

Data Sheet

BI 3102

Low Cost PWM CCFL Controller

Version : 1.3

Notice:

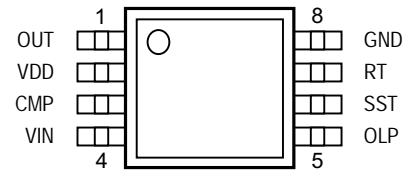
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Features:

- PWM Modulation
- Open Lamp Protection
- Internal UVLO (Under Voltage Look Out) function
- Dimming Control
- CMOS Totem Pole output
- NMOS output driving
- SOP Packing

Pin Layout:



Applications:

- Cold Cathode Fluorescent Lamps system
- Notebook PC
- LCD Monitor
- Palm-top Computers
- Video Phone/ Door Phone
- Portable Instrumentation
- Personal Digital Assistants
- Airline Entertainment Centers
- Automotive Display
- ATM/ Financial Terminal
- POS Terminal
- Navigation Devices (GPS Equipment)
- Test Equipment
- Copiers and Office Equipment
- Medical Equipment

General Description:

To aim at the Cold Cathode Fluorescent Lamp (CCFL) applications, the BI3102 integrated all functions required in a single 8 pin chip. The chip provides a fully functioned PWM control circuit with a true lamp current feedback protection. By setting the required time for striking the lamp through SST (Soft Start), the open-lamp condition can be detected after lamp striking period. The lamp dimming can be done through a PWM feedback loop. CMOS process reduces the operating current (1mA typical) and NMOS output driving capability enhances the system efficiency.

Patent pending.

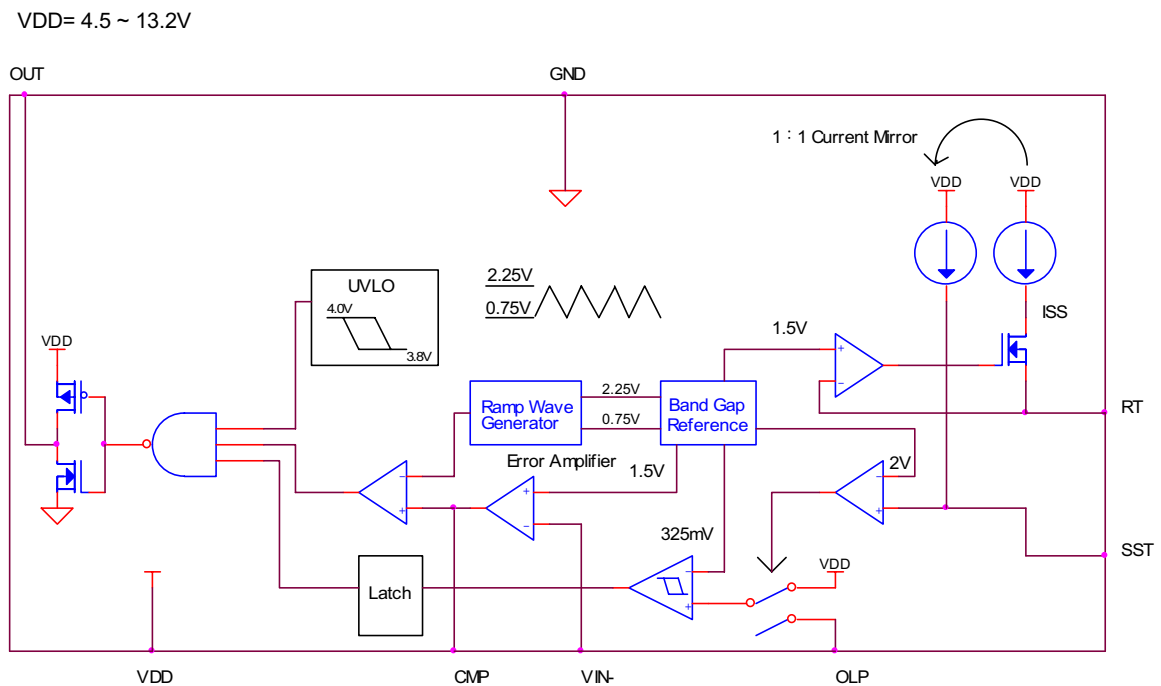
Absolute Ratings: (if Ta=25°C)

VDD.....	-0.3 ~ +15 V
GND.....	±0.3 V
Input Voltage.....	-0.3 ~ VDD+0.3 V
Power Dissipation.....	40 mW
Operating Ambient Temperature.....	0 ~ +70 °C
Operating Junction Temperature.....	+150 °C
Storage Temperature.....	-55~+150 °C

Recommended Operating Condition:

Supply Voltage.....	4.5 ~ 13.2 V
Operating Frequency.....	50K ~ 250K Hz
Operating Ambient Temperature.....	0 ~ 70 °C

Functional Block Diagram:



Function Description:

UVLO: The Under-Voltage-Look-Out circuit turns the output driver off when supplying voltage drops to a specified low level.

Band Gap Reference: This circuit provides a accuracy voltage reference which is very stable even though the operating temperature is variable. Base on this reference, a specified voltage can be generated which is used by another circuit.

Ramp Wave Generator: This circuit generates a typical 140KHz ramp wave. (as $R_T = 100\text{ K}\Omega$) The relation between frequency and resistor R_T is as the equation below:

$$\text{Freq. (KHz)} = 14000/R_T(\text{K}\Omega)$$

PWM Controller: The pulse width modulation control circuit includes a ramp wave generator, an error amplifier and a comparator. These devices provide the required active components for the PWM feedback control application.

Open Lamp Protection: The open lamp detection circuit (OLP) senses the voltage at the feedback port of lamp. If a voltage level which is less than 325mV is sensed, indicates that this lamp is an open circuit, the PWM circuit will be shut down and never restart until the power is turned off and on again.

The current source I_{SS} charges the external resistor and capacitor during power on process. The voltage drops on the SST pin will be increased as

$$V_{SST} = I_{SS}R_{SS} (1 - e^{-t/R_{SS}C_{SS}}); \text{ (Fig.a)}$$

$$I_{SS} = V_{RT}/R_T \pm 10\%, \text{ where } V_{RT} = 1.5\text{V}$$

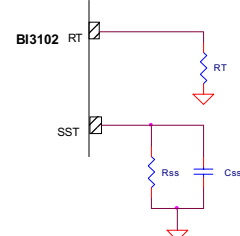


Fig.a

The duty cycle of the PWM will increase with the increasing voltage of C_{SS} to provide high voltage enough for striking the lamp. The open lamp protection circuit will be enable when $V_{SST} > 2\text{V}$ to prevent transformer works at extremely high voltage for a very long period. (Fig.b) The required time for striking the lamp could be calculated as below:

$$T_{\text{STRIKE}} = (R_{SS}C_{SS})$$

$$\ln(I_{SS}R_{SS}/(I_{SS}R_{SS}-2))$$

T_{STRIKE} is decided by the characteristic of lamp.

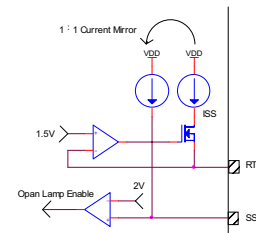
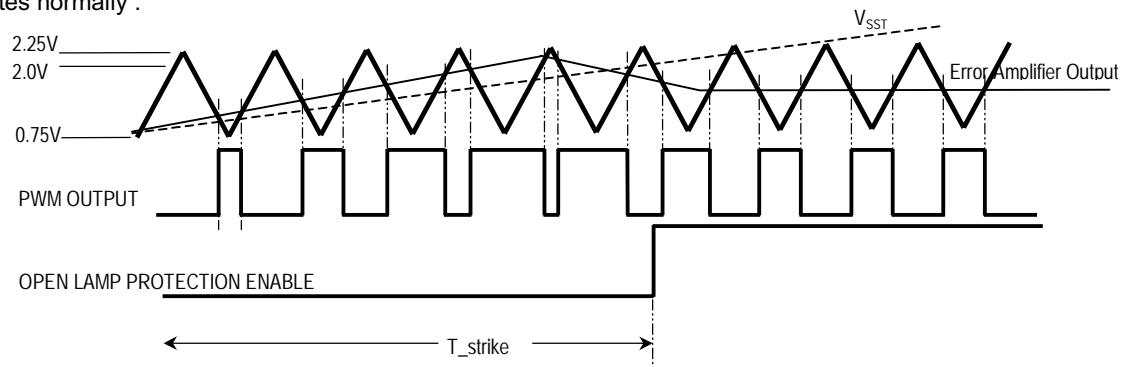


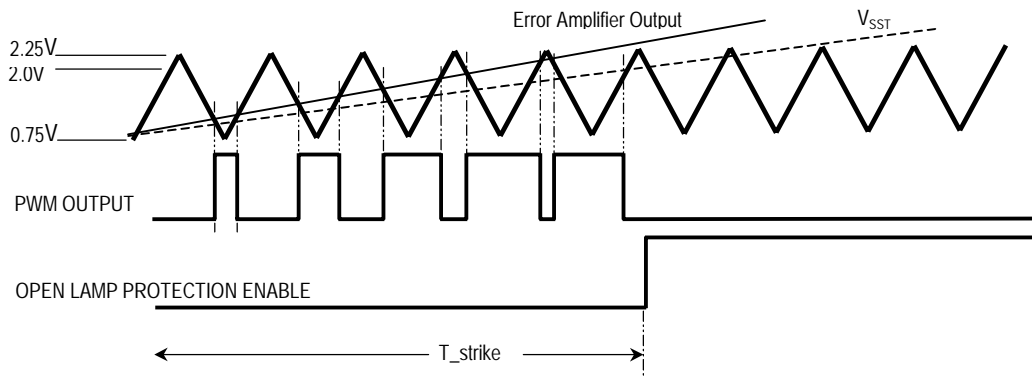
Fig.b

Timing Diagrams:

When lamp operates normally :



When lamp is open :



Pin Description:

Pin No.	Names	Description
1	OUT	PWM output, logic high active for driving NMOS device.
2	VDD	Supply voltage.
3	CMP	PWM controller input, the output of error amplifier.
4	Vin-	PWM controller input, the inverting input of error amplifier.
5	OLP	A voltage sense input pin. If voltage level is less than 325 mV after a user defined period of time, the chip will shut down the OUT and PWM circuits. A digital latch circuit latches this result. The latch condition will be released if the power be turned off.
6	SST	The timer for soft start and open lamp protection.
7	RT	Operation frequency control.
8	GND	Ground

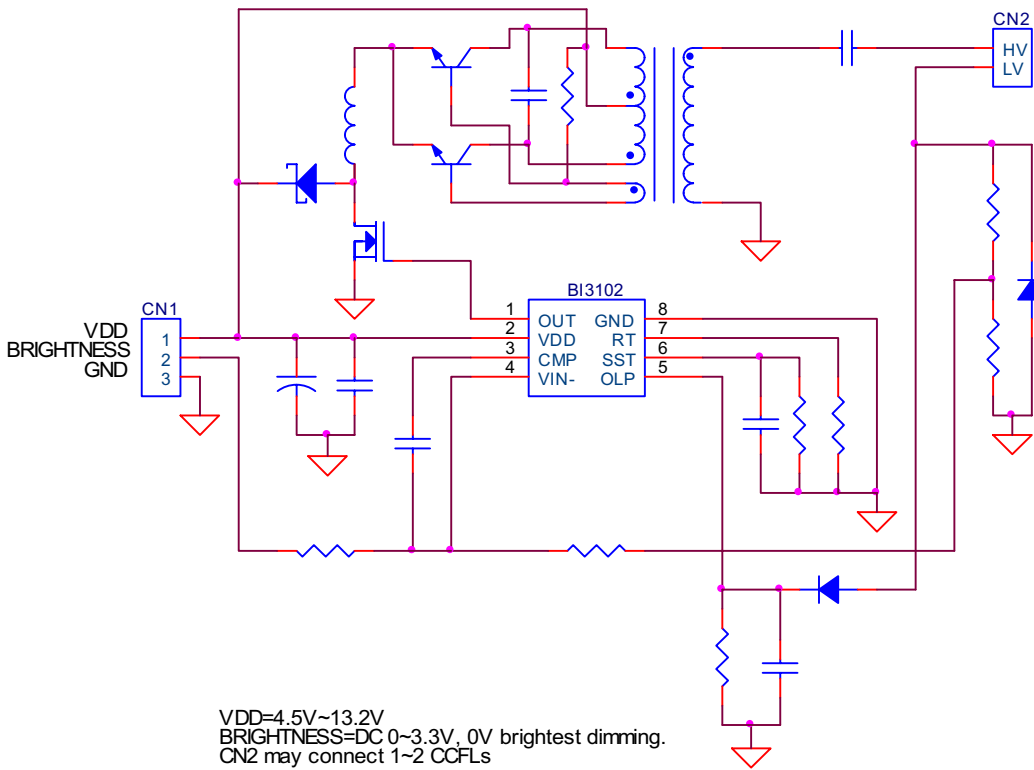
DC/AC Characteristics:

Parameter	Test Conditions	Min.	Typ.(Limits)	Max.	Unit
Reference Voltage					
Output voltage	Measure Vin- VDD=12V, Ta=25°C	1.425	1.5	1.575	V
Line regulation	VDD=4.5 ~ 13.2 V		2	20	mV
Under Voltage Look Out					
Upper threshold voltage	Ta=25°C	3.8	4	4.2	V
Hysteresis		0.1	0.2	0.3	V
Ramp Wave Generator					
Frequency	R _T =100K Ω	120	140	160	KHz
Operating Frequency	note 1	50		250	KHz
Output peak			2.25		V
Output valley			0.75		V
Error Amplifier					
Input voltage	note 1	0.75		2.25	V
Open loop gain		60	80		dB
Unit gain band width		1	1.5		MHz
SST Soft Start and Open Lamp Enable					
Output current	VDD=12V, Ta=25°C		1.5V/R _T		uA
Open lamp detection enable			2		V
Open Lamp Protection					
Open lamp detection lower threshold	VDD=12V, Ta=25°C		325		mV
Hysteresis			50		mV
Output					
CMOS output impedance	note 1		50		Ω
Rising Time	1000pF load,		110		ns
Falling Time	note 1		100		ns

Ta : ambient temperature.

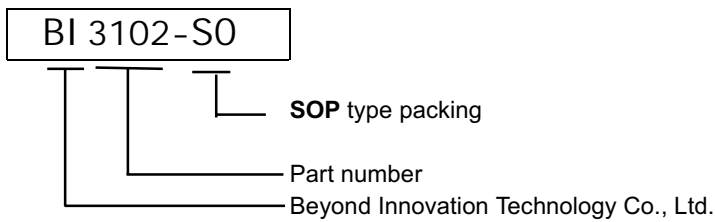
Note 1: It is guaranteed by design not 100% tested.

Application Circuit:



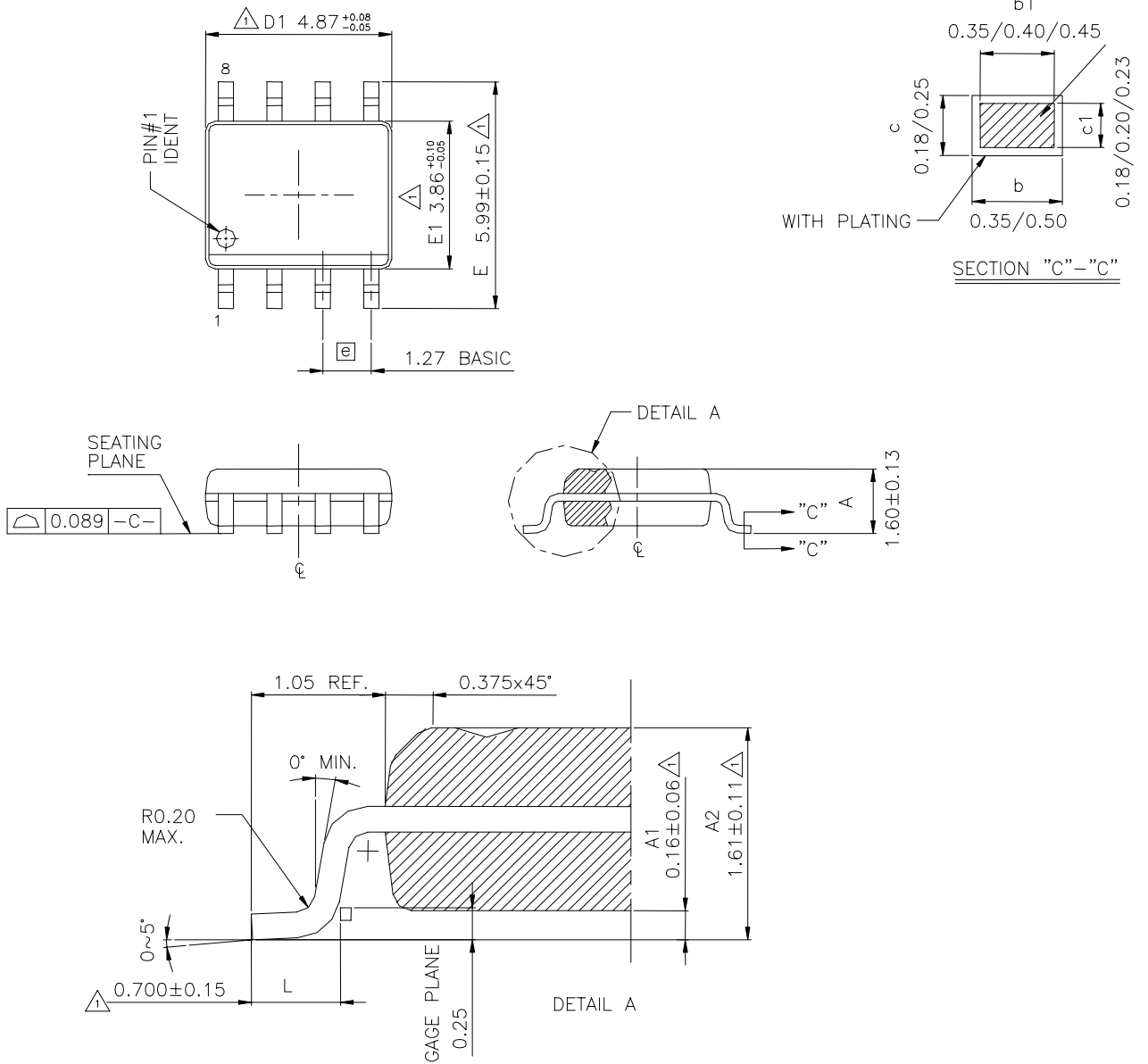
Example 1:
 A low cost 1~2 lamp
 design.

Order Information:



Package Information :

Unit: mm



FORM:EG00005.C