

STRUCTURE TYPE

Silicon Monolithic Integrated Circuit
Flexible Step-Down Switching Regulator

PRODUCT SERIES

BD9778HFP

FEATURES

- Wide input Range:7~35V
- High Precision(Reference Voltage) : $\pm 2\%$
- Integrated 2A P-ch Power MOS FET
- Adjustable Frequency:50~500KH z

○ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Parameter	Symbol	Limits	Unit
Supply Voltage	V_{IN}	36	V
SW Pin Voltage	V_{SW}	V_{IN}	V
Output SW Current	I_{SW}	2 ⁽¹⁾	A
EN Pin Voltage	V_{EN}	V_{IN}	V
RT, FB, INV Pin Voltage	V_{RT}, V_{FB}, V_{INV}	7	V
Power Dissipation	P_d	5.5 ⁽²⁾	W
Operating Temperature Range	T_{opr}	-40 ~ +125	°C
Storage Temperature Range	T_{stg}	-55 ~ +150	°C
Maximum Junction Temperature	T_{jmax}	150	°C

(1) Do not however exceed P_d .

(2) P_d derated at 44mW/°C for temperature above Ta=25°C, Mounted on a double layer PCB 70mm×70mm×1.6mm.
(with Thermal vias / Copper area : 70mm×70mm)

○ OPERATING CONDITIONS(Ta=25°C)

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{IN}	5	35	V
Recommend Supply Voltage	V_{IN}	7	35	V
Output Switch Current	I_{SW}	-	2	A
Oscillator Frequency	F_{OSC}	50	500	kHz
Oscillator Timing Resistance	RT	40	800	kΩ
Output Voltage *1	V_o	1 or $V_{IN} \times 6\%$	V_{IN}	V

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

*1 This Output Voltage is applied to Recommend Supply Voltage (7~35V)

* 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.

* The product is not designed for protection against radioactive rays.

* Status of this document

The Japanese version of this document is the formal specification.

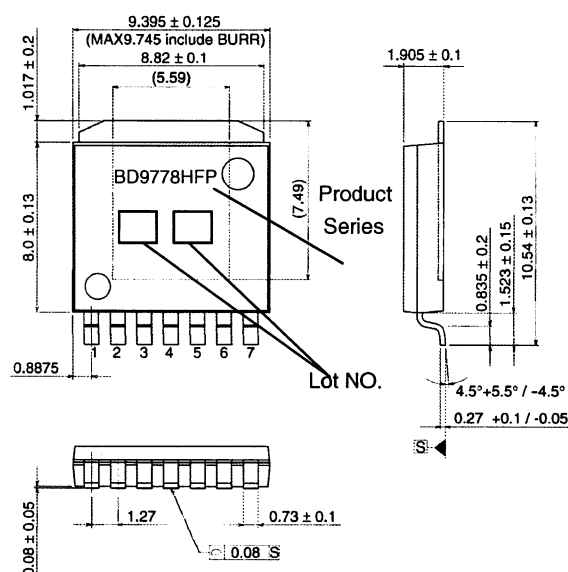
A customer may use this translation version only for a reference to help reading the formal version.

If there are any differences in translation version of this document, formal version takes priority.

○ ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta=-40~125℃, V_{IN}=13.2V, V_{EN}=5V)

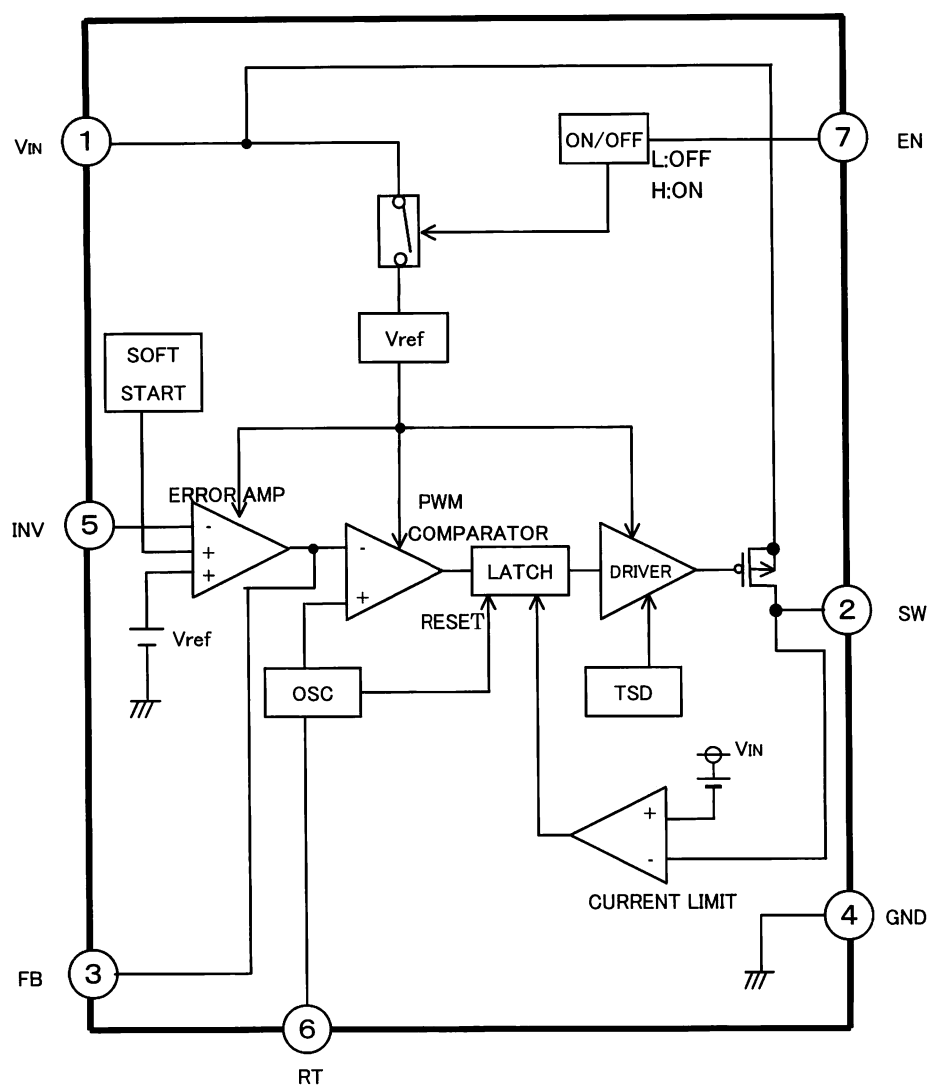
Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
[Entire Device]						
Stand-by Current	I _{STB}	-	0	10	μA	V _{EN} =0V, Ta=25℃
Quiescent Current	I _Q	-	3	4.2	mA	I _O =0A
[Switch]						
Switch On Resistance	R _{ON}	-	0.53	0.9	Ω	I _{SW} =50mA
Output Current Limit	I _{OLIMIT}	2	4	-	A	Design Guarantee
Leakage Current	I _{OLEAK}	-	0	30	μA	V _{IN} =35V, V _{EN} =0V
[Error Amplifier]						
Reference Voltage1	V _{REF1}	0.98	1.00	1.02	V	V _{FB} =V _{INV} , Ta=25℃, S:ON,
Reference Voltage2	V _{REF2}	0.96	1.00	1.04	V	V _{FB} =V _{INV} , S:ON
Line Regulations	ΔV _{REF}	-	0.5	-	%	V _{IN} =5 ~35V, S:ON
Input Bias Current	I _B	-1	-	-	μA	V _{INV} =1.1V
Maximum FB Voltage	V _{FBH}	2.4	2.5	-	V	V _{INV} =0.5V
Minimum FB Voltage	V _{FBL}	-	0.05	0.10	V	V _{INV} =1.5V
FB sink current	I _{FBSINK}	-5.0	-3.0	-0.5	mA	V _{FB} =1.5V, V _{INV} =1.5V
FB source current	I _{FBSOURCE}	70	120	170	μA	V _{FB} =1.5V, V _{INV} =0.5V
Soft Start Period	T _{SS}	-	5	-	mS	Design Guarantee
[Oscillator Section]						
Switching Frequency	F _{OSC}	82	102	122	kHz	RT=390kΩ
Frequency Line Regulation	ΔF _{OSC}	-	2	-	%	V _{IN} =5~35V
[Enable]						
Enable Threshold Voltage	V _{EN}	0.8	1.7	2.6	V	
Sense Current	I _{EN}	-	13	50	μA	V _{EN} =5V

○ PHYSICAL DIMENTIONS • MARKING



HRP7 (UNIT:mm)

○ BLOCK DIAGRAM



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

○ Pin No. • Pin Name

Pin No.	Pin Name
1	VIN
2	SW
3	FB
4	GND
5	INV
6	RT
7	EN
FIN	FIN

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. Operation supply voltage range

The circuit functionality is guaranteed within operation of ambient temperature range, as long as it is within operation supply voltage range. The standard electrical characteristic values are guaranteed at the test circuit voltage of $V_{IN}=13.2V$. They cannot be guaranteed at other voltages in the operating range of 5V-35V. However, the variation will be small.

3. Grounding

It is recommended that every capacitor (bypass and another capacitors) is grounded to PIN7 using single-point connections.

4. Input supply voltage

Input supply pattern layout should be as short as possible.

5. VIN Terminal

For reduce the influence of switching noise, bypass capacitor is connected between VIN and GND.

6. FB Terminal

The FB terminal is for phase margin of the DC/DC system. A capacitor and a resistor or an only capacitor placed between the FB terminal and the INV terminal. The values of the capacitor and the resistor shall be adjusted according to the output current and the output capacitor value. The output may be oscillating if the value of capacitor is not sufficient, also the transient response may become insufficient if the value is too large. Therefore, the value of the capacitor and the resistor shall be adequately set up based on the condition of the temperature, and so on. Since the FB terminal also detects output short condition compulsorily applying an external voltage onto the FB terminal must not be performed because it may activate the timer latch protection circuit.

7. Electromagnetic Fields

The IC is susceptible to strong electromagnetic fields and may cause malfunction. Therefore, caution should be used when placing it on the PCB.

8. Application Design

When designing the external circuit, included adequate margins, including not only steady state but also transient characteristics.

9. Over Output Current Protection

SW Output terminal has over current protection circuit of 4A, with prevents IC from being damage by short circuit at over current.

10. 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 when the thermal circuit works and are turned on when the temperature goes down to the specified level.

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