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

TYPE **BD9739KN**

FEATURES
- Wide input voltage range (1.5 to 10V)
- Controls up to 7 switching regulators:Step-up converter(2 channels),Step-down converter(2channels), Configurable for step-up or step-down conversion(1 channel) Configurable for step-up or step-down/inverting conversion(1 channel),step-up converter For LED(1 channel)
- Transformer-less application available.
- Synchronous rectifying action mode(3 channels)Built-in FET Transistor(2 channels)

○Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	Units
Power Supply Voltage	VBAT, VCC, PVCC	−0.3~12	V
	PVCCH, PVCCL	−0.3~15	V
Power Input Voltage	DRAIN2,3	−0.3~12	V
	OUT1B	−0.3~20	V
	OUT7B	−0.3~17	V
	SWOUT1	−0.3~12	V
	SWIN4,6,7	−0.3~20	V
Power Dissipation	Pd	550(*1)	mW
		1000(*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/℃ over 25℃, when mounted on a PCB (70.0mm×70.0mm×1.6mm).

○operating conditions (Ta = −25℃~+85℃)

parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	Units
Power Supply Voltage	VBAT	1.5	−	10	V
	VCC,PVCC	2.5	−	10	V
	PVCC2	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
SS23 Pin Connect Capacitor	CSS23	0.005	−	1.0	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

	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	units
【Driver】					
DRAIN Pin Input Voltage	VDRAIN	−	−	10	V
Nch FET Output Current(CH2,CH3)	IoFET4	−	−	700	mA
Driver Output Current(CH1,4,5,6)	Iout	−	−	30	mA
Driver Peak Current(CH1,4,5,6)	Ipeak	−	−	200	mA
Built-in NPN TR Sink Current (CH1)	INPN sink	−	−	500	mA
【SW Circuit】					
SWOUT1 Sink Current	ISWOUT1	−	−	10	mA
SWOUT4 Source Current	ISWOUT4	−	−	50	mA
SWOUT6 Source Current	ISWOUT6	−	−	50	mA
SWOUT7 Source Current	ISWOUT7	−	−	30	mA

◎ It is strongly recommended that a capacitor be connected to VREF,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.

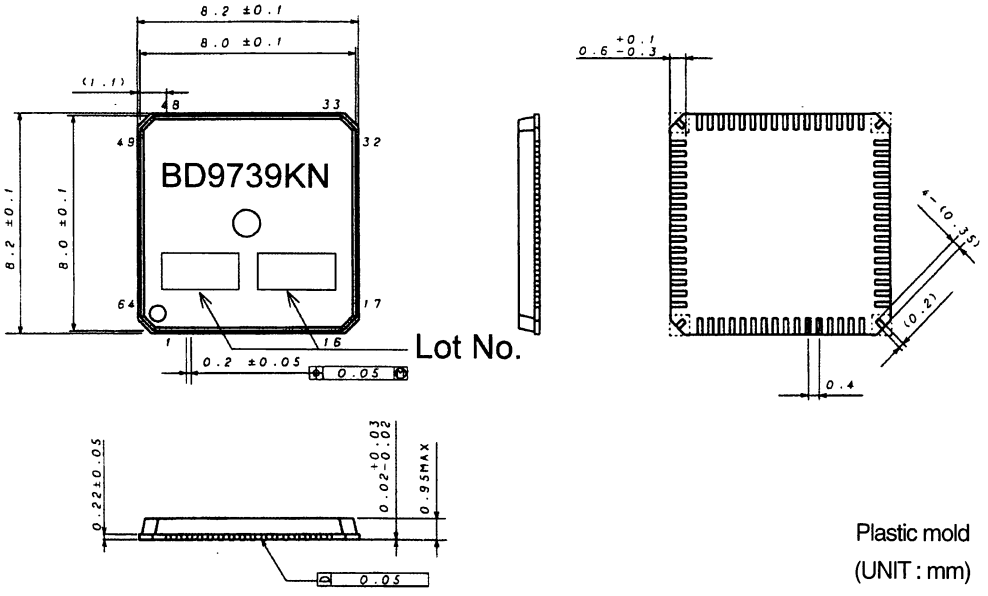
○Electrical characteristics (Ta=25℃, VBAT=3V, VCC=5V, RT=11kohm, CT=180pF, STB1～7=3V ,unless otherwise specified)

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～10.0V
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=1mA
【Low Voltage Input Prevented Operation Faults Circuit】						
Threshold Voltage 1	Vstd1	3.45	3.6	3.75	V	PVCCL monitor
Hysteresis width1	ΔVst1	–	300	–	mV	
Threshold Voltage 2	Vstd2	2.3	2.4	2.5	V	VCC monitor
Hysteresis width2	ΔVst2	–	200	–	mV	
Threshold Voltage 3	Vstd3	–	2.0	–	V	VREGA monitor
Hysteresis width3	ΔVst3	–	50	–	mV	
【Start up Circuit】						
Oscillator Frequency	Fstart	50	120	220	kHz	
Minimum VBAT Voltage	Vst1	1.5	-	-	V	VBAT monitor
Soft Start Charge Current	Iss1	1.1	2.2	3.3	μA	Vss1=0V
【Soft start 23】						
Soft start Charge Current	Iss23	5	10	15	μA	Vss23=0V
【Protection Circuit】						
Timer Start Threshold Voltage	Vtc	2.1	2.2	2.3	V	FB monitor
SCP Output Current	Iscp	0.5	1.0	1.5	μA	VSCP=0.1V
SCP Threshold Voltage	Vtsc	0.45	0.50	0.55	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 ～9.5V
RT Output Voltage	VRT	0.78	1.00	1.22	V	
【Error Amp 1～4,6】						
Low-level Output Voltage	VOL	–	1.3	–	V	INV=2V
High-level Output Voltage	VOH	VREGA-0.3	–	–	V	INV=0V
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 7】						
Low-level Output Voltage	VOL	–	1.3	–	V	INV=2V
High-level Output Voltage	VOH	VREGA –0.3	–	–	V	INV=0V
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
Non-inverting voltage reference	VNON7	–	0.2	–		
【【Error Amp 5】						
NON5 input voltage range	VRES	–0.3	–	1.5	V	
Low-level Output Voltage	VOL	–	1.3	–	V	INV5=2V
High-level Output Voltage	VOH	VREGA – 0.3	–	–	V	INV5=0V
Maximum Sink Current	IOI	36	72	–	μA	FB7=1.7V, VINV5=1.1V NON5=1.0V
Maximum Source Current	IOO	36	72	–	μA	FB7=1.7V, VINV5=0.9V NON5=1.0V
【PWM Comparator】						
Input Threshold Voltage 1,2,3	Vt0	–	1.49	–	V	V1:DUTY0%
	Vt100	–	1.95	–	V	V1:DUTY100%
Input Threshold Voltage 4,5,6,7	Vt0	–	1.49	–	V	V1:DUTY0%
	Vt100	–	1.95	–	V	V1:DUTY100%
MAX DUTY4,5,6,7	Dmax1	77	85	93	%	VINV=0.9V, VSCP=0V
MAX DUTY1(step-up)	Dmax2	77	85	93	%	VINV=0.9V VSCP, UDSEL=0V

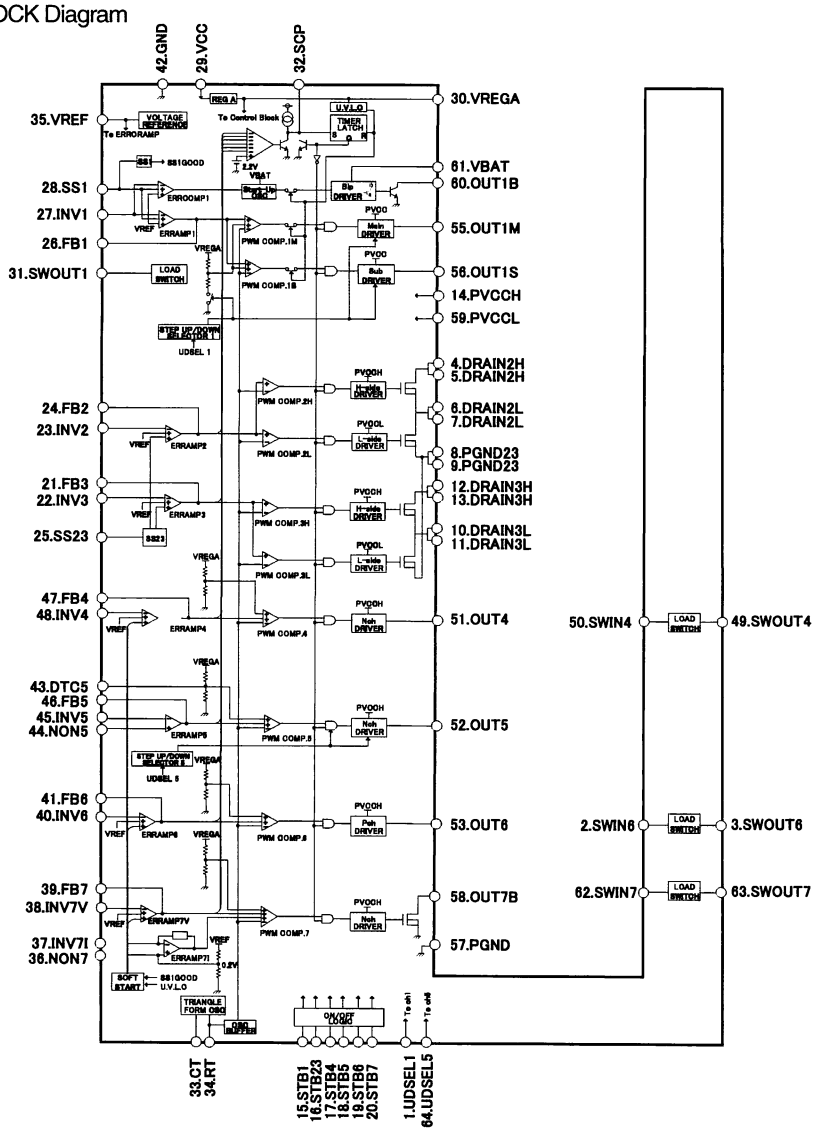
◎ This product is not designed for normal operation wthin a radioactive environment.

parameter		Symbol	Spec. Min.	Typ.	Max.	Units	Conditions
【Output circuit】							
High-level Output Voltage on Driving		VSATH	VCC –1.6	VCC –0.8	–	V	Io=30mA
Low-level Output Voltage on Driving		VSATL	–	0.8	1.6	V	Io=-30mA
Hi-side Nch FET ON Resistor		RonH	–	270	500	mΩ	PVCCH=5V (Io=200mA)
Low-side Nch FET ON Resistor		RonL	–	270	500	mΩ	PVCCL=5V (Io=200mA)
CH7 Nch FET ON Resistor		RonL7	–	0.7	1.4	Ω	PVCCL=5V (Io=50mA)
【Step-up/down Selector】							
UDSEL1,5 Control Voltage	Step down	VUDDO	VCC ×0.7	–	VCC	V	
	Step up	VUDUP	0	–	VCC ×0.3	V	
【Power on Switch】							
SWOUT1	Output Voltage on Driving	VSAT	-	0.1	0.3	V	Io=1mA
	OFF Time Leak Current	ILEAK	-	0	5	μA	STB1=0V
SWOUT 4	Output Voltage on Driving	VSAT	VSW IN4 –0.3	VSW IN4 –0.1	-	V	Io=20mA VSWIN4=5V
	OFF Time Leak Current	ILEAK	-	0	5	μA	STB4=0V
SWOUT6	Output Voltage on Driving	VSAT	VSW IN6 –0.3	VSW IN6 –0.1	-	V	Io=20mA VSWIN6=5V
	OFF Time Leak Current	ILEAK	-	0	5	μA	STB6=0V
SWOUT7	Output Voltage on Driving	VSAT	VSW IN7 –0.3	VSW IN7 –0.1	-	V	Io=10mA VSWIN7=10V
	OFF Time Leak Current	ILEAK	-	0	5	μA	STB7=0V
【STB1～7】							
STB Control Voltage 1	ON	VSTB H1	2.0	-	11	V	STB1
	OFF	VSTB L1	–0.3	-	0.3	V	
STB Pull-down Resistor1		RSTB1	250	400	700	kΩ	STB1
STB Control Voltage 2	ON	VSTB H2	2.0	-	11	V	STB23,4,5,6,7
	OFF	VSTB L2	–0.3	-	0.3	V	
STB Pull-down Resistor2		RSTB2	250	400	700	kΩ	STB23,4,5,6,7
【Circuit Current】							
Stand by Current 1 (VBAT sink current)		ISTB1	-	-	5	μA	STB1～7=0V
Stand by Current 2 (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 Driving 1 (VBAT sink current)		Icc1	-	100	300	μA	CT=1.7V
Circuit Current on Driving 2 (VCC,PVCC sink current)		Icc2	-	5	15	mA	CT=1.7V INV=2.5V

○PACKAGE



○BLOCK Diagram



Pin No.	Pin Name
61	VBAT
29	VCC
54	PVCC
14	PVCCH
59	PVCCL
8,9,57	PGND23,PGND
42	GND
30	VREGA
51,52,53	OUT4,5,6
58	OUT7B
60	OUT1B
4,5,12,13	DRAIN2,3H
6,7,10,11	DRAIN2,3L
55	OUT1M
56	OUT1S
35	VREF
43	DTC 5
26,24,21,47,46,41,39	FB 1~7
27,23,22,48,45,40	INV 1~6
37,38	INV7I,INV7V
44,36	NON5,7
28	SS1
25	SS23
34	RT
33	CT
32	SCP
1,64	UDSEL1,5
15,16,17,18,19,20	STB 1,23 4,5,6,7
50,2,62	SWIN4,6,7
31,49,3,63	SWOUT1,4,6,7

○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.

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