



SANYO Semiconductors

DATA SHEET

LA5754MP

Monolithic Linear IC

Separately-excited Step-down Switching Regulator (Variable Type)

Overview

The LA5754MP is a separately-excited step-down switching regulator (variable type).

Features

- High efficiency
- Four external parts
- Time-base generator (125kHz) incorporated
- Current limiter incorporated
- Thermal shutdown circuit incorporated
- Soft start circuit incorporated

Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN\ max}$		30	V
Output current	$I_O\ max$		3	A
SW pin application reverse voltage	V_{sw}		-1	V
Allowable power dissipation	$P_d\ max1$	Infinite heat sink.	7.5	W
	$P_d\ max2$	No heat sink.	1.75	W
Junction temperature	$T_j\ max$		150	$^\circ\text{C}$
Operating temperature	T_{opr}		-30 to +125	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +150	$^\circ\text{C}$

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LA5754MP

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage range	V _{IN}		5.5 to 28	V
Operating junction temperature range	T _{j op}		-30 to +150	°C

Electrical Characteristics at Ta = 25°C

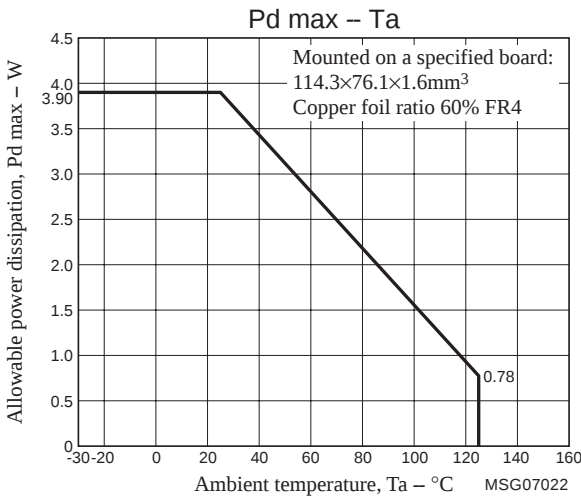
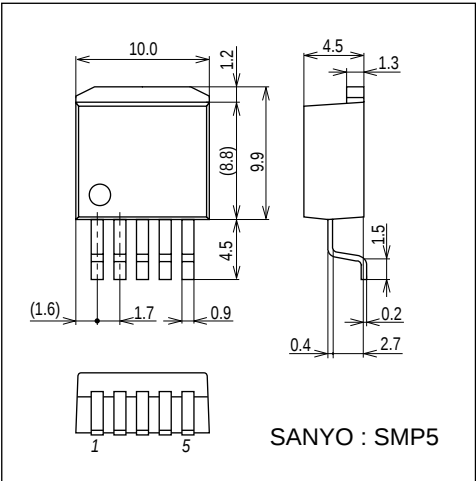
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage	V _O	V _{IN} = 15V, I _O = 1.0A	2.53	2.66	2.76	V
Switching frequency	f	V _{IN} = 15V, I _O = 1.0A	100	125	150	kHz
Line regulation	ΔV _{OLINE}	V _{IN} = 8 to 20V, I _O = 1.0A		25	80	mV
Load regulation	ΔV _{OLOAD}	V _{IN} = 15V, I _O = 0.5 to 1.5A		10	30	mV
Output voltage temperature coefficient	ΔV _O /ΔT _a			±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)

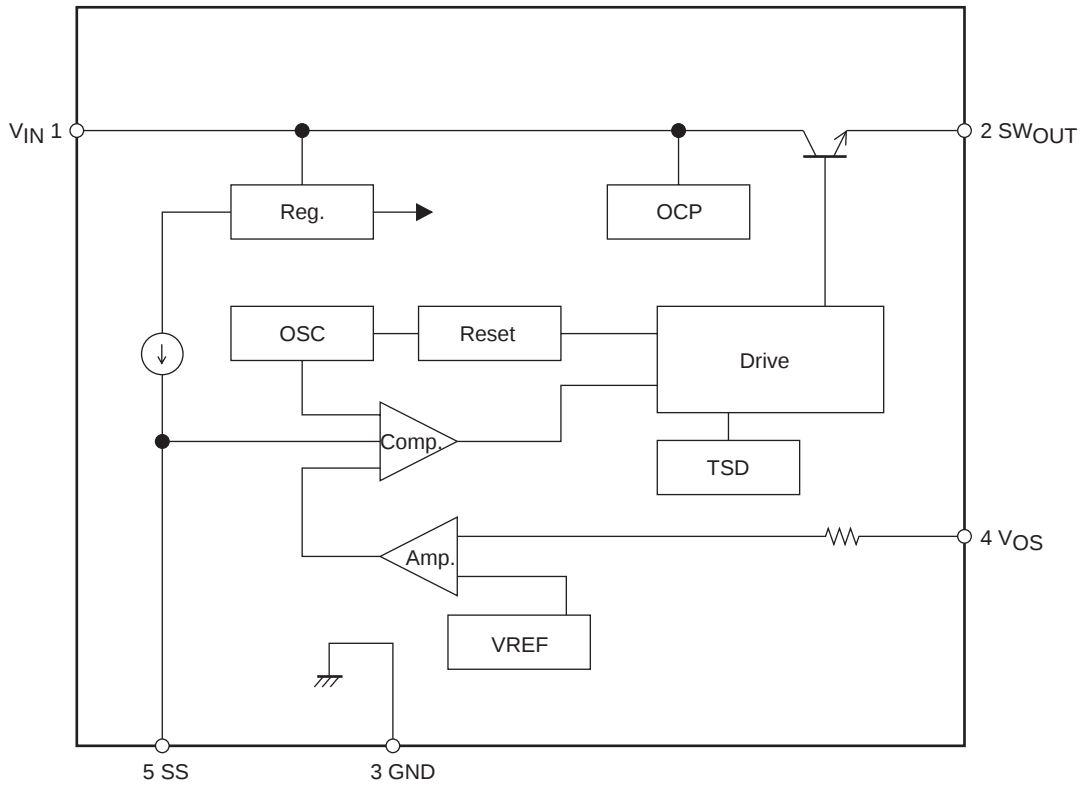
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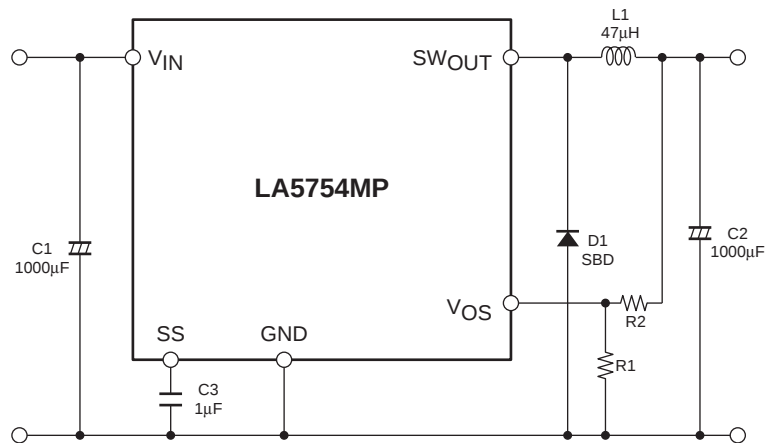
Pin Assignment

(1)V_{IN} (2)SW_{OUT} (3)GND (4)V_{OS} (5)SS

Block Diagram



Application Circuit Example



Notes: $C3$ is for the soft start function. Delete $C3$ and keep the SS pin open when the soft function is not necessary.

Calculation equation to set the output voltage

This IC controls the switching output so that the V_{OS} pin voltage becomes 2.66V (typ).

The equation to set the output voltage is as follows:

$$V_O = \left(1 + \frac{R_2}{R_1}\right) \times 2.66V(\text{typ})$$

The V_{OS} pin has the inrush current of 1 μ A (typ). Therefore, the error becomes larger when $R1$ and $R2$ resistance values are large.

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

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

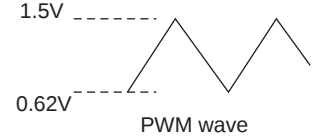
2. Soft start function

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 to be made, for example, the PWM-ON duty has the value as shown below.

$$PWMduty = \frac{V_{OUT} + VF}{V_{IN} - V_{sat} + VF} = 25\%$$

(Note that calculation is made with $V_{sat} = 1V$ and $VF = 0.2V$)



The output voltage of error amplifier, which is 3.3V, is the value with PWM = 25%, as calculated in the above equation, so that this voltage is determined as follows:

$$Ver = (\Delta VPWM) \times PWMduty + VPWML = 0.88V \times 0.25 + 0.62V = 0.84V$$

($\Delta VPWM$ is the PWM amplitude value or 0.88V(typ) while $VPWML$ is the lower limit voltage of PWM waveform or 0.62V(typ))

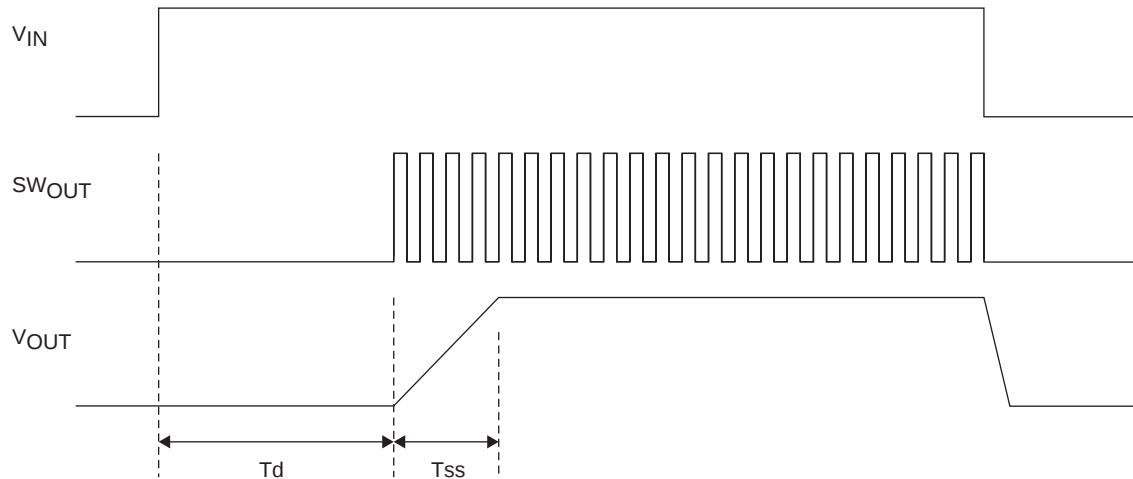
SS pin and error amplifier output voltages are designed to prefer the lower voltages, so that V_{OUT} will reach the designed regulation voltage in timing when the SS pin voltage exceeds the error amplifier output. Therefore, the soft start time is calculated as follows:

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

For the set conditions of $C = 1\mu F$ and $PWMduty = 25\%$:

$$T_{ss} = \frac{1\mu \times 0.88V \times 0.25}{22\mu A} = 10msec$$

Timing Chart



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