ROHM
SEMICONDUCTOR

STRUCTURE	Silicon Monolithic Integrated Circuit
TYPE	Step-down Switching Regulator Integrated High Side Switch

PRODUCT SERIES　　　**BD9070FP**

FEATURES
・Integrated FET 1ch Step-down Switching Regulator
・1ch High Side Switch
・Over Voltage Protection which can be Variable by External Resisters
・Over Current Protection for Switching Regulator
・Over Current Protection for High Side Switch
・Thermal Shut Down Circuit
・Under Voltage Lock Out Circuit
・Over Current Detection Flag pin for High Side Switch

◎ABSOLUTE MAXIMUM RATINGS（Ta＝25℃)）

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[1]	A
EN, SYNC Pin Voltage	$V_{EN/SYNC}$	V_{IN}	V
RT, FB, INV Pin Voltage	V_{RT}, V_{FB}, V_{INV}	7	V
VDD Input Voltage	V_{DD}	15	V
HSDSW Control Voltage	HSDCTL	V_{DD}	V
HSDSW Flag Voltage	HSDFLG	6	V
Over Voltage Protection Detection Terminal	OVPDET	6	V
Power Dissipation	Pd	1.45[2]	W
Operating Temperature Range	Topr	-40～+105	℃
Storage Temperature Range	Tstg	-55～+150	℃
Maximum Junction Temperature	Tjmax	150	℃

（1）However ,do not exceed Pd.
（2）Pd derated at 5.52mW/℃ for temperature above Ta=25℃, Mounted on a double layer PCB 70mm×70mm×1.6mm.
　　(with Thermal vias / Copper area：70mm×70mm)

◎OPERATING CONDITIONS （However、it does not guarantee the electric characteristic.）

| Parameter	Symbol	Min.	Max.	Unit
Recommend Supply Voltage	V_{IN}	7	35	V
Recommend Supply Voltage 2	V_{DD}	2.7	5.5	V
High Side Switch Current	I_{HSW}	-	0.7	A
Output Switch Current	I_{SW}	-	2	A
Oscillator Frequency	F_{OSC}	50	500	kHz
External Synchronous Frequency	F_{SYNC}	F_{OSC}	500[3]	kHz

（3）However, do not exceed OSC×1.5.
＊The product is not designed for protection against radioactive rays

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◎ELECTRICAL CHARACTERISTICS（Unless otherwise specified Ta=25℃,VIN=13.2V,VEN=5V,VDD=5V,HSDCTL=5V）

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
［Entire Device］						
Stand-by Current	ISTB	-	0	10	uA	VEN= 0V
Operation Current	Io	-	4.3	9	mA	Io=0A,RT=51kΩ,INV=0.7V
［Switch］						
Leakage Current	IOLEAK	-	0	30	uA	VIN=35V,VEN=0V
［DC/DC］						
Reference Voltage1	VREF1	0.784	0.800	0.816	V	VFB=VINV
Reference Voltage2	VREF2	0.784	0.800	0.816	V	VIN=10～16V,VFB=VINV
Input Bias Current	IB	-1	-	-	uA	VINV=0.6V
Switching Frequency1	FOSC1	240	300	360	kHz	RT=51kΩ
Switching Frequency2	FOSC2	238.5	300	361.5	kHz	VIN=10～16V,RT=51kΩ
Synchronous Frequency	FSYNC	495	500	505	kHz	RT=51kΩ,EN/SYNC=500kHz, Duty=50%
Over Current Protection Operation Output Current	IOLIMIT	2.1	4	-	A	
Output ON Voltage	VENON	2.6	-	-	V	
Output OFF Voltage	VENOFF	-	-	0.8	V	
Sink Current	IEN	-	35	90	uA	VEN=5V
Over Voltage Detection Voltage	VOVP	0.95	1.00	1.05	V	
Over Voltage Hysteresis Voltage	VOVP HYS	-	50	-	mV	
［High Side Switch］						
［DC Characteristic］						
ON Resistance	RON	-	110	150	mΩ	Io=10mA
Leakage Current	ILEAK	-	0	10	uA	HSDCTL=0V
Over Current Limit Threshold Level	ITHLIM	0.7	1.0	1.3	A	
FLG Output Resistance	RFL	-	305	450	Ω	IFL=1mA
FLG Output Leakage Current	IFLL	-	0	1	uA	VFLG=5V
［Control Terminal］						
HSD CTL Input Voltage H	CTLH	2.0	-	VDD	V	
HSD CTL Input Voltage L	CTLL	-	-	0.8	V	
HSD CTL Input Current	ICTL	-1.0	0.01	1.0	uA	HSD CTL=0V or 5V
［AC Characteristic］						
Output Rise Time	TON1	-	0.8	6	ms	RL=20Ω
Output Turn On Delay Time	TON2	-	1.1	10	ms	RL=20Ω
Output Fall Time	TOFF1	-	2.7	20	us	RL=20Ω
Output Turn Off Delay Time	TOFF2	-	19	40	us	RL=20Ω
Over Current Blanking Time	TBLANK	6	8	10	ms	RT=51kΩ,EN/SYNC=400kHz

TON / TOFF time

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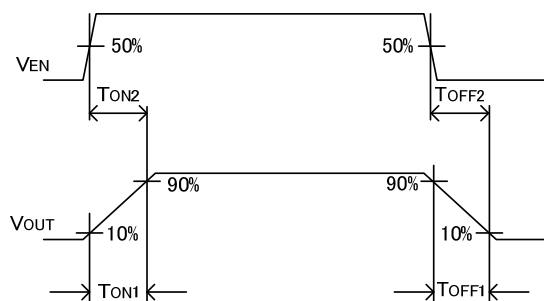
◎BLOCK DIAGRAM

◎PHYSICAL DIMENTIONS・MARKING

HSOP25 （Unit：mm）
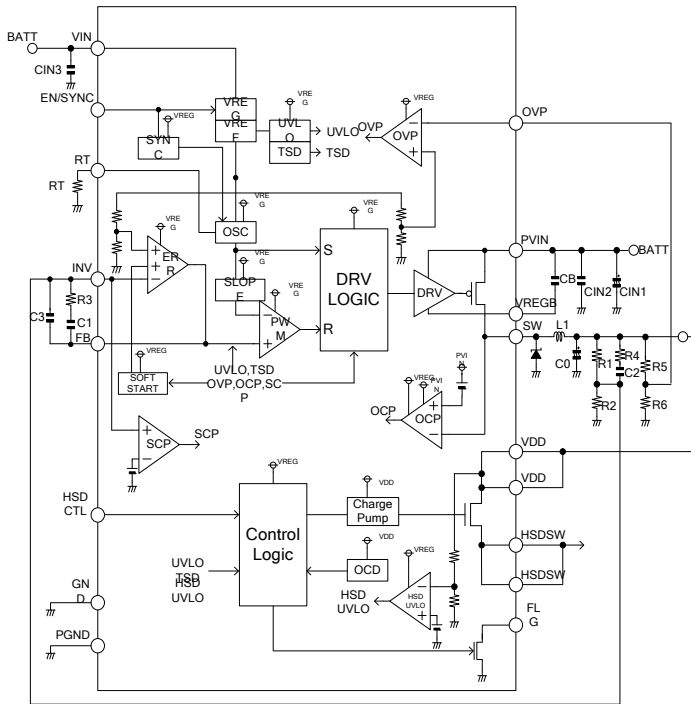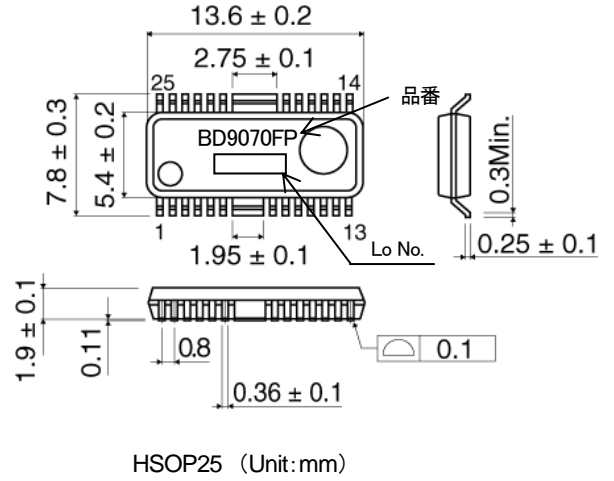
◎Pin No.・Pin Name

Pin No.	Pin Name	Function	Pin No.	Pin Name	Function
1	VREGB	FET Driver Drive Power Supply Pin	14	N.C.	Non-connect (unused) pin
2	V_{IN}	Input Power Supply Pin	15	VDD	High Side Switch Input Pin
3	N.C.	Non-Connect (unused) Pin	16	VDD	High Side Switch Input Pin
4	N.C.	Non-Connect (unused) Pin	17	OVP	Over Voltage Protection Detection Pin
5	PGND	Ground Pin	18	INV	Error Amp Input Pin
6	GND	Ground Pin	19	FB	Error Amp Output Pin
7	RT	Switching Frequency Setting Pin	20	N.C.	Non-connect (unused) pin
8	EN/SYNC	DC/DC ON/OFF Pin External Synchronous Pulse Input Pin	21	SW	DC/DC Output Pin
9	HSDCTL	High Side Switch ON/OFF Pin	22	SW	DC/DC Output Pin
10	FLG	High Side Switch Over Current Flag Pin	23	N.C.	Non-connect (unused) pin
11	N.C.	Non-Connect (unused) Pin	24	PV_{IN}	Input power supply pin
12	HSDSW	High Side Switch Output Pin	25	PV_{IN}	Input power supply pin
13	HSDSW	High Side Switch Output Pin			

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

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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 7V-35V. However, the variation will be small.

3. Grounding
   It is recommended that every capacitor (bypass and another capacitors) is grounded to the ground pin 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. (over 2µF)

6. SOFT START
   The SOFT START block provides a function to prevent from the overshoot of the output voltage Vo through gradually increasing the normal rotation input of the error amplifier when power supply turns ON to gradually increase the switching Duty. The soft start time is set to 5 msec (typ.).

7. 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.

8. 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.

9. Adjacent Pin short mistake fitting
   Use caution when orienting and positioning the IC for mounting on printed circuit boards. Improper mounting may result in damage to the IC.

10. Application Design
    When designing the external circuit, chose parts in condition of the enough margin that not only steady state but also transient characteristics contain.

11. Over Output Current Protection
    It is recommend not to use that continuously operates the protection circuit (For instance, always the load that greatly exceeds the output current ability is connected or the output is short-circuited, etc.) in these protection circuits by an effective one to the destruction prevention due to broken accident.

12. Short Circuit Protection (SCP)
    The short circuit protection operates when the output falls on 70% or less after the over current protection operates. When the short-circuit protection operates, the output voltage is turned off, and the average output current is limited between 1024 pulses of the sending frequency. When the input is turned on, this protection is off before setting voltage.

13. Temperature protection (thermal down) circuit
    This IC has a built-in temperature protection circuit to prevent from the thermal destruction of the IC. As described above, be sure to use this IC within the power dissipation range. Should a condition exceeding the power dissipation range continue, the chip temperature Tj will rise to activate the temperature protection circuit, thus turning OFF the output power element. Then, when the tip temperature Tj falls, the circuit will be automatically reset. Furthermore, if the temperature protection circuit is activated under the condition exceeding the Maximum Junction Temperature, do not attempt to use the temperature protection circuit for set design.

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Version	改定日	改定理由	改定内容
Rev0.0.1	2007/05/11	初版	REV. A

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More detail product informations and catalogs are available, please contact us.

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