Regulators ICs for Digital Cameras and Camcorders

Switching Regulator ICs with Built-in FET (5V)

BD9639MWV

No.11036ECT16

●Description

BD9639MWV is 6ch system switching regulator IC that has built-in FET and Error amp phase compensation for DSC/DVC. The built-in circuit which consist of 2ch Buck-Boost / 2ch Buck / 2ch Boost circuits realize the high efficiency.

●Features

1) 6CH DC/DC converter

・CH1 Boost	FET embedded	Start-up ch,Motor
・CH2 Buck	FET embedded	Core
・CH3 Buck-Boost	FET embedded	CMOS
・CH4 Buck-Boost	FET embedded	Digital
・CH5 Buck	FET embedded	CMOS, Memory
・CH6 Boost	FET embedded	LED

2) Low voltage operation 2.5[V]
3) CH1 supply voltage output for internal circuit
4) CH1 PWM / PFM selectable
5) CH3・CH4 Boost-Buck auto switching
6) CH6 integrated Boost output shutdown (Load switch embedded)
7) Soft-start correspondence to each channel
8) Ground short protection function embedded (CH2 to CH6)
9) Error amp phase compensation (CH1 to CH6)
10) Operating frequency 1.5[MHz] (CH1 to CH6)
11) Package of mounting on high heat radiation side (UQFN056V7070)

●Application

DSC/DVC

●**Absolute maximum ratings** (Ta=25℃)

Parameter	Symbol	Ratings	Unit
Supply voltage permissible voltage	VBAT	-0.3～7	V
	VBAT2		
	VBAT3		
	VBAT4		
	VBAT5		
	VBAT6		
SW6 permissible voltage	SW6	24.0	V
VOUT1 permissible current output	IVOUT1	1.0	A
SW1 permissible current output	ISW1	1.0	A
SW2 permissible current output	ISW2	2.0	A
VOUT3 permissible current output	IVOUT3	1.0	A
DSW3 permissible current output	IDSW3	1.0	A
USW3 permissible current output	IUSW3	1.0	A
VOUT4 permissible current output	IVOUT4	1.0	A
DSW4 permissible current output	IDSW4	1.0	A
USW4 permissible current output	IUSW4	1.0	A
SW5 permissible current output	ISW5	1.0	A
SW6 permissible current output	ISW6	0.2	A
Power dissipation	Pd	4.83 (*1)	W
Operating temperature range	Topt	-20～+85	℃
Storage temperature range	Tstg	-55～+150	℃
Junction temperature	Tjmax	+150	℃

(*1) Implemented on Glass epoxy board (ROHM standard board：74.2×74.2×1.6[mm^3] 4 layers(Copper foil：5502 m^2)
Power dissipation depends on the mounted wiring pattern.

●**Operating supply voltage**

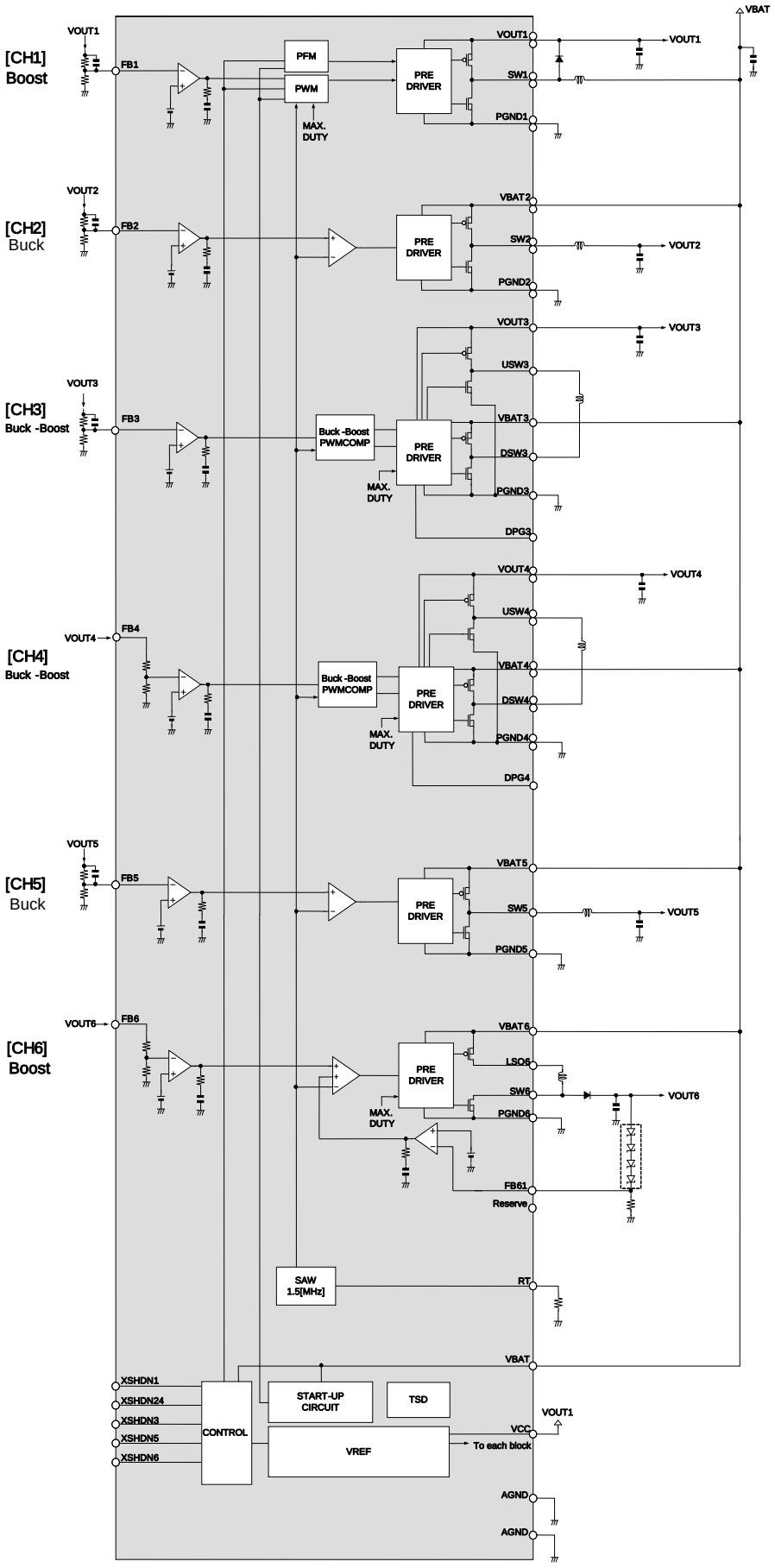
Parameter	Symbol	Limits			Unit
		Min.	Typ.	Max.	
VBAT supply voltage	VBAT	2.5	3.7	5.5	V
	VBAT2	2.5	3.7	5.5	V
	VBAT3	2.5	3.7	5.5	V
	VBAT4	2.5	3.7	5.5	V
	VBAT5	2.5	3.7	5.5	V
	VBAT6	2.5	3.7	5.5	V

●**Electrical characteristics** (Unless otherwise specified, VBAT=VBAT2・3・4・5・6=3.7[V], VCC input terminal =3.7[V], Ta=25[℃])

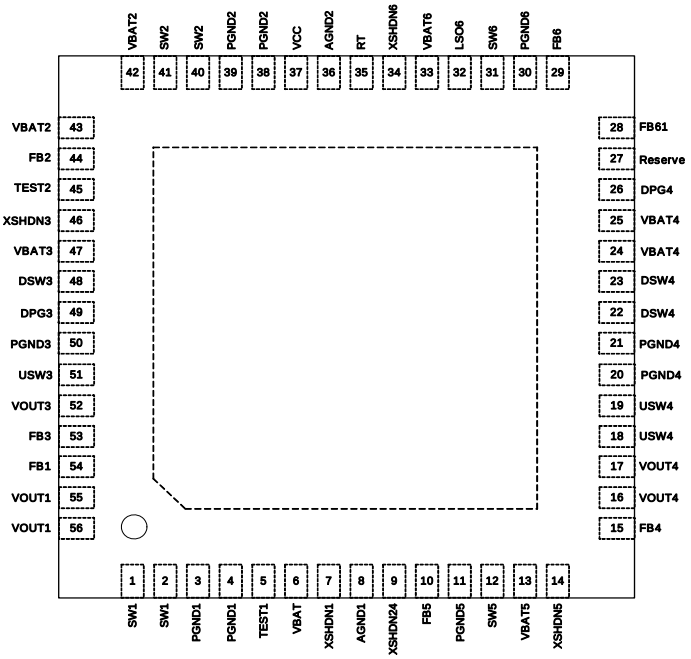
Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Current consumption (PFM)	ICC1	-	72	150	μA	・XSHDN1=H, XSHDN24=L ・Without load on each channel ・FB1=0.5[V] ・sum of VBAT terminal, and VOUT1 terminal
Current consumption (PWM)	ICC2	1.57	2.35	3.53	mA	・XSHDN1=H, XSHDN24=H, TEST1=H ・FB1=0.5[V] ・Sum of VBAT terminal, and VOUT1 terminal
Shutdown current consumption	ICC3	-	0	10	μA	・All setting terminal=L ・Sum of VBAT terminal, and VOUT1 terminal
H input voltage 1	VIH1	VBAT -0.3	-	-	V	XSHDN1
L input voltage 1	VIL1	-	-	GND +0.3	V	
H input voltage 2	VIH3	2.5	-	-	V	XSHDN24, XSHDN3, XSHDN5, XSHDN6
L input voltage 2	VIL3	-	-	GND +0.3	V	
H input current 1	IIH1	4.63	9.25	18.5	μA	Input voltage =3.7[V] XSHDN24, XSHDN3, XSHDN5, XSHDN6
Oscillating frequency 1	FOSC1	1.2	1.5	1.8	MHz	RT=10[kΩ]
Reduced-voltage detection voltage	VUVLO1	1.75	1.95	2.15	V	
Reduced-voltage return voltage	VUVLO2	1.95	2.15	2.35	V	
【CH1】						
Soft-start period 85%	TSS1	310	620	930	μs	Soft-start period 100% 730[μs](Typ.) XSHDN24=L
Error amp reference voltage	EREF1	0.388	0.400	0.412	V	XSHDN24=H
PMOS On resistance	RONP1	-	0.24	0.38	Ω	Power supply 3.7[V]
NMOS On resistance	RONN1	-	0.14	0.23	Ω	Power supply 3.7[V]
Maximum duty	DMAX1	76.5	85.0	93.5	%	XSHDN24=H
【CH2】						
Error amp reference voltage	EREF2	0.390	0.400	0.410	V	
Soft-start period 85%	TSS2	0.43	0.85	1.27	ms	Soft-start period 100% 1.0[ms](Typ.)
PMOS On resistance	RONP2	-	0.13	0.21	Ω	Power supply 3.7[V]
NMOS On resistance	RONN2	-	0.08	0.14	Ω	Power supply 3.7[V]
NMOS On resistance UP side	RONNU3	-	0.16	0.27	Ω	Power supply 3.7[V]

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
【CH3】						
Error amp reference voltage	EREF3	0.390	0.400	0.410	V	
Soft-start period 85%	TSS3	0.85	1.70	2.55	ms	Soft-start period 100% 2.0[ms](Typ.)
PMOS On resistance DOWN side	RONPD3	-	0.24	0.39	Ω	Power supply 3.7[V]
NMOS On resistance DOWN side	RONND3	-	0.25	0.40	Ω	Power supply 3.7[V]
PMOS On resistance UP side	RONPU3	-	0.26	0.42	Ω	Power supply 3.7[V]
Maximum duty	DMAX3	65	80	95	%	
【CH4】						
Error amp reference voltage	EREF4	0.390	0.400	0.410	V	
Soft-start period 85%	TSS4	1.28	2.55	3.83	ms	Soft-start period 100% 3.0[ms](Typ.)
PMOS on resistance DOWN side	RONPD4	-	0.16	0.26	Ω	Power supply 3.7[V]
NMOS on resistance DOWN side	RONND4	-	0.21	0.33	Ω	Power supply 3.7[V]
PMOS on resistance UP side	RONPU4	-	0.24	0.38	Ω	Power supply 3.7[V]
NMOS on resistance UP side	RONNU4	-	0.16	0.26	Ω	Power supply 3.7[V]
Maximum duty	DMAX4	65	80	95	%	
【CH5】						
Error amp reference voltage	EREF5	0.390	0.400	0.410	V	
Soft-start period 85%	TSS5	0.85	1.70	2.55	ms	Soft-start period 100% 2.0[ms](Typ.)
PMOS on resistance	RONP5	-	0.26	0.42	Ω	Power supply [V]
NMOS on resistance	RONN5	-	0.17	0.28	Ω	Power supply [V]
【CH6】						
Error amp reference voltage 1	EREF6	0.380	0.400	0.420	V	Constant voltage control side
Error amp reference voltage 2	EREF6.1	0.380	0.400	0.420	V	Constant voltage control side
Soft-start period 85%	TSS6	2.55	5.10	7.65	ms	Soft-start period 100% 6.0[ms](Typ.)
Load switching on resistance	RONP6	-	0.23	0.37	Ω	Power supply 3.7[V]
NMOS on resistance	RONN6	-	0.47	0.73	Ω	Power supply 3.7[V]
Maximum duty	DMAX6	83	90	97	%	

●Block diagram



●**Terminal configuration diagram** (Top View)

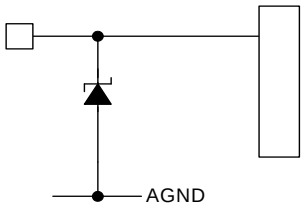


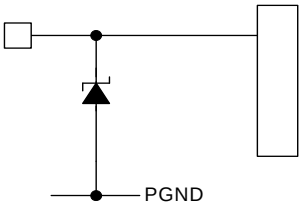
●**Terminal description**

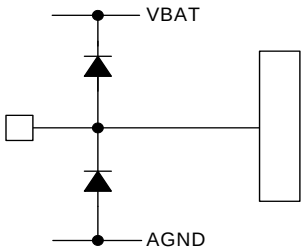
Terminal No.	Name	Equivalent circuit	
1	SW1	CH1 switching terminal	O
2	SW1	CH1 switching terminal	O
3	PGND1	CH1 DRIVER GND terminal	G
4	PGND1	CH1 DRIVER GND terminal	G
5	TEST1	Test terminal	O・G
6	VBAT	Battery input terminal	V
7	XSHDN1	CH1 shutdown terminal	G
8	AGND1	Analog GND terminal	G
9	XSHDN24	CH2・4 shutdown terminal	O・G
10	FB5	CH5 feed buck terminal	G
11	PGND5	CH5 DRIVER GND terminal	G
12	SW5	CH5 switching terminal	O
13	VBAT5	CH5 DRIVER power supply terminal	V
14	XSHDN5	CH5 shutdown terminal	O・G
15	FB4	CH4 feed buck terminal	G
16	VOUT4	CH4 output terminal	O
17	VOUT4	CH4 output terminal	O
18	USW4	CH4 Boost side switching terminal	O
19	USW4	CH4 Boost side switching terminal	O
20	PGND4	CH4 DRIVER GND terminal	G
21	PGND4	CH4 DRIVER GND terminal	G
22	DSW4	CH4 Buck side switching terminal	O
23	DSW4	CH4 Buck side switching terminal	O
24	VBAT4	CH4 DRIVER power supply terminal	V
25	VBAT4	CH4 DRIVER power supply terminal	V
26	DPG4	CH4 gate connecting terminal	O
27	Reserve	Reserve terminal	O・G
28	FB61	CH6 feed buck terminal (Constant current side)	G

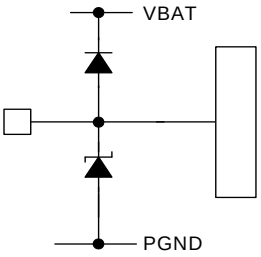
Terminal No.	Name	Equivalent circuit	
29	FB6	CH6 feed buck terminal (Constant voltage side)	G
30	PGND6	CH6 DRIVER GND terminal	G
31	SW6	CH6 switching terminal	O
32	LSO6	CH6 Load switch output terminal	O
33	VBAT6	CH6 Load switch input terminal	V
34	XSHDN6	CH6 shutdown terminal	O・G
35	RT	Triangle wave setting resistor terminal	
36	AGND2	Analog GND terminal	G
37	VCC	Analog power supply terminal	V
38	PGND2	CH2 DRIVER GND terminal	G
39	PGND2	CH2 DRIVER GND terminal	G
40	SW2	CH2 switching terminal	O
41	SW2	CH2 switching terminal	O
42	VBAT2	CH2 DRIVER power supply terminal	V
43	VBAT2	CH2 DRIVER power supply terminal	V
44	FB2	CH2 feed buck terminal	G
45	TEST2	Test terminal	O・G
46	XSHDN3	CH3 shutdown terminal	O・G
47	VBAT3	CH3 DRIVER power supply terminal	V
48	DSW3	CH3 Buck side switching terminal	O
49	DPG3	CH3 gate connecting terminal	O
50	PGND3	CH3 DRIVER GND terminal	G
51	USW3	CH3 Boost side switching terminal	O
52	VOUT3	CH3 output terminal	O
53	FB3	CH3 feed buck terminal	G
54	FB1	CH1 feed buck terminal	G
55	VOUT1	CH1 output terminal	O
56	VOUT1	CH1 output terminal	O

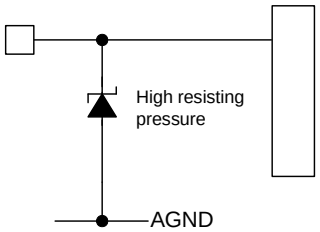
●Terminal protection circuit schematics

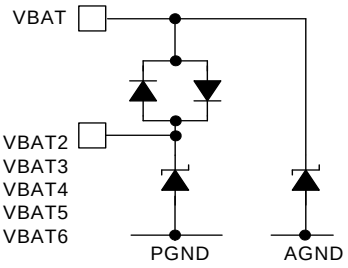
Terminal No.	Terminal Name	Equivalent circuit
7 9 14 15 34 37 46	XSHDN1 XSHDN24 XSHDN5 FB4 XSHDN6 VCC XSHDN3	

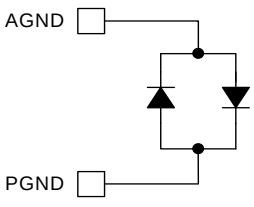
Terminal No.	Terminal Name	Equivalent circuit
1 2 16 17 18 19 51 52 55 56	SW1 SW1 VOUT4 VOUT4 USW4 USW4 USW3 VOUT3 VOUT1 VOUT1	

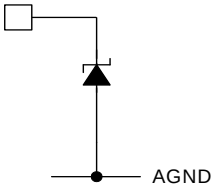
Terminal No.	Terminal Name	Equivalent circuit
5 10 28 35 44 45 53 54	TEST1 FB5 FB61 RT FB2 TEST2 FB3 FB1	

Terminal No.	Terminal Name	Equivalent circuit
12 22 23 26 32 40 41 48 49	SW5 DSW4 DSW4 DPG4 LSO6 SW2 SW2 DSW3 DPG3	

Terminal No.	Terminal Name	Equivalent circuit
29 31	FB6 SW6	

Terminal No.	Terminal Name	Equivalent circuit
6 13 24 25 33 42 43 47	VBAT VBAT5 VBAT4 VBAT4 VBAT6 VBAT2 VBAT2 VBAT3	

Terminal No.	Terminal Name	Equivalent circuit
3 4 8 11 20 21 30 36 38 39 50	PGND1 PGND1 AGND1 PGND5 PGND4 PGND4 PGND6 AGND2 PGND2 PGND2 PGND3	

Terminal No.	Terminal Name	Equivalent circuit
27	Reserve	

●Function description

【Architectonics】

CH	Function	Output voltage	Power output	Setting res.	USE
CH1	Boost converter	3.70[V]～5.50[V]	Embedded	External	Start-up CH, Motor
CH2	Buck converter	1.05[V]～1.80[V]	Embedded	External	Core
CH3	H-BRIDGE converter	1.80[V]～3.30[V]	Embedded	External	CMOS
CH4	H-BRIDGE converter	3.25[V]	Embedded	Embedded	Digital
CH5	Buck converter	1.50[V]～1.80[V]	Embedded	External	CMOS, Memory
CH6	Boost converter	2 灯～6 灯	Embedded	External	LED

【CONTROL】

・Stand-by function related terminals

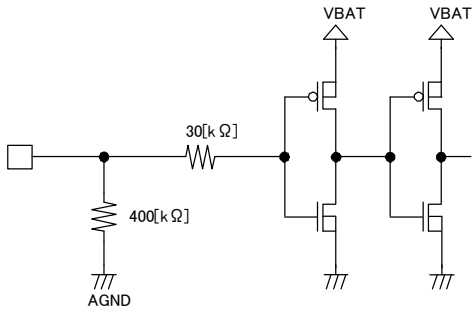
Following table shows start-up condition of each block.

XSHDN1	XSHDN24	XSHDN3	XSHDN5	XSHDN6	CH1 PFM	CH1 PWM	Internal supply	CH2 CH4	CH3	CH5	CH6
L	-	-	-	-	OFF	OFF	OFF	OFF	OFF	OFF	OFF
H	L				ON						
	H	L	L	L	OFF	ON	ON	ON			
		H	L	L					ON		
		L	H						OFF	ON	
			L	H						OFF	ON

* - symbol mean non-condiotion.

・Other setting terminals

・XSHDN24～XSHDN6 terminal equivalent circuit



Because Pull-down is nod as for the terminal XSHDN1,
it is necessary to process the VBAT input and the GND input.

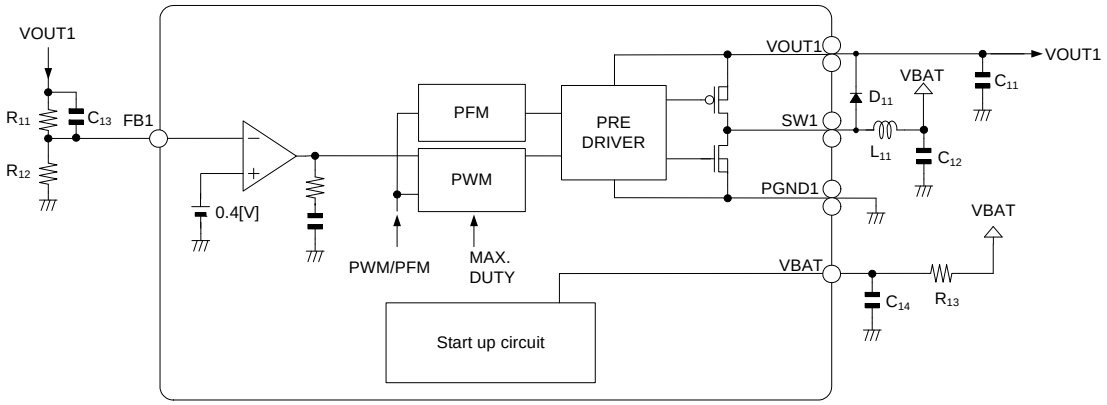
【Start-up circuit】

CH1 begins operating with PFM by the thing made XSHDN1=H.
Next, an internal power supply stands up when making it to XSHDN24=H and CH1 operates in PWM.
From XSHDN24=H to standby time it and be of CH2-CH6 between about 5 ms in state of standby
After it ends at the standby time, CH2 and CH4 begin a soft start.
Moreover, after it ends similarly at the standby time when XSHDN24-XSHDN6 is made High at the same time, CH2-CH6 begins a soft start.

【CH1】

・Function

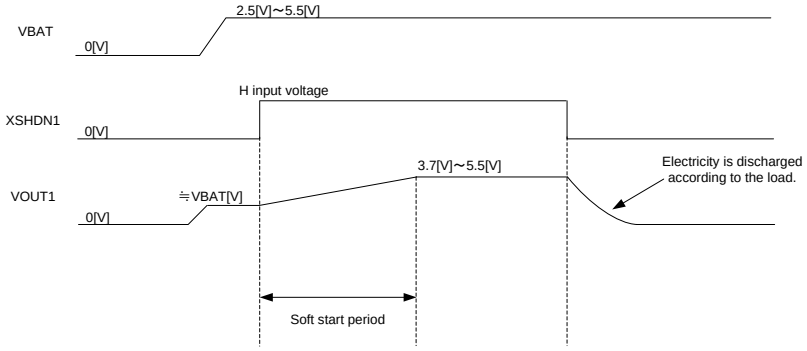
Selectable PWM/PFM boost DC/DC converter.
Output voltage is assumed to be 4.2[V]～5.5[V].
Low voltage operation. Starts up from 1.5[V] and also provide supply voltage to VREF circuit.



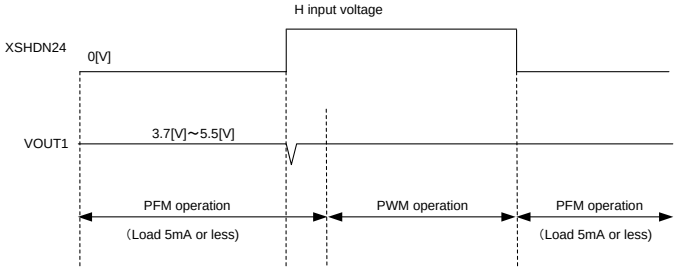
・Recommended external components

Parts name	Value	Maker	Part number
R_{11}	620[kΩ] +24[kΩ]	-	-
R_{12}	56[kΩ]	-	-
R_{13}	10[Ω]	-	-
C_{11}	22[μF] (×2)	Taiyo Yuden	JMK212BJ226MG
C_{12}	10[μF]	Taiyo Yuden	JMK212BJ106KG
C_{13}	100[pF]	Taiyo Yuden	UMK1005CH101JV
C_{14}	1[μF]	Taiyo Yuden	JMK105BJ105KV
L_{11}	2.2[μH]	Taiyo Yuden	NR4018T2R2N
D_{11}	-	ROHM	RB060M-30

・Start-up sequence



・PWM/PFM

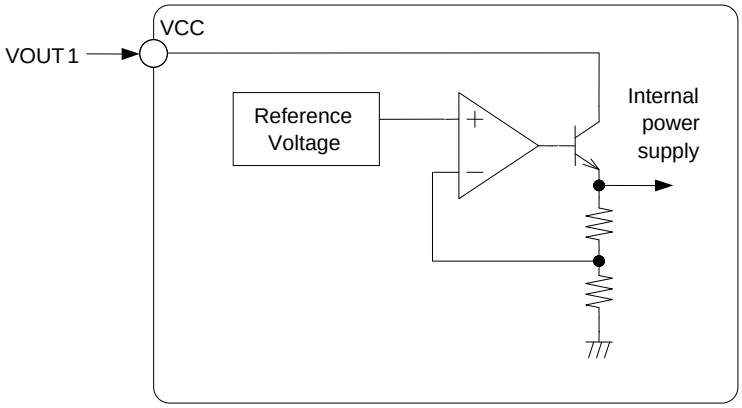


Select PWM/PFM (operation of XSHDN=H and XSHDN24) with light load(10mA or less).

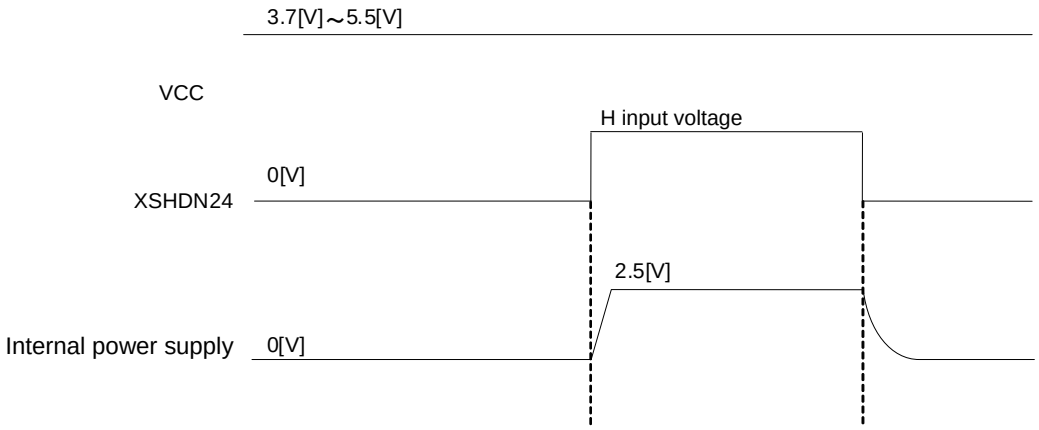
【Internal supply voltage】

・Function

Regulator input voltage is voltage VOUT1.
Output voltage is 2.5[V].
There is no output terminal for an internal power supply.
Use an internal power supply as a power supply of an internal circuit.
An internal power supply stands up in the PWM mode (XSHDN1=H and XSHDN24=H).



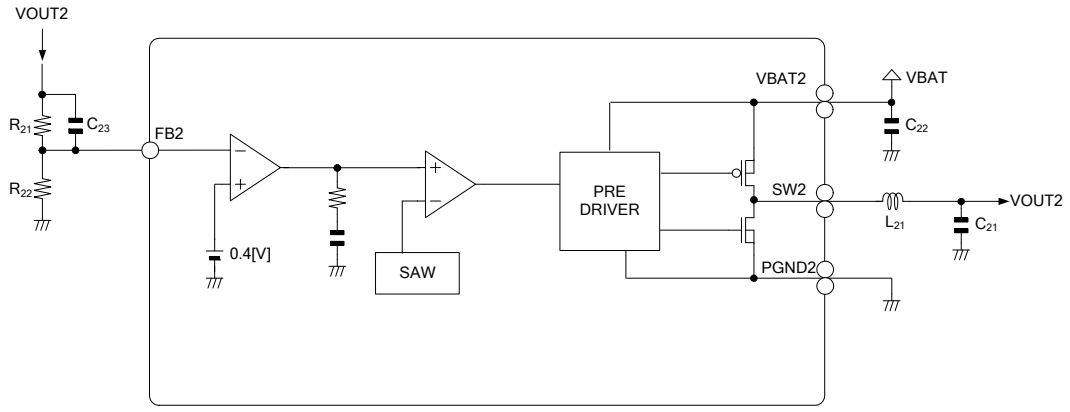
・Start-up sequence



【CH2】

・Function

Synchronous rectification Buck DC/DC converter with integrated output stage power MOS.
Output voltage is assumed to be 1.05[V]～1.80[V].

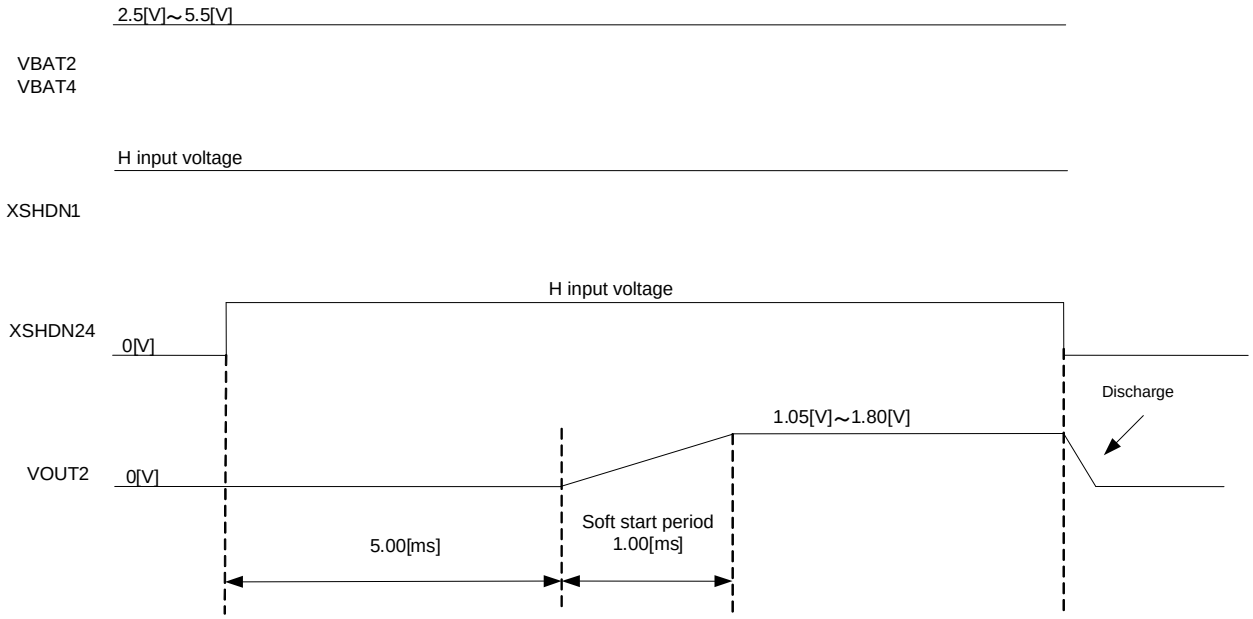


・Recommended external components

Parts name	Value	Maker	Part number
R_{21}	Refer to right table	-	-
R_{22}	Refer to right table	-	-
C_{21}	22[µF]	Taiyo Yuden	JMK212BJ226MG
C_{22}	10[µF]	Taiyo Yuden	JMK212BJ106KG
C_{23}	33[pF]	Taiyo Yuden	UMK105CH330JV
L_{21}	2.0[µH]	TOKO	A915AY-2R0M

VOUT2 / Set external	1.1[V]	1.2[V]
R_{21}	100[kΩ]	100[kΩ]
R_{22}	56[kΩ] + 1.1[kΩ]	20[kΩ] + 30[kΩ]

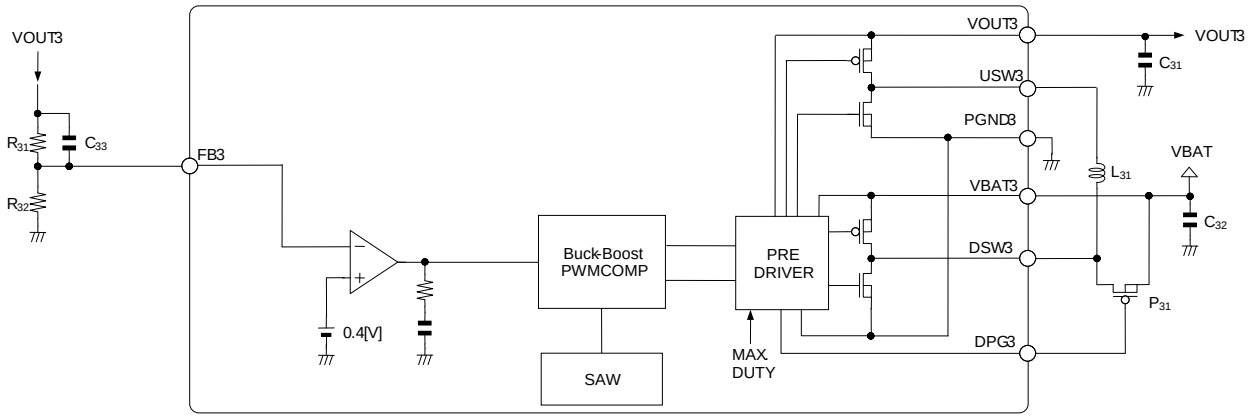
・Start-up sequence



【CH3】

・Function

Synchronous rectification cross converter with integrated output stage power MOS.
Output voltage is assumed to be 1.80[V]～2.80[V].

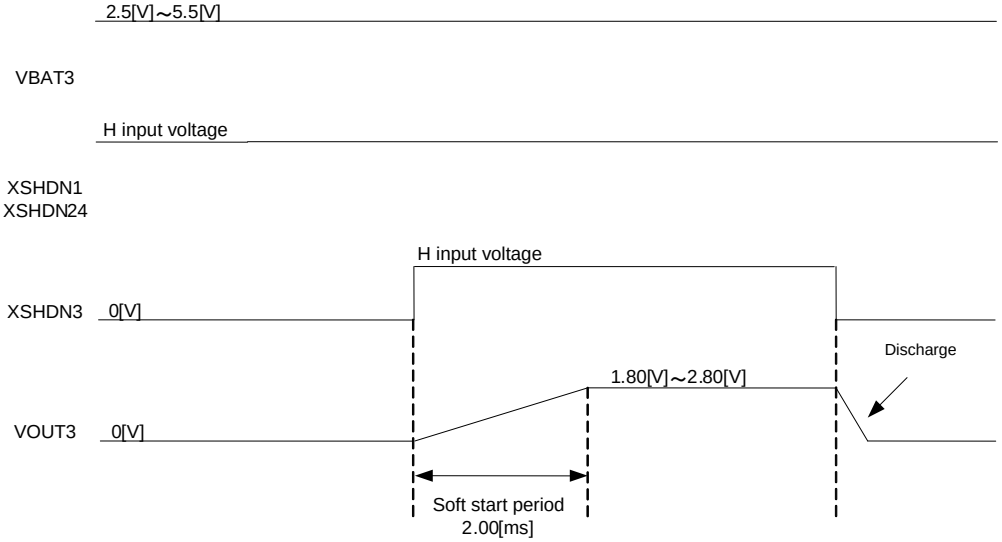


・Recommended external components

Parts name	Value	Maker	Part number
R_{31}	Refer to right table	-	-
R_{32}	Refer to right table	-	-
C_{31}	22[µF]	Taiyo Yuden	JMK212BJ226MG
C_{32}	10[µF]	Taiyo Yuden	JMK212BJ106KG
C_{33}	100[pF]	Taiyo Yuden	UMK105CH101JV
L_{31}	4.7[µH]	Taiyo Yuden	NR3015T4R7M
P_{31}	-	ROHM	RW1A020ZP

VOUT3 / Set external	1.80[V]	2.80[V]
R_{31}	100[kΩ]	100[kΩ]
R_{32}	27[kΩ] + 1.6[kΩ]	12[kΩ] + 4.7[kΩ]

・Start-up sequence



hen the VOUT=1.8 V is set, and VOUT3・USW3 is not used (use it only with Buck),
the Discharge function is not provided.

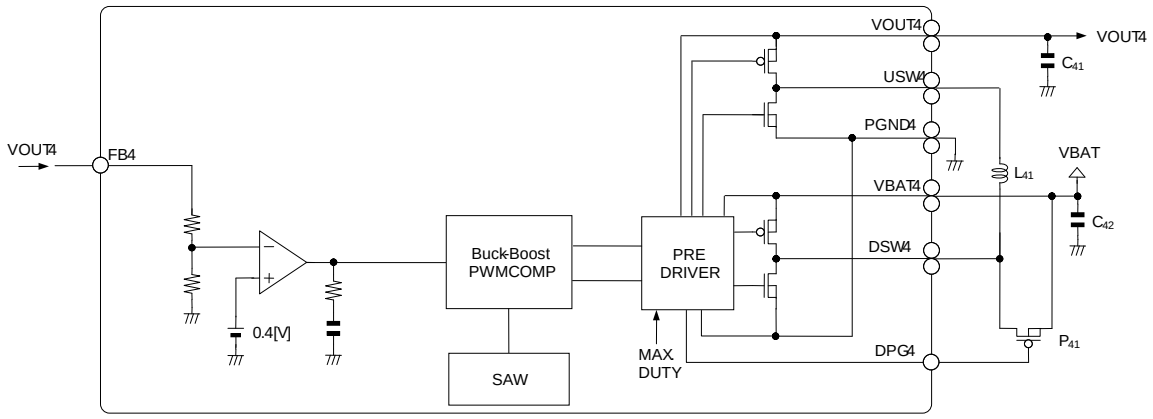
・DPG3

The DPG3 output terminal is a gating signal when PMOS is inserted and used between VBAT3 and DSW3.
It is possible to throw the overcurrent further also at turning on Voltage descent when becoming VBAT=2.85 V or less.
It becomes DPG3=L. external PMOS

【CH4】

・Function

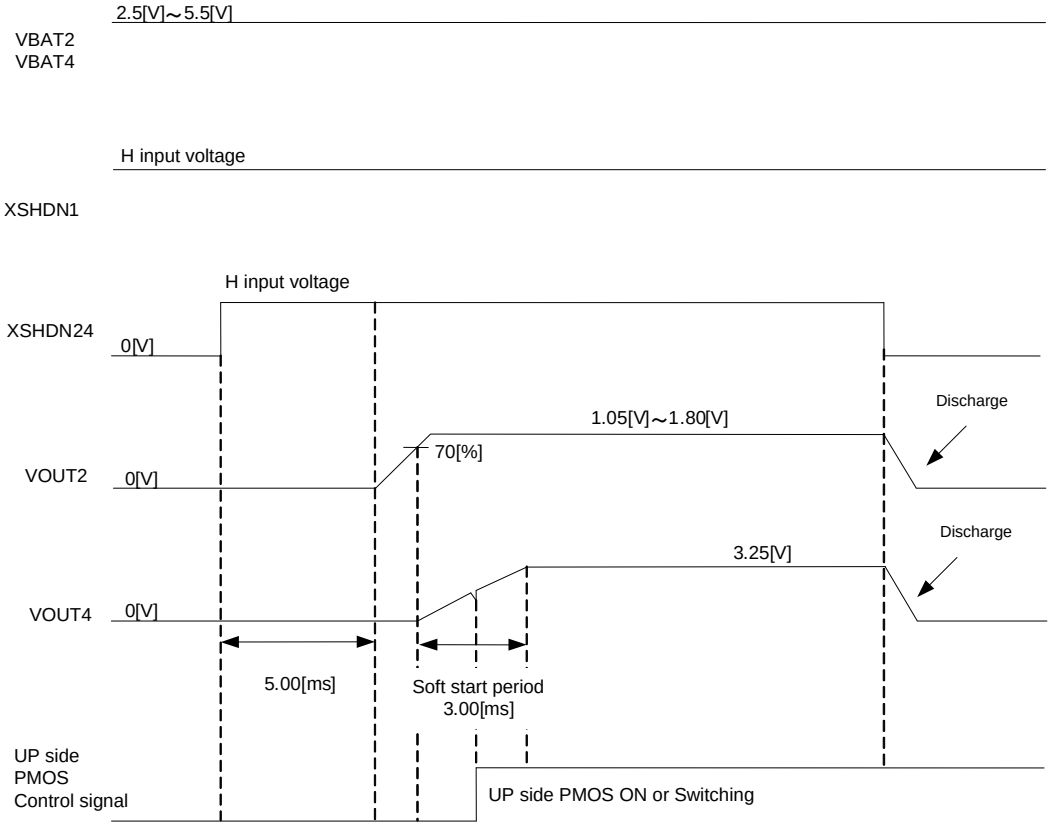
Synchronous rectification cross converter with integrated output stage power-MOS.
The output voltage is 3.25V fixation.



・Recommended external components

Parts name	Value	Maker	Part number
C_{41}	22[µF]	Taiyo Yuden	JMK212BJ226MG
C_{42}	10[µF]	Taiyo Yuden	JMK212BJ106KG
L_{41}	3.3[µH]	Taiyo Yuden	NR4018T3R3M
P_{41}	-	ROHM	RW1A20ZP

・Start-up sequence



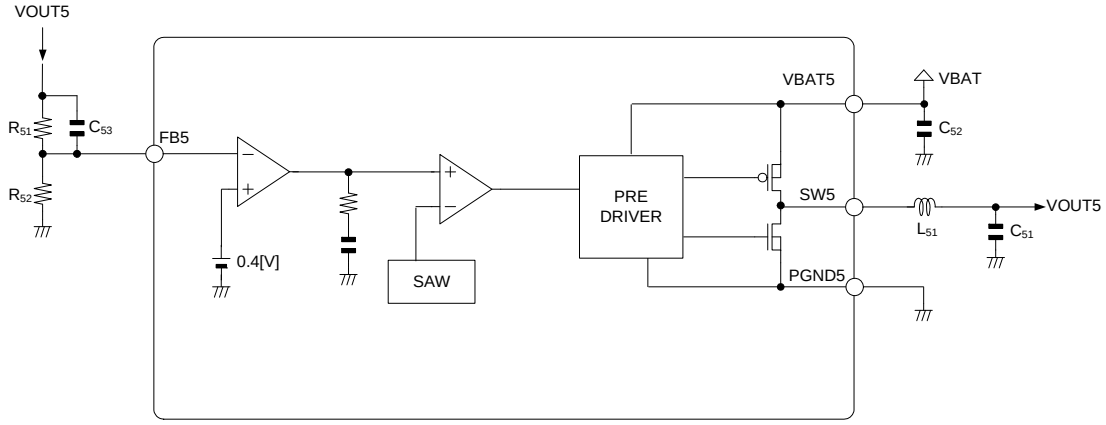
・DPG4

The DPG4 output terminal is a gating signal when PMOS is inserted and used between VBAT4 and DSW4.
It is possible to throw the overcurrent further also at turning on Voltage descent when becoming VBAT=2.85 V or less.
It becomes DPG4=L. external PMOS

【CH5】

・Function

Synchronous rectification Buck DC/DC converter with integrated output stage power MOS.
Output voltage is assumed to be 1.50[V]～1.80[V].

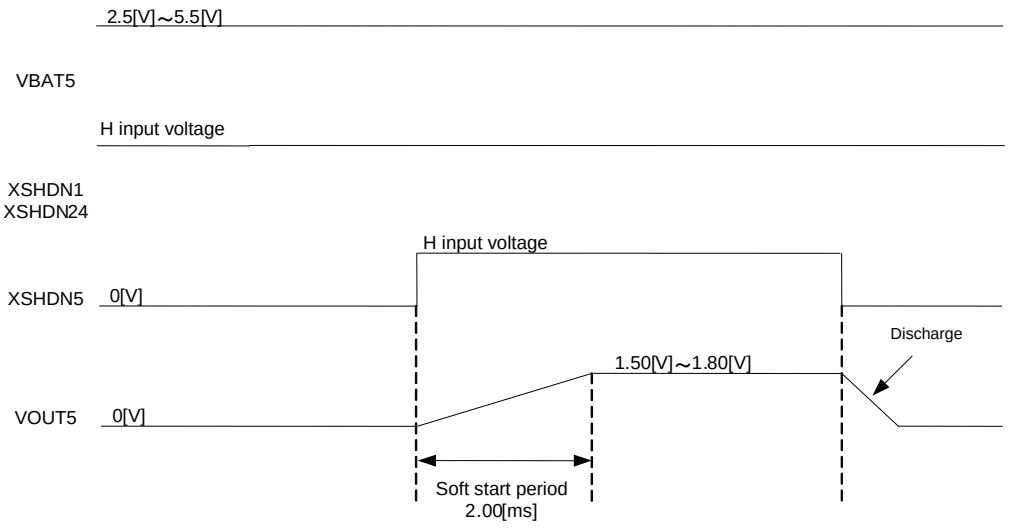


・Recommended external components

Parts name	Value	Maker	Part number
R_{51}	Refer to right table	-	-
R_{52}	Refer to right table	-	-
C_{51}	10[µF]	Taiyo Yuden	JMK212BJ106KG
C_{52}	1[µF]	Taiyo Yuden	JMK105BJ105KV
C_{53}	100[pF]	Taiyo Yuden	UMK105CH101JV
L_{51}	6.8[µH]	Taiyo Yuden	NR3015T6R8M

Set external \ VOUT5	1.5[V]	1.8[V]
R_{51}	100[kΩ]	100[kΩ]
R_{52}	33[kΩ] + 3.3[kΩ]	27[kΩ] + 1.6[kΩ]

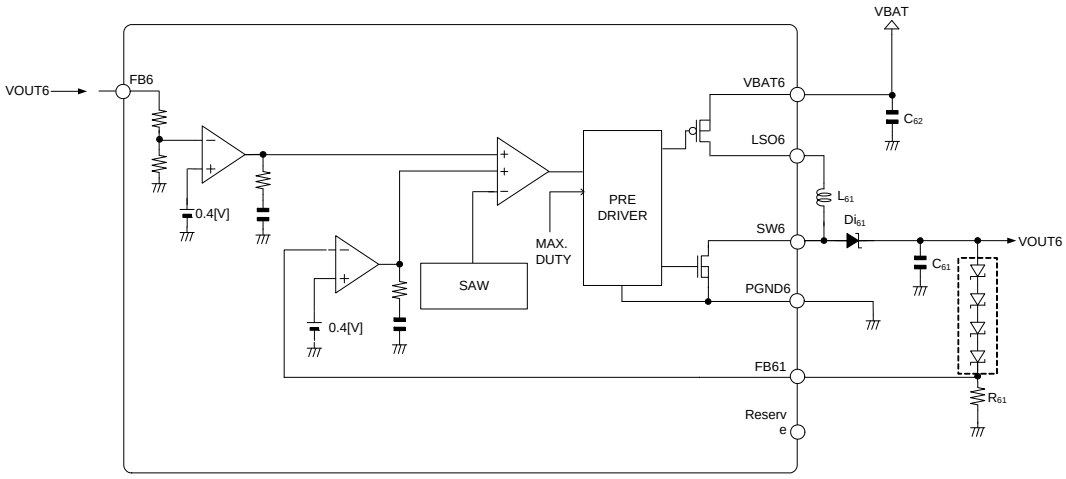
・Start-up sequence



【CH6】

・Function

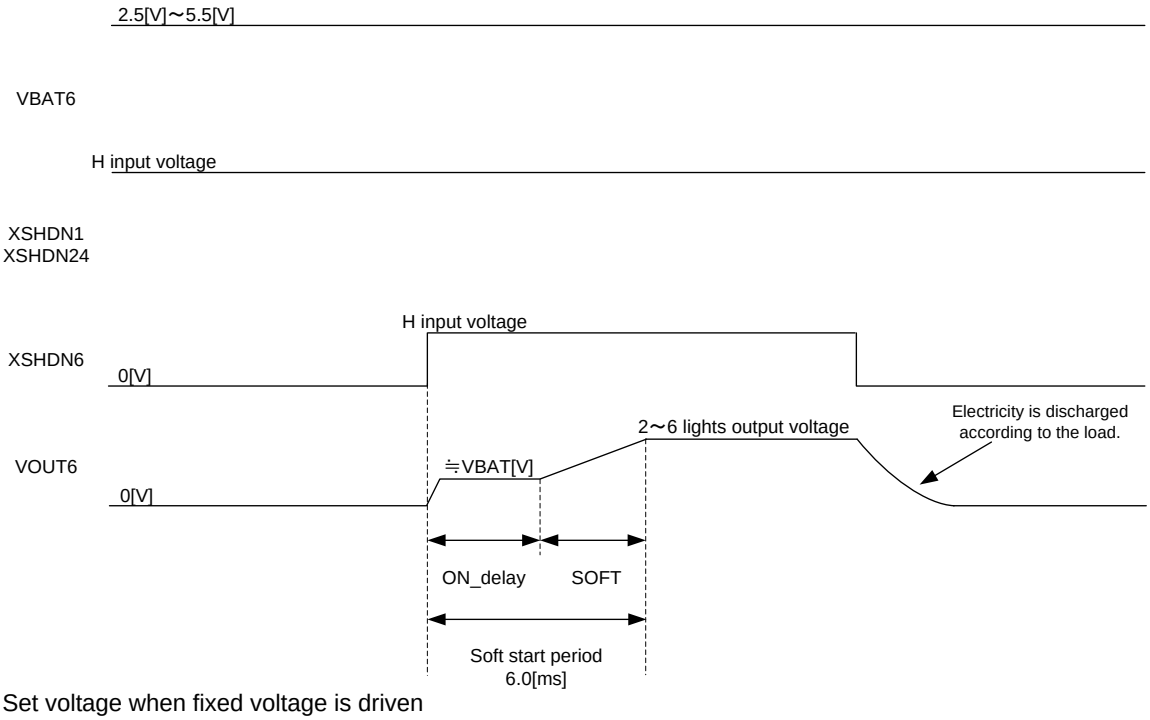
Boost DC/DC converter with integrated load switch.
Constant voltage operation and constant voltage operation for protection is available with output of 2～6 lights.
The loading switch is turned off at XSHDN6=L (CH6 shutdown) and the timer latch.



・Recommended external components

Parts name	Value	Maker	Part number
R_{61}	20[Ω]	-	-
C_{61}	4.7[μF]	Taiyo Yuden	EMK212BJ475KG
C_{62}	1[μF]	Taiyo Yuden	JMK105BJ105KV
L_{61}	10[μH]	Taiyo Yuden	NR3015T100M
Di_{61}	-	ROHM	RB551V-30

・Start-up sequence

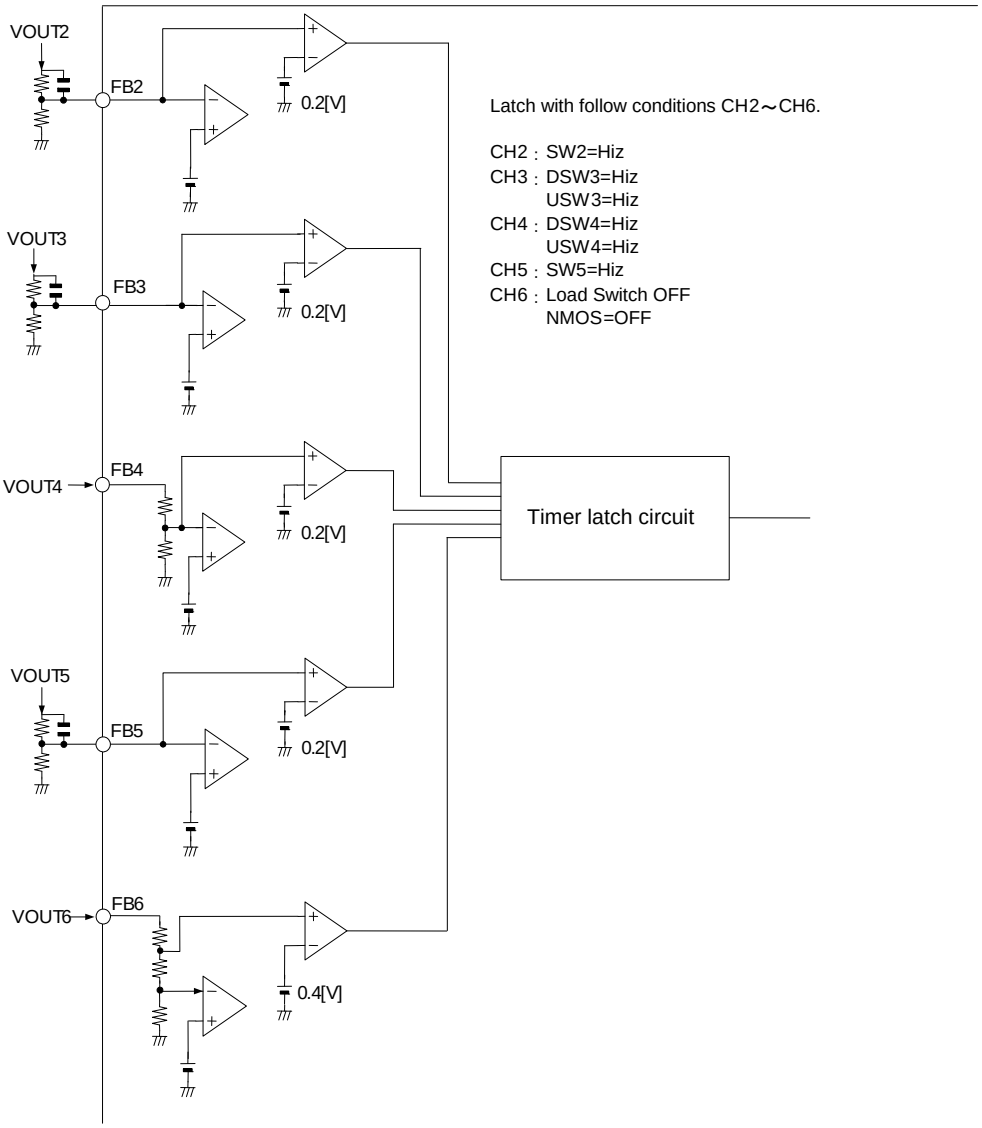


・Set voltage when fixed voltage is driven

When a fixed voltage is driven by internal resistance, it is set to 16V.
It is possible to return in a set voltage by adding external resistance between VOUT6 and FB6.
When a fixed voltage is driven, it becomes 20.1V if 82kΩ is added.
When a fixed voltage is driven, it becomes 22.0V if 120kΩ is added.
However, note the resisting pressure of the capacitance of C61 when stepping up the voltage applying external resistance.

【Ground short protection Function】

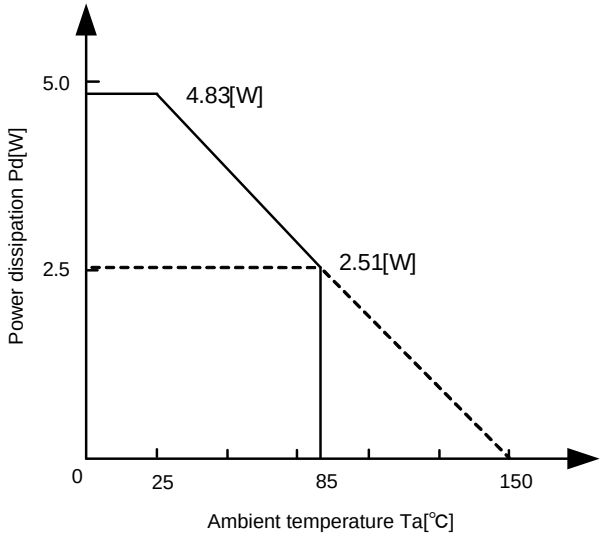
- CH2～CH6 are monitoring error amp input voltage fed backed from output and enable timer circuit with falling below the detection voltage of short protection circuit. Timer latch circuit will latch power MOS to off status of CH2～CH6 if such condition remained for 10ms.
- All channel except CH1 will be latched with any other channels to be over current and/or shorted.
- Latch will be released either setting XSHDN1=GND, XSHDN24=GND or restarting the device.
- Short detection comparator will be disabled by soft start.
- The timer latch circuit doesn't operate when an internal power supply doesn't rise.



【Thermal shutdown function】

Thermal shutdown function is built in to prevent IC from heat distraction.
Thermal circuit will be disabled by PFM.

●Power dissipation



●Notes for use

1. Board patterning
   - ・VBAT,VBAT2,VBAT3,VBAT4,VBAT5, VBAT6 are must be connected to power supply on the board.
   - ・VCC must be connected to VOUT1 output on the board.
   - ・ALL PGND and AGND must be connected to GND on the board.
   - ・ALL power supply line and GND terminals must be wired with wide/short pattern in order to achieve substantially low impedance.

2. Peripheral circuitry
   - ・Use low ESR ceramic capacitor for bypass condenser between power supply and GND terminal and place capacitor right ext to the IC pins.
   - ・Place external components such as L and C by IC with wide/short pattern.
   - ・Draw output voltage from each end of capacitor.
   - ・Causing short circuit at CH1 output will overload the external diode and may breakdown the component.
   - ・Prepare physical countermeasures by adding poli-switches and fuses to avoid excess current flow.

3. Start-up
   - ・Keep light load condition by starting up the device.
   - ・Make it to PWM mode (XSHDN24=L→H) after CH1 is started up in PFM mode (XSHDN1=L→H), and the VOUT1 output voltage stands up.
     Moreover, start it about the start of CH3・CH5・CH6 since the PWM mode (Contain it simultaneously).

4. Absolute maximum ratings
   - ・The quality control of the product has exercised adequate care, however operating above the absolute maximum ratings of supply voltage and/or operational temperature range may cause decay and destroy the IC. If specific mode such that exceeding the Absolute Maximum ratings is expected, please have physical countermeasure such as adding fuses and poli-switches etc.

5. Thermal design
   - ・Take consideration of power dissipation at actual device usage to ensure the satisfactory thermal design margin.
     (Refer page 6)

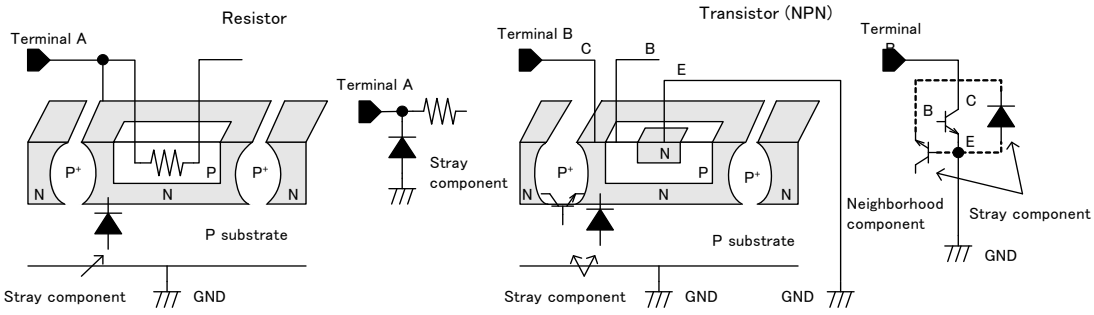
6. Terminal to Terminal short / mis-mounting
   - ・While mounting IC on the board, check direction and shift of the IC. If inadequately mounted, IC might be breakdown. Additionally short circuit from unwanted contamination at power supply and GND and/or between any terminals also may cause the defect.

7. Operating in strong electromagnetic field
   - ・Please pay attention using device in the strong electromagnetic field. Device may cause malfunction.

8. Thermal shut down.(TSD)
   - ・Main purpose of TSD is to shutting IC down from runaway effect. It is not to compensate or to protect IC itself. Therefore, please do not continuously operate the IC after TSD circuit is activated and/or premise operations such that TSD circuit function to be used.

9. Inspection with set board
   - ・While connecting capacitor to Low impedance pins, please discharge capacitor by one process by another to prevent stressing the IC. While mounting and removing the IC to/from the Board in the inspection process, be sure to turn off the power supply by each action. Moreover equip ground earth in assembling process for ESD protection and handle with care during the test and/or transportation.

10. Input terminals
    - This IC is a monolithic IC, and has P^+ isolation and P substrate for the element separation. Therefore, a parasitic PN junction is firmed in this P-layer and N-layer of each element. For example shown in below picture, the resistor or the transistor is connected to the terminal. When the GND voltage potential is greater than the voltage potential at Terminals A or B, the PN junction operates as a parasitic diode. In addition, the parasitic NPN transistor is formed in said parasitic diode and the N layer of surrounding elements close to said parasitic diode. These parasitic elements are formed in the IC because of the voltage relation. The parasitic element operating causes the wrong operation and destruction. Therefore, please be careful so as not to operate the parasitic elements by applying lower voltage than GND (P substrate) to input terminals. Moreover, please apply each input terminal with lower than the power-supply voltage or equal to the specified range in the guaranteed voltage when the power-supply voltage being applied.



Simplified IC structure

11. Usage of this product
    - This IC is designed to be used in DSC/DVD application.
    - Upon using our product to equipments or devices other than above mentioned application, please be sure to consult with our sales representative in advance.

●Ordering part number

B	D	9	6	3	9	M	W	V	-	E	2

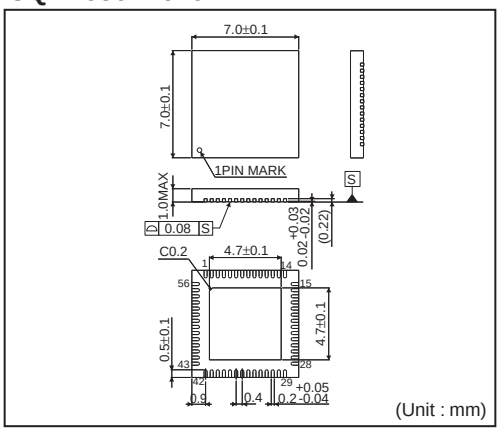
Part No. (BD)

Part No. (9639)

Package
MWV: UQFN056V7070

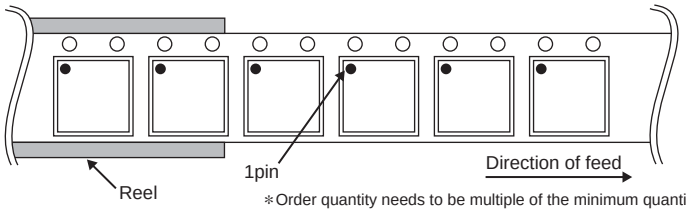
Packaging and forming specification
E2: Embossed tape and reel

UQFN056V7070



<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	1500pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

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- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
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- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
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