Ordering number : ENA1714

SANYO Semiconductors
DATA SHEET

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Bi-CMOS IC

# LV5851M — Step-down Switching Regulator

## Overview

LV5851M is a chopper type 1ch step-down regulator incorporating the drive transistor.
For the LO side switch, the 0.03Ω, and HI side switch, the 0.06Ω resistance is incorporated, enabling driving of the output up to 3 A with high efficiency.
Being of a current mode control type, this product ensures satisfactory load current response and simple phase compensation. The fold-back function is provided as the protection in case of output over-current. This function reduces the frequency in case of over-current and thus reduce the inductor current. The overheat protection function is also provided. For the package, MFP8 without exposed-PAD has been employed.

## Functions

- 3A 1ch step-down switching regulator
- Input Voltage Range (5-18V)
- High efficiency: Max efficiency over 95%
- Compact package: MFP8 (225mil)
  (No backside heat sink)
- Synchronous rectification, Current Mode Operation
- High/Low impedance Switch:
  High-Side Switch: 60mΩ
  Low-Side Switch: 30mΩ
- Soft start time 7.5ms
- Over-current protection

## Specifications

**Maximum Ratings** at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Input voltage | $V_{IN}$-abs | | -0.3 to 20 | V |
| SW pin voltage | $V_{SW}$-abs | | -0.3 to $V_{IN}$+0.3 | V |
| EN pin voltage | $V_{EN}$-abs | | $V_{IN}$-abs | V |
| FB,COMP pin | | | -0.3 to 7 | V |
| Allowable power dissipation | Pd max | With specified board * | 1.0 | W |
| Junction temperature | Tj max | | 150 | °C |
| Operating temperature | Topr | | -30 to 85 | °C |
| Storage temperature | Tstg | | -40 to 150 | °C |

* Specified board: 31.0mm × 34.0mm ×1.7mm, glass epoxy.

**Recommended Operating Conditions** at Ta = 25°C

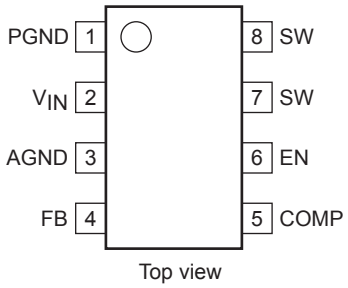
| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Input voltage | $V_{IN}$ | | 5 to 18 | V |
| SW pin voltage | $V_{SW}$ | | -0.3 to $V_{IN}$+0.3 | V |
| Output Voltage Range | | | 0.85 to 0.8$V_{IN}$ | V |
| Maximum Output Current | $I_O$ max | | 3 | A |

**Electrical Characteristics** at Ta = 25°C, $V_{IN}$ = 12V, $V_{OUT}$=5V, unless otherwise specified.

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Supply Voltage | $V_{IN}$ | | 5 | | 18 | V |
| Reference Voltage | $V_{FB}$ | | 0.825 | 0.835 | 0.845 | V |
| Starting input voltage | $V_{UVLO}1$ | | | 4.65 | 4.9 | V |
| Operation stop input voltage | $V_{UVLO}2$ | | 3.8 | 4.3 | | V |
| Feedback Voltage Input Current | $I_{FB}$ | | | 80 | | nA |
| IC operate current | $I_{IN}$ | FB=0.9V | | 3 | | mA |
| EN starting voltage | $V_{EN\_ON}$ | | 2 | | | V |
| EN stopping voltage | $V_{EN\_OFF}$ | | | | 0.6 | V |
| Load Regulation | | | | 0.5 | | % |
| Line Regulation | | | | 1 | | % |
| Switching frequency | $f_{OSC}$ | $V_{IN}$=12V, $I_O$=1.0A | 350 | 500 | 600 | kHz |
| Max Duty cycle | Dmax | | 80 | | | % |
| Min Duty cycle | Dmin | | | | 13.5 | % |
| Shut Down current | Isd | | | 180 | | μA |
| Soft Start Time | St | | 5 | 7.5 | 10 | ms |
| Internal MOS FET High Side ON-Resistance | $R_{ON}H$ | $V_{IN}$=12V | | 60 | 90 | mΩ |
| | | $V_{IN}$=5V | | 90 | 160 | mΩ |
| Internal MOS FET Low Side ON-Resistance | $R_{ON}L$ | $V_{IN}$=12V | | 30 | 50 | mΩ |
| | | $V_{IN}$=5V | | 50 | 90 | mΩ |
| Current limiter operating voltage | $I_S$ | $V_{IN}$=12V | | 4.5 | | A |
| | | $V_{IN}$=5V | | 4.0 | | A |
| Thermal shutdown operating temperature | TSD | *Design guarantee | | 160 | | °C |
| Thermal shutdown Hysteresis width | ΔTSD | *Design guarantee | | 50 | | °C |

*: Design guarantee (value guaranteed by design and not tested before shipment)

## Pin Assignment

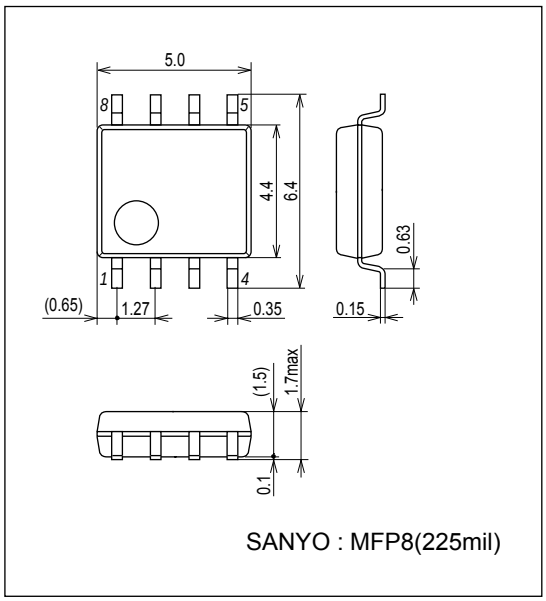


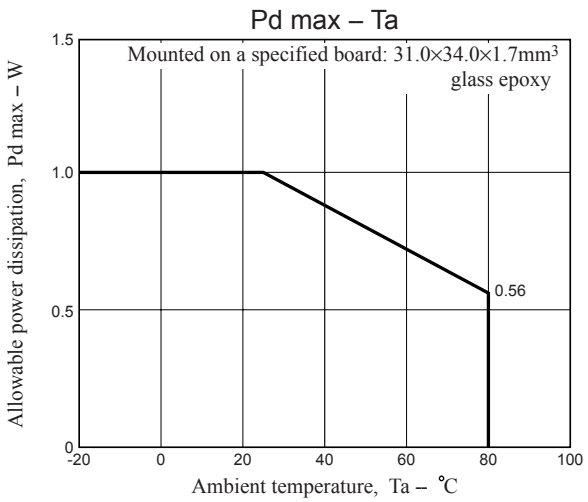
Top view

## Package Dimensions

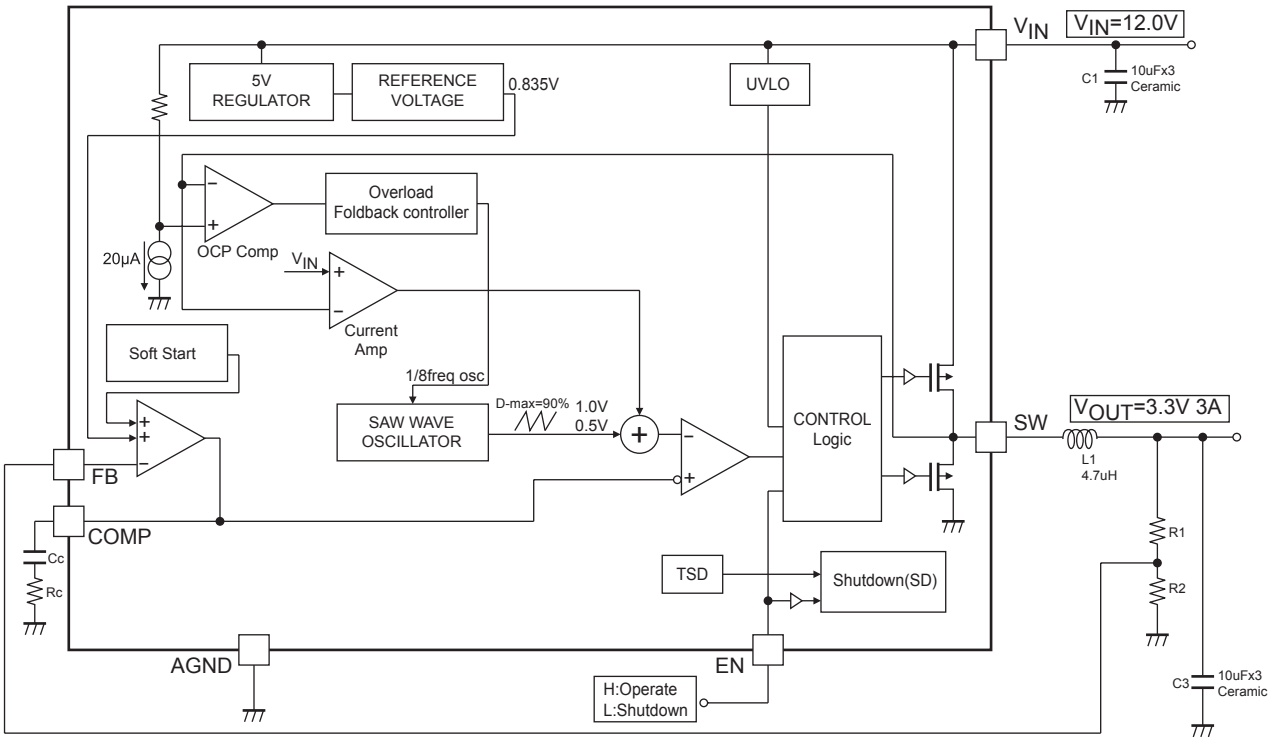
unit : mm (typ)

3032D

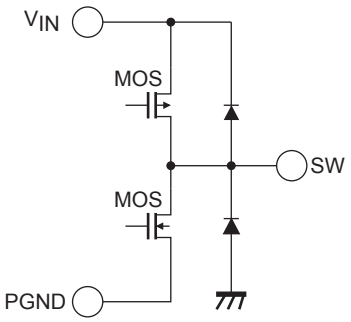
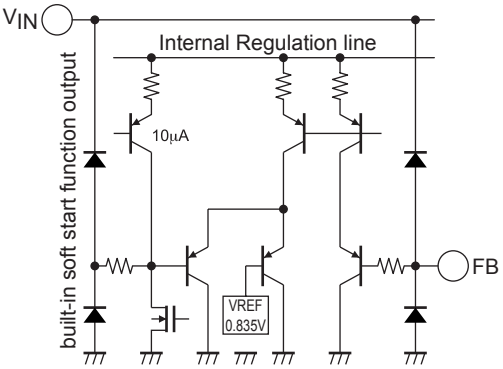
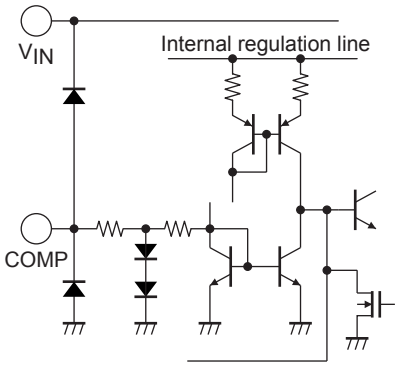
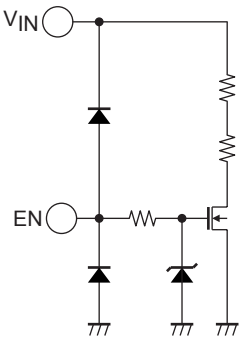



## Block Diagram and Sample Application Circuit



## Pin Function

| Pin No. | Pin name | Function | Equivalent circuit |
|---|---|---|---|
| 1 | PGND | Power Ground pin. Connect to AGND electrically. |  |
| 2 | $V_{IN}$ | Power supply pin.<br>Connect the sufficiently large capacitance (10μF x 3 parallel or more recommended for the output current of 3 A or more between this pin and GND).<br>With the pin voltage of 4.65V or more, the soft start function is activated and IC starts up slowly. When the pin voltage drops to 4.3 V or less, IC stops operation. | |
| 7, 8 | SW | Power Switching Output. Connect Inductor to this pin. | |
| 3 | AGND | Each reference voltage is based on the voltage of the AGND pin. | |
| 4 | FB | Error amplifier reverse input pin.<br>By operating the converter, the voltage of this pin becomes 0.835V.<br>The voltage in which the output voltage is divided by an external resistance is applied to this pin.<br>The output voltage is determined as the follow formula.<br>$V_{OUT}=Vref \times \{1+\frac{R1}{R2}\}$, Vre f= 0.835V<br>Example:3.3V Output voltage<br>(Refer to the Block Diagram and Sample Application Circuit)<br>$V_{OUT}=0.835V \times \{1+\frac{3.0k}{1.0k}\} = 3.340V$ |  |
| 5 | COMP | External loop compensation pin.<br>Connect with the phase compensation external capacitance and resistance of DC / DC converter close loop. |  |
| 6 | EN | ON / OFF pin [High : Operating / Low : Shutdown Open: forbidden]<br>Operate voltage: ≥ 2V<br>Shutdown voltage : ≥ 0.6V |  |

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