

STRUCTURE Silicon Monolithic Integrated Circuit

PRODUCT NAME 1CH STEP-DOWN DC/DC CONVERTER

TYPE **BD93290EFJ**

PACKAGE Fig.1 (HTSOP-J8)

BLOCK DIAGRAM Fig.2

**FEATURE**

- 1) 3A Output Current Integrated MOSFET Step-down Regulator
- 2) Current Mode PWM Controlled
- 3) Wide Operating INPUT Range
- 4) Feedback Voltage 0.9V
- 5) Low ESR Output Ceramic Capacitors are Available
- 6) HTSOP-J8 Package
- 7) Protection Circuit Under Voltage LockOut protection circuit  
Thermal ShutDown circuit  
Over Current Protection circuit

**● ABSOLUTE MAXIMUM RATING (Ta=25°C)**

Parameter	Symbol	Rating	Unit
Supply Voltage	V <sub>IN</sub>	20	V
Switch Voltage	V <sub>SW</sub>	20	V
EN Voltage	V <sub>EN</sub>	20	V
Power Dissipation	P <sub>d</sub>	3760*	mW
Operating Temperature Range	T <sub>opr</sub>	-40~+85	°C
Storage Temperature Range	T <sub>stg</sub>	-55~+150	°C
Junction Temperature	T <sub>jmax</sub>	150	°C
BST Voltage	V <sub>BST</sub>	V <sub>SW</sub> +7	V
SS, FB, COMP Voltage	V <sub>oth</sub>	20	V

\* Derating in done 30.08mW/°C for operating above Ta≥25°C(On 70.0mm×70.0mm×1.6mm 4-layer board)

**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.

**Application example**

- ROHM cannot provide adequate confirmation of patents.
- The product described in this specification is 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 this product 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.
- ROHM assumes no responsibility for the use of any circuits described herein, conveys no license under any patent or other right, and makes no representations that the circuits are free from patent infringement.

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			REV. B	<b>ROHM Co.,Ltd.</b>

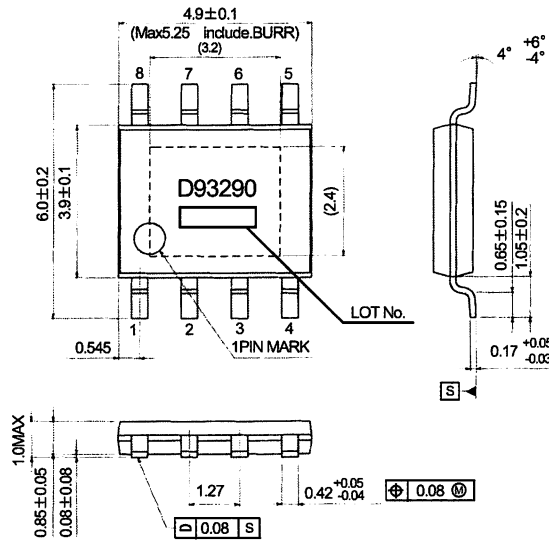
**● OPERATION RANGE** (Ta= -40~85°C)

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V <sub>IN</sub>	4.2	12	18	V
SW Voltage	V <sub>SW</sub>	-0.5	-	18	V

**● Electrical characteristics** (unless otherwise specified VIN=12V Ta=25°C)

Parameter	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Error amplifier block						
FB input bias current	I <sub>FB</sub>	-	0.02	2	μA	
Feedback voltage 1	V <sub>FB</sub>	0.886	0.900	0.914	V	Voltage follower
Feedback voltage 2	V <sub>FB</sub>	0.882	0.900	0.918	V	Ta=-40~85°C
SW block – SW						
Leak current N-channel	I <sub>LEAKN</sub>	-	0	10	μA	V <sub>IN</sub> = 18V , V <sub>SW</sub> = 0/18V
Hi-side FET On-resistance	R <sub>ONU</sub>	-	0.15	-	Ω	I <sub>SW</sub> = -0.8A
Lo-side FET On-resistance	R <sub>OND</sub>	-	0.13	-	Ω	I <sub>SW</sub> = 0.8A
Switch Current Limit	I <sub>LIMIT</sub>	3.5	-	-	A	
Maximum duty cycle	M <sub>DUTY</sub>	-	90	-	%	V <sub>FB</sub> = 0V
General						
Enable Sink Current	I <sub>EN</sub>	90	180	270	uA	V <sub>EN</sub> =12V
Enable Threshold Voltage	V <sub>EN</sub>	1.0	1.2	1.4	V	
Under Voltage Lockout threshold	V <sub>UVLO</sub>	3.5	3.75	4.0	V	V <sub>IN</sub> rising
Under Voltage Lockout Hysteresis	V <sub>HYS</sub>	-	0.3	-	V	
Soft Start Current	I <sub>SS</sub>	5	10	15	μA	V <sub>SS</sub> =0.1V
Operating Frequency	F <sub>OSC</sub>	270	300	330	kHz	
Circuit Current	I <sub>CC</sub>	-	1.5	3	mA	V <sub>FB</sub> = 1.5V, V <sub>EN</sub> = 12V
Quiescent Current	I <sub>QUI</sub>	-	18	27	μA	V <sub>EN</sub> = 0V

\* This product is not designed for protection against radioactive rays

**● PHYSICAL DIMENSION (HTSOP-J8)**


Pin No.	Pin name
1	BST
2	VIN
3	SW
4	GND
5	FB
6	COMP
7	EN
8	SS

 Fig.1 HTSOP-J8 Package  
 (Unit:mm)

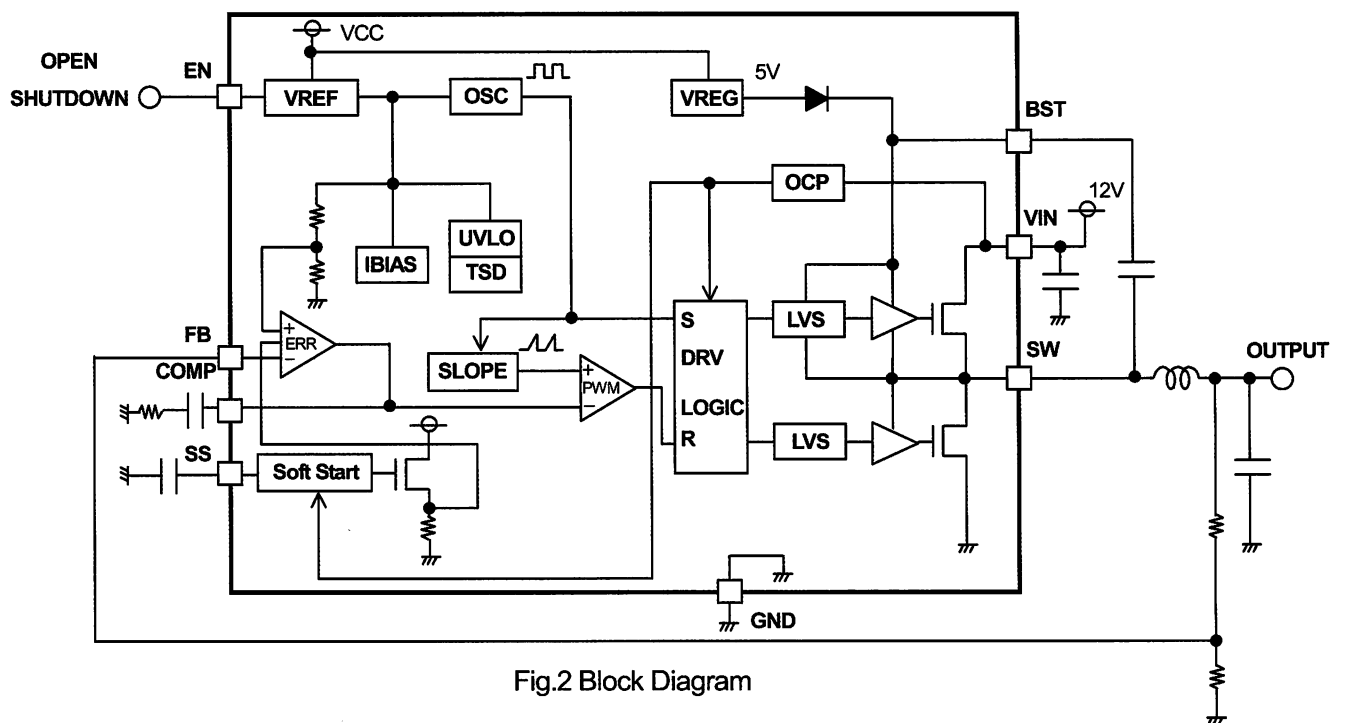
**● Block Diagram**


Fig.2 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 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. When VIN voltage is near the absolute maximum ratings, there are possibilities that the VIN voltage exceed the limit and the IC is destroyed. So please consider using zener diode between VIN-GND or using large input-capacitor in order not to destroy the IC.

## 2) GND potential

Ensure a minimum GND pin potential in all operating conditions.

## 3) Setting of heat

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

## 4) Pin short and 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. Shorts between output pins or between output pins and the power supply and GND pins caused by the presence of a foreign object may result in damage to the IC.

## 5) Actions in strong magnetic field

Use caution when using the IC in the presence of a strong magnetic field as doing so may cause the IC to malfunction.

## 6) 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.

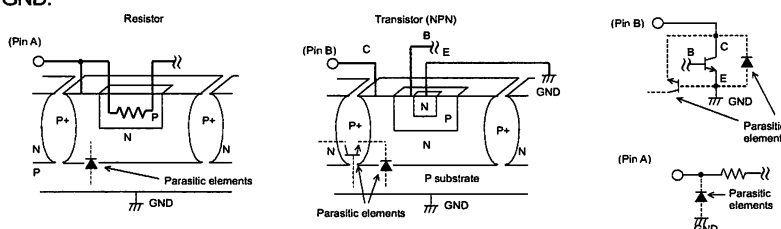
## 7) Ground wiring patterns

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the application's reference point so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring patterns of any external components.

## 8) Regarding input pin of the IC

This monolithic IC contains P+ isolation and P substrate 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 the resistors and transistors are connected to the pins as shown in Fig. , a parasitic diode or a transistor operates by inverting the pin voltage and GND voltage. 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 (P substrate) voltage to input and output pins. The SW voltage becomes lower than GND voltage on the situation, so use the low voltage drop shotkey barrier diode between the SW and the GND.

Fig. Example of a Simple Monolithic IC Architecture



## 9) Overcurrent protection circuits

An overcurrent protection circuit designed according to the output current is incorporated for the prevention of IC damage that may result in the event of load shorting. This protection circuit is effective in preventing damage due to sudden and unexpected accidents. However, the IC should not be used in applications characterized by the continuous operation or transitioning of the protection circuits. At the time of thermal designing, keep in mind that the current capacity has negative characteristics to temperatures.

## 10) Thermal shutdown circuit (TSD)

This IC incorporates a built-in TSD circuit for the protection from thermal destruction. The IC should be used within the specified power dissipation range. However, in the event that the IC continues to be operated in excess of its power dissipation limits, the attendant rise in the chip's junction temperature TJ will trigger the TSD circuit to turn off all output power elements. Operation of the TSD circuit presumes that the IC's absolute maximum ratings have been exceeded. Application designs should never make use of the TSD circuit.

## 11) EN function

When the EN voltage signal falling speed is very slow, the chattering phenomenon (IC repeatedly turns ON and OFF) happens. If this chattering phenomenon happens during the output voltage still remains, the reverse current from the output terminal to the input terminal could be done by the boosting operation and this result in the permanent damage of the IC. Controlling EN voltage signal should be finished within 100us especially when power off. When EN terminal is pulled-up to VIN, this consideration is not necessary.

When starting up the IC using EN voltage signal, IC's state is the re-start mode at which the Lo-side FET is ON. At this mode, if the output capacitor is still charged, the IC's Lo-side FET pull the current from the output capacitor. If this pulled current reaches the Lo-side FET OCP threshold, the Lo-side FET turns OFF suddenly and the current goes to the VIN via Hi-side FET that we called "Reverse Current".

Please be caution that the "Reverse Current" flowing into the input capacitor and the ESR of the input capacitor could cause the fatal voltage surge at the VIN terminal. Also, the voltage between BST and SW is not enough charged to drive the Hi-side FET gate driver while the over current protection is working, which could be the cause of starting up failure. Please do not restart the IC by EN control when the output voltage remains more than 3V.