

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

Send any inquiries to <http://www.renesas.com/inquiry>.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
 - “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
 - “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

R2A20115SP

Power Factor Correction Controller IC

REJ03D0923-0100

Rev.1.00

Oct 06, 2009

Description

R2A20115 is a power-factor correction (PFC) controller IC, which employs continuous conduction mode as PFC control mode. Various kinds of functions such as constant power limit, overvoltage detection, overcurrent detection, soft start function, feedback-loop open detection, and the function holding its operation through momentary outage (PFC hold function) are incorporated in a single chip. These functions reduce external circuitry.

The constant power limit function significantly reduces "coil vibration", which is caused by the operation of a conventional overcurrent detection circuit when the system is overloaded.

The PFC hold function enables quick recovery by keeping PFC operation active for a certain duration (hold time) during momentary outage/power failure. The hold time can be adjusted by an external capacitor.

This IC provides the separated pin used for detecting overcurrent, so that, the preset current value range for overcurrent detection becomes wider than before.

The shutdown function with latch mode is also implemented.

A soft-start control pin is provided for the easy adjustment of soft-start operation.

And also the dynamic over voltage protection function integrated in this IC reduces overshooting of the output voltage, which might occur for the duration of startup, recovery after momentary power failure and just after a sudden variation of a load.

Features

- Maximum ratings
 - Power-supply voltage V_{cc} : 24 V
 - Operating junction temperature T_{jopr} : - 40 to 150°C
- Electrical characteristics
 - VREF output voltage V_{REF} : 5.0 V \pm 1.6%
 - UVLO operation start voltage V_H : 10.4 \pm 0.7 V
 - UVLO operation stop voltage V_L : 8.9 \pm 0.5 V
 - PFC output maximum ON duty $D_{max-out}$: 95% (typ.)
- Functions
 - Constant power limit function
 - Continuous conduction mode
 - Hold function of PFC operation on momentary outage (PFC hold function)
 - Overvoltage detection
 - Overcurrent detection
 - Soft start
 - Feedback loop disconnection detection
 - IC shutdown function
 - Dynamic OVP (Over Voltage Protection)
 - Package lineup: SOP-16

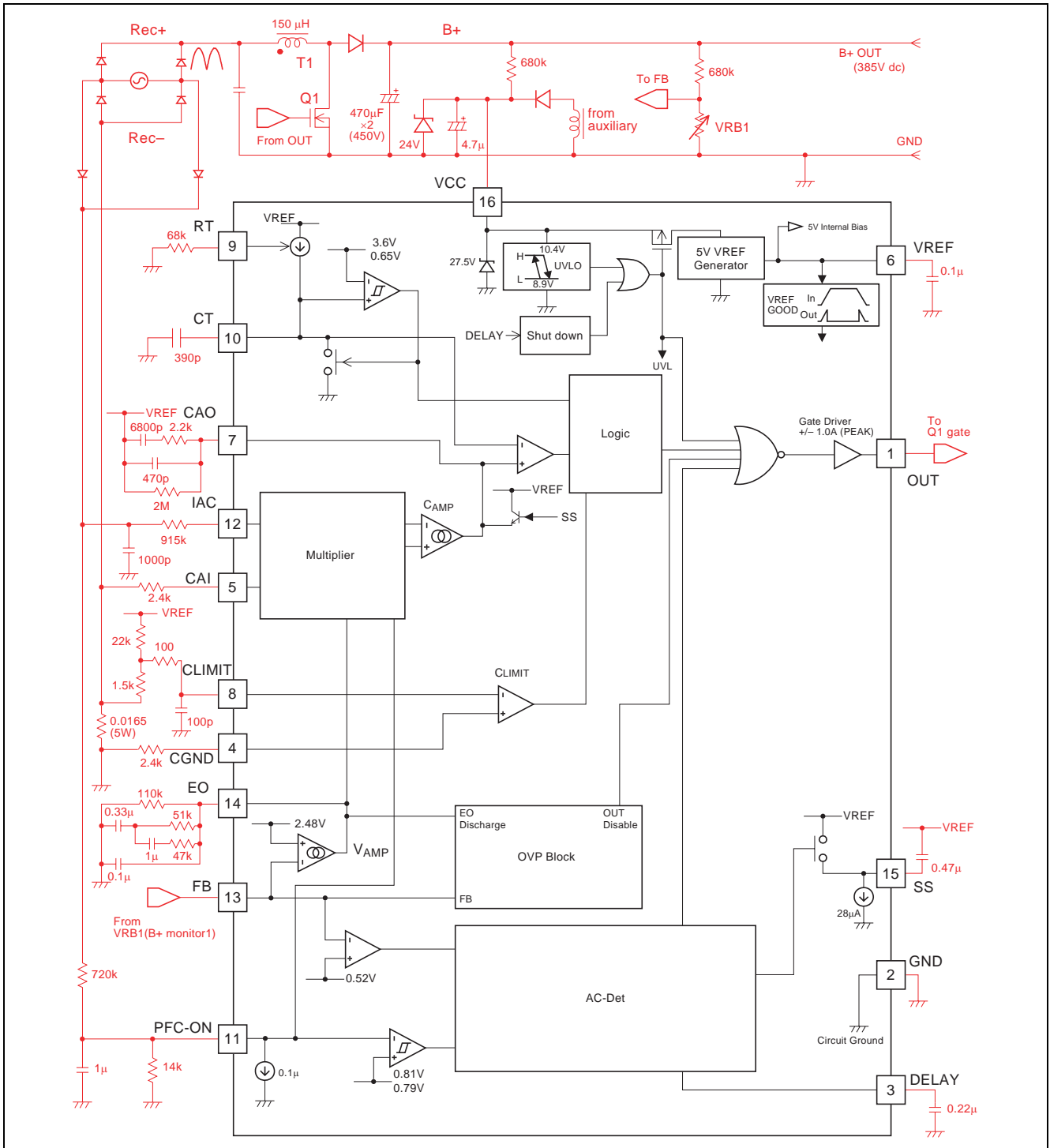
Applications

- Flat panel display
- Projector
- Desktop PC
- White goods

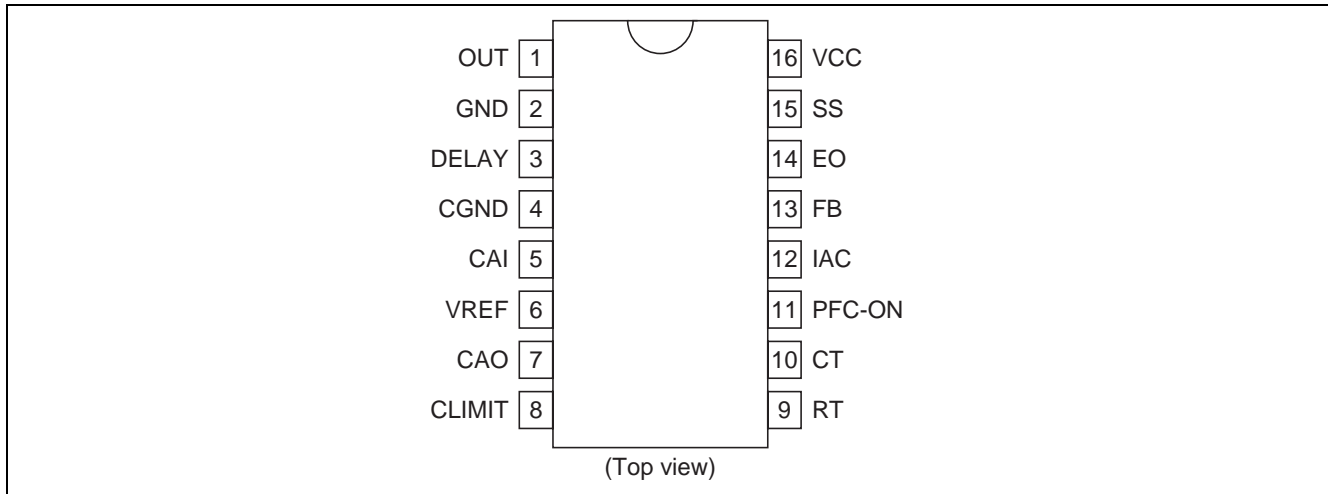
Ordering Information

Part No.	Package Name	Package Code	Taping Spec.
R2A20115SPW0	FP-16DAV	PRSP0016DH-B	2000 pcs./one taping product

System Diagram



Pin Arrangement



Pin Description

Pin No.	Pin Name	I/O	Function
1	OUT	Output	Power MOS FET gate driver output
2	GND	—	Ground
3	DELAY	Input/Output	Hold time adjust and IC shutdown
4	CGND	Input	Non-inverting input of current amplifier
5	CAI	Input/Output	Inverting input of current amplifier and Current output for PFC control
6	VREF	Output	Reference voltage output
7	CAO	Output	Current amplifier output
8	CLIMIT	Input	Overcurrent detection
9	RT	Input/Output	Timing resistor for settings of operational frequency, and the maximum CAI pin and DELAY pin current
10	CT	Output	Timing capacitor for operational frequency adjust
11	PFC-ON	Input	Detection of input AC voltage level
12	IAC	Input	Detection of input AC waveform
13	FB	Input	Voltage amplifier input
14	EO	Output	Voltage amplifier output
15	SS	Output	Timing capacitor for soft-start time adjust
16	VCC	Input	Power supply voltage input

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit	Note
Supply voltage	VCC	24	V	
OUT peak current	Ipk-out	±1.0	A	3
OUT DC current	I _{dc-out}	±0.1	A	
Terminal voltage	Vi-group1	-0.3 to V _{cc}	V	4
	Vi-group2	-0.3 to V _{ref}	V	5
CAO voltage	V _{cao}	-0.3 to V _{caoh}	V	
EO voltage	V _{eo}	-0.3 to V _{eah}	V	
DELAY voltage	V _{delay}	-0.3 to +6.5	V	
CAI voltage	Vi-cs	-1.5 to +0.3	V	
RT current	I _{rt}	-200	μA	
IAC current	I _{iac}	0.6	mA	
VREF current	I _{o-ref}	-5	mA	
Power dissipation	P _t	1	W	6
Operating junction temperature	T _{j-opr}	-40 to +150	°C	
Storage temperature	T _{stg}	-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. The transient current when driving capacitive load.
 4. This is the rated voltage for the following pin:
 OUT.
 5. This is the rated voltage for the following pins:
 CGND, VREF, CLIMIT, RT, CT, PFC-ON, IAC, FB, SS
 6. Thermal resistance of packages

Package	θ _{ja}	θ _{jc}	Note
SOP16	120°C/W	—	40 × 40 × 1.6 [mm], Mounted on a glass epoxy printed board with 10% wiring density
	—	35°C/W	Infinite heat sink

Electrical Characteristics

(Ta = 25°C, VCC = 12 V, RT = 27 kΩ, CT = 1000 pF)

	Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Supply	Start threshold	VH	9.7	10.4	11.1	V	
	Shutdown threshold	VL	8.4	8.9	9.4	V	
	UVLO hysteresis	dVUVL	1.0	1.5	2.0	V	
	Startup current	Is	75	100	145	μA	VCC = 9.5 V
	Is temperature stability	dIs/dTa	—	-0.3	—	%/°C	*1
	Operating current	Icc	2.4	3.4	4.4	mA	IAC = 0 A, CL = 0 F
VREF	Output voltage	Vref	4.92	5.00	5.08	V	Isource = 1 mA
	Line regulation	Vref-line	—	5	20	mV	Isource = 1 mA, VCC = 12 V to 23 V
	Load regulation	Vref-load	—	5	20	mV	Isource = 1 mA to 5 mA
	Temperature stability	dVref	—	±80	—	ppm/°C	Ta = -40 to 125°C *1
Oscillator	Initial accuracy	fout	55.0	61.0	67.0	kHz	Measured pin: OUT
	fout temperature stability	dfout/dTa	—	±0.1	—	%/°C	Ta = -40 to 125°C *1
	fout voltage stability	fout-line	-1.5	0.5	1.5	%	VCC = 12 V to 18 V
	CT peak voltage	Vct-H	—	3.6	4.0	V	*1
	Ramp valley voltage	Vct-L	—	0.65	—	V	*1
	RT voltage	Vrt	1.18	1.22	1.26	V	
Soft start	Sink current	Iss	17.0	28.0	39.0	μA	SS = 2 V
Current limit	Threshold voltage	VCL	-15	0	15	mV	
	Delay to output	td-CL	—	200	300	ns	CLIMIT = 1 to -0.3 V
VAMP	Feedback voltage	Vfb	2.44	2.48	2.52	V	FB-EO Short
	Input bias current	Ifb	-0.3	-0.15	0	μA	Measured pin: FB
	Open loop gain	Av-v	—	53	—	dB	*1
	High voltage	Veoh	4.75	4.9	5.05	V	FB = 2.3 V, EO: Open
	Low voltage	Veol	—	0.1	0.3	V	FB = 2.7 V, EO: Open
	Source current	Isrc-eo	-180	-120	-80	μA	FB = 1.0 V, EO = 2.5 V *1
	Sink current	Isrc-eo	—	350	—	μA	FB = 4.0 V, EO = 2.5 V *1
	Transconductance	Gm-v	120	180	240	μA/V	FB = 2.5 V, EO = 2.5 V
CAMP	Input offset voltage	Vio-ca	-10	—	0	mV	*1
	Open loop gain	Av-ca	—	55	—	dB	*1
	High voltage	Vcaoh	4	4.5	5	V	
	Low voltage	Vcaol	—	0.1	0.3	V	
	Source current	Isrc-ca	-150	-105	-67	μA	CAO = 2.5 V
	Sink current	Isrc-ca	67	105	150	μA	CAO = 2.5 V
	Transconductance	Gm-c	420	660	890	μA/V	*1

Note: 1. Design spec.

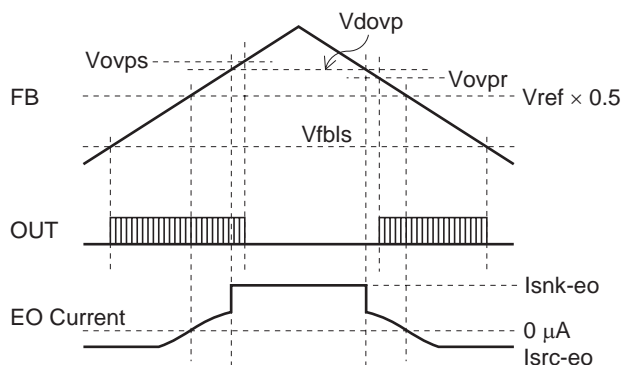
Electrical Characteristics (cont.)

(Ta = 25°C, VCC = 12 V, RT = 27 kΩ, CT = 1000 pF)

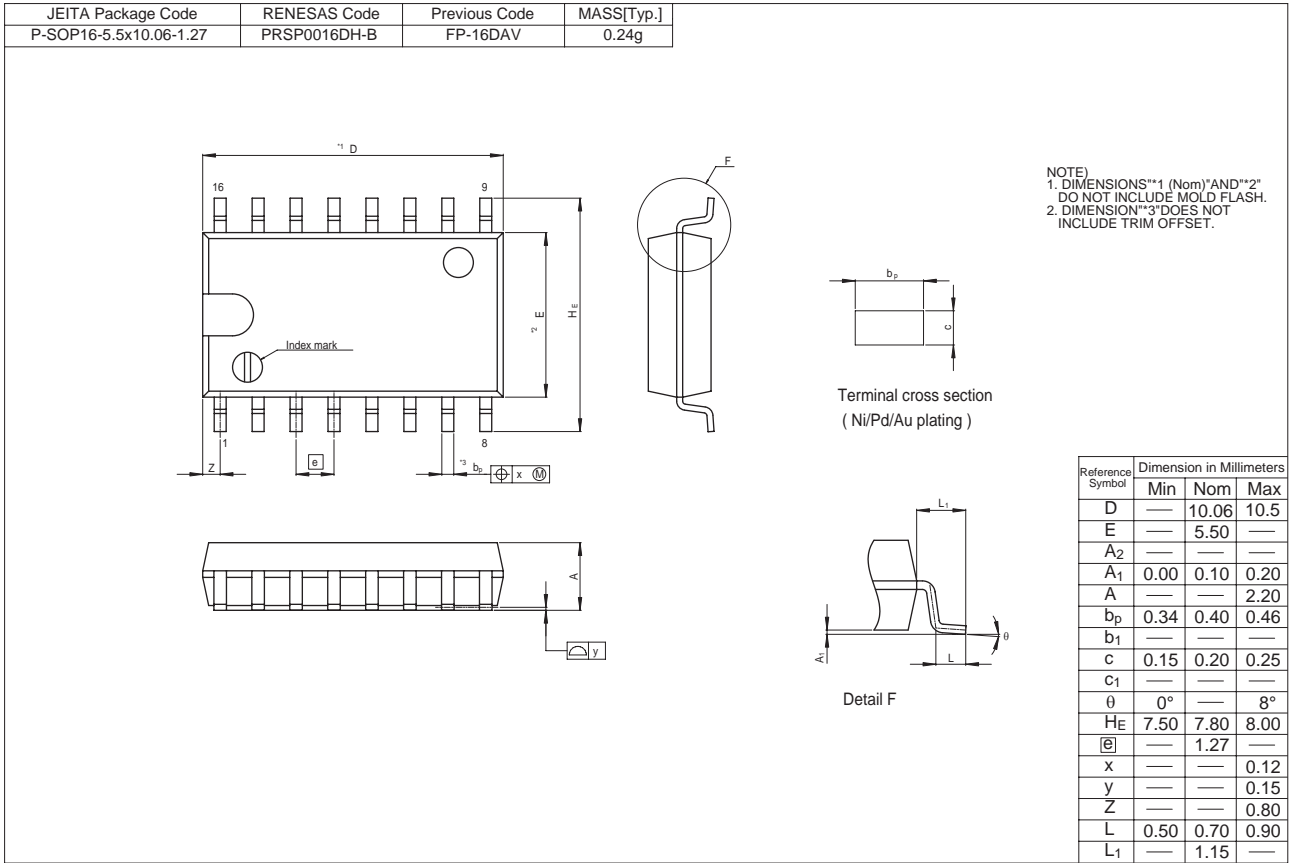
	Item	Symbol	Min	Typ	Max	Unit	Test Conditions
IAC/ Multiplier	IAC pin voltage	Viac	0.4	1.4	2.0	V	IAC = 100 μA
	Imo current 1	Imo1	-57	-47	-37	μA	EO = 2.5 V, IAC = 150 μA PFC-ON = 1.2 V
	Imo current 2	Imo2	-158	-125	-91.5	μA	EO = Vcaoh, IAC = 150 μA PFC-ON = 1.2 V
	Imo current 3	Imo3	-35.5	-30	-24.5	μA	EO = 2.5 V, IAC = 375 μA PFC-ON = 2.5 V
	Imo current 4	Imo4	-98.5	-80	-61.5	μA	EO = Vcaoh, IAC = 375 μA PFC-ON = 2.5 V
OUT	Minimum duty cycle	Dmin-out	—	—	0	%	CAO = 4.0 V
	Maximum duty cycle	Dmax-out	90	95	98	%	CAO = 0 V
	Rise time	tr-out	—	30	100	ns	CL = 1000 pF
	Fall time	tf-out	—	30	100	ns	CL = 1000 pF
	Low voltage	Vol1-out	—	0.08	0.2	V	Iout = 20 mA
		Vol2-out	—	0.5	2.0	V	Iout = 200 mA (Pulse test)
		Vol3-out	—	0.07	0.7	V	Iout = 10 mA, VCC = 5 V
High voltage	Voh1-out	11.5	11.9	—	V	Iout = -20 mA	
	Voh2-out	10.0	11.0	—	V	Iout = -200 mA (Pulse test)	
Shut down	Shut down voltage	Vshut	3.30	4.00	4.70	V	Input: DELAY
	Reset voltage	Vres	—	—	4.0	V	Input: Vcc
	Shut down current	Ishut	45	95	190	μA	VCC = 9 V
Supervisor	PFC enable voltage	Von-pfc	0.73	0.81	0.89	V	Input pin: PFC-ON
	PFC disable voltage	Voff-pfc	0.71	0.79	0.86	V	Input pin: PFC-ON
	PFC disable delay threshold voltage	Vd-pfc	1.10	1.20	1.30	V	Input pin: DELAY
	Input current	Ipfc-on	-1.0	-0.2	1	μA	PFC-ON = 2 V
	B+ OVP set voltage	dVovps	0.125	0.188	0.250	V	Input pin: FB *2
	B+ OVP reset voltage	dVovpr	0.010	0.050	0.100	V	Input pin: FB *2
	Dynamic OVP set/reset voltage	dVdovp	0.045	0.065	0.085	V	Input pin: FB *2
	FB low set voltage	Vfbls	0.47	0.52	0.57	V	Input pin: FB
	DELAY source current	Isrc-delay	-50.5	-45.5	-40.5	μA	DELAY = 1 V RT = 27 kΩ
	DELAY sink current	Istk-delay	—	815	—	μA	DELAY = 1 V RT = 27 kΩ *1

Notes: 1. Design spec.

2. $dVovps = Vovps - Vref \times 0.5$
 $dVovpr = Vovpr - Vref \times 0.5$
 $dVdovp = Vdovp - Vref \times 0.5$



Package Dimensions



Notes:

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guarantees regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
 - (1) artificial life support devices or systems
 - (2) surgical implantations
 - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
 - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



RENESAS SALES OFFICES

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2377-3473

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510