Ordering number : ENA0647A

LA5744TP

ON Semiconductor®

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Monolithic Linear IC

Separately-Excited Step-Down Switching Regulator (Variable Type)

Overview

The LA5744TP is a separately-excited step-down switching regulator (variable type).

Functions

- High efficiency.
- 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}		30	V
Maximum output current	I_O max		2	A
SW pin application reverse voltage	V_{SW}		-1	V
Allowable power dissipation	Pd max	Mounted on a circuit board.*	1.1	W
Operating temperature	Topr		-30 to +125	°C
Storage temperature	Tstg		-40 to +150	°C

* Specified circuit board : 76.1×114.3×1.6mm^3, glass epoxy.

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}		4.5 to 28	V

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

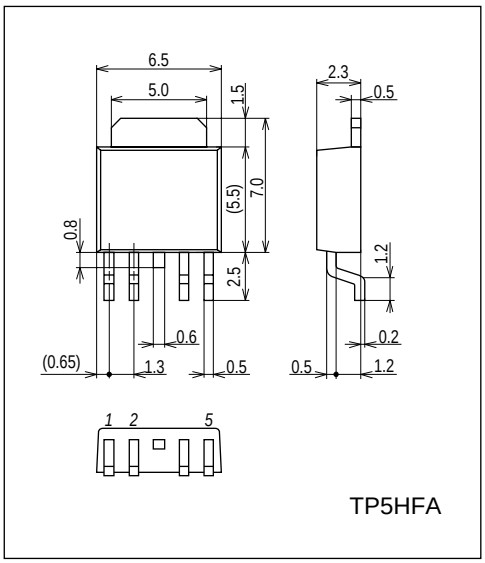
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Reference voltage	V_{OS}	V_{IN} = 15V, I_O = 1.0A	1.20	1.23	1.26	V
Efficiency	η	V_{IN} = 15V, I_O = 1.0A		83		%
Switching frequency	f	V_{IN} = 15V, I_O = 1.0A	240	300	360	kHz
Line regulation	ΔV_OLINE	V_{IN} = 8 to 20V, I_O = 1.0A		40	100	mV
Load regulation	ΔV_OLOAD	V_{IN} = 20V, I_O = 0.5 to 1.5A		10	30	mV
Output voltage temperature coefficient	$\Delta V_O/\Delta Ta$	Designed target value. *		±0.5		mV/°C
Ripple attenuation factor	RREJ	f = 100 to 120Hz		45		dB
Current limiter operating voltage	I_S	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

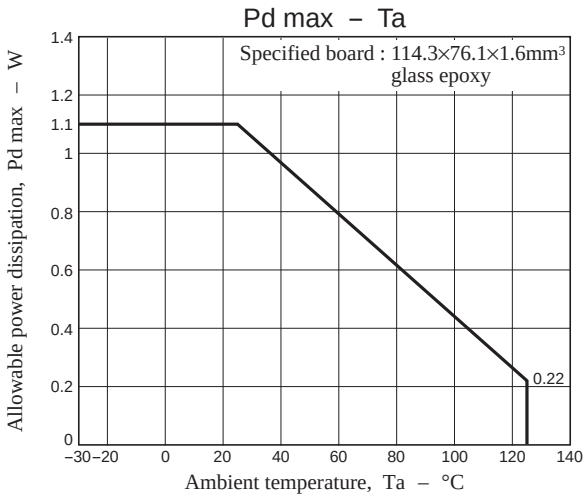
* Design target value : No measurement made.

Package Dimensions

unit : mm (typ)

3332

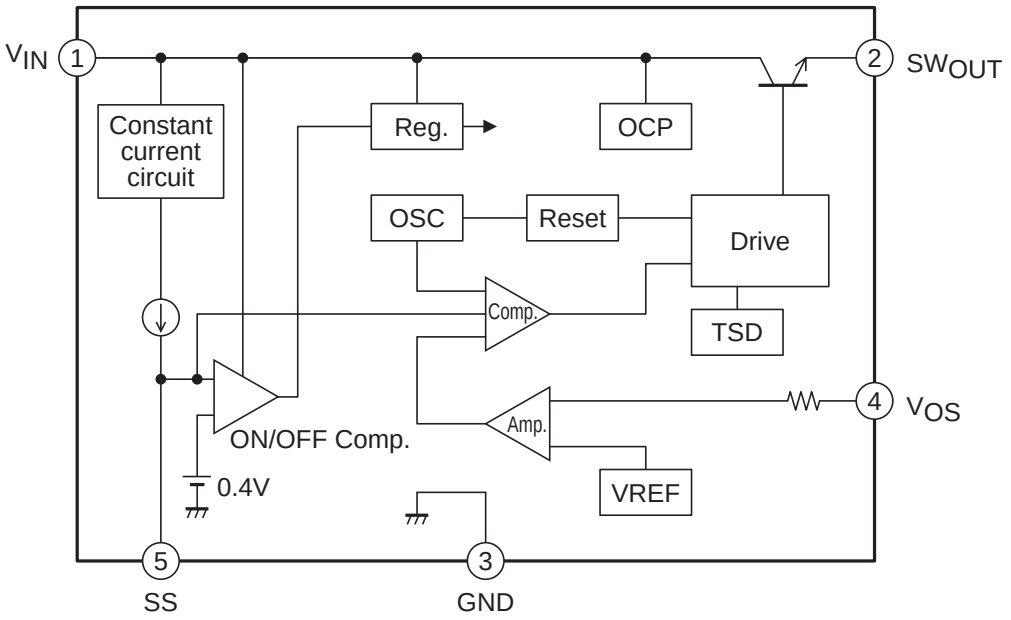




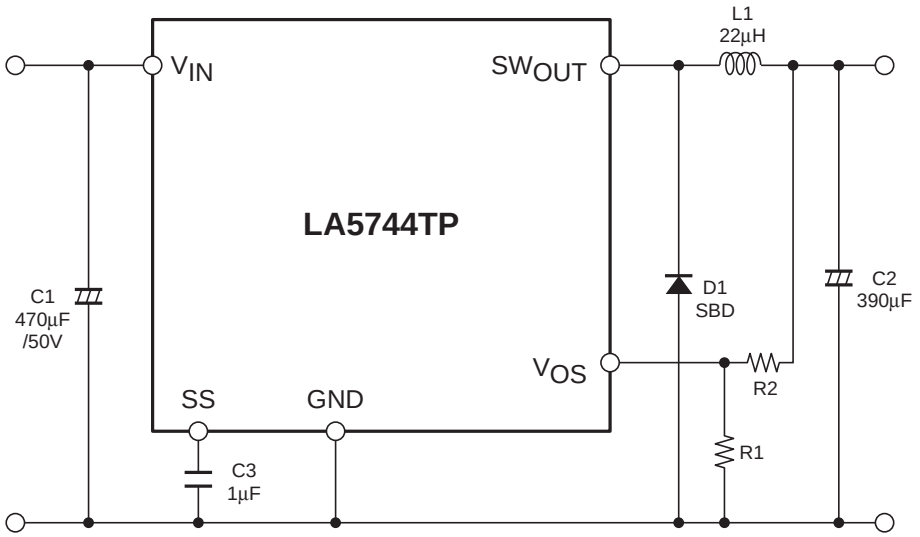
Pin Assignment

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

Block Diagram



Application Circuit Example

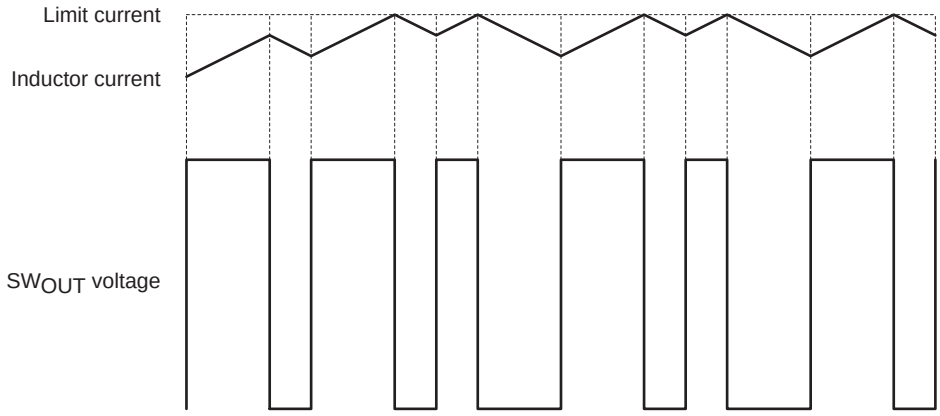


Notes :

1. C3 is for the soft start function. Delete C3 and keep the SS pin open when the soft start function is not necessary.
2. In some cases, the output may not turn on if power is applied when a load is connected. If this is a problem, increase the value of the inductor.

Protection Circuit Functional Descriptions

1. Overcurrent protection function
   The overcurrent protection function detects, on a cycle-by-cycle basis, the output transistor current and turns off that output transistor current if it exceeds 3.1A.



2. Short circuit protection function
   This IC prevents the current from increasing when the outputs are shorted by setting the switching frequency to 30kHz if the V_{OS} pin voltage falls below 0.8V.

Note 3 : If the soft start function is not used, the IC will start up with the overcurrent protection function operating. At this time, the switching frequency will be cut in half. This means that the switching frequency will be 15kHz at startup.

Note 4 : Since the switching frequency becomes 30kHz when the V_{OS} pin voltage falls under 0.8V, the current capacity is reduced. If a load is applied with the V_{OS} pin voltage over 0.8V, the inductance value operates at 22µH. If a load is to be applied when this voltage is under 0.8V, the inductance value must be increased.

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 1.23V (typ).
   The equation to set the output voltage is as follows :

$$V_O = \left(1 + \frac{R2}{R1}\right) \times 1.23V(typ)$$

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

2. Startup Delay Function
   The output voltage rises when the internal voltage reaches 0.4V (typical). Until that point, a capacitor is charged from an internal 10µA (typical) constant-current supply. The startup delay time can be calculated as shown below

   Example : Assume a 1µF capacitor is used.

$$Td = \frac{C \times V}{i} = \frac{1\mu F \times 0.4}{10\mu A} = 40\ ms$$

Timing Chart