R2A20135SP

LED Lighting Power Controller

R03DS0061EJ0301
Rev.3.01
Jan 08, 2016

Description

R2A20135 is LED lighting controller IC with dimming function.

High accuracy LED current feed-back system makes more efficient LED performance.

With non-Isolation step-down control makes it possible to reduce external parts and realize high power factor and efficiency. Moreover, this IC builds in the dimming function and can control many types dimming mode such as Triac, PWM, and DC dimming.

Switching mode can chosen Zero Current detect Mode or Fixed Frequency Mode according to the required features. By the Constant On Time control, both modes have power factor correct function.

Zero Current detect Mode is better performance for noise immunity, and Fixed Frequency Mode is for power factor correction and THD.

Features

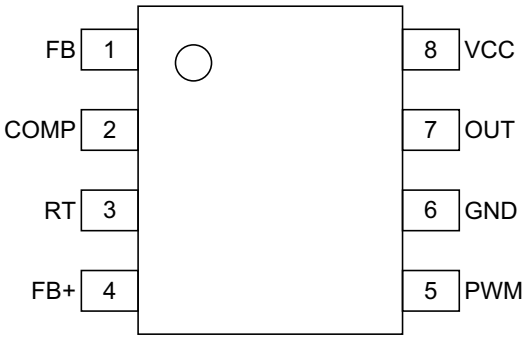
- Absolute Maximum Ratings
  - Supply voltage Vcc: 24 V
  - Junction temperature Tj: –40 to +150°C
- Electrical characteristics
  - UVLO operating start voltage VH: 12 V ± 0.8 V
  - UVLO operating shutdown voltage VL: 9.2 V ± 0.7 V
  - UVLO hysteresis voltage Hysuvl: 2.8 V ± 0.7 V
- Functions
  - Dimming function (Triac, PWM, DC dimming)
  - Zero current detection mode (when Rrt is OPEN)
  - Fixed frequency mode (when Rrt is connected by GND)
  - Adjustable switching frequency (when Rrt is connected by GND)
  - Package lineup: Pb-free SOP-8 (JEDEC)

Ordering Information

Part No.	Package Name	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
R2A20135SP#W5	—	PRSP0008DJ-A	SP	W (2,500 pcs/reel)

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Pin Arrangement



(Top view)

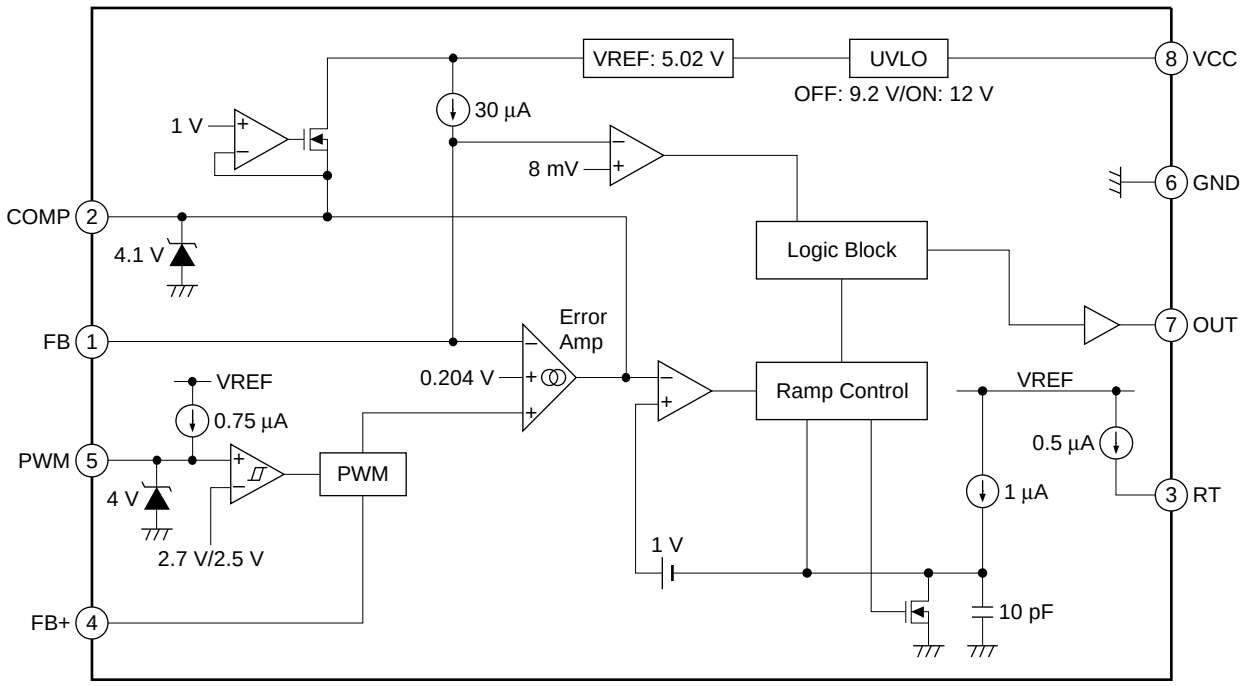
Pin Function

Pin No.	Pin Name	Input/Output	Function
1	FB	Input	Error amplifier input pin
2	COMP	Output	Error amplifier output pin
3	RT	Input/Output	A resistor connection pin for RAMP current setting
4	FB+	Input/Output	A conductor connection pin for PWM voltage stability and DC dimming
5	PWM	Input	Input PWM signal
6	GND	—	Ground
7	OUT	Output	Power MOSFET drive pin
8	VCC	Input	Supply voltage pin

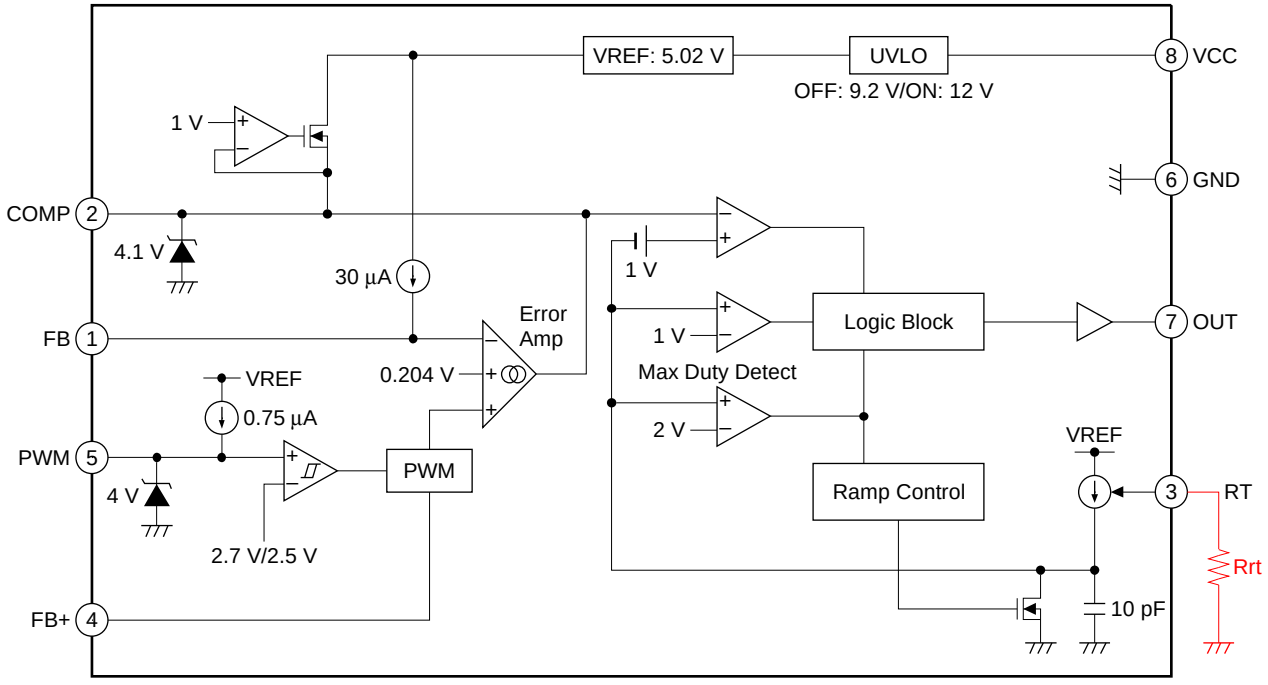
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Block Diagram

· **Rrt: OPEN (Zero Current Detection Mode)**



· **Rrt: Connect to GND (Fixed Frequency Mode)**



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Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit	Note
Power supply voltage	VCC	–0.3 to +24	V	
FB pin voltage	Vt-fb	–0.3 to +5	V	
COMP pin voltage	Vt-comp	–0.3 to +5	V	
RT pin voltage	Vt-rt	–0.3 to +5	V	
FB+ pin voltage	Vt-fb+	–0.3 to +5	V	
PWM pin voltage	Vt-pwm	–0.3 to +5	V	
OUT pin peak current	Ipk-snk-out	0.9	A	3
	Ipk-src-out	–0.50		
OUT pin DC current	Idc-snk-out	100	mA	
	Idc-src-out	–50		
RT pin current	Irt	–200 to +100	µA	
PWM pin current	Ipwm	500	µA	
Power dissipation	Pt	0.68	W	4
Operating ambient temperature	Ta-opr	–40 to +125	°C	
Junction temperature	Tj	–40 to +150	°C	5
Storage temperature	Tstg	–55 to +150	°C	

Notes: 1. Rated voltages are with reference to the GND pin.
2. For rated currents, inflow to the IC is indicated by (+), and outflow by (–).
3. Shows the transient current when driving a capacitive load.
4. In case of R2A20135SP: θja = 120°C/W
This value is a thing mounting on 40 × 40 × 1.6 [mm], a glass epoxy board of wiring density 10%.
5. Stresses exceeding the absolute maximum ratings may damage the device.
These are stress ratings only. Functional operation above the recommended operating ambient temperature range is not implied.
Extended exposure to stresses above the absolute maximum ratings may affect device reliability.

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Electrical Characteristics

(Ta = 25°C, VCC = 15 V, FB = COMP, RRT = 200 kΩ)

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Supply	UVLO turn-on threshold	Vuvlh	11.2	12	12.8	V	
	UVLO turn-off threshold	Vuvll	8.5	9.2	9.9	V	
	UVLO hysteresis	Hysuvl	2.1	2.8	3.5	V	
	Standby current	Istby	—	130	200	µA	VCC = Vuvlh – 0.2 V
	Operating current	Icc	—	2.2	3.3	mA	
Error amplifier	Feedback voltage	Vfb	0.194	0.204	0.214	V	*3
	Minimum feedback voltage	Vfb_min	—	0	—	mV	
	Input bias current	Ifb	–50	–30	–15	µA	Vfb = 13 mV
	Open loop gain	Av	—	63	—	dB	
	Upper clamp voltage	Vclamp_comp	3.85	4.10	4.30	V	FB = 0 V COMP: Open
	Low voltage	Vl-comp	—	0.9	—	V	FB = 0.4 V COMP: Open
	Source current	Isrc-comp	–14	–9	–5	µA	FB = 0 V COMP = 2.5 V
	Sink current	Isnk-comp	12	20	27	µA	FB = 1 V COMP = 2.5 V
	Transconductance	gm	25	45	70	µs	FB = 0.15 V ↔ 0.25 V COMP = 2.5 V
Zero current detector	ZCD threshold voltage	Vzcd	2	8	14	mV	
Restart	Restart time delay	Tstart	45	75	140	µs	FB = 0 V, COMP = 2.5 V, RT = Open
RT	RAMP offset voltage	Voffset_ramp	—	1.0	—	V	
	RAMP amplitude	dVramp	2.9	3.1	3.3	V	*2
	RT voltage1	V-rt1	1.9	2.0	2.1	V	RT-GND: 200 kΩ
	RT bias current	Irt	–0.7	–0.5	–0.2	µA	RT = 2.5 V
PWM	Maximum input frequency	Fpwm_max	—	—	100	kHz	*1
	Input bias current	Ipwm	–0.35	–0.75	–1.5	µA	
	Upper clamp voltage	Vclamp_pwm	3.5	4.0	4.5	V	Clamp current = 100 µA
	PWM high threshold voltage	Vr_pwm	2.40	2.70	3.00	V	
	PWM low threshold voltage	Vf_pwm	2.25	2.5	2.75	V	
FB+	Minimum output voltage	Vfb+_lo	—	0	10	mV	Vpwm = 0 V
OUT	Rise time	tr-out	—	30	100	ns	CL = 1000 pF
	Fall time	tf-out	—	30	100	ns	CL = 1000 pF
	OUT low voltage	Vol1-out	—	0.08	0.20	V	Isink = 20 mA
		Vol2-out	—	0.05	0.70	V	Isink = 10 mA, VCC = 5 V
	OUT high voltage	Voh-out	14.5	14.8	—	V	Isource = –20 mA
	OUT frequency	fout	43	48	53	kHz	RT-GND: 200 kΩ
	Maximum duty cycle	Dmax	47	52	57	%	RT-GND: 200 kΩ

Notes: *1 Design spec

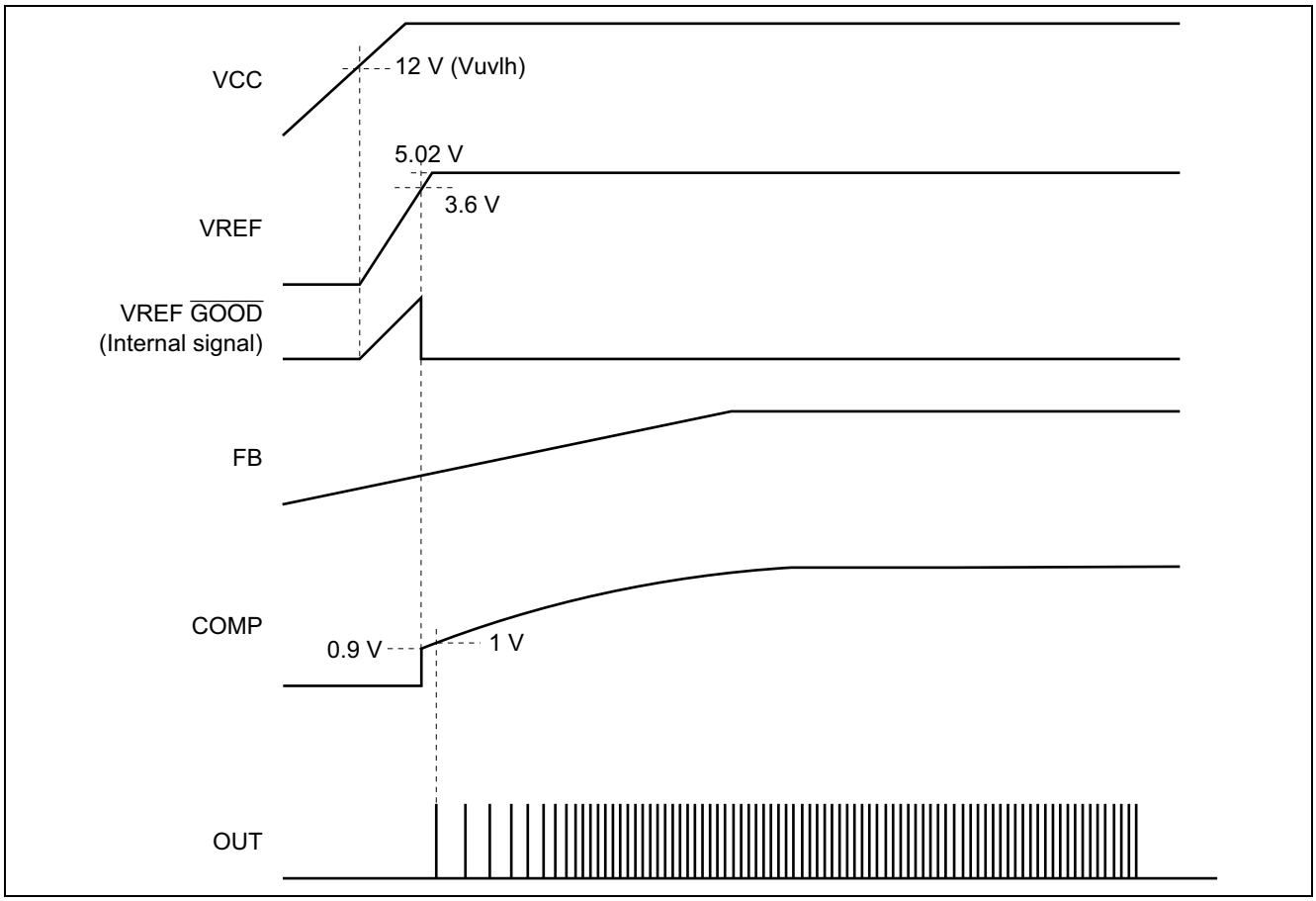
*2 dVramp = Vclamp_comp – Voff_ramp

*3 There is the possibility of change for the standard value.

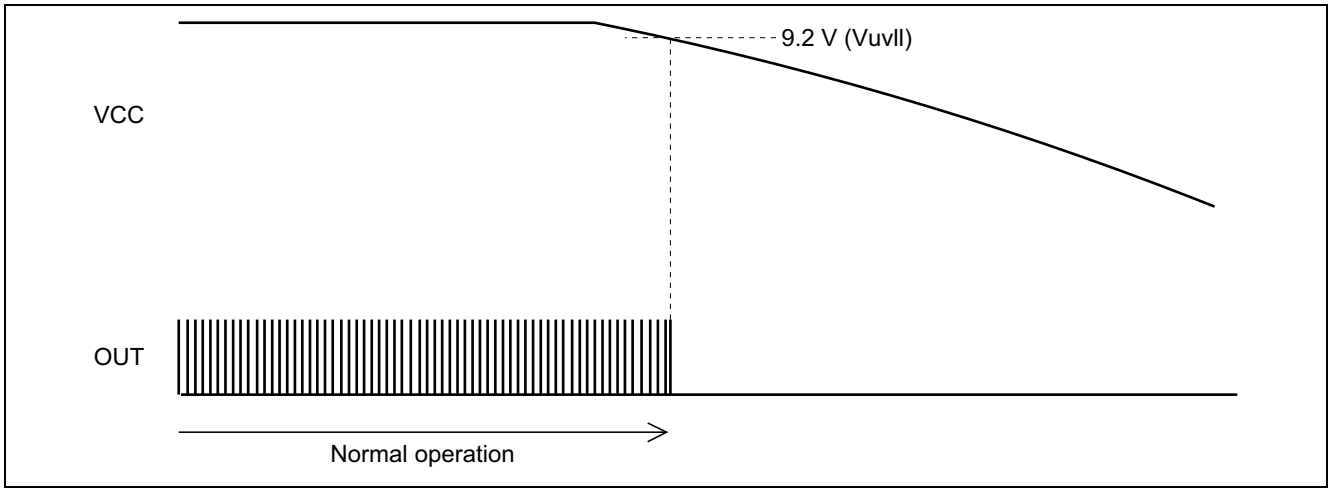
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Waveforms (Zero Current Detection Mode/Fixed Frequency Mode common)

1. Start-up Timing (Zero Current Detection Mode/Fixed Frequency Mode common)

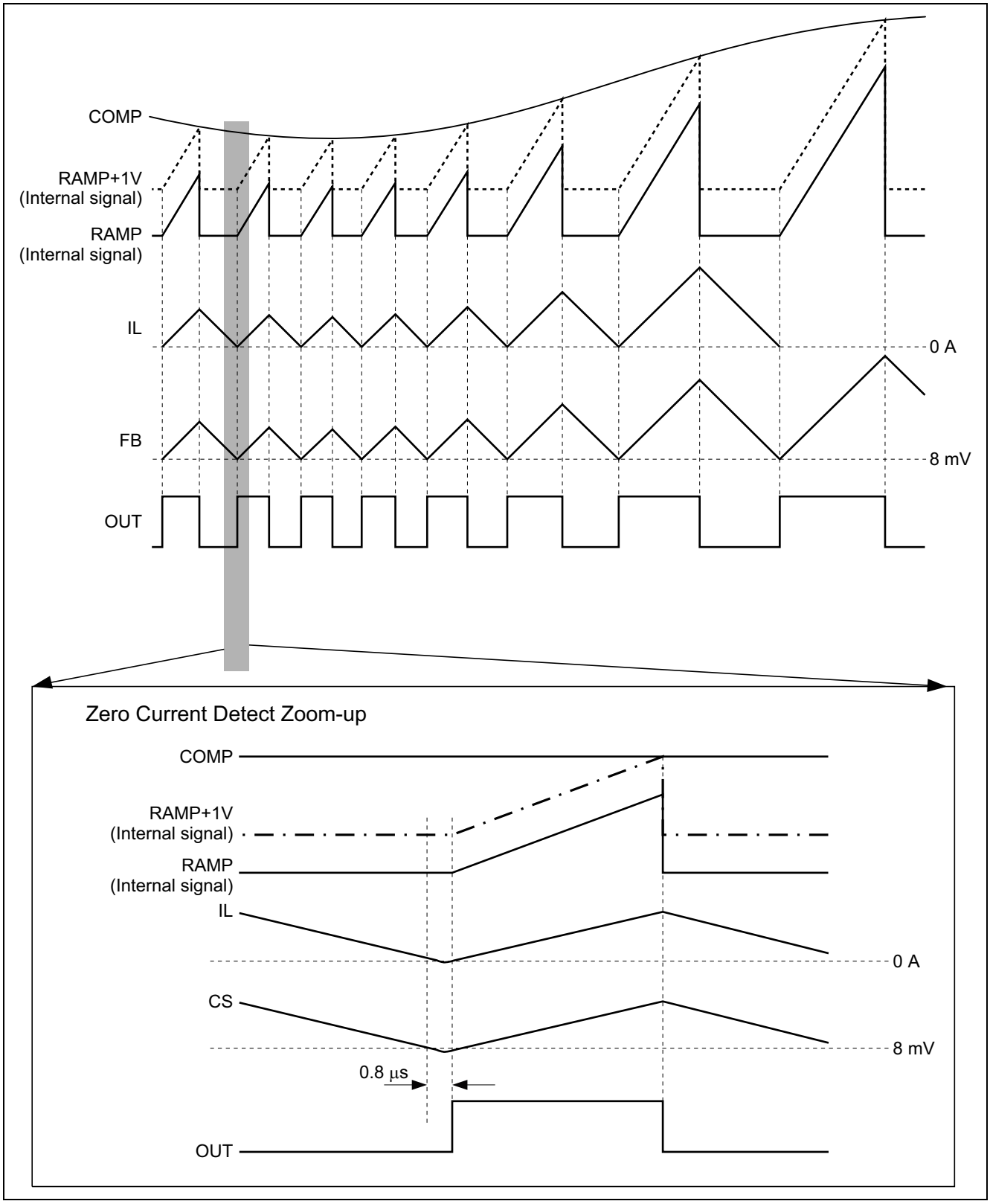


2. Stop Timing (Zero Current Detection Mode/Fixed Frequency Mode common)



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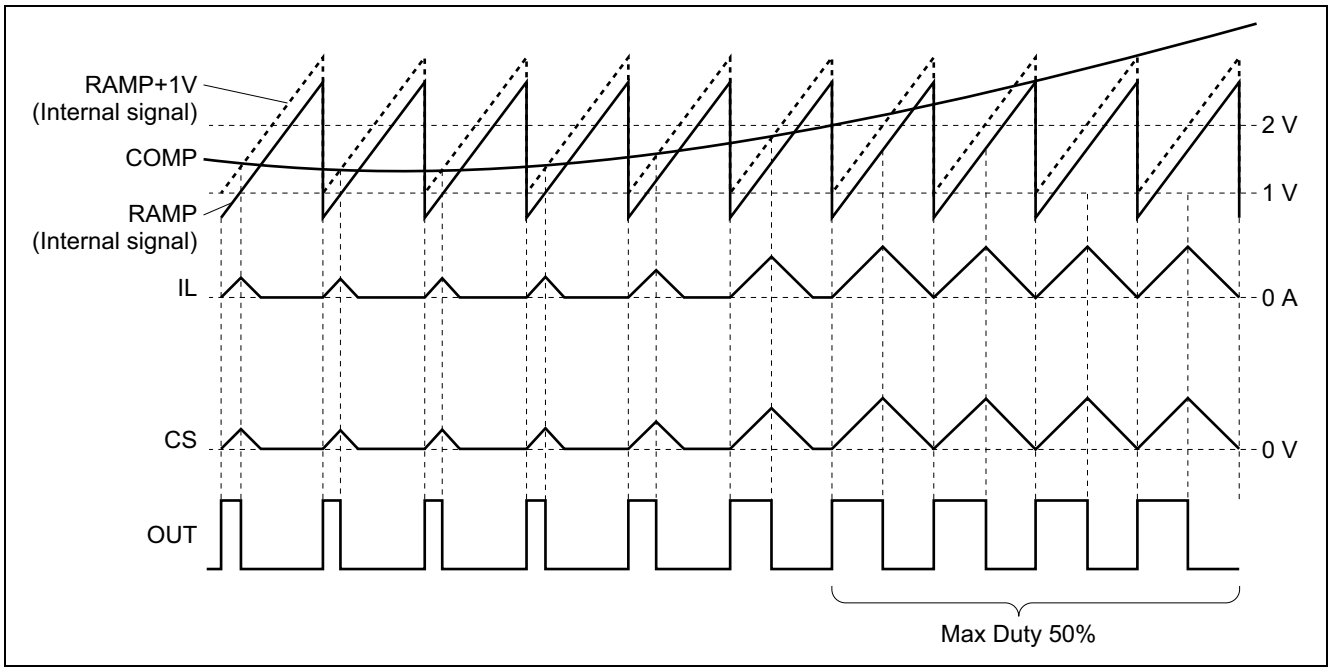
3. Gate Drive Output (Zero Current Detection Mode)



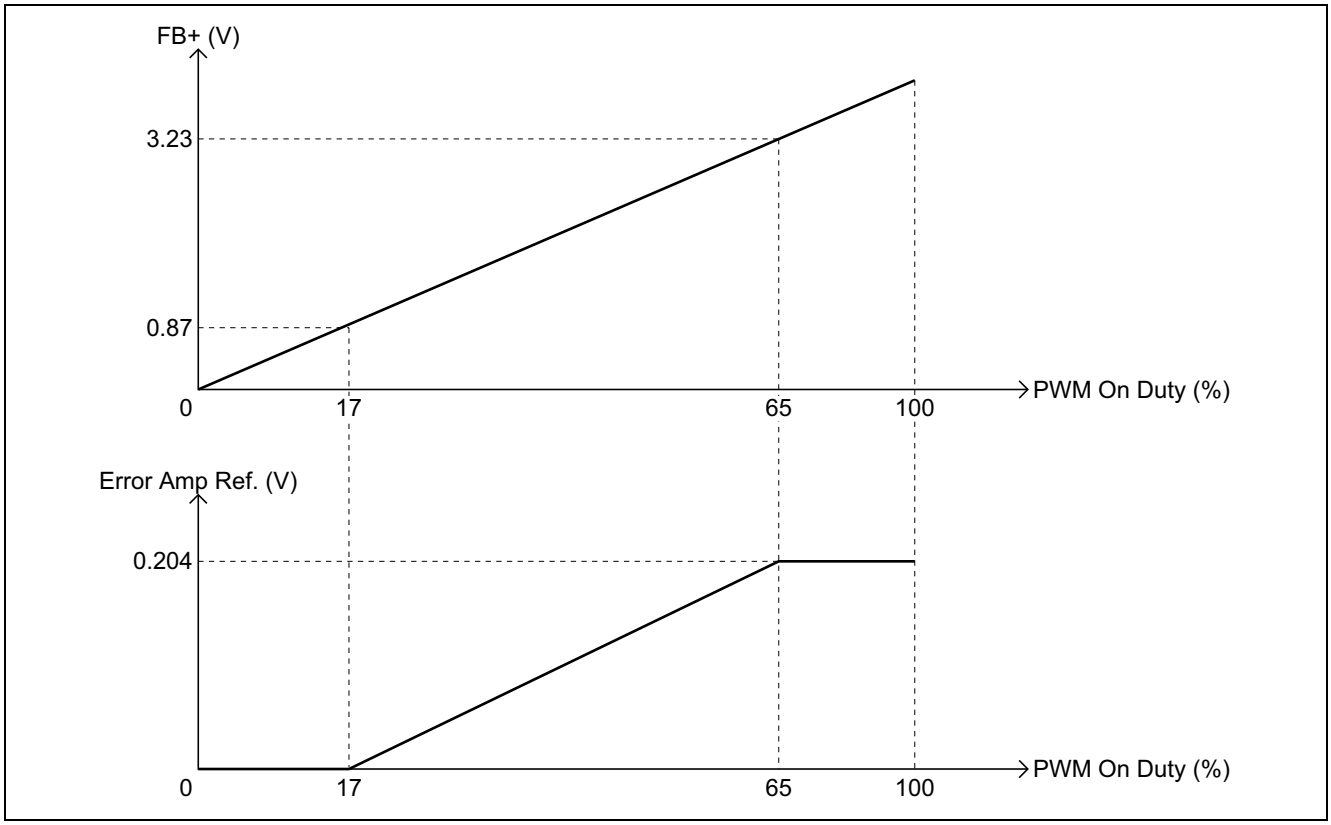
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4. Gate Drive Output (Fixed Frequency Mode)

4.1 Error Amp Control Mode



5. PWM Characteristics

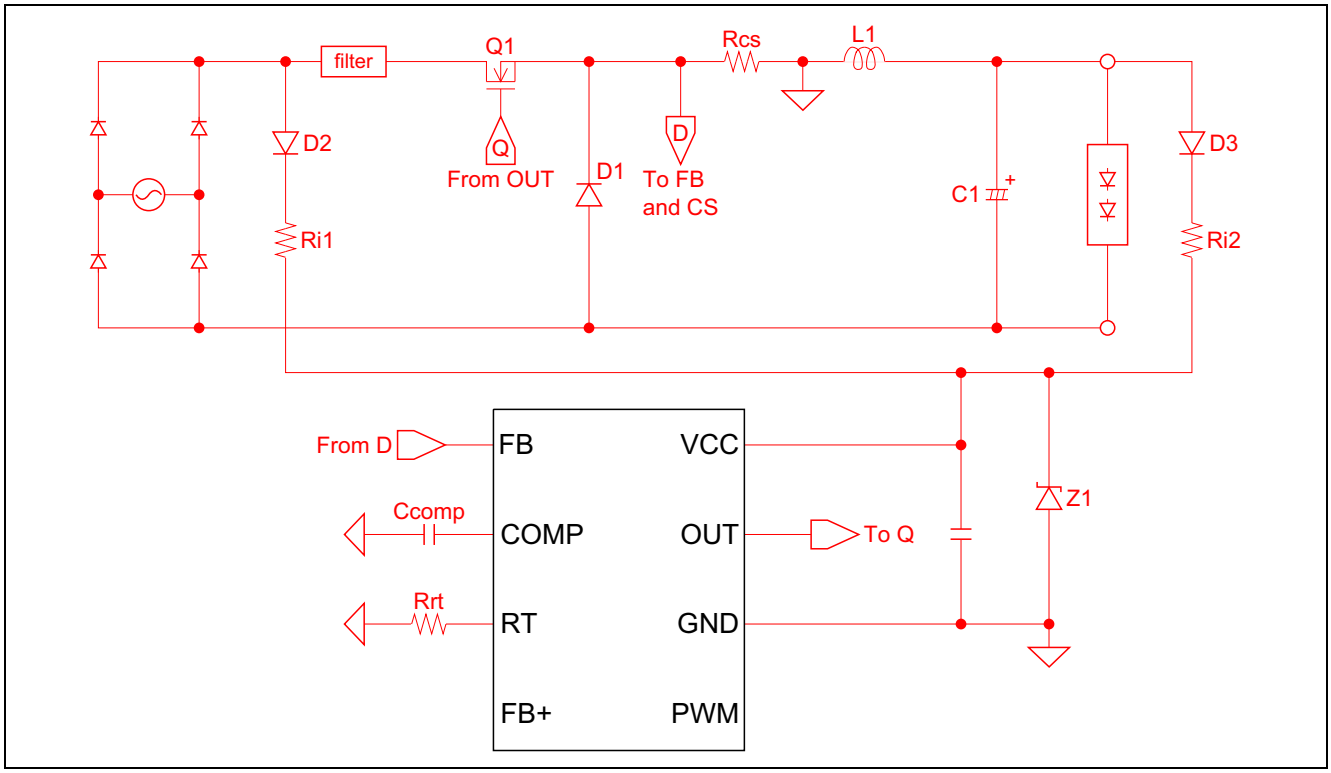


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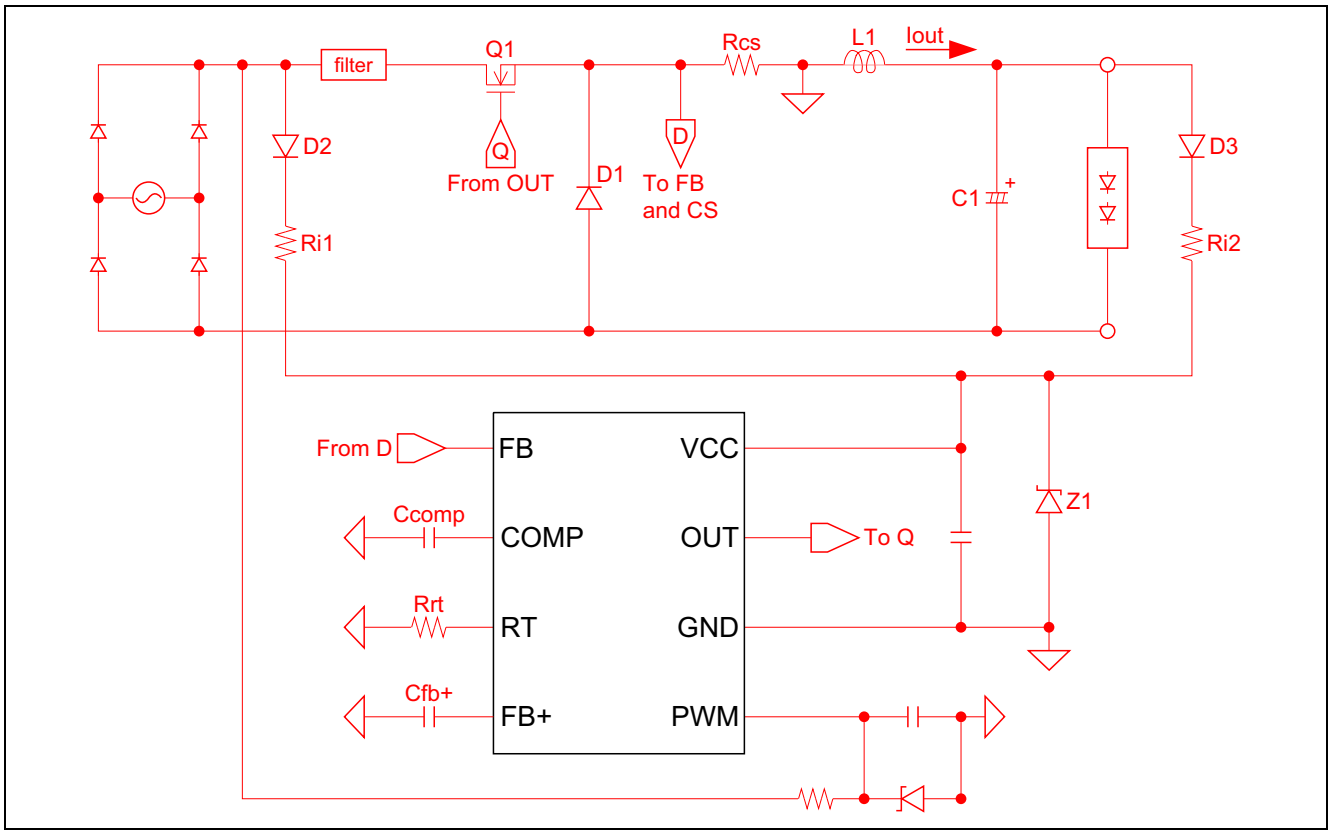
System Diagram

1. Step-down Fixed Frequency Mode

1.1 Non Dimming



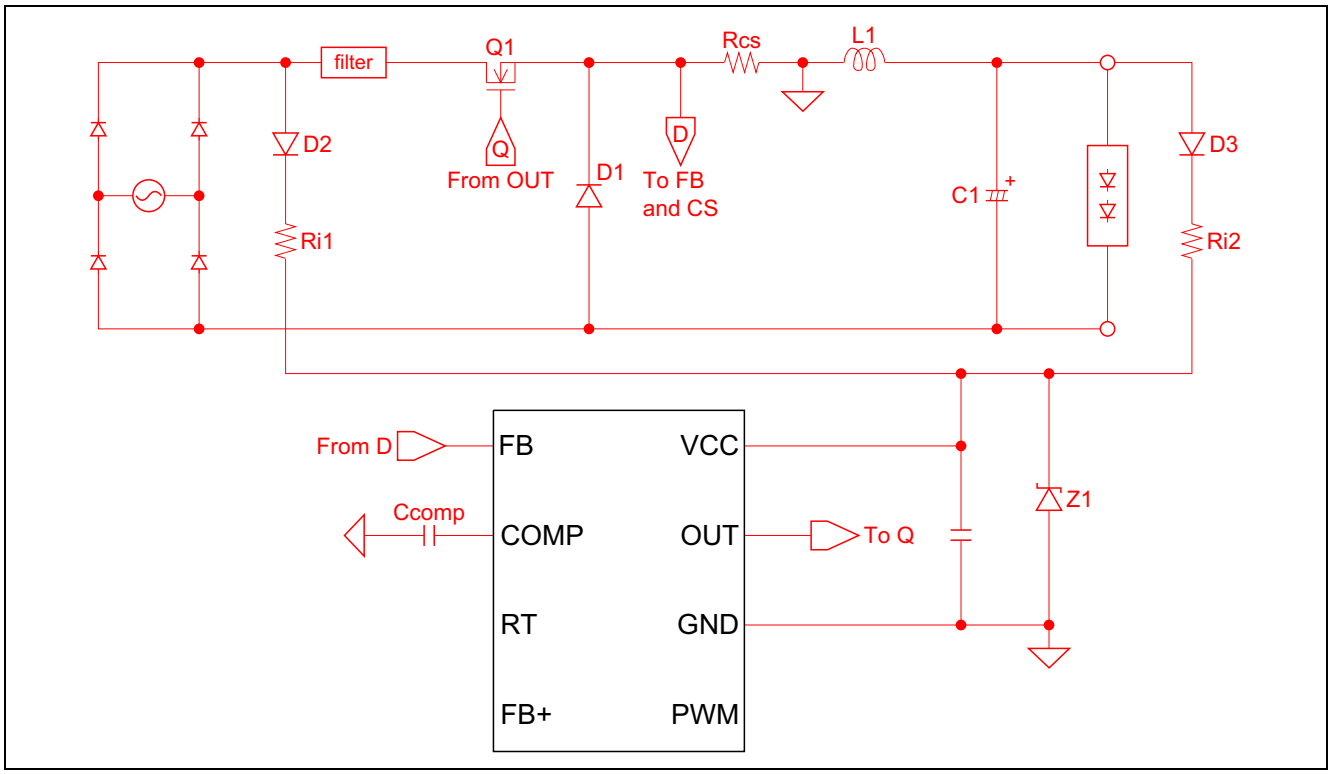
1.2 Triac Dimming



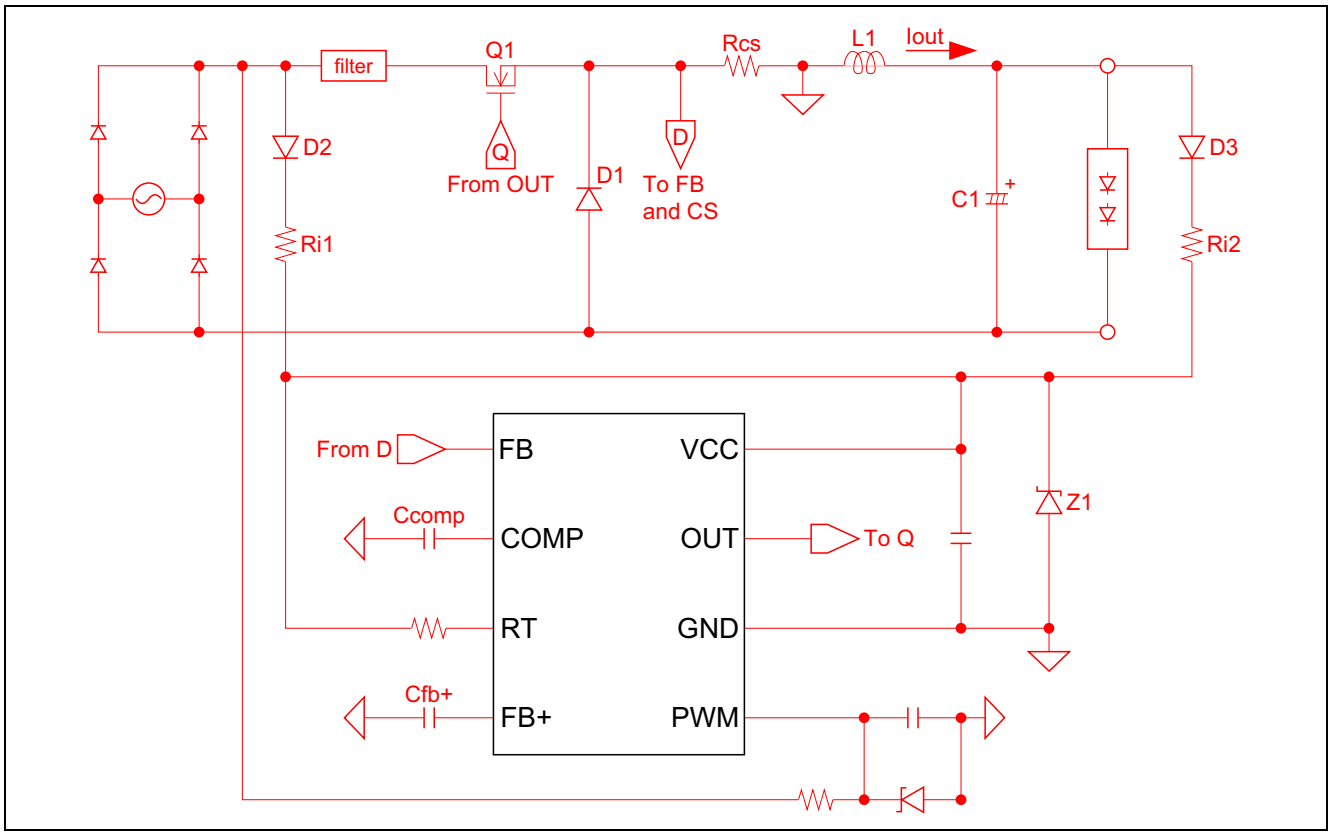
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2. Step-down Zero Current Detection Mode

2.1 Non Dimming



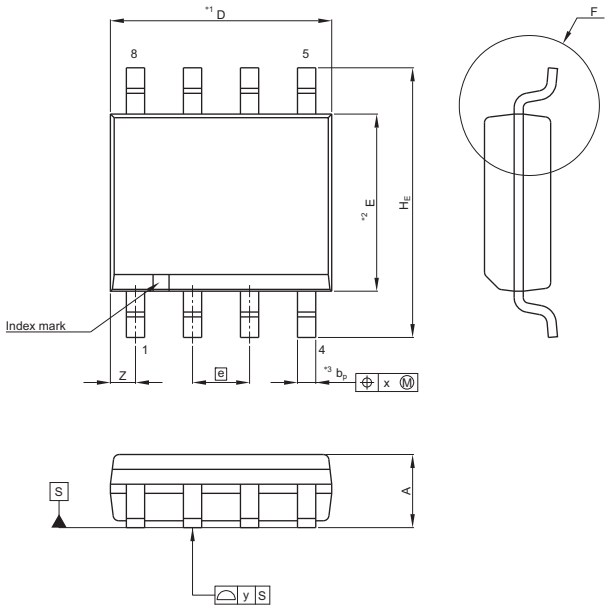
2.2 Triac Dimming



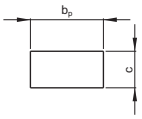
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Package Dimensions

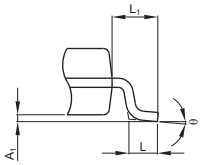
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-3.94x4.93-1.27	PRSP0008DJ-A	—	0.073g



NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.



Terminal cross section
(Ni/Pd/Au plating)



Detail F

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	4.80	4.93	4.98
E	3.81	3.94	3.99
A_2	—	1.47	—
A_1	0.10	0.15	0.25
A	—	—	1.73
b_p	0.35	0.41	0.49
b_1	—	—	—
c	0.19	0.20	0.25
c_1	—	—	—
θ	0°	—	8°
H_E	5.84	5.99	6.20
e	—	1.27	—
x	—	—	0.25
y	—	—	0.10
Z	—	0.56	—
L	0.41	0.64	0.89
L_1	—	1.03	—

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