

STRUCTURE
PRODUCT SERIES

Silicon Monolithic Integrated Circuit
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°C)

Parameter	Symbol	Limits	units
Power Supply Voltage	VBAT	-0.3~12	V
	VCC,PVCC	-0.3~15	V
	PVCOH	-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	°C
Storage Temperature	Tstg	-55~+125	°C

(*1) Without external heat sink, the power dissipation reduces by 5.0mW/°C over 25°C.

(*2) Reduced by 7.6mW/°C over 25°C, when mounted on a PCB(70.0mm x 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
	PVCOH	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

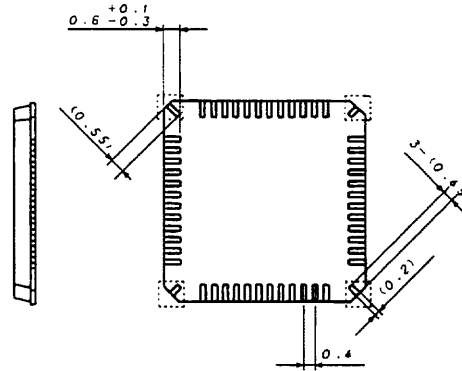
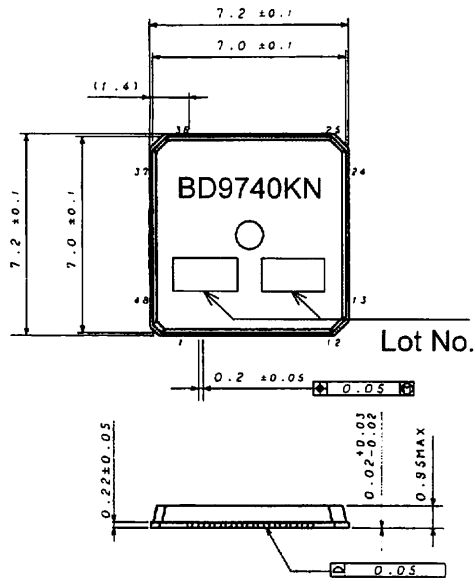
- ◎ It is strongly recommended that a capacitor be connected to VREF and VREGA pin to prevent oscillation.
- ◎ The IC may not operate properly due to undetermined state of the internal logic when Vcc voltage is applied suddenly while STB pins are already ON.
In this case make sure STB pins are initially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

○Absolute maximum ratings(Ta=25°C)

Parameter	Symbol	Spec.			Units	Conditions
		Min.	Typ.	Max.		
[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=10 μA ~100 μA
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	Vst1	3.45	3.6	3.75	V	PVCC monitor
Hysteresis width 1	ΔVst1	—	300	—	mV	
Threshold Voltage 2	Vst2	2.3	2.4	2.5	V	VCC monitor
Hysteresis width 2	ΔVst2	—	200	—	mV	
Threshold Voltage 3	Vst3	—	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	Vic	2.1	2.2	2.3	V	FB monitor
SCP Output Current	Iscp	2	4	6	μA	VSCP=0.1V
SCP Threshold Voltage	Vsc	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 Amp 6]						
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	

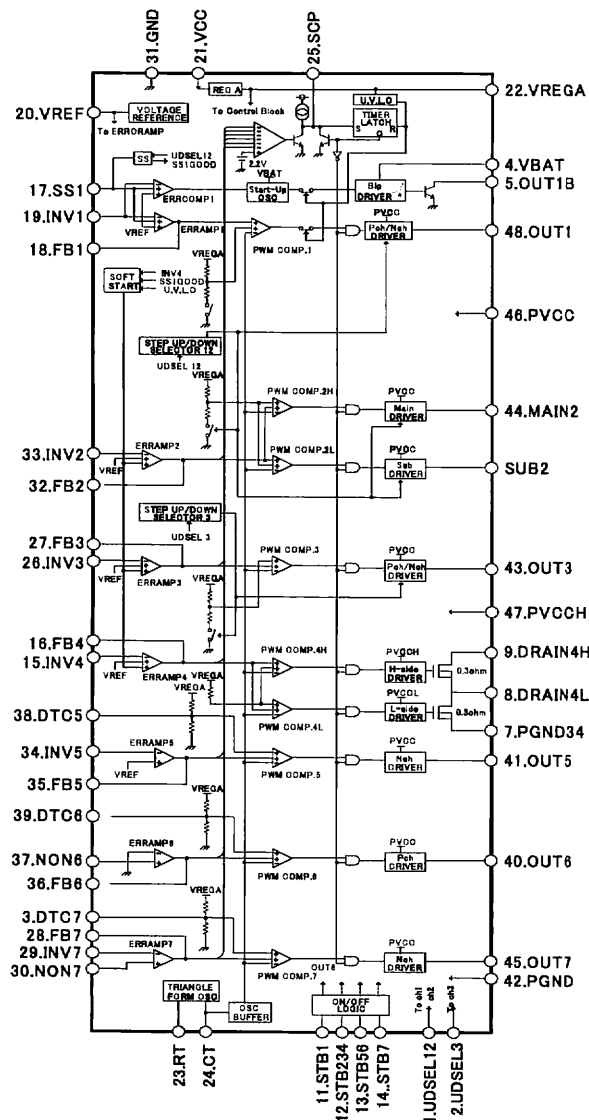
Parameter	Symbol	Spec			Units	Conditions
		Min.	Typ.	Max.		
[Error Amp 7]						
Low-level Output Voltage	VOL	—	1.3	—	V	INV=2V, NON7=1V
High-level Output Voltage	VOH	VREGA —0.3	—	—	V	INV=0.5V, NON7=1V
Maximum Sink Current	IOI	36	72	—	μA	FB7=1.7V, INV7=0.5V
Maximum Source Current	IOO	36	72	—	μA	FB7=1.7V, 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	VIO	—	1.49	—	V	V1:DUTY0%
	V100	—	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	I _o =30mA, CH1~3, 5~7
Low-level Output Voltage on Driving	VSATL	—	0.8	1.6	V	I _o =30mA
H-side Nch FET ON Resistor	RonH4	—	300	500	mΩ	PVCC=5V
L-side Nch FET ON Resistor	RonL4	—	300	500	mΩ	PVCC=5V
[Step-up/down Selector]						
UDSEL123 Control Voltage	Step down	VUDDO	VCC x0.7	—	VCC	V
	Step up	VUDUP	0	—	VCC x0.3	V
[Soft-Start]						
Soft-start time CH4	Tss1	1.8	3.6	6.0	msec	VCC=PVCC=5V PVCC=5.0V STB0~3V
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	VP4	0.72	0.80	0.88	V	VCC=PVCC=5V PVCC=5.0V
[STB1~7]						
STB Control Voltage1	ON	VSTBH1	2.0	—	11	V
	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)	Ioc1	—	100	300	μA	CT=1.7V
Circuit Current on Driving2 (VCC,PVCC sink current)	Ioc2	—	5	15	mA	CT=1.7V INV=2.5V

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



Plastic mold
(UNIT : mm)

Block diagram



Pin No.	Pin Name
4	VBAT
21	VCC
46	PVCC
10	PVCC
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	STB1,2,3,4,5,6,7

○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

- No technical content pages of this document may be reproduced in any form or transmitted by any means without prior permission of ROHM CO.,LTD.
- The contents described herein are subject to change without notice. The specifications for the product described in this document are for reference only. Upon actual use, therefore, please request that specifications to be separately delivered.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by
- ROHM CO., LTD. is granted to any such buyer.
- Products listed in this document are no antiradiation design.

The products listed in this document are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys).

Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

About Export Control Order in Japan

Products described herein are the objects of controlled goods in Annex 1 (Item 16) of Export Trade Control Order in Japan.

In case of export from Japan, please confirm if it applies to "objective" criteria or an "informed" (by MITI clause) on the basis of "catch all controls for Non-Proliferation of Weapons of Mass Destruction.

Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available,
please contact your nearest sales office.

Please contact our sales offices for details ;

U.S.A / San Diego	TEL : +1(858)625-3630	FAX : +1(858)625-3670
Atlanta	TEL : +1(770)754-5972	FAX : +1(770)754-0691
Dallas	TEL : +1(972)312-8818	FAX : +1(972)312-0330
Germany / Dusseldorf	TEL : +49(2154)9210	FAX : +49(2154)921400
United Kingdom / London	TEL : +44(1)908-282-666	FAX : +44(1)908-282-528
France / Paris	TEL : +33(0)1 56 97 30 60	FAX : +33(0) 1 56 97 30 80
China / Hong Kong	TEL : +852(2)740-6262	FAX : +852(2)375-8971
Shanghai	TEL : +86(21)6279-2727	FAX : +86(21)6247-2066
Dalian	TEL : +86(411)8230-8549	FAX : +86(411)8230-8537
Beijing	TEL : +86(10)8525-2483	FAX : +86(10)8525-2489
Taiwan / Taipei	TEL : +866(2)2500-6956	FAX : +866(2)2503-2869
Korea / Seoul	TEL : +82(2)8182-700	FAX : +82(2)8182-715
Singapore	TEL : +65-6332-2322	FAX : +65-6332-5662
Malaysia / Kuala Lumpur	TEL : +60(3)7958-8355	FAX : +60(3)7958-8377
Philippines / Manila	TEL : +63(2)807-6872	FAX : +63(2)809-1422
Thailand / Bangkok	TEL : +66(2)254-4890	FAX : +66(2)256-6334

Japan /
(Internal Sales)

Tokyo	2-1-1, Yaesu, Chuo-ku, Tokyo 104-0082	
	TEL : +81(3)5203-0321	FAX : +81(3)5203-0300
Yokohama	2-4-8, Shin Yokohama, Kohoku-ku, Yokohama, Kanagawa 222-8575	
	TEL : +81(45)476-2131	FAX : +81(45)476-2128
Nagoya	Dainagayo Building 9F 3-28-12, Meieki, Nakamura-ku, Nagoya, Aichi 450-0002	
	TEL : +81(52)581-8521	FAX : +81(52)561-2173
Kyoto	579-32 Higashi Shiokouji-cho, Karasuma Nishi-iru, Shiokoujidori, Shimogyo-ku, Kyoto 600-8216	
	TEL : +81(75)311-2121	FAX : +81(75)314-6559
(Contact address for overseas customers in Japan)		
Yokohama	TEL : +81(45)476-9270	FAX : +81(045)476-9271