

## Data Sheet

# BI T3102A

## Low Cost PWM CCFL Controller

Version: 1.3

*Notice:*

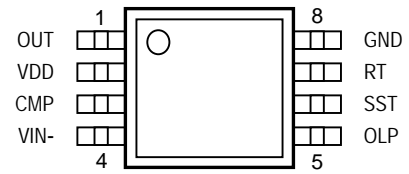
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**Features:**

- PWM Modulation
- Open Lamp Protection
- Internal UVLO (Under Voltage Look Out) function
- Dimming Control
- CMOS Totem Pole output
- NMOS output driving
- SOP /DIP 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 BIT3102A 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, 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.

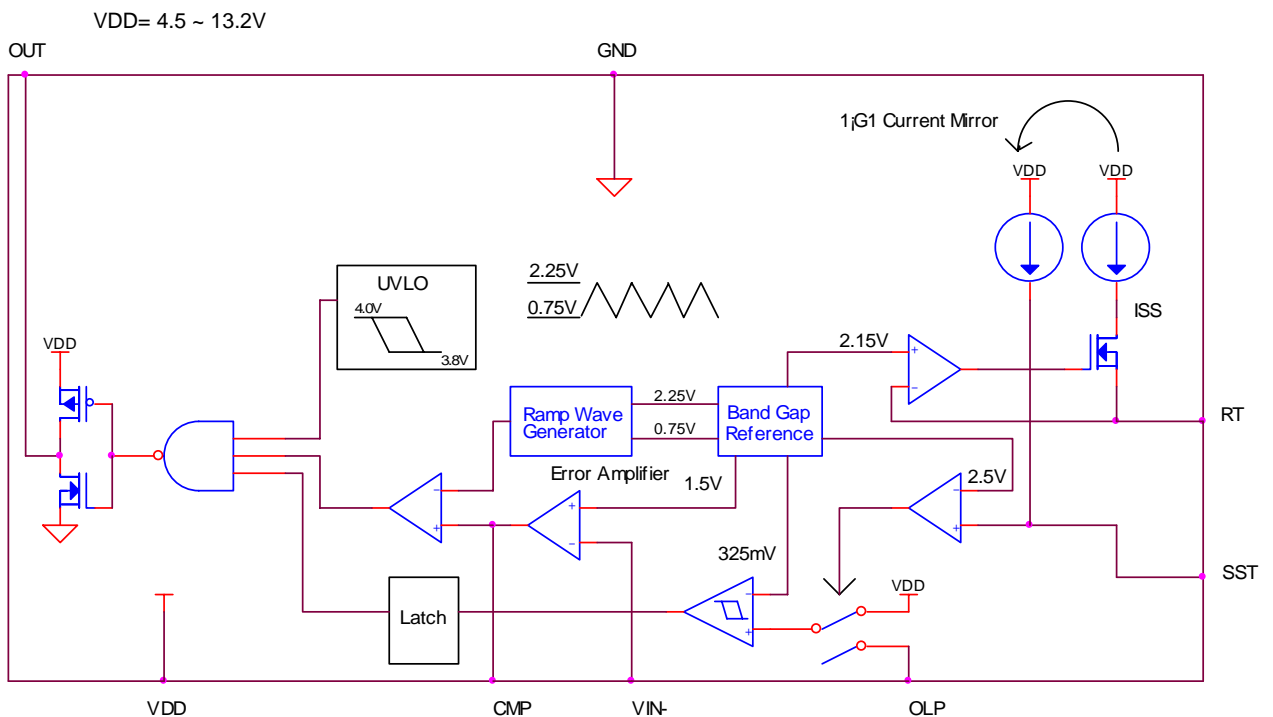
**Recommended Operating Condition:**

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

**Absolute Ratings: (if Ta=25 )**

VDD.....-0.3 ~ +13.7 V  
 GND.....±0.3 V  
 Input Voltage.....-0.3 ~ VDD+0.3 V  
 Operating Ambient Temperature.....0 ~ +70  
 Operating Junction Temperature....+150  
 Storage Temperature.....-55~+150

**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  $R_T = 100\text{K}$ ) The relation between frequency and resistor  $R_T$  is as the equation below:

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

**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.

**The Power On Initialization and Open Lamp Protection**

**Protection:** 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

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

Where  $I_{SS} = V_{RT}/R_T \pm 10\%$ , and  $V_{RT} = 2.15\text{V}$

The output is disabled to "low" level and open lamp protection is disable while  $SST < 0.325\text{V}$ . A ~ 180uA current is flow into INN to set the initial state. The PWM controller is enable while  $2.5\text{V} < SST < 0.325\text{V}$ . The open lamp protection circuit will be enable when  $V_{SST} > 2.5\text{V}$  (Fig.b)

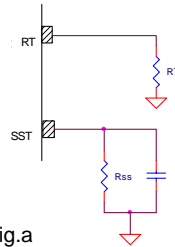


Fig.a

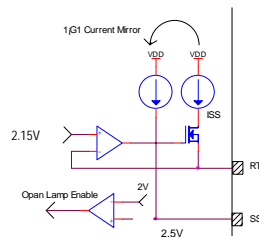


Fig.b

The required time for striking the lamp could be calculated as bellow:

$$T_{\text{STRIKE}} = (R_{SS}C_{SS}) \ln((I_{SS}R_{SS} - 0.325)/(I_{SS}R_{SS} - 2.175))$$

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

Table 1. Power On Initialization and Open Lamp Protection

	OUT	OLP	VIN-
$SST < 0.325\text{V}$	Disable to "Low"	Disable	Internally Forced to "High"
$2.5\text{V} < SST < 0.325\text{V}$	Enable	Disable	Externally Controlled
$SST > 2.5\text{V}$	Enable	Enable	Externally Controlled

**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 open lamp protection.
7	RT	Operation frequency control.
8	GND	Ground

**DC/AC Characteristics:**

Parameter	Test Conditions	Min.	Typ.(Limits)	Max.	Unit
<b>Reference Voltage</b>					
Output voltage	Measure Vin- VDD=12V, Ta=25°C	1.455	1.5	1.545	V
Line regulation	VDD=4.5 ~ 13.2 V		2	20	mV

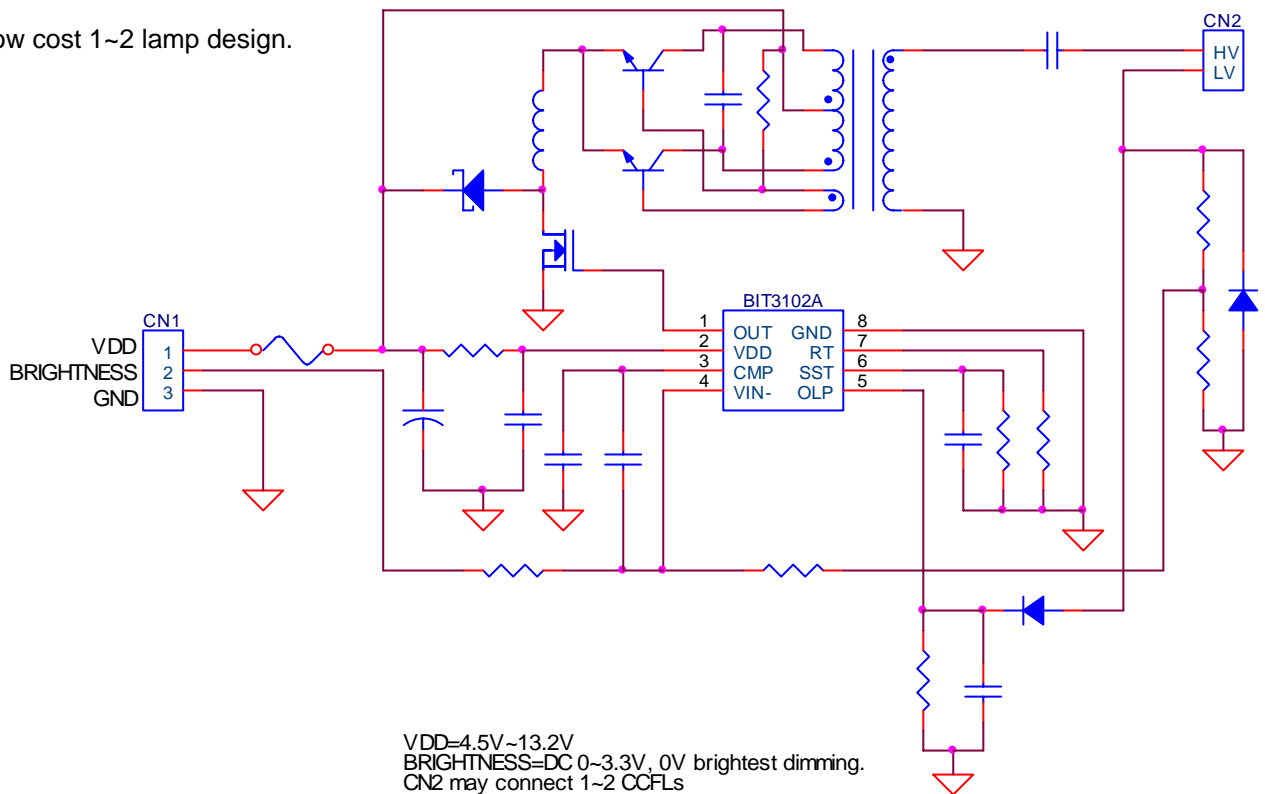
Under Voltage Look Out					
Upper threshold voltage	Ta=25	3.8	4	4.2	V
Hysteresis		0.1	0.2	0.3	V
Ramp Wave Generator					
Frequency	R <sub>T</sub> =100K	120	140	160	KHz
Operating Frequency	note 1	50		250	KHz
Output peak			2.25		V
Output valley			0.75		V
Error Amplifier					
Input voltage	note 1	0.75		2.25	V
Open loop gain		60	80		dB
Unit gain band width		1	1.5		MHz
Open Lamp Enable					
Output current	VDD=12V, Ta=25		2.15V/R <sub>T</sub>		uA
Open lamp detection enable			2.5		V
Open Lamp Protection					
Open lamp detection lower threshold	VDD=12V, Ta=25		325		mV
Hysteresis			50		mV
Output					
CMOS output impedance	note 1		50		
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:**

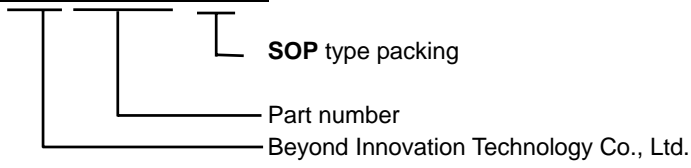
A low cost 1~2 lamp design.



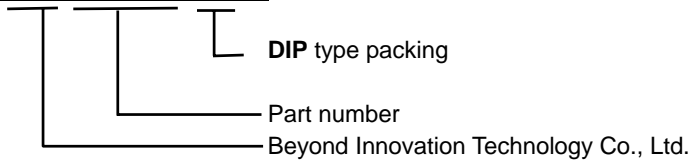
VDD=4.5V~13.2V  
 BRIGHTNESS=DC 0~3.3V, 0V brightest dimming.  
 CN2 may connect 1~2 CCFLs

**Order Information:**

BI T3102A-S0



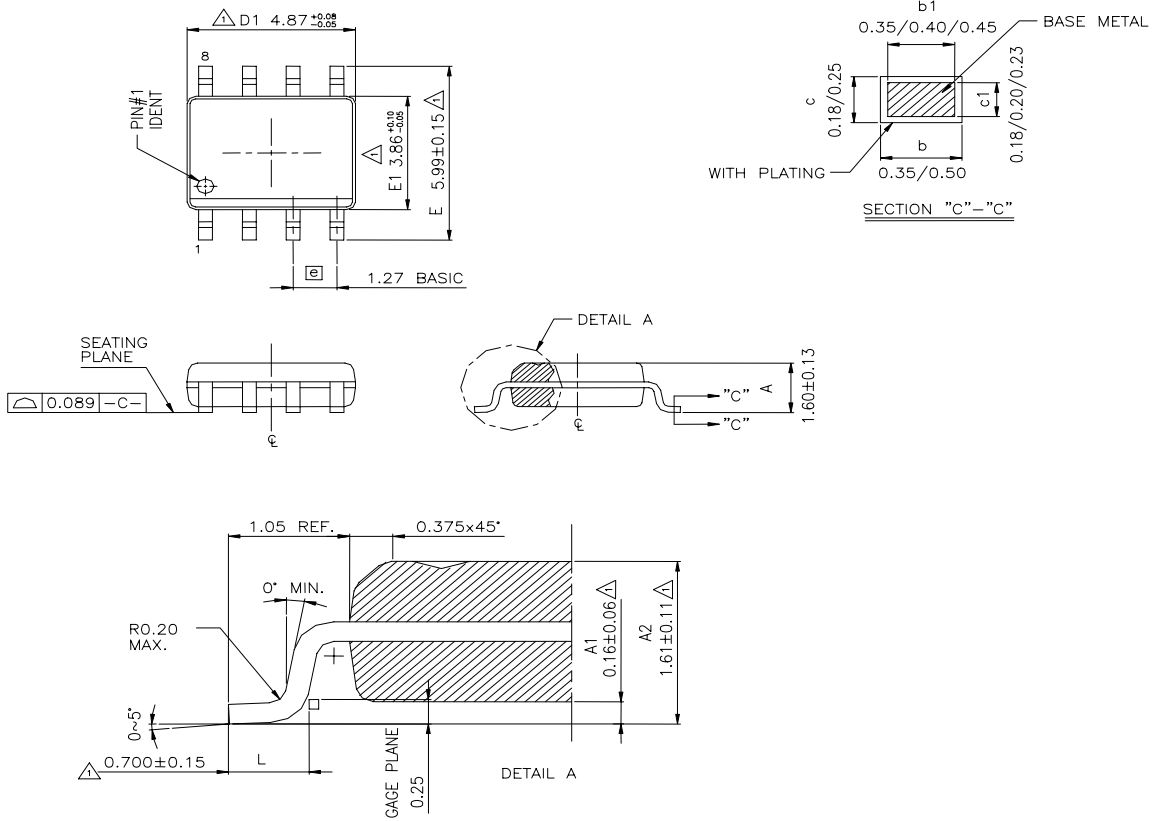
BI T3102A-DP



**Package Information :**

Unit: mm

SOP type :



DIP type :

