

STRUCTURE	Silicon Monolithic Integrated Circuit		
PRODUCT NAME	Flexible Step-Down Switching Regulator		
TYPE	<b>B D 9 0 0 2 H F P</b>		
FEATURES	• Wide Input Range : 12~46V	• High Precision(Reference voltage) : $\pm 2\%$	
	• Integrated 2.5A Pch Power MOS FET	• Adjustable Frequency : 50~300KHz	

## ○ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Parameter	Symbol	Limits	Unit
Supply Voltage	$V_{IN}$	50	V
SW Pin Voltage	$V_{SW}$	$V_{IN}$	V
Output SW Current	$I_{SW}$	2.5 <sup>(1)</sup>	A
SS, RT, FB, INV Pin Voltage	$V_{SS}, V_{RT}, V_{FB}, V_{INV}$	7	V
Power Dissipation	$P_d$	5.5 <sup>(2)</sup>	W
Operating Temperature Range	$T_{opr}$	-40~+125	°C
Storage Temperature Range	$T_{sto}$	-55~+150	°C
Maximum Junction Temperature	$T_{jmax}$	150	°C

<sup>(1)</sup> Do not however exceed  $P_d$ .<sup>(2)</sup>  $P_d$  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	$V_{IN}$	12	46	V
Output Switch Current	$I_{SW}$	—	2.5	A
Output Voltage (ON Duty)	$D_{ON}$	6	100	%
Oscillator Frequency	$F_{osc}$	50	300	kHz
Oscillator Timing Resistance	$RT$	100	800	kΩ

\*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

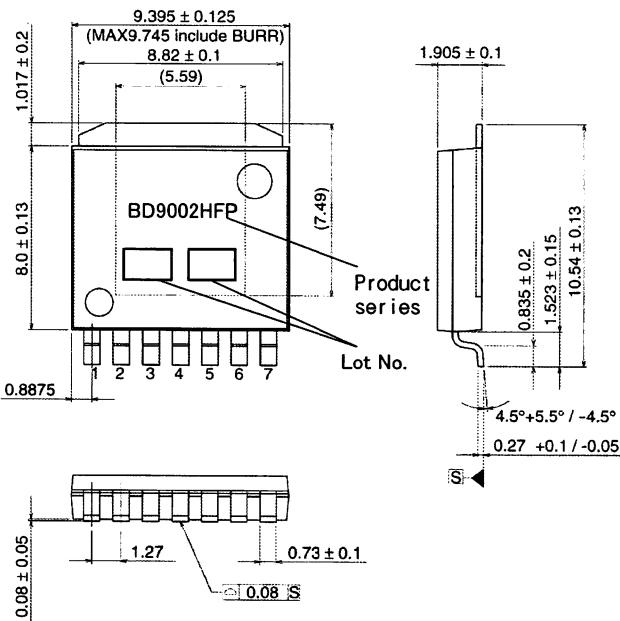
The Japanese version of this document is the formal specification.

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,  $T_a = -40 \sim 125^\circ\text{C}$ ,  $V_{IN} = 13.2\text{V}$ )

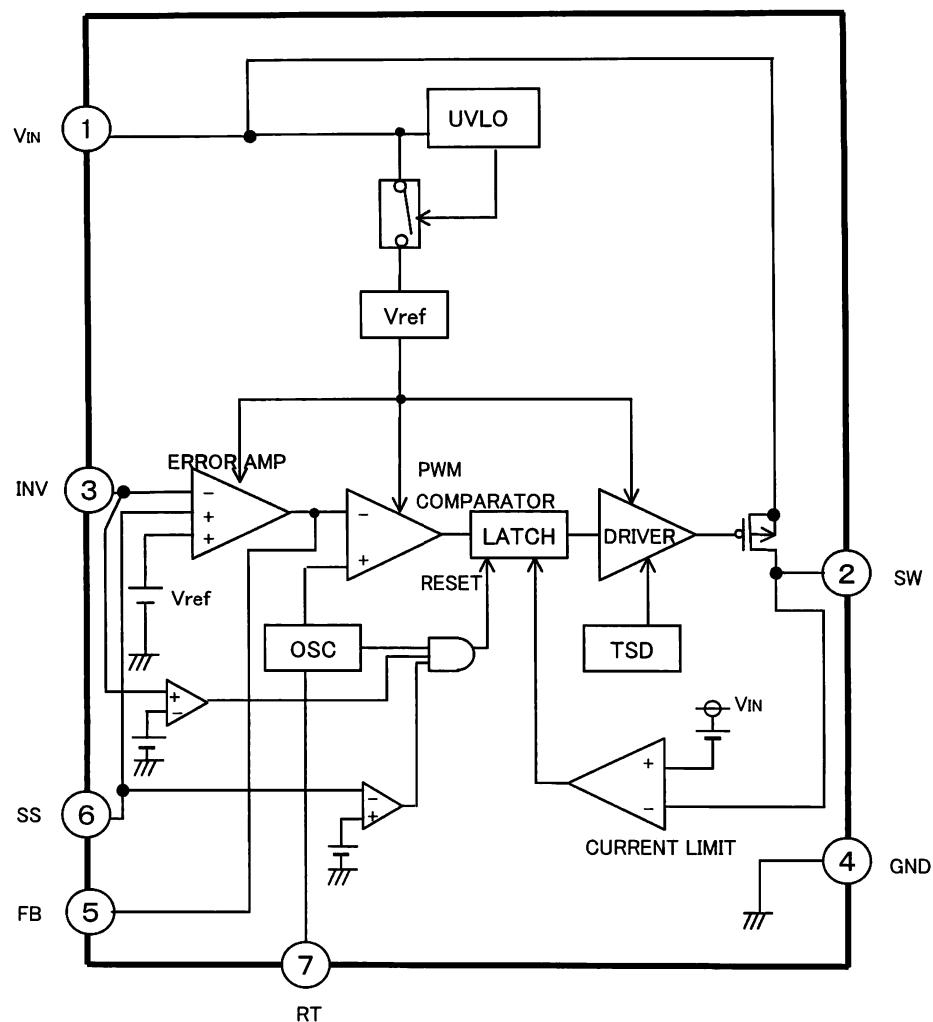
Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
[Entire Device]						
Circuit Current	$I_0$	-	3	8	mA	$I_0 = 0\text{A}$
[Switch]						
Switch On Resistance	$R_{ON}$	-	0.6	1.2	$\Omega$	$I_{SW} = 50\text{mA}$
Output Current Limit	$I_{OLIMIT}$	2.5	4	-	A	Design Guarantee
[Error Amplifier]						
Reference Voltage1	$V_{REF1}$	0.98	1.00	1.02	V	$V_{FB} = V_{INV}$ , S:ON, $T_a = 25^\circ\text{C}$
Reference Voltage2	$V_{REF2}$	0.96	1.00	1.04	V	$V_{FB} = V_{INV}$ , S:ON
Line Regulations	$\Delta V_{REF}$	-	0.5	-	%	$V_{IN} = 12 \sim 46\text{V}$ , S:ON
Input Bias Current	$I_B$	-1	-	-	$\mu\text{A}$	$V_{INV} = 0.9\text{V}$
Maximum FB Voltage	$V_{FBH}$	2.4	2.5	-	V	$V_{INV} = 0.5\text{V}$
Minimum FB Voltage	$V_{FBL}$	-	0.05	0.10	V	$V_{INV} = 1.5\text{V}$
FB sink current	$I_{FBsink}$	-5.0	-2.3	-0.5	mA	$V_{FB} = 1.5\text{V}$ , $V_{INV} = 1.5\text{V}$
FB source current	$I_{FBsource}$	70	120	170	$\mu\text{A}$	$V_{FB} = 1.5\text{V}$ , $V_{INV} = 0.5\text{V}$
[Oscillator Section]						
Switching Frequency	$F_{OSC}$	82	102	122	kHz	$RT = 360\text{k}\Omega$
Frequency Line Regulation	$\Delta F_{OSC}$	-	2	-	%	$V_{IN} = 12 \sim 46\text{V}$
[UVLO]						
UVLO Threshold Voltage	$V_{UVLO}$	9.7	10.2	10.7	V	Output ON
Hysteresis	$V_{HYS}$	0.4	0.7	1.0	V	Output OFF
[Soft Start]						
Charge Current	$I_{SS}$	-4.0	-2.5	-1.0	$\mu\text{A}$	$V_{SS} = 1.0\text{V}$
Threshold Voltage	$V_{SS}$	-	1.0	-	V	$V_{INV} = 1.0\text{V}$ , SS voltage
Stand-by voltage	$V_{SSSTB}$	-	10	100	mV	SS voltage
Output OFF Threshold	$V_{THOFF}$	0.2	0.31	-	V	SS voltage
[Short Detector]						
Threshold Voltage	$V_{SHORT}$	0.18	0.2	0.22	V	Output short detect, $T_a = 25^\circ\text{C}$

## ○PHYSICAL DIMENSIONS • 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	INV
4	GND
5	FB
6	SS
7	RT
FIN	GND

## 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 VIN=13.2V. They cannot be guaranteed at other voltages in the operating range of 10V–46V. However, the variation will be small.

**3. Grounding**

It is recommended that every capacitor (bypass and another capacitors) is grounded to PIN4 and FIN 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. Over current protection operate at 300nsec after over current threshold.

**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(about 150°C) and are turned on when the temperature goes down to the specified level.

**11. Short protection**

When output voltage is less than 20% while over current protect is operating , IC is OFF Latch. This OFF Latch is released by U.V.L.O.. However, when SS is less than 1.5V, OFF Latch is no operating.

## Appendix

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