IP2333

1 IP2333特性

- 3.6V-6V, 23V
- :
  3.6V~4.55V , 3.2V (3.6V)
- ±0.5%
- VSYS
  VSYS
- VIN VSYS
- VBAT VSYS
- DPM
- IP2333_I2C I2C CC,CV,IIN-DPM,
  VIN-DPM EOC, Pre-charger ,VDD
- IP2333_I2C I2C
- 500mA
- 1mA EOC
- 20mA VDD
- NTC JEITA
- 1μA
- , ,IC ,NTC
- Shipping mode 400nA
- DFN8(0303)

2 IP2333应用

- TWS
-
-

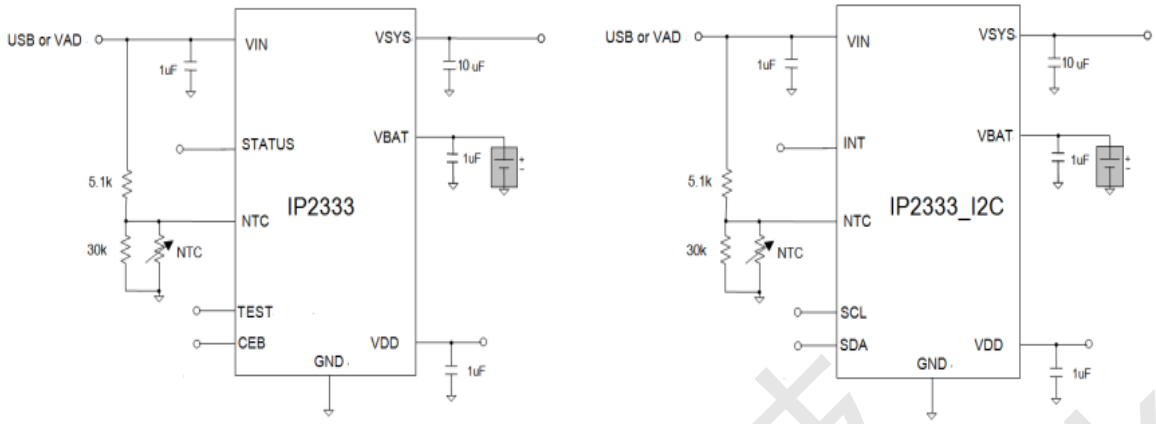
3 IP2333简介

IP2333
1 IP2333
(TC) CC CV
(TC)
CC
CV
IP2333
500mA
±0.5%

IP2333_I2C I2C /CV
23V IP2333

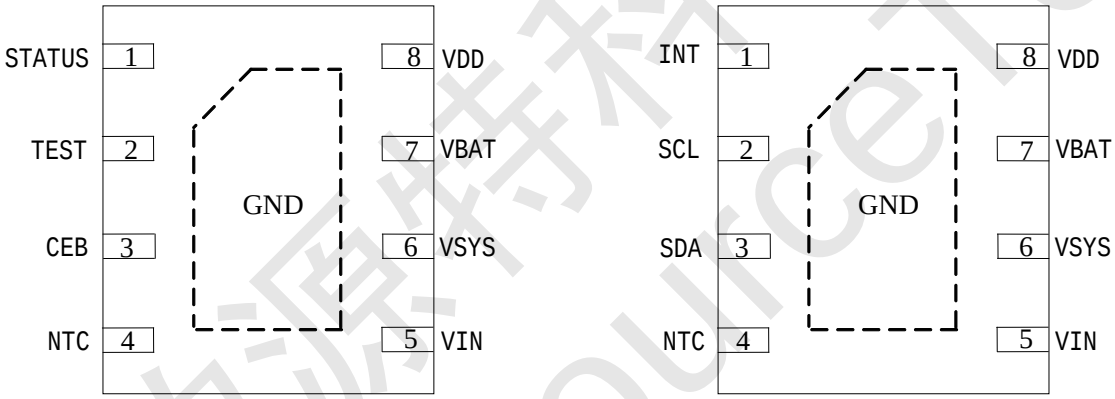
IP2333 VSYS
VSYS
IP2333 20mA VDD
IP2333 VBAT 1mA EOC
,TWS
IP2333

DFN8(0303)



1 IP2333 IP2333_I2C

4 IP2333引脚定义



DFN8(0303) IP2333 DFN8(0303)IP2333_I2C

2 IP2333

IP2333

1	STATUS	LED VIN
2	TEST	1K VBAT
3	CEB	1Mohm VIN
4	NTC	PCB VIN NTC NCP18XH103 $B_{25/50}$=3380K NTC
5	VIN	USB
6	VSYS	
7	VBAT	
8	VDD	LDO 20mA MCU VDD
EPAD	GND	

IP2333_I2C

1	INT	
2	SCL	I2C
3	SDA	I2C
4	NTC	PCB VIN NTC NCP18XH103 $B_{25/50}$=3380K NTC
5	VIN	USB
6	VSYS	
7	VBAT	
8	VDD	LDO 20mA MCU I2C VDD
EPAD	GND	

5 IP2333版本修订记录

V1.0		2021-5-14
V1.1	1 I2C 2 VBAT	2021-8-26
V1.2	1 VIN VBAT 1uF	

6 IP2333极限参数

	VIN, STATUS/INT NTC	-0.3V to 24	
	VSYS,VBAT	-0.3V to 9	
	SCL/TEST,SDA/CEB, VDD	-0.3V to 6	
	T_J	-40 ~ 125	
	Tstg	-60 ~ 150	
	θ_{JA}	70	
	ESD_HBM	±4	
	ESD_CDM	±1	

7 IP2333推荐工作条件

	VIN	3.6	--	6	V
	T_A	-40	--	85	

*

8 IP2333型号列表

IP2333	CEB GPIO STATUS	GPIO TEST,CEB I2C CEB STATUS LED
IP2333_I2C	SCL,SDA I2C INT	I2C

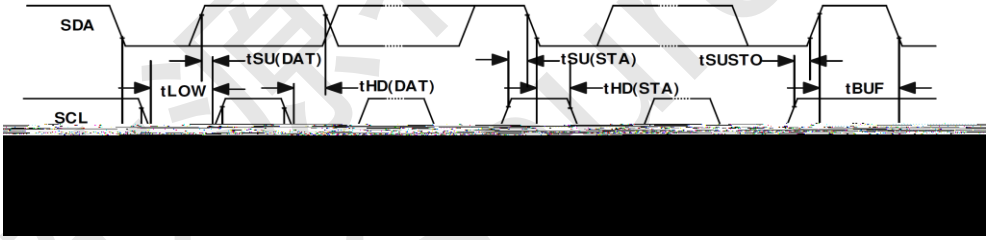
9 IP2333电气特性

T_A = -40℃ to 85°C.Typical values are for T_A = 25℃.VIN = 5 V, NTC = 3 V, VBAT =3.6V.

VIN VSYS						
	VIN		3.6	5	6	V
VIN	I_Q	VIN=5V		1	2	mA
VIN	VIN_{OVP}	VIN	5.8	6	6.2	V
	VIN_{OVP_HYS}	VIN	150	200	250	mV
VIN	VIN_{UVLO}	BAT=3V, VIN	3.60	3.70	3.85	V
	VIN_{UVLO_HYS}	BAT=3V, VIN				

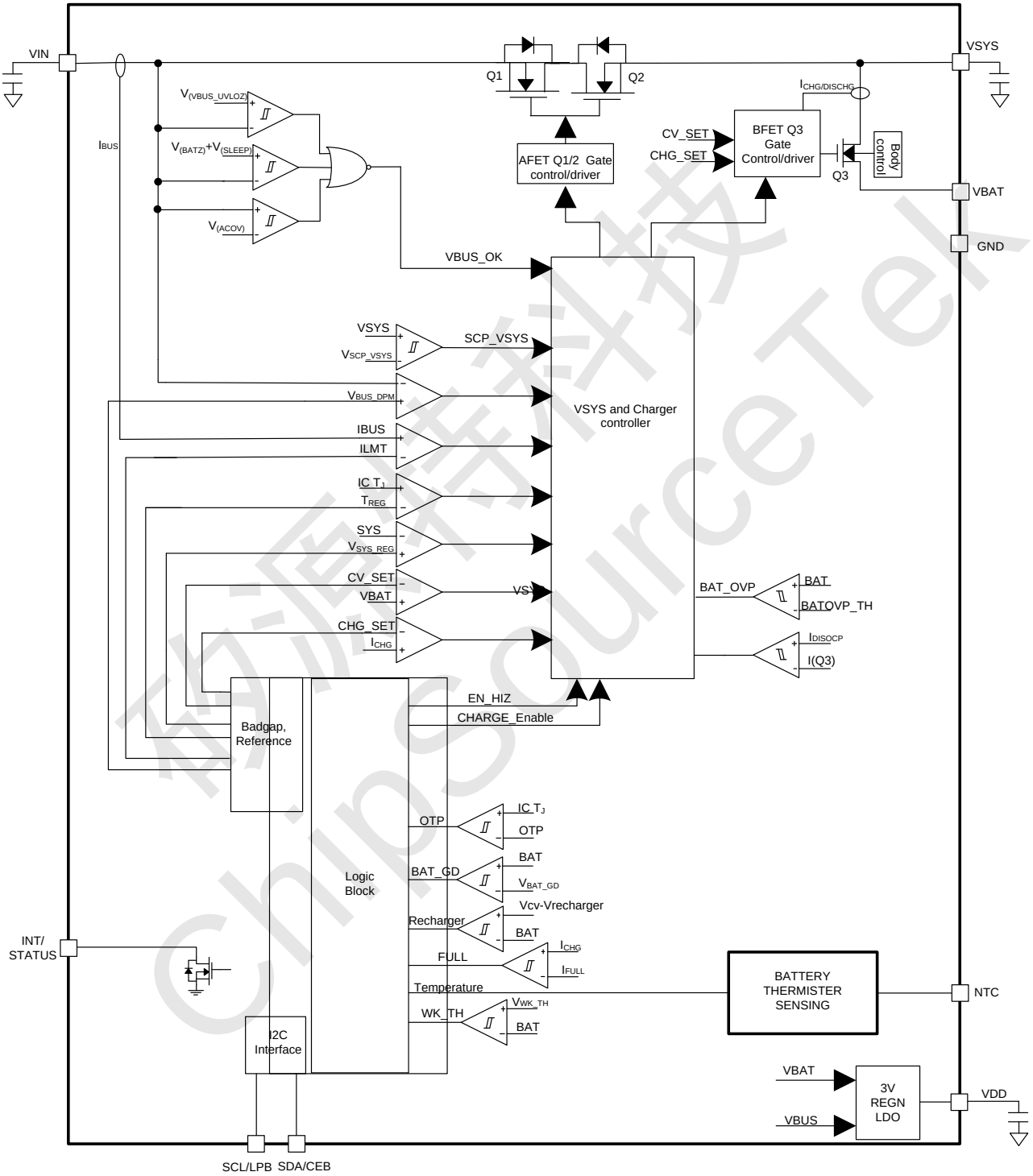
UVLO	V_{BOFF}	BFET, 2.8V	2.7	2.8	2.9	V
	V_{BON}		2.9	3	3.1	V
VBAT< V_{BOFF}	I_{BOFF}	VBAT=2V		1.7	2	uA
	T.O_prech		50	60	70	Min
	T.O_normal	5	4	5	6	Hr
	Vre_ch	0.2V	150	200	250	mV
	I_{DIS_LIMIT}	2.2A	1.8	2.2	2.6	A
INT	T_{RST_DGL}	16s	12	16	20	S
INT	T_{RST_DUR}	4s	3	4	5	S
INT	$T_{EXIT\_SHIPPING}$		1.5	2	2.5	S
STATUS, NTC,INT						
STATUS	I_{STATUS}			5		mA
INT			110	125	140	uS
NTC	$V_{NTC\_HOT\_TH}$	V_{NTC} VIN ,REG08<2:1>=00 60°C	32.5	34.5	36.5	%
	$V_{NTC\_HOT\_TH\_HSY}$	V_{NTC} VIN ,REG08<2:1>=00 5°C		3.25		%
	$V_{NTC\_WT\_TH}$	V_{NTC} VIN , 45°C	42.7	44.7	46.7	%
	$V_{NTC\_WT\_TH\_HSY}$	V_{NTC} VIN 5°C		3.75		%
	$V_{NTC\_COOL\_TH}$	V_{NTC} VIN ,REG08<0>=0 10°C	66.25	68.25	70.25	%
	$V_{NTC\_COOL\_TH\_HSY}$	V_{NTC} VIN , 5°C		3		%
	$V_{NTC\_COLD\_TH}$	V_{NTC} VIN , 0°C	71.25	73.25	75.25	%
	$V_{NTC\_COLD\_TH\_HSY}$	V_{NTC} VIN 5°C		2.5		%
	T_{OTP}			150		
	ΔT_{OTP}			25		
	Tdie			120		

IP2333_I2C	SDA/SCL					
	V_{L_IN}	SCL/SDA	-	-	0.8	V
	V_{H_IN}	SCL/SDA	1.6	-	-	V
	V_{L_OUT}	SDA,Sink 3mA			0.2	V
	f_{SCL}		-	100	-	KHz
			-	400	-	KHz
	$t_{HD;STA}$		4	-	-	μs
			0.6	-	-	μs
	$t_{SU;STA}$		4.7	-	-	μs
			0.6	-	-	μs
	$t_{HD;DAT}$		-	-	3.45	μs
			-	-	0.9	μs
	$t_{SU;DAT}$		250	-	-	ns
			100	-	-	ns
	$t_{SU;STO}$		4	-	-	μs
			0.6	-	-	μs
SCL	t_{LOW}		4.7	-	-	μs
			1.3	-	-	μs
SCL	t_{HIGH}		4	-	-	μs
			0.6	-	-	μs



3:IP2333_I2C

10 IP2333功能描述



4: IP2333

IP2333 I2C (IP2333_I2C)
IP2333 (TC) CC CV (TC)
CC CV
IP2333 1mA IP2333

IP2333 LDO AFET LDO BFET AFET LDO LDO BFET

LDO BFET IP2333_I2C I2C CC CV EOC
Auto-recharge NTC JEITA
120 ° C default
VIN DPM 0
supplement mode supplement mode
BFET
IP2333 I2C 1uA
,TWS

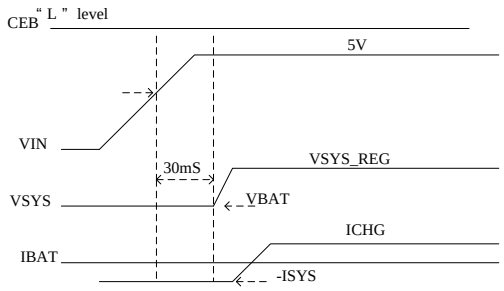
IP2333 VDD VIN VBAT VIN VIN UVLO
VIN AFET LDO BFET
BFET LDO VIN UVLO BFET
BFET shipping BFET VBAT
I2C (IP2333_I2C) 400nA

I2C IP2333_I2C

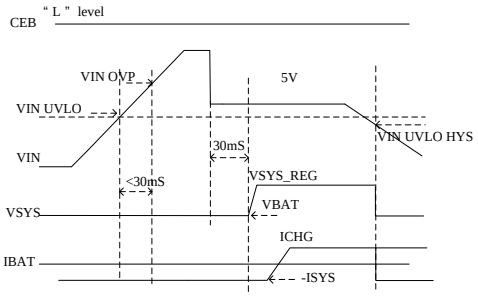
VIN I2C I2C I2C master VIN
UVLO I2C I2C I2C
master I2C SCL I2C I2C I2C master
I2C I2C I2C REG05[6:5] , I2C
REG05[7] I2C

VIN

IP2333 23V IP2333
OVP (UVLO) 3.6-21V OVP UVP
AFET OVP UVP 30ms IP2333
AFET VIN 5 VIN
6



5: VIN



6: VIN OVP UVP

AFET BFET

AFET VIN VSYS BFET VBAT VSYS AFET BFET

,

AFET

- VIN>VIN OVP
- VIN<VIN UVLO
- REG01[4] AFET_ENB 1(IP2333_I2C)
- INT (IP2333_I2C)

BFET

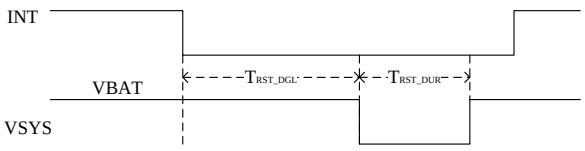
- VBAT<VBAT UVLO VIN OK
- VIN I2C REG01[3] CEB 1(IP2333_I2C)
- VIN CEB VIN OK
- Shipping mode (IP2333_I2C)
- INT (IP2333_I2C)
- EOC VIN OK
- NTC VIN OK

IP2333_I2C

IP2333_I2C

INT T_{RST_DGL} IP2333_I2C AFET BFET VSYS 0 AFET BFET

T_{RST_DUR} AFET BFET 7

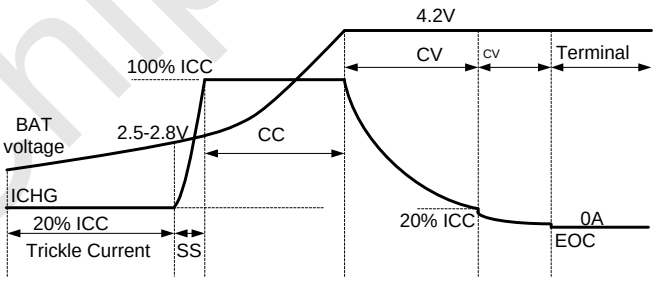


7: INT

DPM VIN-DPM IIN-DPM

DPM IP2333 VIN-DPM IIN-DPM DPM
I2C REG0[7:0] IP2333_I2C IIN-DPM VIN
VIN-DPM IIN-DPM IIN-DPM
IIN-DPM VIN VIN-DPM VIN-DPM
DPM VSYS VSYS_REG-135mV VIN-0.35V
0
supplement mode
VIN-DPM VIN VIN-DPM IIN-DPM IIN IIN-DPM
IP2333 VIN_SLEEP VIN-VBAT>VIN_SLEEP_TH
VIN-DPM VIN_SLEEP VIN-DPM VBAT+VIN_SLEEP
VIN-DPM I2C REG07[6] (IP2333_I2C)
VIN-DPM 300mV

8 IP2333 4.2V pre-charge
(V_{VBAT_PRE}) IP2333 pre-charge CC/5 (Pre_charge Current)
Pre_charge CC REG02[5:0]
CV CV
CC/5 CV
CV EOC
EOC 8mA 8mA
EOC 8mA 16mA 16mA
EOC 16mA 24mA
CV CV EOC



8:

IP2333 (EOC) CV

IP2333_I2C CC,CV,EOC, , I2C

I2C

EOC (Recharge)

IP2333 EOC CV EOC EOC
4ms IP2333 EOC BFET VIN-DPM IIN-DPM EOC E0C
I2C REG05[4] supplement
Recharge BFET LDO MOSFET
timer Recharge I2C REG04[0] (IP2333_I2C)
EOC Recharge

VBAT OVP

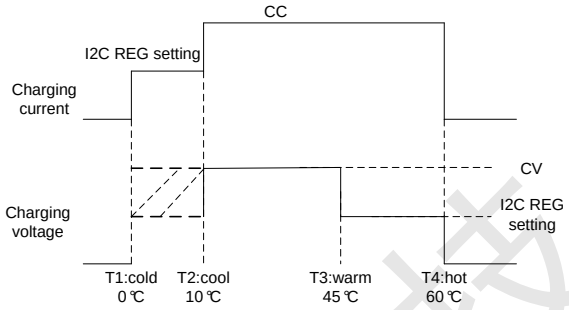
IP2333 CV 100mV VBAT OVP BFET
Recharge

VBAT UVLO

IP2333 VBAT UVLO ,
VBAT UVLO IP2333_I2C VBAT UVLO I2C REG01[2:0]

$V_{NTC\_WT\_TH}$ hot $V_{NTC\_HOT\_TH}$ CV I2C REG09[1:0] cool $V_{NTC\_COOL\_TH}$ cold $V_{NTC\_COLD\_TH}$ CV CC I2C REG09[3:0] I2C NTC $V_{NTC\_WT\_TH}$ $V_{NTC\_COLD\_TH}$ 45 ° C 0 ° C cool hot I2C REG08[2:0]

JEITA 9



9:JEITA

NTC NTC NCP18XH103 B25/50=3380K RT1 RT2

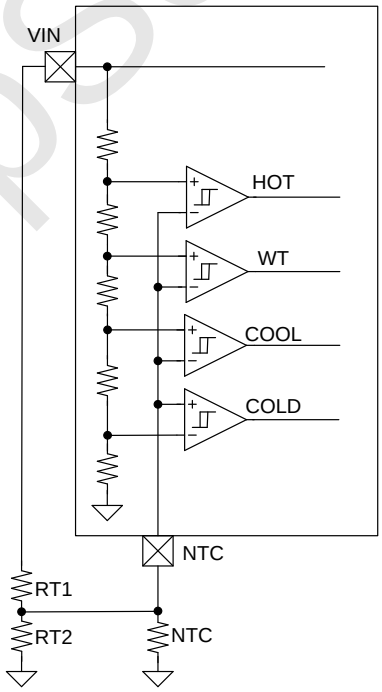
$$RT2 = \frac{V_{IN} \times RTH_{COLD} \times RTH_{HOT} \times \left(\frac{1}{VT1} - \frac{1}{VT5}\right)}{RTH_{HOT} \times \left(\frac{V_{IN}}{VT5} - 1\right) - RTH_{COLD} \times \left(\frac{V_{IN}}{VT1} - 1\right)}$$

$$RT1 = \frac{\left(\frac{V_{IN}}{VT1} - 1\right)}{\frac{1}{RT2} + \frac{1}{RTH_{COLD}}}$$

60℃ Hot RTH_{COLD}= 27.22 kΩ RTH_{HOT}= 3.01kΩ

VT1=73.25% x VIN VT5=34.37% x VIN

RT2=30.18kΩ, RT1=5.23kΩ



10::NTC

Safety Timer

IP2333 safety timer Pre-charge Pre_charge Timer Pre_charge 60min IP2333

IP2333 (Fast Charge Timer) (3-24hours IP2333_I2C I2C REG05[2:1])

-
- CEB REG01[3] CEB
- Reset
- Safety timer I2C REG05[3]
- re-charge

Shipping mode IP2333_I2C

I2C REG06[5] BAT_FET_CTR 1 $T_{RST\_SHIPPING}$ I2C BFET I2C VBAT 0.5uA VIN (shipping mode) VIN (shipping mode) INT (shipping mode) INT (shipping mode)

shipping mode

- VIN I2C VIN 2
- INT 2S

VDD LDO

IP2333 20mA LDO I2C REG08[5:4] I2C REG05[0] LDO Shipping-mode LP VDD LDO

IP2333 STATUS

-
-
- 1Hz NTC /

LP

IP2333_I2C I2C REG02[7](IP2333_I2C) LP LP
1uA , VDD UVLO BFET
VIN>VIN UVLO VIN<VIN OVP LP
IP2333 LP VIN 1uA

INT IP2333_I2C

IP2333_I2C INT 125us INT

- VIN OVP VIN DPM
- VIN OK
- VBAT OVP
- EOC
- NTC

INT I2C 1 I2C NTC

I2C INT

I2C REG03[6:4] 60uS
BFET hiccup

SCP

VSYS VSYS AFET BFET 64ms
hiccup
VIN SCP

- VSYS<2.4V
- 100uS

11 IP2333_I2C 寄存器表

23H and 22H .

MSB							LSB
0	0	1	0	0	0	1	R/W

11.1 INPUT Register, OFFSET=0x00, Default value=0x9F

Bit(s)	Name	Description	R/W	Reset
7:4	VIN_MIN<3:0>	VDPM Offset: 3.68V 80mV Step Range: 3.68V – 4.8 V(0001-1111) Default: 4.32V 1001	RW	1001
3:0	ILMT_SET<3:0>	Offset: 50mA 30mA Step Range: 50mA –500mA(0000-1111) Default: 500mA 1111	RW	1111

11.2 MOSFETs setting register: Offset=0x01, Default value=0xA4

Bit(s)	Name	Description	R/W	Reset
7:5	TRST_DGL TRST_DUR	INT TRST_DGL INT TRST_DUR 000 TRST_DGL=8S TRST_DUR=2S 001 TRST_DGL=8S TRST_DUR=4S 010 TRST_DGL=12S TRST_DUR=2S 100 TRST_DGL=16S TRST_DUR=2S 101 TRST_DGL=16S TRST_DUR=4S 110 TRST_DGL=20S TRST_DUR=2S Default: TRST_DGL=16S TRST_DUR=4S 101	RW	101
4	AFET_ENB	AFET ON/OFF 0: ON 1:OFF Default: ON 0	RW	0
3	CEB	0:enable 1:disable Default: enable 0	RW	0
2:0	VBAT_UVLO<2:0>	UVLO offset:2.4V, 100mV Step Range: 2.4 V – 3.1 V(000-111) Default: 2.8 V 100	RW	100

11.3 CC setting register: Offset=0x02, Default value=0x8F

Bit(s)	Name	Description	R/W	Reset
7	LPB_EN	I2C 0:enable 1:disable Default: disable 1	RW	1
6	RSV	RSV	RW	0

5:0	CC<5:0>	Offset: 8mA 8mA Step Range: 8mA –512mA(000000-111111) Default: 128mA 001111	RW	001111

11.4 Current threshold setting register:Offset=0x03, Default value=0x71

Bit(s)	Name	Description	R/W	Reset
7	RSV	RSV	RW	0
6:4	IDSCHG<2:0>	000 250mA; 001 500mA 010 750mA 011 1050mA 100 1350mA 101 1750mA 110 2200mA 111 3100mA Default: 3100mA 111	RW	111
3:0	EOC<3:0>	EOC Offset: 1mA 2mA Step Range: 1mA –31mA(0000-1111) Default: 3mA 0001	RW	0001

11.5 Charging setting register: Offset=0x04, Default value=0xA3

Bit(s)	Name	Description	R/W	Reset
7:2	CV<5:0>	CV Offset: 3.6V 15mV Step Range: 3.6V –4.545V(000000-111111) Default: 4.2V 101000	RW	101000
1	V_{WK_SET}	0:2.8V 1:3V Default: 3V 1	RW	1
0	RCHG_SET	0:CV-100 mV, 1:CV-200 mV Default: 200mV 1	RW	1

11.6 Control register1: Offset=0x05, Default value=0xBB

Bit(s)	Name	Description	R/W	Reset
7	EN_WTD	I2C 0:Disable 1:enable Default: enable 1	RW	1
6:5	WTD<1:0>	00:10s; 01:20s; 10:40s; 11:80s; Default: 20s 01	RW	01
4	EN_EOC	EOC 0:Disable 1:enable Default: enable 1	RW	1
3	TIMER_EN	0:Disable 1:enable Default: enable 1	RW	1
2:1	CHG_TMR<1:0>	00:3hour; 01:5hour; 10:8hour; 11:12hour	RW	01

		Default: 5hour 01		
0	EN_LDO	VDD 0:disable 1:enable Default: enable 1	RW	1

11.7 Control register2: Offset=0x06, Default value=0x80

Bit(s)	Name	Description	R/W	Reset
7	EN_NTC	NTC 0:Disable 1:Enable Default: enable 1	RW	1
6	RSV	RSV	RW	0
5	BATFET_CTL	BFET 0: ON 1: OFF Default:ON 0	RW	0
4	PG_INT_EN	VIN 0: Disable 1: Enable Default: Disable 0	RW	0
3	EOC_INT_EN	0: Disable 1: Enable Default: Disable 0	RW	0
2	RSV	RSV	RW	0
1	NTC_INT_EN	NTC 0: Disable 1: Enable Default: Disable 0	RW	0
0	BATTOVP_INT_EN	0: Disable 1: Enable Default: Disable 0	RW	0

11.8 Control setting register3: Offset=0x07, Default value=0X39

Bit(s)	Name	Description	R/W	Reset
7	PCB_OTP_EN	PCB OTP 0: Disable 1: Enable Default: Disable 0	RW	0

		Offset: 4.2V 50mV Step Range: 4.2V –4.95(0000-1111) Default: 4.65V(1001)		

11.9 Control setting register4: Offset=0x08, Default value=0x06

Bit(s)	Name	Description	R/W	Reset
7:6	SHP_DGL<1:0>	00: 1s 01: 2s 10: 4s 11: 8s Default: 1s 00	RW	00
5:4	LDO_SET<1:0>	VDD 00:3V 01:2.5V 10:1.8V 11:1.5V Default: 3V 00	RW	00
3	JEITA_CV_EN	COOL JIETA CV 0:Disable 1:Enable Default: Disable 0	RW	0
2:1	JEITA_HOT<1:0>	JEITA hot 11:45℃: VNTC falling threshold:44.75% 10:50℃: VNTC falling threshold:41.25% 01:55℃: VNTC falling threshold:37.75% 00:60℃: VNTC falling threshold:34.5% Default: 45℃ 11	RW	11
0	JEITA_COOL	JEITA cool 0 10℃ VNTC rising threshold:68.25% 1 15℃, VNTC rising threshold:65.25% Default: 10℃ 0	RW	0

11.10 Control setting register5: Offset=0x09, Default value=0x25

Bit(s)	Name	Description	R/W	Reset
7 5	I2C_SADDR	I2C 0010XXXY, XXX for	RW	001
4	RSV	RSV	RW	0
3:2	JEITA_CC<1:0>	JEITA CC 00: CC 01:1/2CC 10:1/4CC 11:1/8CC Default: 1/2CC 01	RW	01
1:0	JEITA_CV<1:0>	JEITA CV 00: CV 01: CV-100mV 10:CV-200mV 11:CV-300mV Default: CV-100mV 01	RW	01

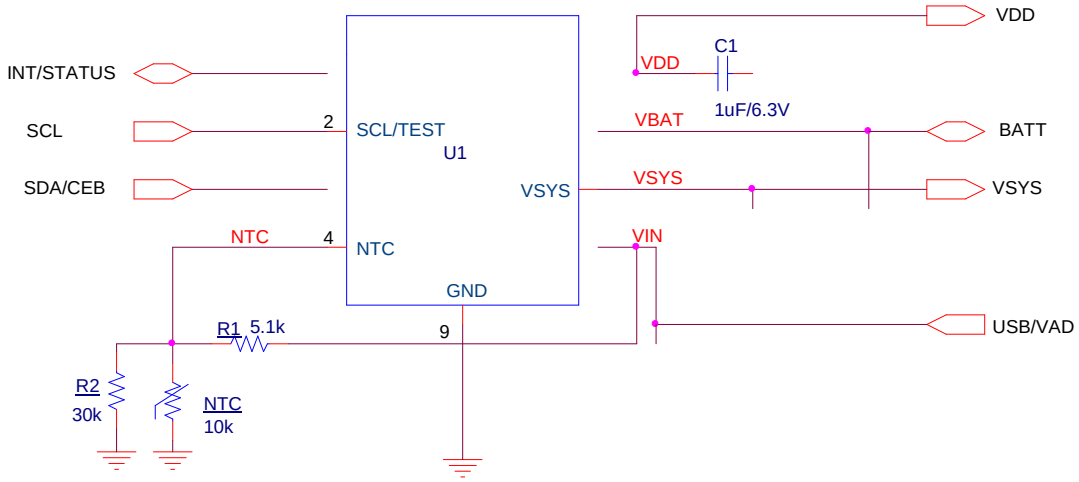
11.11 Status register0: Offset=0x0D,

Bit(s)	Name	Description	R/W	Reset
7	WATCHDOG_FAULT	0: normal; 1: timer out trigger Note:	R	
6:5	RSV	RSV	R	
4:3	CHG_STAT<1:0>	00 – Not Charging, 01 –Wake up, 10 –CC+CV, 11 –FULL	R	
2	VIN_DPM	DPM 0:Not DPM, 1:DPM	R	
1	RSV	RSV	R	
0	T_J REG	0: normal, 1:die junction thermal regulation status	R	

11.12 Status register1: Offset=0x0E,

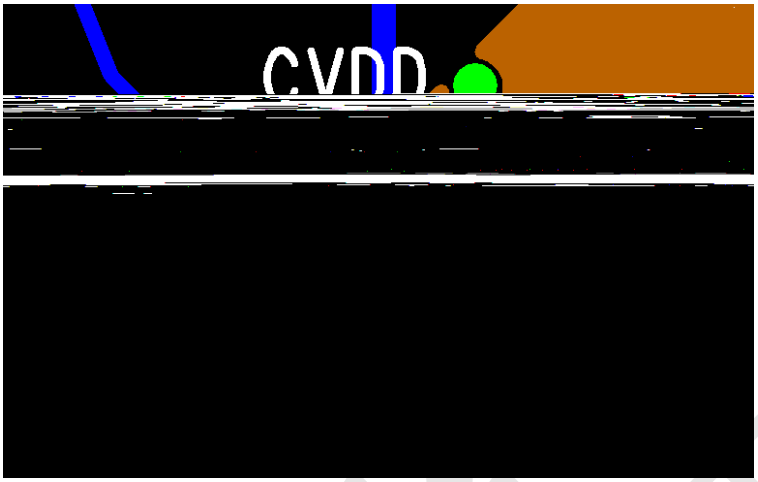
Bit(s)	Name	Description	R/W	Reset
7:6	RSV	RSV	R	
5	VIN_FAULT	0: Normal, 1: fault: OVP or bad source Note:	R	
4	THEM_SD	0: normal 1:thermal shutdown Note:	R	
3	BAT_FAULT	0: normal 1:battery OVP Note:	R	
2	TIME_OUT	0: Normal, 1: timer expiration Note:	R	
1:0	NTC_FAULT<1:0>	NTC 00:Normal 01:hot Fault 10:cold Fault 11:cool or warm fault	R	

12 IP2333典型应用原理图



11:IP2333

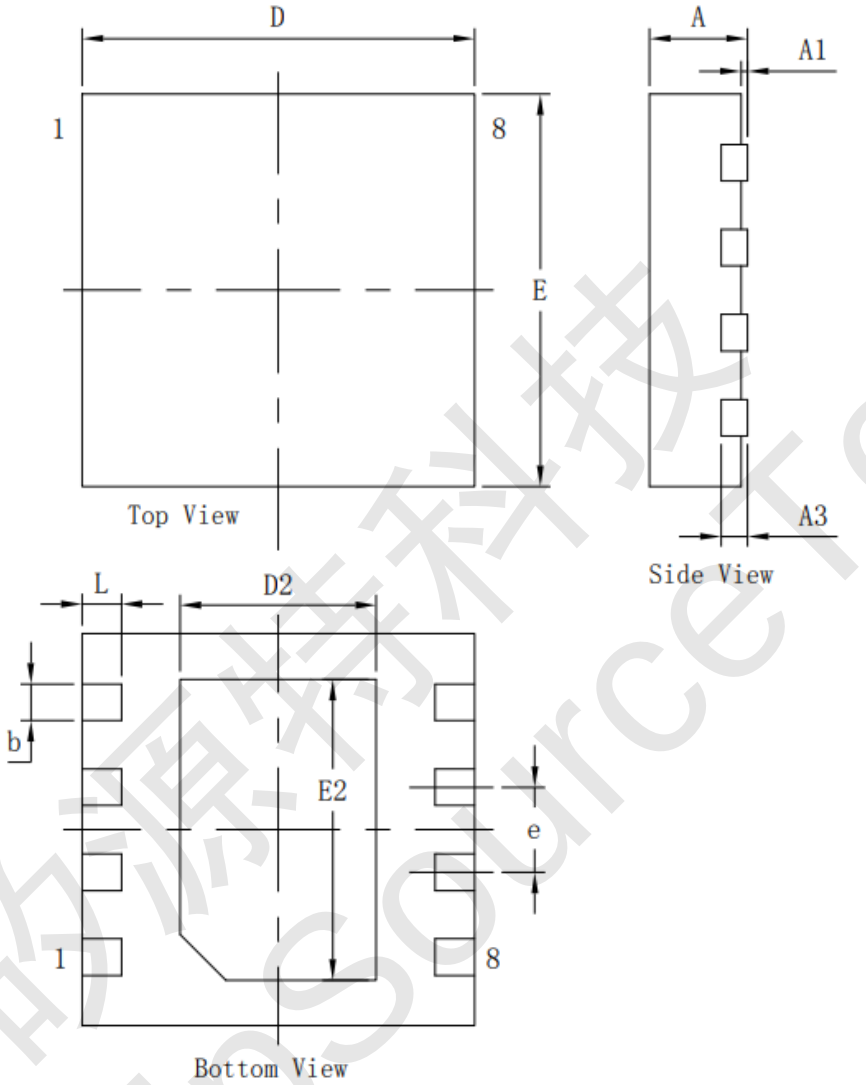
13 IP2333 LAYOUT 参考



12: Layout

CVIN,CVSYS,CVBAT,CVDD

14 IP2333封装信息



尺寸 / 标注	最小(mm)	标准(mm)	最大(mm)	尺寸 / 标注	最小(mm)	标准(mm)	最大(mm)
A	0.70	0.75	0.80	E	2.90	3.00	3.10
A1	-	-	0.05	D2	1.40	1.50	1.60
A3	0.203 REF			E2	2.20	2.30	2.40
b	0.23	0.28	0.33	e	0.65 TYP		
D	2.90	3.00	3.10	L	0.25	0.30	0.35

13 IP2333 DFN8(0303)

15 IP2333 IC 丝印说明

14 IP2333 IC

16 IP2333

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