RN5T566A

Product Specifications

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RICOH

RICOH COMPANY, LTD.
Electronic Devices Company

This specification is subject to change without notice.

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1. Outline

RN5T566A is the power management IC for GPS. It integrates 2 high-efficiency step-down DCDC controllers, 5 low dropout regulators, power control logic, 3 voltage detections, thermal shut-down, UVLO and etc.

2. Feature

- High Efficiency Synchronous Step-down DCDC Converters
  - ✓ DC/DC1 1.15～1.90V by external resistors @ 700mA (for Memory)
  - ✓ DC/DC2 1.00~1.30V by external resistors @ 1A (for Core)
  - ✓ Soft-start circuit (DCDC1, 2)

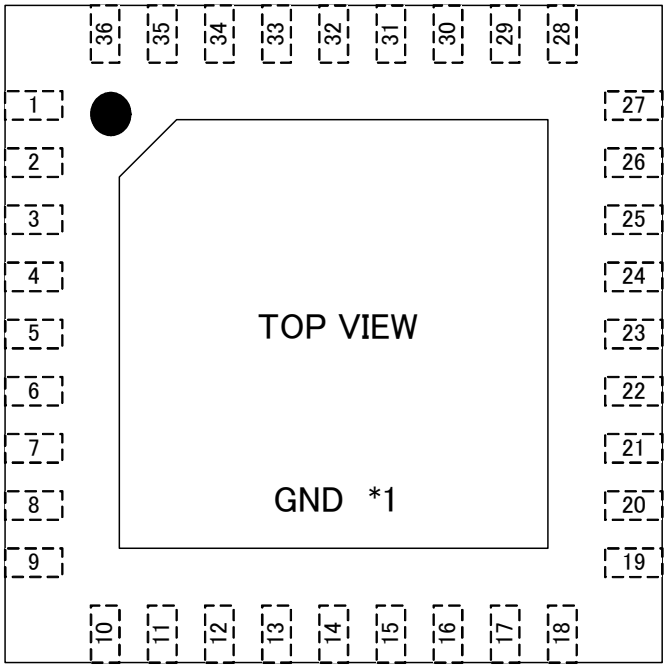
- Low Drop Voltage Regulator
  - ✓ LDO1 3.3V by trimming @ 150mA (for Analog)
  - ✓ LDO2 1.7～3.3V by external resistors @ 300mA (for I/O)
  - ✓ LDO3 1.1V by trimming @ 20mA (for PLL)
  - ✓ LDO4 1.7～3.3V by external resistors @ 100mA (for RF)
  - ✓ LDO5 3.3V by trimming @ 5mA with reverse protection (for RTC)
  - ✓ ON/OFF control through pin (LDO1, LDO2, LDO3, LDO4)
  - ✓ Over current protection

- Others
  - ✓ UVLO
  - ✓ Thermal shut-down
  - ✓ Voltage detection for RTC reset (LDO5 voltage monitor)
  - ✓ Voltage detection for battery and adapter voltage detection (External circuit PIN)

- Package
  - ✓ QFN0606-36pin (size=6.0x6.0mm, pitch=0.5mm, t=0.9mm)

- Process
  - ✓ CMOS process

3. Pin Configuration



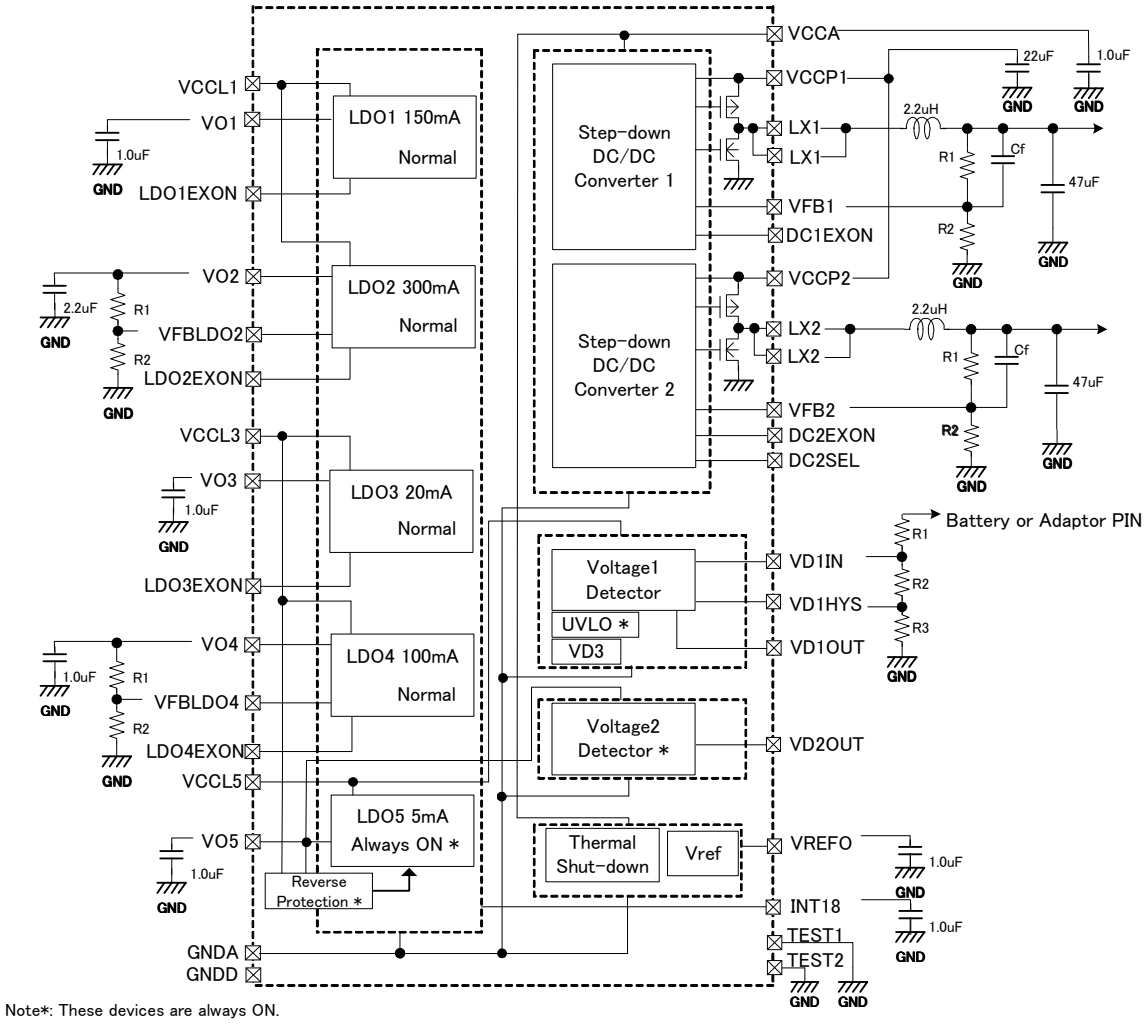
Note*1: Tab on the bottom side must be connected to GND.

Fig 3-1 QFN0606-36Pin

Pin No.	Name	Pin No.	Name
1	DC2EXON	19	GNDD
2	DC1EXON	20	TEST2
3	DC2SEL	21	TEST1
4	VCCA	22	VD1HYS
5	VO1	23	VD1IN
6	VCCL1	24	INT18
7	VO2	25	LDO1EXON
8	VFBLDO2	26	LDO2EXON
9	VREFO	27	LDO3EXON
10	GNDA	28	LDO4EXON
11	VO3	29	VFB2
12	VCCL3	30	LX2
13	VO4	31	LX2
14	VFBLDO4	32	VCCP2
15	VO5	33	VCCP1
16	VD2OUT	34	LX1
17	VD1OUT	35	LX1
18	VCCL5	36	VFB1

Table 3-1 Pin Configuration

4. Block Diagram



Note*: These devices are always ON.

Fig 4-1 Block Diagram

5. Pin Description

No.	Name	I/O	Function	I/F Level	Notes
1	DC2EXON	I	DCDC2 ON/OFF input	Coin Battery	
2	DC1EXON	I	DCDC1 ON/OFF input	Coin Battery	
3	DC2SEL	I	DCDC2 Output Voltage Select	2.7-3.3V	
4	VCCA	PWR	Power supply	VCC	
5	VO1	O	LDO1 output	-	
6	VCCL1	PWR	Power supply	VCC	
7	VO2	O	LDO2 output	-	
8	VFBLDO2	I	Output voltage feedback input of LDO2	I	
9	VREFO	O	Bypass capacitor connecting pin	-	Connect only Capacitor load
10	GNDA	G	Ground	GND	
11	VO3	O	LDO3 output	-	
12	VCCL3	PWR	Power supply	VCC	
13	VO4	O	LDO4 output	-	
14	VFBLDO4	I	Output voltage feedback input of LDO4	I	
15	VO5	O	LDO5 output	-	
16	VD2OUT	O	Voltage detection2 output (Nch-opendrain)	N-ch OD	
17	VD1OUT	O	Voltage detection1 output (Nch-opendrain) *The Protective device for power is Pch-Tr(Diode)	N-ch OD	
18	VCCL5	PWR	Power supply (for LDO5)	VCC	
19	GNDD	G	Ground	GND	
20	TEST2	I	Test mode pin	-	Connect to GND
21	TEST1	I	Test mode pin	-	Connect to GND
22	VD1HYS	I	Hysteresis in	VCC	
23	VD1IN	I	Voltage detection1 in	VCC	
24	INT18	O	Bypass capacitor connecting pin	-	Connect only Capacitor load
25	LDO1EXON	I	LDO1 ON/OFF input	Coin Battery	
26	LDO2EXON	I	LDO2 ON/OFF input	Coin Battery	
27	LDO3EXON	I	LDO3 ON/OFF input	Coin Battery	
28	LDO4EXON	I	LDO4 ON/OFF input	Coin Battery	
29	VFB2	I	Output voltage feedback input of DCDC2 converter	-	
30	LX2	O	DCDC converter switch output	-	
31	LX2	O	DCDC converter switch output	-	
32	VCCP2	PWR	Power supply	VCC	
33	VCCP1	PWR	Power supply	VCC	
34	LX1	O	DCDC converter switch output	-	
35	LX1	O	DCDC converter switch output	-	
36	VFB1	I	Output voltage feedback input of DCDC1 converter	-	
-	GND	GND	Tab Ground. Tab on the bottom side must be connected to GND.	-	

Table 5-1 Pad Description

6. Function Block

6.1 LDO, DCDC Table

	LDO1	LDO2	LDO3	LDO4	LDO5	DCDC1	DCDC2
	(Analog)	(I/O)	(PLL)	(RF)	(RTC)	(Memory)	(Core)
Current Capability	150mA	300mA	20mA	100mA	5mA	700mA	1A
Mode	-	-	-	-	-	PWM/SKIP	PWM/SKIP
Output Voltage Range	3.3V	1.7～3.3V by external resistors	1.1V	1.7～3.3V by external resistors	3.3V	1.15～1.9V by external resistors	1.0～1.3V by external resistors
ON/OFF Control	PIN	PIN	PIN	PIN	Always ON	PIN	PIN
Bypass Capacitance (C_{OUT}) Note*1	1.0uF	2.2uF	1.0uF	1.0uF	1.0uF	47uF 2.2uH	47uF 2.2uH

Table 6-1 LDO, DCDC Table

Note*1: Available Capacitors＆Inductor s

Bypass Capacitors for LDO 1.0uF：C1005JB1C105K(TDK)/ 2.2uF：C1608JB0J225K(TDK)

Bypass Capacitors for DCDC 10uF：2012 Size(mm) or more

Inductor For DCDC 2.2uH：MIPSZ2520D2R2M（FDK）

Input Capacitors for DCDC 22uF：GRM21BB30J226ME38(murata)

47uF：C2012X5R0J476M(TDK)

6.2 LDO

RN5T566A integrates 5 LDO regulators.LDO1～LDO4 are on/off controlled by LDO1EXON～LDO4EXON ("H"=ON, "L"=OFF) and LDO5 is always ON.

6.2.1 Regulator Block Diagram

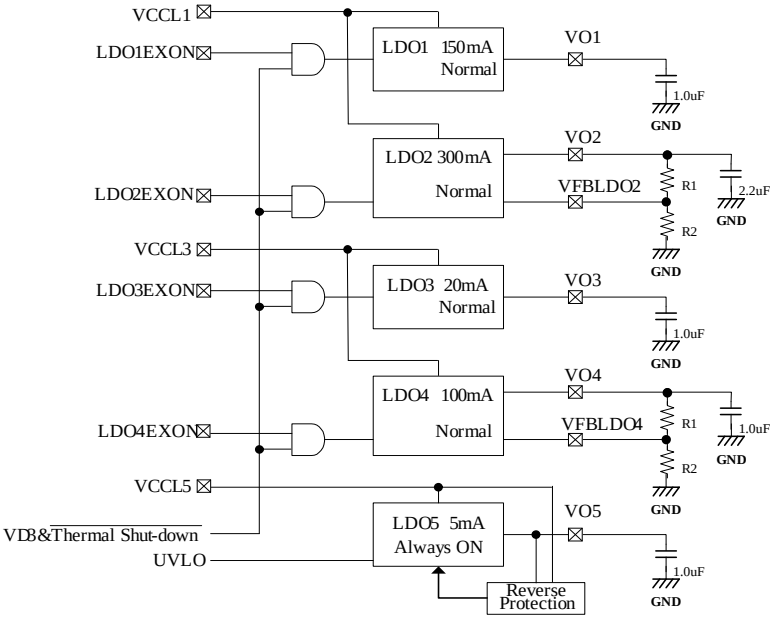


Fig 6-1 LDO Block Diagram

6.2.2 LDO ON/OFF Control

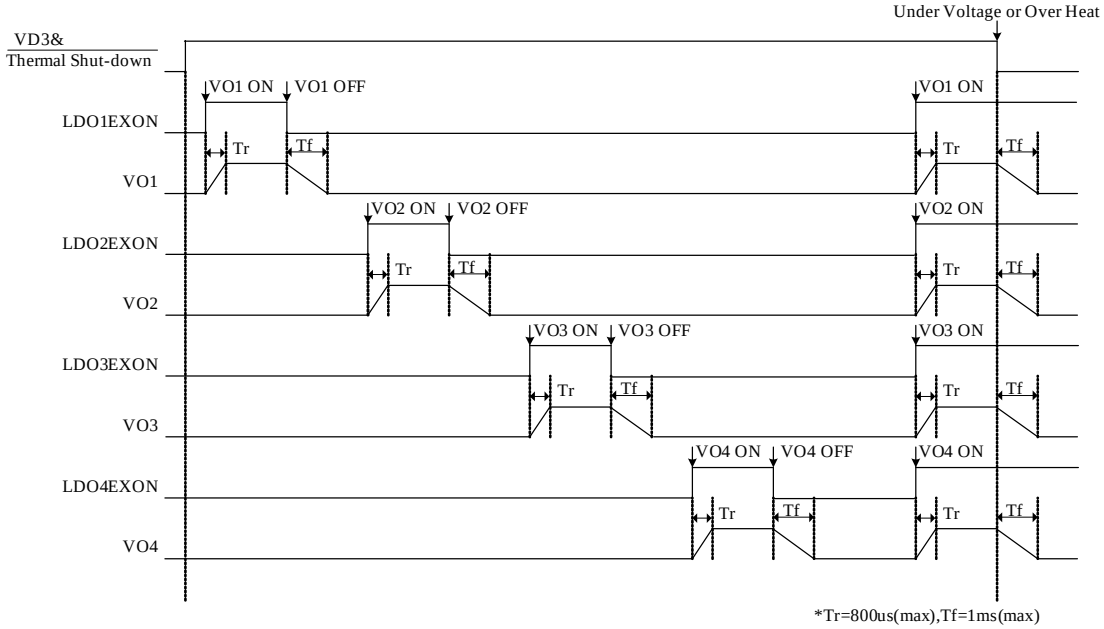


Fig 6-2 LDO ON/OFF Control

6.2.3 LDO1 Electrical Characteristics

Operating Conditions (unless otherwise specified) VCCL = 3.6V, C_{REFO} = 1.0µF, T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
VIN1	Input Voltage Range	VCCL1 pin	VOUT1 +0.2		5.5	V
VOUT1	Output Voltage	Iload=50uA～150mA	-2%	3.3	+2%	V
IOUT1	Output Current	-			150	mA
ILIM1	Current Limit	VOUT1=3.3V	200	300	600	mA
VDRP1	Drop-out Voltage	IOUT1=150mA 2.7V≦VCCL			200	mV
$\frac{\Delta VOUT1}{\Delta VCCL}$	Line Regulation	IOUT1=75mA	0	3	10	mV
$\frac{\Delta VOUT1}{\Delta IOUT1}$	Load Regulation	50µA＜IOUT1＜150mA	0	15	35	mV
$\frac{\Delta VOUT1}{\Delta T_a}$	Output Voltage Temperature Coefficient	-40℃≦T_a≦85℃			±100	ppm/℃
RR1	Ripple Rejection	f=10Hz-10kHz, C_{out}=1.0µF,VIN1=3.6V IOUT1=75mA, VOUT≦3.3V	50	60		dB
ISS1	Supply Current	LDO1EXON = "H" (ON)	30	80	150	µA
		LDO1EXON = "L" (OFF)			1	
EN1	Output Noise	BW=100Hz-100kHz, IOUT1=75mA		50	100	µVrms

Table 6-2 LDO1 Electrical Characteristics

Note*: Bypass capacitor: 1.0uF, in mounted state.

For optimized phase compensation, the bypass capacitor must be ceramic type.

6.2.4 LDO2 Electrical Characteristics

Operating Conditions (unless otherwise specified) VCCL = 3.6V, C_{REFO} = 2.2uF, T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
VIN2	Input Voltage Range	VCCL1 pin	VOUT2 +0.2		5.5	V
VOUT2	Output Voltage Range	Iload=50uA～300mA	1.7		3.3	V
VFB2	Reference Voltage	-	-2%	1	+2%	V
IOUT2	Output Current	-			300	mA
ILIM2	Current Limit	VOUT2=3.3V	350	450	750	mA
VDRP2	Drop-out Voltage	IOUT2=300mA 2.7V≦VCCL			200	mV
$\frac{\Delta VOUT2}{\Delta VCCL}$	Line Regulation	IOUT2=150mA	0	3	10	mV
$\frac{\Delta VOUT2}{\Delta IOUT2}$	Load Regulation	50μA＜IOUT2＜300mA	0	5	35	mV
$\frac{\Delta VOUT2}{\Delta T_a}$	Output Voltage Temperature Coefficient	-40℃≦T_a≦85℃			±100	ppm/℃
RR2	Ripple Rejection	f=10Hz-10kHz, C_{out}=2.2μF,VIN2=3.6V IOUT1=150mA,VOUT≦3.0V	50	60		dB
ISS2	Supply Current*1	LDO2EXON = "H" (ON)	30	90	150	μA
		LDO2EXON = "L" (OFF)			1	
EN2	Output Noise	BW=100Hz-100kHz IOUT2=150mA,VOUT2=3.0V		110	150	μVrms

Table 6-3 LDO2 Electrical Characteristics

Note*: Bypass capacitor: 2.2uF, in mounted state.

For optimized phase compensation, the bypass capacitor must be ceramic type.

Note*1: Supply current does not include the consumption current of external resistors.

Output Voltage	R1	R2	Notes
3.30V	230kΩ	100kΩ	
3.00V	200kΩ	100kΩ	
2.85V	185kΩ	100kΩ	
2.80V	180kΩ	100kΩ	
1.80V	80kΩ	100kΩ	

Table 6-4 LDO2 External Resistors Table

6.2.5 LDO3 Electrical Characteristics

Operating Conditions (unless otherwise specified) VCCL = 3.6V, C_{REFO} = 1.0µF, T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
VIN3	Input Voltage Range	VCCL3 pin	2.7		5.5	V
VOUT3	Output Voltage	Iload=50uA～20mA	-2%	1.1	+2%	V
IOUT3	Output Current	-			20	mA
ILIM3	Current Limit	VOUT3=1.1V	150	200	500	mA
$\frac{\Delta VOUT3}{\Delta VCCL}$	Line Regulation	IOUT3=10mA	0	1	3	mV
$\frac{\Delta VOUT3}{\Delta IOUT3}$	Load Regulation	50µA＜IOUT3＜20mA	0	8	15	mV
$\frac{\Delta VOUT3}{\Delta T_a}$	Output Voltage Temperature Coefficient	-40℃≦T_a≦85℃			±100	ppm/℃
RR3	Ripple Rejection	f=10Hz-10kHz, C_{out}=1.0µF,VIN3=3.6V IOUT3=10mA	50	60		dB
ISS3	Supply Current	LDO3EXON = "H" (ON)	25	50	75	µA
		LDO3EXON = "L" (OFF)			1	
EN3	Output Noise	BW=100Hz-100kHz, IOUT3=10mA		50	80	µVrms

Table 6-5 LDO3 Electrical Characteristics

Note*: Bypass capacitor: 1.0uF, in mounted state.

For optimized phase compensation, the bypass capacitor must be ceramic type.

6.2.6 LDO4 Electrical Characteristics

Operating Conditions (unless otherwise specified) VCCL = 3.6V, C_{REFO} = 1.0µF, T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
VIN4	Input Voltage Range	VCCL3 pin	VOUT4 +0.2		5.5	V
VOUT4	Output Voltage Range	Iload=50uA～100mA	1.7		3.3	V
VFB4	Reference Voltage	-	-2%	1	+2%	V
IOUT4	Output Current	-			100	mA
ILIM4	Current Limit	VOUT4=3.3V	150	250	500	mA
VDRP4	Drop-out Voltage	IOUT4=100mA 2.7V≦VCCL			200	mV
$\frac{\Delta VOUT4}{\Delta VCCL}$	Line Regulation	IOUT4=50mA	0	3	10	mV
$\frac{\Delta VOUT4}{\Delta IOUT4}$	Load Regulation	50µA＜IOUT4＜100mA	0	10	25	mV
$\frac{\Delta VOUT4}{\Delta T_a}$	Output Voltage Temperature Coefficient	-40℃≦T_a≦85℃			±100	ppm/℃
RR4	Ripple Rejection	f=10Hz-10kHz, C_{out}=1.0µF,VIN4=3.6V IOUT4=50mA,VOUT≦3.0V	50	60		dB
ISS4	Supply Current*1	LDO4EXON = "H" (ON)	30	90	150	µA
		LDO4EXON = "L" (OFF)			1	
EN4	Output Noise	BW=100Hz-100kHz, IOUT4=50mA,VOUT4=3.0V		110	150	µVrms

Table 6-6 LDO4 Electrical Characteristics

Note*: Bypass capacitor: 1.0uF, in mounted state.

For optimized phase compensation, the bypass capacitor must be ceramic type.

Note*1: Supply current does not include the consumption current of external resistors.

Output Voltage	R1	R2	Notes
3.30V	230kΩ	100kΩ	
3.00V	200kΩ	100kΩ	
2.85V	185kΩ	100kΩ	
2.80V	180kΩ	100kΩ	
1.80V	80kΩ	100kΩ	

Table 6-7 LDO4 External Resistors Table

6.2.7 LDO5 Electrical Characteristics

Operating Conditions (unless otherwise specified) VCCL = 3.6V, C_{REFO} = 1.0μF, T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
VIN5	Input Voltage Range	VCCL5 pin	VOUT5 +0.2		5.5	V
VOUT5	Output Voltage	Iload=50uA～5mA	-3%	3.3	+3%	V
		Iload=1mA & 3.3V≦VCCL	3.0			V
IOUT5	Output Current	-			5	mA
ILIM5	Current Limit	VOUT5=3.3V	15	60	120	mA
VDRP5	Drop-out Voltage	IOUT5=5mA 2.7V≦VCCL			200	mV
$\frac{\Delta VOUT5}{\Delta VCCL}$	Line Regulation	IOUT5=5mA	0	3	10	mV
$\frac{\Delta VOUT5}{\Delta IOUT5}$	Load Regulation	50μA＜IOUT5＜5mA	0	8	15	mV
$\frac{\Delta VOUT5}{\Delta T_a}$	Output Voltage Temperature Coefficient	-40℃≦T_a≦85℃			±100	ppm/℃
ISS5	Supply Current*1	ON		2	5	μA
IRR5	Reverse Current	VOUT5=3.3V & VCCL =0V			1	μA

Table 6-8 LDO5 Electrical Characteristics

Note*: Bypass capacitor: 1.0uF, in mounted state.

For optimized phase compensation, the bypass capacitor must be ceramic type.

Note*1: The consumption current of the reverse protection is not included.

6.3 Step-down DC/DC Converter

6.3.1 Step-down DC/DC Converter1 Electrical Characteristics

Operating Conditions (unless otherwise specified) VCCA, VCCP = 3.6V, T_a = 25℃ L1=2.2uH, C_{OUT}=47uF

Symbol	Parameter	Condition	Min	Typ	Max	Units
-	Input Voltage Range	VCCA, VCCP pin	2.7		5.5	V
DVOUT1	Output Voltage Range	2.7V≦VCCA,VCCP≦5.5V	1.15		1.9	V
DIOUT1	Output current	-			700	mA
FREQ1	Frequency		2.0	2.25	2.5	MHz
DISS1	Consumption Current	VCCA=VCCP=VFB=3.6V DIOUT1=0mA, no switching	50	70	200	uA
DIOFF1	Standby Current	OFF state			1	uA
DILIM1	Limit detection Current	-	1000		1600	mA
VFB1	FB Voltage	VCCA=VCCP=3.6V,DIOUT1=1mA	-1.5%	0.60	+1.5%	V
$\frac{\Delta VFB1}{\Delta VCC}$	FB Line Regulation	2.7V≦VCCA,VCCP≦5.5V DIOUT=DIOUTmax / 2	0	1	3	mV
$\frac{\Delta VFB1}{\Delta DIOUT1}$	FB Load Regulation	1mA≦DIOUT1≦700mA	0	1	3	mV
$\frac{\Delta VFB1}{\Delta T}$	FB Voltage Temperature Coefficient	-40℃≦Ta≦+85℃			±100	ppm/℃
t_r *1	Soft-start Time	-		210	300	us

Table 6-9 Step-down DC/DC Converter1 Electrical Characteristics

Note*1: When all regulators are off, Soft-start time will be added up with Vref boot up time.

t_r(Typ) = 210us(DCDC only) + 500us(Vref boot up time)

Output Voltage	R1	R2	Cf	Notes
1.775V	47kΩ	24kΩ	100pF	
1.5V	36kΩ	24kΩ	100pF	
1.2V	30kΩ	30kΩ	220pF	

Table 6-10 Step-down DC/DC Converter1 External Resistors Table

6.3.2 Step-down DC/DC Converter2 Electrical Characteristics

Operating Conditions (unless otherwise specified) VCCA, VCCP = 3.6V, T_a = 25℃, L1=2.2uH, C_{OUT}=47uF

Symbol	Parameter	Condition	Min	Typ	Max	Units
-	Input Voltage Range	VCCA, VCCP pin	2.7		5.5	V
DVOUT2	Output Voltage Range	2.7V≦VCCA,VCCP≦5.5V DC2SEL="L"	1.0		1.3	V
DV2_09	Output Voltage	2.7V≦VCCA,VCCP≦5.5V DC2SEL= "H"		DVOUT2 x0.9		V
DIOUT2	Output current	-			1000	mA
FREQ2	Frequency		2.0	2.25	2.5	MHz
DISS2	Consumption Current	VCCA=VCCP=VFB=3.6V DIOUT2=0mA, no switching	50	70	200	uA
DIOFF2	Standby Current	OFF state			1	uA
DILIM2	Limit detection Current	-	1200		1600	mA
VFB2	FB Voltage	VCCA=VCCP=3.6V,DIOUT2=1mA	-1.5%	0.60	+1.5%	V
$\frac{\Delta VFB2}{\Delta VCC}$	FB Line Regulation	2.7V≦VCCA,VCCP≦5.5V DIOUT=DIOUTmax / 2	0	1	3	mV
$\frac{\Delta VFB2}{\Delta DIOUT2}$	FB Load Regulation	1mA≦DIOUT1≦1000mA	0	1	3	mV
$\frac{\Delta VFB2}{\Delta T}$	FB Voltage Temperature Coefficient	-40℃≦Ta≦+85℃			±100	ppm/℃
t_r *1	Soft-start Time	-		210	300	us
SR	Slew rate rise & fall	VFB2 Signal	-20%	3.5	+20%	mV /µsec
tst2	Trans Start Time	-		30		µs

Table 6-11 Step-down DC/DC Converter2 Electrical Characteristics

Note*1: When all regulators are off, Soft-start time will be added up with Vref boot up time.

t_r(Typ) = 210us(DCDC only) + 500us(Vref boot up time)

Don't change the DC2SEL signal during Soft-start time(tr).

Output Voltage	R1	R2	Cf	Notes
1.2V	30kΩ	30kΩ	220pF	
1.1V	30kΩ	36kΩ	220pF	
1.0V	22kΩ	33kΩ	220pF	

Table 6-12 Step-down DC/DC Converter2 External Resistors Table

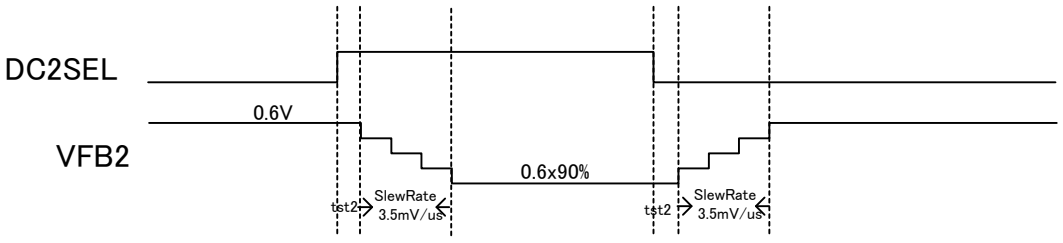


Fig 6-3 Step-down DC/DC2 DC2SEL Control

6.3.3 Step-down DC/DC Converter1, DC/DC Converter1,2 Block Diagram

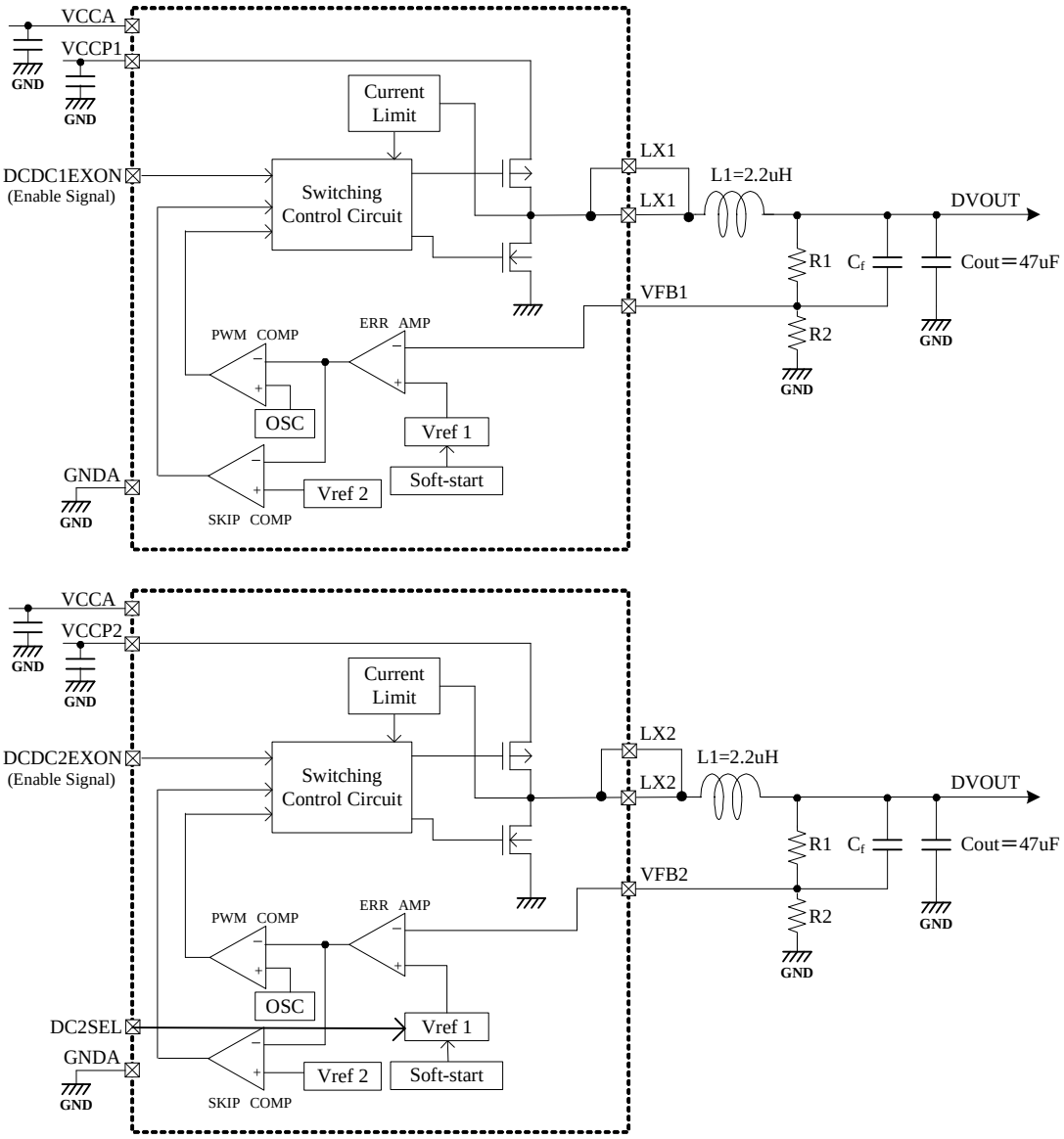


Fig 6-4 Step-down DC/DC Converter 1,2 Block Diagram

6.3.4 Step-down DC/DC Converter1, DC/DC Converter2 ON/OFF Control

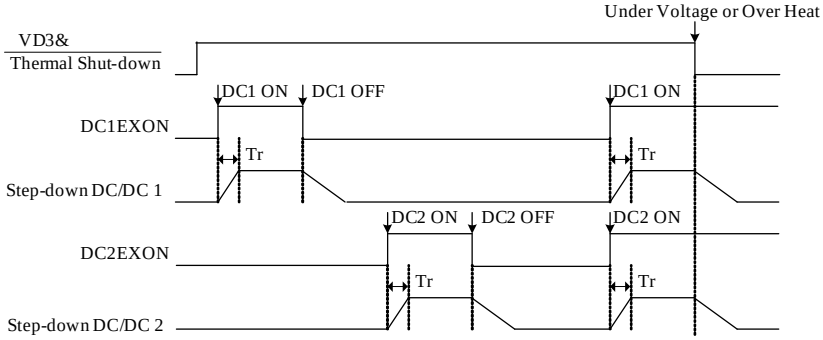
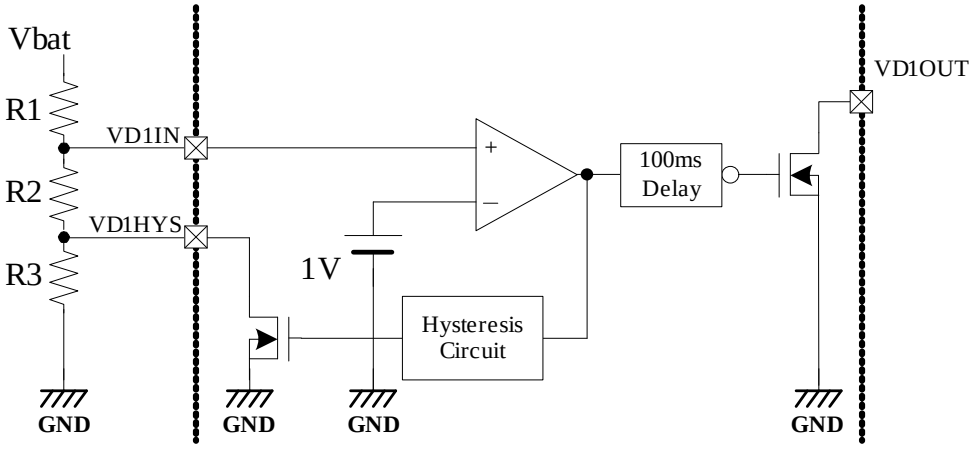


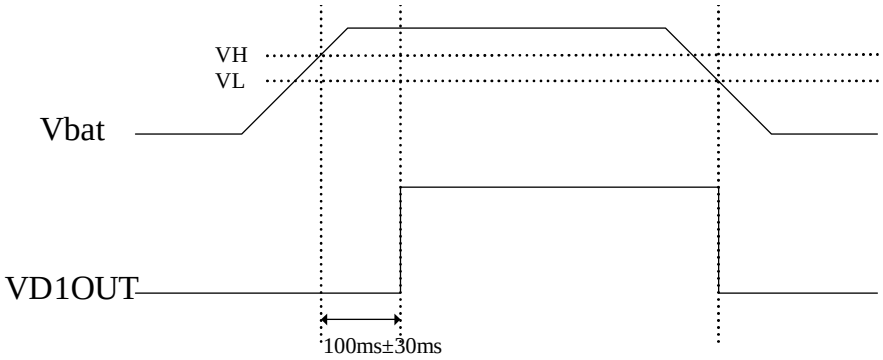
Fig 6-5 Step-down DC/DC ON/OFF Control

6.4 Voltage Detection1 Function

After VD1IN pin rises, VD1OUT signal turns to “H” after 100ms from the detection voltage is detected.

VD1OUT is Nch-opendrain output pin, and if it is used, pull up the pin with the voltage not exceeding VCC* power.





VH = Higher voltage threshold
VL = lower voltage threshold
Vref = reference voltage

Example:
VH=3.4V, VL=3.3V
: R1=240kΩ, R2=100kΩ R3 = 4.3kΩ
VL=(R1+R2+R3)/(R2+R3)×Vref
VH=(R1+R2)/R2×Vref

Fig 6-6 Voltage Detection1 Timing

Note*: Control these resistors so that VD1IN and VD1HYS don't exceed 5.5V.
Also, if UVLO detects under voltage (Max:2.7V) this VD1 cannot operate.

Operating Conditions (unless otherwise specified) T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{DET1}	VD1IN Voltage	VD1IN Voltage	-3%	1.0	+3%	V

Table 6-13 Voltage Detection1 Electrical Characteristics

6.5 Voltage Detection2 Function

After LDO5 output (VO5) rises, VD2OUT signal turns to “H” after 400ms from the detection voltage is detected.

VD2OUT is Nch-opendrain output pin.

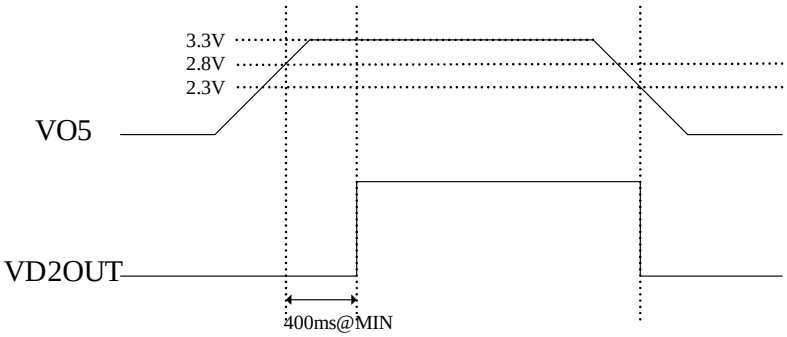


Fig 6-7 Voltage Detection2 Timing

Operating Conditions (unless otherwise specified) T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{Release2}$	VD2 Threshold Voltage	VO5 rising		2.8		V
$V_{Detect2}$	VD2 Threshold Voltage	VO5 falling	2.13	2.3	2.47	V
V_{HYS2}	VD2 Hysteresis	-		500		mV

Table 6-14 Voltage Detection2 Electrical Characteristics

6.6 UVLO (Under Voltage Lock Out) Electrical Characteristics

When the system can not operate due to the low VCCL5 voltage, UVLO turns off the LDO5.

6.6.1 UVLO Block Diagram (for LDO5)

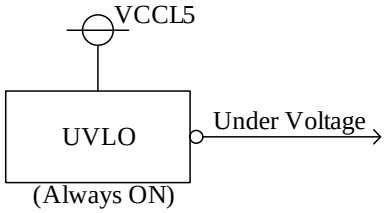


Fig 6-8 UVLO Block Diagram

Operating Conditions (unless otherwise specified) T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
$VL5_{Detect}$	Under voltage lock out threshold	VCCL5 falling			2.7	V
$VL5_{HYS}$	UVLO Hysteresis	-		250		mV

Table 6-15 UVLO Electrical Characteristics

6.7 Voltage Detection3 Function

When the system can not operate due to the low VCCA voltage, VD3 turns off the system (LDO1~4 and DCDC1~2 are turned off.)

6.7.1 VD3 Block Diagram (for LDO1～4、DCDC1～2)

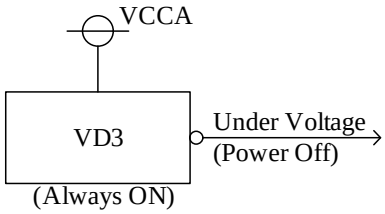


Fig 6-9 VD3 Block Diagram

Operating Conditions (unless otherwise specified) T_a = 25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{Release}$	VD3 Threshold Voltage	VCCA rising		2.8		V
V_{Detect}	VD3 Threshold Voltage	VCCA falling	-3%	2.7	+3%	V
V_{HYS}	VD3 Hysteresis	-		100		mV

Table 6-16 VD3 Electrical Characteristics

6.8 Thermal Shut-down Circuit Electrical Characteristics

The thermal shut-down circuit turns off the system (LDO1～4 and DC/DC1~2 are turned off, however, LDO5 is not affected.) and prevents the chip from damaging when overheating is detected.

The thermal shut-down operates when LDO or DC/DC turns on.

6.8.1 Thermal Shut-down Block Diagram

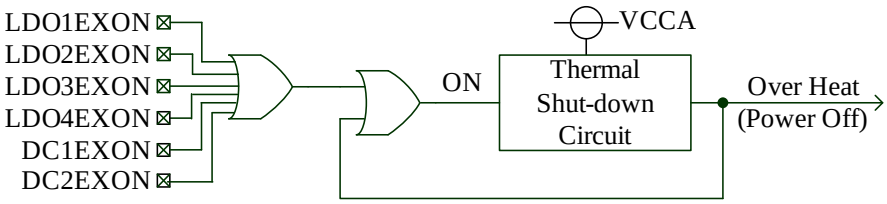


Fig 6-10 Thermal Shut-down Diagram

Operating Conditions (unless otherwise specified) VCCA = 3.6V

Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{DET}	Detected Temperature	-	130	140	150	℃
T_{RET}	Return Temperature	-	100	110	120	℃

Table 6-17 Thermal Shut-down Circuit Electrical Characteristics

7. Electrical Characteristics

7.1 Absolute Maximum Ratings

Exposure to the condition exceeded Absolute Maximum Ratings may cause the permanent damages and affects the reliability and safety of both device and systems using the device. The functional operations cannot be guaranteed beyond specified values in the recommended conditions.

Symbol	Parameter	Condition	Rated value	Units
VCC_{abs}	Power Supply Voltage	Pin = VCC*	-0.3～6.5	V
Vin	Input Voltage Range	Pin = LDO1EXON～LDO4EXON, DC1EXON～DC2EXON,DC2SEL	-0.3～VCCA+0.3	V
Vout	Output Voltage Range	Pin = VD1OUT,VD2OUT	-0.3～VCC_VO5*+0.3	V
PD	Package Allowable Dissipation	JEDEC substrate mounting state, Wind velocity 0m/s Ta=25°C Linear derating coefficient = 0.03125 W/°C	3.125	W
T_{stg}	Storage Temperature	-	-55～+125	℃

*VCC_VO5 : LDO5_Output or Coin Battery

Table 7-1 Absolute Maximum Ratings

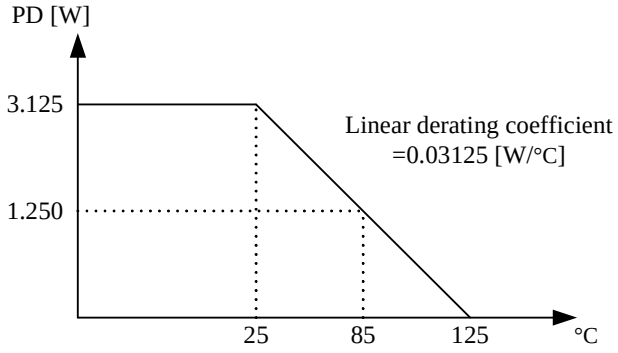


Fig 7-1 Maximum Package Allowable Dissipation

7.2 Recommendation of Operating Conditions

Symbol	Parameter	Condition	Min	Typ	Max	Units
VCC	Power Supply Voltage	Pin=VCC*	2.7 *	3.6	5.5	V
Ta	Temperature of Operation	-	-40		+85	℃

* It is 2.7V±3%, because detection voltage of VD3 is 2.7V±3%.

Table 7-2 Recommendation of Operation Conditions

7.3 DC Characteristics

Unless otherwise specified, VCC*=3.6V, Ta=25℃

Symbol	Parameter	Condition	Min	Typ	Max	Units
Vih	“H” Input Voltage	Pin = LDO1EXON～LDO4EXON, DC1EXON～DC2EXON	1.4			V
Vil	“L” Input Voltage	Pin = LDO1EXON～LDO4EXON, DC1EXON～DC2EXON,DC2SEL			0.4	V
Vol	“L” Output Voltage	Pin = VD1OUT,VD2OUT, Iol=1mA			0.2	V
Istandby	Standby Consumption Current	*1		8	20	μA

Table 7-3 DC Characteristics

Note*1: LDO1EXON～LDO4EXON,DC1EXON～DC2EXON = “L”
UVLO and LDO5 are ON.

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