# LA5771MP

**Monolithic Linear IC**

# Separately-excited Step-down Switching Regulator (3.3V)

**ON Semiconductor®**

http://onsemi.com

## Overview

The LA5771MP is a separately-excited step-down switching regulator (3.3V).

## Features

- High efficiency
- Four external parts
- Time-base generator (160kHz) incorporated
- Current limiter incorporated
- Thermal shutdown circuit incorporated
- Soft start circuit incorporated

## Specifications

**Absolute Maximum Ratings** at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Input voltage | $V_{IN\ max}$ | | 30 | V |
| Output current | $I_{O\ max}$ | | 3 | A |
| SW pin application reverse voltage | Vsw | | -1 | V |
| Allowable power dissipation | Pd max | Mounted on the specified board * | 3.9 | W |
| Operating temperature | Topr | | -30 to +125 | °C |
| Storage temperature | Tstg | | -40 to +150 | °C |

* Mounted on a specified board: 114.3mm×76.1mm×1.6mm, Copper foil ratio 60% FR4

| |
|---|
| 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. |

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

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Input voltage range | $V_{IN}$ | | 5.5 to 28 | V |

# LA5771MP

## Electrical Characteristics at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings min | Ratings typ | Ratings max | Unit |
|---|---|---|---|---|---|---|
| Output voltage | $V_O$ | $V_{IN}$=15V, $I_O$=1.0A | 3.17 | 3.30 | 3.43 | V |
| Efficiency | η | $V_{IN}$=15V, $I_O$=1.0A | | 79 | | % |
| Switching frequency | f | $V_{IN}$=15V, $I_O$=1.0A | 128 | 160 | 192 | kHz |
| Line regulation | ΔVOLINE | $V_{IN}$=8 to 20V, $I_O$=1.0A | | 25 | 80 | mV |
| Load regulation | ΔVOLOAD | $V_{IN}$=15V, $I_O$=0.5 to 1.5A | | 10 | 30 | mV |
| Output voltage temperature coefficient | ΔVO/ΔTa | Designeed target value* | | ±0.5 | | mV/°C |
| Ripple attenuation factor | RREJ | F=100 to 120Hz | | 45 | | dB |
| Current limiter operating voltage | IS | $V_{IN}$=15V | 3.1 | | | A |
| Thermal shutdown operating temperature | TSD | Designed target value* | | 165 | | °C |
| Thermal shutdown hysteresis width | ΔTSD | Designed target value* | | 15 | | °C |

* Designed target value: No measurement made.

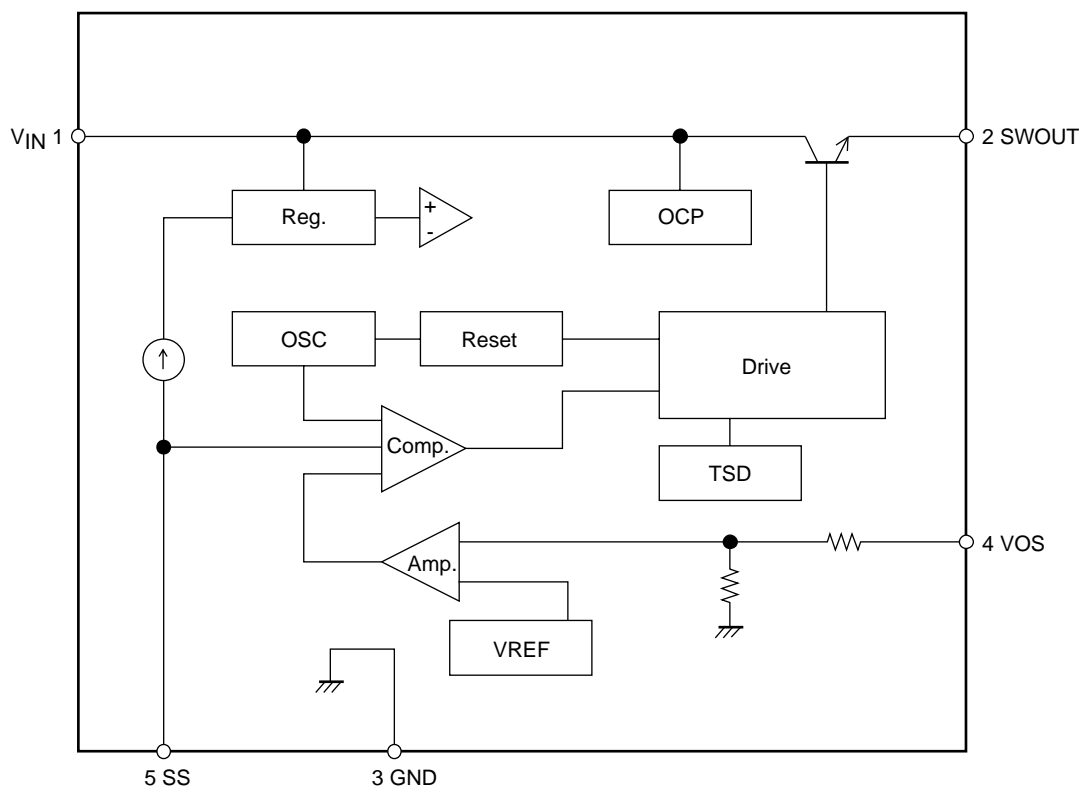## Package Dimensions

unit : mm (typ)
3275



SMP5

Pd max - Ta

Mounted on a specified board:
114.3mm×76.1mm×1.6mm,
Copper foil ratio 60% FR4

ILA07131
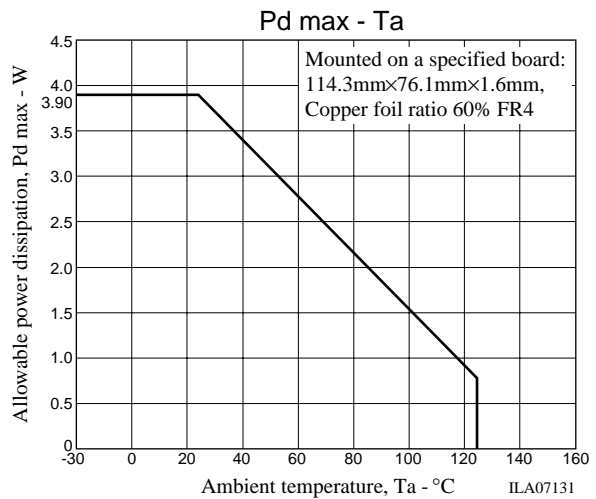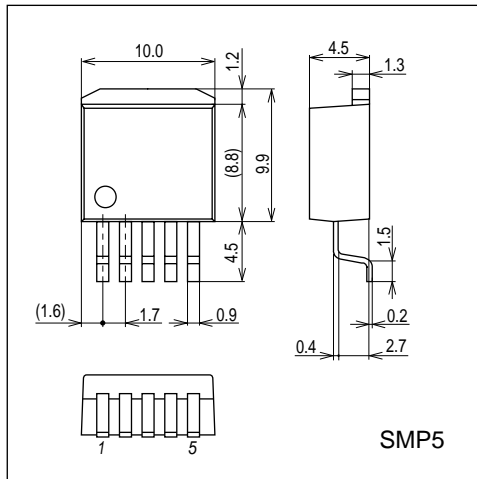
## Pin Assignment

①VIN ②SWOUT ③GND ④VOS ⑤SS

## Block Diagram



## Application Circuit Example



C1: 220μF/35V
C2: 1000μF/6.3V
C3: 1μF/50V
D1: SBD
L1: 68μH
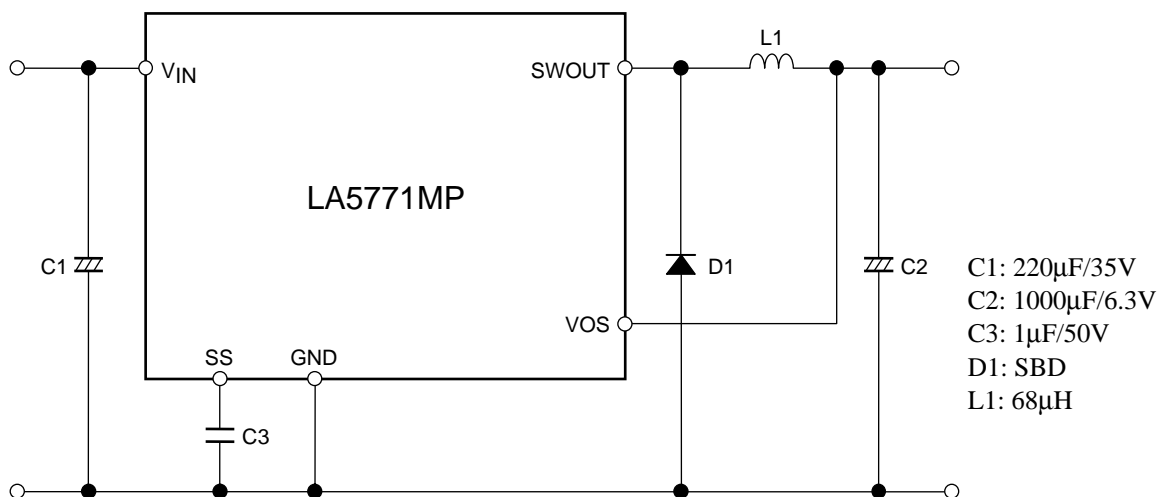
Notes: C3 is for the soft start function. Delete C3 and keep the SS pin open when the soft function is not necessary.

## Description of Functional Settings

1.Start delay function

The SS pin has the internally-connected 22μA (typ) constant-current supply. When the voltage of SS pin exceeds the threshold voltage, the regulator starts operation. As the threshold is 0.62V(typ), the start delay time can be calculated as follows:

ex. For setting at 1μF

$$Td = \frac{C \times V}{i} = \frac{1\mu A \times 0.62V}{22\mu A} = 28.2ms$$

2.Soft start function

The internal PWM waveform has the voltage value as shown in the right.
If down-conversion from the voltage of $V_{IN}=15V$ to 3.3V output is to be made, for example, the PWM-ON duty has the value as shown below.



1.5V

0.62V

PWM wave
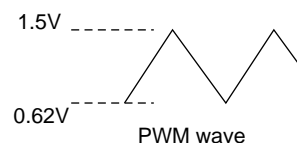
$$PWMduty = \frac{V_{OUT}}{V_{IN} - Vsat + VF} = 23\%$$

(Note that calculation is made with Vsat=1V and VF=0.2V)

The output voltage of error amplifier, which is 3.3V, is the value with PWM=23%, as calculated in the above equation, so that this voltage is determined as follows:

Ver=(ΔVPWM)×PWMduty+VPWML=0.88V×0.23+0.62V=0.82V
(ΔVPWM is the PWM amplitude value or 0.88V(typ) while VPWML is the lower limit voltage of PWM waveform or 0.62V(typ))

SS pin and error amplifier output voltages are designed to prefer the lower voltages, so that $V_{OUT}$ will reach the designed regulation voltage in timing when the SS pin voltage exceeds the error amplifier output. Therefore, the soft strt time is calculated as follows:

$$Tss = \frac{C \times \Delta VPWM \times PWMduty}{i} = \frac{C \times 0.88V \times PWMduty}{22\mu A}$$

For the set conditions of C=1μF and PWMduty=23%:

$$Tss = \frac{1\mu A \times 0.88V \times 0.23}{22\mu A} = 9.2ms$$

## Timing Chart