

# R2A20134SP

R03DS0033EJ0301

Rev.3.01

Jan 08, 2016

## LED Lighting Power Controller

### Description

R2A20134SP is a LED lighting controller IC.

Control method is selectable for each system demand, fixed frequency or zero current detection mode.

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

Critical Conduction Mode PFC control realizes high power factor and zero current switching.

And Peak Current Mode makes it possible to reduce external parts and realize low system cost.

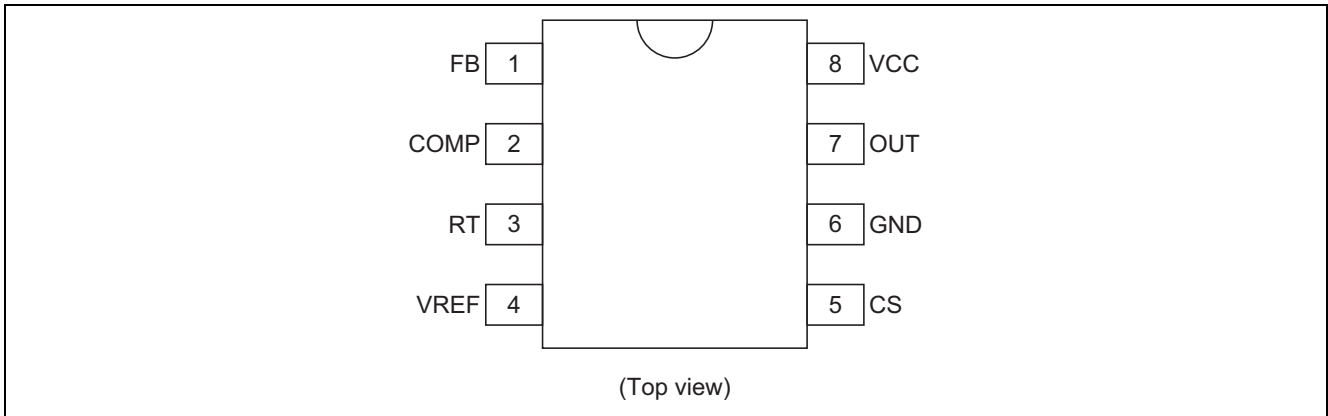
### Features

- Absolute Maximum Ratings
  - Supply voltage  $V_{cc}$ : 24 V
  - Junction temperature  $T_j$ :  $-40$  to  $+150^{\circ}\text{C}$
- Electrical characteristics
  - UVLO operation start voltage  $V_H$ :  $12\text{ V} \pm 0.8\text{ V}$
  - UVLO operation shutdown voltage  $V_L$ :  $9.2\text{ V} \pm 0.7\text{ V}$
  - UVLO hysteresis voltage  $H_{ysuvl}$ :  $2.8\text{ V} \pm 0.7\text{ V}$
- Functions
  - Selectable for each targeted system,
    1. Zero current detection mode (When  $R_{rt}$  is connected by GND)
    2. Fixed frequency mode (When  $R_{rt}$  is connected by  $V_{ref}$ )
  - Adjustable for Switching frequency (When  $R_{rt}$  is connected by  $V_{ref}$ )
  - Overcurrent protection
  - Package lineup: Pb-free SOP-8 (JEDEC)

### Ordering Information

Part No.	Package Name	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
R2A20134SP#W5	—	PRSP0008DJ-A	SP	W (2,500 pcs/reel)

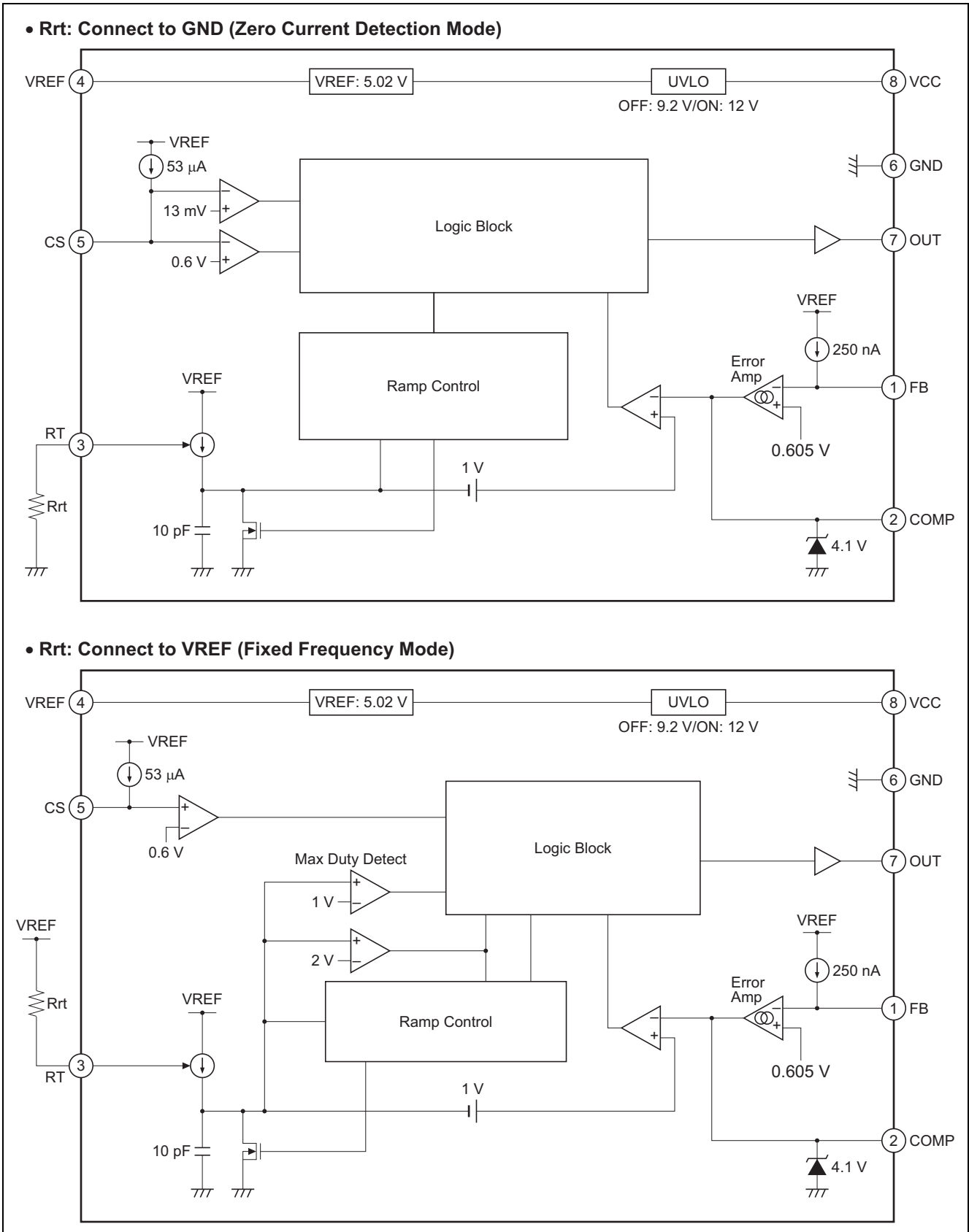
## Pin Arrangement



## Pin Function

Pin No.	Pin Name	Input/Output	Function
1	FB	Input	Error amplifier input terminal
2	COMP	Output	Error amplifier output terminal
3	RT	Input/Output	A resistor connection terminal for RAMP current setting
4	VREF	Output	Reference voltage output terminal
5	CS	Input	Zero current detection and overcurrent detection input terminal
6	GND	—	Ground
7	OUT	Output	Power MOSFET drive terminal
8	VCC	Input	Supply voltage terminal

### Block Diagram



## Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit	Note
Power Supply Voltage	VCC	-0.3 to +24	V	
OUT terminal peak current	l <sub>pk-snk-out</sub>	0.9	A	3
	l <sub>pk-src-out</sub>	-0.50		
OUT terminal DC current	l <sub>dc-snk-out</sub>	100	mA	
	l <sub>dc-src-out</sub>	-50		
RT terminal current	I <sub>rt</sub>	-200	μA	
VREF terminal current	I <sub>ref</sub>	-5	mA	
Vref terminal voltage	V <sub>t-ref</sub>	-0.3 to V <sub>ref</sub> + 0.3	V	
FB terminal voltage	V <sub>t-fb</sub>	-0.3 to +5	V	
CS terminal voltage	V <sub>cs</sub>	-0.3 to +5	V	
Power dissipation	P <sub>t</sub>	0.68	W	4
Operating ambient temperature	T <sub>a-opr</sub>	-40 to +125	°C	
Junction temperature	T <sub>j</sub>	-40 to +150	°C	5
Storage temperature	T <sub>stg</sub>	-55 to +150	°C	

- Notes:
- Rated voltages are with reference to the GND terminal.
  - For rated currents, inflow to the IC is indicated by (+), and outflow by (-).
  - Shows the transient current when driving a capacitive load.
  - In case of R2A20134SP:  $\theta_{ja} = 120^{\circ}\text{C}/\text{W}$   
This value is a thing mounting on  $40 \times 40 \times 1.6$  [mm], a glass epoxy board of wiring density 10%.
  - 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.

## Electrical Characteristics

(Ta = 25°C, VCC = 15 V, CS = 0 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	250	μA	VCC = Vuvlh – 0.2 V
	Operating current	Icc	—	2.2	3.3	mA	
VREF	Reference voltage	Vref	4.945	5.020	5.095	V	Isource = 0 mA
	Temperature stability	dVref	—	±80	—	ppm/°C	Tj = –40 to 150°C *1
	Line regulation	Vref-line	—	5	20	mV	Isource = 0 mA Vcc = 10 V to 24 V
	Load regulation	Vref-load	—	5	20	mV	Isource = 0 mA to –5 mA
Error amplifier	Feedback voltage	Vfb	0.587	0.605	0.623	V	
	Input bias current	Ifb	–0.75	–0.25	–0.1	μA	Measured pin: FB
	Open loop gain	Av	—	63	—	dB	
	Upper clamp voltage	Vclamp_comp	3.85	4.10	4.30	V	FB = 0.3 V COMP: Open
	Low voltage	VI-comp	—	0.1	0.3	V	FB = 0.9 V COMP: Open
	Source current	Isrc-comp	–13	–9.5	–6	μA	FB = 0.3 V COMP: 2.5 V
	Sink current	Isnk-comp	6	9.5	13	μA	FB = 0.9 V COMP: 2.5 V
	Transconductance	gm	25	45	70	μs	FB = 0.55 V ↔ 0.65 V COMP: 2.5 V
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 voltage2	V-rt2	2.9	3.0	3.1	V	RT-Vref: 200 kΩ
Zero current detector	ZCD threshold voltage	Vzcd	7	13	19	mV	
	Input bias current	Ics	–85	–53	–25	μA	Vcs = 13 mV
Restart	Restart time delay	Tstart	45	75	140	μs	FB = 0.3 V, COMP = 2.5 V

Notes: \*1 Design spec

\*2 dVramp = Vclamp\_comp – Voff\_ramp

## Electrical Characteristics (cont.)

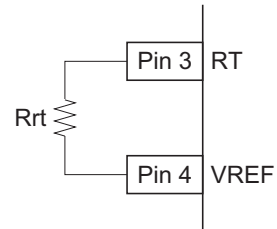
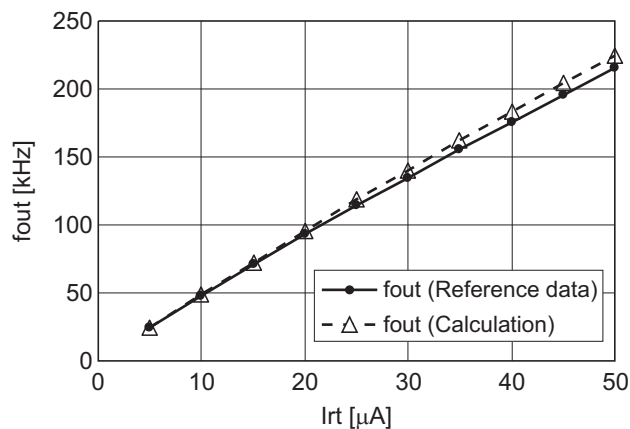
(Ta = 25°C, VCC = 15 V, CS = 0 V, FB = COMP, RRT = 200 kΩ)

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
OUT	Rise time	tr-out	—	30	100	ns	CL = 1000 pF, FB = 0.3 V, COMP = 2.5 V
	Fall time	tf-out	—	30	100	ns	CL = 1000 pF, FB = 0.3 V, COMP = 2.5 V
	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 *1
	OUT frequency	fout	43	48	53	kHz	RT-Vref: 200 kΩ *3
Maximum duty cycle	Dmax	47	52	57	%	RT-Vref: 200 kΩ	
Over current protection	OCP threshold voltage	Vocp	0.57	0.6	0.63	V	
	OCP blanking time	tblank	170	300	450	ns	

Notes: \*1 Design spec

\*3 The fout is adjusted by changing resistance of Rrt connected between RT-VREF terminals. Reference data and a calculating formula are shown as follows.

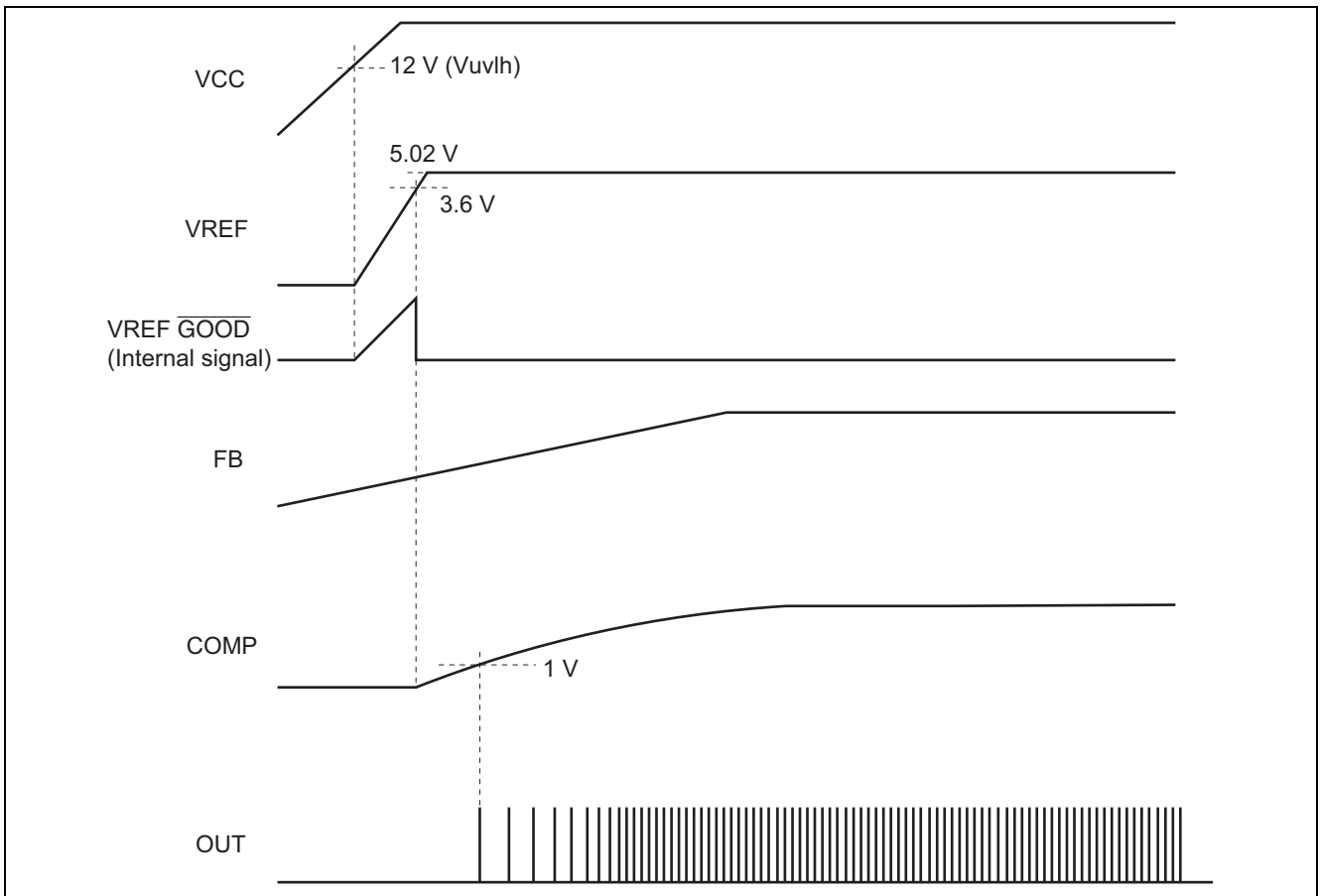
$$f_{out} [\text{kHz}] = \frac{1}{(100 \times 10^{-9} \times R_{rt}) + (450 \times 10^{-6})}$$



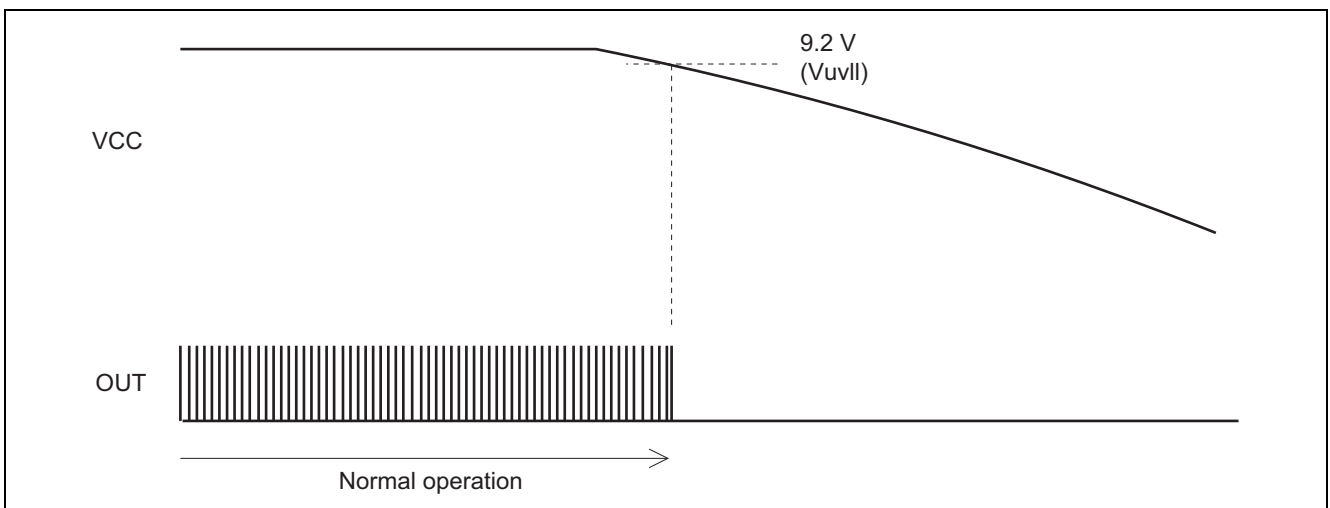
\* The graph is for reference only and does not guarantee actual characteristic.

## Waveforms

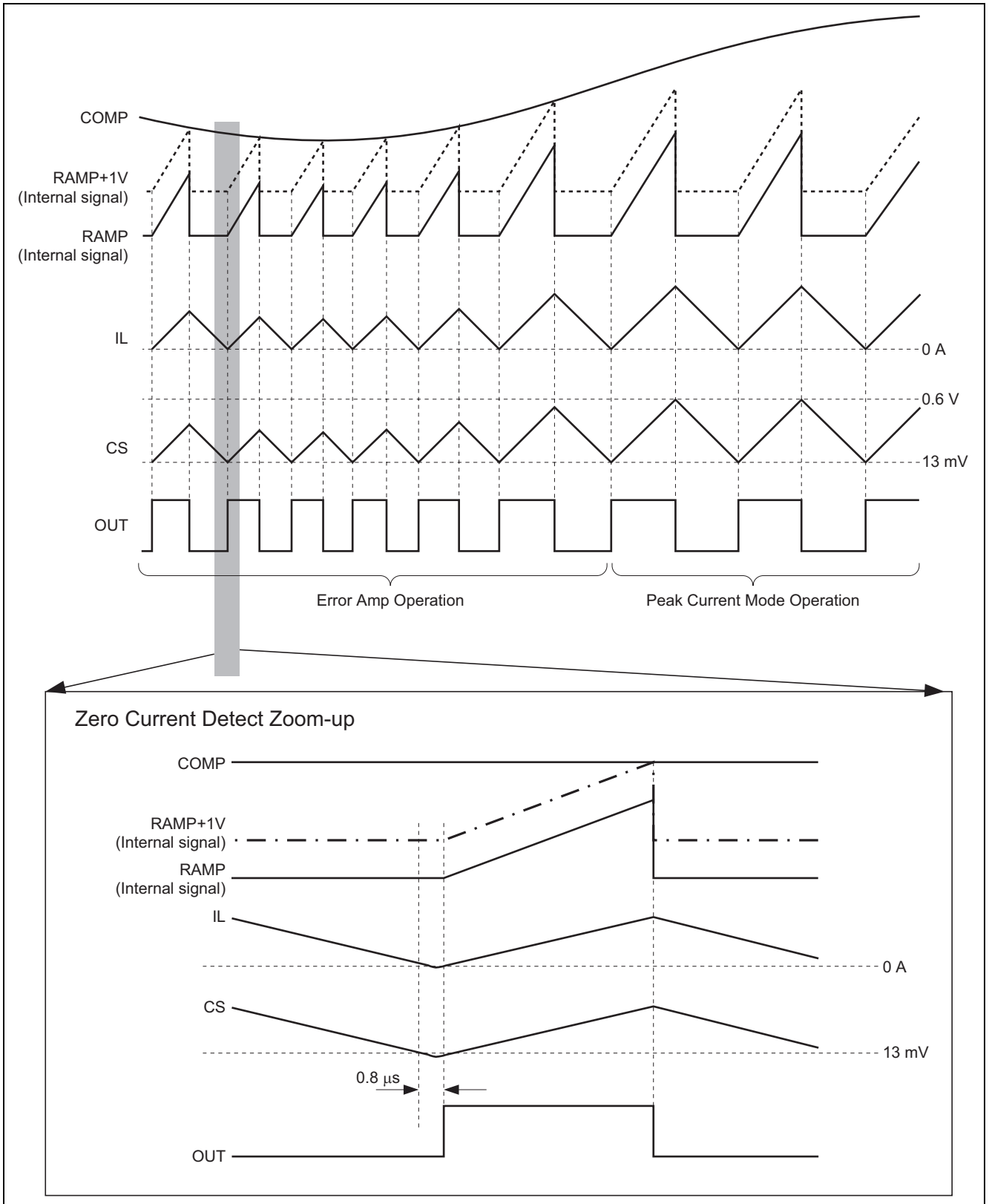
### 1. Start-up Timing (Zero Current Detection Mode/Fixed Frequency Mode common)



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

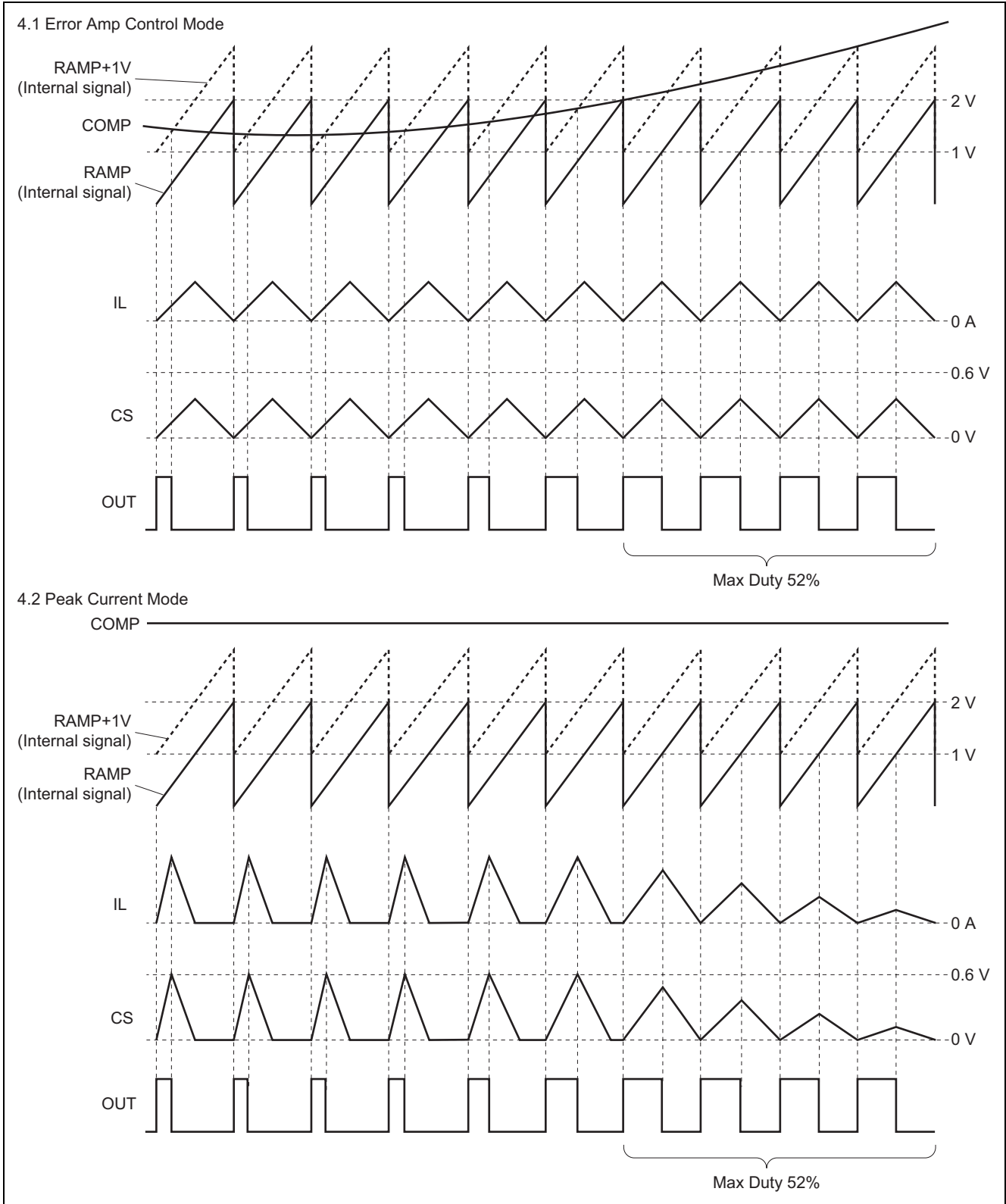


### 3. Gate Drive Output (Zero Current Detection Mode)



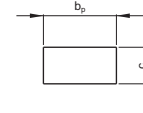
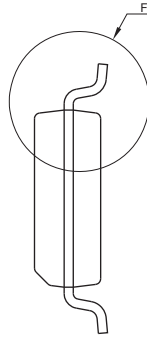
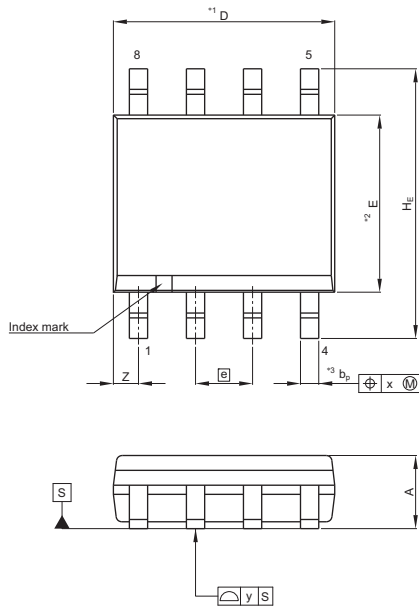


### 4. Gate Drive Output (Fixed Frequency Mode)

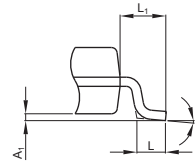


### Package Dimensions

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



Terminal cross section  
(Ni/Pd/Au plating)



Detail F

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

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	4.80	4.93	4.98
E	3.81	3.94	3.99
A <sub>2</sub>	—	1.47	—
A <sub>1</sub>	0.10	0.15	0.25
A	—	—	1.73
b <sub>p</sub>	0.35	0.41	0.49
b <sub>1</sub>	—	—	—
c	0.19	0.20	0.25
c <sub>1</sub>	—	—	—
$\theta$	0°	—	8°
H <sub>E</sub>	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 <sub>1</sub>	—	1.03	—

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