

STRUCTURE Silicon Monolithic Integrated Circuit

PRODUCT NAME 1ch DC/DC Converter IC built in synchronous rectifier

TYPE **BD9140MUV**FEATURES

- Output Voltage : Adjustable(3.0V~6.0V), Output Current : 2.0A
- High Efficiency and Fast Transient Response

## ○ABSOLUTE MAXIMUM RATING (Ta=25°C)

Parameter	Symbol	Limit	Unit
Power Supply Voltage	V <sub>CC</sub>	-0.3~+15 <sup>*1</sup>	V
Power Supply Voltage	P <sub>VCC</sub>	-0.3~+15 <sup>*1</sup>	V
EN Voltage	V <sub>EN</sub>	-0.3~+15	V
SW Voltage	V <sub>SW</sub>	-0.3~+15	V
ITH, V <sub>REG</sub> , ADJ Voltage	V <sub>ITH</sub> , V <sub>REG</sub> , V <sub>ADJ</sub>	-0.3~+7	V
SW Output Current	I <sub>SW</sub>	2.3	A
Power Dissipation 1	P <sub>d1</sub>	0.34 <sup>*2</sup>	W
Power Dissipation 2	P <sub>d2</sub>	0.70 <sup>*3</sup>	W
Power Dissipation 3	P <sub>d3</sub>	1.21 <sup>*4</sup>	W
Power Dissipation 4	P <sub>d4</sub>	3.56 <sup>*5</sup>	W
Operating Temperature Range	T <sub>OPR</sub>	-40~+105	°C
Storage Temperature Range	T <sub>STG</sub>	-55~+150	°C
Maximum Junction Temperature	T <sub>JMAX</sub>	+150	°C

<sup>\*1</sup> Pd, ASO, and Tj=150°C should not be exceeded.<sup>\*2</sup> IC only.<sup>\*3</sup> 1 layer, mounted on a board 74.2mm×74.2mm×1.6mm Glass-epoxy PCB (Copper foil area : 10.29mm<sup>2</sup>)<sup>\*4</sup> 4 layers, mounted on a board 74.2mm×74.2mm×1.6mm Glass-epoxy PCB(Copper foil area : 10.29mm<sup>2</sup>), copper foil in each layers.<sup>\*5</sup> 4 layers, mounted on a board 74.2mm×74.2mm×1.6mm Glass-epoxy PCB(Copper foil area : 5505mm<sup>2</sup>), copper foil in each layers.

## ○OPERATING CONDITIONS (Ta=-40~+105°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	V <sub>CC</sub>	4.5	8.0	13.2	V
Power Supply Voltage	P <sub>VCC</sub>	4.5	8.0	13.2	V
EN Voltage	V <sub>EN</sub>	0	-	V <sub>CC</sub>	V
Output Voltage Range	V <sub>OUT</sub>	3.0	-	6.0 <sup>*6</sup>	V
SW Average Output Current	I <sub>SW</sub>	-	-	2.0 <sup>*7</sup>	A

<sup>\*6</sup> V<sub>CCMIN</sub>=V<sub>OUT</sub>+1.3V.<sup>\*7</sup> Pd and ASO should not be exceeded.

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 protection against radioactive rays.

Status of this document

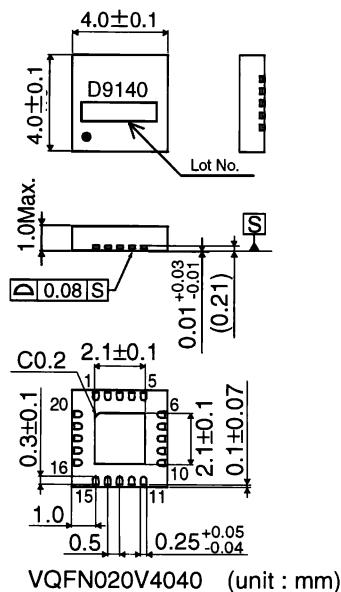
The Japanese version of this document is the formal specification. A customer may use this translation version only for a reference to help reading the formal version. If there are any differences in translation version of this document, formal version takes priority.

## ○ELECTRICAL CHARACTERISTICS

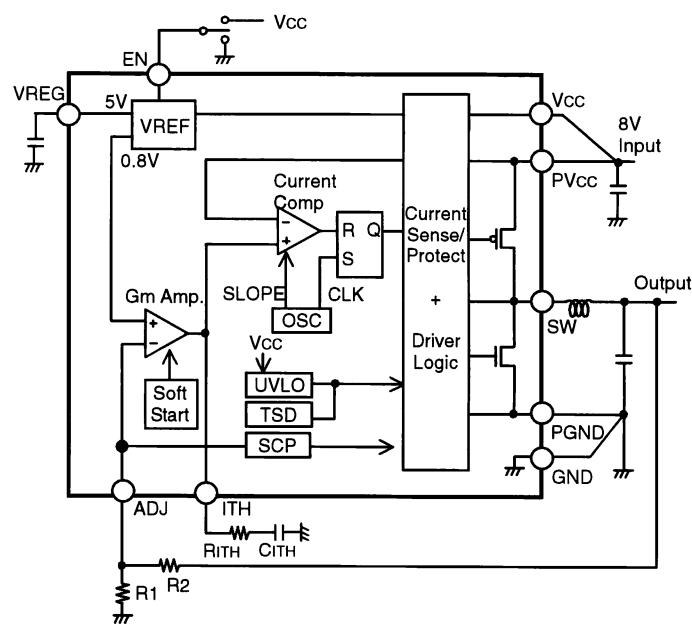
(Unless otherwise specified,  $T_a=25^\circ\text{C}$   $V_{CC}=PV_{CC}=8\text{V}$ ,  $EN=V_{CC}$ ,  $R_1=8.2\text{k}\Omega$ ,  $R_2=43\text{k}\Omega$ )

Parameter	Symbol	Limit			Unit	Condition
		Min.	Typ.	Max.		
Standby Current	ISTB	-	0	10	$\mu\text{A}$	EN=GND
Bias Current	ICC	-	300	500	$\mu\text{A}$	
EN Low Voltage (Stand-by Mode)	VENL	-	GND	0.8	V	
EN High Voltage (Active Mode)	VENH	2.0	V <sub>CC</sub>	-	V	
EN Input Current	IEN	-	1.6	10	$\mu\text{A}$	VEN=8V
Oscillation Frequency	FOSC	400	500	600	kHz	
Highside FET ON Resistance <sup>1</sup>	RONH	-	150	300	$\text{m}\Omega$	PV <sub>CC</sub> =8V
Lowside FET ON Resistance <sup>1</sup>	RONL	-	80	160	$\text{m}\Omega$	PV <sub>CC</sub> =8V
ADJ Reference Voltage	VADJ	0.788	0.800	0.812	V	
ITH SINK Current	ITHSI	10	20	-	$\mu\text{A}$	VADJ=1.0V
ITH Source Current	ITHSO	10	20	-	$\mu\text{A}$	VADJ=0.6V
UVLO Threshold Voltage	VUVLO1	3.90	4.10	4.30	V	V <sub>CC</sub> =8V $\rightarrow$ 0V
UVLO Release Voltage	VUVLO2	3.95	4.20	4.50	V	V <sub>CC</sub> =0V $\rightarrow$ 8V
Soft Start Time	TSS	0.5	1	2	ms	
Timer Latch Time	TLATCH	1	2	3	ms	SCP/TSD Operated
Output Short circuit Threshold Voltage	TSCP	-	0.4	0.56	V	VADJ=0.8V $\rightarrow$ 0V

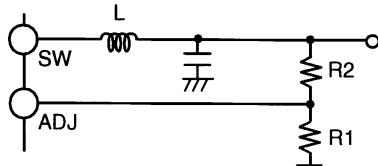
## ○PHYSICAL DIMENSION



## ○BLOCK DIAGRAM • APPLICATION CIRCUIT



## ○ SETTING THE OUTPUT VOLTAGE



The Output Voltage is set by the external resistor divider and is calculated as :

$$V_{out} = (R_2/R_1 + 1) \times V_{ADJ} \quad \dots \quad ①$$

V<sub>ADJ</sub> : ADJ pin reference Voltage (0.8V typ)

It's possible to adjust the output voltage by R<sub>1</sub> and R<sub>2</sub>.  
(The V<sub>out</sub> must be set from 3.0V to 6.0V.)

Resistance R<sub>1</sub> ≈ 10k $\Omega$  is recommended. Please confirm the ripple voltage, if you can use the resistance more than 100k $\Omega$ .

## ○PIN No., PIN NAME

pin no	PIN NAME	pin no	PIN NAME
1	SW	11	GND
2	SW	12	ADJ
3	SW	13	ITH
4	SW	14	VREG
5	SW	15	N.C.
6	PVCC	16	N.C.
7	PVCC	17	EN
8	PVCC	18	PGND
9	N.C.	19	PGND
10	VCC	20	PGND

○ NOTES FOR USE

(1) Absolute Maximum Ratings

We are careful enough for quality control about this IC. So, there is no problem under normal operation, excluding that it exceeds the absolute maximum ratings. However, this IC might be destroyed when the absolute maximum ratings, such as impressed voltages or the operating temperature range, is exceeded, and whether the destruction is short circuit mode or open circuit mode cannot be specified. Please take into consideration the physical countermeasures for safety, such as fusing, if a particular mode that exceeds the absolute maximum rating is assumed.

(2) GND Potential

Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage except for SW, PGND, GND terminals including an actual electric transient.

(3) Thermal design

Do not exceed the power dissipation (Pd) of the package specification rating under actual operation, and please design enough temperature margins.

(4) Short circuit mode between terminals and wrong mounting

In order to mount the IC on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can destroy the IC. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the IC can destroy.

(5) Operation in Strong electromagnetic field

Be noted that using the IC in the strong electromagnetic radiation can cause operation failures.

(6) ASO(Area of Safety Operation.)

Do not exceed the maximum ASO and the absolute maximum ratings of the output driver.

(7) TSD(Thermal Shut-Down) circuit

The thermal shutdown circuit (TSD circuit) is built in this product. When IC chip temperature becomes higher, the thermal shutdown circuit operates and turns output off. The guarantee and protection of IC are not purpose. Therefore, please do not use this IC after TSD circuit operates, nor use it for assumption that operates the TSD circuit.

(8) GND wiring pattern

Use separate ground lines for control signals and high current power driver outputs. Because these high current outputs that flows to the wire impedance changes the GND voltage for control signal. Therefore, each ground terminal of IC must be connected at the one point on the set circuit board. As for GND of external parts, it is similar to the above-mentioned.

(9) Operation in supply voltage range

Functional Circuit operation is guaranteed within operation ambient temperature, as long as it is within operation supply voltage range. The electrical characteristics standard value cannot be guaranteed. However, there is no drastic variation in these values, as long as it is within operation supply voltage range.

(10) We are confident in recommending the above application circuit example, but we ask that you carefully check the characteristics of this circuit before using it. If using this circuit after modifying other external circuit constants, be careful to ensure adequate margins for variation between external devices and this IC, including not only static characteristics but also transient characteristics. If switching noise is high, please insert the Low pass filter between Vcc pin and PVcc pin, insert the schottky barrier diodes between SW pin and PGND pin.

(11) Overcurrent protection circuit

The overcurrent protection circuit is built in the output. If the protection circuit operates more than for specific hours (when the load is short.), the output will be latched in OFF. The output returns when EN is turned on or UVLO is released again. These protection circuits are effective in the destruction prevention by broken accident. Please do not use in continuous circuit operation.

**(12) Selection of inductor**

It is recommended to use an inductor with a series resistance element (DCR)  $0.1\Omega$  or less. When using an inductor over  $0.1\Omega$ , be careful to ensure adequate margins for variation between external devices and this IC, including transient as well as static characteristics. Furthermore, in any case, it is recommended to start up the output with EN after supply voltage is within operation range.

## Appendix

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