STRUCTURE Silicon Monolithic Integrated Circuit

PRODUCT NAME Dual Synchronous DC/DC converter controller

TYPE **BD9011KV**

FEATURES
- Wide Input Range
- High Precision Reference Voltage
- Bult-in over current protect with OFF latch and Auto remove
- Adjustable Frequency with synchronous function

○ABSOLUTE MAXIMUM RATINGS (Ta=25℃)

| Symbol | Limits | Unit | Symbol | Limits | Unit |
|---|---|---|---|---|---|
| EXTVCC | 34 *1 | V | VREG33 | VREG5 | V |
| VCCCL1,2 | 34 *1 | V | SS1,2、FB1,2 | | |
| CL1,2 | 34 | V | COMP1,2 | | |
| SW1,2 | 34 *1 | V | DET1,2 | | |
| BOOT1,2 | 40 *1 | V | RT、SYNC | | |
| BOOT1,2-SW1,2 | 7 *1 | V | Power Dissipatio | 0.875 *2 | W |
| STB、EN1,2 | VCC | V | Operating Temperature Range | -40～+105 | ℃ |
| VREG5,5A | 7 | V | Storage Temperature Range | -55～+150 | ℃ |
| | | | Maximum Junction Temperature | +150 | ℃ |

(1) Do not however exceed Pd.
(2) Pd derated at 7mW/℃ for temperature above Ta=25℃, Mounted on PCB 70mm×70mm×1.6mm.

○OPERATING CONDITIONS (Ta=25℃)

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage 1 | EXTVCC1 | 3.9 | 30 | V |
| Supply Voltage 2 | VCC1 | 3.9 | 30 | V |
| Recommend Supply Voltage 1 | EXTVCC2 | 6 | 24 | V |
| Recommend Supply Voltage 2 | VCC2 | 6 | 24 | V |
| BOOT−SW Voltage | BOOT−SW | 4.5 | VREG5 | V |
| Oscillator Frequency | OSC | 250 | 550 | kHz |
| Synchronizing Frequency | SYNC | OSC | 550 | kHz |

※Electrical characteristics are not guaranteed (especially when operating on reduce voltage)

*The product described in this specification is a strategic product (and/or service) subject to COCOM regulations. It should not be exported without authorization from the appropriate government.

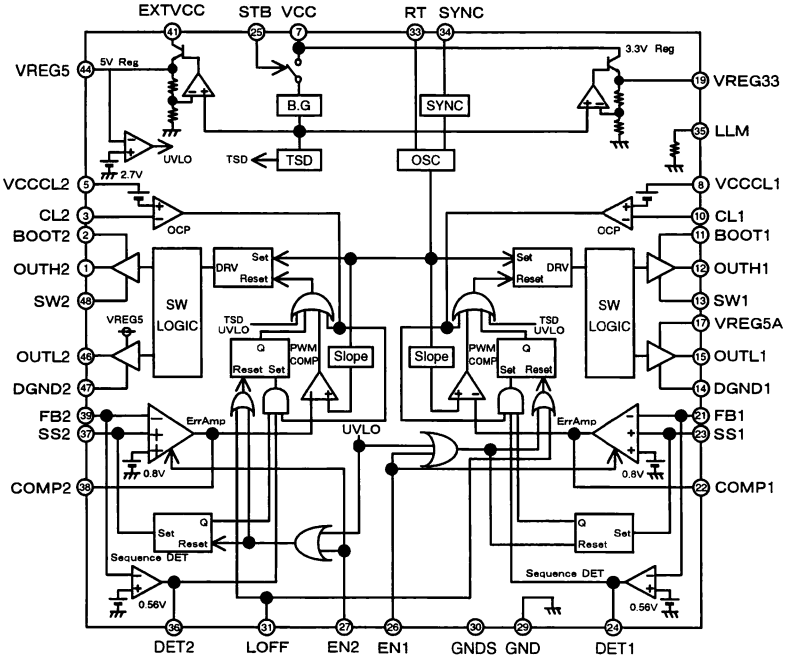
*This product is not designed for normal operation within a radio active environment.

*Status of this document
The Japanese version of this document is the formal specification.
A customer may use this translation version only for a reference to help reading the formal version.
If there are any differences in translation version of this document, formal version takes priority.

○ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta=25℃ VCC/EXTVCC=12V STB=5V EN1,2=5V)

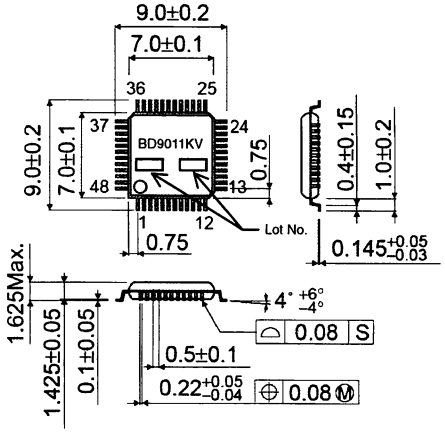
| Parameter | Symbol | Limit | | | Unit | Conditions | Test Circuit |
|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | | |
| VIN Bias Current | IIN | - | 5 | 10 | mA | | |
| Stand-by Current | IST | - | 0 | 10 | μA | VSTB=0V | |
| STB Low Voltage | Vstblow | GND | - | 1.0 | V | | |
| STB High Voltage | Vstbhigh | 2.0 | - | Vcc | V | | |
| STB input Voltage | Istb | 10 | 20 | 30 | μA | VSTB=5V | |
| [VREG5] | | | | | | | |
| Output Voltage | VREG5 | 4.8 | 5 | 5.2 | V | IREF=6mA | |
| Peak Output Current | IREG5_MAX | 10 | - | - | mA | | |
| Line Regulation | VREG5_I | - | 10 | 50 | mV | VIN=7.5 to 25V | |
| Load Regulation | VREG5_L | - | 10 | 50 | mV | IREF=0 to 6mA | |
| [VREG33] | | | | | | | |
| Output Voltage | VREG33 | 3.0 | 3.3 | 3.6 | V | IREG=6mA | |
| Peak Output Current | IREG33_MAX | 10 | - | - | mA | | |
| Line Regulation | VREG33_I | - | 10 | 50 | mV | VIN=7.5 to 25V | |
| Load Regulation | VREG33_L | - | 10 | 50 | mV | IREG=0 to 6mA | |
| [Under Voltage Lock Out] | | | | | | | |
| VREG5 Threshold Voltage | VREG_UVLO | 2.6 | 2.8 | 3.0 | V | VREG:Sweep down | |
| VREG5 Hysteresis Voltage | DVREG_UVLO | 50 | 100 | 200 | mV | VREG:Sweep up | |
| [Oscillator Section] | | | | | | | |
| Oscillator Frequency | FOSC | 270 | 300 | 330 | kHz | RT=100 kΩ | |
| Synchronus Frequency | Fsync | - | 550 | - | kHz | RT=100 kΩ<br>SYNC=550kHz | |
| Synchronus Pulse Low voltage | Vsynclow | GND | - | 1.0 | V | | |
| Synchronus Pulse High voltage | Vsynchigh | 3 | - | VREG5 | V | | |
| SYNC input Current | Isync | 10 | 20 | 30 | μA | Vsync=5V | |
| [Error Amp] | | | | | | | |
| Open Loop Gain | Averr | - | 46 | - | dB | | |
| VO Bias Current | Ivo+ | - | - | 1 | μA | | |
| Comp Source Current | Isource | -14 | -7 | -3 | mA | VFB=0.6V | |
| Comp Sink Current | Isink | 1 | 2 | 4 | mA | VFB=1.0V | |
| Reference Voltage | VOB | 0.792 | 0.800 | 0.808 | V | | |
| Temperature Coefficient of Reference Voltage | VOB+ | - | ±0.04 | - | mV/℃ | | |
| Output rise Threshold | VODET | 0.51 | 0.61 | 0.71 | V | VFB | |
| Output Short Threshold | Vosh | 0.46 | 0.56 | 0.66 | V | VFB | |
| [Soft Start] | | | | | | | |
| Charging Current | ISS | 6.5 | 10 | 13.5 | μA | VSS=1V | |
| Temperature Coefficient of Charging Current | ISS+ | - | ±0.03 | - | μA/℃ | Vss=1V | |
| Discharging Current | IDIS | 0.6 | 1.7 | 3 | mA | VSS=1V,VCC=3V | |
| Temperature Coefficient of Discharging Current | IDIS+ | - | ±0.006 | - | mA/℃ | Vss=1V,VCC=3V | |
| Maximum Voltage | VSS_MAX | 2.05 | 2.25 | 2.45 | V | | |
| Stand-by Voltage | VSS_STB | - | - | 0.3 | V | VCC=3V | |
| [FET Driver] | | | | | | | |
| HG Pch ON Resistance | HGhon | - | 1.5 | 3.0 | Ω | | |
| HG Nch ON Resistance | HGlon | - | 1.0 | 2.0 | Ω | | |
| LG Pch ON Resistance | LGhon | - | 1.5 | 3.0 | Ω | | |
| LG Nch ON Resistance | LGlon | - | 0.5 | 1.0 | Ω | | |
| [Over Current Protect] | | | | | | | |
| CL Threshold voltage | Vswth | 70 | 90 | 110 | mV | | |
| Temperature Coefficient of CL Threshold Voltage | Vswth+ | - | ±0.04 | - | mV/℃ | | |
| CL Bias current 1 | Iswin1 | - | - | 10 | μA | | |
| CL Bias current 2 | Iswin2 | - | - | 10 | μA | | |
| [CTL] | | | | | | | |
| EN1,2 Low Voltage | VENth1 | GND | - | 1.0 | V | | |
| EN1,2 High Voltage | VENth2 | 2.0 | - | Vcc | V | | |
| EN1,2 input Current | IEN | 10 | 20 | 30 | μA | VEN=5V | |

○BLOCK DIAGRAM




※Refer to the Technical Note about the details of the application.

○PHYSICAL DIMENSIONS・MARKING




VQFP(単位:mm)

○Pin No.・Pin Name

| Pin No. | Pin Name | Function | Pin No. | Pin Name | Function |
|---|---|---|---|---|---|
| 1 | OUTH2 | High Aide FET Gate Driver 2 | 25 | STB | Stand-by Input |
| 2 | BOOT2 | OUTH2 Driver Supply Input | 26 | EN1 | Control Voltage Input 1 |
| 3 | CL2 | OCP Setting terminal by External Resistance 2 | 27 | EN2 | Control Voltage Input 2 |
| 4 | N.C. | Non Connect | 28 | N.C. | Non Connect |
| 5 | VCCCL2 | Supply Voltage for OCP 2 | 29 | GND | Ground |
| 6 | N.C. | Non Connect | 30 | GNDS | Sense Ground |
| 7 | VCC | Power Input | 31 | LOFF | OCP OFF Latch ON/OFF CONTROL |
| 8 | VCCCL1 | Supply Voltage for OCP 1 | 32 | N.C. | Non Connect |
| 9 | N.C. | Non Connect | 33 | RT | Connect to External Resistor Setting Operating Frequency |
| 10 | CL1 | OCP Setting terminal by External Resistance 2 | 34 | SYNC | Synchronized Pulse Input |
| 11 | BOOT1 | OUTH1 Driver Supply Input | 35 | LLM | Pull Down Resistance |
| 12 | OUTH1 | High Side FET Gate Driver 1 | 36 | DET2 | FB2 Detector Output 2 |
| 13 | SW1 | High Side FET Source 1 | 37 | SS2 | Soft Start 2 |
| 14 | DGND1 | Low Side FET Source 1 | 38 | COMP2 | Error Amp Output 2 |
| 15 | OUTL1 | Low Side FET Gate Drive 1 | 39 | FB2 | Error Amp Inverting Input 2 |
| 16 | N.C | Non Connect | 40 | N.C | Non Connect |
| 17 | VREG5A | FET Driver REG Input | 41 | EXTVCC | External Power Input |
| 18 | N.C | Non Connect | 42 | N.C | Non Connect |
| 19 | VREG33 | 3.3V Regulator Output | 43 | N.C | Non Connect |
| 20 | N.C | Non Connect | 44 | VREG5 | 5V Regulator Output |
| 21 | FB1 | Error Amp Inverting Input 1 | 45 | N.C | Non Connect |
| 22 | COMP1 | Error Amp Output 1 | 46 | OUTL2 | Low Side FET Gate Driver 2 |
| 23 | SS1 | Soft Start 1 | 47 | DGND2 | Low Side FET Source 2 |
| 24 | DET1 | FB1 Detector Output 1 | 48 | SW2 | High Side FET Source 2 |

NOTES FOR USE

1. Absolute maximum range
   Absolute Maximum Ratings are those values beyond which the life of a device may be destroyed we cannot be defined the failure mode, such as short mode or open mode.
   Therefore physical security countermeasure, like fuse, is to be given when a specific mode to be beyond absolute maximum ratings is considered.

2. GND pin voltage
   GND terminal should be connected the lowest voltage, under all conditions. And all terminals except SW should be under GND terminal voltage under all conditions including transient situations.If a terminal exists under GND,it should be inserting a bypass route.

3. Power dissipation
   If IC is used on condition that the power loss is over the power dissipation, the reliability will become worse by heat up, such as reduced output current capability.
   Also, be sure to use this IC within a power dissipation range allowing enough of margin.

4. Input supply voltage
   Input supply pattern layout should be as short as possible.

5. Electrical characteristics described in these specifications may vary, depending on temperature, supply voltage, external circuits and other conditions. Therefore, be sure to check all relevant factors, including transient characteristics.

6. Thermal Shut Down Circuit
   A temperature control is built in the IC to prevent the damage due to overheat. Therefore, the output is turned off without VREG5 when the thermal circuit works and are turned on when the temperature goes down to the specified level.

7. Mounting Failures
   Mounting failure, such as misdirection or mismount, may cause a malfunction in the device.

8. Internal circuits or elements may be damaged when Vcc and pin voltage are reversed. For example, Vcc short circuit to GND while a external capacitor is charged. Pin capacitor of Vreg5 and VREG33 outputs is recommended no larger than 100 $\mu$F. In addition, inserting a Vcc series countercurrent prevention diode, or a bypass diode between the various pins and the vcc, is recommended.

9. Malfunction may be happened when the device is used in the strong electromagnetic field.

10. We recommend to put Diode for protection purpose in case of output pin connected with large load of impedance or reserve current occurred at initial and output off.

11. Precautions for board inspection
    Connecting low-impedance capacitors to run inspections with the board may produce stress on the IC. Therefore, be certain to use proper discharge procedure before each process of the test operation.
    To prevent electrostatic accumulation and discharge in the assembly process, thoroughly ground yourself and any equipment that could sustain ESD damage, and continue observing ESD-prevention procedures in all handing, transfer and storage operations. Before attempting to connect components to the test setup, make certain that the power supply is OFF. Likewise, be sure the power supply is OFF before removing any component connected to the test setup.

12. GND pattern
    When both a small-signal GND and high current GND are present, single-point grounding (at the set standard point ) is recommended, in order to separate the small-signal and high current patterns, and to be sure the voltage change stemming from the wiring resistance and high current does not cause any voltage change in the small-signal GND. In the same way, care must be taken to avoid voltage fluctuations in any connected external component GND.

13. SW Terminal
    A counter-electromotive force may generate a negative potential at the SW terminal during connection to the particular application. Therefore,it should be inserting a bypass route between SW to GND.

14. Drop-out operation
    A decrease in the input voltage to less than 90% of the output voltage (varies depending on operating frequency fluctuation) may prevent the MOS at the OUTL side to turn ON, which will, in turn, prevent BOOST STRAP operation. A load should be connected in order to reduce the SW voltage to the GND level in the event the difference in the input and output voltages is small.

## 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 with 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 |
| Dilian | 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


As of 18th. April 2005