

# High Power Factor & Accuracy Constant Current LED Driver

## Features

- High Power Factor by One Cycle Control
- Accuracy Constant Current
- Low BOM Cost
- Linear Dimming on DIM Pin
- Average Current / Fixed Frequency Control
- Gate Output Voltage Clamp
- LED Open Protection (OVP)
- LED Short Protection (SCP)
- Over Current Protection (OCP)
- Internal OTP Protection
- 300mA Driving Capability for OUT Pin

## Application


- E26/27, T5/T8 LED Lamp
- Others LED Lighting Applications

## Description

The GL8211 is a highly-integrated, low startup current, average current mode, one cycle control PFC and fixed switching frequency PWM controller. These functions enable the LED driver to easily meet the accuracy average LED current and high power factor requirements. The integrated functions also include the LED short protection, open protection, and internal over temperature protection. The COMP pin controls the duty by connected an RC compensation network to ground and forming the closed loop feedback control. To protect the external power MOSFET from being damaged by supply over voltage, the GL8211 OUT pin voltage is clamped to about 15V.

The GL8211 improves the performance and reduces the cost of the LED driver. It is a 6-pin SOT-26 package.

## Ordering and Marking Information

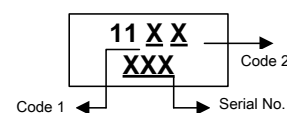
**GL8211** 

**Package Code**  
C: SOT-26

**RoHS Code**  
G: Green (Halogen Free) Device  
L: PB Free Device

---

**SOT-26**

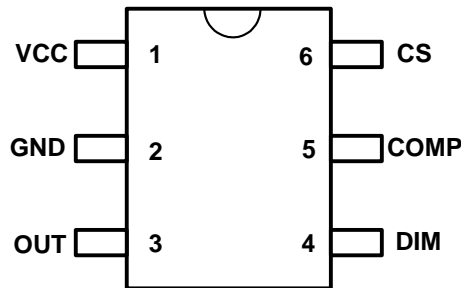


Code 1	8	9	A	B				
Year	2008	2009	2010	2011	...			
Code 2	1	2	3	4	...			
Month	Jan.	Feb.	Mar.	Apr.	...			

G	H	I	J
2016	2017	2018	2019
9	A	B	C
Sep.	Oct.	Nov.	Dec.

greenergy OPTO Inc. reserves the right to make changes to improve reliability or manufacture ability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

## Pin Configuration



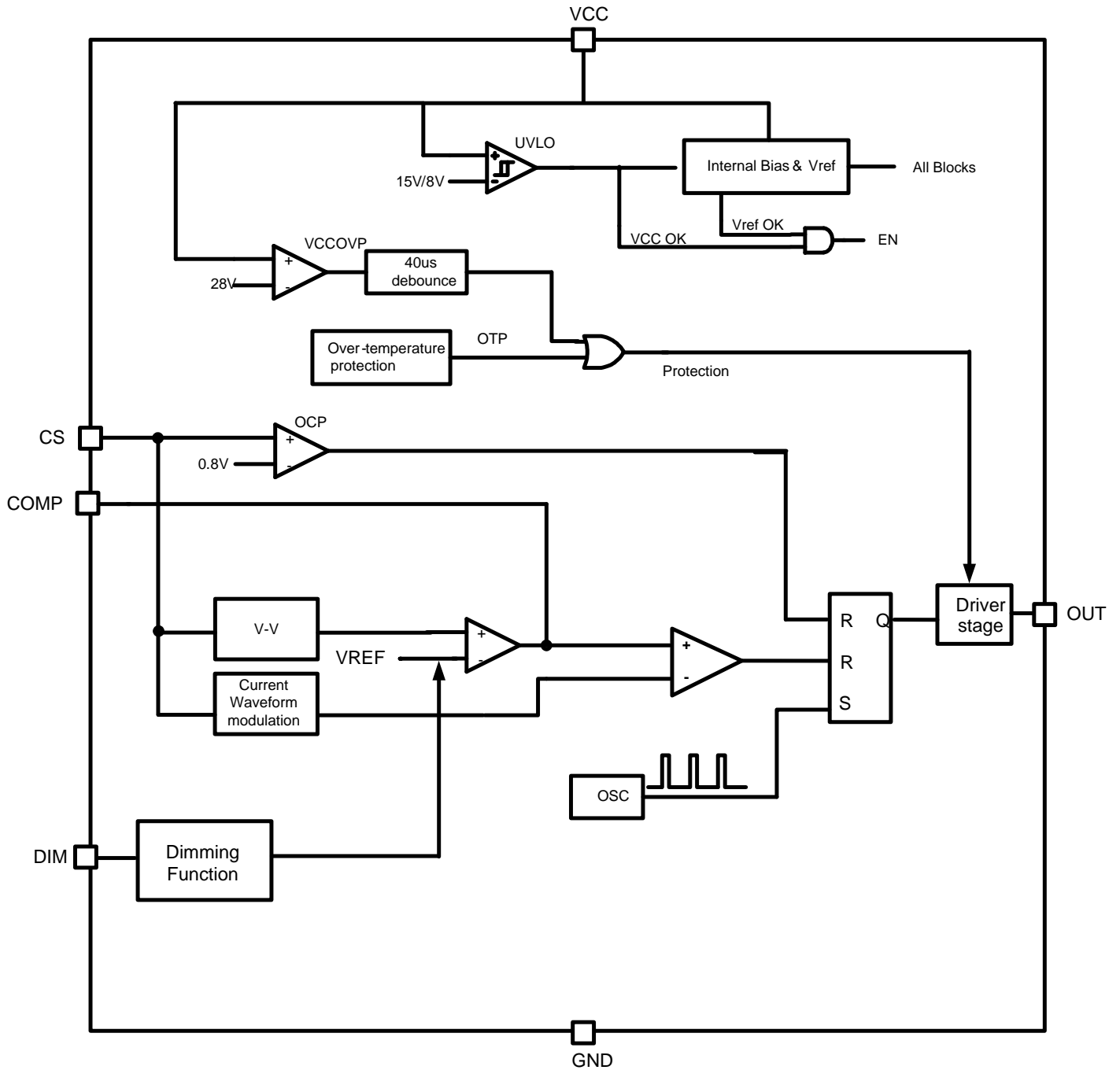
## Pin Description

Pin No.	Name	Function
1	VCC	Power supply pin
2	GND	Ground pin
3	OUT	The output driver for driving the external MOSFET
4	DIM	Dimming control pin by input a DC voltage
5	COMP	Feedback compensation network
6	CS	Current sense pin, connect to sense the MOSFET current

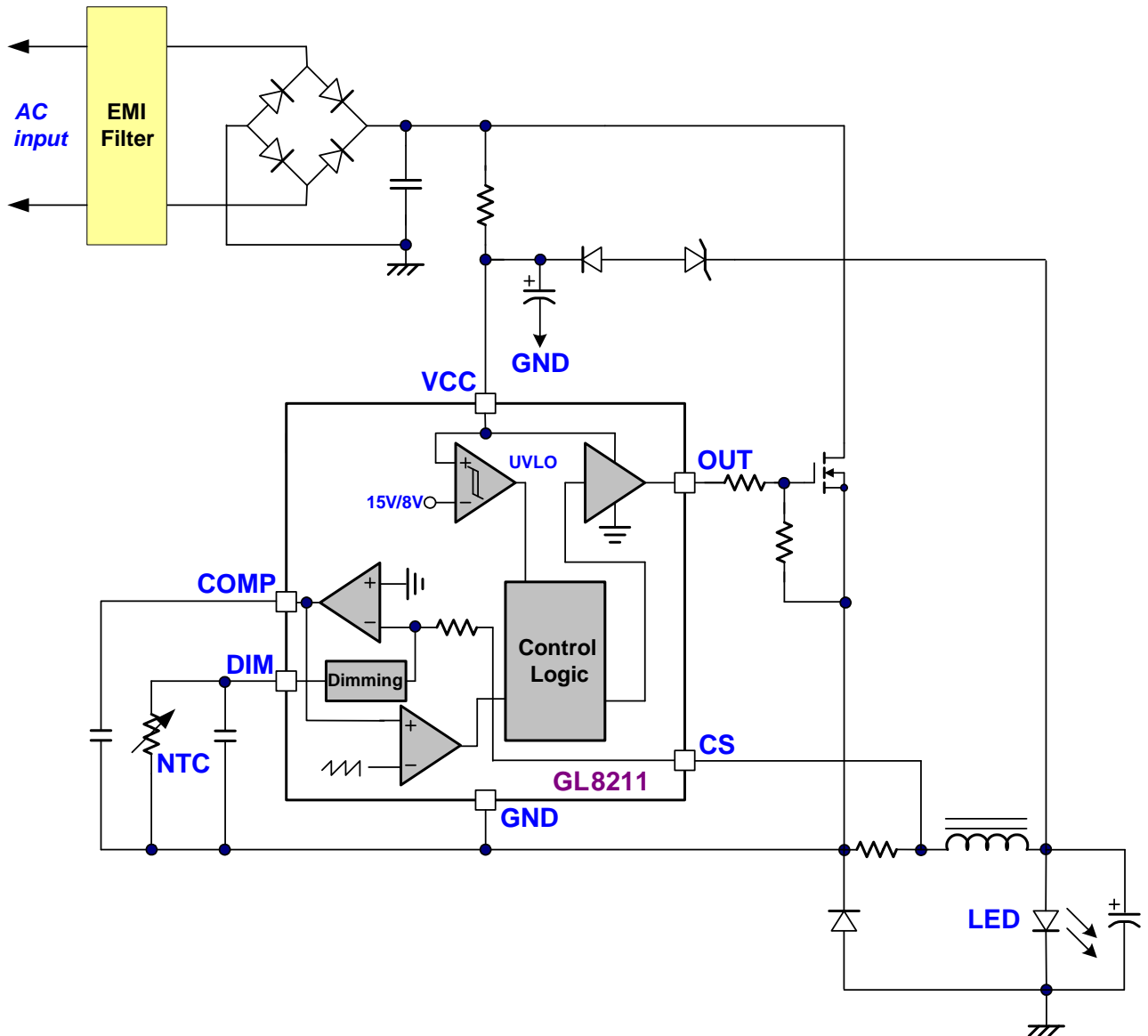
## Absolute Maximum Ratings

Supply voltage VCC	30V
DIM, COMP, CS	-0.3V ~ 7V
OUT	15V
Junction temperature	150°C
Operating ambient temperature	-20°C ~ 85°C
Storage temperature range	-65°C ~ 150 °C
SOT-26 package thermal resistance (junction to ambient)	250°C/W
Power dissipation (SOT-26, at ambient temperature = 85°C)	250mW
Lead temperature (All Pb free packages, soldering, 10 sec)	260°C
ESD voltage protection, human body model	2KV
ESD voltage protection, machine model	200V

## Function Block



## Application Circuit



**Electrical Characteristics (VCC = 15.0V & TA = +25°C, unless otherwise specified.)**

Parameter	Pin	Min.	Typ.	Max.	Unit
-----------	-----	------	------	------	------

**SUPPLY VOLTAGE**

Startup Current (VCC=UVLO on - 1V)	1		8	15	uA
Operating Current (with 1nF load on OUT pin), Vcomp = 2.5V	1		2	3	mA
Operating Current (with 1nF load on OUT pin), Protection Tripped (OCP, OVP, SCP, OTP)	1		0.7	1	mA
UVLO(off)	1	7	8	9	V
UVLO(on)	1	14	15	16	V
OVP Level on VCC Pin	1	26.5	28	29.5	V
OVP De-Bounce Time	1	36	40	60	us

**VOLTAGE FEEDBACK**

Feedback Reference Voltage	5	0.197	0.200	0.203	V
Tran-Conductance	5	100	120	140	uS
Output Sink Current	5	10	12	14	uA
Output Source Current	5	10	12	14	uA

**CURRENT SENSING**

Input Over Voltage Protection	6	0.75	0.80	0.85	V
Open Loop Voltage, CS Pin Open	6	2	5		V
Leading-Edge Blanking Time	6	360	410	460	nS
Delay to Output	6		100	220	nS

**SWITCHING FREQUENCY**

Switching Frequency	-	42	45	48	KHz
Optional (65KHz)		60	65	70	KHz
Maximum Duty	-	90			%
Frequency Jitter Range			+/-4		%
Temp. Stability (-40°C ~ 125°C)	-			3	%
Voltage Stability (VCC = 11V~25V)	-			1	%

**GATE DRIVER OUTPUT**

Rising Time, Load Capacitance = 1000pF	3		160	320	nS
Falling Time, Load Capacitance = 1000pF	3		80	160	nS
VGATE-Clamp (VCC = 25V )	3		13.5	15	V

**DIM INPUT SECTION**

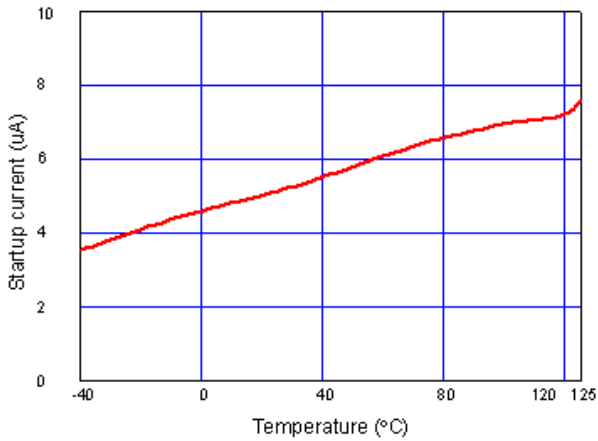
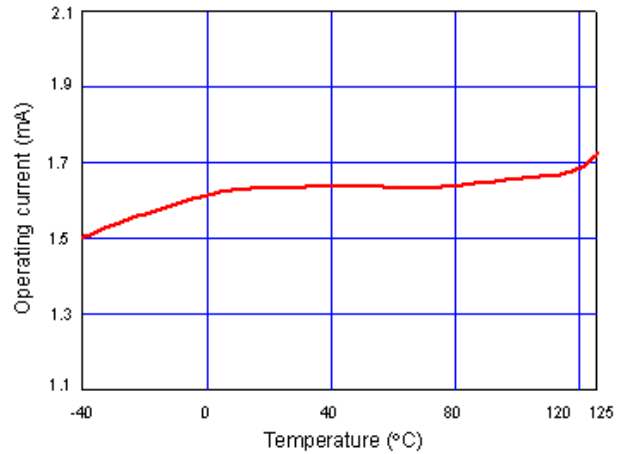
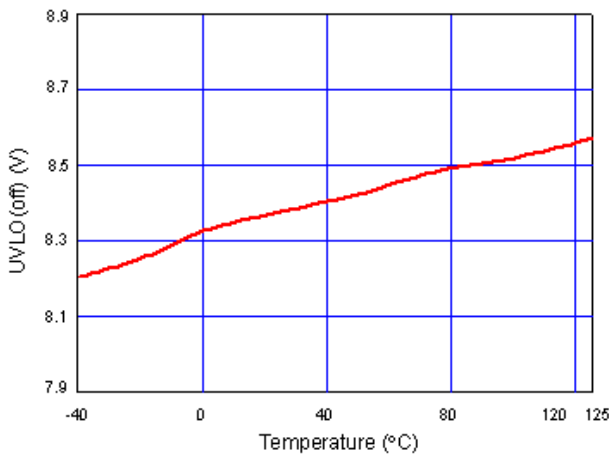
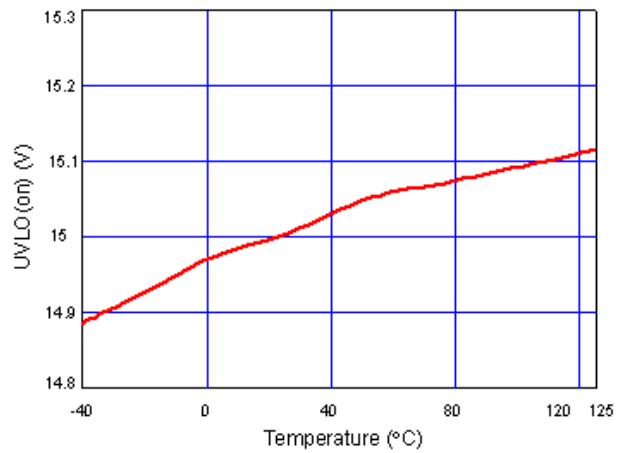
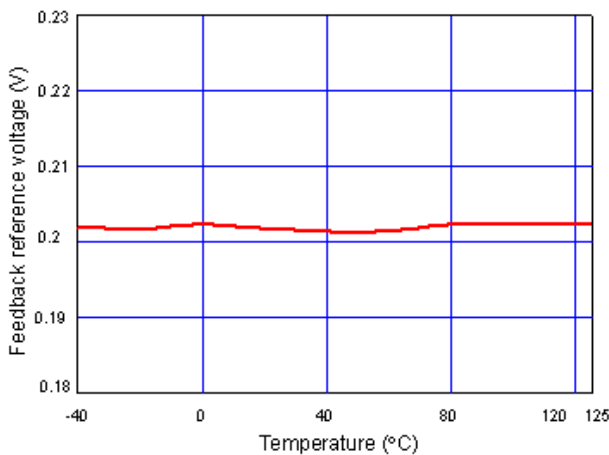
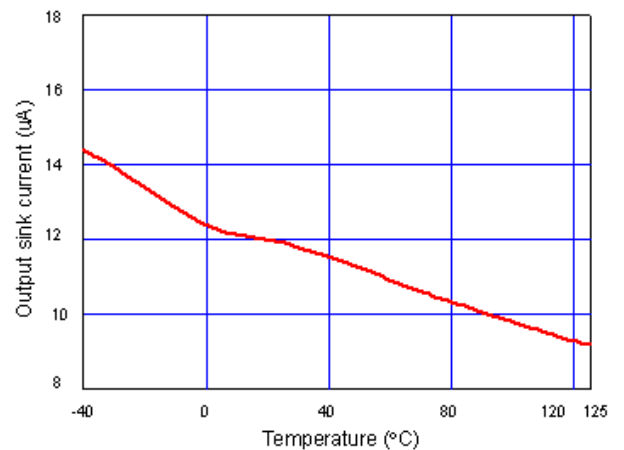
Saturation Threshold Voltage	4	3.0			V
Linear Dimming Range	4	0.3		3.0	V
LED Current off Threshold Voltage	4			0.3	V
Current Source	4	290	300	310	uA

**OTP SECTION**

OTP Trip Point	-	140	150	160	°C
OTP Release Point	-	120	130	140	°C
OTP Threshold Level	-		20		°C
OTP De-Bounce Time	-	40	80	120	uS

Note:

1. OCP, SCP, OTP: Auto Recovery Type
2. OVP: Auto Recovery Type (Latch off type optional)

**Typical Performance Characteristics**

**Fig. 1 Startup current vs. Temperature**

**Fig. 2 Operating current vs. Temperature**

**Fig. 3 UVLO(off) vs. Temperature**

**Fig. 4 UVLO(on) vs. Temperature**

**Fig. 5 Feedback reference voltage vs. Temperature**

**Fig. 6 Output sink current vs. Temperature**

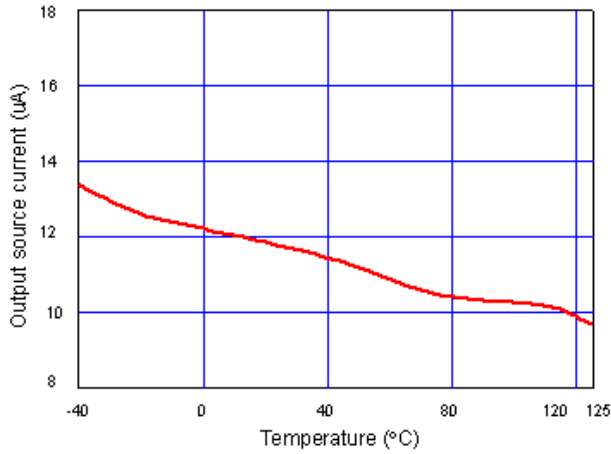


Fig. 7 Output source current vs. Temperature

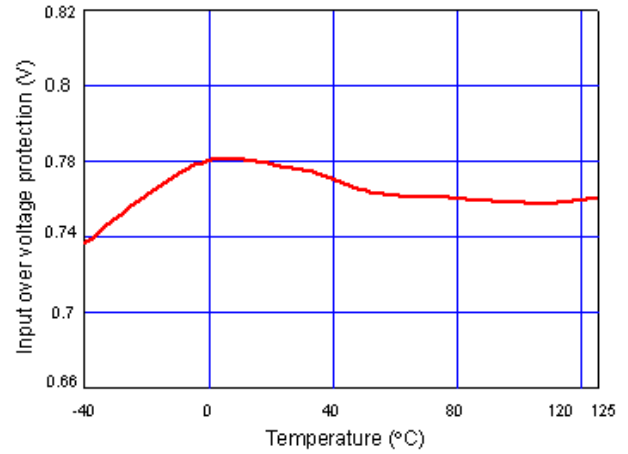


Fig. 8 Input over voltage protection vs. Temperature

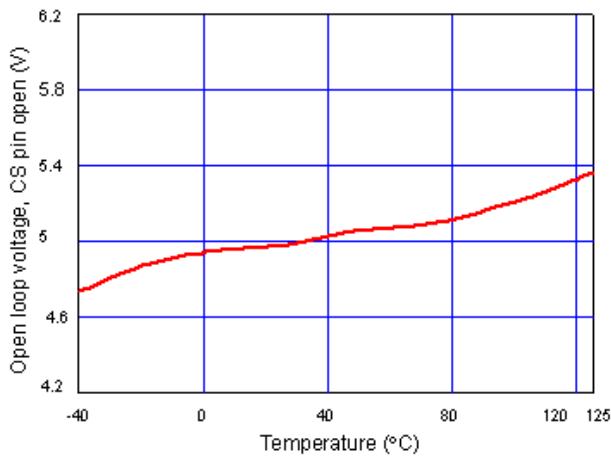


Fig. 9 Open loop voltage, CS pin open vs. Temperature

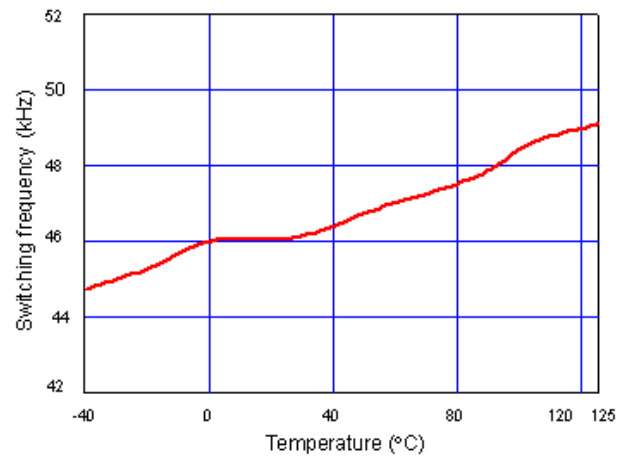


Fig. 10 Switching frequency vs. Temperature



## Application Information

### Start-up Current

The typical start-up current is around 8uA. Very low start-up current allows the PWM controller to increase the value of start-up resistor and then reduce the power dissipation on it.

### UVLO (Under Voltage Lockout)

A hysteresis UVLO comparator is implemented in GL8211, then the turn-on and turn-off thresholds level are fixed at 15V and 8V respectively. This hysteresis shown in Fig.11 ensures that the start-up capacitor will be adequate to supply the chip during start-up. For quickly startup the LED driver, the start-up resistor should be matched with the startup capacitor. Due to the low UVLO on level, so the turn-on delay time will also never greater than the general PWM IC.

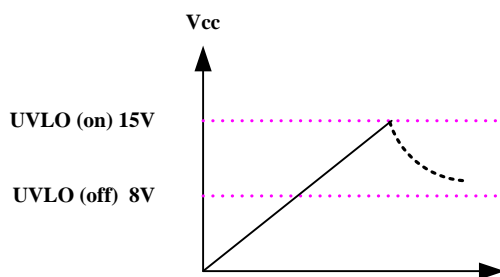


Fig.11

### Oscillator

The maximum duty-cycle of internal oscillator is up to 90% for driving high LED voltage string. The frequency of the oscillator is fixed to 45KHz by internal setting.

### LEB (Leading-Edge Blanking)

Each time the power MOSFET is switched on, a turn-on spike will inevitably occur at the sense resistor. To avoid fault trigger, a 410ns leading-edge blanking time is built in. Conventional RC filtering can therefore be omitted. During this blanking period, the current-limit comparator is disabled and can not switch off the gate driver.

### OCP (Over Current Protection)

The GL8211 has an over current protection function on CS pin. An internal circuit detects the current level, when the current is larger than a threshold level, the gate output will keep on low level. Then VCC decreases below UVLO off level, the controller resets again.

### OVP (Over Voltage Protection) on VCC

To prevent the LED driver from being damaged, the GL8211 is implemented an OVP function on VCC. When the VCC voltage is higher than the OVP threshold voltage 28V, the output gate driver circuit will be shut down immediately to stop the switching of power MOSFET. The VCC pin OVP function is an auto recovery type protection (latch off type optional). If the OVP condition happens, the pulses will be stopped and never recovery unless the VCC pin voltage is down to the UVLO off level. The GL8211 is working in an auto-recovery mode as shown in Fig. 12.

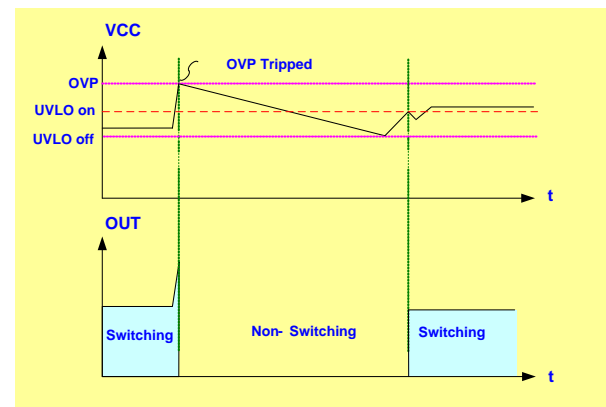


Fig. 12

### Gate Clamp/Soft Driving

Driver is clamped to 15V by an internal clamping circuit. Those damages usually come from undesired over-voltage gate signals. Under the conditions listed below, the gate output will turn off immediately to protect the power circuit. The GL8211 also has soft driving function to minimize EMI.

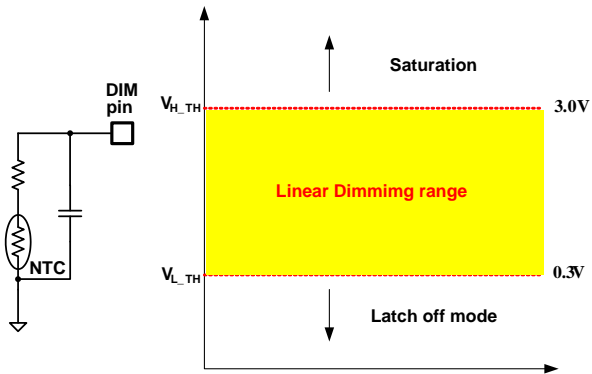
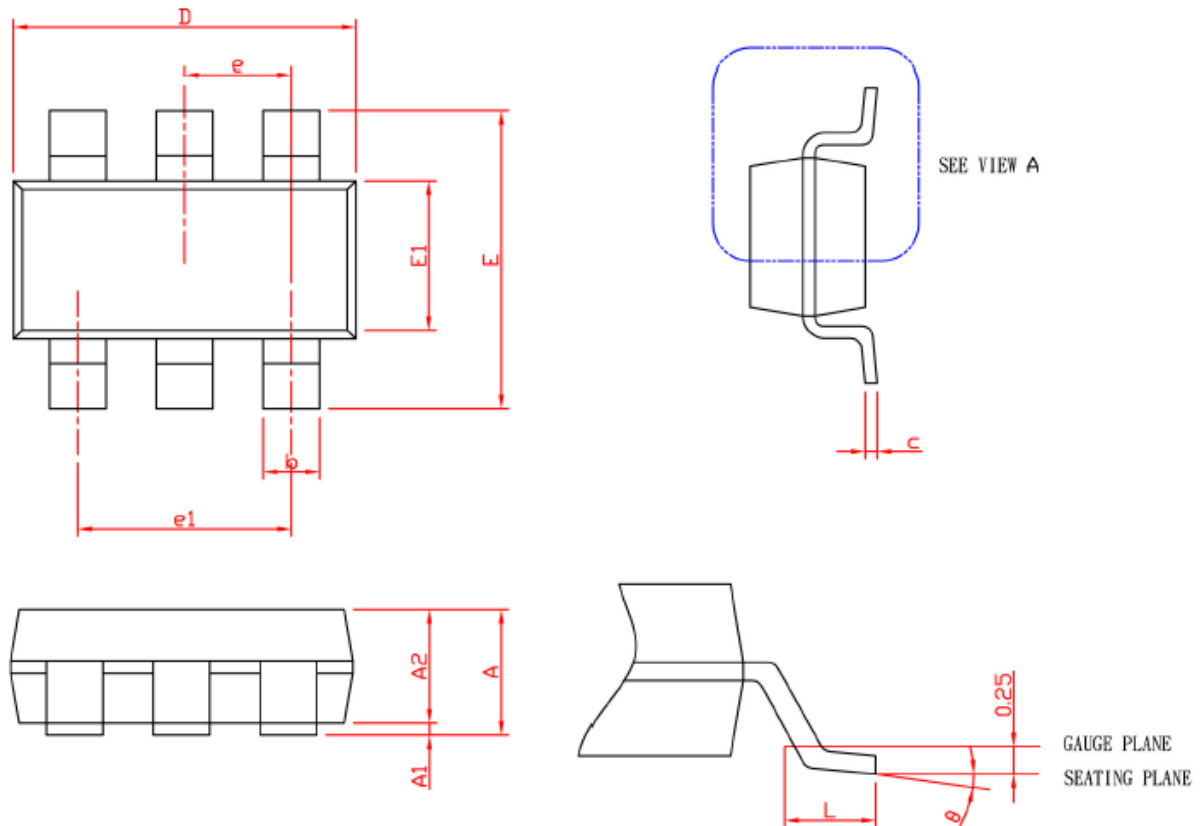
**Over Temperature Protection/Dimming Function**


Fig. 13

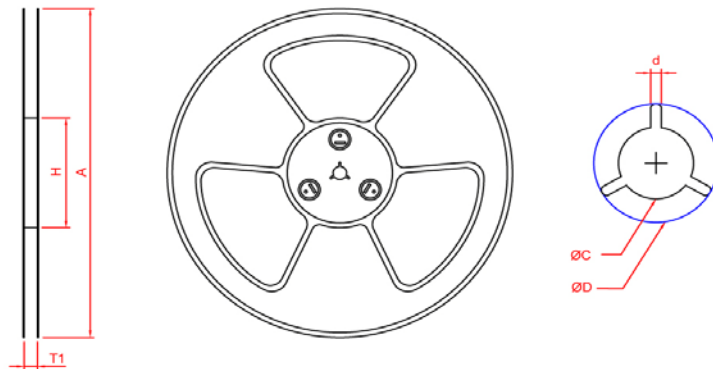
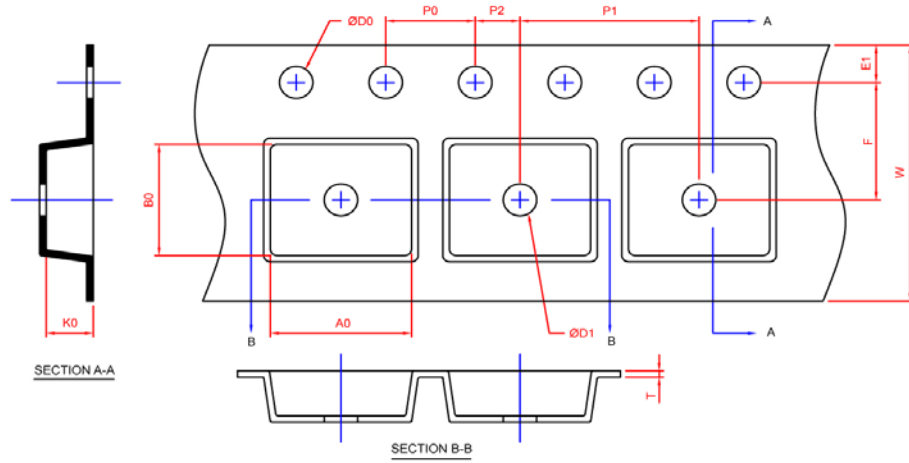
The typical application for DIM pin is shown in Fig. 13. The NTC thermistor is setting as an external OTP protection. In the DIM pin, there is one comparator for latch-off mode protection. While the voltage on this pin is lower than 0.3V, the GL8211 will shut down. When the voltage is in the range of 0.3 to 3.0V, the GL8211 is operating on the linear dimming range. While the voltage is higher than 3.0V, the GL8211 is operating on the normal status. It also could let this Pin open when the function is not required for the user.

**Package Information**
**SOT-26**


SYMBOL	SOT-26			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.45		0.057
A1	0.00	0.15	0.000	0.006
A2	0.90	1.30	0.035	0.051
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.70	3.10	0.106	0.122
E	2.60	3.00	0.102	0.118
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30	0.60	0.012	0.024
$\theta$	0°	8°	0°	8°

Note: 1. Followed from JEDEC TO-178 AB.

2. Dimension D and E1 do not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 10 mil per side

**Carrier Tape & Reel Dimensions**
**SOT-26**


Application	A	H	T1	C	d	D	W	E1	F
<b>SOT-26</b>	178.0±2.00	50 MIN.	8.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	8.0±0.30	1.75±0.10	3.5±0.05
	<b>P0</b>	<b>P1</b>	<b>P2</b>	<b>D0</b>	<b>D1</b>	<b>T</b>	<b>A0</b>	<b>B0</b>	<b>K0</b>
	4.0±0.10	4.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.0 MIN.	0.6+0.00 -0.40	3.20±0.20	3.10±0.20	1.50±0.20

Application	Carrier Width	Cover Tape Width	Devices Per Reel
<b>SOT -26</b>	8	5.3	3000

(mm)

## Tape and Specification Reel

## SOT 26

