

LED Lighting Products Introduction

Product Aspects

AC/DC Conversion

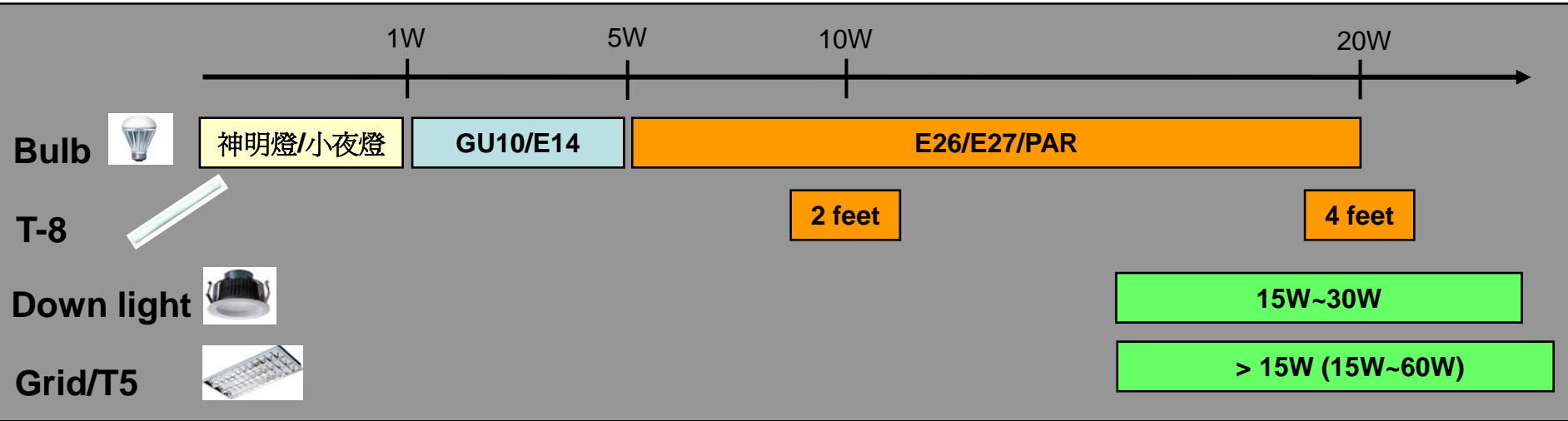
- **PWM Controllers**
- **PFC Controllers**
- **Resonant Controllers**
- **Synchronize Rectifier Controllers**
- **Supervisors / Housekeeping**
- **Current and Voltage Controllers**
- **MCM**

Lighting Power Solutions

- **LED Lighting**
- **Fluorescent Lamp Lighting**

Battery Management

- **Li, NiMH Charger**
- **Cell Protection**
- **Battery Charger**



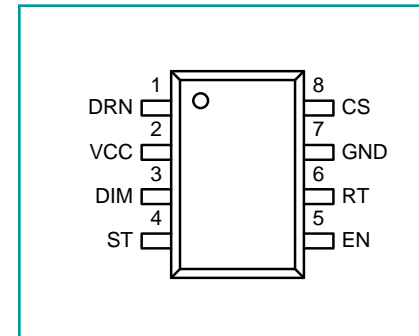
Type	Topology	Products
神明燈/小夜燈 (E11)	CR+HVLED	GL8200
GU10 / E14	CR+HVLED, Buck	GL8200, GR1001, GL8211(PFC)
E26 / E27 / PAR	Buck/Flyback/PSR	Buck: GR1001 → GL8211(PFC) Flyback (non_iso): GL8216 (PFC) PSR: GR8818 / GL8258 PSR+PFC: GL8259 (2012/Q1E)
T8 / Down light / Grid	Flyback	GR8762, G1001, GL8211, GL8216

Features

- Cascade Buck Based Topology
- Constant peak current & Constant-off time operation
- High/Low line peak current compensation
- Linear and PWM Dimming capability
- Brown in/out protection
- On chip OTP (latch type)
- CS pin short protection
- Frequency reducing in light load or short circuit
- Low BOM cost



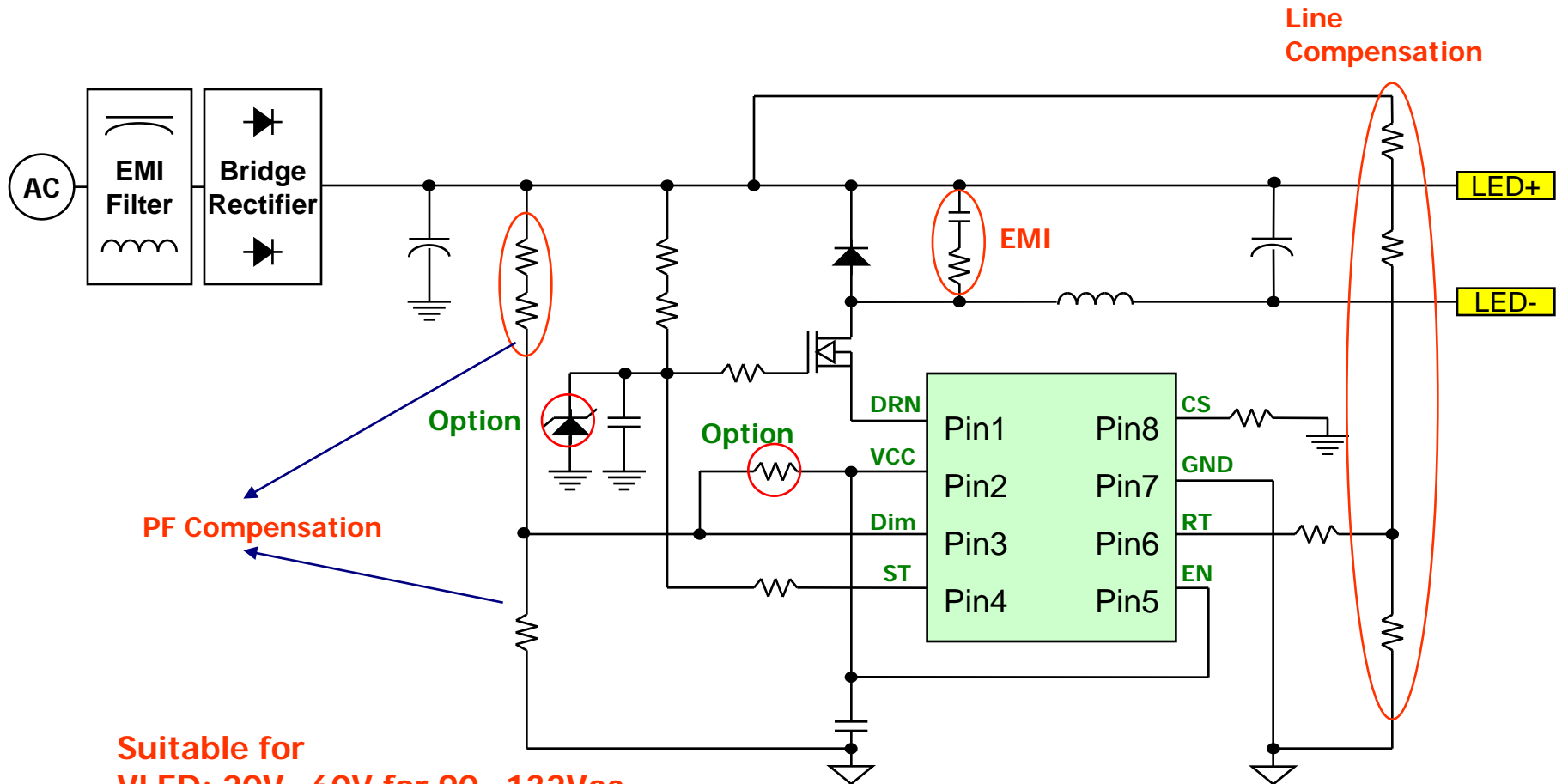
Pinning



Pin description

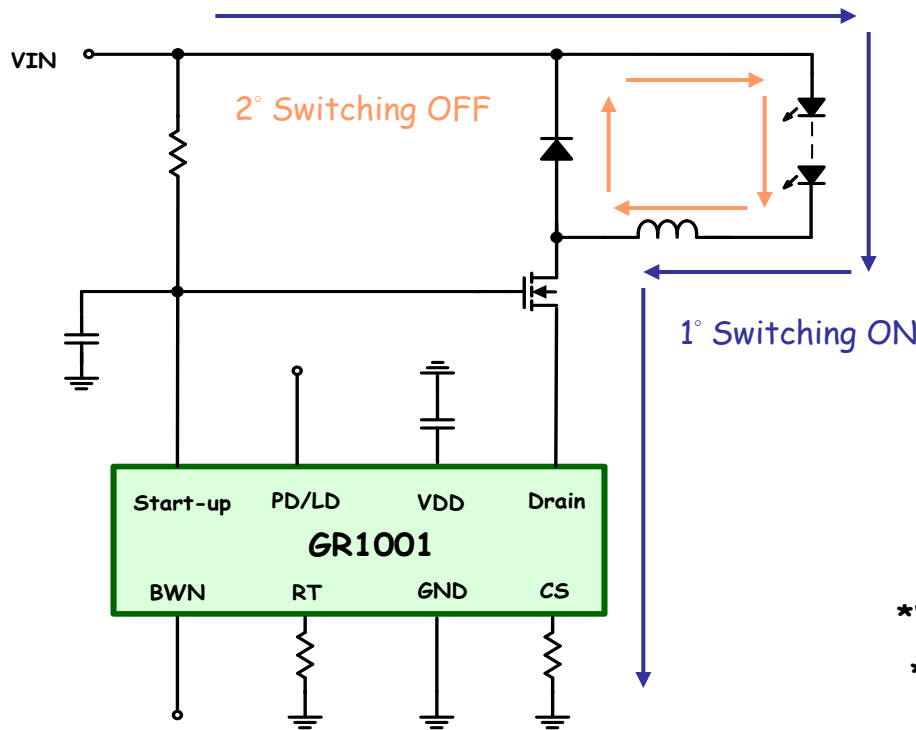
Pin No.	Name	Function
1	DRN	Driving external power MOS pin.
2	VCC	Positive power supply pin.
3	DIM	Dimming control signal input pin.
4	ST	Anode terminal of the internal Zener diode.
5	EN	Chip enable input pin.
6	RT	Setting constant off time pin.
7	GND	The ground pin.
8	CS	Current sense pin.

Schematic (non-isolation buck topology)



Suitable for
VLED: 20V ~ 60V for 90 ~ 132Vac
40V ~ 120V for 180 ~ 264Vac
ILED: < 450mA

Cascade Topology Operation



Current in inductor

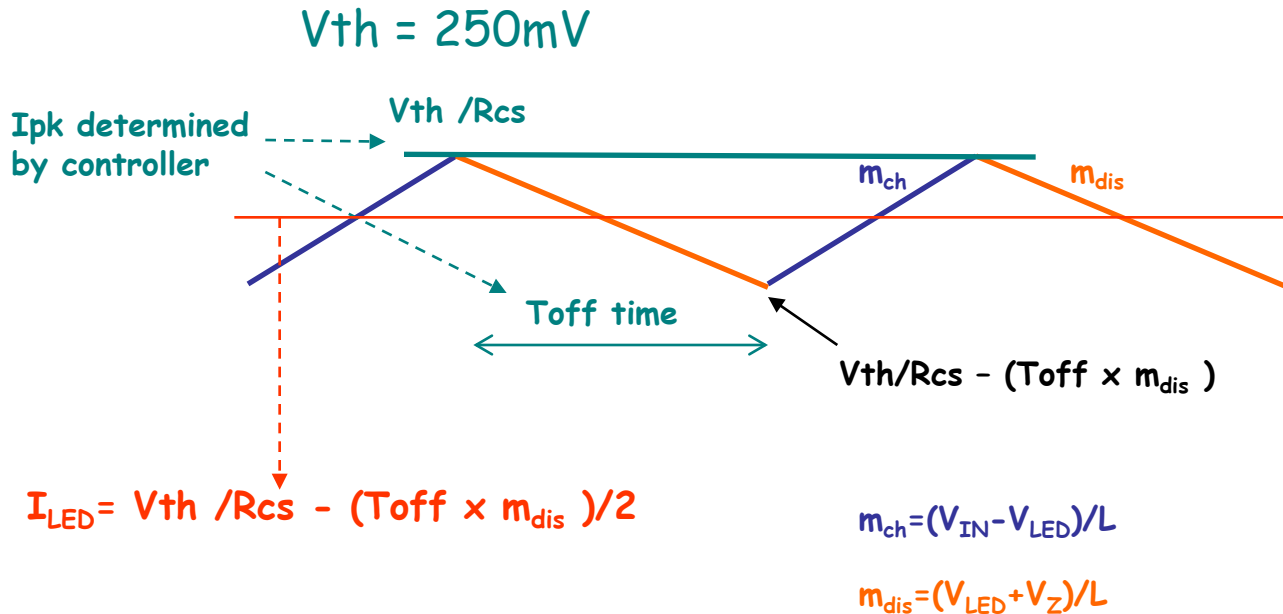
$$m = (V_{IN} - V_{LED}) / L$$

$$m = (V_{LED} + V_Z) / L$$

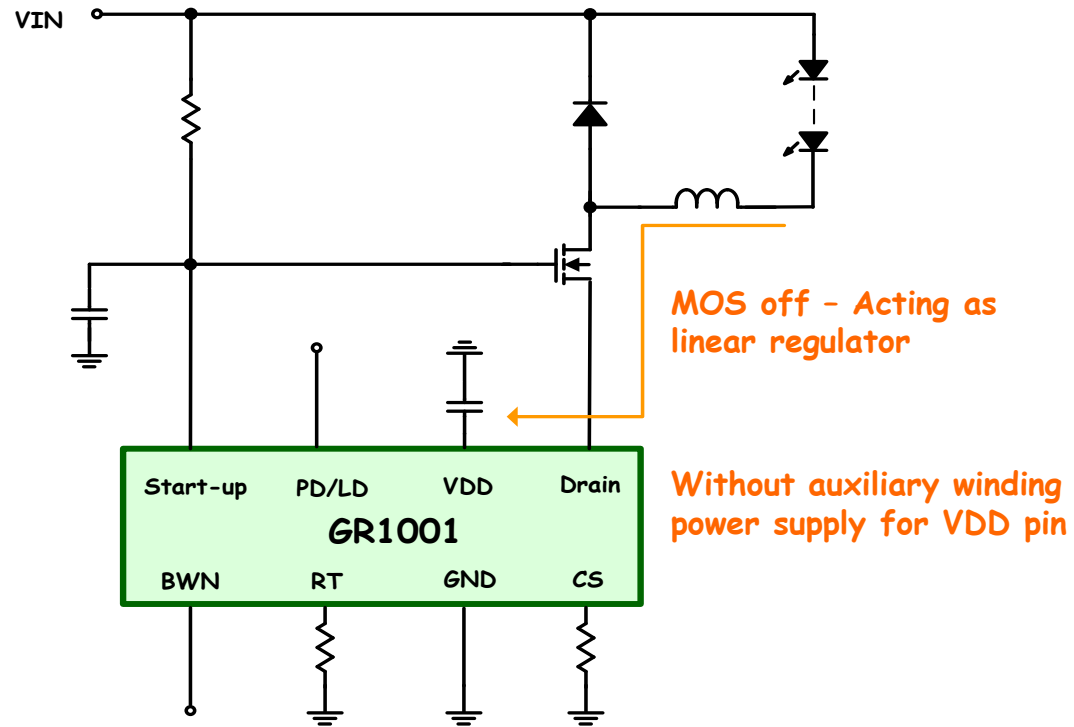
$$*V_{LED}: (3V \sim 4V) * N$$

$$*V_Z: \sim 1V$$

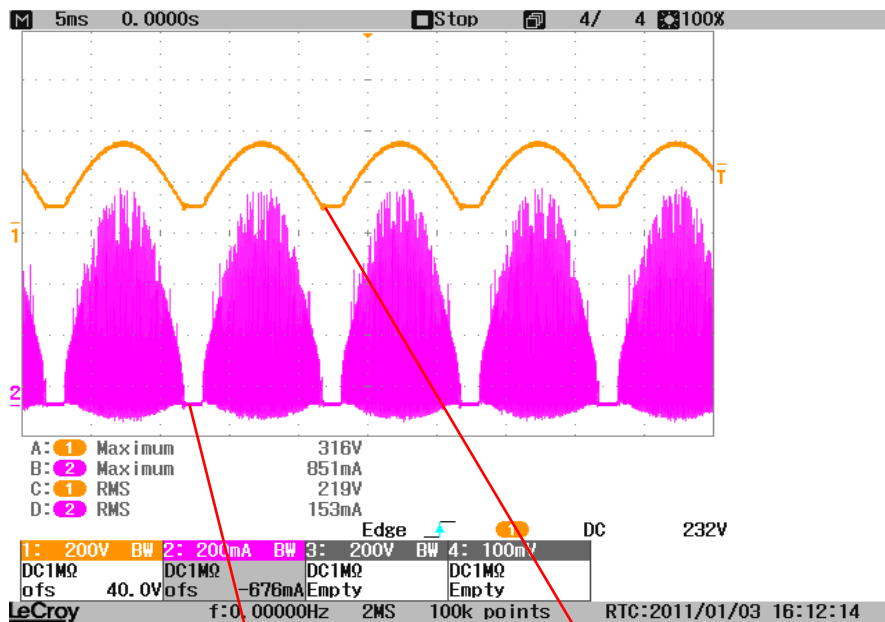
Constant-OFF Time / Constant Peak Current Operation



VDD Biasing



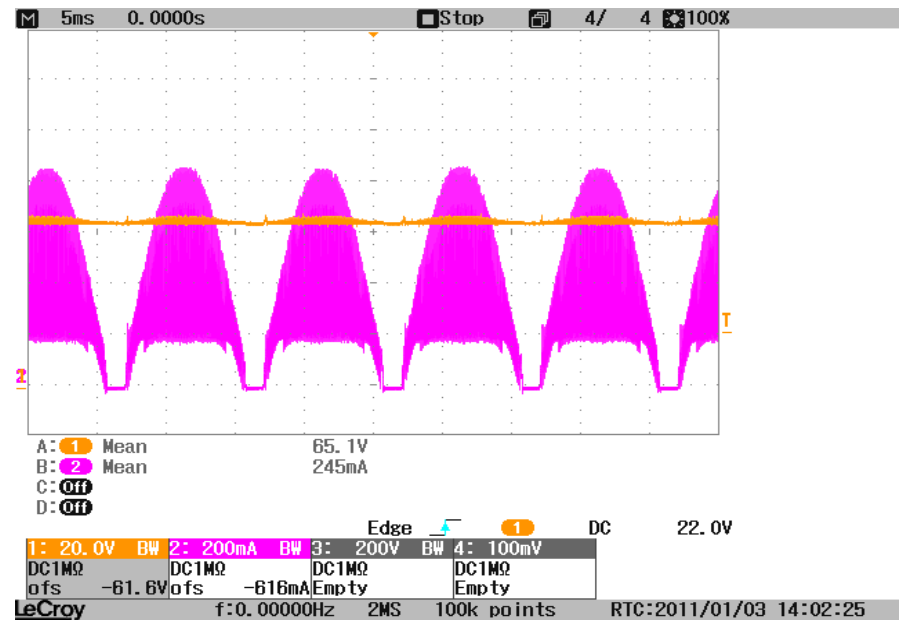
Cascade Input/Output Drawing



輸入電流

輸入電壓

圖a: 電流波形與電壓波形同向位

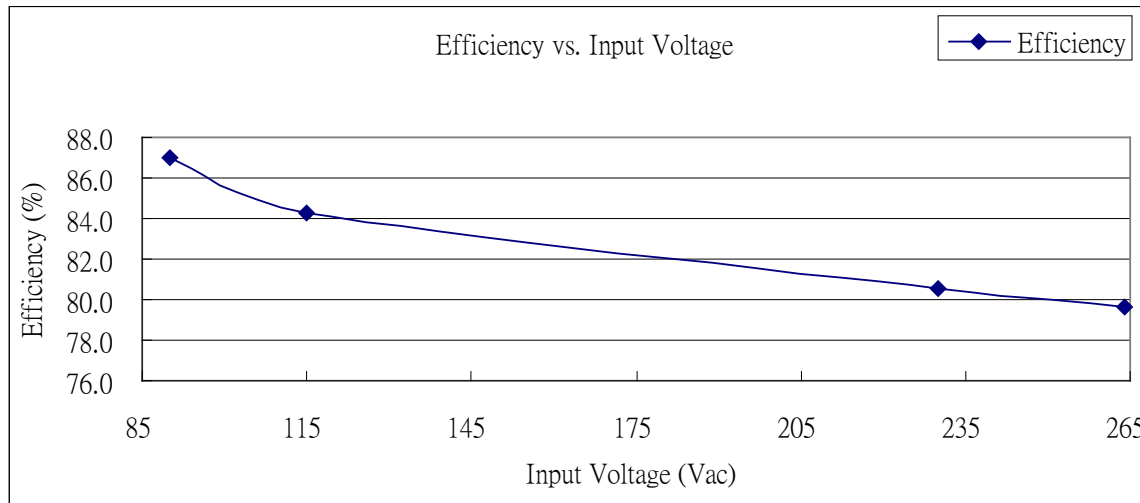


圖b: 流經LED 電流與電壓波形

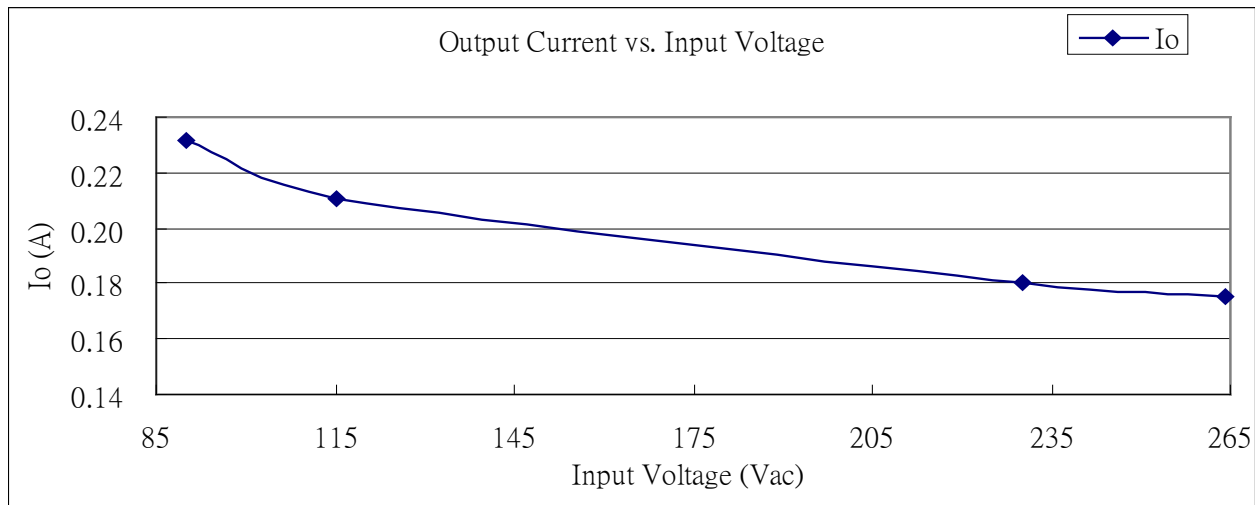
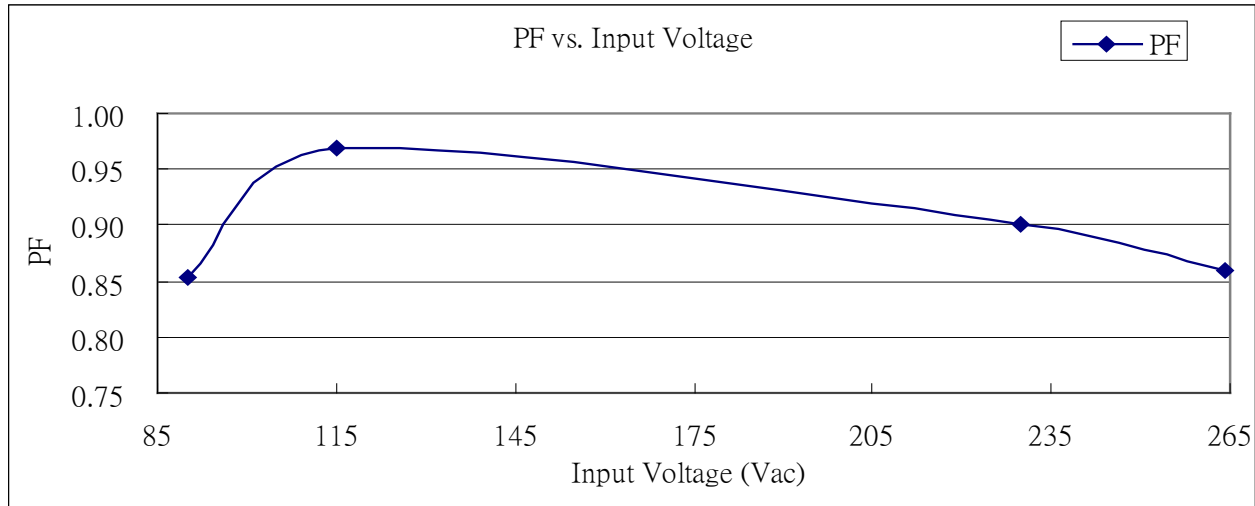
GR1001 Introduction

Output Voltage=60V ,Output Current=0.2A

	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
Efficiency	88.04%	89.24%	90.58%	91.61%
PF	0.853	0.970	0.900	0.860
Io	0.232 A	0.211 A	0.180 A	0.175 A



GR1001 Introduction

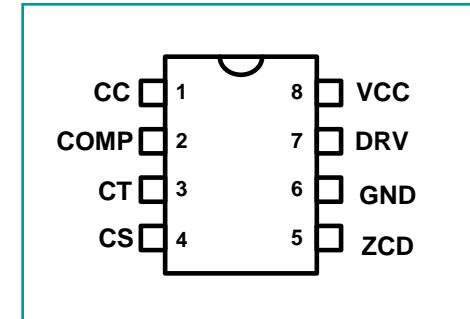


Features

- Critical conduction mode for HPF (>0.9)
- Accuracy current regulation ($< +/-3\%$)
- Cycle-by-cycle peak current control
- SCP (short circuit protection)
- VCC OVP (28V)
- Constant On Time PWM Control
- Low BOM cost



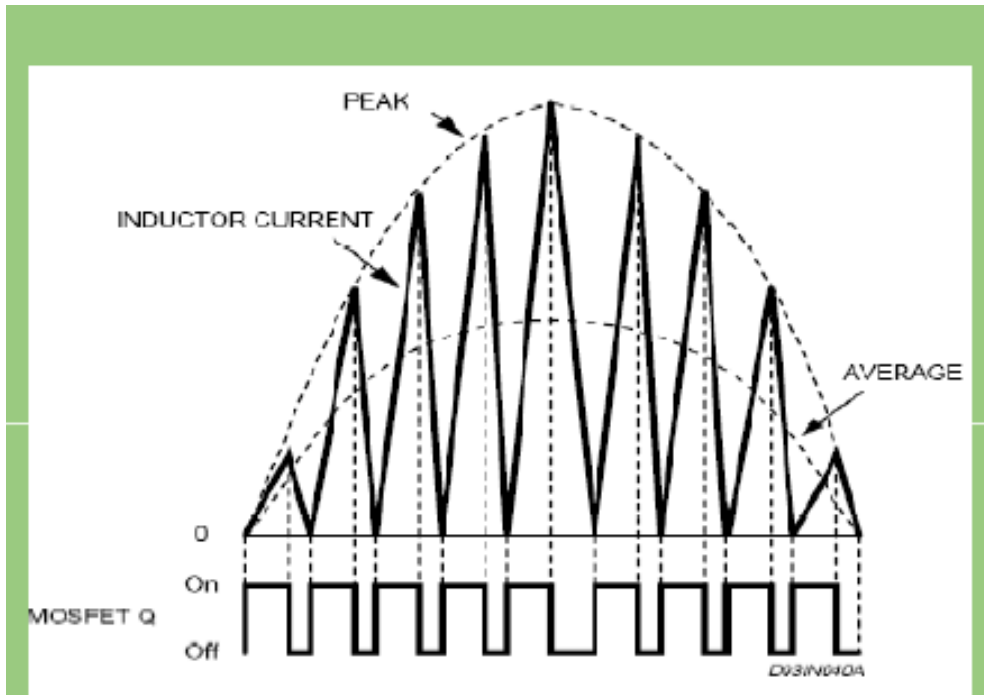
Pinning



Pin description

Pin No.	Name	Function
1	CC	Constant current sense pin.
2	COMP	Error amplifier compensation.
3	CT	Sawtooth waveform generator pin.
4	CS	Over current sense pin.
5	ZCD	The Zero Current Detector pin.
6	GND	The ground pin.
7	DRV	Driving external power MOS pin.
8	VCC	Positive power supply pin.

Constant on Time PFC Operation

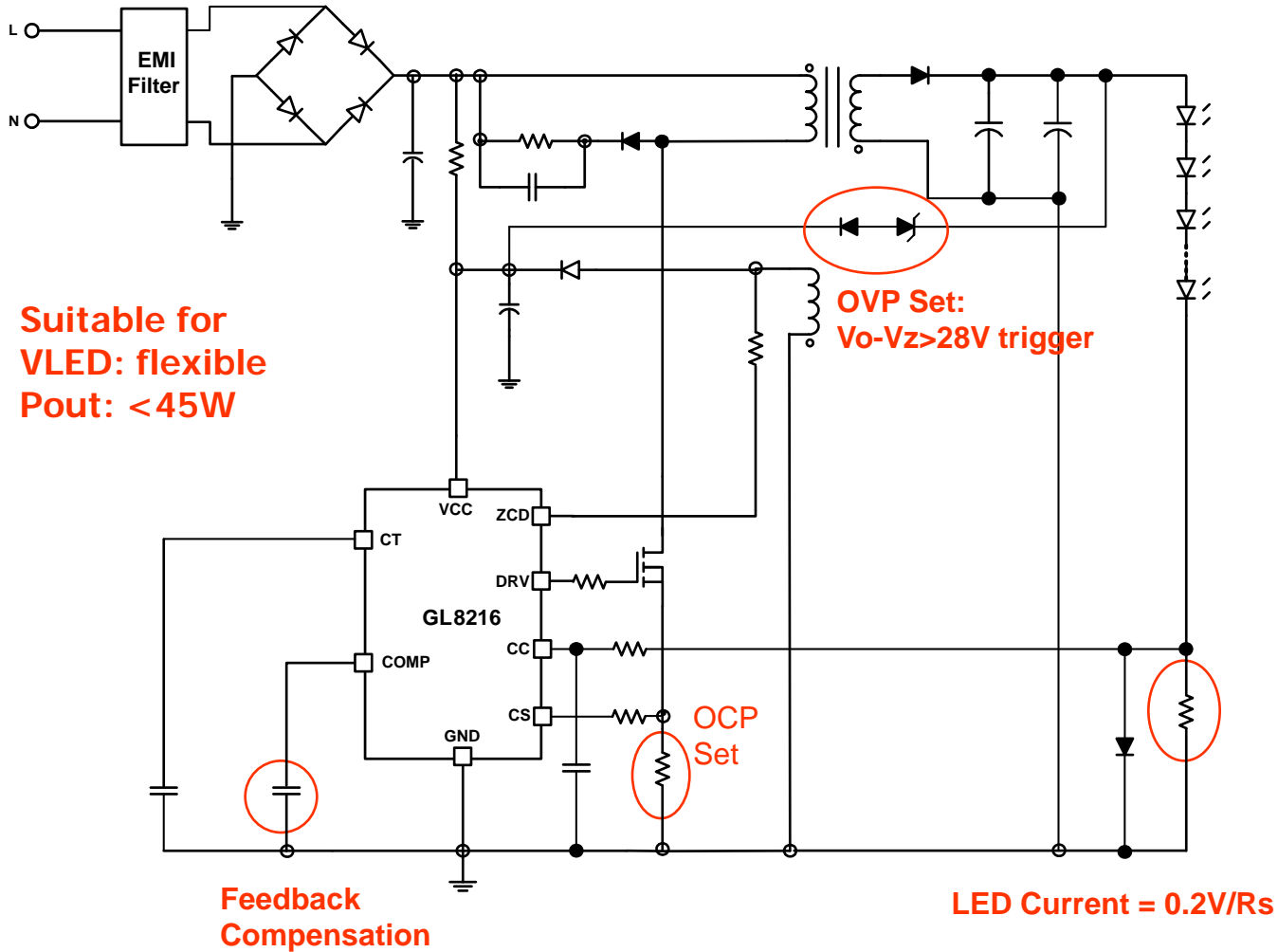


$$i_{pk}(t) = \frac{v_s(t) \cdot T_{on}}{L} = \frac{V_m \cdot D \cdot T_s}{L} \sin \omega t$$

$$I_P = \frac{V_m \cdot T_{on}}{L} \sin\left(\frac{\pi}{2}\right) = \frac{V_m \cdot T_{on}}{L}$$

$I_{avg} = I_P / 2 \propto V_{in}$,
so input current in
phase with input
voltage

Schematic (non-isolation flyback topology)



ILED

IAC

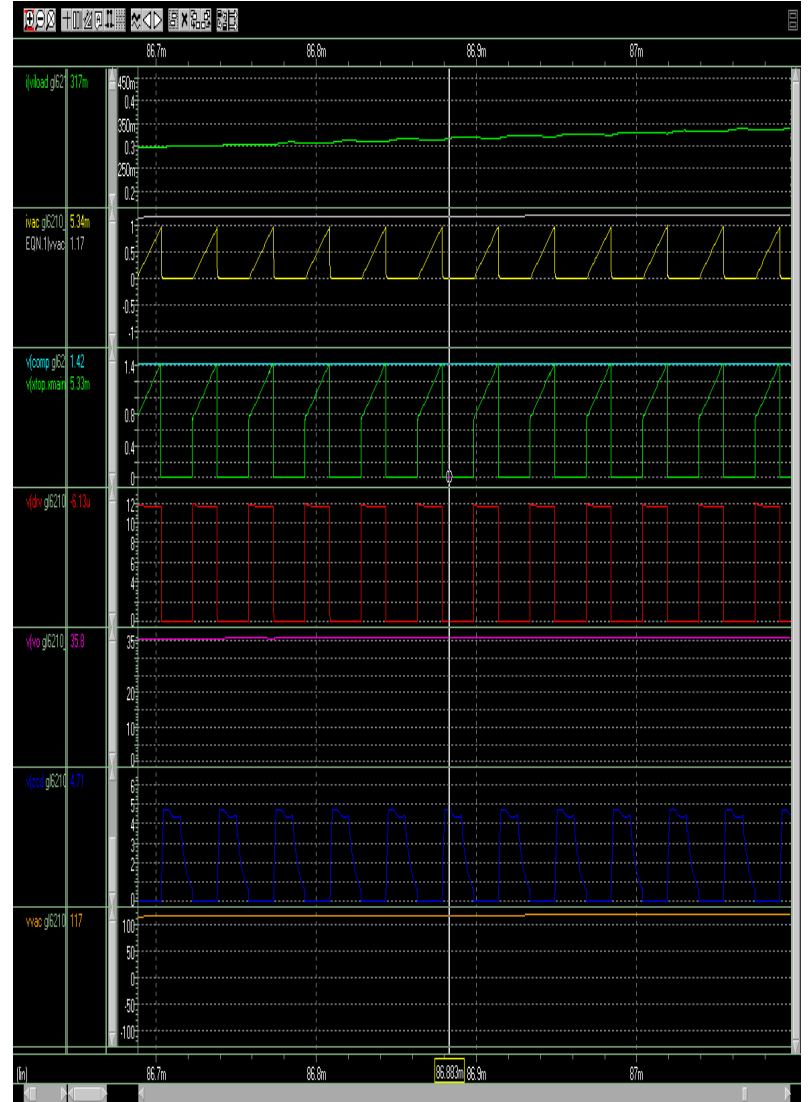
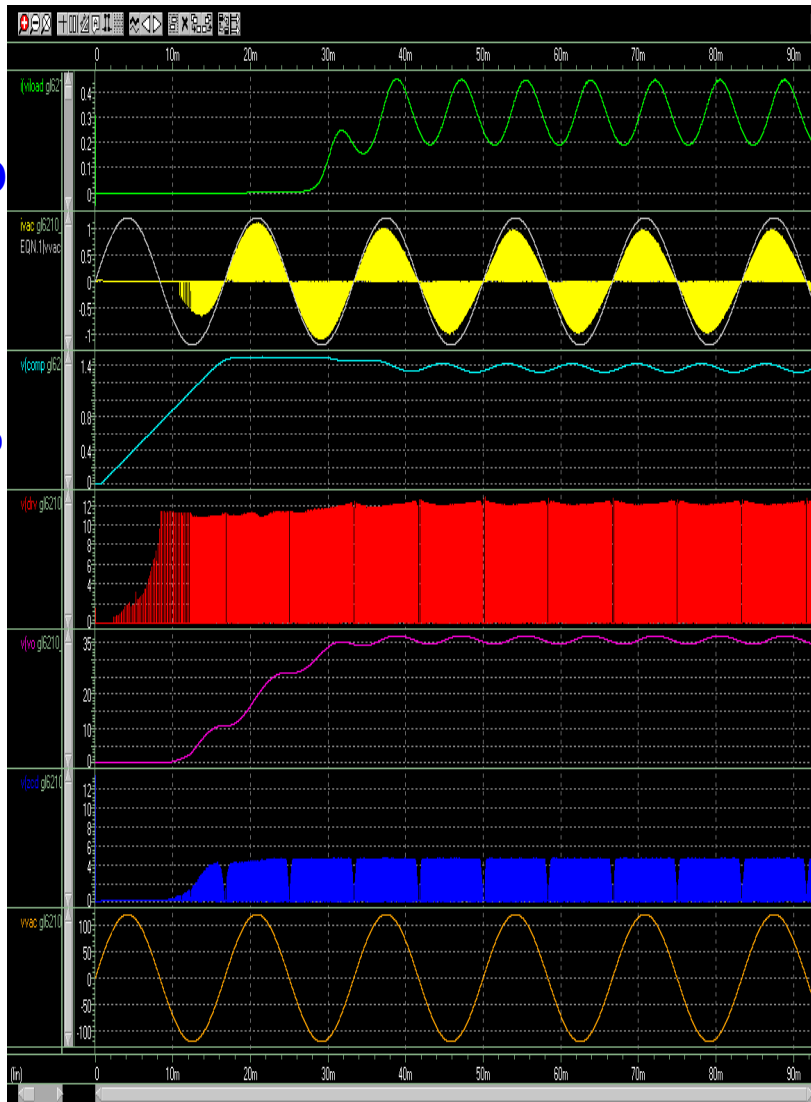
COMP

DRV

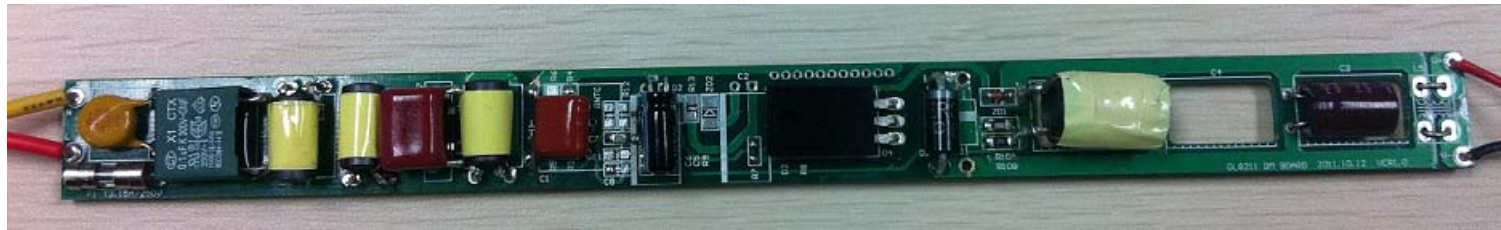
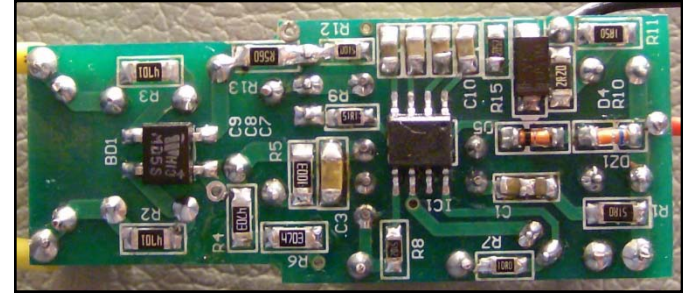
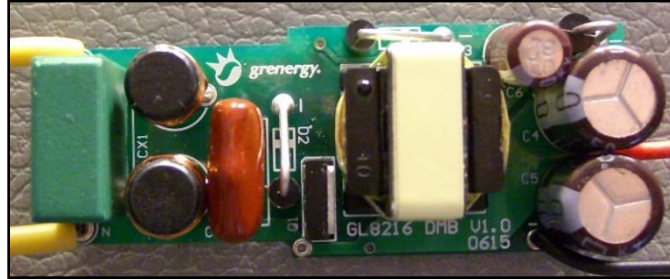
VF

ZCD

VAC



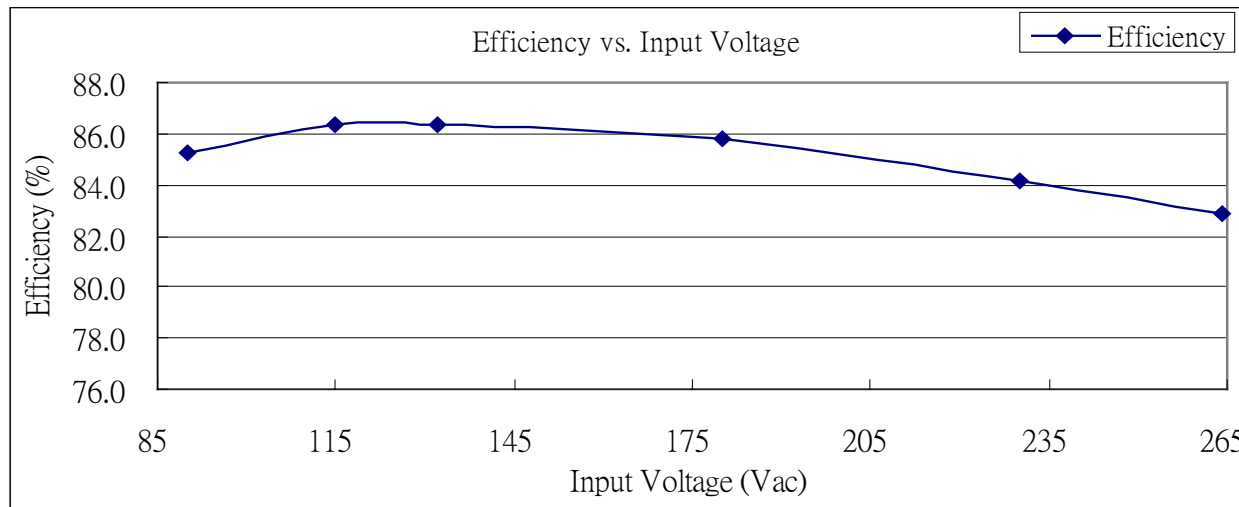
GL8216 Demo board



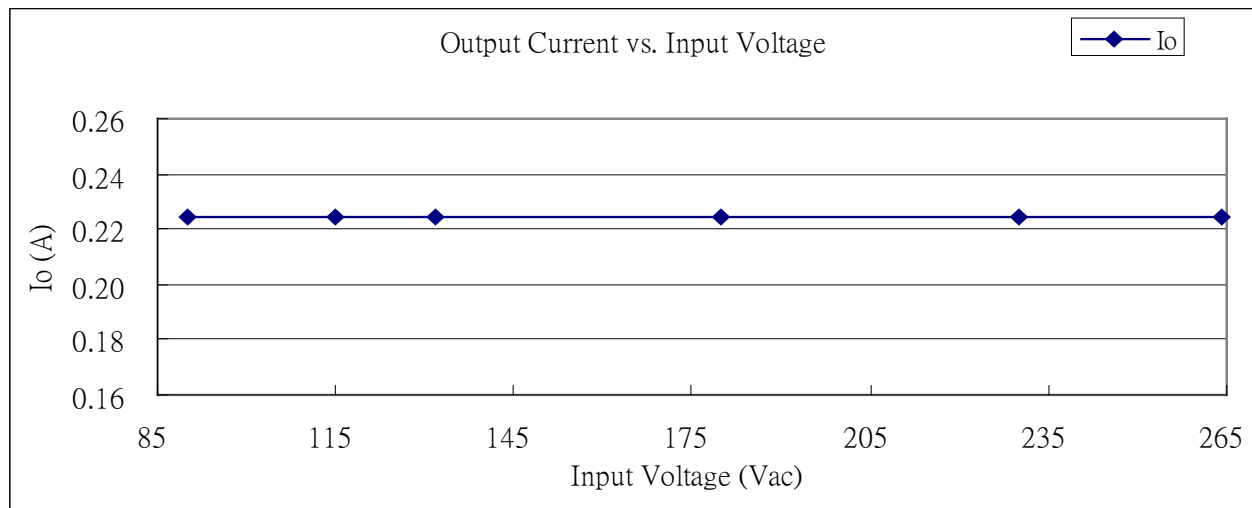
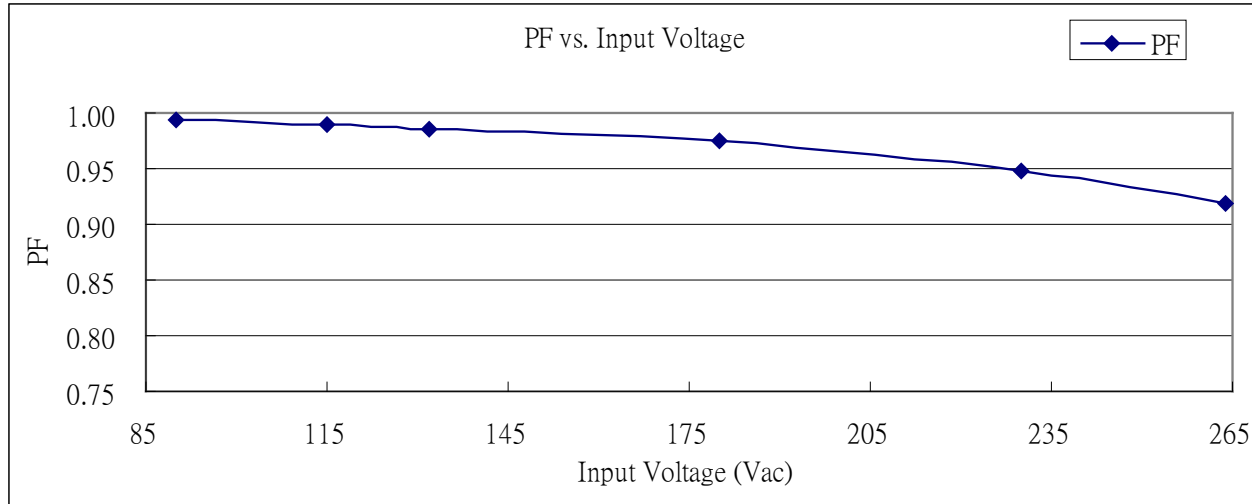
GL8216 Introduction

Output Voltage=32V ,Output Current=0.22A

	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
Efficiency	85.26%	86.31%	84.12%	82.85%
PF	0.994	0.989	0.947	0.919
Io	0.224 A	0.224 A	0.224 A	0.224 A



GL8216 Introduction

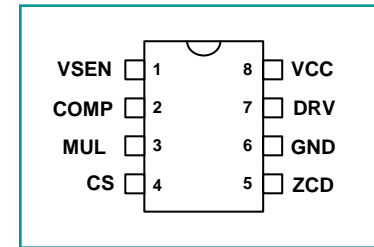


Features

- Critical conduction mode PFC for HPF (>0.9)
- Very low startup current ($<50\mu\text{A}$)
- Zero current detector for critical conduction mode
- Dynamic and static output over-voltage protection
- Gate output maximum voltage clamped
- THD optimization



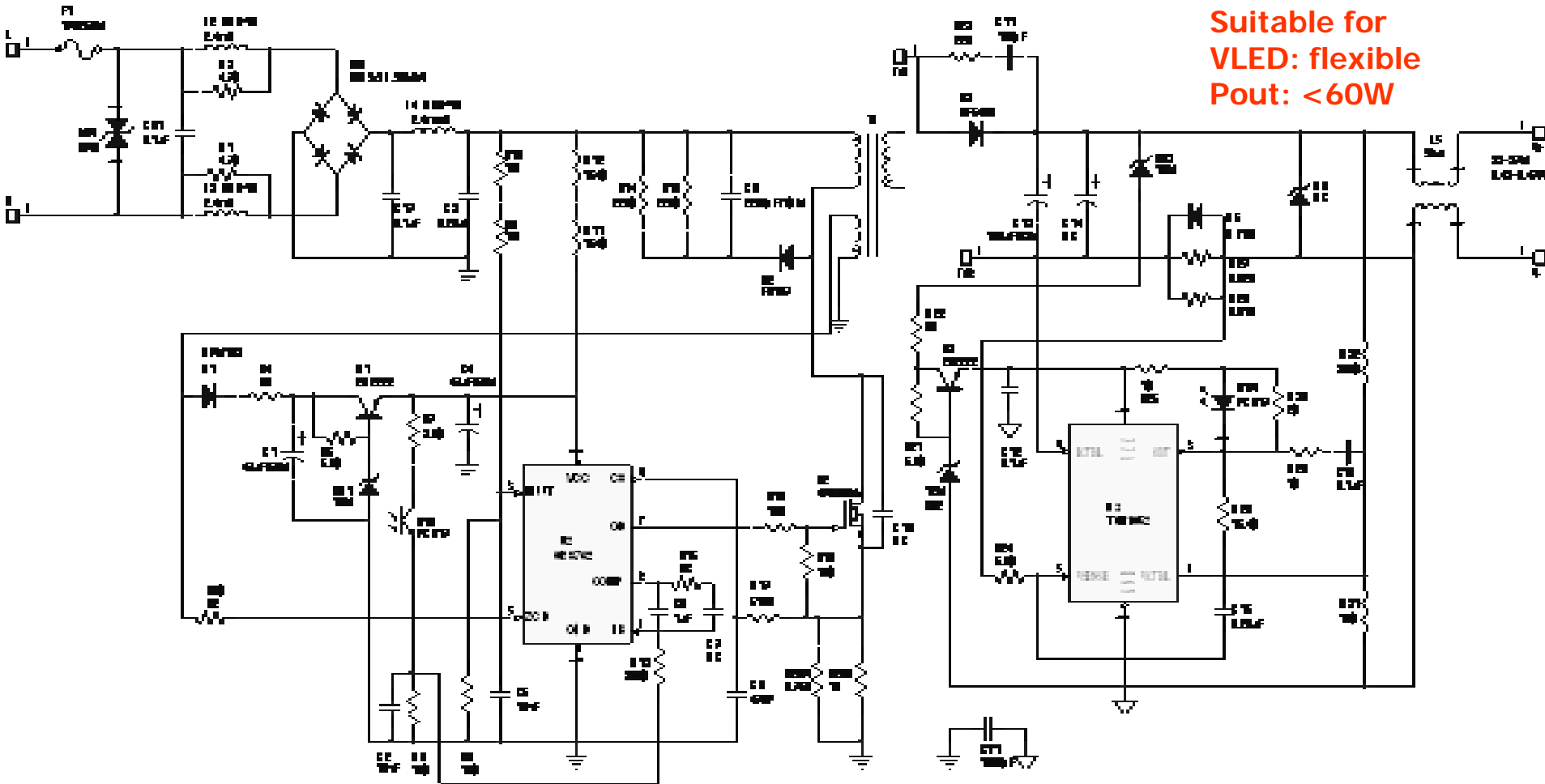
Pinning



Pin description

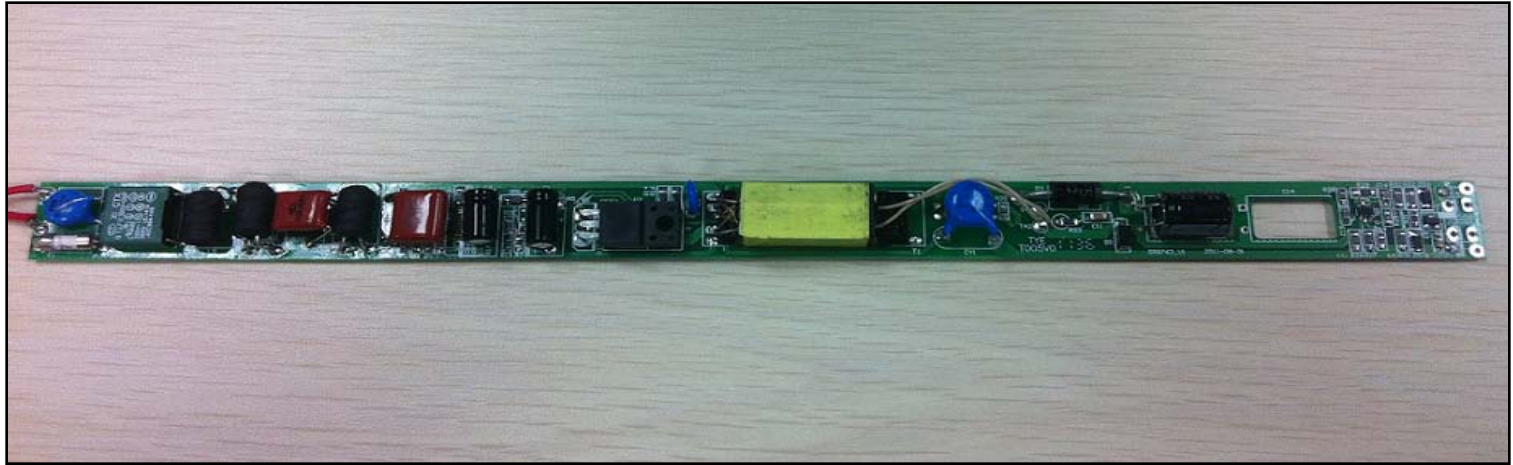
Pin no.	Symbol	Description
1	VSEN	Voltage error amplifier Inverting Input pin.
2	COMP	Voltage error amplifier output pin.
3	MUL	Multiplier input pin.
4	CS	Current sense input pin.
5	ZCD	Zero current detector input pin.
6	GND	The ground pin.
7	DRV	Driving external power MOS pin.
8	VCC	The positive voltage supply pin.

Schematic (isolation flyback topology)

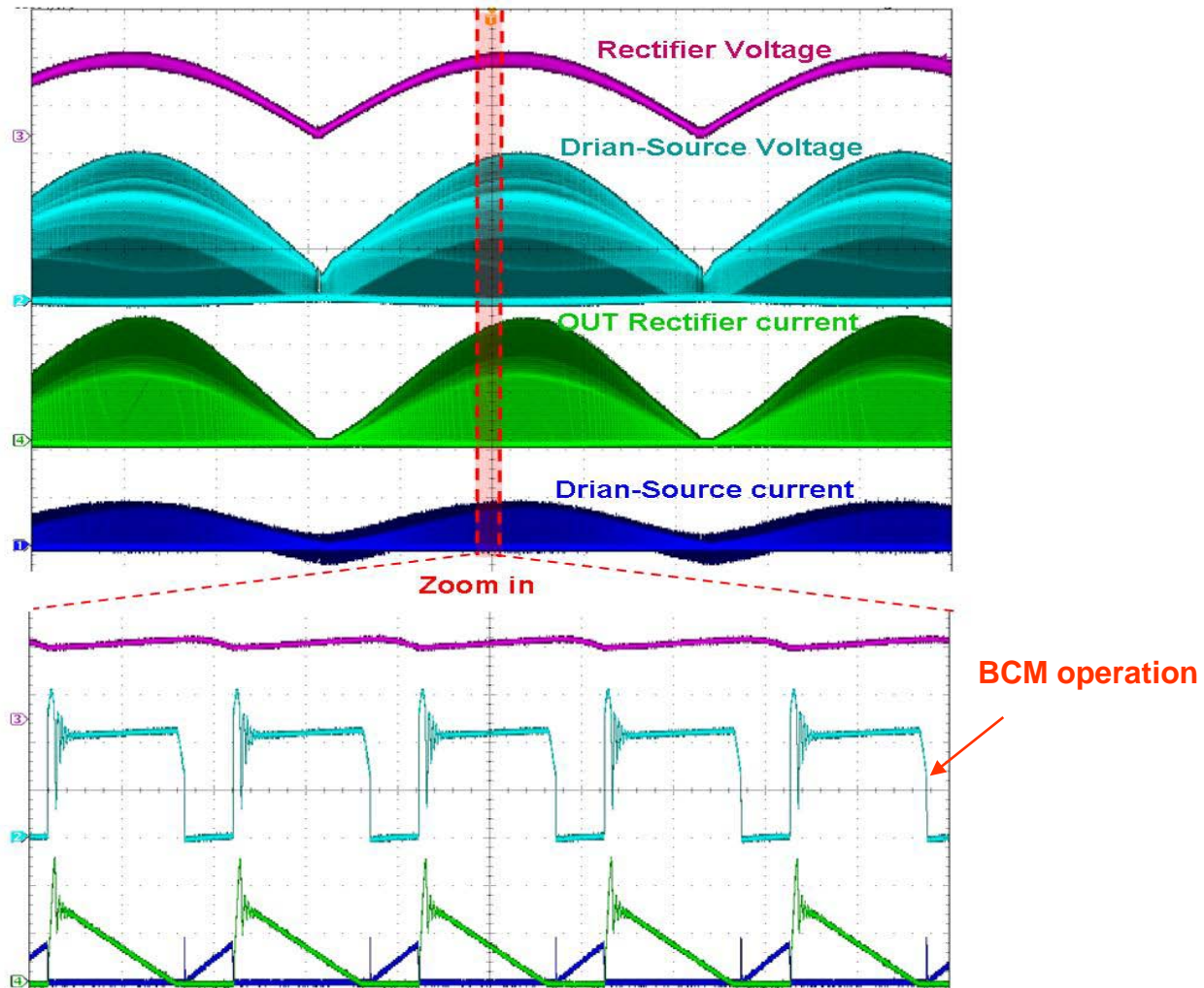


Suitable for
VLED: flexible
Pout: <60W

GR8762 Demo board

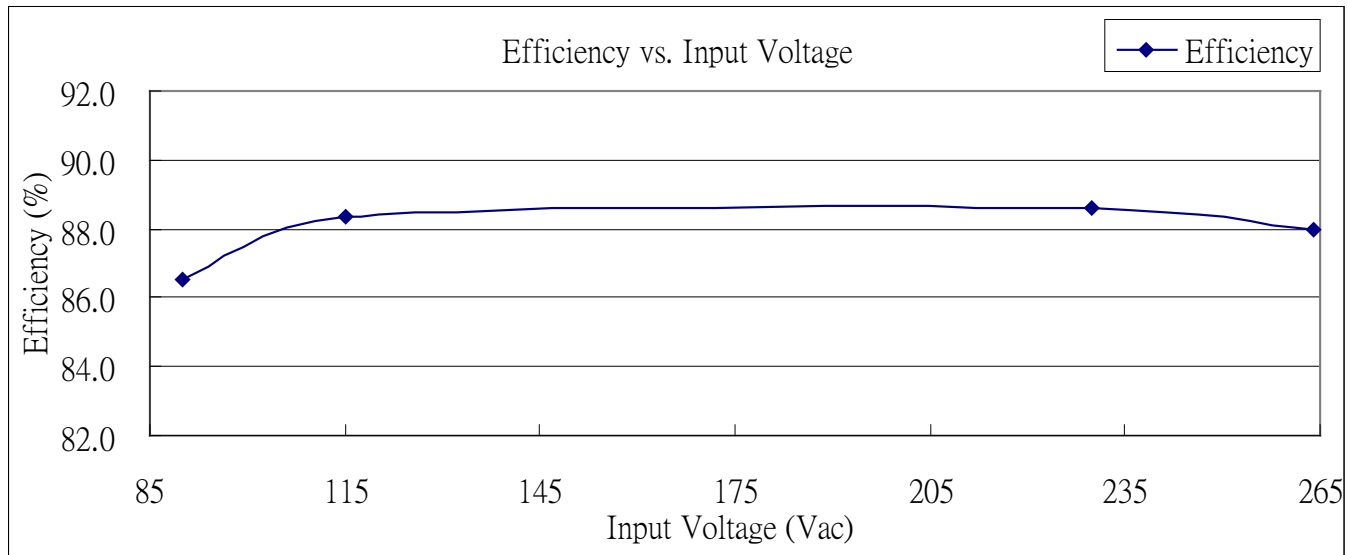


Operation



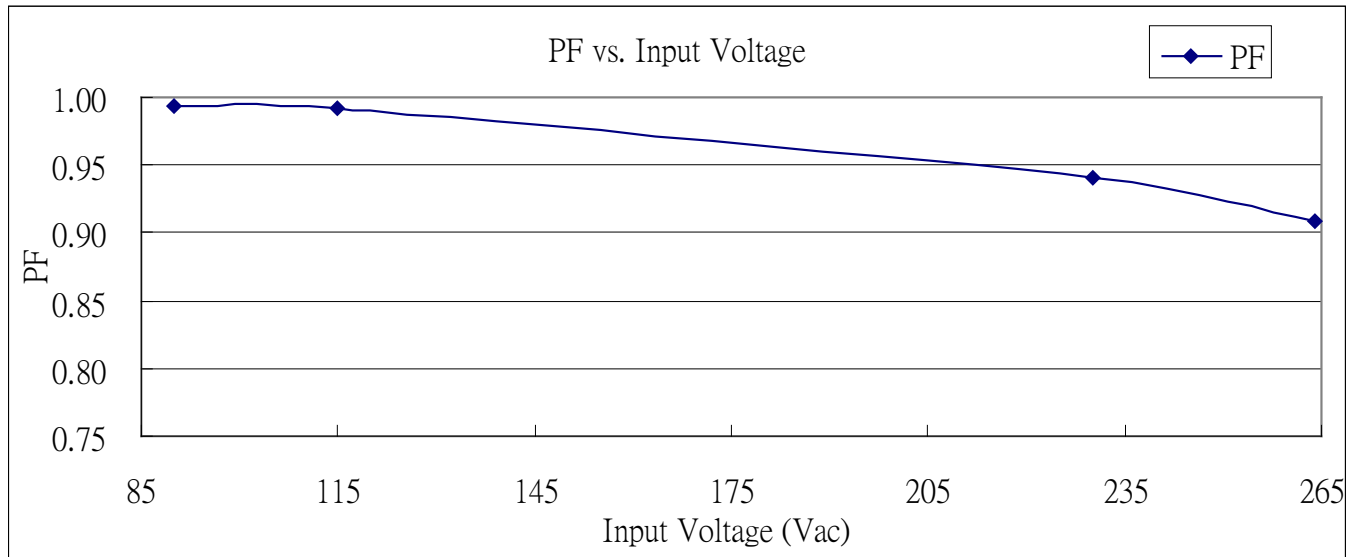
GR8762 Introduction

	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
Efficiency	86.52%	88.33%	88.62%	87.98%



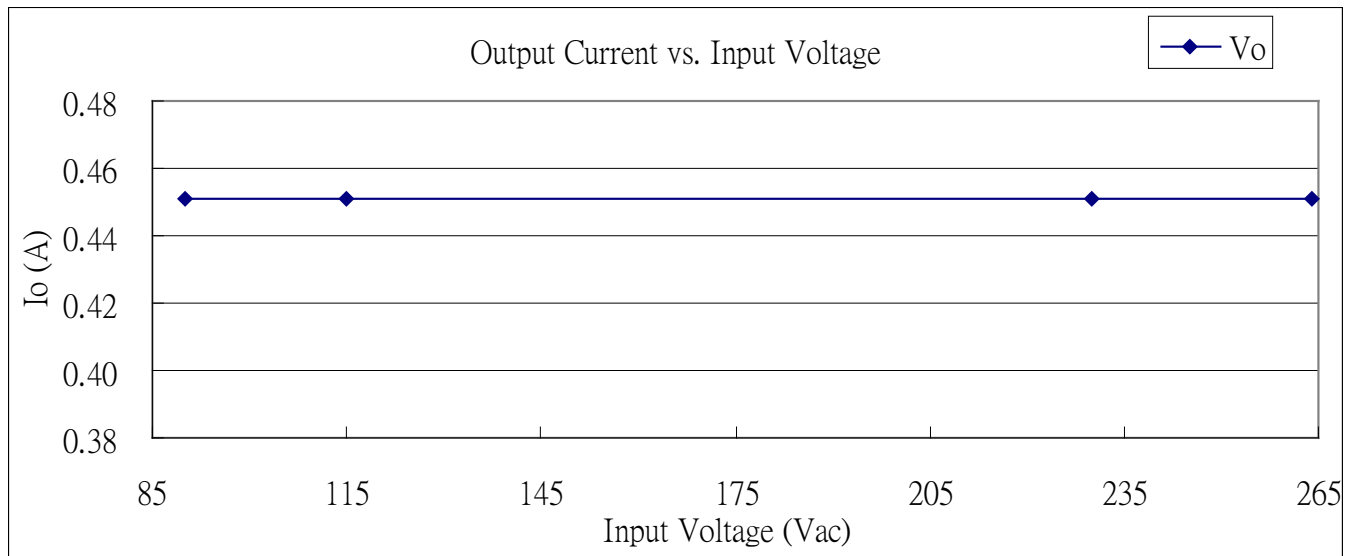
GR8762 Introduction

	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
PF	0.994	0.992	0.940	0.908



GR8762 Introduction

	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
Vo	33.7V	33.7V	33.7V	33.6V
Io	0.451A	0.451A	0.451A	0.451A



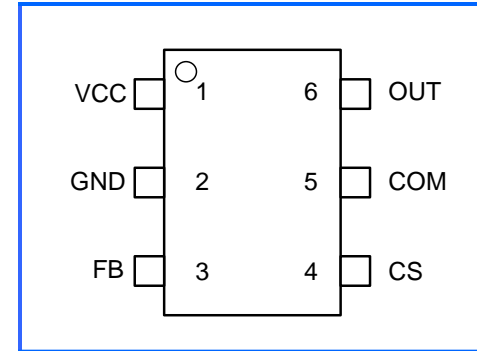


Features

- SOT23-6 package
- **Driving BJT(8818)/MOS(8258)**
- Below 50mw of standby power
- Low BOM cost solution
- **CV < +/-5% & CC < +/-6%**
- VCC pin OVP
- 40KHz switching frequency w/i jitter



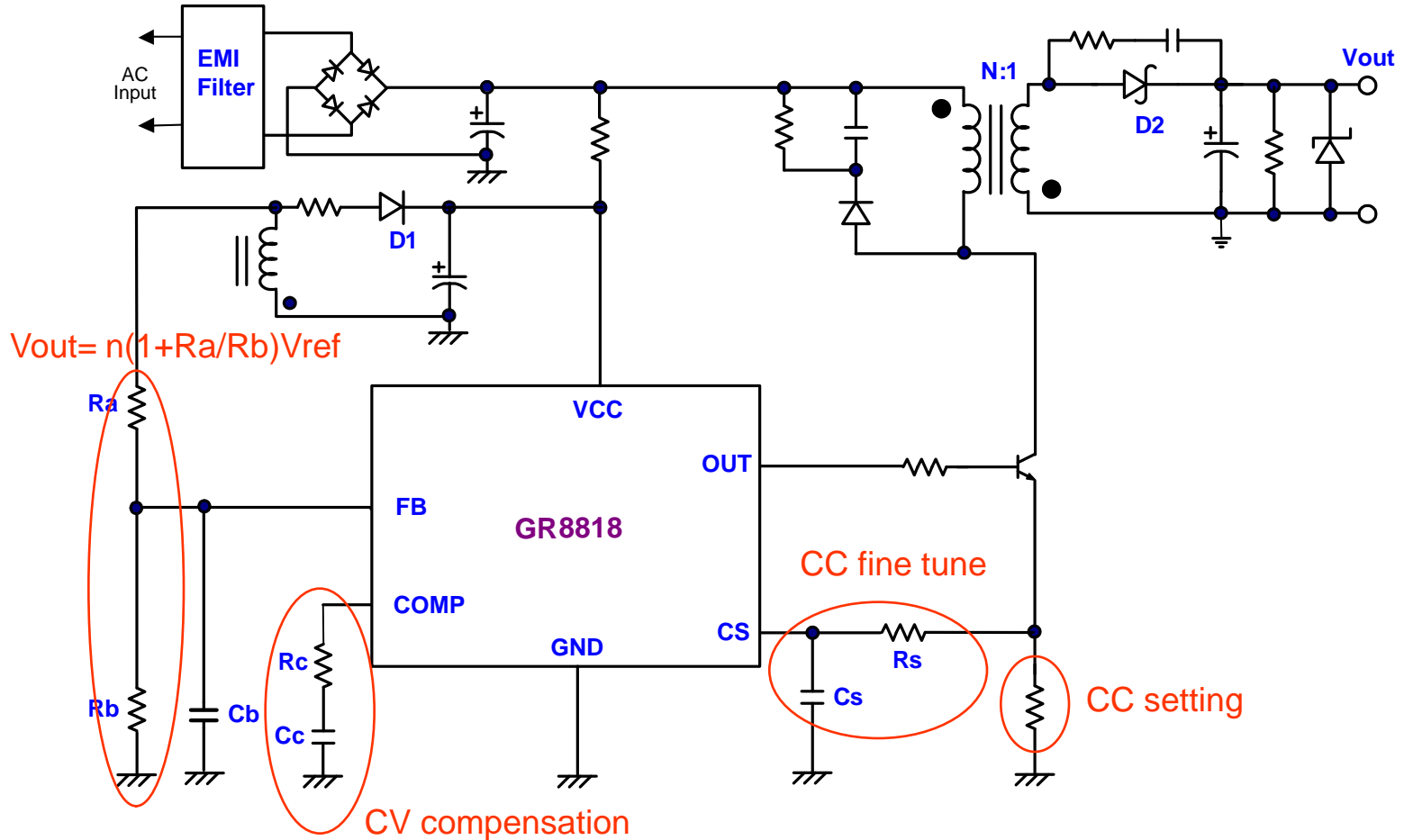
Pinning



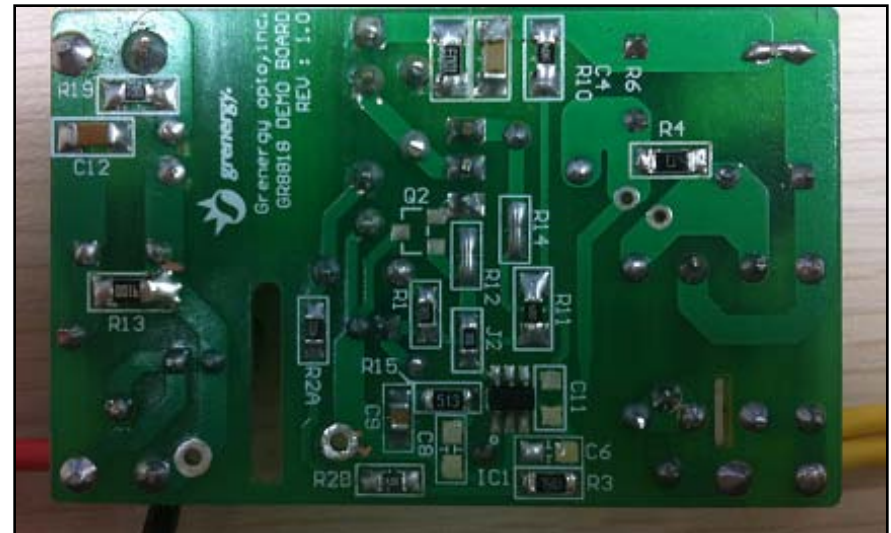
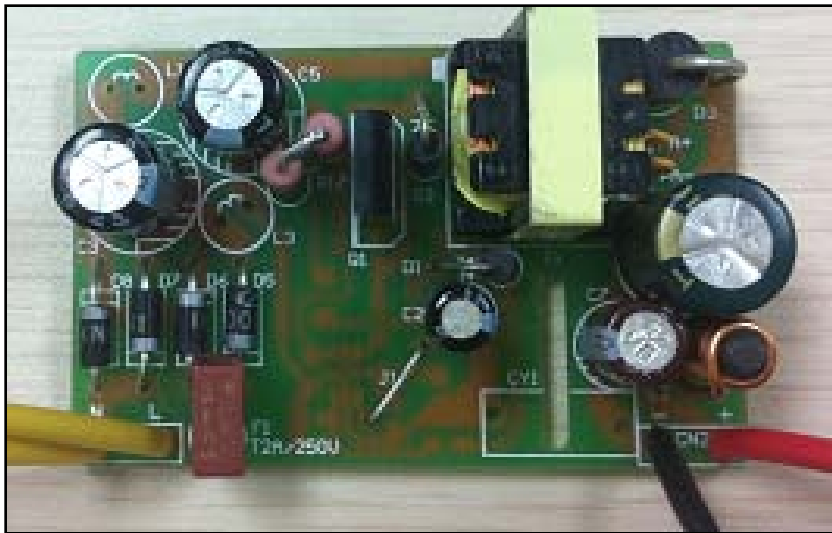
Pin description

Pin No.	Name	Function
1	VCC	The power supply pin.
2	GND	The ground pin.
3	FB	Auxiliary winding output voltage sense pin.
4	CS	Current sense pin.
5	COM	CV loop Gm error amplifier compensation.
6	OUT	Driving external power transistor pin.

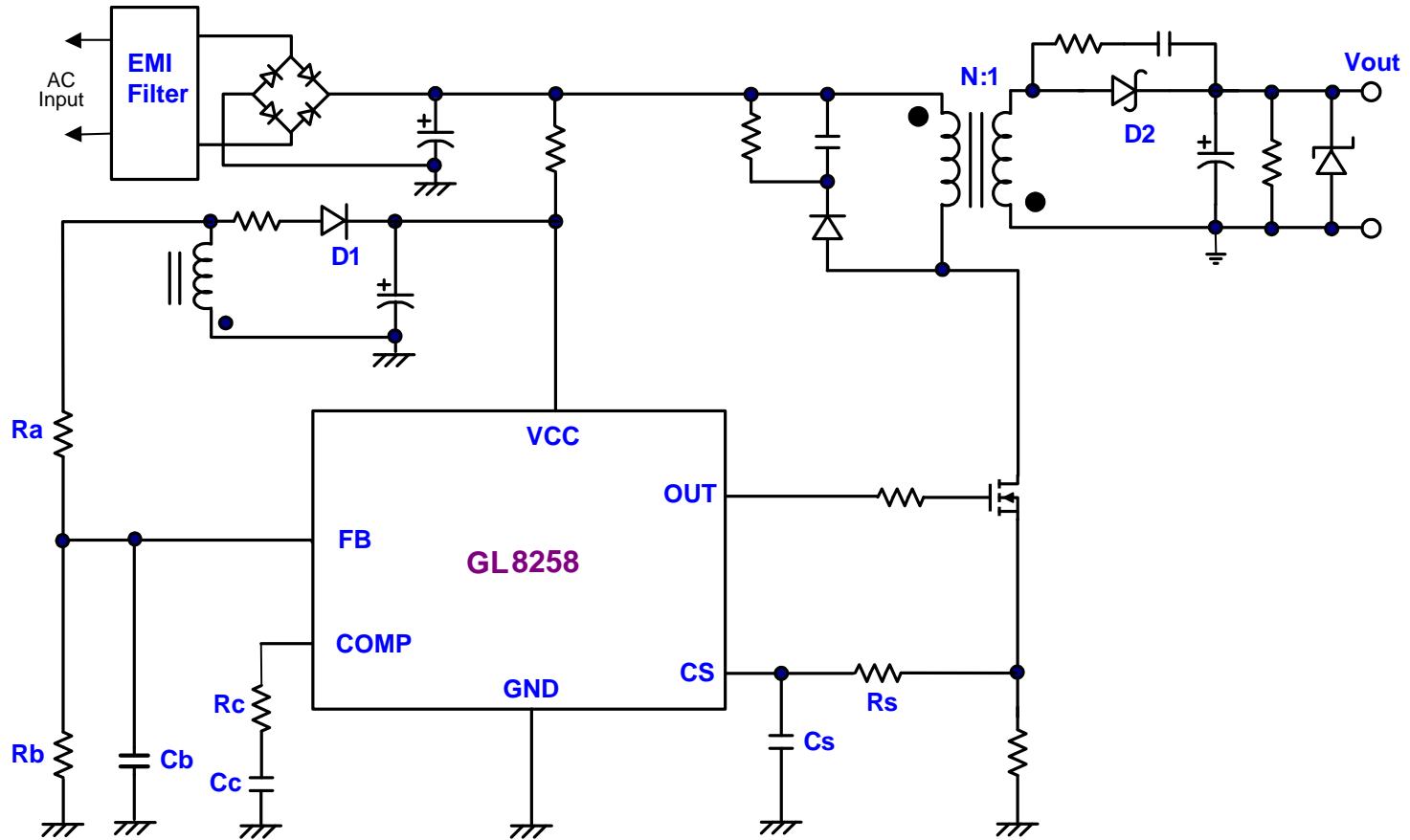
GR8818 Schematic (1 ~ 5W)



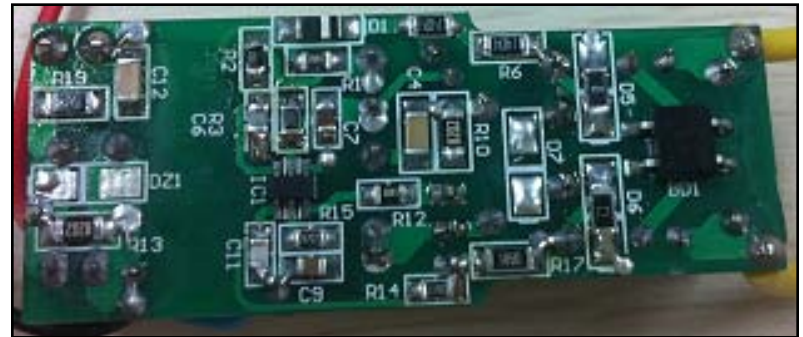
GR8818 Demo board



GL8258 Schematic (5 ~ 10W)



GL8258 Demo board

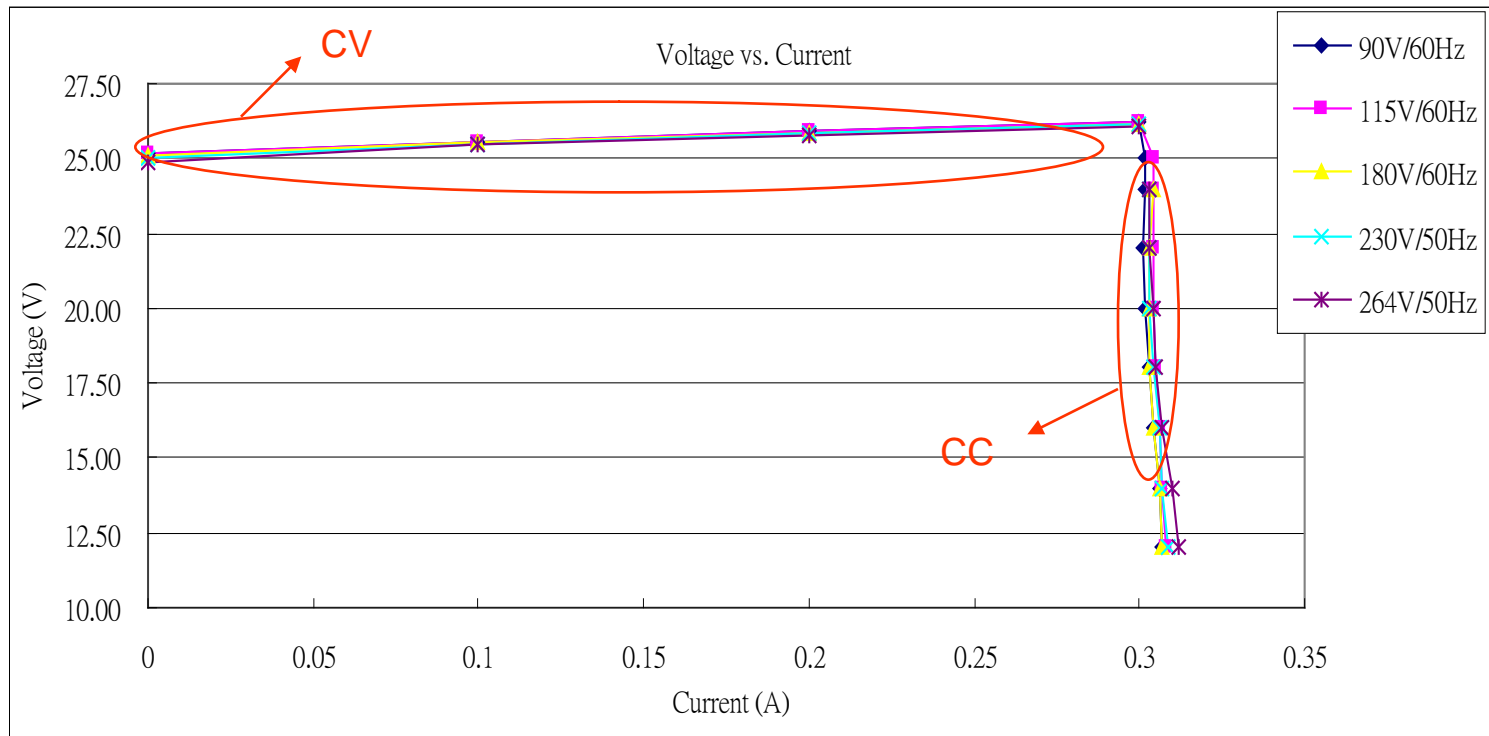


Efficiency

Output Voltage=25V ,Output Current=0.27A (Full Load)

I_Load(A)	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
25%	79.11%	78.03%	72.19%	71.27%
50%	79.88%	80.10%	78.15%	76.05%
75%	78.69%	79.75%	78.89%	77.72%
100%	76.54%	78.67%	80.14%	80.00%
Av. (%)	78.55%	79.14%	77.34%	76.26%

Output Voltage & Output Current Curve



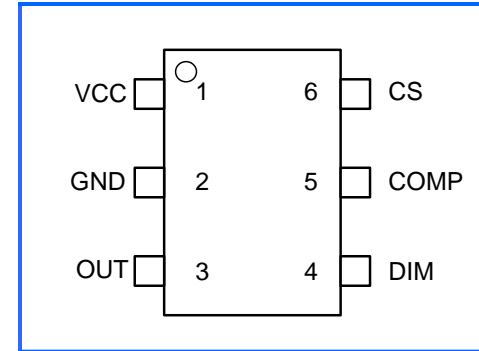


Features

- One cycle PFC control (PF>0.9)
- Average current mode control (CC<3%)
- SCP/OCP/OTP/OLP
- Very low BOM cost solution
- Linear dimming on DIM pin
- VCC pin OVP(28V)
- Fixed 45KHz switching frequency



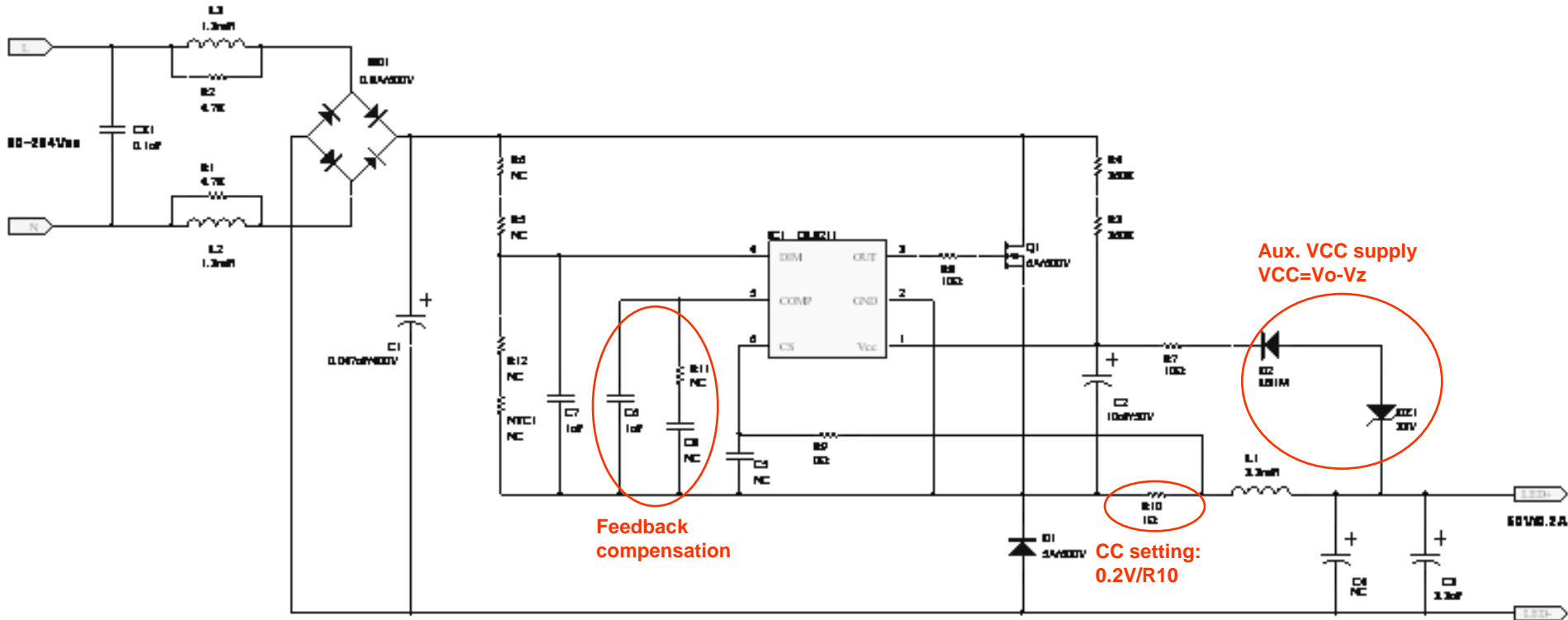
Pinning



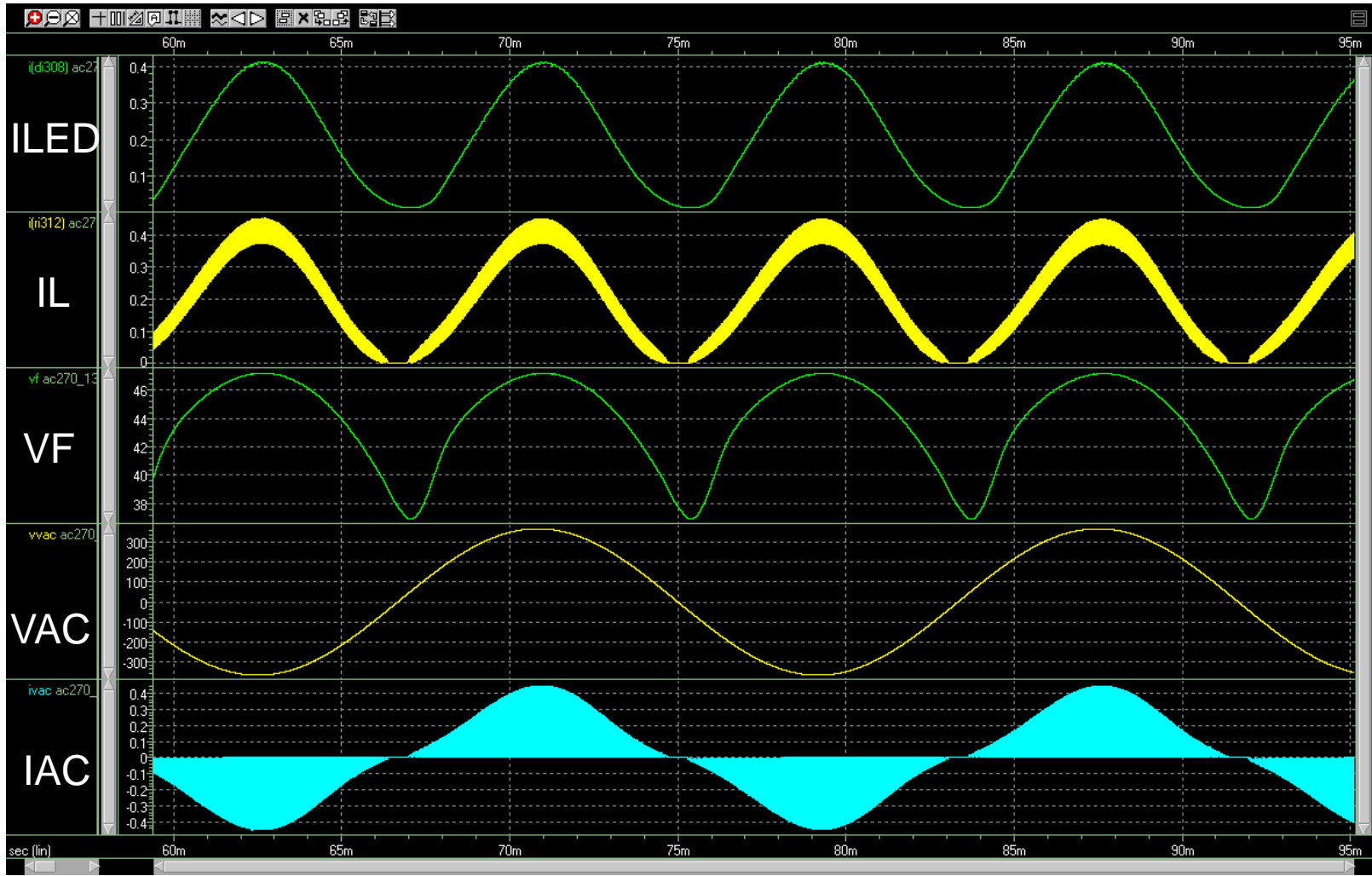
Pin description

Pin No.	Name	Function
1	VCC	The power supply pin.
2	GND	The ground pin.
3	OUT	Driving external power MOS pin.
4	DIM	Linear dimming pin.
5	COMP	Gm error amplifier compensation.
6	CS	LED current sense pin.

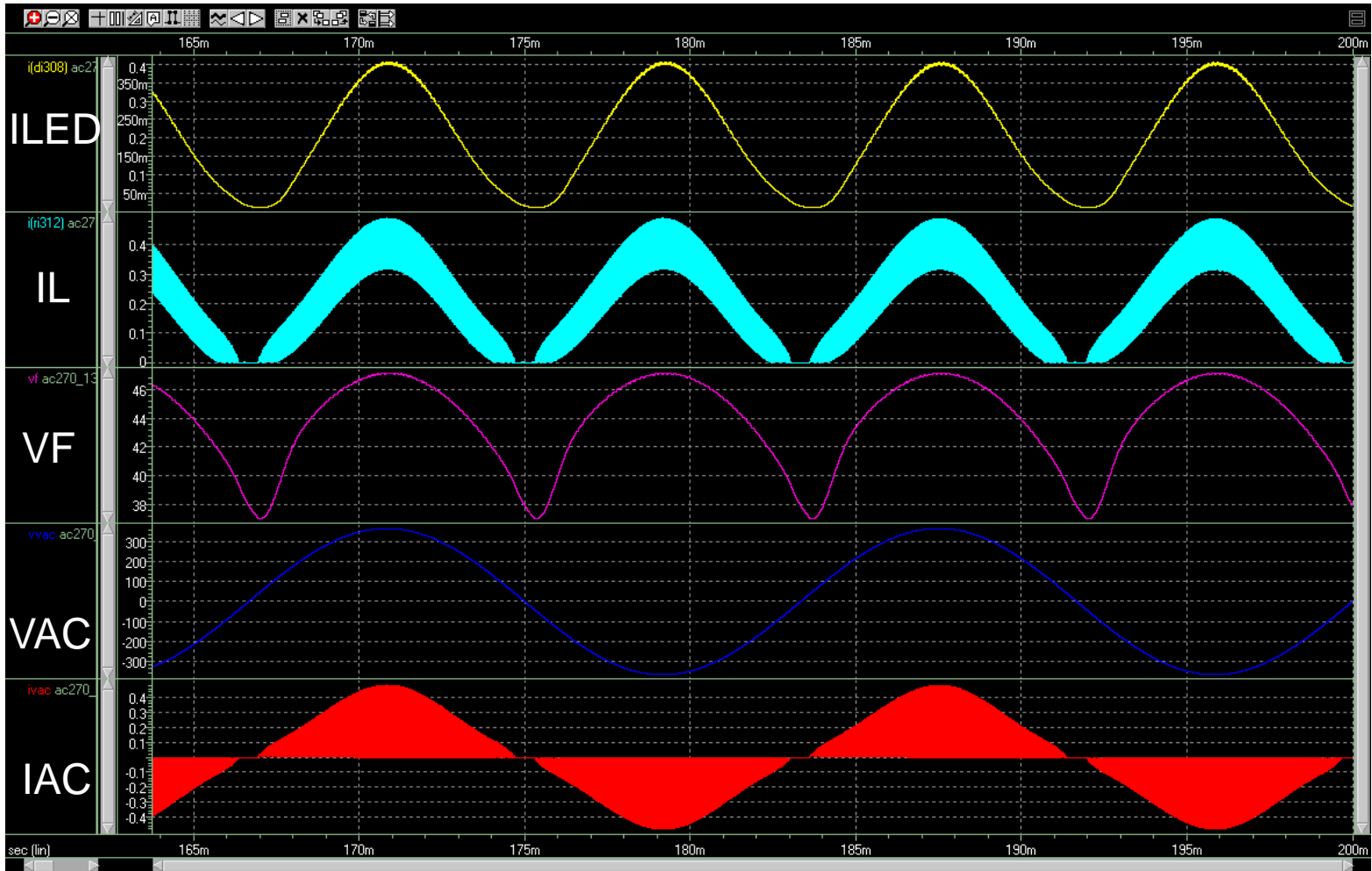
GL8211 Schematic



Suitable for
 VLED: 20V~60V for 90~264Vac,
 20V~120V for 180~264Vac
 Pout: <45W

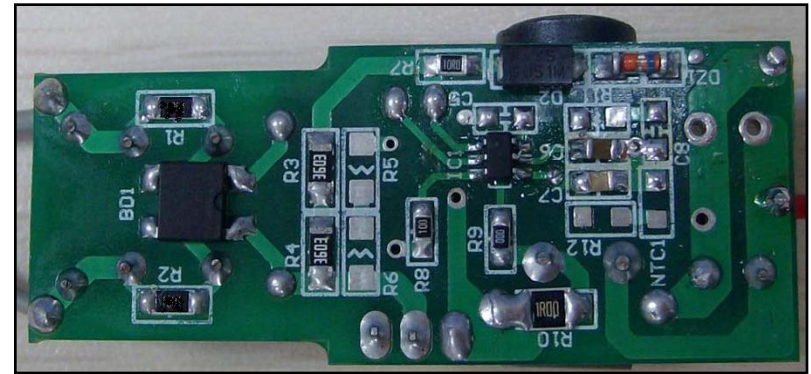
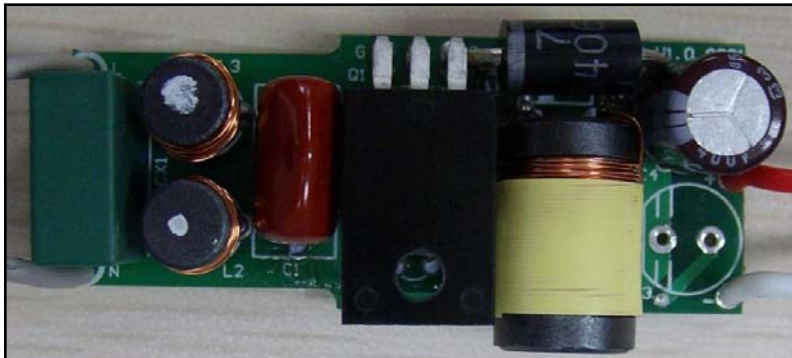
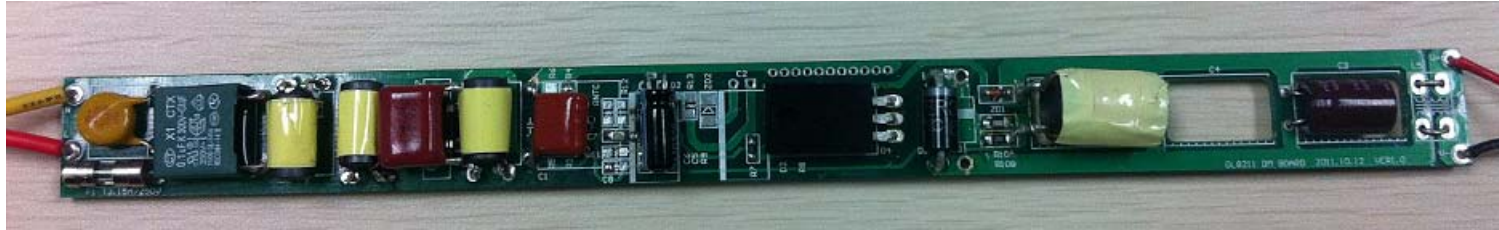


L=10mH



L=4.7mH

GL8211 Demo board

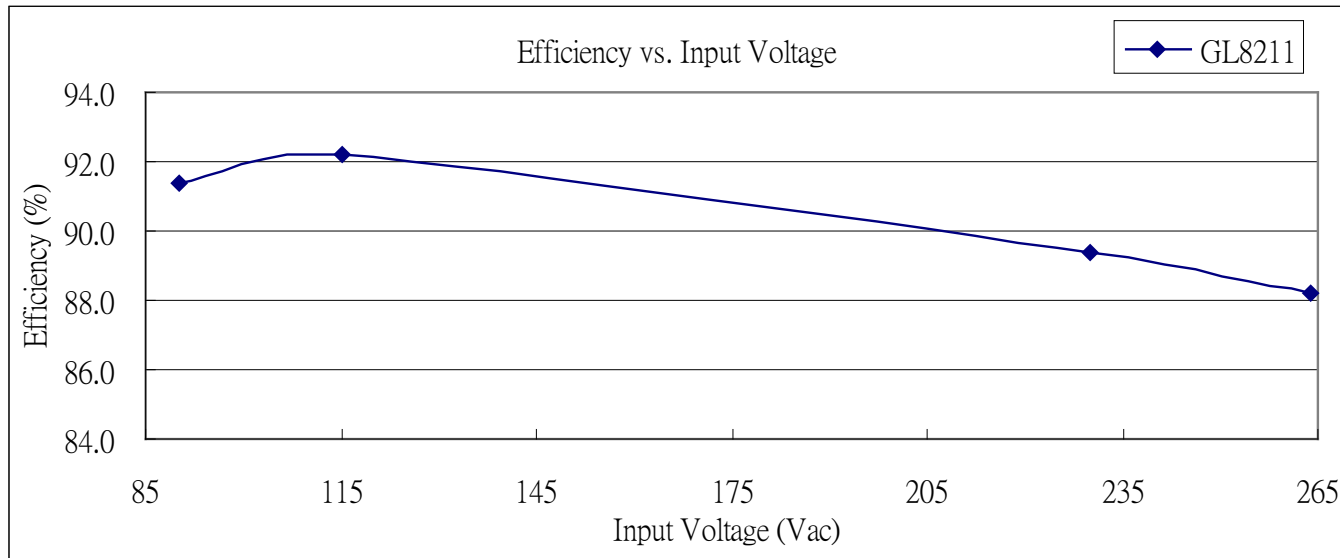




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GL8211 Introduction

	90V / 60Hz	115V / 60Hz	230V / 50Hz	264V / 50Hz
Efficiency	91.39%	92.21%	89.40%	88.24%

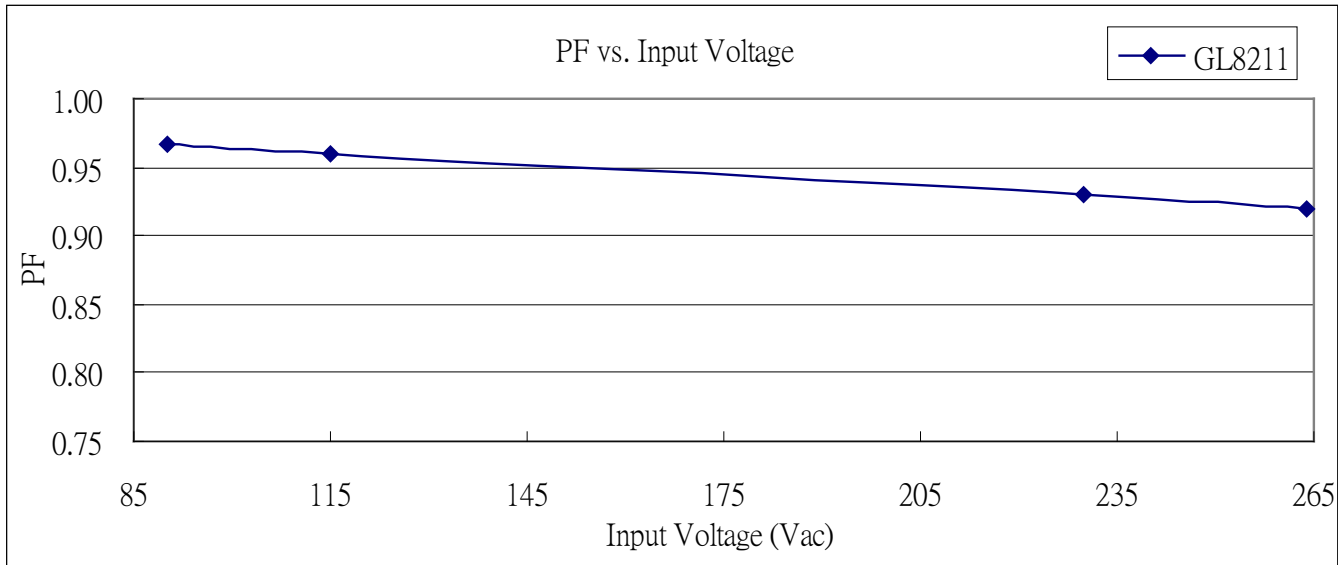




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GL8211 Introduction

	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
PF	0.966	0.960	0.931	0.920

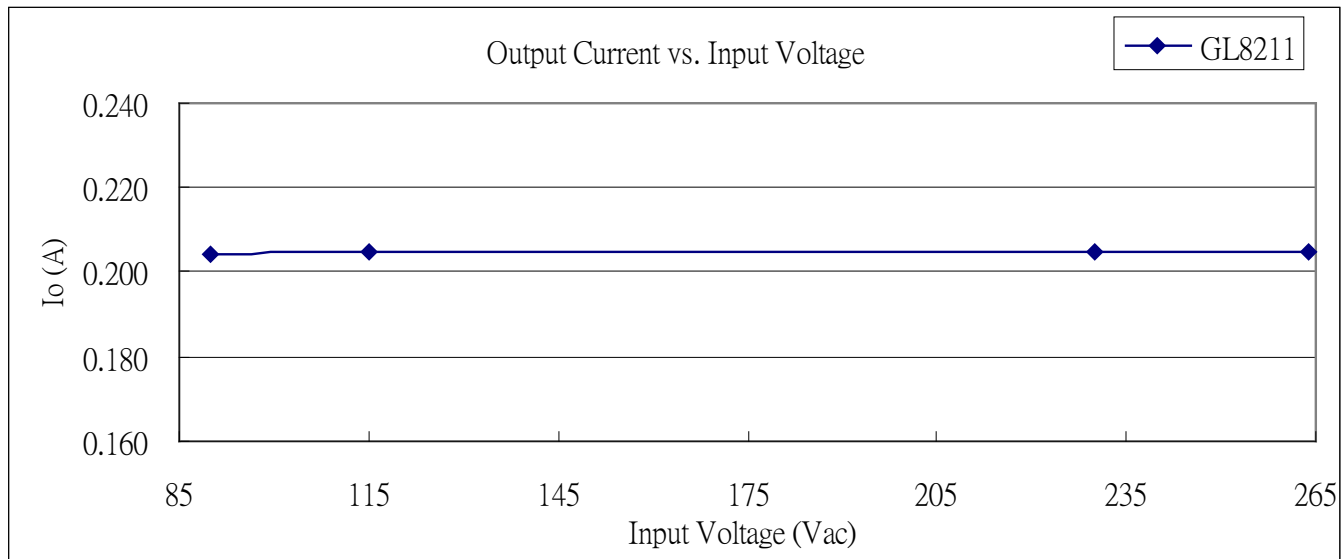




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GL8211 Introduction

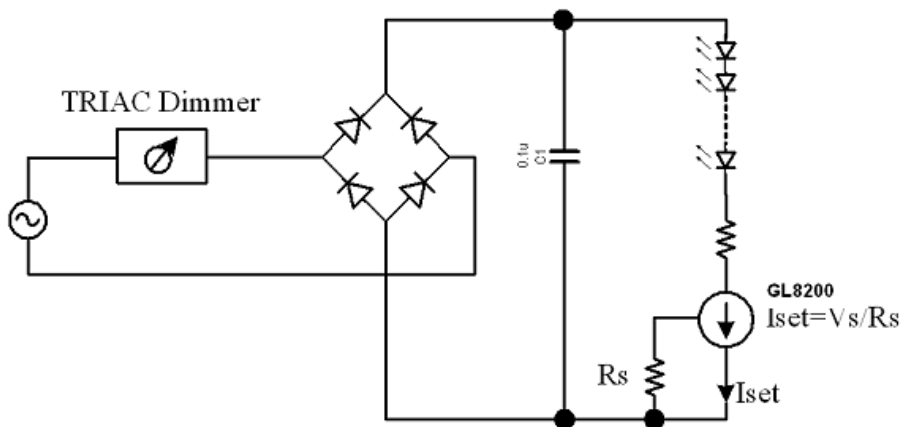
	90Vac/60Hz	115Vac/60Hz	230Vac/50Hz	264Vac/50Hz
I_o	0.204 A	0.205 A	0.205 A	0.205 A



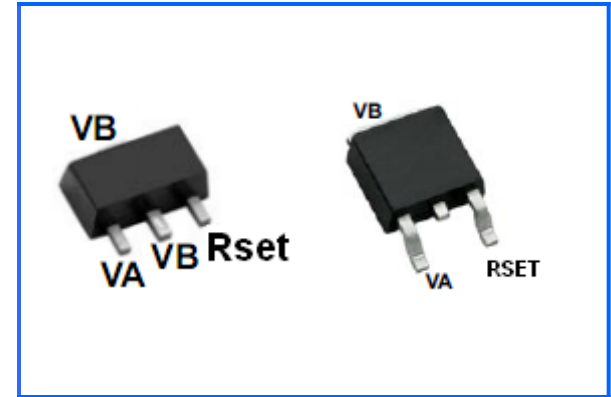
Features

- 7.5 ~ 130V operating voltage range
- Current accuracy < 5%
- 0.01%/°C temp. coefficient
- External resistor setting current
- For higher LED current allowable in parallel
- On chip OTP (auto recovery)
- 10mA(SOT-89)/20mA(D-PAK) avg. & 50mA max. output current
- SOT-89 & D-PAK package

Schematic



Pinning



Pin description

Pin No.	Name	Function
1	VA	Anode pin
2	VB	Cathode Pin
3	RSET	LED current setting

GL8200 Demo board



VLED: 100V for 90~132Vac,
200V for 180~264Vac
ILED: <20mA

LED Lighting Driver IC Family

Application	Part No.	Features	Topology	Package
Non-isolation	GR1001	a. +Passive PFC: universal, CC< +/-10%, PF>0.7 b. Single, CC< +/-10%, PF>0.9 c. +Bulk cap.: universal, CC< +/- 5%	Buck	SOP-8
	GL8211	Universal, CC< +/-3%, PF>0.9	Buck	SOT-26
	GL8216	Universal, CC< +/-3%, PF>0.9	Flyback	SOP-8
	GL8200	Current Regulator (20mA avg., 50mA max.)	Series	SOT-89 D-PAK
Isolation	GR8762	Universal, CC< +/-3%, PF>0.9	Flyback	SOP-8 DIP-8
	GR8818(BJT) GL8258(MOS)	Universal, CC< +/- 6%	PSR Flyback	SOT-26
	GL8259	PSR+PFC	PSR+PFC Flyback	SOP-8

Notes: GL8259-- under development

EVB Performance

part no.	application	model	input	output	size LxWxH	performance (115v/230v)				component #
						eff.	PF	THD	CC	
8216	Bulb	7w	90~264	36v 220mA	50 x 20/17 x 18	86% / 84%	0.98 / 0.94	12% / 14%	+/- 1%	40
8216	Bulb	9w	90~264	19v 500mA	50 x 20/17 x 18	83% / 82%	0.99 / 0.93	13% / 15%	+/- 1%	40
8216	Bulb	6w	90~264	100v 60mA	50 x 20/17 x 18	87% / 82%	0.99 / 0.93	8% / 9%	+/- 1%	40
8762	T8	18w	90~264	45v 400mA	255 x 17.5 x 10	87% / 87%	0.98 / 0.95	12% / 18%	+/- 1%	70
8762	T8	9w	90~264	60v 160mA	230 x 17.5 x 10	85% / 85%	0.96 / 0.91	29% / 19%	+/- 1%	70
8258	Bulb	8w	90~264	54v 150mA	50 x 20/17 x 18	88% / 86%	x	x	+/- 4%	40
8258	Bulb	9w	90~264	13v 700mA	50 x 20/17 x 18	83% / 83%	x	x	+/- 4%	40
8258	Bulb	11w	90~264	31v 350mA	50 x 20/17 x 18	85% / 85%	x	x	+/- 6%	40
8211	Bulb	7w	90~264	36v 220mA	50 x 20/17 x 18	89% / 88%	0.92 / 0.92	20% / 20%	+/- 1%	26
8200	candle	1w	90~132	100v 10mA						8

Thank You