ROHM

STRUCTURE Silicon Monolithic Integrated Circuit
PRODUCT SERIES 7-Channel Switching Regulator Controller for Digital Camera

TYPE **BD9740KN**

FEATURES
- Wide input voltage range (1.5V to 10V)
- controls up to 7 switching regulators : Step up converter(1channel),Step-down converter(1channel),Configurable for step-up or step-down conversion(3channels), Positive to negative converter(1channel), Step-up converter for LED (1channel)
- Synchronous rectifying action mode (2channels) Built-in FET Transistor (1channel)

Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	units
Power Supply Voltage	VBAT VCC,PVCC	−0.3~12	V
	PVCCH	−0.3~15	V
Power Input Voltage	DRAIN4H,4L	−0.3~12	V
	OUT1B	−0.3~20	V
Power Dissipation	Pd	500(*1)	mW
		760(*2)	mW
Operating Temperature	Topr	−25~+85	℃
Storage Temperature	Tstg	−55~+125	℃

(*1)Without external heat sink ,the power dissipation reduces by 5.0mW/℃ over25℃.
(*2)Reduced by 7.6mW/℃ over25℃,when mounted on a PCB(70.0mm×70.0mm,1.6mm)

○Recommended operating conditions

Parameter	symbol	Standard value			units
		Min.	Typ.	Max.	
Power Supply Voltage	VBAT	1.5	−	10	V
	VCC,PVCC	2.5	−	10	V
	PVCCH	4.0	−	14	V
VREF Pin Connect Capacitor	CVREF	1.0	−	4.7	μF
VREGA Pin Connect Capacitor	CVREGA	1.0	−	10	μF
SCP Pin Connect Capacitor	CSCP	0.001	−	2.2	μF
SS1 Pin Connect Capacitor	CSS1	0.001	−	2.2	μF
[Oscillator]					
Oscillator Frequency	fosc	0.1	−	1.2	MHz
OSC Timing Resistor	RT	4.7	−	30	kΩ
OSC Timing Capacitor	CT	100	−	10000	pF

Parameter	symbol	Standard value			Units
		Min.	Typ.	Max.	
[Driver]					
DRAIN Pin Input Voltage	VDRAIN	−	−	10	V
Nch FET Output Current (CH4)	IoFET4	−	−	700	mA
Driver Output Current (CH1~3, 5~7)	Iout	−	−	30	mA
Driver Peak Current (CH1~3, 5~7)	Ipeak	−	−	200	mA
Built-in NPN TR Sink Current(CH1)	INPNsink	−	−	500	mA

(*3) VREGA drops under VCC=2.8V
◎ It is strongly recommended that a capacitor be connected to VREF and VREGA pin to prevent oscillation.
◎ The IC may not operate properly due to undetermined state of the internal logic when Vcc voltage is applied suddenly while STB pins are already ON.
In this case make sure STB pins are initially OFF.

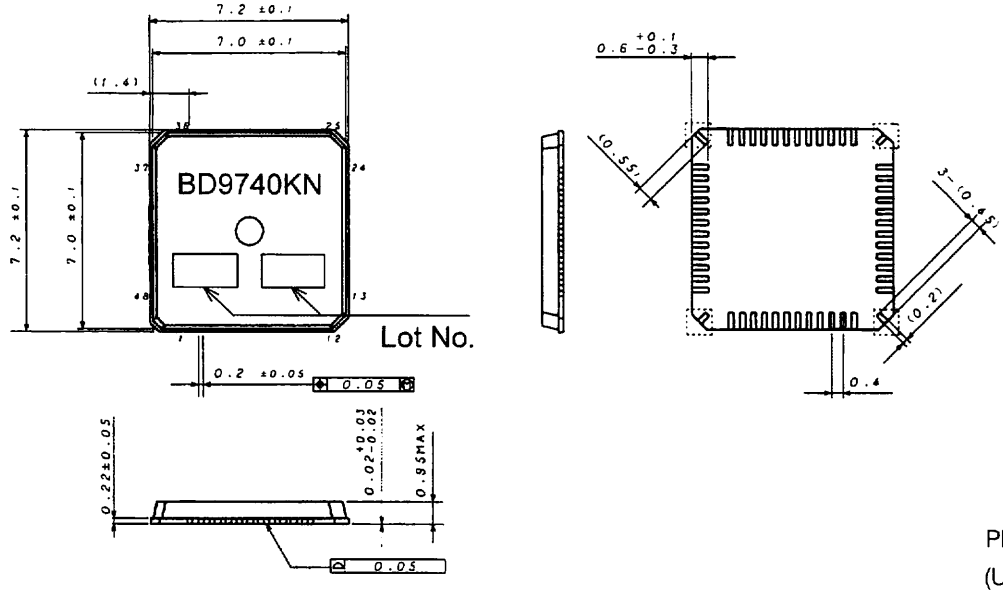
○Absolute maximum ratings(Ta=25°C)

Parameter	Symbol	Spec. Min.	Typ.	Max.	Units	Conditions
[Reference Voltage]						
Reference Voltage	Vref2	0.99	1.0	1.01	V	
Line Regulation	DVLi	–	4.0	12.5	mV	Vcc=3.0V ~9.0V
Load Regulation	DVLo	–	1.0	7.5	mV	Iref=10μA ~100μA
Short-Circuit Output Current	Ios	0.2	1	–	mA	Vref=0V
[Internal Regulator]						
REGA Output Voltage	VREGA	2.4	2.5	2.6	V	Ireg=5mA
[Low Voltage Input Prevented Operation Faults Circuit]						
Threshold Voltage 1	Vstd1	3.45	3.6	3.75	V	PVCCH monitor
Hysteresis width 1	ΔVst1	–	300	–	mV	
Threshold Voltage 2	Vstd2	2.3	2.4	2.5	V	VCC monitor
Hysteresis width 2	ΔVst2	–	200	–	mV	
Threshold Voltage 3	Vstd3	–	2.0	–	V	VREGA monitor
Hysteresis width 3	ΔVst3	–	50	–	mV	
[Start up Circuit]						
Oscillator Frequency	Fstart	50	120	220	kHz	
Minimum VBAT Voltage	Vst1	1.5	-	-	V	
Slow Start Charge Current	Iss1	1.1	2.2	3.3	μA	Vss=0V
[Protection Circuit]						
Timer Start Threshold Voltage	Vtc	2.1	2.2	2.3	V	FB monitor
SCP Output Current	Iscp	2	4	6	μA	VSCP=0.1V
SCP Threshold Voltage	Vtsc	0.9	1.0	1.1	V	
SCP Standby Voltage	Vssc	–	22	170	mV	
[Triangular wave oscillator]						
Oscillator Frequency	f osc1	450	500	550	kHz	RT=11kohm, CT=180pF
Frequency Stability (Vcc)	Df	–	0.3	2	%	VCC=3.0V~9.0V
RT Output Voltage	VRT	0.78	1.00	1.22	V	
[Error Amp 1 ~ 4]						
Low-level Output Voltage	VOL	–	1.3	–	V	INV=2V
High-level Output Voltage	VOH	VREGA –0.3V	–	–	V	INV=0.5V
Maximum Sink Current	IOI	36	72	–	μA	FB=1.7V, VINV=1.1V
Maximum Source Current	IOO	36	72	–	μA	FB=1.7V, VINV=0.9V
[[Error Amp 5]						
Low-level Output Voltage	VOL	–	1.3	–	V	INV=2V
High -level Output Voltage	VOH	VREGA –0.3	–	–	V	INV=0.5V
Maximum Sink Current	IOI	36	72	–	μA	FB=1.7V, VINV=1.1V
Maximum Source Current	IOO	36	72	–	μA	FB=1.7V, VINV=0.9V
DTC resistance VREGA side	RDTCU5	20	30	40	KΩ	
DTC resistance GND side	RDTCD5	65	95	125	KΩ	
[[Error Amp6]						
Low-level Output Voltage	VOL	–	1.3	–	V	NON6=–0.2V
High-level Output Voltage	VOH	VREGA –0.3	–	–	V	NON6=0.5V
Maximum Sink Current	IOI	36	72	–	μA	FB6=1.7V NON6=–0.2V
Low-level Output Voltage	IOO	36	72	–	μA	FB6=1.7V NON6=0.5V
DTC resistance VREGA side	RDTCU6	20	30	40	kΩ	
DTC resistance GND side	RDTCD6	65	95	125	kΩ	
NON6 input range	VRES6	–0.3	–	1.5	V	

Parameter	Symbol	Spec. Min.	Typ.	Max.	Units	Conditions
[Error Amp 7]						
Low -level Output Voltage	VOL	–	1.3	–	V	INV=2V, NON7=1V
High -level Output Voltage	VOH	VREGA –0.3	–	–	V	INV=0.5V, NON7=1V
Maximum Sink Current	IOI	36	72	–	μA	FB7=1.7V, INV7=0.5V
Maximum Source Current	IOO	36	72	–	μA	FB7=1.7V, INV7=1.5V
NON7 input range	VRES7	0	–	1.5	V	
DTC resistance VREGA side	RDTCU 7	20	30	40	kΩ	
DTC resistance GND side	RDTCD 7	65	95	125	kΩ	
[PWM Comparator]						
Input Threshold Voltage	Vt0	–	1.49	–	V	V1:DUTY0%
	Vt100	–	1.95	–	V	V1:DUTY100%
MAX DUTY1,2,3 (step-down)	Dmax1	–	100	–	%	UDSEL=VCC
MAX DUTY1,2,3 (step-up)	Dmax3	77	85	93	%	UDSEL=0V
MAX DUTY4	Dmax2	–	100	–	%	
MAX DUTY5,6,7	Dmax4	77	85	93	%	
[Output circuit]						
High-level Output Voltage on Driving	VSATH	VCC –1.6	VCC –0.8	–	V	Io=30mA, CH1~3, 5~7
Low-level Output Voltage on Driving	VSATL	–	0.8	1.6	V	Io=-30mA
Hi-side Nch FET ON Resistor	RonH4	–	300	500	mΩ	PVCCH=5V
Lo- side Nch FET ON Resistor	RonL4	–	300	500	mΩ	PVCCH=5V
[Step-up/down Selector]						
UDSEL123 Control Voltage — Step down	VUDDO	VCC ×0.7	-	VCC	V	
UDSEL123 Control Voltage — Step up	VUDUP	0	-	VCC ×0.3	V	
[Soft-Start]						
Soft-start time CH4	Tss1	1.8	3.6	6.0	msec	VCC=PVCC=5V PVCCH=5.0V STB 0→3V
Soft-start time CH2,CH3	Tss2	1.8	3.6	6.0	msec	VCC=PVCC=5V STB=3V INV4=0→1.2V
INV4 voltage to start CH2,3	VPG4	0.72	0.80	0.88	V	VCC=PVCC=5V PVCCH=5.0V
[STB1~7]						
STB Control Voltage1 — ON	VSTBH1	2.0	-	11	V	
STB Control Voltage1 — OFF	VSTBL1	–0.3	-	0.3	V	
STB Pull-down Resistor	RSTB1	250	400	700	KΩ	
[Circuit Current]						
Stand by Current1 (VBAT sink current)	ISTB1	-	-	5	μA	STB1~7=0V
Stand by Current2 (VCC, PVCC sink current)	ISTB2	-	-	5	μA	STB1~7=0V
Start up Current (VBAT sink current)	IST	-	30	100	mA	CT=1.7V VCC=0V
Circuit Current on Driving1 (VBAT sink current)	Icc1	-	100	300	μA	CT=1.7V
Circuit Current on Driving2 (VCC,PVCC sink current)	Icc2	-	5	15	mA	CT=1.7V INV=2.5V

◎This product is not designed for normal operation within a radioactive environment.

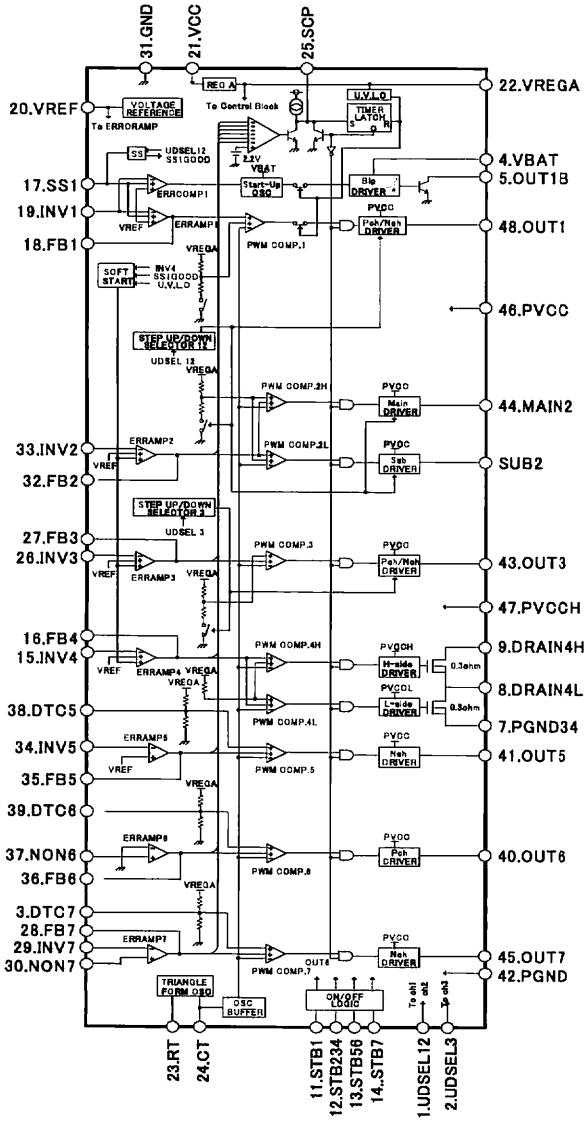
○PACKAGE



Plastic mold

(UNIT : mm)

○Block diagram



Pin No.	Pin Name
4	VBAT
21	VCC
46	PVCC
10	PVCCH
42	PGND
6,7	PGND4
31	GND
22	VREGA
40,41,45,47,48	OUT1,3,5,6,7
44	MAIN2
43	SUB2
5	OUT1B
9	DRAIN4H
8	DRAIN4L
20	VREF
3,38,39	DTC 5~7
16,18,27,28,32,35,36	FB 1~7
15,19,26,29,33,34	INV 1~5,7
30,37	NON6,NON7
17	SS1
23	RT
24	CT
25	SCP
1	UDSEL12
2	UDSEL3
11,12,13,14	STB1,234,56,7

○NOTE FOR USE

(1) Absolute maximum rating
The device may be destroyed when applied voltage or operating temperature exceeds its absolute maximum rating. Because the source, such as short mode or open mode, cannot be identified if the device is destroyed, it is important to take physical safety measures (such as fusing) if a special mode in excess of absolute rating limits is to be implemented.

(2) Supply line
Since the motor's reverse electromotive force gives rise to the return of regenerative current, measures should be taken to establish a channel for the current, such as adding a capacitor between the power supply and GND. In determining the approach to take, make sure that no problems will be posed by the various characteristics involved, such as capacitance loss at low temperatures with an electrolytic capacitor.

(3) GND potential
Make sure the potential for the GND pin is always kept lower than the potentials of all other pins, regardless of the operating mode.

(4) Thermal design
Be sure to factor in allowable power dissipation (Pd) in actual operation, and to build sufficient margin into the thermal design to accommodate this power loss.

(5) Operation in strong magnetic fields
Use in strong electromagnetic fields may cause malfunctions. Exercise caution with respect to electromagnetic fields.

(6) ASO
Set the parameters so that output Tr will not exceed the absolute maximum rating or ASO value when the IC is used.

(7) Thermal shutdown circuit
This IC is provided with a built-in thermal shutdown (TSD) circuit, which is activated when the chip temperature reaches the threshold value listed below. When TSD is on, the device goes to high impedance mode. Note that the TSD circuit is provided for the exclusive purpose shutting down the IC in the presence of extreme heat, and is not designed to protect the IC per se or guarantee performance when or after extreme heat conditions occur. Therefore, do not operate the IC with the expectation of continued use or subsequent operation once the TSD is activated.

(8) Mutual impedance
Use short and wide wiring tracks for the main supply and ground to keep the mutual impedance as small as possible. Use inductor and capacitor network to keep the ripple voltage minimum.

(9) Voltage of STB pin
The threshold voltages of STB pin are 0.3V and 2.0V. STB state is set below 0.3V while action state is set beyond 2.0V.
The region between 0.3V and 2.0V is not recommended and may cause improper operation.

(10) Setting Max Duty
Max duty limit might not work normally at high frequency. Consider adequate margin when operating circuit above the maximum allowable switching frequency.

(11) Please use the same power supply of driver block as that of main block.
This IC can't be used on the application that arbitrary voltage is applied to driver block.

Notes

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