

Transition Mode PFC Controller for LED Lighting

General Description

EM8609/A is a voltage mode PFC controller operating at transition mode.

This device provides protections of internal soft start, over voltage protection, over current protection and thermal shutdown. It can minimize the external components counts, and makes the design easy.

It also provides functions of low start up current, disable function, under voltage lockout and internal leading edge blanking of the current sensing.

This part is available in SOP-8 package.

- Leading Edge Blanking on CS Pin
- Over Voltage Protection
- Cycle by Cycle Current Limiting
- Feedback Open Protection
- CS Open Protection
- RT Open/Short Protection
- 2ms Soft-Start Current Limit
- Thermal Shutdown



Ordering Information

Part Number	Package	Remark
EM8609G	SOP-8	with AC Absent function
EM8609AG	SOP-8	without AC Absent function

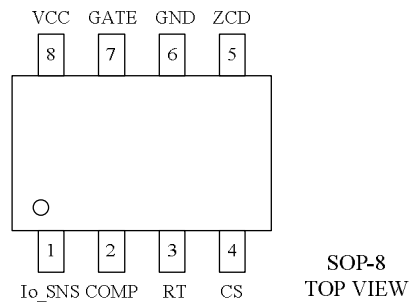
Applications

- Ballast
- General LED lighting

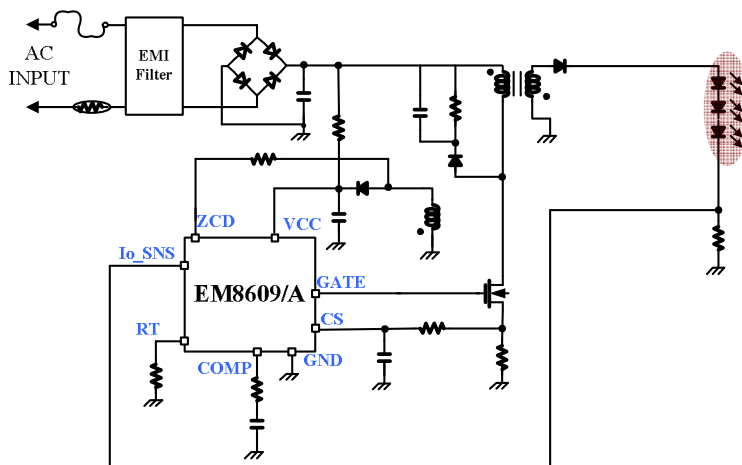
Features

- Transition Mode PFC
- Voltage Mode Control
- Programmable Max. On-Time
- Low Start Up Current (<30uA)

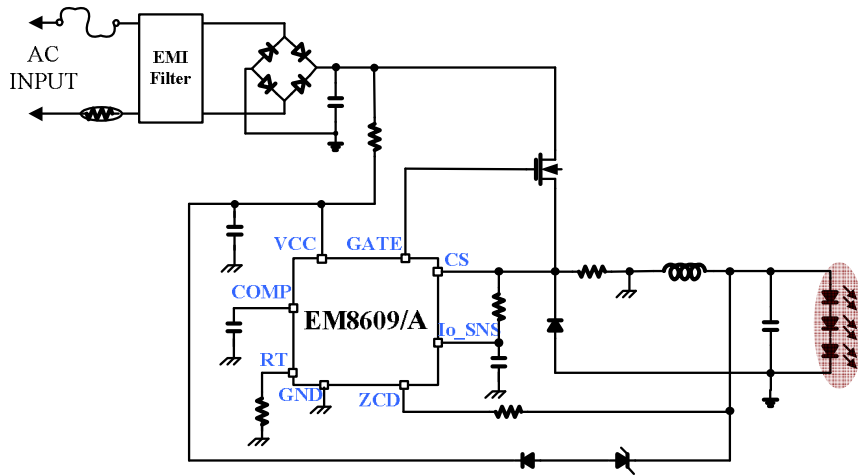
Pin Configuration



Typical Application Circuit



Fly-back Application

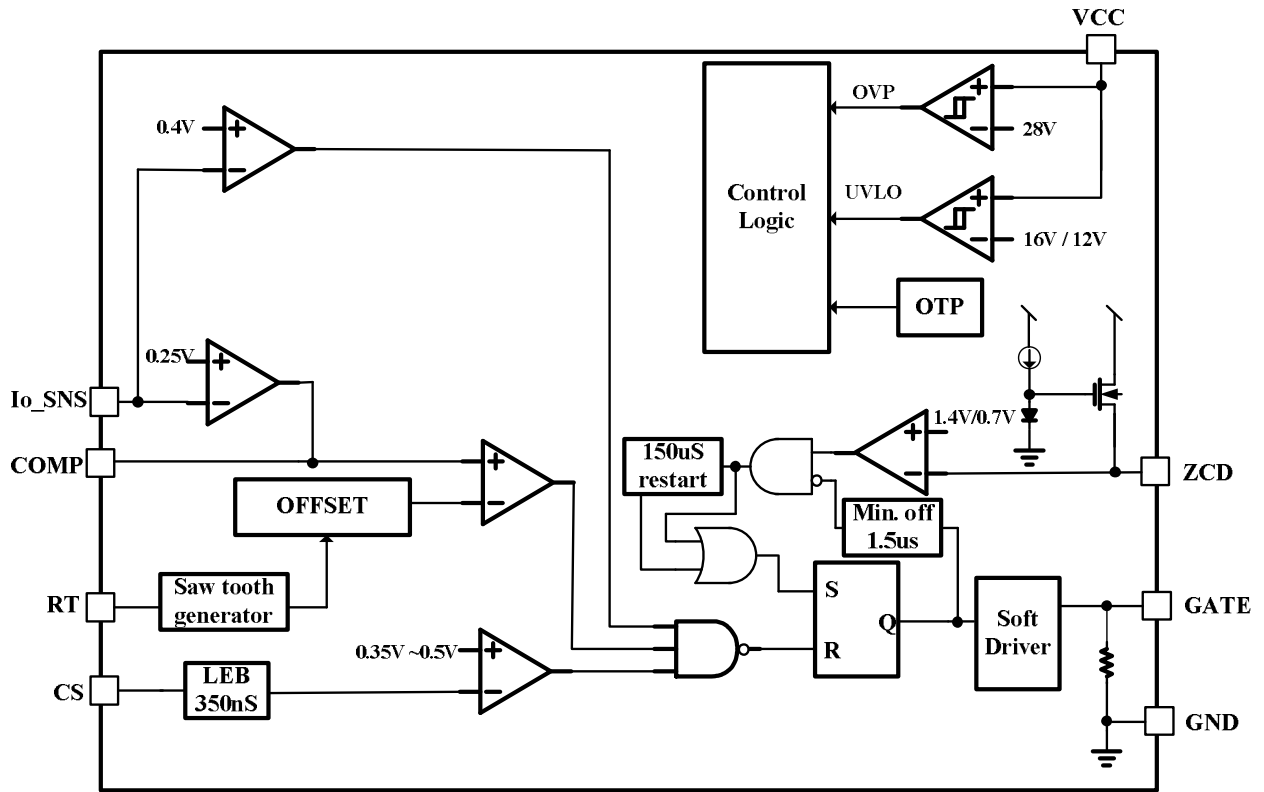


Buck Application

Pin Assignment

Pin Name	Pin No.	Pin Function
Io_SNS	1	Output current feedback control
COMP	2	Output of the error amplifier for voltage loop compensation
RT	3	Ramp generator, connecting a resistor to GND pin to set the saw tooth signal
CS	4	Senses the peak current.
ZCD	5	Detecting zero crossing of input signal
GND	6	Ground.
GATE	7	Gate drive output to drive the external MOSFET.
VCC	8	IC power supply pin.

Function Block Diagram



Absolute Maximum Ratings (Note 1)

● Supply Input Voltage, VCC	-----	32V
● Gate pin	-----	32V
● other Pins	-----	- 0.3V to 6V
● Power Dissipation, PD @ TA = 25 °C		
● SOP8	-----	0.909W
● Package Thermal Resistance		
● SOP-8 (Note 2),	-----	110°C /W
● Junction Temperature	-----	150°C
● Lead Temperature (Soldering, 10 sec.)	-----	260°C
● Storage Temperature Range	-----	-65°C to 150°C
● ESD Susceptibility (Note3)		
● HBM (Human Body Mode)	-----	2kV
● MM (Machine Mode)	-----	200V
● Gate Output Current	-----	500mA

Recommended Operating Conditions (Note4)

● Junction Temperature	-----	-40°C to 125°C
● Ambient Temperature	-----	-40°C to 85°C
● Supply Input Voltage, V _{CC}	-----	12V to 16V
● V _{CC} capacitor	-----	4.7uF to 10uF

Electrical Characteristics

V_{CC}=16V, T_A=25°C, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
VCC Section						
Start Up Current		V _{CC} <UVLO (on)		20		uA
Operating Current (C _{GATE} =1nF)				2		mA
UVLO (OFF)				12		V
UVLO (ON)			15	16	17	V
VCC OVP Protect voltage	V _{OVP}		26.5	28	30	V
Error Amplifier						
Feedback input voltage, V _{REF}				0.25		V
Trans-conductance				115		uS
Output sink current		V _{I_O SNS} =V _{REF} +0.1V		12		uA
Output source current		V _{I_O SNS} =V _{REF} -0.1V		-12		uA
Output upper clamp voltage		V _{I_O SNS} =V _{REF} -0.1V		5.4		V
Burst mode hysteresis				100		mV

Io_SNS Section						
OVP threshold			0.35	0.4	0.45	V
OVP hysteresis				0.175		V
CS Section						
Current sense input threshold voltage		$I_{ZCD} < 100 \mu A$		0.5		V
				0.35		
Input bias current		$V_{CS}=0V\sim 1V$			1	μA
Leading edge blank time				350		ns
ZCD section						
Upper Clamp Voltage		$I_{ZCD}=2mA$		6.7		V
Lower Clamp Voltage		$I_{ZCD}=-2mA$		-0.7		V
Input voltage threshold				1.4		V
				0.7		V
Input bias current		$V_{ZCD}=1V\sim 5V, OUT=OFF$			1	μA
Max. delay from ZCD to OUT				250		ns
RT Section						
Max. On-Time voltage		$R_{RT}=20k$		2.9		V
Max. On-Time programming		$R_{RT}=20k$	10	12	14	μs
Max. On-Time		$R_{RT}=100k$		40		μs
Min. Off-Time Section						
Min. Off-Time				1.5		μs
GATE Drive Output Section						
Output low level		$V_{CC}=16V, I_{SINK}=20mA$			0.5	V
Output high clamp level		$V_{CC}=16V$		12		V
Rising time		$V_{CC}=16V, C_L=1000pF$		35		ns
Falling time		$V_{CC}=16V, C_L=1000pF$		25		ns
Protection Section						
Start time period				150		μs
Soft Start Time				2		ms
VIN Absent Delay		EM8609		20		ms
OTP trip level				140		$^{\circ}C$
OTP hysteresis				30		$^{\circ}C$

Note 1. Stresses listed as the above “Absolute Maximum Ratings” may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

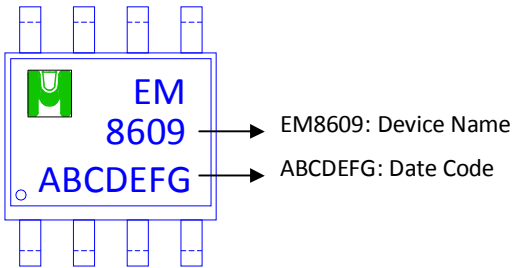
Note 2. θ_{JA} SOP-8 packages is $52^{\circ}C/W$ on JEDEC 51-7 (4 layers, 2S2P) thermal test board with $50mm^2$ copper area.

Note 3. Devices are ESD sensitive. Handling precaution is recommended.

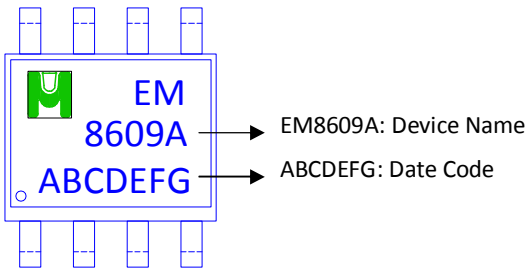
Note 4. The device is not guaranteed to function outside its operating conditions.

Ordering & Marking Information

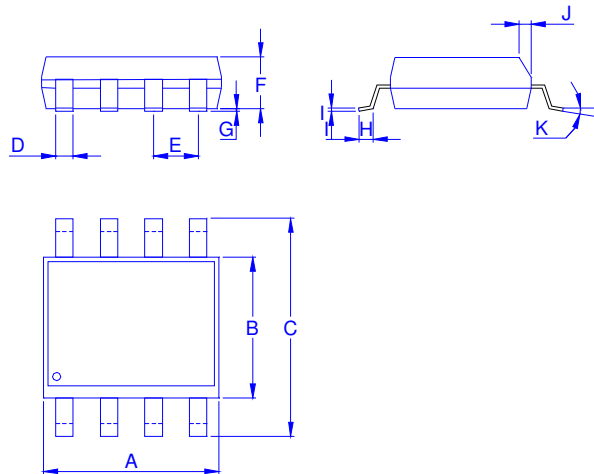
Device Name: EM8609G for SOP-8



Device Name: EM8609AG for SOP-8



Outline Drawing



Dimension in mm

Dimension	A	B	C	D	E	F	G	H	I	J	K
Min.	4.70	3.70	5.80	0.33		1.20	0.08	0.40	0.19	0.25	0°
Typ.					1.27						
Max.	5.10	4.10	6.20	0.51		1.62	0.28	0.83	0.26	0.50	8°