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ROHM
SEMICONDUCTOR

STRUCTURE   Silicon Monolithic Integrated Circuit

TYPE   8 Channel Switching Regulator Controller and 1 Series Regulator for DVC

PRODUCT SERIES   **BD9833KV**

FEATURES   ・ 8 DC/DC controller,1 Series Regulator

                   ・ DC/DC controller: FET direct driver (Pch driver:7ch, Nch driver:1ch)

                   ・ Series Regulator: Variable output voltage

                     stable with Ceramic Output Capacitor
                   ・ Package: VQFP48C(0.5mm pitch)

○Absolute maximum ratings（Ta=25℃）

Parameter	Symbol	Limits	Units
Power Supply Voltage1	VCC,VIN2345,VIN6789	12	V
Power Supply Voltage2	VIN1	12	V
Power Dissipation	Pd	600(*1)	mW
		950(*2)	mW
Operating Temperature	Topr	-25～+85	℃
Storage Temperature	Tstg	-55～+125	℃

(*1) Without external heat sink, the power dissipation degrades by 6.0mW/℃ above 25℃.

(*2) Power dissipation degrades by 9.5mW/℃ above 25℃, when mounted on a PCB (70.0mm × 70.0mm × 1.6mm).

○Recommended operating conditions（Ta=-25～+75℃）

| Parameter	Symbol	Spec.	Units
Power Supply Voltage	VCC,VIN2345,VIN6789	4.0～10	V
	VIN1	2.8～10	
Oscillator Frequency	fosc	100kHz～1.2MHz	

Status of this document

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○Electrical characteristics（Ta=25℃, VCC=7V, VIN1=7V STB=3V,　unless otherwise specified）

Parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max	Units	Conditions.
■DC/DC controller						
【Reference Voltage】						
Reference Voltage	Vref	2.475	2.500	2.525	V	
Line Regulation	DVLi	-	-	10	mV	Vcc=4.0V～10V
Load Regulation	DVLo	-	-	10	mV	Iref=-0.1mA～ -1.0mA
Short-Circuit Output Current	Ios	-40	-12	-5	mA	Vref=0V
【Load Regulation】						
Short-Circuit Output Current1(VCC)	Vstd1	3.55	3.65	3.75	V	VCC monitor Sweep down
Hysteresis width (VCC)	ΔVst1	0.6	0.11	0.16	V	
Threshold Voltage 2(VREF)	Vstd2	2.2	2.3	2.4	V	VREF monitor
【Soft start】						
Soft standby voltage	Vsso1	-	10	100	mV	
Input Source Current	ISOFT1	-2.0	-1.0	-0.5	μA	
【Protection Circuit】						
INV Threshold Voltage	Vscpth	0.65	0.75	0.85	V	CH2,3,4,5,6,7, INV Voltage"L" detect
SCP Output Current	Iscp	-3.0	-2.0	-1.5	μA	VSCP=0.75V
SCP Threshold Voltage	Vtsc	1.4	1.5	1.6	V	
SCP Standby Voltage	Vssc	-	10	100	mV	
【Triangular wave oscillator】						
Oscillator Frequency	fosc	580	680	780	kHz	RT=11kohm,CT=180pF
Frequency Stability (Vcc)	Df	-	0.3	2	%	VCC=4.0～10V
RT Output Voltage	VRT	0.95	1.00	1.05	V	
■DC/DC controller						
【Reference Voltage】	Vthea	0.980	1.00	1.020	V	CH2,3,4,5,6,7
Reference Voltage	VOFST	-	-	10	mV	CH8,9
Line Regulation	Ibias1	-150	0	150	nA	CH2,3,4,5,6,7 INV pin
Load Regulation	Ibias2	-170	-40	-	nA	CH8,9 INV pin
Short-Circuit Output Current	Ibias3	-170	-40	-	nA	CH8,9 NON pin
【Load Regulation】	AV	50	65	80	dB	DC Design Guarantee
Short-Circuit Output Current1(VCC)	BW	0.5	1	2	MHz	AV=0dB Design Guarantee
Hysteresis width (VCC)	Vfbh	Vref -0.1	-	-	V	
Threshold Voltage 2(VREF)	Vfbl	-	-	0.1	V	
【Soft start】	Isink1	1.3	2.6	3.9	mA	
Soft standby voltage	Isink2	3.4	6.7	10	mA	
Input Source Current	Isource1	-240	-150	-90	μA	
【Protection Circuit】	Isource2	-280	-190	-130	μA	
INV Threshold Voltage	VCM	0	-	VCC-2	V	
【PWM Comparator】						
Input Threshold Voltage 2,3,4,5,6,7,8,9	Vt0	1.730	1.820	1.910	V	DUTY0%
	Vt100	2.090	2.180	2.270	V	DUTY100%
【FET Driver】						
ON Resistance	RonHI1	7	14	21	Ω	VG2, 3, 4, 5, 6, 7, 8, 9　VG="H"
	RonLO1	6	12	18	Ω	VG2, 3, 4, 5, 6, 7, 8, 9　VG="L"
Current Ability	Isink1	70	170	250	mA	VG2, 3, 4, 5, 6, 7, 8, 9　VG="L"
	Isource1	-240	-160	-80	mA	VG2, 3, 4, 5, 6, 7, 8, 9　VG="H"
【Control】						
STB Threshold Voltage	Vstb	1.0	1.5	2.0	V	
STB Input Current	Istb	-	-	30	μA	STB=3V
STB5,6 Threshold Voltage	Vstb5,6	1.0	1.5	2.0	V	
STB5,6 Input Current	Istb5,6	-	-	30	μA	STB5, 6=3V
【Circuit Current】						
Standby Current	Iccs	-	0	5	μA	STB=0V
Circuit Current on Driving	Icc	1	5	10	mA	
【Series Regulator】						
Output Voltage	Vo1	2.94	3.00	3.06	V	R1=200KΩ, R2=100KΩ Refer to below figure
Reference Voltage	VFB1	0.98	1.00	1.02	V	
Output Current Ability	Io1	300	-	-	mA	
The Difference between Input voltage and output voltage	DV1	70	120	250	mV	VIN1=VOUT1x0.97, IOUT1=20mA
Line Regulation11	DVLi11	-	4	10	mV	VIN1=4V to10V IOUT1=100mA
Line Regulation12	DVLi12	-	4	10	mV	VIN1=3.5V to10V IOUT1=10mA
Load Regulation1	DVLo1	-	10	30	mV	IOUT1=1mA to 100mA
Load Regulation2	DVLo2	-	30	90	mV	IOUT1=1mA to 300mA
Short-Circuit Output Current	Ios1	-140	-70	-35	mA	VOUT1=0V
Circuit Current	IVIN1	40	80	160	μA	IOUT1=0mA
VOUT1 pin Connect Capacitor	COUT	2.2	-	-	μF	

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○Package Dimensions

BD9833KV

LOT No.
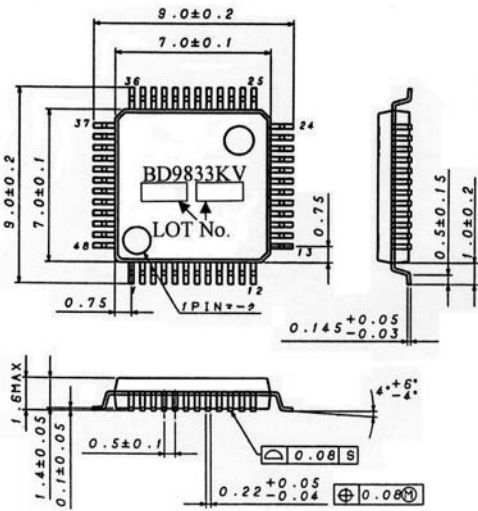
VQFP48C　（Unit:mm）

○Block Diagram
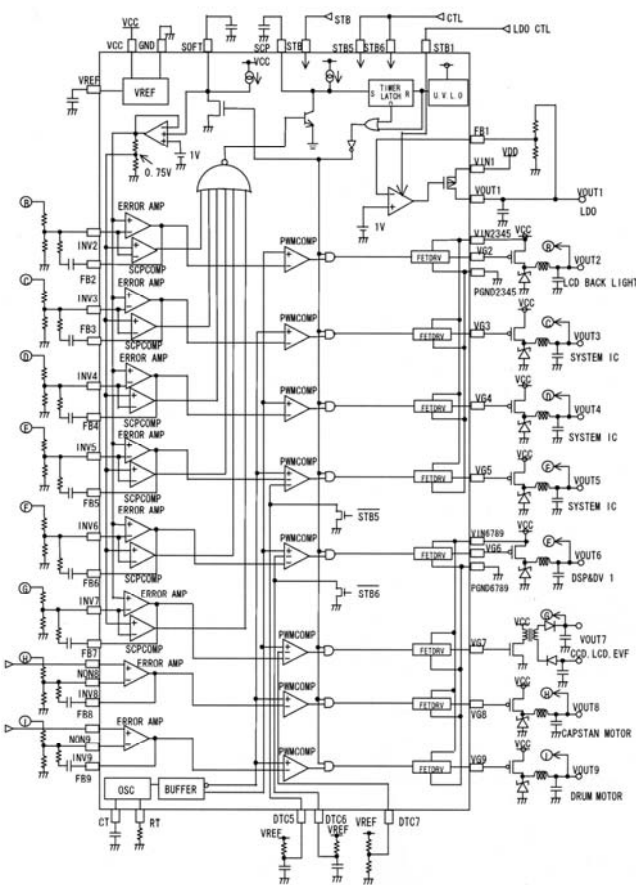
○Pin Description

番号	端子名	機能
1	INV5	Error Amp inverted input（CH5）
2	FB5	Error Amp output (CH5)
3	INV6	Error Amp inverted input（CH6）
4	FB6	Error Amp output (CH6)
5	INV7	Error Amp inverted input（CH7）
6	FB7	Error Amp output (CH7)
7	NON8	Error Amp non-inverted input（CH8）
8	INV8	Error Amp inverted input（CH8）
9	FB8	Error Amp output (CH8)
10	NON9	Error Amp non-inverted input（CH9）
11	INV9	Error Amp inverted input（CH9）
12	FB9	Error Amp output (CH9)
13	VG9	FET Driver Output (CH9)
14	VG8	FET Driver Output (CH8)
15	VIN6789	Power supply for the output circuit (CH6,7,8,9)
16	PGND6789	Power Ground for the output circuit (CH6,7,8,9)
17	VG7	FET Driver Output (CH7)
18	VG6	FET Driver Output (CH6)
19	VG5	FET Driver Output (CH5)
20	VG4	FET Driver Output (CH4)
21	VIN2345	Power supply for the output circuit (CH2,3,4,5)
22	PGND2345	Power Ground for the output circuit (CH2,3,4,5)
23	VG3	FET Driver Output (CH3)
24	VG2	FET Driver Output (CH2)
25	FB2	Error Amp output (CH2)
26	INV2	Error Amp inverted input（CH2）
27	FB3	Error Amp output (CH3)
28	INV3	Error Amp inverted input（CH3）
29	STB	SW for CH2〜9, Hi：Operating
30	GND	Ground
31	FB4	Error Amp output (CH4)
32	INV4	Error Amp inverted input（CH4）
33	STB5	SW for CH5, Hi：Operating
34	STB6	SW for CH6, Hi：Operating
35	STB1	SW for CH1, Hi：Operating
36	VOUT1	Series Regulator Output
37	VIN1	Power supply for Series Regulator
38	FB1	Amp inverted input
39	N. C.	Non-Connected pin
40	SCP	A capacitor is placed to set up the delay time of the SCP
41	SOFT	Soft start/This pin connects to a capacitor to set up the start-up time
42	VREF	Reference Voltage Output pin
43	VCC	Power supply for DC/DC
44	CT	A capacitor is to set up the triangular-wave frequency
45	RT	A resistor is to set up the triangular-wave frequency
46	DTC5	Dead time control pin for CH5
47	DTC6	Dead time control pin for CH6
48	DTC7	Dead time control pin for CH7.And this pin connects to a capacitor to set up the start-up time.

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〇Operation Notes

1) Absolute maximum ratings
Use of the IC in excess of absolute maximum ratings such as the applied voltage or operating temperature range may result in IC deterioration or damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure such as a fuse should be implemented when use of the IC in a special mode where the absolute maximum ratings may be exceeded is anticipated.

2) GND potential
Ensure a minimum GND pin potential in all operating conditions. In addition, ensure that no pins other than the GND pin carry a voltage lower than or equal to the GND pin, including during actual transient phenomena.

3) Thermal design
Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

4) Inter-pin shorts and mounting errors
Use caution when orienting and positioning the IC for mounting on printed circuit boards. Improper mounting may result in damage to the IC. Shorts between output pins or between output pins and the power supply and GND pin caused by the presence of a foreign object may result in damage to the IC.

5) Operation in a strong electromagnetic field
Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

6) Thermal shutdown circuit (TSD circuit)
This IC incorporates a built-in thermal shutdown circuit (TSD circuit). The TSD circuit is designed only to shut the IC off to prevent runaway thermal operation. Do not continue to use the IC after operating this circuit or use the IC in an environment where the operation of the thermal shutdown circuit is assumed.

7) Testing on application boards
When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Ground the IC during assembly steps as an antistatic measure, and use similar caution when transporting or storing the IC. Always turn the IC's power supply off before connecting it to or removing it from a jig or fixture during the inspection process.

8) Common impedance
Power supply and ground wiring should reflect consideration of the need to lower common impedance and minimize ripple as much as possible (by making wiring as short and thick as possible or rejecting ripple by incorporating inductance and capacitance).

9) Applications with modes that reverse VCC and pin potentials may cause damage to internal IC circuits.
For example, such damage might occur when VCC is shorted with the GND pin while an external capacitor is charged. It is recommended to insert a diode for preventing back current flow in series with VCC or bypass diodes between VCC and each pin.
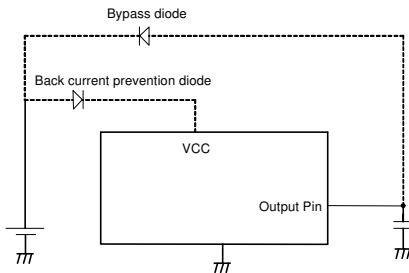
10) Timing resistor
Timing resistor connected between RT and GND, has to be placed near RT terminal (45pin). With the connection must be as short as possible.

11) IC pin input
This monolithic IC contains P+ isolation and PCB layers between adjacent elements in order to keep them isolated.
P/N junctions are formed at the intersection of these P layers with the N layers of other elements to create a variety of parasitic elements.
For example, when a resistor and transistor are connected to pins as shown in follow chart,
　　　〇 the P/N junction functions as a parasitic diode when GND > (Pin A) for the resistor or GND > (Pin B) for the transistor (NPN).
　　　〇 Similarly, when GND > (Pin B) for the transistor (NPN), the parasitic diode described above combines with the N layer of other adjacent elements to operate as a parasitic NPN transistor.
The formation of parasitic elements as a result of the relationships of the potentials of different pins is an inevitable result of the IC's architecture. The operation of parasitic elements can cause interference with circuit operation as well as IC malfunction and damage. For these reasons, it is necessary to use caution so that the IC is not used in a way that will trigger the operation of parasitic elements, such as by the application of voltages lower than the GND (PCB) voltage to input and output pins.
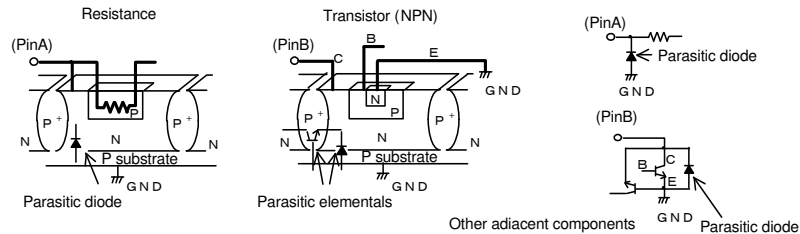
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