

SANYO Semiconductors DATA SHEET

An ON Semiconductor Company

LA5757TP

Monolithic Linear IC

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

Overview

The LA5757TP is a separately-excited step-down switching regulator (variable type).

Features

- Output smoothing condenser can use a Low ESR condenser for the reliability improvement
- High efficiency
- Four external parts
- Time-base generator (300kHz) incorporated
- Current limiter incorporated
- Thermal shutdown circuit incorporated
- Soft start circuit incorporated

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	V _{IN max}		34	V
Output current	I _O max		1.5	Α
SW pin application reverse	V _{SW}		-1	V
Allowable power dissipation	Pd max	Mounted on a specified board*	1.1	W
Operating temperature	Topr		-30 to +125	°C
Storage temperature	Tstg		-40 to +150	°C

^{*} Specified board: 114.3mm \times 76.1mm \times 1.6mm, glass epoxy board.

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage range	V_{IN}		4.5 to 32	V

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Electrical Characteristics at Ta = 25°C, $V_O = 5V$

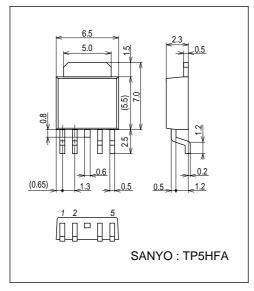
Parameter	Symbol	Conditions	Ratings			1.1-34
Parameter			min	typ	max	Unit
Reference voltage	Vos		1.230	1.255	1.280	V
Efficiency	η			83		%
Switching frequency	f	V _{IN} = 15V, I _O = 1.0A	240	300	360	kHz
Line regulation	ΔV _O LINE	V _{IN} = 8 to 20V, I _O =1.0A		40	100	mV
Load regulation	$\Delta V_{\mbox{O}} \mbox{LOAD}$	$V_{IN} = 15V$, $I_O = 0.5$ to 1.5A		10	30	mV
Output voltage temperature coefficient	ΔV _Ο /ΔΤα	Designed target value*		±0.5		mV/°C
Ripple attenuation factor	RREJ	f = 100 to 120Hz		45		dB
Current limiter operating voltage	IS	V _{IN} = 15V	1.6			Α
Thermal shutdown operating temperature	TSD	Designed target value*		165		°C
Thermal shutdown hysteresis width	ΔTSD	Designed target value*		15		°C

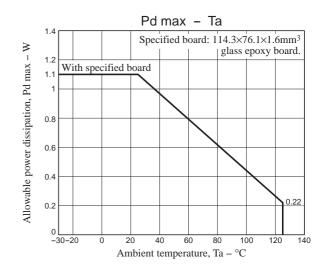
^{*} Designed target value: No measurement made.

Package Dimensions

unit: mm (typ)

3332

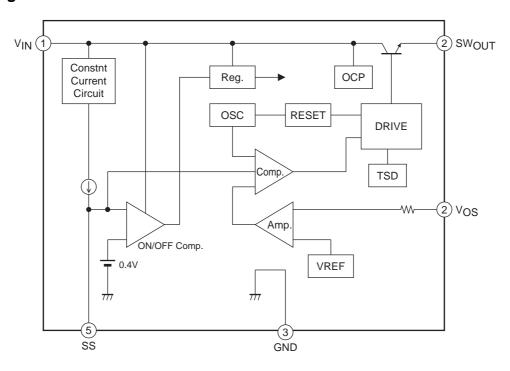




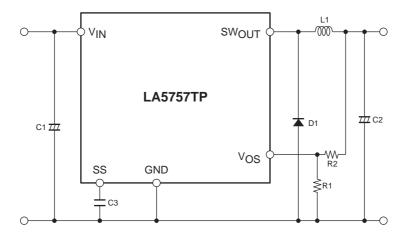
Pin Assignment

(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.

Description of Functional Settings

1. Calculation equation to set the output voltage This IC controls the switching output so that the V_{OS} pin voltage becomes 1.255V (typ). The equation to set the output voltage is as follows:

$$V_O = \left(I + \frac{R2}{RI}\right) \times 1.255 V(typ)$$

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

2. Start delay function

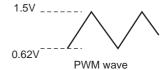
The SS pin has the internally-connected $10\mu A$ (typ) constant-current supply. When the voltage of SS pin exceeds the threshold voltage, the regulator starts operation. As the threshold is 0.62V(typ), the start delay time can be calculated as follows:

ex. For setting at 1µF

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

3. Soft start function

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



$$PWMduty = \frac{VOUT + VF}{VIN - Vsat + VF} = 25\%$$

(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 = 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))

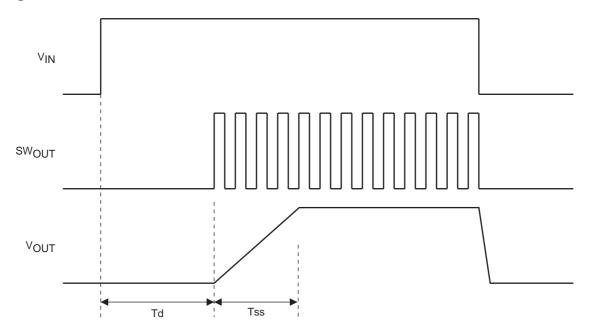
SS pin and error amplifier output voltages are designed to prefer the lower voltages, so that V_{OUT} will reach the designed regulation voltage in timing when the SS pin voltage exceeds the error amplifier output. Therefore, the soft strt time is calculated as follows:

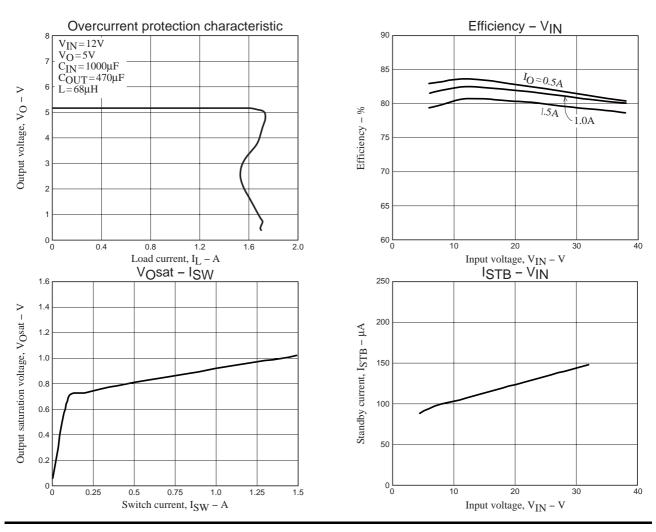
$$Tss = \frac{C \times \Delta VPWM \times PWMduty}{i} = \frac{C \times 0.88 \times PWMduty}{22 \mu A}$$

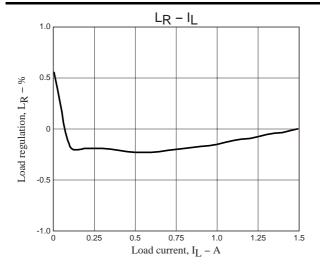
For the set conditions of $C = 1\mu F$ and PWMduty = 25%:

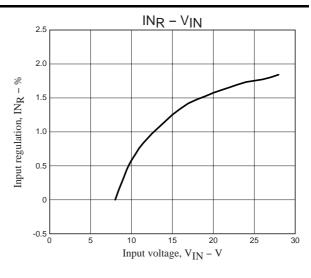
$$Tss = \frac{1\mu \times 0.88V \times 0.25}{22\mu A} = 10msec$$

Timing Chart









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