

# LA5772

## Monolithic Linear IC — Separately-excited Step-down Switching Regulator (5V)

### Overview

The LA5771 is a separately-excited step-down switching regulator (5V).

### 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 $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN\ max}$		34	V
Output current	$I_O\ max$		3	A
SW pin application reverse voltage	$V_{sw}$		-1	V
Allowable power dissipation	$P_d\ max1$	No heat sink	1.75	W
	$P_d\ max2$	Infinite heat sink	7.5	W
Operating temperature	$T_{opr}$		-30 to +125	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +150	$^\circ\text{C}$

#### Recommended Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage range	$V_{IN}$		7 to 32	V

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## Electrical Characteristics at Ta = 25°C

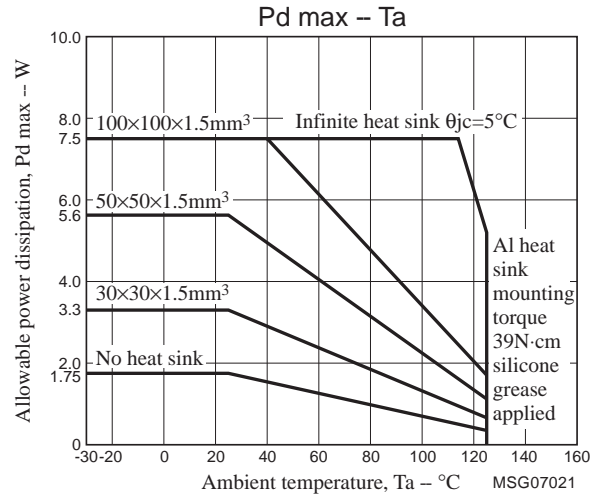
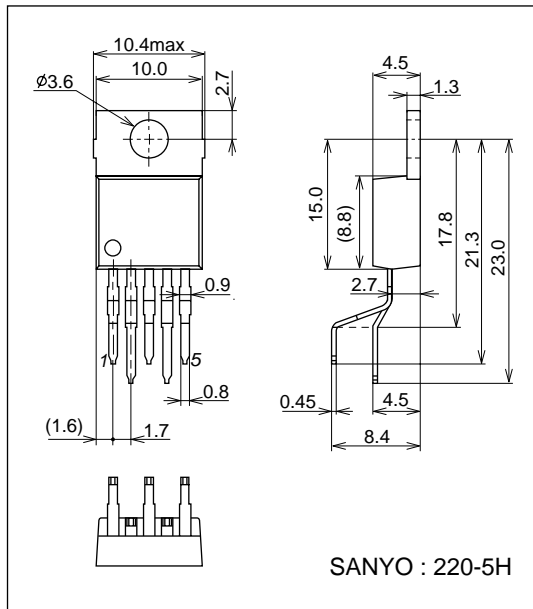
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage	$V_O$	$V_{IN}=15V, I_O=1.0A$	4.80	5.00	5.20	V
Efficiency	$\eta$	$V_{IN}=15V, I_O=1.0A$		84		%
Switching frequency	f	$V_{IN}=15V, I_O=1.0A$	120	160	200	kHz
Line regulation	$\Delta V_{OLINE}$	$V_{IN}=8 \text{ to } 20V, I_O=1.0A$		40	100	mV
Load regulation	$\Delta V_{OLOAD}$	$V_{IN}=15V, I_O=0.5 \text{ to } 1.5A$		10	30	mV
Output voltage temperature coefficient	$\Delta V_O/\Delta T_a$			$\pm 0.5$		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	$\Delta TSD$	Designed target value*		15		°C

\* Designed target value: No measurement made.

## Package Dimensions

unit : mm (typ)

3079C



## Pin Assignment

(1)VIN (2)SWOUT (3)GND (4)VOS (5)SS



**Description of Functional Settings**

1. Start delay function

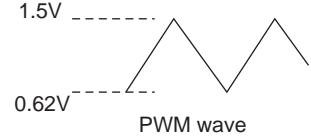
The SS pin has the internally-connected 22μA (typ) constant-current supply. When the voltage of SS pin exceeds the threshold voltage, the regulator starts operation. As the threshold is 0.62V(typ), the start delay time can be calculated as follows:

ex. For setting at 1μF

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

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<sub>IN</sub>=20V to 5V output is to be made, for example, the PWM-ON duty has the value as shown below.



$$PWMduty = \frac{V_{OUT} + VF}{V_{IN} - V_{sat} + VF} = 27\%$$

(Note that calculation is made with V<sub>sat</sub>=1V and VF=0.2V)

The output voltage of error amplifier, which is 5V, is the value with PWM=27%, as calculated in the above equation, so that this voltage is determined as follows:

$$V_{er} = (\Delta VPWM) \times PWMduty + VPWML = 0.88V \times 0.27 + 0.62V = 0.86V$$

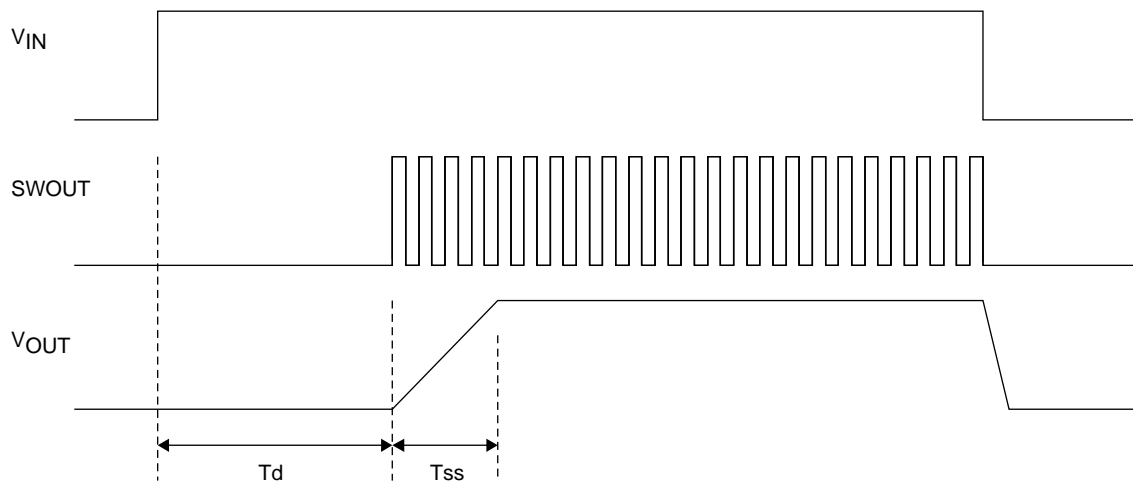
(ΔVPWM is the PWM amplitude value or 0.88V(typ) while VPWML is the lower limit voltage of PWM waveform or 0.62V(typ))

SS pin and error amplifier output voltages are designed to prefer the lower voltages, so that V<sub>OUT</sub> 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=1μF and PWMduty=27%:

$$T_{ss} = \frac{1\mu \times 0.88V \times 0.27}{22\mu A} = 10.8 \text{ msec}$$



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