

# SANYO Semiconductors DATA SHEET

**Bi-CMOS IC** 

# LV5068V

# Low power consumption and high efficiency Step-down Switching Regulator Controller

#### Overview

LV5068V is 1ch step-down switching regulator. The operation current is about  $80\mu A$ , and low power consumption is achieved.

#### **Functions**

- 1ch SBD rectification controller IC
- Maximum value of light load mode current is 80µA.
- Built-in OCP circuit with P-by-P method
- When P-by-P is generated continuously, it shifts to the HICCUP operation.
- If connect C-HICCUP to GND pin, then latch-off when over current.
- The oscillatory frequency can be set by the external pin. The oscillatory frequency is 300 kHz to 2.2MHz
- Built-in UVLO, TSD
- Synchronous driving with external signal

#### **Specifications**

**Maximum Ratings** at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	V <sub>IN</sub> max		45	V
Allowable pin voltage	PDR,HDRV,RSNS, ILIM,EN,PG		V <sub>IN</sub>	V
	V <sub>IN</sub> -PDR		6	V
	REF		6	V
	SS,FB,COMP,RT C-HICCUP,SYNC		REF	V
Allowable power dissipation	Pd max	Specified substrate *1	0.74	W
Operating temperature	Topr		-40 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

<sup>\*1:</sup> Specified substrate 114.3mm×76.1mm×1.6mm<sup>3</sup> glass-epoxy

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# LV5068V

# Recommended Operating Conditions at $Ta=25^{\circ}C$

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage range	VIN		4.5 to 40	V

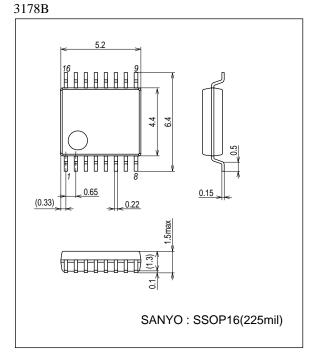
### **Electrical Characteristics** at Ta = 25 °C, $V_{\mbox{\footnotesize{IN}}} = 15 V$

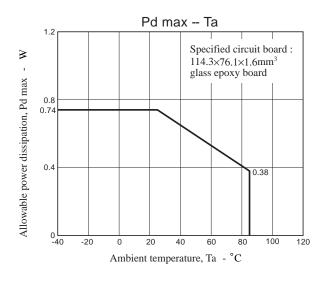
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Parameter	Symbol Condit	Conditions	ions	Ratings		Unit	
	Conditions		min	typ	max	J	
Reference voltage			<u>,                                      </u>				
Internal reference voltage	Vref		1.241	1.260	1.279	V	
Pch drive voltage	V <sub>PDR</sub>	I <sub>OUT</sub> =0 to -5mA	V <sub>IN</sub> -5.5	V <sub>IN</sub> -5.0	V <sub>IN</sub> -4.5	V	
Saw wave oscillator							
Oscillatory frequency	Fosc	RT=470kΩ	280	330	380	kHz	
ON/OFF circuit							
IC start-up voltage	VCNT_ON		1.5		$V_{\text{IN}}$	V	
Disable voltage	VCNT_OFF		0		0.3	V	
Soft start circuit							
Soft start source current	I <sub>SS</sub> _SC	EN>1.5V	1.3	2.0	2.7	μΑ	
Soft start sink current	I <sub>SS</sub> _SK	EN<0.3V, SS=4V	1.0	1.6	2.2	mA	
UVLO circuit							
UVLO release voltage	VUVLON	FB=COMP	3.3	3.7	4.1	V	
UVLO lock voltage	VUVLOF	FB=COMP	2.5	2.9	3.3	V	
Error amplifier			<u> </u>				
Input bias current	I <sub>EA</sub> _IN		-100	-50	100	nA	
Error amplifier gain	G <sub>EA</sub>		100	250	400	μΑ/V	
Output sink current	I <sub>EA</sub> _OSK	FB=1.75V	-40	-20	-10	μА	
Output source current	I <sub>ES</sub> _OSC	FB=0.75V	10	20	40	μА	
Over current limit circuit	20-					· · · · · ·	
Reference current	I <sub>LIM</sub> 1		48.4	55	61.6	μА	
Over current detection	V <sub>LIM_OFS</sub>		-5		+5	mV	
comparator offset voltage	LIN_OI 3						
RSNS pin input range	V <sub>RSNS</sub>		V <sub>IN</sub> -0.175		$V_{IN}$	V	
HICCUP timer start-up cycle	NLCYCLES			15		cycle	
HICCUP comparator threshold	V <sub>tHIC</sub>		1.2	1.26	1.32	V	
voltage							
HICCUP timer change current	IHIC		1	2	3	μА	
PWM comparator	T		, , , , , , , , , , , , , , , , , , ,				
Maximum On-duty	D max		95			%	
Logic output							
Power good "L" sink current	I <sub>PWRGD_</sub> L	PG=5V	4	5	6	mA	
Power good "H" leakage current	I <sub>PWRGD_</sub> H	PG=5V	0		1	μΑ	
Power good threshold voltage	V <sub>tPG</sub>		1.0	1.1	1.2	V	
Power good hysteresis	V <sub>PG</sub> _H		40	50	60	mV	
Output							
Output on-resistance (High)	R <sub>ON</sub> H			3		Ω	
Output on-resistance (Low)	R <sub>ON</sub> L			3		Ω	
Output on-current (High)	I <sub>ON</sub> H		500			mA	
Output on-current (Low)	I <sub>ON</sub> L		500			mA	
The entire device							
Stand-by current	Iccs	EN<0.3V	0		1	μА	
Light load mode consumption	I <sub>SLEEP</sub> 1	EN>1.5V,	30	55	80	μА	
current		No switching					
Thermal shutdown	TSD	*2	150	170	190	$^{\circ}\mathrm{C}$	

<sup>\*2:</sup> Design certification

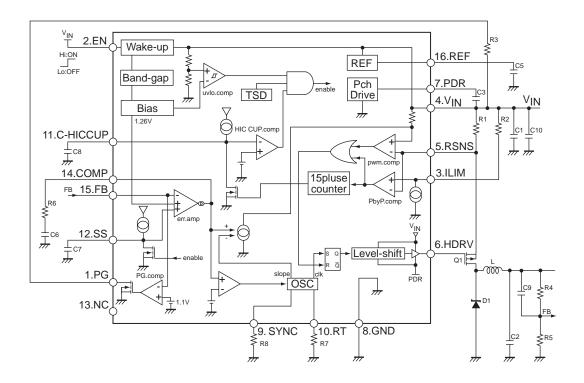
#### **Package Dimensions**

unit: mm (typ)

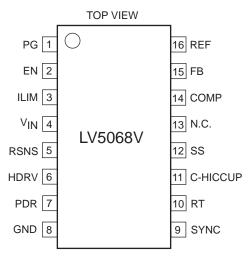




# **Block Diagram**



# **Pin Assignment**



### **Pin Descriptions**

	Fill Descriptions					
Pin No.	Pin name	Descriptions	Equivalent circuit			
1	PG	Power good pin. Connect to open drain of MOS-FET in ICs inside. Setting output voltage to "L", when FB voltage is 1.05V or less	PG \$ 1kΩ			
2	EN	ON/OFF pin	V <sub>IN</sub> 4.8MΩ 5			
3	ILIM	For current detection. Sink current is about $55\mu A$ . The current limiter comparator works when an external resistor is connected between this pin and $V_{1N}$ , and if the voltage of this resistor is less than the voltage of RSNS then Pch MOS is turned off. This operation is reset each PWM pulse.	$\begin{array}{c c} V_{\text{IN}} & & & \\ \hline & 5k\Omega \\ \hline & 1k\Omega \\ \hline & & \\ \end{array}$			
4	VIN	Supply voltage pin. It is observed by the UVLO function. When its voltage becomes 3.7V or more, ICs startup in soft start.	VIN ————————————————————————————————————			
5	RSNS	Current detection resistor connection pin. Resistor is connected between V <sub>IN</sub> and this pin, and the current flows to MOSFET are measured.	RSNS $5k\Omega$ GND			

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Pin No.	Pin name	Descriptions	Equivalent circuit
6	HDRV	The external high-side MOSFET gate drive pin.	VIN \$130kΩ HDRV PDR
7	PDR	Gate drive voltage of the external Pch MOSFET. Meanwhile, the bypass capacitor is connected between $V_{\mbox{\scriptsize IN}}$ and this pin.	1.3MΩ \$ 1.5MΩ \$ 10kΩ \$ 10kΩ \$ FDR
8	GND	Ground Pin. Ground pin voltage is reference voltage.	V <sub>IN</sub> ————————————————————————————————————
9	SYNC	Pin of using combined of external synchronous signal input pin	SYNC 1kΩ GND
10	RT	Oscillation frequency setting pin. Resistor is connected between this pin and GND.	VIN 1kΩ RT
11	C-HICCUP	It is capacitor connection pin for setting re-startup cycle in HICCUP mode.  If connect it to GND pin, then latch-off when over current.	C-HICCUP W
12	SS	Capacitor connection pin for soft start. About 2μA current charges the soft start capacitor.	$V_{\text{IN}}$ $1k\Omega$ $10k\Omega$ $1k\Omega$ $10k\Omega$
13	NC	NC pin.	

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Pin No.	Pin name	Descriptions	Equivalent circuit
14	COMP	Error Amplifier Output Pin.  The phase compensation network is connected between GND pin and COMP pin.  Thanks to current-mode control, COMP pin voltage would tell you the output current amplitude. COMP pin is connected internally to an int.comparator which comparators with 0.9V reference. If COMP pin voltage is larger than.  0.9V, IC operates in "continuous mode". If COMP pin voltage is smaller than 0.9V, IC operates in "discontinuous mode (low consumption mode)".	$\begin{array}{c} V_{\text{IN}} \\ \hline \\ 70\text{k}\Omega \\ \hline \\ \text{S}1\text{k}\Omega \\ \hline \\ \text{GND} \\ \end{array}$
15	FB	Error amplifier reverse input pin. ICs make its voltage keep 1.26V. Output voltage is divided by external resistors and it across FB.	$V_{\text{IN}}$ $10k\Omega$ $1k\Omega$ $1k\Omega$ $1k\Omega$ $1k\Omega$
16	REF	Reference voltage.	$V_{\text{IN}}$ REF $10\Omega$ $10\Omega$ $10\Omega$ $51k\Omega$ $10\Omega$ $10$

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