
V_{IN}	ACIN Input Voltage		3.8		6.3	V
I_{OUT}	V_{OUT} Current Available Before Loading BAT	500mV Voltage Drop	2500			mA
V_{UVLO}	ACIN Under Voltage Lockout		3.8			V
V_{OUT}	IPS Output Voltage		2.9	5.0		V
R_{ACIN}	Internal Ideal Diode On Resistance	PIN to PIN, ACIN to IPSOUT		170		

mΩ

VBUS

V
IN
VBUS Input Voltage
3.8
6.3
V
I
OUT
V
OUT
Current Available Before
Loading BAT
500
900
mA
V
UVLO
VBUS Under Voltage Lockout
3.8
V
V
OUT
IPS Output Voltage
2.9
5.0
V
R
VBUS
Internal
Ideal
Diode
On
Resistance
PIN to PIN, VBUS to
IPSOUT
300
mΩ

Battery Charger

V
TRGT
BAT Charge Target Voltage
-0.5%
4.2
+0.5%
V
I
CHRG
Charge Current
1200
1800
mA
I
TRKL
Trickle Charge Current
10%
I

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mA
V
TRKL
Trickle
Charge
Threshold
Voltage
3.0
V
ΔV
RECHG
Recharge Battery
Threshold
Voltage
Threshold
Voltage
Relative to V
TARGET
-100
mV
T
TIMER1
Charger
Safety
Timer
Termination Time
Trickle Mode
40
Min
T
TIMER2
Charger
Safety
Timer
Termination Time
CC Mode
480
Min
I
END
End of Charge
Indication
Current Ratio
CV Mode
10%
15%
I
CHRG
mA

Backup Battery

V
TRGT
Backup Battery Charge Target
Voltage
2.5
3.0
3.1
V

I
CHRG
Backup Battery Charge Current
50
200
400
uA

I
Backup
Current
when use Backup
Battery
10
15
uA

NTC

Charge
2.112
V
TL
Cold
Temperature
Fault
Threshold Voltage
Discharge
0
3.226
3.264
V
Charge
0.397
V

TH
Hot Temperature Fault Threshold
Voltage
Discharge
0
0.282
3.264
V
V

TE
NTC Disable Threshold Voltage
Falling Threshold
Hysteresis
0.2
V

Ideal Diode

R

SYMBOL	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
ds (on)	On Resistance (BAT to IPSOUT)			75		mΩ
Off Mode Current						
I BATOFF	OFF Mode Current	BAT = 3.8V		27		µA
I SUSPEND	USB VBUS suspend Mode current	BAT = 3.8V, VBUS = 5V, N_VBUSEN = 1		86		µA
Logic						
V IL	Logic Low Input Voltage				0.3	V
V IH	Logic High Input Voltage		2			V
TWSI						
V CC	Input Supply Voltage			3.3		V
ADDRESS	TWSI Address			0x68		
f SCK	Clock Operating Frequency		400		1200	kHZ
t f	Clock Data Fall Time	2.2Kohm Pull High			60	ns

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Symbol	Description	Condition	Min	Typ	Max	Unit
t_r	Clock Data Rise Time	2.2Kohm Pull High			100	ns
DCDC						
f_{OSC}	Oscillator Frequency	Default		1.5		MHz
DCDC2						
I_{LIM2}	PMOS Switch Current Limit	PWM Mode		2300		mA
I_{DC2OUT}	Available Output Current	PWM Mode		1800		mA
V_{DC2OUT}	Output Voltage Range		0.7		2.275	V
DCDC3						
I_{LIM3}	PMOS Switch Current Limit	PWM Mode		1400		mA
I_{DC3OUT}	Available Output Current	PWM Mode		1000		mA
V_{DC3OUT}	Output Voltage Range		0.7		3.5	V

SYMBOL DESCRIPTION

		CONDITIONS	MIN	TYP	MAX	UNITS
LDO1						V
V_{LDO1}	Output Voltage	I_{LDO1} = 1mA	-1%	1.3	3.3	1%	V
I_{LDO1}	Output Current			30		mA
LDO2						V
V_{LDO2}	Output Voltage	I_{LDO2} = 1mA		1.8	3.3	V
I_{LDO2}	Output Current			200		mA
PSRR	Power Supply Rejection Ratio	I_{LDO2} = 60mA, 1KHz		TBD		dB
e_N	Output Noise ,20-80KHz	Vo = 3V, Io = 150mA		28		µV RMS
LDO3						V
V_{LDO3}	Output Voltage	I_{LDO3} = 1mA				

0.7
3.5
V
I
LDO3
Output Current
200
mA
PSRR
Power Supply Rejection Ratio
I
LDO3
= 10mA, 1KHz
TBD
dB
e
N
Output Noise ,20-80KHz
Vo = 1.8V, Io = 150mA
TBD
µV
RMS
LDO4
V
LDO3
Output Voltage
I
LDO3
= 1mA
1.8
3.3
V
I
LDO3
Output Current
200
mA
PSRR
Power Supply Rejection Ratio
I
LDO3
= 10mA, 1KHz
TBD
dB
e
N
Output Noise ,20-80KHz
Vo = 1.8V, Io = 150mA
18
µV
RMS
LDO5
V
LDO5
Output Voltage
I
LDO5
= 1mA

1.5
3.3
V
I
LDO5
Output Current
50
mA
PSRR
Power Supply Rejection Ratio
I
LDO5
= 10mA, 1KHz
TBD
dB
e
N
Output Noise ,20-80KHz
Vo = 1.8V, Io = 30mA
18
μV
RMS

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6. Typical Characteristics (Typical Characteristics)
DC-DC Efficiency vs. Load (3.8Vin)
DC-DC Load Transient (Typical)

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DC-DC Ripple
V
REF
vs Temperature

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V
TRGT
vs Temperature
Off Mode Current vs V

BAT

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7. The pins definition of (Pin Description)
Num
Name
Type
Condition
Function Description
1
SDA
IO
Data pin for serial interface, normally it connect a 2.2K
resistor to 3.3VI / O power
2
SCK
I
it is the Clock pin for serial interface, normally it connect
a 2.2K resistor to 3.3VI / O power
3
GPIO3
IO
REG9EH [7]
GPIO 3
4
N_OE
I
Power output on / off switch
GND: on; IPSOUT: off
5
GPIO2
IO
REG92H [2:0]
GPIO 2
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
LDO4
O
Output Pin of LDO4
12
LDO2
O
Output Pin of LDO2

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13
LDO24IN
PI
Input to LDO2 and LDO4
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
GPIO 1
18
GPIO1
IO
REG93H [2:0]
ADC Input
GPIO 0
Low noise LDO / Switch
19
GPIO0
IO
REG90H [2:0]
ADC Input
20
EXTEN
O
External Power Enable
21

Pin	Name	Type	Description
	APS	PI	Internal Power Input
22	AGND	G	Analog Ground
23	BIAS	IO	External 200Kohm 1% resistor
24	VREF	O	Internal reference voltage
25	PWROK	O	Power Good Indication OutPut
26	VINT	PO	Internal logic power, 2.5V
27	LDO1SET	I	It set the LDO1 default voltage.
28	LDO1	O	LDO1 output, for Host RTC block
29	DC3SET	I	It set the DCDC3 default voltage
30	BACKUP	IO	Backup battery pin
31	VBUS	PI	USB VBUS input
32,33	ACIN	PI	Adapter input
34,35	IPSOUT	IO	Main Battery
36	CHGLED	O	charger status indication
37	TS	I	Battery Temperature sensor input or an external ADC input

38,39 BAT
PO
System power source
40
LDO3IN
O
LDO3 input source
41
LDO3
I
Output Pin of LDO3
42
BATSENSE
I
Current sense port1
43
CHSENSE
O
Current sense port2
44
VIN1
PI
DCDC1 input source
45
LX1
IO
Inductor Pin for DCDC1
46
PGND1
G
NMOS Ground for DCDC1
47
PWRON
I
Power On-Off key input, Internal 100k pull high to APS
48
IRQ /
WAKEUP
IO
IRQ output or wakeup
49
EP
G
Exposed Pad, need to connect to system ground

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8. Functional Block Diagram (Functional Block Diagram)
BAT
Bat
Temperature
Monitor
Output voltage

monitor / LBO
LDO2
DC-DC3
DC-DC2
Serial Interface
LDO4
IPS
IRQ
SCK
SDA
VBUS
IPSOUT
APS
Control Logic
PWRON
GPIO3
GPIO1
GPIO0/LDOio0
GPIO2
DC3SET
PWROK
AGND
EP
BATSENSE
LDO1
LDO1SET
Reference
Voltage
TS
N_VBUSEN
ACIN
Register
CHGLED
BIAS
CHSENSE
12 bit ADC
Current Monitor
Voltage Monitor
Temperature Monitor
LDO2
LDO4
LDO1
LX2
DCDC2
PGND2
VIN2
LX3
DCDC3
PGND3
VIN3
VREF
BACKUP
LDO24IN
VINT
N_OE
PWM
Charger
LX1

PGND1
VIN1
LDO3
LDO3
EXTEN
LDO3IN

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9. Control and operation (Control and Operating)

When AXP209 work the, TWSI interface SCK / SDA pin pulled system IO power, the Host through this interface AXP209
The working status of the flexible adjustment and monitoring, and a wealth of information can be obtained.

Note: "Host" refers to the application system's main processor.

Note: as "external power" referred to contain the ACIN and VBUS input.

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

Keys (PEK)

AXP209 PWRON pin can be connected between the GND of a button, as a separate switch key Power Enable Key (PEK)
Or sleep / wake button. AXP209 can automatically identify the key "long" and "short" and react accordingly.

Several boot source (Power on Source)

1, ACIN, VBUS and battery access.

2, N_OE from high to low.

3, PEK.

Boot (Power On)

N_OE is low, when the meet the requirements of the main power supply (ACIN or VBUS> 3.8V, the battery voltage is higher than the off voltage) access, AXP209
Whether the automatic boot automatically boot (external power access can be rewritten according to external demand).

N_OE low and turned off the boot action through PEK operation to complete.

In the case of an external power supply or battery, N_OE low changes will cause AXP209 boot.

Can by PEK (AXP209 key time over "ONLEVEL") boot. In practical applications, the output signal of the timing of the Host (Alarm)
Number can also be connected to PWRON-PEK parallel, Alarm signal is active (low), equivalent to the PEK press, can also be AXP209
Boot.

After the completion of the power, DC-DC and LDO will be in accordance with the timing set sequential soft-start, start by the Host by TWSI Open / Close
Corresponding power.

Shutdown (Power Off)

PEK "long time is greater than IRQLEVEL in PEK interrupt service routine, Host will" register REG32H [7]
Write "1" to notify AXP209 enter the off state. AXP209 turn off all power except LDO1, output will enter the off state.

, AXP209 will automatically shut down in the following cases:

1, the input voltage is too low, low electrical protection;

2, the load is too large causing the power supply output voltage is too low, overload protection;

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3, the input voltage is too high, the overvoltage protection (as detailed in the "power path management section);

4, N_OE from low to high, waiting for more than a set time (default 2S);

5, PEK time greater than OFFLEVEL (default 6S) the System automatically turn off the other output (can be omitted Reset

button) except LDO1;

Automatic protection mechanism in AXP209 avoid application system disorders occur when the irreversible damage of the device is powered, so as to protect the entire

Systems.

Sleep and wake (Sleep and wakeup)

In the case of the boot, if the system needs to enter the Sleep mode, and a road or power output shut down or change to other

Voltage can REG31H [3] control, decide whether PEK key signal, GPIO0, GPIO1, GPIO2 GPIO3 rise

Falling edge (As for the rising or falling edge or double-edge, by REG90H [7:6], REG92H [7:6], REG93H [7:6], and REG95H [7:6] setting) triggered wakeup, PMU outputs to the power supply voltage is restored to its default state, the brightest are shut down or change the electrical

Source in accordance with the provisions of the power-on timing in turn re-open.

Note: PEK IRQ (REG42H [1]), GPIO0 is the INPUT Edge IRQ (REG44H [0]), the GPIO1 the INPUT Edge the IRQ (REG44H [1]), GPIO2 INPUT Edge IRQ (REG44H [2]), GPIO3 INPUT Edge IRQ (REG44H [3]) must be

Enable, in order to inform the host processor through the IRQ PIN exit Sleep state.

Follows for Sleep and wakeup mode control flow.

REG31H [3] write

1 Open the wake-up function,

PMU record the

REG12H settings

Shutdown corresponding power or

Regulating voltage

Sleep and wait

Wakeup occurs

Wakeup?

Power is restored to the default

Output voltage values

Y

N

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System reset function and output monitoring function (PWROK)

AXP209 the PWROK can be used as a reset signal for the application system. In the boot process AXP209, PWROK output low

Reaches the preset value when the output voltage of each power supply stability, PWROK is pulled up, the application of the system in order to achieve power-on reset.

Application system during normal operation, AXP209 been monitoring the the brightest output voltage and load conditions, and overload or undervoltage

In the case of pressure, PWROK immediately output low, the application system is reset to prevent malfunction and possible data error.

9.2 power path management (IPS)

The the power input of AXP209 can from the lithium battery BAT for USB VBUS input, external power supply ACIN (such as the AC adapter AC

Adapter), IPS according to the state of the external power supply and a lithium battery to select a suitable power distribution.

o When only access the lithium battery, no external power supply input, using the lithium battery-powered;

o When you access an external power supply (VBUS or ACIN), priority in the use of an external power supply;

o battery connection the case, when the external power supply is removed immediately "seamless" turn powered by lithium batteries;

o When the VBUS and ACIN both simultaneously access priority ACIN powered and rechargeable Li-ion battery;

o If the ACIN driving ability is not enough, it will open the VBUS pathway timely, ACIN / VBUS common power supply;

o If the drive capacity is still insufficient, it will reduce the charge current until 0, then supplement with battery-powered;

The compatibility of the input power can thus greatly enhance the system for different external drive capability, without the manufacturers provide special custom adapter.
See the following icons:
As shown above, the when ACIN load capacity is insufficient, IPSOUT voltage decreased BAT from charging into the discharge with ACIN
Together with the load current.

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The Host can through TWSI access the internal register of AXP209 to set the parameters of the IPS and read their feedback.
Limited voltage / current limiting mode and direct mode
In order not to affect the USB communication VBUS pathway default in the the VBUS voltage limiter mode ". In this mode, AXP209 will VBUS
The voltage is maintained at a set reference voltage V
HOLD
Above, in order to meet the USB specification. V
HOLD
Default is 4.4V, is available in register
Reg30H [5:3] to adjust.
If the system limit demand, the size of the current drawn from the USB VBUS provides a current limiting modes to choose from (see register
REG30H [1]), the current limit optional 900mA/500mA/100mA (register Reg30H [0]).
If the system is USB powered and do not mind USB communication, or using a USB power adapter, you can modify the register
REG30H [6] AXP209 set VBUS through mode ", this time AXP209 priority to meet the electricity needs of the application system. When the USB
Host drive capacity is too weak or the system power consumption is too strong and the VBUS voltage is below V
HOLD
, AXP209 will issue an IRQ inform Host VBUS
The power supply capacity is weak, indicating the USB communication may be affected by the decision of the follow-up action by the Host software.
The reaction of AXP209 external power supply into
AXP209 can automatically detect the insertion operation of the external power supply. When will automatically determine the external electric AXP209 detected after the external power supply into
Source is available, and the results are provided in the corresponding register, also issued IRQ, notifying the Host.
Register status bit on the external power supply and their meanings are shown in the following table:
The status bits of the register
Meaning
Register REG00H [7]
Indicates external adapter power ACIN
Register REG00H [6]
The ACIN is available indicates that the external adapter power
Register REG00H [5]
Indicates external power supply VBUS
Register REG00H [4]
Indicates that the external power supply VBUS availability
Register REG00H [3]
The instructions access external power supply VBUS VBUS voltage is above V
HOLD
Register REG00H [1]
Indicates that the external power supply ACIN / the VBUS is whether in the short-circuit on the PCB
Register REG00H [0]
Indicate whether the system is triggered by the ACIN / VBUS boot

Instructions access an external power supply VBUS VBUS voltage is higher than V
HOLD
"This flag allows the Host to the receipt of IRQ7
When (referring to the VBUS power supply capacity is weak), judge VBUS pulled low because the load on the system access or external power voltage is lower than the
V
HOLD
Host software, making it easy to decide is to continue working in the pressure-limiting mode or changed to pass-through mode.
The choice of whether the VBUS as an input power
AXP209 whether selection VBUS input power will be N_VBUSEN and register REG30H [7] to decide:
N_VBUSEN
REG30H [7]
Input power
Meaning
Low
0
VBUS
VBUS valid ACIN selection
Low
1
VBUS
The VBUS valid when VBUS as input power

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Enhanced single Cell Li-Battery and Power System Management IC
AXP209
High
1
VBUS
High
0
ACIN / BAT
Not to use VBUS
Low-battery warning, and low power protection (automatic shutdown)
AXP209 can set the low-battery warning voltage V
WARNING
And automatic shutdown voltage V
OFF
And system power their comparison. Once found
System power is lower than V
WARNING
, On the issue IRQ19/IRQ20. If APS is lower than V
OFF
, AXP209 automatically enters shutdown mode, turn off
The output all except LDO1.
V
WARNING
Two tranches set: LEVEL1/LEVEL2 application for the two tranches of alarm definitions different tips, such as Level1
For suggesting that lack of electricity, Level2 prompted the impending shutdown.
V
WARNING
And V
OFF

The default values in the register REG3AH REG3BH REG31H [2:0] settings.

Overvoltage protection

When the external power supply voltage exceeds 6.3V, AXP209 issue IRQ1 / 4, prompting an external power supply overvoltage. When an external power supply more than 7V, AXP209

Automatic shutdown.

9.3 Adaptive PWM charger (Adaptive PWM Charger)

AXP209 integrated a constant current / constant voltage PWM charger can automatically control the charging cycle, the built-in security clock can automatically stop

Stop charging without processor intervention. This charger can be based on the power consumption of the system automatically adjusts the charging current, and also with battery detection Trickle

Charging and activate the function, built-in temperature detection circuit can automatically reduce the charge current when the temperature is too high or too low.

The integration of the PWM charger system power consumption and battery fast charging, relatively traditional linear charger module

Greatly improved efficiency, thereby reducing energy consumption, system temperature rise be greatly improved.

Adaptive charging process start

Charger default is enable the state to shut down (by setting register see "register REG33H). When external power access

After, AXP209 first determine whether the external power supply can be used for charging, when subject to the conditions of the external power is available, and the charging function is turned on,

The AXP209 automatically start the charging process, the IRQ issue to Host the beginning of the charging process. CHGLED pin output low,

Can drive external LEDs indicate the charging status.

Charging process voltage and current diagram

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AXP209

I

TRKL

V

TRKL

I

CHRG

V

TRGT

Two flags voltage

V

TRGT

, Charging target voltage. V

TRGT

By register settings, the default is 4.2V (see "Register REG33H [6:5]"). At the same time,

In the external power supply voltage is low, AXP209 will automatically adjust the the charging target voltage.

V

RCH

Automatically re-charging voltage. V

RCH

= V

TRGT

-0.1V.

Charging current

The charging current can register REG33H [3:0] settings, the default value is 500mA or 1200mA.

Charging process

If the battery voltage is lower than 3.0V, the charger automatically enters precharge mode, the charging current to the default value of 1/10. If within 40 minutes (this

A time to adjust, see "the register REG34H), the battery voltage is still not reached 3.0V, the charger automatically enters battery activation patterns.

The specific details see "battery active mode.

Once the battery voltage is higher than 3.0V, the charger into the constant current mode. If the charging current is less than 65% of the default, the system sends

IRQ17 this notification external power drive capability, the charging current does not reach the set value, which will extend the charging time, if you want to

Faster fully charged, it is recommended to replace the stronger power or turn off the power consumption function.

When the battery voltage reaches the target voltage V

TRGT

From the constant current mode, the charger enters the constant charge current decreases.

The end of the charge cycle when the charge current is less than the default value of 10% or 15% (can be set, see "registers REG33H"), charging stop

Ended, when charging is completed, AXP209 will issue IRQ18, CHGLED pin stop indicates the charging status. When the battery voltage drops below the lower V

RCH

Will start automatically recharge while issuing IRQ17.

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In the non-pre-charging mode, if at 480 minutes (this time can be adjusted, see "register REG34H), the charging cycle did

End, the battery charger will automatically enter active mode.

Battery activation patterns

, AXP209 will be issued from either the pre-charging mode or from entering the battery from the constant current charging mode activation mode (timer timeout case)

IRQ10, indicates that the battery may be damaged.

Activated in the battery mode, Charger always smaller current to charge the battery, if the battery voltage reaches V

RCH

, Exit

Active mode, also issued IRQ11.

AXP209 in register REG01H indicate battery charger is in active mode.

CHGLED

Used to indicate charging status and alarm CHGLED pin, it has four states: is charging, not charging, battery abnormal alarm and external

Supply overvoltage alarm. CHGLED NMOS Open Drain (open-drain type) output through a current limiting resistor to directly drive a

The light emitting diodes to display the status of the four. Two methods of work but it has shown in the following table:

REG34H [4] state

Performance

Note

Charging low

Not charging high impedance

Battery abnormal 1Hz blinking charger into the battery activation patterns, or the battery temperature is too high, too low

0

Overvoltage

4Hz flashing external power supply input voltage is too high

Charging 1Hz blinking

Can not charge high impedance

No external power supply

Not charging low

1

Overvoltage

4Hz flashing external power supply input voltage is too high or the battery temperature is too high, too low

Battery temperature detection

In charge / process, AXP209 by a temperature-sensitive resistor in the TS pin external monitor battery temperature. Circuit schematic, such as
The following figure:

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NTC
TS
BAT
C2
10uF
GND
In the figure above, VTH / VTL door for high temperature and low temperature limit set, respectively, through the register REG38H/39H/3CH/3DH settings
VTE = 0.2V. Suggested that the temperature-sensitive resistor selected 25 ℃ 10Kohm, accuracy 1% NTC temperature sensitive resistor. AXP209 will be sent on the TS pin
Constant current, this current can be set to 20uA, 40uA, 60uA, 80uA four (see register REG84H), in order to adapt to different NTC electric
Resistance. This current flowing through the temperature-sensitive resistor to obtain a detection voltage, AXP209 ADC measured voltage value and to be compared with the set value, thereby
Issue the corresponding IRQ or suspend charging.
Temperature sensitive resistor is too large or too small, you can be in its path in parallel or in series on the extra resistance, in order to expand its detection range.
If the battery does not have a temperature-sensitive resistor, the TS pin is connected to the ground, this time AXP209 automatically disable the battery temperature monitoring function.
Battery detection
The AXP209 will automatically detect whether the battery and identification in the register (see register REG01H), and issuing IRQ13 IRQ14.
Battery detection by Host control to open or close the (see register REG32H).
9.4 battery backup (Backup Batttery)
AXP209 support backup battery use and charging without mains (BAT / ACIN / VBUS) exist, LDO1 input source select an alternate
Battery, and its output is used to maintain the system real-time clock circuit.
When the main power is present, by setting REG35H [7] spare battery charging its target voltage defaults to 3.0V (by REG35H [6:5] is set), the default charging current of 200uA (also by REG35H [1:0] setting).

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9.5 multi-channel power output (Multi-Power Outputs)
Multiple output voltage AXP209 provider and the feature list is as follows:
Output path
Type
Default voltage
Application examples
Drive capability
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
1.3V PLL
200 mA
LDO4
LDO
Can be set
1.8V HDMI
200 mA
LDO5
LDO
Can be set
Vmic
50 mA

AXP209 contains 2-channel synchronous buck DC-DC Road LDO, a variety of start timing and control. The operating frequency of the DC-DC Mo

That 1.5MHz, by setting registers to adjust the peripheral use of small inductors and capacitive elements. Two DC-DC can be set

Into PWM mode or automatic mode (by AXP209, automatic switching) based on the size of the load, see "register REG80H".

DC-DC2 / 3

DCDC3 output voltage range of 0.7-3.5V, DCDC2 output voltage of 0.7-2.275V, by register settings (see "register REG23H 27H ").

DCDC2 / 3 output capacitor recommended small ESR 10uF X7R ceramic capacitors; When the output voltage is set to 2.5V or more, pushing

Recommended 2.2uH inductor 4.7uH inductor recommended below 2.5V, inductor saturation current need is greater than this maximum demand of power path

Seeking for more than 50% of the current.

The following is a list of recommended inductance and capacitance:

Inductance
Model
Current specifications
DC 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
Tolerance
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

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LDO1
LDO1 never open, can provide uninterrupted power supply for the application of the system's real-time clock (RTC) circuit, the drive capacity of 30mA.
LDO2/3/4
LDO2 / 4 low output noise 18uVrms, the applications of analog circuits provide power. LDO3 systems such as SRAM
Or PLL provides power. Drive capability of 200mA.
LDO5
LDO5 using the design of low-noise output drive capacity of 50mA.
Soft-start (Soft Start)
Soft-start output DC-DC and LDO support the establishment of the way, to avoid the impact of the sudden change of the current input pathway startup.
Self-diagnosis: load monitoring and limiting protection
DC-DC and LDO load monitoring and limiting function, when the load current exceeds its drive capacity, the output voltage will
Drop, in order to protect the internal circuit. Two DC-DC output voltage is lower than 85% of the set voltage, AXP209 automatic shutdown. Within the system at the same time

Automatically records specific due to which output voltage is too low to cause a shutdown (see register REG46H [5:2]) and issued the corresponding IRQ.

DC-DC does not require an external Schottky diode and resistor divider feedback circuit. If the application does not need to use a DC-DC

Simply corresponding the LX pin floating can.

9.6 default voltage / start timing settings (Default Voltage / Timing Setting)

AXP209 customizable default voltage of each power supply, start timing.

Start timing: contains a total of eight start at the same time can be set for each step start time interval, optional for 1,4,16,32 mS.

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

LDO1SET PIN for setting an initial voltage of **LDO1:**

LDO1SET

LDO1SET ground

LDO1SET then VINT

LDO1 voltage

1.3V

3.3V

DC3SET PIN is used to set the initial voltage of the **DC-DC3:**

DC3SET

DC3SET ground

DC3SET then APS

DC3SET floating

The voltage of the DC-DC3

1.8V

3.3V/2.5V

1.2V/1.5V

About the contents of this section, see "default configuration instructions" document.

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9.7 Signal Acquisition System (Signal Capture)

Battery monitor usually estimated by measuring the battery voltage to the battery charge, while 12Bit ADC, AXP209 multiple subject

That can measure battery voltage, battery current and the external power supply voltage, the current can be measured, the internal integration of the battery charge and discharge library

The Lun meter. Host can be based on these data a more accurate calculation of battery power, in addition, you can also calculate the system's real-time power consumption

Remaining battery power, battery charging progress, remaining battery time remaining full time power supply information.

The brightest ADC enable control and sampling speed can be set by register REG82H, 83H, 84H, and stored in the phase of the sampling results

See the register description of the ADC data class should register. GPIO [1:0] input range can be set through the register REG85H.

The direction of the battery current is charged or discharged by the the register REG00H [2] to indicate.

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 ℃

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

A 9.8 multifunction Pin Description (Multi-Function Pin Description)

GPIO [3:0]

Can be used as GPIO [3:0] ADC Input (monitoring external signal), LDO, etc. Refer REG90H-96H Description.

CHGLED

Charge status indicator and, overvoltage overtemperature alarm function and GPO functions, use see REG32H description.

9.9 Timer (Timer)

AXP209 contains a 7 bit internal timer by setting register REG8AH [6:0] can change the timer value, REG8AH [6:0]

For all 0, the timer the Disable; the REG8AH [6:0] = A timer starts counting from 0 to A, and set bit REG8AH [7], but also to

AXP209
Issued by the timer interrupt. Write REG8AH [7] to clear the flag, and re-start the timer. Clear the interrupt flag will not re-open

To start counting. Timer timing smallest step for one minute, and the timing is 1127 minutes.

9.10 decryption (Decryption)

AXP209 including a decryption module. The Host by write data to be decrypted to REG300-REG30F, then register

Write 1, as of REGB8H [1] started decryption, AXP209 decrypt completed after will state bit REGB8 [0] is set to 1, the Host can

REG31x read back the the password data after decryption. The start again decryption AXP209 automatically clear status bits.

9.11 HOST interface and interrupt (TWSI and IRQ)

...
...
...
...
...
...
...
...
...
...
...
...
...
...

Figure 1: Single Read and Write

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Figure 2: Multi Read and Write

Host interface through TWSI to the access AXP209 register its operation timing as above shown, supports standard 100KHz or

400KHz frequency, maximum speed up to 1.2MHz, while supporting the tonal / write operation, the device address is 69H (read) and 68H (write).

Certain events, AXP209 by driving down the IRQ interrupt mechanism to remind the Host, and interrupt state is saved in the interrupt

Status Register (see Register REG48H, register REG49H, register REG4AH, register REG4BH, register

REG4CH), write to the corresponding status register bit 1 clears the corresponding interrupt when no interrupt events, IRQ output pulled (by external

Pull 51K resistor). Each interrupt can be masked by the interrupt control register (see register REG40H, register REG41H, Send

Register REG42H, register REG43H, register REG44H).

Location
Interrupt number
Meaning
Location
Interrupt number
Meaning
Register 48H [7]
IRQ1
Power ACIN overpressure
Register 4AH [3]
IRQ20

DCDC3 voltage is too low
Register 48H [6]
IRQ2
Power ACIN insert
Register 4AH [2]
Retention
Register 48H [5]
IRQ3
Power ACIN removed
Register 4AH [1]
IRQ22
PEK short press
Register 48H [4]
IRQ4
Power VBUS overpressure
Register 4AH [0]
IRQ23
PEK long press
Register 48H [3]
IRQ5
Power VBUS insertion
Register 4BH [7]
IRQ24
N_OE boot
Register 48H [2]
IRQ6
Power VBUS removed
Register 4BH [6]
IRQ25
N_OE shutdown
Register 48H [1]
IRQ7
VBUS voltage is less than
V
HOLD
Register 4BH [5]
IRQ26
VBUS valid
Register 48H [0]
Retention
Register 4BH [4]
IRQ27
VBUS invalid
Register 49H [7]
IRQ8
Battery access
Register 4BH [3]
IRQ28
VBUS Session Valid
Register 49H [6]
IRQ9
Battery removal
Register 4BH [2]
IRQ29
VBUS Session End
Register 49H [5] IRQ10
Into the battery activation patterns
Register 4BH [1]

IRQ30
Low battery warning LEVEL1

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Register 49H [4] IRQ11
Exit the battery activation patterns
Register 4BH [0]
IRQ31
Low battery warning LEVEL2
Register 49H [3] IRQ12
Is charging
Register 4CH [7]
IRQ32
Timer interrupt
Register 49H [2] IRQ13
Charging is complete
Register 4CH [6]
IRQ33
PEK rising edge
Register 49H [1] IRQ14
Battery temperature is too high
Register 4CH [5]
IRQ34
PEK falling edge
Register 49H [0] IRQ15
Battery temperature is too low
Register 4CH [4]
Retention
Register 4AH [7]
IRQ16
IC internal over-temperature
Register 4CH [3]
IRQ35
GPIO3 input edge trigger
Register 4AH [6]
IRQ17
Insufficient charging current
Register 4CH [2]
IRQ36
The GPIO2 enter edge triggered
Register 4AH [5]
IRQ18
DCDC1 voltage is too low
Register 4CH [1]
IRQ37
The GPIO1 input edge trigger
Register 4AH [4]
IRQ19
DCDC2 voltage is too low
Register 4CH [0]
IRQ38
The GPIO0 enter edge triggered

10 registers (Registers)

Group 1, the power control class

Address	Register Description	R / W	Default values
00	Power Status Register	R	
01	Power mode / charging status register	R	
02	The OTG VBUS State register	R	
04-0F	Data cache register	R / W	00H
12	DC-DC2 / 3 & LDO2/3/4 & EXTEN control register	R / W	XXH
23	DC-DC2 voltage setting register	R / W	XXH
25	DC-DC2/LDO3 voltage slope parameter setting register	R / W	00H
27	DC-DC3 voltage setting register	R / W	XXH
28	LDO2 / 3 voltage setting register	R / W	XXH
30	The VBUS-IPSOUT path setting register	R / W	60H
31	V OFF The shutdown voltage setting register	R / W	X3H
32	Shutdown, battery testing, CHGLED control register	R / W	46H
33	The charging control register 1	R / W	CXH
34			

Charging control register 2

R / W

41H

35

The spare battery charging control register

R / W

22H

36

The PEK parameter setting register

R / W

5DH

37

DCDC converter operating frequency setting register

R / W

08H

38

Charge the battery low temperature alarm setting register

R / W

A5H

39

Charge the battery temperature alarm setting register

R / W

1FH

3A

The APS low electric Level1 set register

R / W

68H

3B

The APS low electric Level2 set registers

R / W

5FH

3C

Discharge the battery low temperature alarm setting register

R / W

FCH

3D

Battery discharge temperature alarm setting register

R / W

16H

80

The DCDC work mode setting register

R / W

E0H

82

ADC enable set register 1

R / W

83H

83

ADC enable set register 2

R / W

80H

Address	Register Description	R / W	Default values
84	ADC sample rate is set, TS pin control register	R / W	32H
85	GPIO [1:0] input range setting register	R / W	X0H
86	GPIO1 ADC IRQ rising edge threshold set	R / W	FFH
87	GPIO1 ADC IRQ falling edge threshold set	R / W	00H
8A	Timer control register	R / W	00H
8B	VBUS monitoring set register	R / W	00H
8F	Over-temperature shutdown control register	R / W	01H

Group 2, GPIO control class

Address	Register Description	**R / W**	Default values
90	The GPIO0 control register	R / W	07H
91	LDO5 output voltage setting register	R / W	A0H
92	The GPIO1 Control register	R / W	07H
93	The GPIO2 control register	R / W	07H
94	GPIO [2:0] signal status register	R / W	00H
95	GPIO3 control register	R / W	00H

Group 3, interrupt control class

Address	Register Description	R / W	Default values
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
44	IRQ enable control register 5	R / W	00H
48	IRQ status register 1	R / W	00H
49	IRQ status register 2	R / W	00H
4A	IRQ status register 3	R / W	00H
4B	IRQ status register 4	R / W	00H
4C	IRQ status register 5	R / W	00H

Group 4, the ADC data class

Address	Register Description	R / W
56 [7:0]	ACIN voltage ADC data 8	R
57 [3:0]	ACIN voltage ADC data 4	R
58 [7:0]	High the ACIN current ADC data 8	R

59 [3:0]
Low four the ACIN current ADC data
R
5A [7:0]
The VBUS voltage ADC data 8
R
5B [3:0]
The VBUS voltage ADC data 4
R
5C [7:0]
The VBUS current ADC data 8
R

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5D [3:0]
VBUS current ADC data 4
R
5E [7:0]
AXP209 internal temperature monitoring ADC data 8
R
5F [3:0]
AXP209 internal temperature monitoring ADC data 4
R
62 [7:0]
TS 8 input ADC data, the default monitoring battery temperature
R
63 [3:0]
TS input a low ADC data four default monitoring battery temperature
R
64 [7:0]
High the GPIO0 voltage ADC data 8
R
65 [3:0]
Low four the GPIO0 voltage ADC data
R
66 [7:0]
High the GPIO1 voltage ADC data 8
R
67 [3:0]
The GPIO1 voltage ADC data low 4
R
70 [7:0]
Instantaneous power of the battery 8
R
71 [7:0]
8 battery instantaneous power
R
72 [7:0]
Instantaneous power of the battery is low 8
R
78 [7:0]
Battery voltage 8

R

79 [3:0]

The battery voltage is low 4

R

7A [7:0]

Battery charging current 8

R

7B [3:0]

Low battery charge current 4

R

7C [7:0]

Battery discharge current 8

R

7D [4:0]

Battery discharge current low 5

R

7E [7:0]

High the system IPSOUT voltage 8

R

7F [3:0]

Low voltage systems IPSOUT 4

R

Note: The battery-powered power is calculated as

Pbat = 2 * Register value * voltage the LSB * current LSB / 1000.

Voltage LSB 1.1mV, the current LSB to 0.5mA results mW.

Address

Register Description

R / W

Default values

B0

Battery charge coulomb meter data register [31:24]

R / W

00H

B1

Battery charge coulomb meter data register [23:16]

R / W

00H

B2

Battery charge coulomb meter data register [15:8]

R / W

00H

B3

Battery charge coulomb meter data register [7:0]

R / W

00H

B4

Battery discharge coulomb meter data register [31:24]

R / W

00H

B5

Battery discharge coulomb meter data register [23:16]

R / W

00H

B6

Battery discharge coulomb meter data register [15:8]

R / W

00H

B7

Battery discharge coulomb meter data register [7:0]

R / W

00H

B8

The Coulomb Counter encryption module control register

R / W

00H

B9

Electricity metering result register

R / W

00H

Coulomb calculation: C = 65536 * current LSB * (charge Coulomb denominated - discharge coulomb denominated) / 3600 / ADC sampling rate.

Including: ADC sampling rate reference to REG84H settings; the current LSB to 0.5mA; the results units mAh.

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10.1 REG 00H: input power status

Bit

Description

R / W

7

ACIN presence indicates

0: ACIN does not exist; 1: ACIN presence

R

6

Instructions the ACIN whether available

R

5

VBUS is present indication

0: VBUS does not exist; 1: VBUS exist

R

4

Indicate the VBUS whether available

R

3

The directions VBUS access before use is greater than V

HOLD

R

2

Indicates that the battery current direction

0: battery discharge; 1: The battery is charged

R

1

Indicate whether ACIN and VBUS input is shorted on the PCB

R

0

The instructions start ACIN source is or VBUS

0: Start source non-ACIN / VBUS is;: Start source ACIN / VBUS

R

10.2 REG 01H: power operating mode and charge status indication

Bit

Description

R / W

7

Indicating AXP209 whether over-temperature

0: not too warm; 1: overtemperature

R

6

Charging indicator

0: not charging or charging has been completed; 1: Charging

R

5

The battery state of existence indicates

0: no battery connected to AXP209; 1: the battery has been connected to the AXP209

R

4

Reservations, can not be changed

R

3

Indicates whether the battery into the active mode

0: not to enter the the battery activation patterns; 1: has entered the battery activation mode

R

2

Indicate the charging current is less than the desired current

0: The actual charge current is equal to the desired current; 1: the actual charge current is less than the desired current

R

1-0

Reservations, can not be changed

R

10.3 REG 02H: USB OTG VBUS status indication

Bit

Description

R / W

7-3

Reservations, can not be changed

2

Indicate the VBUS whether effective, effective

R

1

The directions VBUS Session A / B is effective, and 1 indicates that a valid

R

0

Indicative Session End state 1 indicates

R

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10.4 REG 04-0FH: data cache

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

10.5 REG 12H: Power output control

Default value: XXH

Bit

Description

R / W

Default values

7

Reservations, can not be changed

RW

X

6

LDO3 switch control

0: off; 1: open

RW

X

5

Reservations, can not be changed

RW

X

4

DC-DC2 switch control

RW

X

3

LDO4 switch control

RW

X

2

LDO2 switch control

RW

X

1

DC-DC3 switch control

RW

X

0

The EXTEN switch control

0: off; 1: open

RW

X

10.6 REG 23H: DC-DC2 output voltage setting

Default value: XXH

Bit

Description

R / W

Default values

7-6

Reservations, can not be changed

5-0

DC-DC2 output voltage setting

0.7-2.275V, 25mV/step

Vout = [0.7 + (Bit5-0) * 0.025] V

RW

X

10.7 REG 25H: DC-DC2/LDO3 dynamic voltage scaling parameter settings

Default value: 00H

Bit

Description

R / W

Default values

7-4

Reservations, can not be changed

3

LDO3 VRC enable control
0: open; 1: Close
RW
0
2
DC-DC2 VRC enable control
0: open; 1: Close
RW
0
1
LDO3 VRC control the slope of the voltage rise
0: 25mV/15.625us = 1.6mV/us
1: 25mV/31.250us = 0.8mV/us
RW
0
0
DC-DC2 VRC control the slope of the voltage rise
0: 25mV/15.625us = 1.6mV/us
1: 25mV/31.250us = 0.8mV/us
RW
0

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10.8 REG 27H: DC-DC3 output voltage setting
Default value: XXH
Bit
Description
R / W
Default values
7
Reservations, can not be changed
6-0
DC-DC3 output voltage setting
0.7-3.5V, 25mV/step
Vout = [0.7 + (Bit6-0) * 0.025] V
RW
X
10.9 REG 28H: LDO2 / 4 output voltage settings
Default value: XXH
Bit
Description
R / W
Default values
7-4
LDO2 output voltage settings
1.8-3.3V, 100mV/step
Vout = [1.8 + (Bit7-4) * 0.1] V
RW
X
3-0
LDO4 output voltage settings
1.25 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.5 2.7

2.8 3.0 3.1 3.2 3.3
RW
X

10.10 REG 29H: LDO3 output voltage settings

Default value: XXH

Bit
Description
R / W
Default values

7
LDO3 mode select:
0: LDO mode, the voltage is set by the [6:0]
1: switch-mode voltage is decided by LDO3IN
RW
0

6-0
LDO3 output voltage setting Bit6-Bit0
0.7-2.275V, 25mV/step
Vout = [0.7 + (Bit6-0) * 0.025] V
RW
X

10.11 REG 30H: VBUS-IPSOUT channel management

Default value: 6XH

Bit
Description
R / W
Default values

7
VBUS available when the VBUS-IPSOUT pathway selection control signal
0: N_VBUSEN pin, to decide whether to open this path
1: VBUS-IPSOUT path select Open, regardless N_VBUSEN state
RW
0

6
VBUS V
HOLD
Pressure limiting control
0: not limited pressure; 1: limited pressure
RW
1

5-3
V
HOLD
Set up
V
HOLD
= [4.0 + (Bit5-3) * 0.1] V
RW
100

2
Reservations, can not be changed

1-0
VBUS current limit control open time limit stream selection
RW
0

00:900 mA; 01:500 mA; 10:100 mA; 11: not limit

10.12 REG 31H: V

OFF

Shutdown voltage setting

Default value: X3H of

Bit	Description	**R / W**	Default values
7-4	Reservations, can not be changed		
3	Sleep mode the PEK or GPIO edge the wakeup enable set: 0: off 1: Open After writing this bit automatically cleared each into Sleep mode again write 1		
2-0	V OFF Set up V OFF = [2.6 + (Bit2-0) * 0.1] V Default: 2.9V	RW	011

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

Default value: 46H

Bit	Description	**R / W**	Default values
7	Shutdown control This bit write output closes AXP209	RW	0
6	Battery monitoring function set bit: 0: off; 1: Open	RW	1
5-4	CHGLED pin functions set 00: Hi-Z 01: 25% 1Hz blinking 10: 25% 4Hz blinking 11: output low	RW	00
3	CHGLED pin control set 0: control by charging function 1: REG 32H [5:4] control by the register		

RW
0

2
Output Close timing control
0: Close
1: Contrary to start timing
RW
0

1-0
Shutdown delay N_OE AXP209 from low to high
Delay time
00: 128mS; 01: 1S;
10: 2S;
11: 3S
RW
10

10.14 REG 33H: charge control
Default value: CXH

Bit
Description
R / W
Default values

7
Charging functions enable control bit
0: Off, 1: open
RW
1

6-5
Charging the target voltage set
RW
10

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00:4.1 V; 01:4.15 V; 10:4.2 V; 11:4.36 V

4
Charging the end of the current set
0: The charging current is less than 10% of the set value, end-of-charge
1: The charging current is less than 15% of the set value, end-of-charge
RW
0

3-0
Charging current is set
I
charge
= [300 + (Bit3-0) * 100] mA
RW
X

10.15 REG 34H: charge control
Default value: 45H

Bit
Description
R / W

Default values

7

Precharge timeout settings Bit1

RW

0

6

Precharge timeout setting Bit0

00: 40 min; 01: 50min;

10: 60min; 11: 70min

RW

1

5

Retention

4

CHGLED mode selection

0: Charging Steady

1: flashes when charging

RW

0

3-2

Reservations, can not be changed

1-0

The constant current mode timeout setting Bit1-0

00: 6Hours; 01: 8Hours;

10: 10Hours; 11: 12Hours

RW

01

10.16 REG 35H: spare battery charging control

Default value: 22H

Bit

Description

R / W

Default values

7

Backup battery charge enable control

0: off; 1: open

RW

0

6-5

Target backup battery charging voltage set

00:3.1 V; 01:3.0 V; 10:3.6 V; 11:2.5 V

RW

01

4-2

Reservations, can not be changed

1-0

Spare battery charging current is set

00: 50uA; 01: 100uA; 10: 200uA; 11:

400uA

RW

10

10.17 REG 36H: PEK key parameter settings

Default value: 9DH

Bit

Description

R / W

Default values

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7-6
Boot time settings
00: 128mS; 01: 3S; 10: 1S; 11: 2S.
RW
01
5-4
Long key time set
00: 1S; 01: 1.5S; 10: 2S; 11: 2.5S.
RW
01
3
Key long when you grew up in the shutdown automatic shutdown feature set
0: off; 1: open
RW
1
2
The complete power start PWROK signal delay
0:8 mS; 1:64 mS
RW
1
1-0
Length setting shutdown
00: 4S; 01: 6S; 10: 8S; 11: 10S.
RW
01
10.18 REG 37H: DC-DC operating frequency is set
Default value: 08H
Bit
Description
R / W
Default values
7-4
Reservations, can not be changed
3-0
DC-DC switching frequency is set
Each level change of 5%, the default value of 1.5MHz
$F = [1 + / - (Bit3-0) * 5\%)] * 1.5MHz$
RW
1000
10.19 REG 38H: V
LTF-charge
Charging the battery temperature threshold set
Default value: A5H of
Bit
Description
R / W
Default values
7-0
When charging the battery temperature threshold settings, M
M * 10H, when M = A5H corresponding 2.112V;
Corresponding voltage 0V3.264V
RW

A5H
V
LTF-charge
= M * 10H * 0.0008V
10.20 REG 39H: V
HTF-charge
Battery charging high temperature threshold settings
Default value: 1FH
Bit
Description
R / W
Default values
7-0
Charging battery high temperature threshold settings, N
N * 10H, when N = 1FH corresponding 0.397V; can
Corresponding voltage 0V3.264V
RW
1FH
V
HTF-charge
= N * 10H * 0.0008V
10.21 REG 3AH: system IPSOUT Vwarning Level1
Default value: 68H
Bit
Description
R / W
Default values
7-0
System IPSOUT Vwarning Level1
RW
68H

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10.22 REG 3BH: IPSOUT Vwarning Level2
Default value: 5FH
Bit
Description
R / W
Default values
7-0
System IPSOUT Vwarning Level2
RW
5FH
The voltage setting of REG3AH, REG3BH corresponding relations as follows (assuming that the register value of n):
Vwarning = 2.8672 + 1.4mV * n * 4
10.23 REG 3CH: V
LTF-discharge
Battery discharge temperature threshold set
Default value: FCH
Bit
Description
R / W

Default values

7-0

Discharge the battery temperature threshold settings, M

M * 10H, when M = FCH corresponding 3.226V;

Corresponding voltage 0V3.264V

RW

FCH

V

LTF-discharge

= M * 10H * 0.0008V

10.24 REG 3DH: V

HTF-discharge

Battery discharge high temperature threshold settings

Default value: 16H

Bit

Description

R / W

Default values

7-0

Battery discharge high temperature threshold settings, N

N * 10H, when of N = 16H, corresponding to 0.282V; can

The voltage 0V3.264V,

RW

16H

V

LTF-discharge

= N * 10H * 0.0008V

10.25 REG 80H: DC-DC mode selection

Default value: E0H

Bit

Description

R / W

Default values

7-3

Reservations, can not be changed

2

DC-DC2 operating mode control

RW

0

1

DC-DC3 operating mode control

0: PFM / PWM auto-switching

1: fixed PWM

RW

0

0

Reservations, can not be changed

10.26 REG 82H: ADC Enable 1

Default value: 83H

Bit

Description

R / W

Default values

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7
Battery voltage ADC enable
RW
1
6
Battery current ADC enable
RW
0
5
The ACIN Voltage ADC is enabled.
RW
0
4
The ACIN current ADC is enabled.
RW
0
3
VBUS voltage ADC enable
RW
0
2
The VBUS current ADC enable
RW
0
1
APS voltage ADC enable
RW
1
0
TS pin ADC function is enabled
0: Off, 1: open
RW
1

10.27 REG 83H: ADC Enable 2

Default value: 80H

Bit
Description
R / W
Default values
7
AXP209 internal temperature monitoring ADC enable
0: Off, 1: open
RW
1
6-4
Reservations, can not be changed
3
The GPIO0 ADC enable
RW
0
2
The GPIO1 ADC enable
RW
0
1-0

Reservations, can not be changed
0: Off, 1: open
10.28 REG 84H: ADC sample rate settings, the TS pin control
Default value: 32H
Bit
Description
R / W
Default values
7-6
ADC sampling rate is set
25×2
n
Sampling rates of 25, 50, 100, 200Hz
RW
0
5-4
TS pin output current settings:
00:20 uA; 01:40 uA; 10:60 uA; 11:80 uA
RW
11
3
Reservations, can not be changed
2
TS pin function selection
0: battery temperature monitoring function, 1: independent external ADC input path
RW
0
RW
1
1-0
TS pin current output settings
00: Close
01: charging current output
10: ADC Sample input could be saving
11: has been open
RW
0
10.29 REG 85H: ADC input range
Default value: X0H of

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Bit
Description
R / W
Default values
7-2
Reservations, can not be changed
1
The GPIO1 ADC input range
RW
0
0

The GPIO0 ADC input range
0:0-2.0475 V
1:0.7-2.7475 V
RW
0

10.30 REG 86H: GPIO1 ADC IRQ rising edge threshold set
Default value: FFH

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

10.31 REG 87H: GPIO1 ADC IRQ falling edge threshold set
Default value: 00H

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

10.32 REG 8AH: timer control
Default value: 00H

Bit
Description
R / W
Default values
7
Timer expires
Write 1 to clear this status
RW
0
6-0
Set regular time in minutes
To write 0 closed this timer
RW
0000000

10.33 REG: VBUS is pin monitoring SRP function control 8BH
Default value: 00H

Bit
Description
R / W
Default values
7-6
Reservations, can not be changed
5-4
VBUS valid voltage settings
00:4.0 V; 01:4.15 V; 10:4.45 V; 11:4.55 V
RW
00
3
VBUS Valid detection function settings: 0: Off, 1: Open
RW
0

2

VBUS Session detection function settings: 0: Off, 1: Open

RW

0

1

Discharge VBUS discharge feature set

0: Close VBUS discharge resistor; 1: VBUS discharge resistor

RW

0

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0

Charge VBUS charge feature set

0: Disconnect VBUS charge resistor; 1: VBUS charging resistor to VBUS charge

RW

0

10.34 REG 8FH: over-temperature shutdown feature set

Default value: 21H

Bit

Description

R / W

Default values

7-3

Reservations, can not be changed

RW

0

2

AXP209 internal over-temperature shutdown feature set

0: Shutdown; 1: Shutdown

RW

0

1-0

Reservations, can not be changed

10.35 REG 90H: GPIO0 feature set

Default value: 07H

Bit

Description

R / W

Default values

7

GPIO0 rising edge IRQ or Wakeup function

RW

0

6

GPIO0 falling edge of IRQ or Wakeup function

0: disable

1: enable

RW

0

5-3

Reservations, can not be changed

RW

0

2

RW

1

1

RW

1

0

The GPIO0 pin feature set Bit 2-0

000: low output

001: output (3.3V)

010: universal input function

011: low noise LDO5

100: ADC input

1XX: floating

RW

1

10.36 REG 91H: LDO5 output voltage as well as the EXTEN / GPIO output high set

Default value: A5H of

Bit

Description

R / W

Default values

7-4

LDO5 output voltage settings

Vout = [1.8 + (Bit7-4) * 0.1] V; defalt = 1.8 +10 * 0.1 = 2.8V

RW

1010

3

Reservations, can not be changed

2-0

EXTEN, and GPIO [1:0] set the output high

000:1.8 V; 001:2.5 V; 010:2.8 V; 011:3.0 V; 100:3.1 V; 101:3.3 V; 110:3.4 V; 111:3.5 V

RW

101

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10.37 REG 92H: GPIO1 feature set

Default value: 07H

Bit

Description

R / W

Default values

7

GPIO1 rising edge IRQ or Wakeup function

RW

0

6

GPIO1 rising edge IRQ or Wakeup function

0: disable

1: enable

RW

0

5-3

Reservations, can not be changed

RW

0

2-0

The GPIO1 pin functions set

000: low output

001: output (3.3V)

010: universal input function

011: low-noise LDO

100: ADC input

1XX: floating

RW

111

10.38 REG 93H: GPIO2 feature set

Default value: 07H

Bit

Description

R / W

Default values

7

GPIO2 rising edge IRQ or Wakeup function

RW

0

6

The GPIO2 falling edge of the IRQ or Wakeup function

0: disable

1: enable

RW

0

5-3

Reservations, can not be changed

RW

0

2-0

The GPIO2 pin functions set

000: low output

001: floating

010: universal input function

XXX: floating

RW

111

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

Default value: 00H

Bit

Description

R / W

Default values

7

Reservations, can not be changed

R

6

The GPIO2 enter state

R

5

The GPIO1 enter state

R

4
The GPIO0 enter state
0: input low
1: input high
R
3-0
Reservations, can not be changed
10.40 REG 95H: GPIO3 set
Default value: 00H

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Bit
Description
R / W
Default values
7
GPIO3 rising edge IRQ or Wakeup function
RW
0
6
GPIO3 falling edge of IRQ or Wakeup function
0: disable
1: enable
RW
0
5-3
Reservations, can not be changed
2
GPIO3 feature set
0: NMOS Open Drain Output
1: digital input function
RW
0
1
GPIO3 output settings
0: output low, NMOS open
1: floating, NMOS Close
RW
1
0
GPIO3 input state
0: input high
1: input low
R
10.41 REG 40H and 48H: IRQ enable IRQ state
The IRQ enable 1, REG40H: The default value: D8H
IRQ state REG48H: default value: 00H
Bit
Description
R / W
Default values
7-0

The meaning of the status bits of each bit corresponding to 40H;
For example: Bit7 is ACIN overvoltage IRQ status bits
RW
0
10.42 REG 41H and 49H of the: IRQ Enable IRQ state 2
IRQ energy 2 REG41H: default value: FFH
Bit
Description
R / W
Default values
7
IRQ enable battery access
RW
1
6
IRQ enable battery removed
RW
1
5
The battery activation patterns IRQ enable
RW
1
4
The exit cell activation patterns IRQ enable
RW
1
3
The is charging IRQ enable
RW
1
2
The charging completed IRQ enable
RW
1
1
Battery over-temperature IRQ enabled
RW
1
0
IRQ Enable battery low temperature
RW
1
Bit
Description
R / W
Default values
7
The ACIN overvoltage IRQ enable
RW
1
6
The ACIN access IRQ enable
RW
1
5
ACIN out of IRQ enable
RW
0

4
VBUS overvoltage IRQ enabled
RW
1
3
And VBUS access IRQ enable
RW
1
2
The VBUS removed IRQ enabled
RW
0
1
VBUS available but less than V
HOLD
IRQ is enabled
RW
0
0
Reservations, can not be changed
RW
0

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The IRQ state REG49H: default value: 00H
Bit
Description
R / W
Default values
7-0
The meaning of the status bits, respectively, each bit of the corresponding 41H
RW
0
10.43 REG 42H 4AH: IRQ enable IRQ state
IRQ can 3 REG42H: default value: 03H
Bit
Description
R / W
Default values
7
AXP209 Internal overtemperature IRQ enable
RW
0
6
The charging current is less than the set current IRQ enable
RW
0
5
Reservations, can not be changed
4
DC-DC2 output voltage is less than the set value IRQ enable
RW

0
3
DC-DC3 output voltage is less than the set value IRQ enable
RW
0
2
LDO3 output voltage is less than the set value IRQ enable
1
The PEK short key IRQ enable
RW
1
0
PEK long keys IRQ enable
RW
1

The IRQ state REG4AH: default value: 00H

Bit
Description
R / W
Default values
7-0
The meaning of the status bits, respectively, each bit of the corresponding 42H
RW
0

10.44 REG 43H 4BH: IRQ Enable 4 and IRQ state

IRQ Enable 4, REG43H: default value: 01H

Bit
Description
R / W
Default values
7
N_OE boot IRQ enable
RW
0
6
IRQ enable N_OE shutdown
RW
0
5
VBUS valid IRQ enabled
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
The APS low pressure IRQ Enable (LEVEL1)
RW
0

0

The APS low pressure IRQ Enable (LEVEL2)

RW

1

The IRQ state REG4BH: default value: 00H

Bit

Description

R / W

Default values

7-0

The meaning of the status bits, respectively, each bit of the corresponding 43H

RW

0

10.45 REG 44H and 4C: IRQ enable IRQ state 5

IRQ can 5 REG44H default value: 00H;

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Bit

Description

R / W

Default values

7

Timer timeout IRQ enable

RW

0

6

PEK button on the rising edge IRQ enable

RW

0

5

PEK buttons enable falling edge of IRQ

RW

0

4

Reservations, can not be changed

RW

0

3

GPIO3 input edge-triggered IRQ enable

RW

0

2

GPIO2 input edge-triggered IRQ enable

RW

0

1

The GPIO1 input edge-triggered or ADC input IRQ enabled

RW

0

0

GPIO0 input edge-triggered IRQ enable

RW

0

The the IRQ state of 5 REG4CH: default value: 00H

Bit

Description

R / W

Default values

7-0

The meaning of the status bits, respectively, each bit of the corresponding 44H

RW

0

Note: All IRQ status register corresponding bit write clears state.

10.51 REG B8H: Coulomb Counter Control

Default value: 00H

Bit

Description

R / W

Default values

7

The coulomb meter switch control

RW

0

6

Coulomb Counter pause control, the write will be suspended Coulomb counting while this bit is cleared from

RW

0

5

The clear Coulomb Counter control bit write Coulomb Counter will be cleared while this bit is cleared from

RW

0

4-2

Reservations, can not be changed

RW

0

1-0

The decryption start bit, decryption start automatically cleared

RW

0

0

Decryption is complete

0: not completed

1: Complete

RW

0

10.52 REG B9H: power measurement results

Default value: 7FH

Bit

Description

R / W

Default values

7

Metering system control

0: normal operating mode

1: suspend work

RW

0

6-0

Measurement results, the percentage of

R

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11. Package (Package)
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