Product Specification

GENERAL DESCRIPTION

OB3370N is a high integrated and cost effective Light Emitting Diode (LED) driver optimized for LCD monitor and LCD TV backlight application. The OB3370N operates in voltage mode boost topology with fixed frequency to regulate the LED current. The LED current is sensed through an external current sense resistor. The voltage across the sensing resistor is compared with reference level of 200mV, the error is amplified to control the pulse width of the power switch thus to regulate the current flowing the LED.

It offers both internal burst and external low frequency PWM (LPWM) dimming methods for a wide range of dimming control.

OB3370N integrates under voltage lockout (VCC UVLO) and output over voltage protections that prevent the damage in the event of abnormal conditions. The output voltage level is monitored through OVP pin and it turns off the converter if an over voltage condition is present due to an open circuit condition.

The OB3370N is available in SOP-8 Packages.

FEATURES

- Voltage Mode PWM Controller
- Flexible Dimming Mode Control:
  - Internal burst dimming control
  - External burst (LPWM) dimming control
- 0-2V DC voltage direct dimming control without external circuits
- Output Over Voltage Protections
- Under Voltage Lockout
- Soft Start

APPLICATIONS

- LCD Monitor
- LCD TV
- Flat panel display

TYPICAL APPLICATION

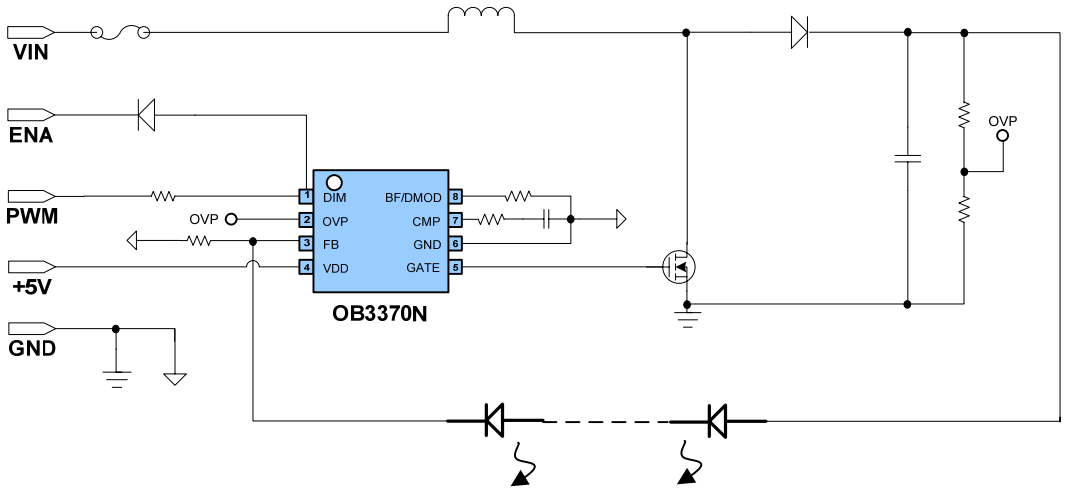


Figure1. OB3370N Typical Application Schematic

Absolute Maximum Ratings

Parameter	Value
VDD Input Voltage to GND	7V
I/O to GND	-0.7V to VDD + 0.3V
Operating Ambient Temp. T_A	-20℃ ~ 85℃
Operating Junction Temp. T_J	150℃
Min/Max Storage Temp. T_{stg}	-55℃ ~150℃
Lead Temp. (10 Sec)	260℃

Note: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

Recommended Operating Range

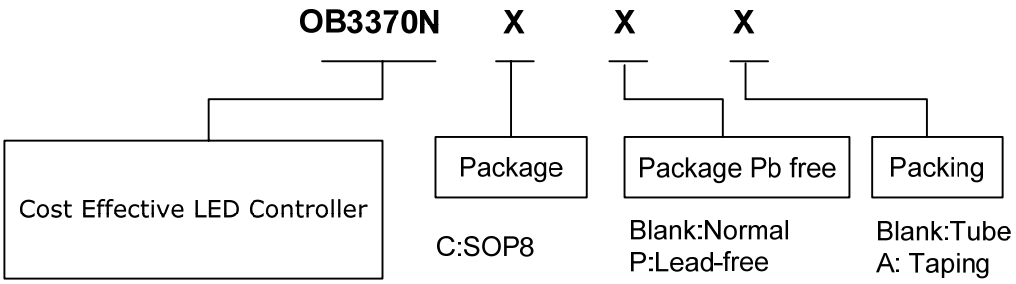
Parameter	Value
VDD Voltage	4.5V to 5.5V
Burst Dimming Frequency	100Hz to 1KHz

Package Thermal Characteristics

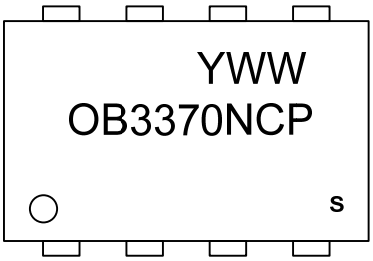
Parameter	Value
Thermal Resistance θJA (SOP)	85℃/W

Ordering Information

Part Number	Description
OB3370NCP	SOP8, pb-free in tube
OB3370NCPA	SOP8, pb-free in T&R

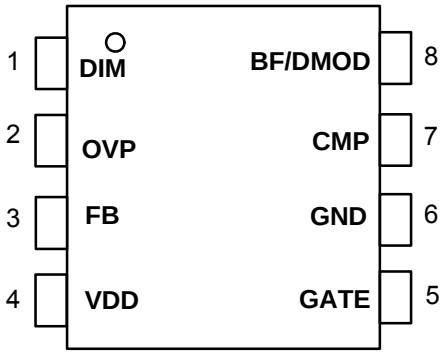


Package Marking Information



Y:Year Code
WW:Week Code(01-52)
C:SOP8 Package
P:Pb-free Package
S:Internal Code(Optional)

Pin Configuration



Terminal Assignment

Number	Pin Name	I/O	Pin Function
1	DIM	Input	Dimming signal input. Digital PWM signal input for external PWM dimming mode or 0V-2V DC voltage input to adjust duty cycle for internal burst dimming mode.
2	OVP	Input	Output Over Voltage Protection—Signal input. Connect OVP to an external output voltage divider. The detection threshold for voltage limiting at OVP is 2V (typical).
3	FB	Input	Feedback signal input. An external current sensing resistor is connected in series between LED strings and ground, The voltage signal is fed back to pin FB (error amplifier input). The reference voltage for current regulation is 0.2V (typical).
4	VDD	P	DC power supply pin. A decoupling capacitor to ground must be placed close to this pin to minimize the switching noise.
5	GATE	Output	Gate drive output for power MOSFET.
6	GND	P	Ground.
7	CMP	I/O	Loop compensation. Connecting a capacitor or a series RC network from CMP to ground to compensate the control loop.
8	BF/DMOD	I/O	Dimming mode selection and Internal PWM dimming frequency setting: ● Connected to GND to set external LPWM dimming mode ● Connect an external capacitor to GND to set internal burst dimming mode. The burst mode frequency is determined by the external capacitor

Functional Block Diagram

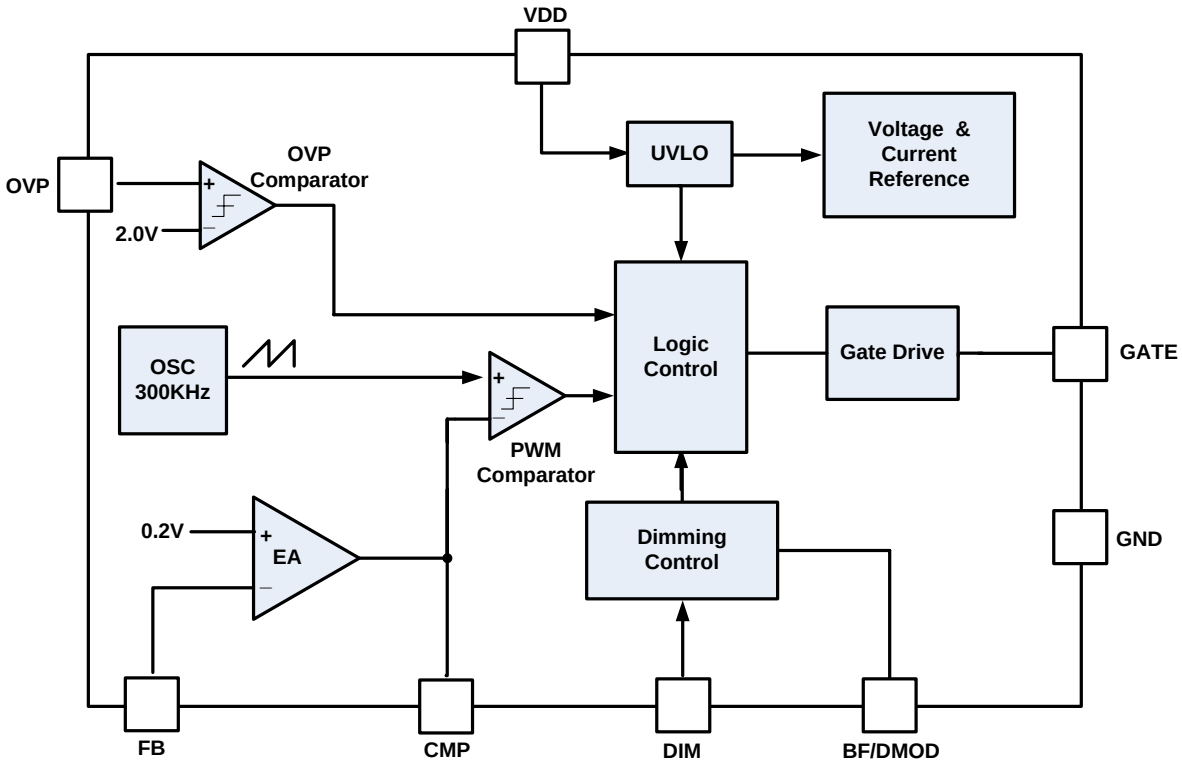


Figure2. OB3370N Functional Block Diagram

Electrical Characteristics

VDD=5V, T_A=25℃, if not otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Current Consumption						
Input voltage range	Vdd		4.5	-	5.5	V
Operating supply current	I_{VDD}	No loading, CMP=5V	-	3.5	5	mA
Operating supply current	I_{VDD}	C_{load}=2nF, CMP=5V	-	7	9	mA
VDD UVLO						
UVLO on			3.6			V
UVLO off					4.4	V
Soft start						
Soft start current	I_{SST}			3		uA
PWM Control						
Operating frequency	F_{OP}		-	300	-	KHz
Max duty cycle for OB3370N	D_{max}			92.5		%
Error Amplifier						
Reference voltage	V_{ref_EA}	Reference voltage at non-inverting input		0.2		V
Open loop voltage gain	A_m			60		dB
Transconductance of EA	Gm			33		umho
Output source current	I_{source}			60		uA
Output sink current	I_{sink}			-120		uA
PWM Dimming						
Burst frequency		$C_{BF/DMOD}$=22nF	180	200	220	Hz
Max. burst duty	D_{burst_max}	$C_{BF/DMOD}$=22nF, DIM<0.2V	-	100	-	%
External LPWM duty		BF/DMOD=0V	0	-	100	%
External LPWM Logic input level	high	BF/DMOD=0V	2.0			V
	low	BF/DMOD=0V			0.8	V
Protection Threshold						
OVP	Vth_ovp	Threshold of output over voltage		2.0		V
Gate Driver Output						
Gate	R_{ON}	$I_{sink/Isource}$=70mA	-	8	12	ohm

Function Description

General Operation

OB3370N LED driver is designed for LCD LED backlight system applications. It operates in voltage mode boost topology with constant frequency to regulate the current of series string of white LED.

Fixed-Frequency Boost converter

OB3370N operates in a fixed-frequency (300 KHz), voltage mode, boost converter that sets the LED current by regulating the voltage at FB pin to 200mV. The resulting error signal is amplified and compared to the internal ramp signal to determine the switching MOSFET on-time. The output of error amplifier controls the PWM duty cycle thus the power delivered to the load. If the feedback voltage starts to drop, the output of the error amplifier increases. This results in more current flowing through the power FET, thus increasing the power delivered to the output.

UVLO

OB3370N has Under Voltage Lockout (UVLO) function. The chip is disabled when the VDD is below the UVLO threshold and the hysteresis of UVLO is nearly 200mV.

Soft Start

OB3370N has internal soft-start to limit the amount of current through VIN at startup and to also limit the amount of overshoot on the output.

Setting LED Current

The LED current is sensed by the sensing resistor, Rs, shown in Figure 4 or Figure 5. The current through the LED strings is given by the equation below:

$$I_{LED} = \frac{0.2V}{R_s}$$

Dimming Control

Two commonly used dimming modes, internal burst mode dimming and external burst (PWM) dimming, are supported without any additional components. Different dimming modes are selected by BF/DMOD pin. The LED brightness is determined by the control signal at DIM pin.

External LPWM burst dimming mode is selected by shorting BF/DMOD pin to ground. OB3370N accepts an external LPWM signal to DIM pin with a swing voltage of 0V to a level greater than 2V. The LED brightness is controlled by the duty cycle of the LPWM signal. The burst frequency is equal to LPWM frequency.

Internal burst mode dimming is obtained by connecting a capacitor to BF/DMOD pin. A low frequency triangular waveform generator is formed by the capacitor and internal circuit of IC. The triangular voltage waveform with peak of 2V and valley of 0.2V at this pin is used for the internal low frequency burst PWM generation. Duty cycle hence the LED brightness is controlled by the analog signal at DIM pin. The burst mode dimming frequency F_{burst} is set by the following equation:

$$F_{burst}(Hz) = \frac{4400}{C_{BF}[nF]}$$

A DC voltage ranging from 0.2V to 2V at DIM pin corresponds to a LED brightness of approximately 100% to 0%, as shown in Figure 3.

$$Duty = \frac{(2 - V_{DIM})}{1.8} \times 100\% \quad \text{for} \quad 0.2V \le V_{DIM} \le 2V$$

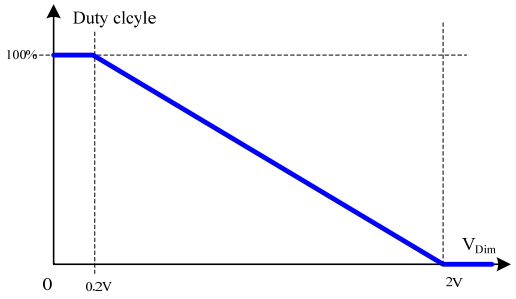


Figure. 3 Duty of burst vs DIM voltage

Function	Pin Connection		Ratio
	BF/DMOD	DIM	
Internal Burst	Capacitor	0.2V-2V	Set by customer
External LPWM	<0.2V	PWM	Set by customer

Over Voltage Protection

OB3370N shouts down the output if the output voltage is higher than the predetermined threshold level. In case of LED failing, the current of LED and the resulted voltage drop on sensing resistor is nearly zero, the converter will run at maximum duty cycle that boosts the output voltage to a very high level. To prevent this happen, the output voltage is monitored through Pin OVP and converter is shut down if the output voltage exceeds the predetermined level. This protection is auto-recovery.

Reference Application

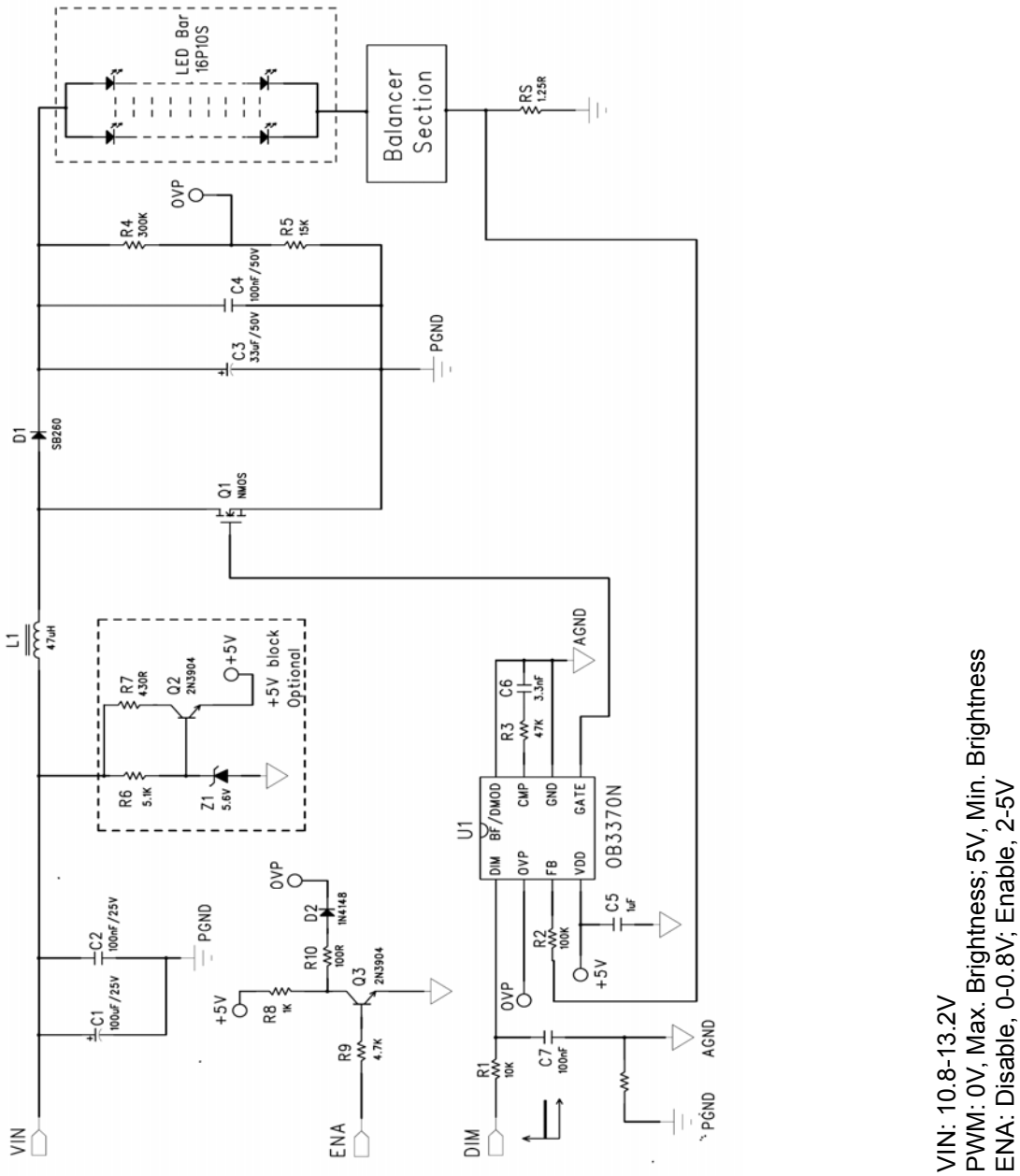


Figure4. OB3370N for internal burst dimming Reference Application Schematic

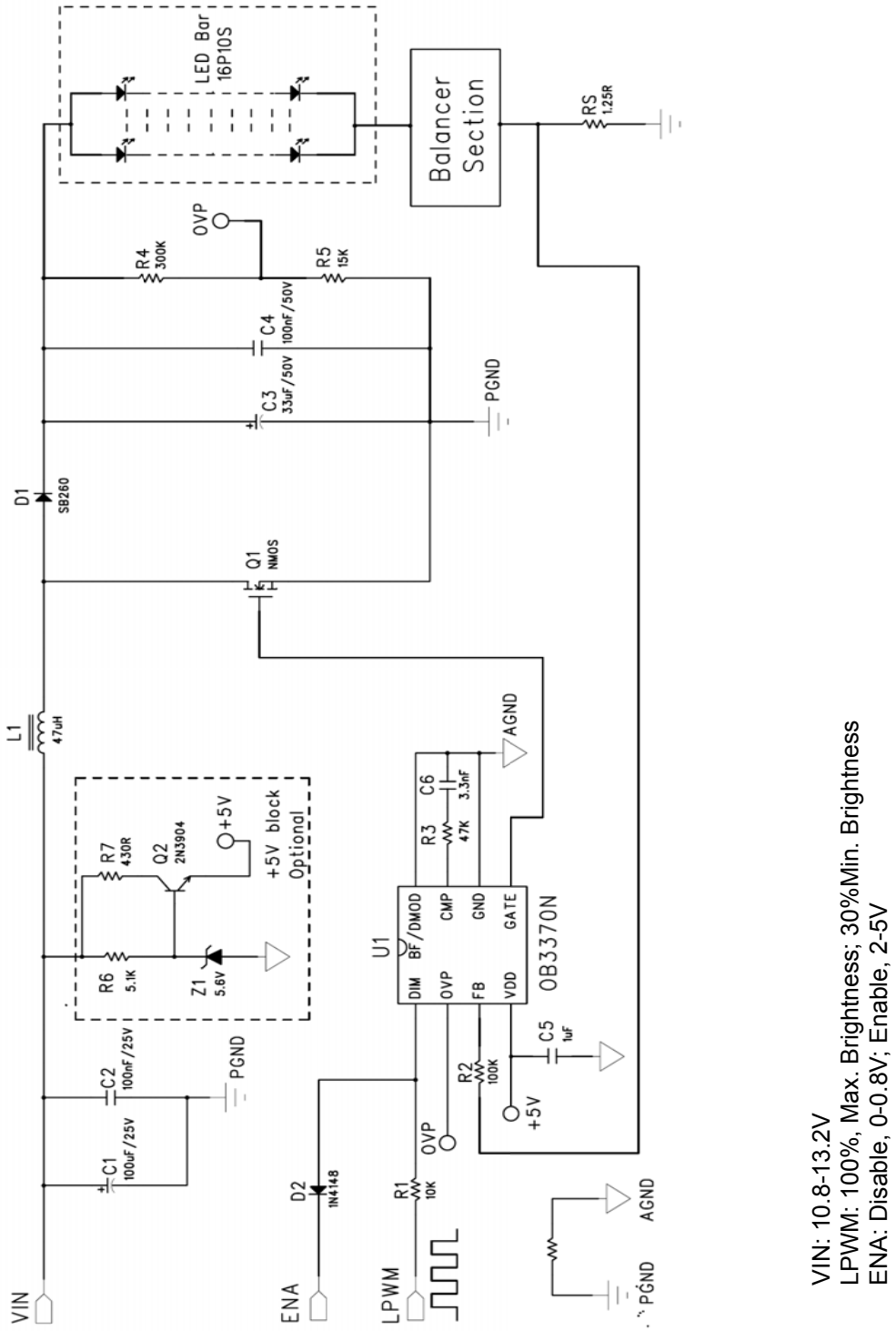
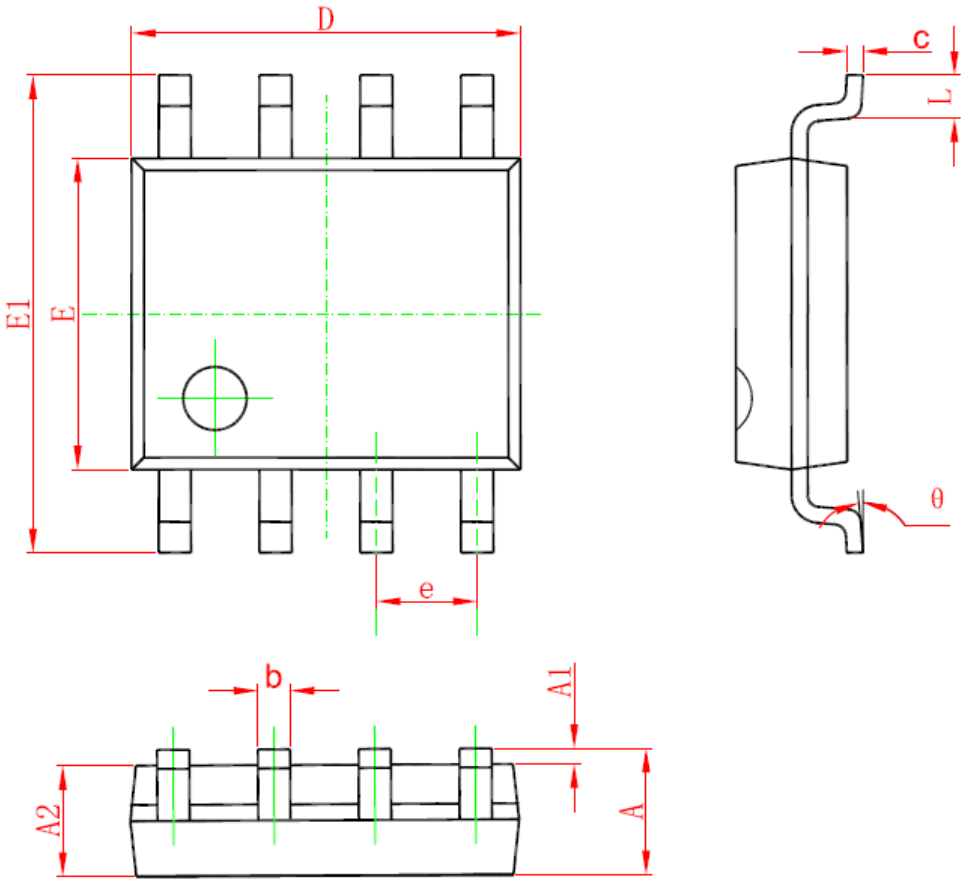


Figure5. OB3370N for external LPWM dimming Reference Application Schematic

PACKAGE MECHANICAL DATA

SOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.650	0.049	0.065
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	4.700	5.150	0.185	0.203
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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