



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

## LV5990M

Bi-CMOS IC

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

### Overview

LV5990M is 1ch DC-DC converter with built-in power Pch MOS transistor. The recommended operating range is 4.5V to 18V. The maximum current is 3A. The operating current is about 90 $\mu$ A, and low power consumption is achieved.

### Functions

- 1ch SBD rectification DC-DC converter IC with built-in power Pch MOS transistor
- 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 is 360kHz.
- UVLO and built-in 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	SW		30	V
	EN, PG		V <sub>IN</sub>	V
	PDR		V <sub>IN</sub> -6	V
	REF		6	V
	SS,FB,COMP C-HICCUP		REF	V
Allowable power dissipation	Pd max	specified substrate *	1.05	W
Operating temperature	Topr		-40 to 85	°C
Storage temperature	Tstg		-55 to 150	°C

\* Specified board: 40.0mm × 30.0mm × 1.6mm, glass epoxy.

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# LV5990M

## Recommended Operating Conditions at Ta = 25°C

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

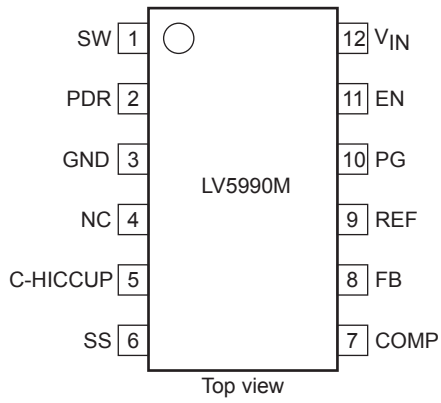
## Electrical Characteristics at Ta = 25°C, V<sub>IN</sub> = 15V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
<b>Reference voltage</b>						
Internal reference voltage	VREF		1.235	1.260	1.285	V
Pch drive voltage	VPDR	I <sub>OUT</sub> =0 to -5mA	V <sub>CC</sub> -5.5	V <sub>CC</sub> -5.0	V <sub>CC</sub> -4.5	V
<b>Saw wave oscillator</b>						
Oscillatory frequency	F <sub>OSC</sub>		300	360	420	kHz
<b>ON/OFF circuit</b>						
IC startup voltage (EN pin)	V <sub>CNT_ON</sub>		1.5		V <sub>IN</sub>	V
Disable voltage (EN pin)	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	3	μA
Soft start sink current	I <sub>SS_SK</sub>	EN<0.3V, SS=0.4V	120	150	180	μA
<b>UVLO circuit</b>						
UVLO release voltage	V <sub>UVLO_N</sub>	FB=COMP	3.0	3.4	3.8	V
UVLO lock voltage	V <sub>UVLO_F</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_OSK</sub>	FB=1.75V	-40	-20	-10	μA
Output source current	I <sub>EA_OSC</sub>	FB=0.75V	10	20	40	μA
<b>Over current limit circuit</b>						
Current limit peak	I <sub>CL</sub>		3.2	4.7	6.2	A
HICCUP timer start-up cycle	N <sub>LCYCLES</sub>			15		cycle
HICCUP comparator threshold voltage	V <sub>tHIC</sub>		1.20	1.26	1.32	V
HICCUP timer charge current	I <sub>HIC</sub>		1	2	3	μA
<b>PWM comparator</b>						
Maximum on-duty	D <sub>MAX</sub>		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 FB voltage	V <sub>tPG</sub>		1.0	1.1	1.2	V
Power good hysteresis	V <sub>PG_H</sub>		40	50	60	mV
Power good impedance	R <sub>PG</sub>			1		kΩ
<b>Output</b>						
Output on-resistance	R <sub>ON</sub>	I <sub>O</sub> =1A		150		mΩ
<b>The entire device</b>						
Standby current	I <sub>CCS</sub>	EN<0.3V			1	μA
Light load mode consumption current	I <sub>sleep1</sub>	EN>1.5V, I <sub>LOAD</sub> =0, No oscillatory -20°C≤Ta≤70°C *	50	70	90	μA
Thermal shutdown	TSD	*		170		°C

\*: Design certification

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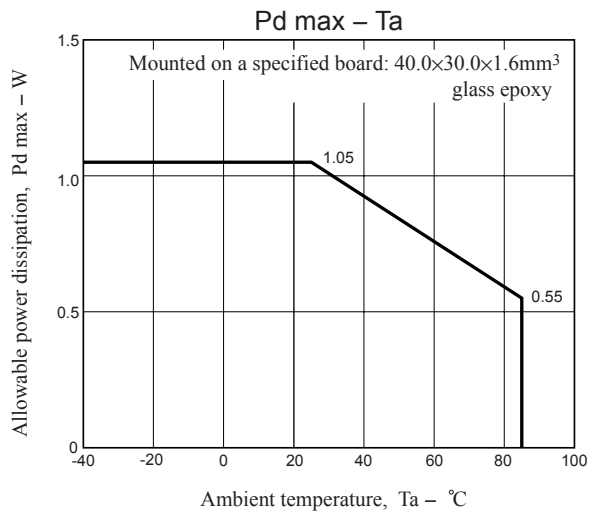
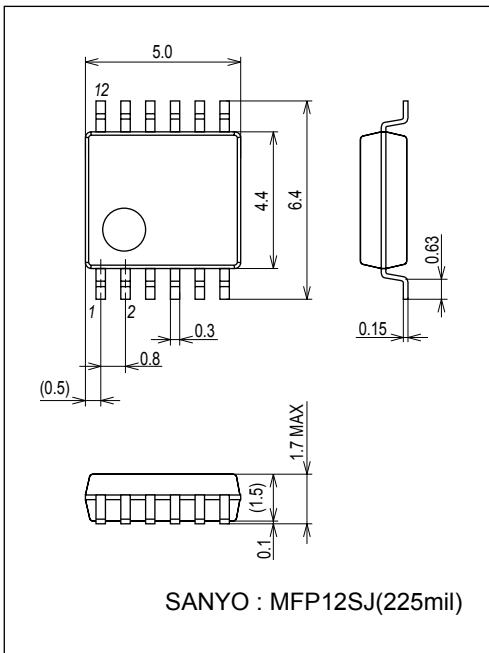
## Pin Assignment



## Package Dimensions

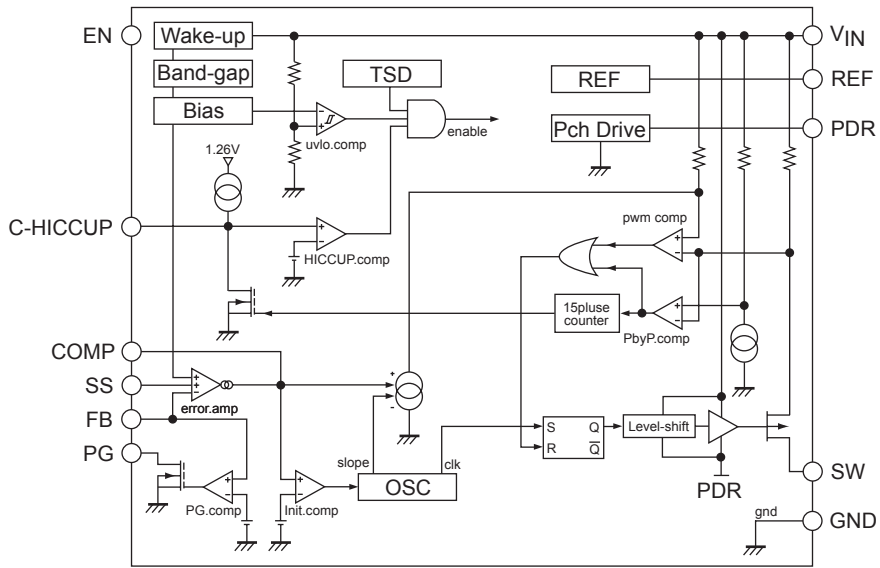
unit : mm (typ)

3403

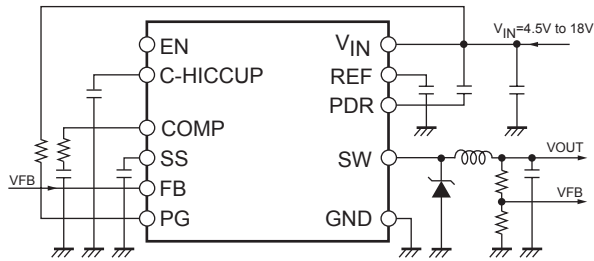


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## Block Diagram



## Application Circuit



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## Pin Function

Pin No.	Pin name	Function	Equivalent circuit
1	SW	High-side Pch MOSFET drain pin	
2	PDR	Pch MOSFET gate drive voltage The bypass capacitor is necessarily connected between this pin and $V_{IN}$ .	
3	GND	Ground pin. Ground pin voltage is reference voltage.	
12	$V_{IN}$	Supply voltage pin. It is observed by the UVLO function. When its voltage becomes 3.4V or more, ICs startup in soft start.	
5	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.	
6	SS	Capacitor connection pin for soft start. About 2μA current charges the soft start capacitor.	
7	COMP	Error amplifier output pin. The phase compensation network is connected between GND pin and COMP pin.	
8	FB	Error amplifier reverse input pin. ICs make its voltage keep 1.26V. Output voltage is divided by external resistances and it across FB.	

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Pin No.	Pin name	Function	Equivalent circuit
9	REF	Reference voltage	
10	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.	
11	EN	ON/OFF pin.	

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