Data Sheet

BIT3368O

High Performance PWM Controller

Version: A06

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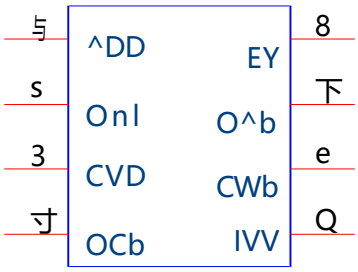
Features:

. CnLLeu! 山oqe cou!Lol guq \!xeq \Ledneuc入 obeLg!!ou
. 8^) s8^ obeLg!!ou ^ol!g?e (***Note 1***)
. Iu!eLugl 山!u!山n山 o\\ !!山e
. Iu!eLugl eo\!-e!gL!
. O^eL ^ol!g?e bLo!ec!!ou, O^b
. 「ogq epoL! bLo!ec!!ou, 「eb
. ecpo!!k入 epoL! bLo!ec!!ou, eeb
. ecpo!!k入 obeu bLo!ec!!ou
. 「ED cg!poqe epoL! bLo!ec!!ou, 「Ceb
. O^eL !e山beLg!nLe bLo!ec!!ou, Olb
. Iuqnc!oL epoL! bLo!ec!!ou
. Iu!eLugl nuqeL ^ol!g?e lock on!, n^ 「O
. lo!e山 bole on!bn!
. eOb-8 bgckg?e

Pin Layout:



BIT3368O

General Description:

Ipe BII33e8O !e g DC-DC cou^eL!eL M!!p CnLLeu!-Woqe cou!Lol guq !pLee ob!!ougl obeLg!!ou bMW \Ledneuc!ee. 「oM 0.s与^ \eeqpgck ^ol!g?e, O^eL ^ol!g?e bLo!ec!!ou, O^eL CnLLeu! bLo!ec!!ou, ecpo!!k入 q!oqe obeu\epoL! bLo!ec!!ou guq !uqnc!oL-epoL!eq bLo!ec!!ou 山gke BII33e8O !o pe gu !qegl cou!LolleL \oL 「ED pgckl!?p! qL!^eL. Iu!eLugl eo\! e!gL! \nuc!!ou cgu g^o!q !uLnep cnLLeu! pgbbeueq !u !pe e!gL!-nb beL!oq. Yqq!!!ougl O^eL-le山beLg!nLe-bLo!ec!!ou guq n^ 「O 山gke e入e!e山 山oLe Lel!gple. CWOe bLoceee ?Leg!!入 Leqncee !pe obeLg!!u? cnLLeu! Mpeu co山bgL!u? !o e!山!lgL bLoqnc!e.

Recommended Operating Condition:

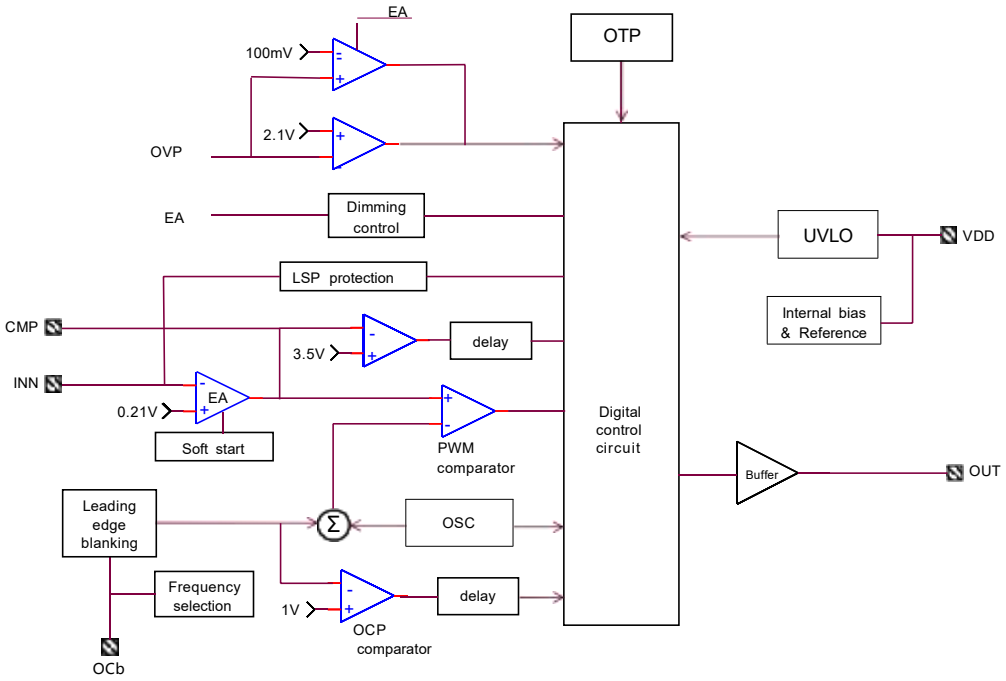
enbbl入 ^ol!g?e····· 8^) s8^ (***Note 1***)
ObeLg!!u? \Ledneuc入····· QQkHS\与与0kHS\ss0kHS
ObeLg!!u? g山p!eu! !e山beLg!nLe... ...-寸0°C) +8Q°C

Absolute ratings

^DD, EY, Onl····· -0.3) +s8 ^ (***Note 1***)
CVD·····干0.3^
OCb, IVV, CWb, O^b····· +Q ^
ObeLg!!u? g山p!eu! !e山beLg!nLe····· -寸0°C) +8Q°C
ObeLg!!u?)nuc!!ou !e山beLg!nLe... ... . -寸0°C) +与Q0°C
e!oLg?e !e山beLg!nLe..... ... .-QQ°C) +与Q0°C

Note 1: If VDD > 20V, the external Boost MOS V_{GS} (Gate to Source Voltage) has to be ± 30V (V_{GS}± 30V).

Functional block diagram:



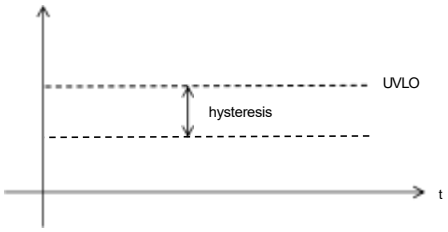
Pin description:

Pin No.	Symbol	Descriptions
1	VDD	Power supply
2	OUT	Output pin
3	GND	Ground pin
4	OCP	Over current protection and frequency selection
5	INN	The inverting input of the error amplifier
6	CMP	Output of the error amplifier
7	OVP	Over voltage protection
8	EA	Enable pin

Functional Description:

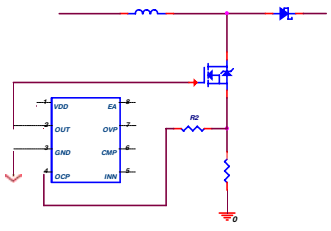
Under Voltage Locked Out, UVLO:

To avoid the abnormal condition happened when the input voltage drops to low voltage, it is needed to set a low voltage operation point. Please refer following figure, when the input voltage is below the low voltage operation point, the under voltage lockout (UVLO) function will turn-off its output and most of its internal functions. The recovery hysteresis voltage is about 1V.



Frequency selection

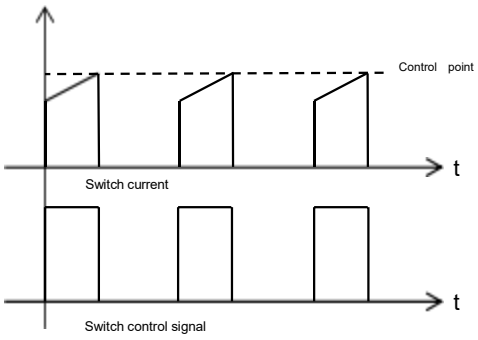
In the initial state, BIT3368O frequency can be selected by an external resistor (R1) connected in OCP pin. Please refer to the figure below for the frequency setting table.



Resistor	frequency
10k ohm	55kHz
1k ohm	110kHz
22k ohm	220kHz

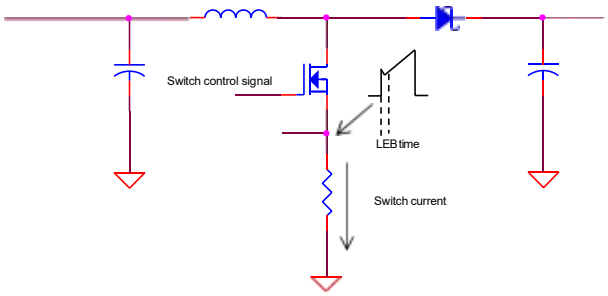
Current mode control and slope compensation

For the Boost converter operation, peak current mode controls power switch according inductor current. It detects the rising inductor current and turns off power switch when the inductor current reaches the control level. In addition, BIT3368O built-in slope compensation is used to avoid sub-harmonic oscillation when the duty cycle is larger than 50% for the peak current operation. The advantages of current mode control is fast response on line and load regulation, it is also easily been compensated for stability requirement.



Leading edge blanking and current limit

For the turn on of power switch, please refer following figure, the current spike will be happened in the rising edge. The leading edge blanking (LEB) time was built-in the OCP pin to prevent the false-trigger from the current spike. In addition, BIT3368O limits the maximum current flowing through the external MOSFET.

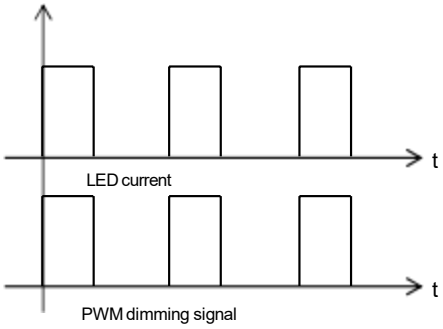


Soft start

To avoid inrush current happened in the start-up period, the soft-start circuit is needed. It can reduce current overshoot happened in the start-up period and used components suffer less over stress and better lifecycle. The long soft-start time of BIT3368O makes system reliable and can be applied in many different applications.

PWM dimming and EA control

For the LED backlight application, the dimming function is needed to adjust backlight brightness. Normally, it adjusts LED brightness by controlling LED current directly. BIT3368O supports positive-PWM-dimming function. The figure below shows PWM dimming signal vs. LED current.



The LED dimming function is controlled by the PWM signal at EA pin. This EA can accept an external PWM signal in the range of 100Hz to 1kHz with the low level of < 0.8V and high level >2.5V. The dimming range is 1%~100%.

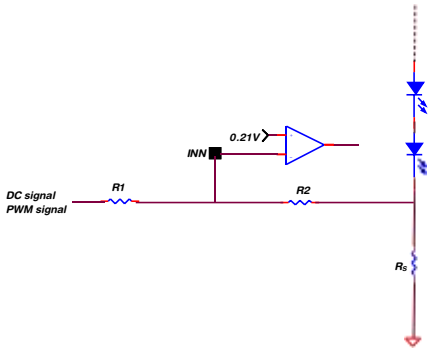
LED current regulation and DC dimming

To stabilize the LED current, BIT3368O senses LED current and adjust PWM duty cycle for the purpose. The average LED current is approximated by following equation,

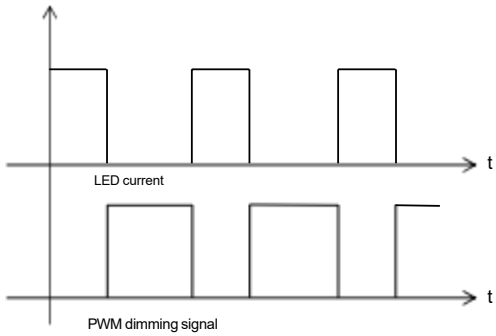
$I_{LED}=0.21/R$

Where, 0.21V is BIT3368O internal reference voltage.

In addition, the DC dimming can also be applied in this feedback loop. Please check following figure for detailed.

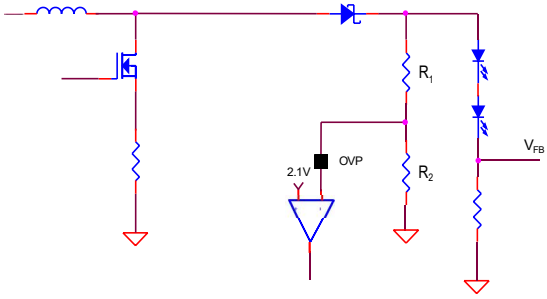


For the negative PWM dimming, following figure shows PWM dimming signal vs. LED current.



Over voltage protection, OVP:

When LED is fault or open status, the feedback loop of LED current is opened and results in maximum duty. This maximum duty cycle will cause the output voltage raising to a very high level. BIT3368O detects this high voltage level in its OVP pin and latch-off its output. It can be released by VDD or EA.

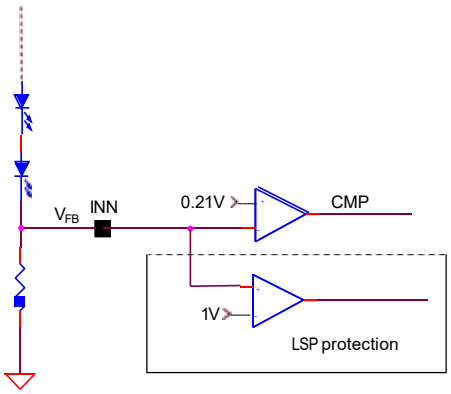


The OVP voltage is as following

$$OVP = \frac{R_2}{R_1 + R_2} V_{OVP}$$

Load short protection, LSP

When some of a series LED are short suddenly, LSP function will be enabled to latch-off its output immediately. Please refer following figure, the INN pin monitors LED feedback current and LSP function. When all the LEDs are connected in series but some of them are short suddenly, this fault condition will cause a higher voltage signal in INN pin. When INN pin detects a high voltage in this pin, BIT3368O will latch-off its output.



LED cathode short protection, LCSP

There is a fault condition of LED, its cathode short to ground. This fault condition will cause no feedback signal and maximum duty. When maximum duty is happened and kept, BIT3368O will latch-off its output.

Schottky short protection

Normally, BIT3368O is operated in boost converter usually. It's constructed by inductor, power switch and Schottky diode. Schottky diode short is one fault condition that causes a large current flowing through the power MOS. When OCP pin detects this large current, BIT3368O will latch-off its output.

Schottky open protection

In the boost converter operation, Schottky diode open is one fault condition that causing no feedback signal. When Schottky diode is opened, there will be maximum duty and abnormal current in its input and power MOS.

When Schottky diode is opened, there will have no output voltage to be detected in the OVP pin of BIT3368O. When system is powered-on and OVP voltage is low, BIT3368O will latch-off its output.

Inductor short protection

In the boost converter operation, inductor short is one fault condition that causing large current in the input and power MOS. When OCP pin detects this large current, BIT3368O will latch-off its output.

Over Temperature Protection, OTP

BIT3368O provides over temperature protection that makes the system more reliable. When the operation temperature is too high, BIT3368O will shut off its output. When the temperature drops below the threshold, BIT3368O will automatically recover to work again.

DC/AC Characteristics: T_A=25℃ unless otherwise specified.

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Supply voltages					
Pin VDD input	Note 1	8		28	V
Under voltage look out					
Positive Going Threshold		6	7	8	V
Hysteresis		0.5	1	1.5	V
Chip consumed current			2	4	mA
Enable control					
ON	VDD=12V	2		VDD	V
OFF	VDD=12V	0		0.8	V
Error amplifier reference voltage					
Non-Inverting input of the error amplifier	VDD=12V	203.7	210	216.3	mV
Operating frequency and DIM frequency					
Operating frequency	VDD=12V, Rosc=1KΩ	99	110	121	KHz
	VDD=12V, Rosc=10 KΩ	49.5	55	60.5	kHz
	VDD=12V, Rosc=22 KΩ	198	220	242	kHz
DIM frequency		100		1,000	Hz
Error amplifier					
Open loop gain	Note 2		70		dB
Over current protection, OCP and over voltage protection, OVP					
OCP Current-Sense (CS) Voltage	VDD=12V		0.3		V
OCP Shutdown Protection Voltage	VDD=12V		1		V
OVP voltage	VDD=12V	2	2.1	2.2	V
Load short protection, LSP					
LSP voltage	VDD=12V	0.8	1	1.2	V
Over temperature protection, OTP					
Over temperature protection, OTP	Note 2		180		C
hysteresis	Note 2		50		C
Soft start and minimum output off time					
Soft start time	Note 2		30		ms
Minimum off time		300	450	600	ns
Output drive					
OUT voltage	VDD=10V ~ 28V (Note 1)	0		VDD	V
Rising Time	VDD=12V, 1000pF load Note 2		30		ns
Falling Time			25		ns

Note 2. Only guaranteed by simulation or sampled evaluation during –40°C ~+85°C. Not 100% tested.

SolpaJin6 in}oJme}ion

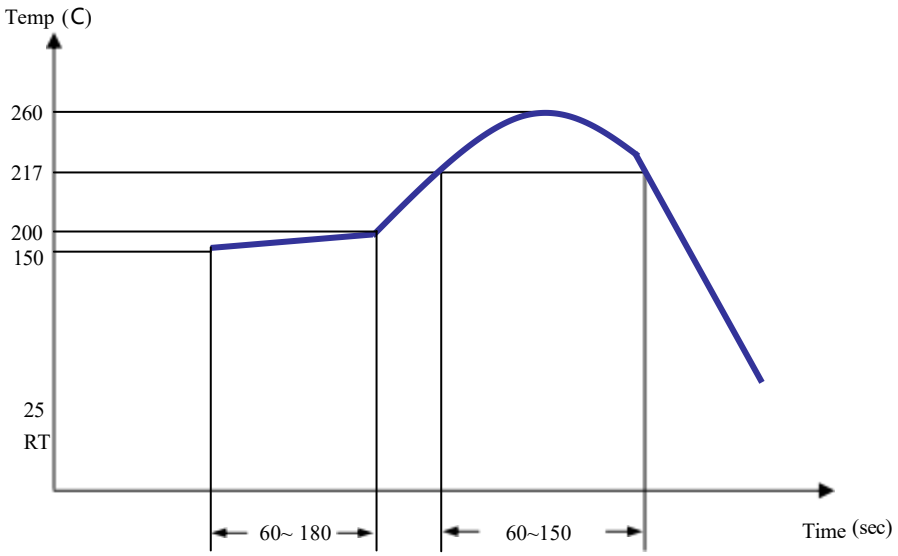
Reflow soldering:

The choice of heating method may be influenced by plastic QFP package). If infrared or vapor phase heating is used and the package is not absolutely dry (less than 0.1% moisture content by weight), vaporization of the small amount of moisture in them can cause cracking of the plastic body. Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stenciling or pressure-syringe dispensing before package placement. Several methods exist for reflowing; for example, convection or convection/infrared heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 270 °C depending on solder paste material. The top-surface temperature of the packages should preferable be kept below 245 °C for thick/large packages (packages with a thickness ≧ 2.5 mm or with a volume ≧ 350 mm^3 so called thick/large packages). The top-surface temperature of the packages should preferable be kept below 260 °C for thin/small packages (packages with a thickness < 2.5 mm and a volume < 350 mm^3 so called thin/small packages).

Stage	Condition	Duration
1'st Ram Up Rate	max3.0+/-2C/sec	-
Preheat	150C~200C	60~180 sec
2'nd Ram Up	max3.0+/-2C/sec	-
Solder Joint	217C above	60~150 sec
Peak Temp	260 +0/-5C	20~40 sec
Ram Down rate	6C/sec max	-



Wave soldering:

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

Manual soldering:

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

Order information:

BIT3368O-SO

- *SO: SOP*
- *Part number*
- *Beyond Innovation Technology Co., Ltd.*

Package information :

Unit: mm

SOP type :