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# LV5061V

Bi-CMOS IC

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

### Overview

LV5061V is 1ch step-down switching regulator. The operation current is about 90 $\mu$ A, and low power consumption is achieved.

### Functions

- 1ch SBD rectification controller IC
- Maximum value of light load mode current is 90 $\mu$ A.
- 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

### Specifications

**Maximum Ratings** at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	V <sub>IN</sub> max		22	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, C-HICCUP,RT		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

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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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## Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage range	V <sub>IN</sub>		4.5 to 18	V

## Electrical Characteristics at Ta = 25°C, V<sub>IN</sub> = 15V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
<b>Reference voltage</b>						
Internal reference voltage	V <sub>ref</sub>		1.235	1.260	1.285	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
<b>Saw wave oscillator</b>						
Oscillatory frequency	F <sub>OSC</sub>	RT=470kΩ	280	330	380	kHz
<b>ON/OFF circuit</b>						
IC start-up voltage	V <sub>CNT_ON</sub>		1.5		V <sub>IN</sub>	V
Disable voltage	V <sub>CNT_OFF</sub>				0.3	V
<b>Soft start circuit</b>						
Soft start source current	I <sub>SS_SC</sub>	EN>1.5V	1.3	2.0	2.7	μA
Soft start sink current	I <sub>SS_SK</sub>	EN>1.5V, I <sub>LIM</sub> >RSNS SS=4V at HICCUP	1.2	2.0	2.8	mA
<b>UVLO circuit</b>						
UVLO release voltage	V <sub>UVLON</sub>	FB=COMP	3.0	3.4	3.8	V
UVLO lock voltage	V <sub>UVLOF</sub>	FB=COMP	2.5	2.9	3.3	V
<b>Error amplifier</b>						
Input bias current	I <sub>EA_IN</sub>		-100	-50	100	nA
Error amplifier gain	G <sub>EA</sub>		100	250	400	μA/V
Output sink current	I <sub>EA_OS</sub>	FB=1.75V	-40	-20	-10	μA
Output source current	I <sub>ES_OS</sub>	FB=0.75V	10	20	40	μA
<b>Over current limit circuit</b>						
Reference current	I <sub>LIM1</sub>		48.4	55	61.6	μA
Over current detection comparator offset voltage	V <sub>LIM_OFS</sub>		-5		+5	mV
RSNS pin input range	V <sub>RSNS</sub>		V <sub>IN</sub> -0.175		V <sub>IN</sub>	V
HICCUP timer start-up cycle	N <sub>L</sub> CYCLES			15		cycle
HICCUP comparator threshold voltage	V <sub>IHIC</sub>		1.2	1.26	1.32	V
HICCUP timer change current	I <sub>IHIC</sub>		1	2	3	μA
<b>PWM comparator</b>						
Maximum On-duty	D max		95			%
<b>Logic output</b>						
Power good "L" sink current	I <sub>PWRGD_L</sub>	PG=5V	4	5	6	mA
Power good "H" leakage current	I <sub>PWRGD_H</sub>	PG=5V			1	μA
Power good threshold voltage	V <sub>IPG</sub>		1.0	1.1	1.2	V
Power good hysteresis	V <sub>PG_H</sub>		40	50	60	mV
<b>Output</b>						
Output on-resistance (High)	R <sub>ONH</sub>			3		Ω
Output on-resistance (Low)	R <sub>ONL</sub>			3		Ω
Output on-current (High)	I <sub>ONH</sub>		500			mA
Output on-current (Low)	I <sub>ONL</sub>		500			mA
<b>The entire device</b>						
Stand-by current	I <sub>CCS</sub>	EN<0.3V			1	μA
Light load mode consumption current	I <sub>SLEEP1</sub>	EN>1.5V, No switching	50	70	90	μA
Thermal shutdown	TSD	*2		170		°C

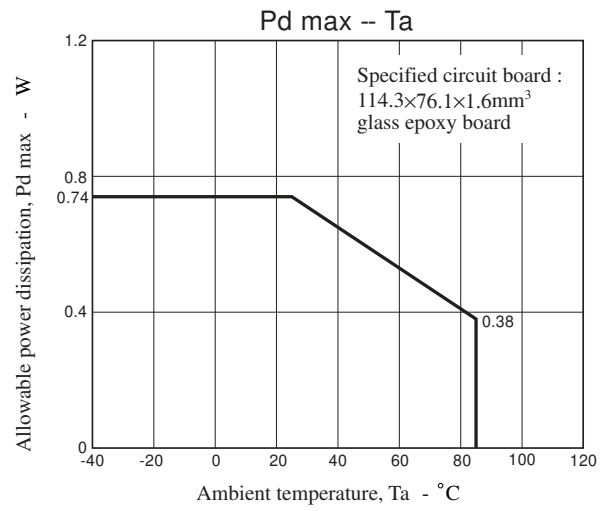
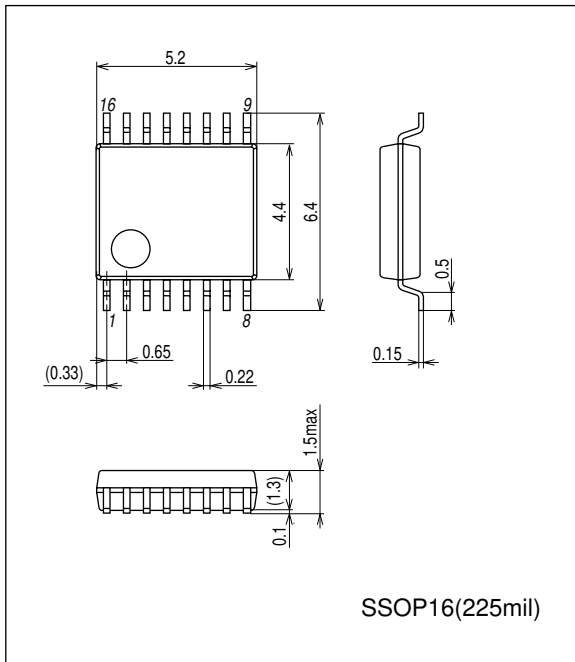
\*2: Design certification

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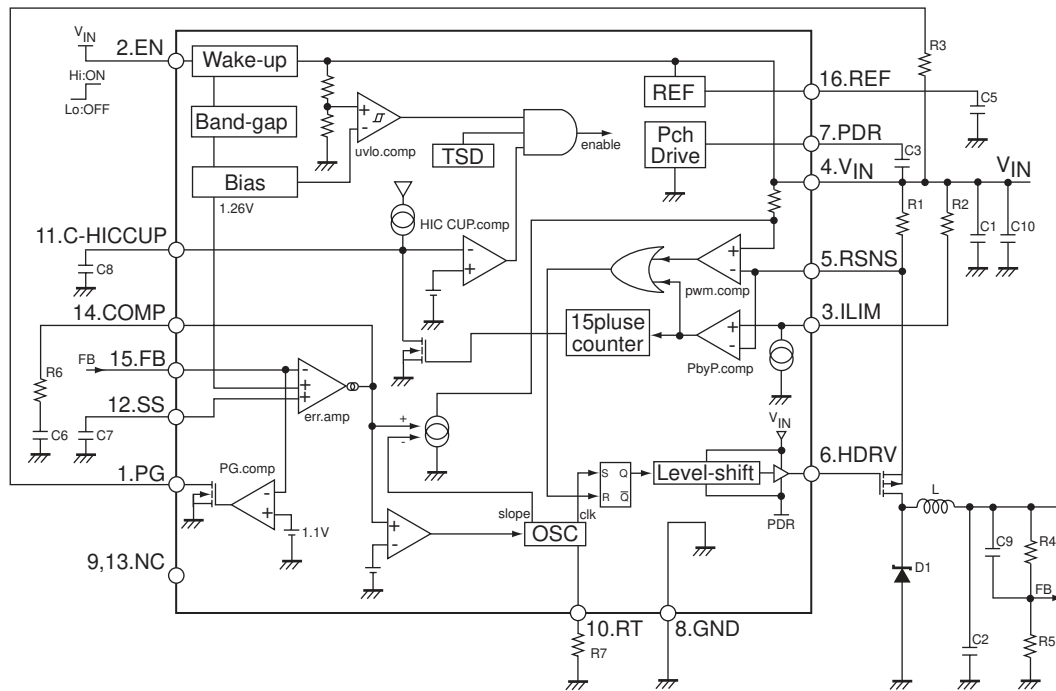
## Package Dimensions

unit : mm (typ)

3178B

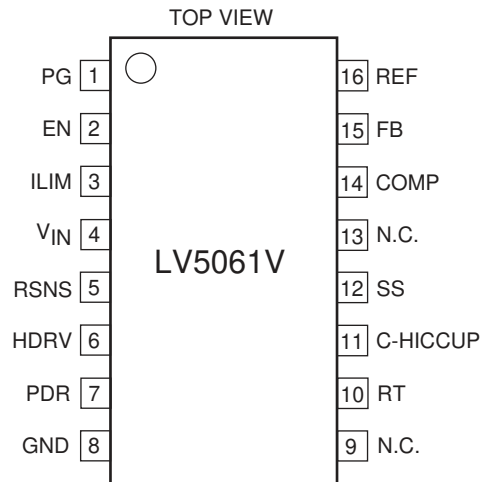


## Block Diagram



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## Pin Assignment



## Pin 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	
2	EN	ON/OFF pin	
3	ILIM	For current detection. Sink current is about 55μA. The current limiter comparator works when an external resistor is connected between this pin and V <sub>IN</sub> , 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.	
4	V <sub>IN</sub>	Supply voltage pin. It is observed by the UVLO function. When its voltage becomes 3.4V or more, ICs startup in soft start.	
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.	

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Pin No.	Pin name	Descriptions	Equivalent circuit
6	HDRV	The external high-side MOSFET gate drive pin.	
7	PDR	Gate drive voltage of the external Pch MOSFET. Meanwhile, the bypass capacitor is connected between $V_{IN}$ and this pin.	
8	GND	Ground Pin. Ground pin voltage is reference voltage.	
9	NC	N.C. pin.	
10	RT	Oscillation frequency setting pin. Resistor is connected between this pin and GND.	
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.	
12	SS	Capacitor connection pin for soft start. About 2μA current charges the soft start capacitor.	
13	NC	NC pin.	
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)".	

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Pin No.	Pin name	Descriptions	Equivalent circuit
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.	
16	REF	Reference voltage.	

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