STRUCTURE Silicon Monolithic Integrated Circuit
PRODUCTSERIES 2-ch Switching Regulator Controller

TYPE **BD9848FV**

FEATURES
- ・High Input-voltage (Vcc=35V)
- ・MOSFET-driver circuit built-in（dual circuit for step-down output）
- ・Built-in circuits for error amplifier reference voltage (1.0 V±1%)
- ・5 consecutive over current pulse detection circuit built in.
- ・Soft-start timing adjustable
- ・Master/Slave function

○Absolute maximum ratings（Ta=25℃）

Item	Symbol	Limits	Unit
Power Supply Voltage	Vcc	36	V
Power dissipation	Pd	812*1	mW
Output pin voltage	VOUT	Vcc-7V～Vcc	V
C5V pin voltage	VC5V	Vcc-7V～Vcc	V
Operating temperature	Topr	-40～+105	℃
Storage temperature	Tstg	-55～+150	℃
Maximum Junction temperature	Tjmax	150	℃

*1 Should be deleted by 6.5mW/℃ at Ta=25℃ or more. When mounted on a glass epoxy PCB of 70.0mm × 70.0 mm × 1.6 mm

○Recommended operating range (Ta=25℃)

Item	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	Vcc	3.6	6.0	35	V
Output pin voltage	VOUT	C5V	-	Vcc	V
Error amplifier input voltage	INV	0	-	VREF-0.9	V
Timing capacitor	CCT	47	-	3000	pF
Oscillation frequency	fosc	100	-	1500	kHz
STB input voltage	VSTB	0	-	VCC	V
DT input voltage	DT	0	-	VREF+0.3	V
OCP+/- input voltage	VOCP	Vcc-0.2	-	Vcc+0.2	V
CTexternal oscillation waveform	VctH	1.9	-	2.3<VREF	V
input voltage range	VctL	1.4	-	1.6<VREF	V

○Electrical characteristics (Unless otherwise specified, Ta=25℃, VCC=6V)

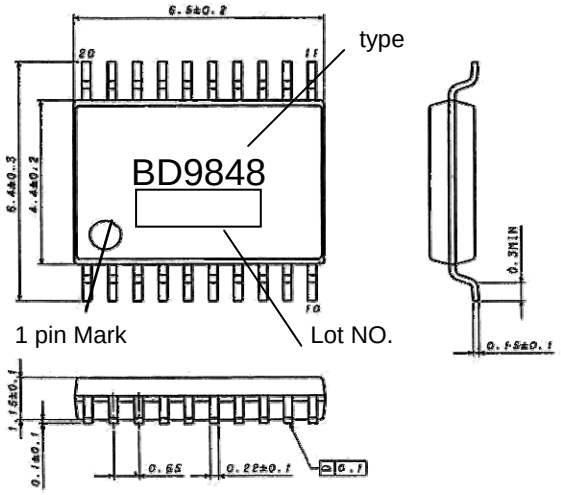
Item	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
【VREF output block】						
VREF output voltage	VREF	2.475	2.500	2.525	V	IO=0.1mA
Line regulation	Line reg.	—	1	10	mV	Vcc=3.6V→35V
Load regulation	Load reg.	—	2	10	mV	IO=0.1mA→2mA
Output max. current	IOMAX	2	13	—	mA	VREF=(typ.)＊0.95

○Electrical characteristics (Unless otherwise specified, Ta=25℃, VCC=6V)

Item	Symbol	limits			Unit	Conditions
		Min.	Typ.	Max.		
【Triangular wave oscillator block】						
Oscillation frequency	fOSC	95	106	117	kHz	CCP=1800pF
Frequency variation	fDV	—	0	1	%	Vcc=3.6V→35V
【Soft-start block】						
SS pin source current	ISSSO	1.4	2	2.6	μA	SS=0.5V
SS pin sink current	ISSSI	5	12	—	mA	SS=0.5V
【Dead time adjustable circuit block】						
DT pin input bias current	IDT	—	0.1	1	μA	DT=1.75V
DT pin sink current	IDTSI	1	3.3	—	mA	DT=1.75V, (OCP+)-(OCP-)=0.5V
【UVLO block】						
Threshold voltage	VUTH	3.0	3.2	3.4	V	Vcc when rise time
Hysterisis	VUHYS	—	0.15	0.25	V	
【Error Amp block】						
Non-Inverting input reference	VINV	0.99	1	1.01	V	INV=FB
Reference voltage variation	dVinv	—	1	6	mV	Vcc=3.6V→35V
INV input bias current	IIB	—	0	1	μA	INV=1V
Open loop gain	AV	70	85	—	dB	
Output FB voltage (Hi)	VFBH	2.30	—	VREF	V	
Output FB voltage (Low)	VFBL	—	0.6	1.3	V	
Output sink current	IFBSI	0.5	1.5	—	mA	FB=1.25V , INV=1.5V
Output source current	IFBSO	50	105	—	μA	FB=1.25V , INV=0V
【PWM comparator】						
Input threshold voltage	Vt0	1.4	1.5	1.6	V	On duty 0%
（fosc=100kHz）	Vt100	1.9	2	2.1	V	On duty 100%
【Output block】						
Output ON resistance H	RONH	—	4	10	Ω	RONH=(VCC -OUT)/ Iout, Iout=0.1A
Output ON resistance L	RONL	—	3.3	10	Ω	RONL=(OUT-C5V)/ Iout, Iout=0.1A
C5V clamp voltage	VCLMP	4.5	5	5.5	V	VCLMP= VCC-C5V , VCC ＞7V
【Over current protection circuit (OCP) block】						
OCP threshold voltage	VOCPTH	0.04	0.05	0.06	V	Voltage between (OCP+)-(OCP-)
OCP-input bias current	IOCP-	—	0.1	10	μA	OCP+= VCC, OCP-= VCC-0.05V
Delay time for OCP	tdocpth	—	200	400	nS	OCP-= VCC→VCC-0.2V
Min. hold time for OCP	tdocpre	0.8	1.6	—	mS	OCP-= VCC-0.2V→VCC
【Stand-by switch block】						
Threshold voltage for each CH stop	VDTthL	1.1	1.25	1.4	V	DT Pin H/L
Stand-by mode setting voltage range	VSTBL	0	—	0.5	V	
Slave mode setting voltage range	VSTBM	2.4	2.5	2.6	V	
Active(Master) mode setting voltage range	VSTBH	3	—	VCC	V	
STB current	ISTB	—	70	100	μA	STB=6V
【Total device】						
Stand-by current	ICCS	—	0	1	μA	STB=0V
Average current consumption	ICCA	1.5	3	6	mA	INV=0V, FB=H, DT=1.75V

※Not designed for radiation resistance.

○Outline figure



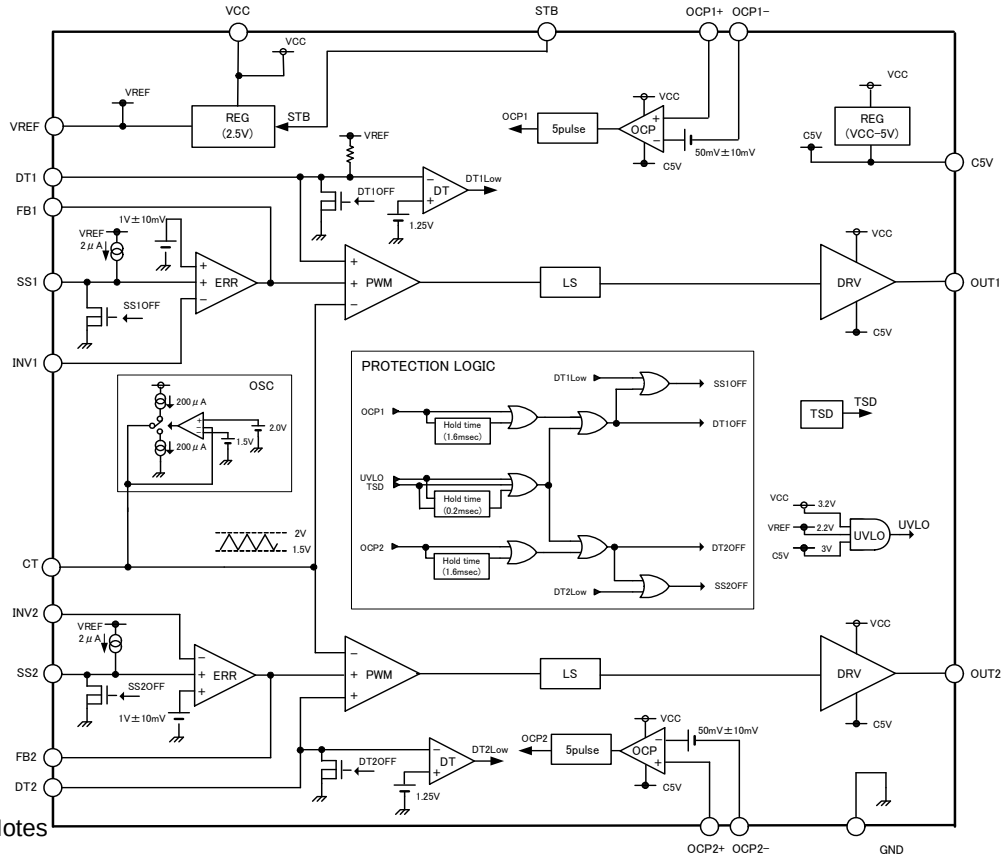
SSOP-B20 (Unit : mm)

○PIN No./ name / function

Pin No.	Pin name	Pin function
1	CT	External Capacitor pin for timing change
2	DT2	Dead time setting (CH2)
3	SS2	Soft-start time setting (CH2)
4	INV2	Error Amp inverting input (CH2)
5	FB2	Error Amp output (CH2)
6	GND	GROUND
7	OCP2−	Over current error amp inverting input (CH2) ※
8	OCP2＋	Over current error amp input (CH2) ※
9	C5V	Output L voltage（Vcc-5V）
10	OUT2	CH2 Output
11	OUT1	CH1 Output
12	Vcc	Power supply input
13	OCP1＋	Over current error amp input (CH1) ※
14	OCP1−	Over current error amp inverting input (CH1) ※
15	STB	Stand-by mode control
16	FB1	Error Amp output (CH1)
17	INV1	Error Amp inverting input (CH1)
18	SS1	Soft-start time setting (CH1)
19	DT1	Dead time setting (CH1)
20	VREF	Reference voltage（2.5V）output

※ Refer p.4 Operation note(9)

○Block Diagram



○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).

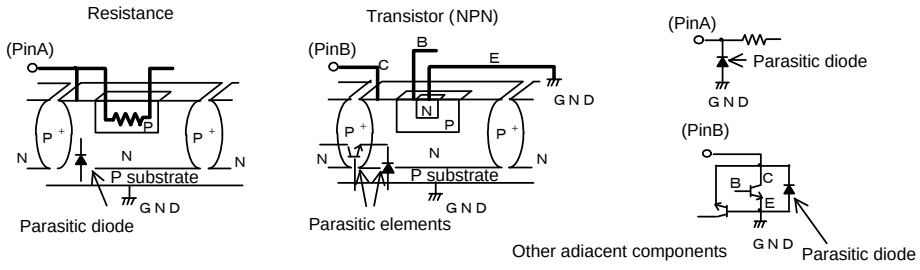
9) Over Current Protection
The OCP circuit is designed to be very sensitive circuit for protection of an application device. Therefore, it may detect ringing noises besides the true current signal. This depends on an application circuit and a layout pattern. In this case, the OCP current value is lower than the designed value. For the measure of this, please use CR filter on OCP input referring the circuit of the technical note.

10) General
Please refer the technical note on designing.

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 Fig. 10,

- ○ The P/N junction functions as a parasitic diode when GND > (Pin A) for the resistor or GND > (Pin B) for the transistor (NPN).
- ○ 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.



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.

Precaution Regarding Intellectual Property Rights

1. All information and data including but not limited to application example contained in this document is for reference only. ROHM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data. ROHM shall not be in any way responsible or liable for infringement of any intellectual property rights or other damages arising from use of such information or data.:

2. No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of ROHM or any third parties with respect to the information contained in this document.

Other Precaution

1. This document may not be reprinted or reproduced, in whole or in part, without prior written consent of ROHM.

2. The Products may not be disassembled, converted, modified, reproduced or otherwise changed without prior written consent of ROHM.

3. In no event shall you use in any way whatsoever the Products and the related technical information contained in the Products or this document for any military purposes, including but not limited to, the development of mass-destruction weapons.

4. The proper names of companies or products described in this document are trademarks or registered trademarks of ROHM, its affiliated companies or third parties.

General Precaution

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.

2. All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.

3. The information contained in this document is provided on an "as is" basis and ROHM does not warrant that all information contained in this document is accurate and/or error-free. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties resulting from inaccuracy or errors of or concerning such information.