THV81800

8A 1ch Buck Converter Module

Description

THV81800 is a synchronous buck switching regulator Power supply module of Maximum output current 8A. It is possible to design a power only with a minimum of external components for built-in MOSFET and Inductor.

The synchronous rectifier technology provides high efficiency more than 90%. Utilizing the latest and THine's unique architecture "Transphase", THV81800 achieves ultra quick transient response.

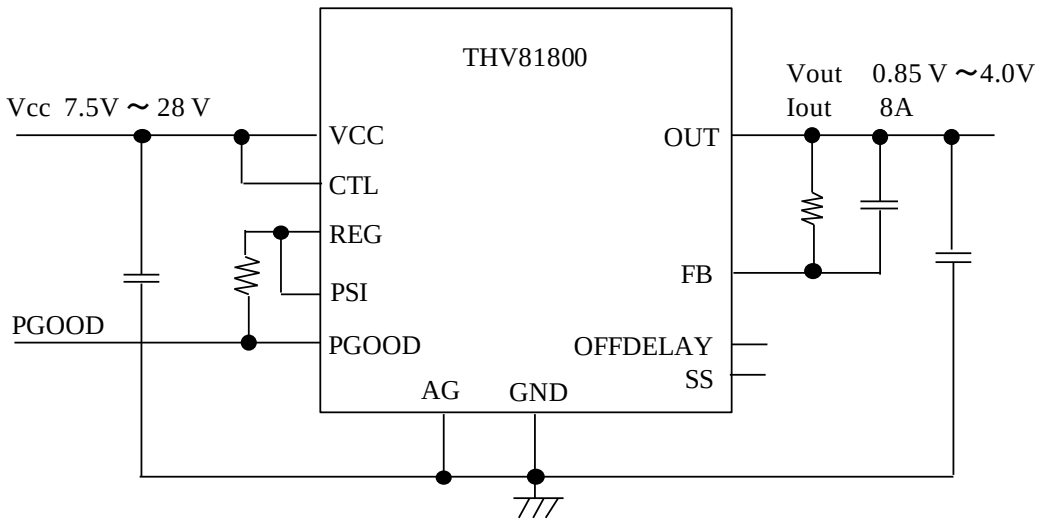
Soft start by SS pin makes constant and stable soft start curve not depend on the load fluctuation. THV81800 also has the Power-good function and the Off-delay function to facilitate the setting of On/Off sequence.

Applications

・ Microprocessor core / ASIC / FPGA / DSP

Features

・Synchronous rectifier DC/DC converter
・Input voltage range(Vcc)：7.5V ~ 28V
・Output voltage range(Vout)：0.85V ~ 4.0V
・Maximum output current(Iout)：8.0A
・Feed back voltage accuracy：±1%
・Oscillation frequency：500 kHz
・Over current protection
・Short circuit protection (latch function)
・Under voltage lockout function
・Power-good function
・Off Delay function
・Programmable soft start
・Power standby indication
・Thermal shutdown
・15mm x 15mm LGA Package



Typical Applications

"Transphase" is THine's registered trademark.

Absolute maximum ratings

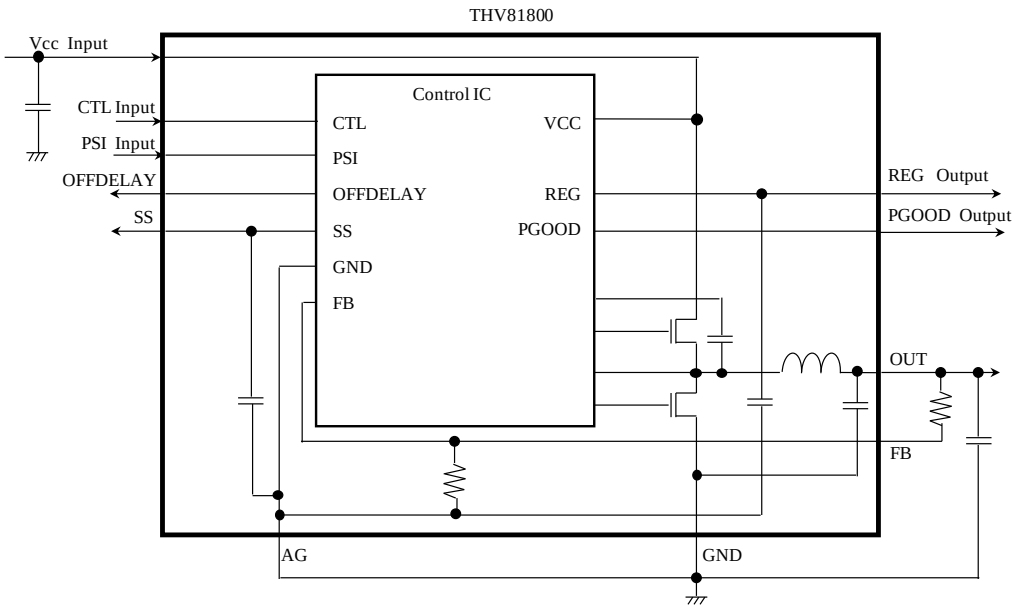
Parameter	Symbol	Min	Max	Units
VCC voltage	Vcc	-0.3	30	V
CTL voltage	Vctl	-0.3	30	V
PSI voltage	Vpsi	-0.3	5.5	V
FB, SS, OUT, OFFDELAY, PGOOD voltage	FB, SS, Vout OFFDELAY,PGOOD	-0.3	5.5	V
Junction Temperature	Tj	-	125	ºC
Storage Temperature	Tstg	-55	125	ºC

Recommended Operation Conditions

Parameter	Symbol	Min	Max	Unit
VCC voltage	Vcc	7.5	28	V
Output voltage	Vout	0.85	4.0	V
Output current	Iout	-	8 *1	A
REG current	Ireg	-	30	mA
Operating Temperature	Ta	-40	+85	ºC

*1 The maximum output current is limited to Tj ≦ 125 ℃.

Block Diagram

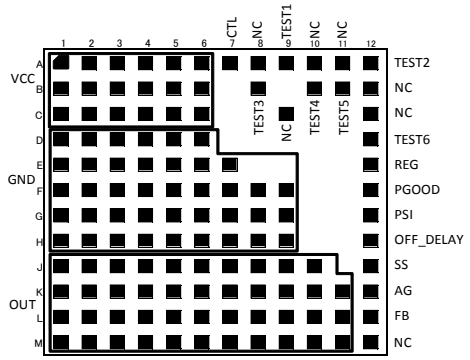


Electrical Characteristics（Vcc=12V, Vctl=5V, Vpsi=5V, Vout=3.3V, Ta=25°C unless otherwise noted.）

Parameter	Symbol	Condition	Min	Typ	Max	Units
Operation Current 1	Icc_1	Vcc = 28V, I_{OUT} = 0	-	38	76	mA
Operation Current 2	Icc_2	Vcc = 28 V,I_{OUT} = 0, Vpsi= 0V	-	2.2	5.0	mA
Stand-by current	Ist	Vctl = 0V	-	38	75	μA
Maximum Output Current	I_{OUT}_DC		-	-	8.0 *1	A
OCP threshold	I_{OUT}_OCP		-	11	-	A
UVLO threshold	V_UVLO	Vcc＝ L → H	6.0	6.5	7.0	V
UVLO hysteresis	V_UVLO hys		-	0.17	-	V
Efficiency		Io= 3A	-	90	-	%
Output Line Regulation	⊿VOUT(Line)	Vcc= 7.5V to 28 V, Io= 3 A	-	3.0	-	%
Output Load Regulation	⊿VOUT(Load)	Io= 0 A to 8A	-	1.0	-	%
REG output voltage	V_REG	Ireg=0.1mA	4.75	5.0	5.25	V
REG output current	Ireg		-	-	30	mA
Feed Back Voltage	V_FB		0.841	0.85	0.859	V
Feed Back Resistance	RFBL	FB – AG	9.88	10	10.12	kΩ
SCP delay time	tscp		3.5	4.1	4.7	ms
CTL OFF threshold voltage	VIL_CTL		-	-	0.7	V
CTL ON threshold voltage	VIH_CTL		1.5	-	-	V
PSI OFF threshold voltage	VIL_PSI		-	-	1.0	V
PSI ON threshold voltage	VIH_PSI		4.0	-	-	V
CTL high level input current	IIH_CTL	Vctl=3.3V	0.5	2.0	4.0	μA
PSI high level input current	IIH_PSI	Vpsi=5V	6	12.5	25	μA
OFFDELAY Sink current	I_OFFD		2.4	4.0	6.0	μA
Off delay time	T_{OFFD}	C_{OFFD} = 0.01uF	4.2	8.5	13	ms
Soft start time	Tss	C_{SS} = none	2.1	3.5	5.2	ms
Soft start current	I_SS		1.2	2.0	3.0	μA
Power good threshold voltage	VT_PG	Detect at FB pin FB ＝ L→H	0.65	0.70	0.75	V
Power good hysteresis voltage	V_PGhys	Detect at FB pin	-	0.1	-	V
Power good output ON resistance	R_{ON}_PG	PGOOD= 0.1 V	-	1.0	2.0	kΩ
Power good output off leak current	Ileak_PG	VPGOOD = 5V	-	0	1.0	uA
Oscillation Frequency	F_{OSC}	Vpsi=5V	440	500	560	kHz
Minimum Oscillation Frequency	F_{OSCMIN}	Vpsi=0V	7.0	8.0	9.0	kHz

*1 The maximum output current is limited to Tj ≦ 125 ℃.

Pin description（Top view）



Pin description

Pin	Symbol	I/O	Function
A1 ～ A6, B1 ～ B6 C1 ～ C6	Vcc	—	Power Supply
D1 ～ D6, E1 ～ E7 F1 ～ F9, G1 ～ G9 H1 ～ H9	GND	—	Ground
J1 ～ J10, K1 ～ K11 L1 ～ L11, M1 ～ M11	OUT	O	Output
A7	CTL	I	Enable pin. Active at high level.
A9	TEST1	—	Non Connection.
A12	TEST2	—	Non Connection.
B8	TEST3	—	Non Connection.
B10	TEST4	—	Non Connection.
B11	TEST5	—	Non Connection.
D12	TEST6	—	Non Connection.
E12	REG	O	5V regulator output. Internal power supply.
F12	PGOOD	O	Power good output. N-MOS open drain output.
G12	PSI	I	Power standby Indication. Applying low level voltage to this pin, IC goes into the light load mode. Applying high level, IC operates in the synchronous mode.
H12	OFFDELAY	I	Shut-off delay time setting.
J12	SS	I	Soft start time setting pin.
K12	AG	—	Analog Ground. AG pin should be connected to GND.
L12	FB	O	Output voltage feedback.
A8,A10,A11 B12,C9,C12,M12	NC	—	Non Connection.

Function Description

●Under voltage Lockout （UVLO）
THV81800 has the built-in Under voltage Lockout circuit to prevent the device from malfunction at low input voltages. UVLO stops switching operation and soft start operation, until Vcc voltage rises up to 6.5V(typ). Having the hysteresis circuit, UVLO stops switching operation and start to discharge SS pins, when Vcc voltage falls down under 6.33V(typ).

●Thermal Shut Down （TSD）
THV81800 has the built-in Thermal Shutdown circuit to prevent damages caused by excessive heat. When the junction temperature Tj of control IC reaches 125 ℃ (typ), TSD circuit stops output voltage and 5V regulator. When Tj falls down (20 ℃ typical hysteresis), THV81800 restart.

●Over Current Protection （OCP）
THV81800 has the built-in Over Current Protection circuit to limit over current caused by abnormal load current, etc. When the output current which flows to a OUT terminal is exceed 8.6A (typ), the over current protection function is restricted to the output current by Pulse -by-pulse. When the output current increased in more than 1/2 of a output ripple current, output is turned off. Over Current (Iout_ocp) is dependent on input voltage (Vcc) and output voltage (Vout), and calculated as following.

$$\mathrm{Iout\_ocp(typ)}=8.6+\mathrm{V_{out}}\times\left(1-\frac{V_{out}}{V_{cc}}\right)$$

●Short Circuit Protection （SCP）
SCP circuit is activated, when the output shorted continues. Feedback voltage drops less than 0.6V(typ), SCP detects a short circuit. If such condition continues for more than 4.1ms(typ), the device stops switching operation and go into latch state. The latch state will be released by restarting to apply voltage on CTL pin or Vcc pin.

●Power Good (PGOOD)
PGOOD pin is NMOS open drain output. Power Good is a function to notify external circuits that the output voltage has reached to the normal voltage, and available as a sequence control or a reset signal for micro-processor. When the feedback voltage exceeds 0.7V(typ) , PGOOD pin is turned from Low level(NMOS on) to High impedance(NMOS off). When the feedback voltage drops 0.6 V(typ), PGOOD pin is turned to Low level. If CTRL pin is low level, PGOOD also be low level. When usually using, recommend to use a 5V power supply of a REG Pin. Or it's possible to pull up a PGOOD pin using the outside power supply. Please note following when using the outside power supply.

First : When Vcc voltage is less than 2.5V, PGOOD pin is High impedance(NMOS off) even though the output voltage doesn’t reach to the user defined voltage.

Second : When Vcc voltage exceeds 2.5V, PGOOD pin is turned Low level.

Third : When feedback voltage reaches to 0.7V(typ) after the exceeded UVLO threshold, PGOOD pin is High impedance(NMOS off) again.

●Output Voltage Setting

THV81800 output voltage detects the output ripple voltage(Vrip) and output voltage lower limit(Vout_bottom) defined as following formula.

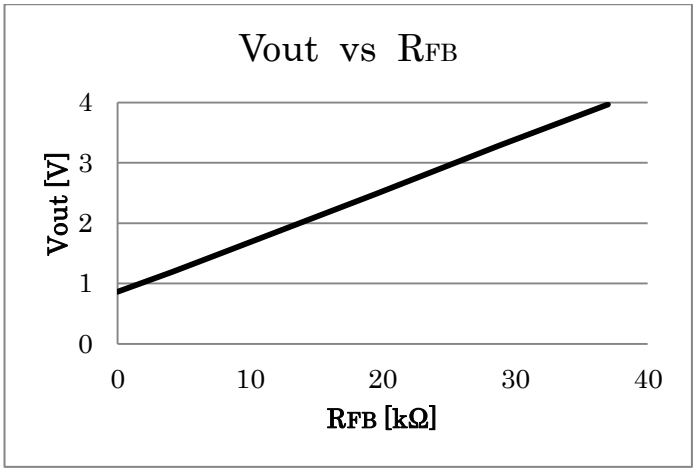
$$V_{OUT\_bottom} = V_{\_FB} \times \left(1 + \frac{R_{\_FB}}{10}\right)$$

V_FB = 0.85V, R_FB(kΩ) = Output voltage setting resistance of between FB pin and OUT pin.

Output voltage at the continuous mode is calculated as following formula, adding the average of the ripple voltage. Please contact us if you have questions about the output ripple voltage.

$$V_{OUT} = 0.85 \times \left(1 + \frac{R_{\_FB}}{10}\right) + \frac{1}{2}V_{rip}$$

The relation between output voltage(Vout) and output voltage setting resistance($R_{\_FB}$) as following.



●Power Stand-by Indicator (PSI)

Continuous/Light Load modes are selectable by PSI pin, High or Low. High = continuous mode, Low = light load mode. PSI pin is held Low and stops the operation of Low side FET in the light load mode.

●Soft Start（SS）

THV81800 has soft start circuit allows a gradual rising of output voltage to prevent overshooting of output voltage and high inrush current during start up. The initial setting of the output voltage rise up time is 3.5msec(typ.). The output rise time can be controlled by the choice of soft-start capacitor(Css).

$$T_{SS}[ms] = 3.5 + 350 \times C\_ss\ [uF]$$

●OFF Delay (OFFDELAY)

Off Delay function works to set the delay time from when Low level voltage is applied on CTL pin till the device goes into standby state. The delay time can be set by connecting a capacitor between OFFDELAY pin and GND.

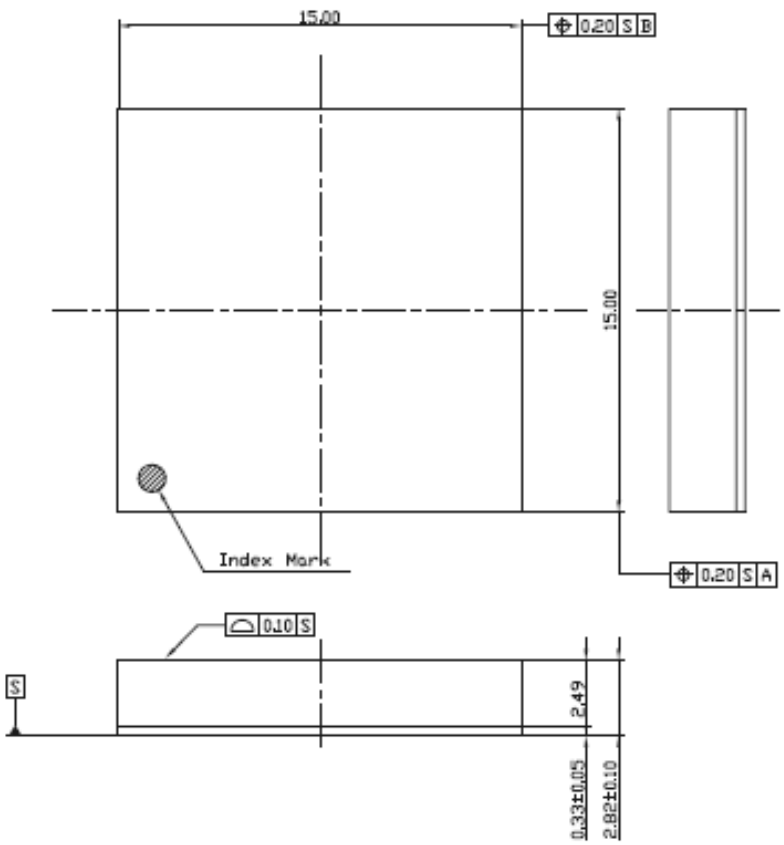
$$T_{OFFD}[ms] = 850 \times C_{\_OFFD}\ [uF]$$

●Output Pull-Down

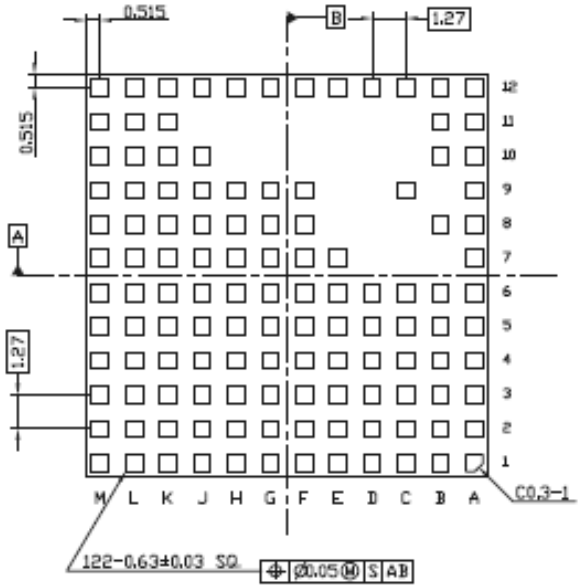
THV81800 has a built-in Output Pull-Down function to shorten the output fall time. When CTL pin is low, turn on an internal transistor and discharge the output capacitor.

Package Outline

Top View



Bottom View



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THine Electronics, Inc.
sales@thine.co.jp