Ordering number : EN8273A

LA5771MP

ON Semiconductor®

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Monolithic Linear IC

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

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

Electrical Characteristics at Ta = 25°C

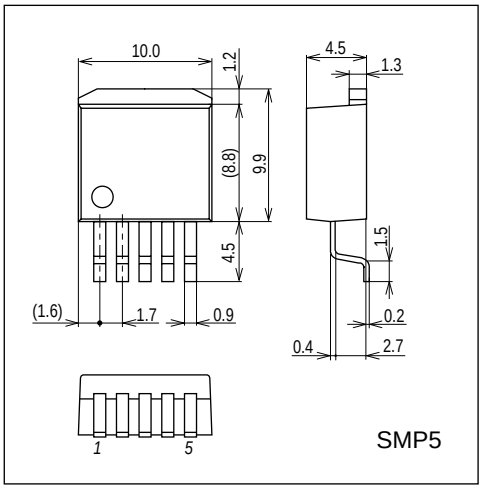
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage	V_O	V_{IN}=15V, I_O=1.0A	3.17	3.30	3.43	V
Efficiency	η	V_{IN}=15V, I_O=1.0A		79		%
Switching frequency	f	V_{IN}=15V, I_O=1.0A	128	160	192	kHz
Line regulation	ΔVOLINE	V_{IN}=8 to 20V, I_O=1.0A		25	80	mV
Load regulation	ΔVOLOAD	V_{IN}=15V, 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

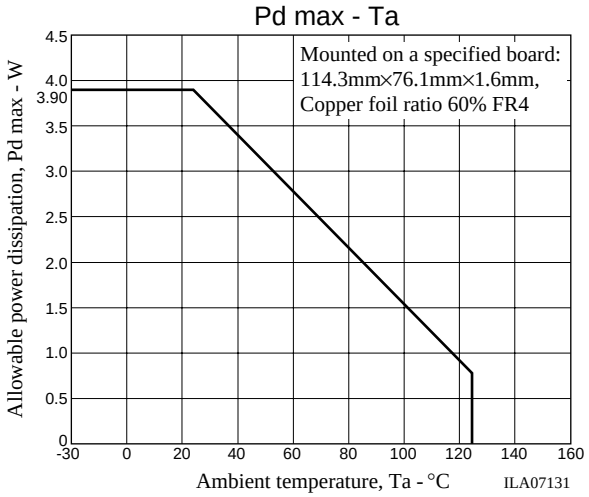
* Designed target value: No measurement made.

Package Dimensions

unit : mm (typ)

3275

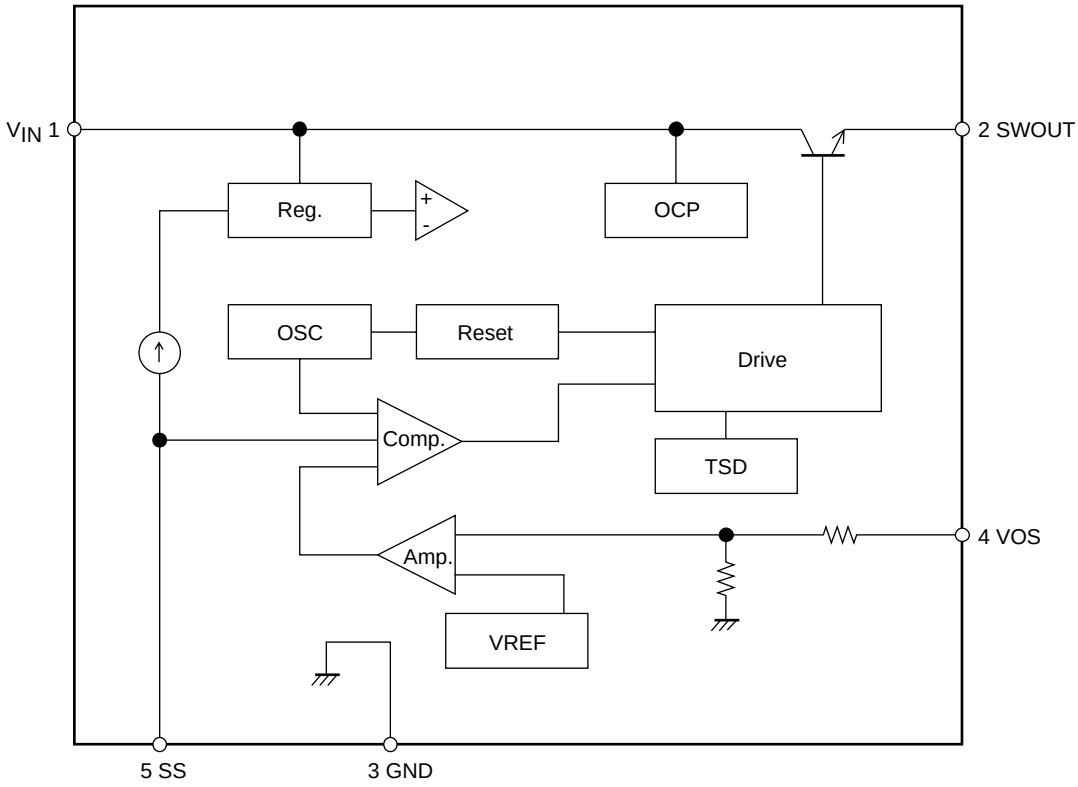




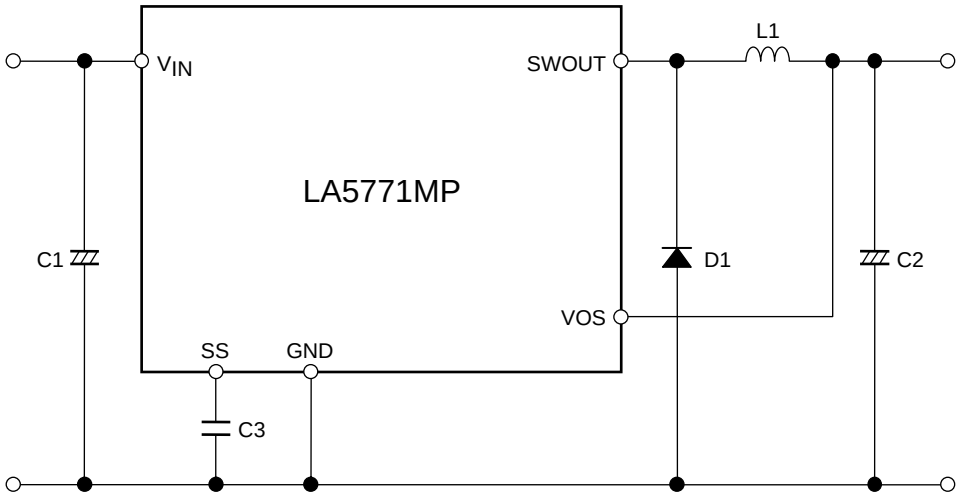
Pin Assignment

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

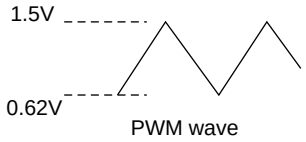
The SS pin has the internally-connected 22μA (typ) constant-current supply. When the voltage of SS pin exceeds the threshold voltage, the regulator starts operation. As the threshold is 0.62V(typ), the start delay time can be calculated as follows:

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.



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