



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 μ 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 μ 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 _{IN} -max | | 22 | V |
| Allowable pin voltage | SW | | 30 | V |
| | EN, PG | | V _{IN} | V |
| | PDR | | V _{IN} -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.

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment (home appliances, AV equipment, communication device, office equipment, industrial equipment etc.). The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for applications outside the standard applications of our customer who is considering such use and/or outside the scope of our intended standard applications, please consult with us prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

SANYO Semiconductor Co., Ltd.

<http://semicon.sanyo.com/en/network>

LV5990M

Recommended Operating Conditions at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---------------------|-----------------|------------|-----------|------|
| Input voltage range | V _{IN} | | 4.5 to 18 | V |

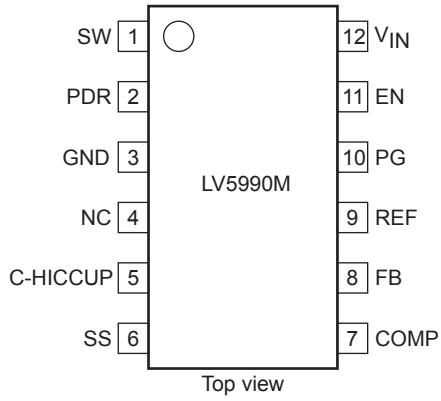
Electrical Characteristics at Ta = 25°C, V_{IN} = 15V

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|-------------------------------------|----------------------|--|----------------------|----------------------|----------------------|-------|
| | | | min | typ | max | |
| Reference voltage | | | | | | |
| Internal reference voltage | VREF | | 1.235 | 1.260 | 1.285 | V |
| Pch drive voltage | VPDR | I _{OUT} =0 to -5mA | V _{CC} -5.5 | V _{CC} -5.0 | V _{CC} -4.5 | V |
| Saw wave oscillator | | | | | | |
| Oscillatory frequency | F _{OSC} | | 300 | 360 | 420 | kHz |
| ON/OFF circuit | | | | | | |
| IC startup voltage (EN pin) | V _{CNT_ON} | | 1.5 | | V _{IN} | V |
| Disable voltage (EN pin) | V _{CNT_OFF} | | | | 0.3 | V |
| Soft start circuit | | | | | | |
| Soft start source current | I _{SS_SC} | EN>1.5V | 1.3 | 2 | 3 | μA |
| Soft start sink current | I _{SS_SK} | EN<0.3V, SS=0.4V | 120 | 150 | 180 | μA |
| UVLO circuit | | | | | | |
| UVLO release voltage | V _{UVLO_N} | FB=COMP | 3.0 | 3.4 | 3.8 | V |
| UVLO lock voltage | V _{UVLO_F} | FB=COMP | 2.5 | 2.9 | 3.3 | V |
| Error amplifier | | | | | | |
| Input bias current | I _{EA_IN} | | -100 | -50 | 100 | nA |
| Error amplifier gain | G _{EA} | | 100 | 250 | 400 | μA/V |
| Output sink current | I _{EA_OSK} | FB=1.75V | -40 | -20 | -10 | μA |
| Output source current | I _{EA_OSC} | FB=0.75V | 10 | 20 | 40 | μA |
| Over current limit circuit | | | | | | |
| Current limit peak | I _{CL} | | 3.2 | 4.7 | 6.2 | A |
| HICCUP timer start-up cycle | N _{LCYCLES} | | | 15 | | cycle |
| HICCUP comparator threshold voltage | V _{thIC} | | 1.20 | 1.26 | 1.32 | V |
| HICCUP timer charge current | I _{HIC} | | 1 | 2 | 3 | μA |
| PWM comparator | | | | | | |
| Maximum on-duty | D _{MAX} | | 95 | | | % |
| Logic output | | | | | | |
| Power good "L" sink current | I _{pwrgd_L} | PG=5V | 4 | 5 | 6 | mA |
| Power good "H" leakage current | I _{pwrgd_H} | PG=5V | | | 1 | μA |
| Power good threshold FB voltage | V _{tPG} | | 1.0 | 1.1 | 1.2 | V |
| Power good hysteresis | V _{PG_H} | | 40 | 50 | 60 | mV |
| Power good impedance | R _{PG} | | | 1 | | kΩ |
| Output | | | | | | |
| Output on-resistance | R _{ON} | I _O =1A | | 150 | | mΩ |
| The entire device | | | | | | |
| Standby current | I _{CCS} | EN<0.3V | | | 1 | μA |
| Light load mode consumption current | I _{sleep1} | EN>1.5V, I _{LOAD} =0, No oscillatory -20°C≤Ta≤70°C * | 50 | 70 | 90 | μA |
| Thermal shutdown | TSD | * | | 170 | | °C |

*: Design certification

LV5990M

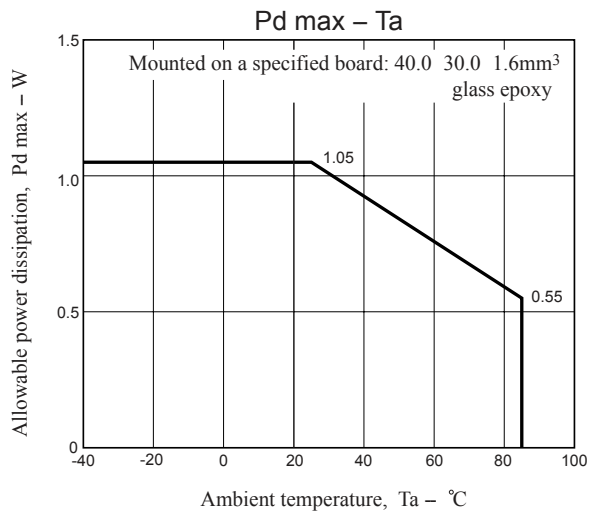
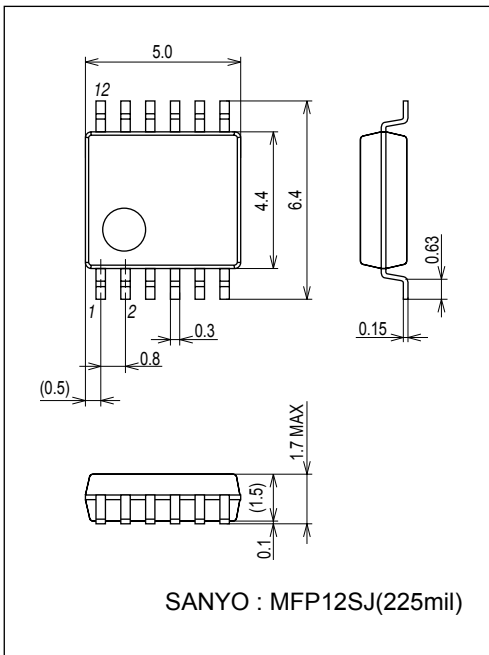
Pin Assignment



Package Dimensions

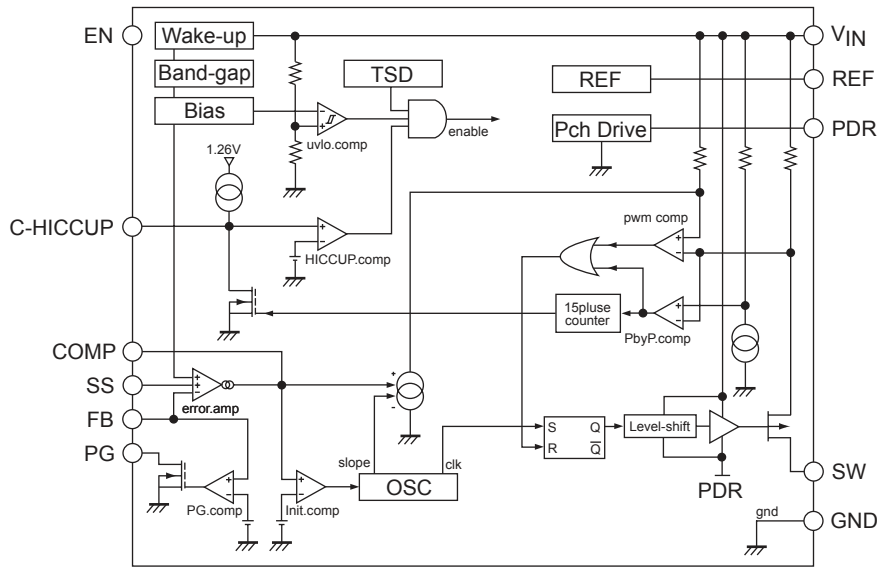
unit : mm (typ)

3403

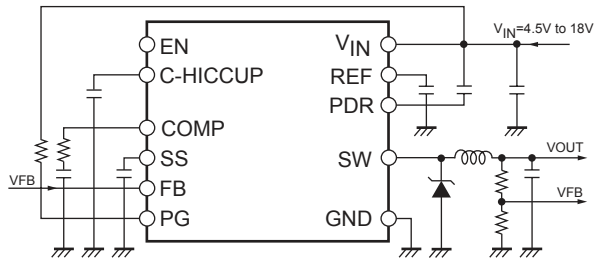


LV5990M

Block Diagram



Application Circuit



LV5990M

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. | |

Continued on next page.

LV5990M

Continued from preceding page.

| 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. | |

- SANYO Semiconductor Co.,Ltd. assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of October, 2010. Specifications and information herein are subject to change without notice.