To our customers,

Old Company Name in Catalogs and Other Documents

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

April 1st, 2010
Renesas Electronics Corporation

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R2A20111SP

Power Factor Correction Controller IC

REJ03F0231-0200
Rev.2.00
Sep 29, 2009

Description

The R2A20111 is a power-factor correction (PFC) controller IC.
This IC adopts continuous conduction mode as PFC operation.
Various functions such as constant power limit, overvoltage detection, overcurrent detection, soft start, feedback-loop disconnection detection, and holding function of PFC operation through momentary outage (PFC hold function) are incorporated in a single chip. These functions reduce external circuitry.
The constant power limit function allows to eliminate a significant amount of coil noise which is generated due to overcurrent detection operation in case of conventional overload.
The PFC hold function enables quick recovery by continuing PFC operation after momentary outage. The hold time can be adjusted by an external capacitance.
Overcurrent detection pin is separately provided.
Latch mode shutdown function is incorporated.
A soft-start control pin provides for the easy adjustment of soft-start operation, and can be used to prevent overshooting of the output voltage.

Features

- Maximum ratings
  - Power-supply voltage Vcc: 24 V
  - Operating junction temperature Tjopr: – 40 to 125°C
- Electrical characteristics
  - VREF output voltage VREF: 5.0 V ± 3%
  - UVLO operation start voltage VH: 10.5 ± 0.9 V
  - UVLO operation stop voltage VL: 9.0 ± 0.7 V
  - PFC output maximum ON duty Dmax-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
  - Package lineup: SOP-16

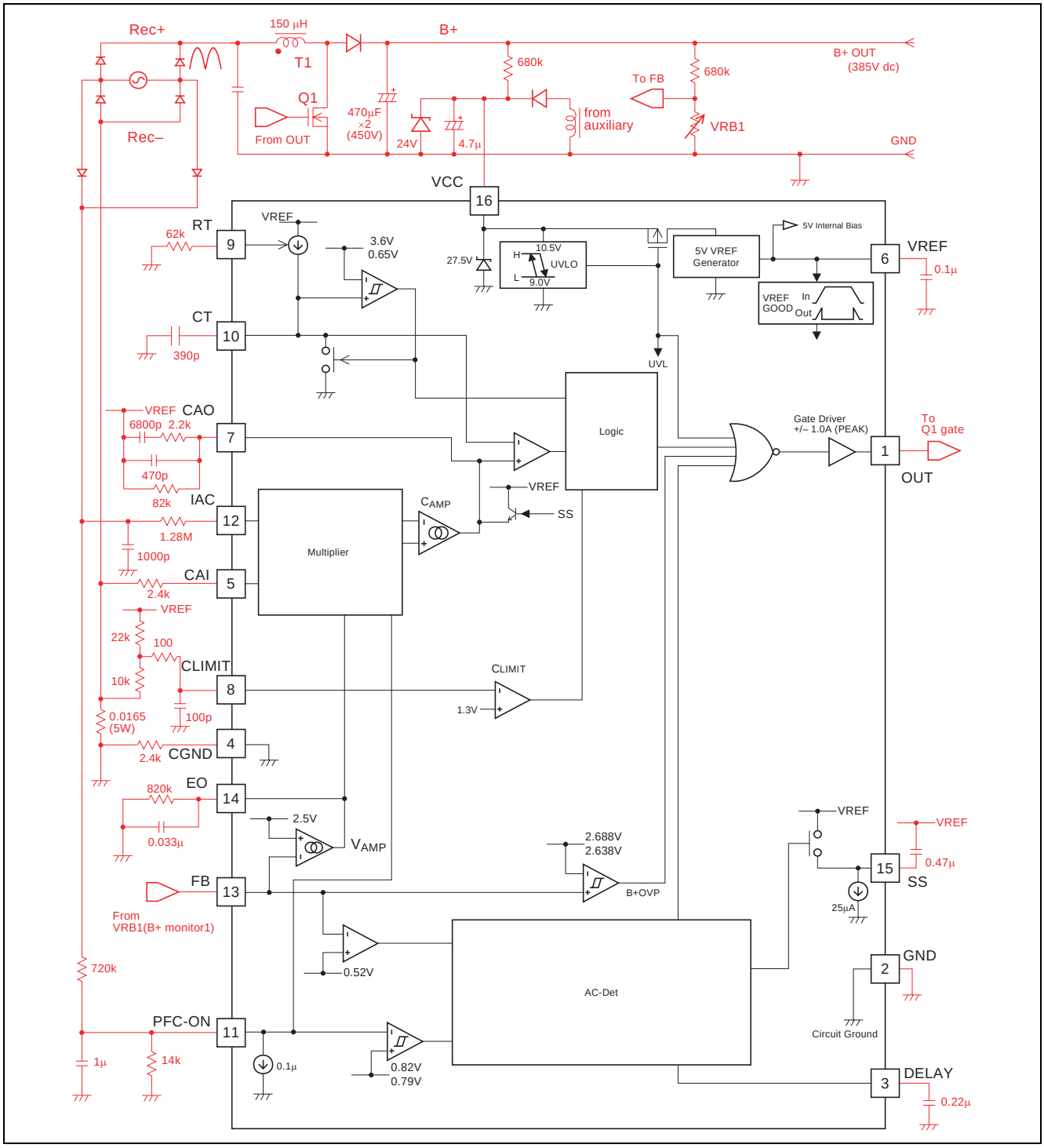
Applications

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

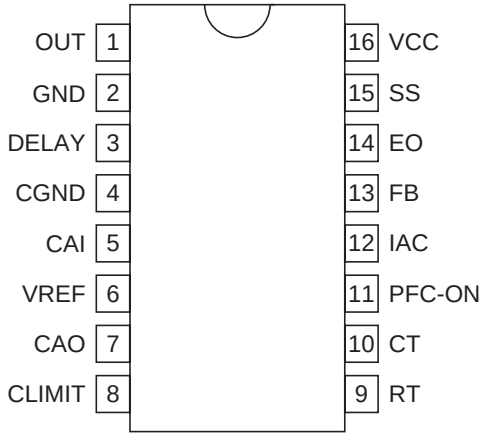
Ordering Information

Part No.	Package Name	Package Code	Taping Spec.
R2A20111SPW0	FP-16DAV	PRSP0016DH-B	2000 pcs./one taping product

System Diagram



Pin Arrangement



(Top view)

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	Idc-out	±0.1	A	
Terminal voltage	Vi-group1	–0.3 to Vcc	V	4
	Vi-group2	–0.3 to Vref	V	5
CAO voltage	Vcao	–0.3 to Vcaoh	V	
EO voltage	Veo	–0.3 to Veoh	V	
DELAY voltage	Vdelay	–0.3 to +6.5	V	
CAI voltage	Vi-cs	–1.5 to +0.3	V	
RT current	Irt	–200	μA	
IAC current	Iiac	0.6	mA	
VREF current	Io-ref	–5	mA	
Power dissipation	Pt	1	W	6
Operating junction temperature	Tj-opr	–40 to +125	°C	
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. 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	θja	θjc	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	9.6	10.5	11.4	V	
	Shutdown threshold	VL	8.3	9.0	9.7	V	
	UVLO hysteresis	dVUVL	1.0	1.5	2.0	V	
	Startup current	Is	140	200	260	μA	VCC = 9.5 V
	Is temperature stability	dIs/dTa	—	–0.3	—	%/°C	*1
	Operating current	Icc	3.45	4.5	6.45	mA	IAC = 0 A, CL = 0 F
VREF	Output voltage	Vref	4.85	5.00	5.15	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	58.5	65	71.5	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	1.17	1.25	1.33	V	
Soft start	Sink current	Iss	15.0	25.0	35.0	μA	SS = 2 V
Current limit	Threshold voltage	VCL	1.222	1.3	1.378	V	
	Delay to output	td-CL	—	100	200	ns	CLIMIT = 2 to 0 V
V_{AMP}	Feedback voltage	Vfb	2.40	2.50	2.60	V	FB-EO Short
	Input bias current	Ifb	–0.3	0	0.3	μA	Measured pin: FB
	Open loop gain	Av-v	—	53	—	dB	*1
	High voltage	Veoh	5.2	5.7	6.2	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	–90	μA	FB = 1.0 V, EO = 2.5 V
	Sink current	Isnk-eo	90	120	180	μA	FB = 4.0 V, EO = 2.5 V
	Transconductance	Gm-v	150	200	290	μA/V	FB = 2.5 V, EO = 2.5 V
C_{AMP}	Input offset voltage	Vio-ca	—	(–10)	0	mV	*1
	Open loop gain	Av-ca	—	68	—	dB	*1
	High voltage	Vcaoh	5.2	5.7	6.2	V	
	Low voltage	Vcaol	—	0.1	0.3	V	
	Source current	Isrc-ca	–135	–90	–67	μA	CAO = 2.5 V
	Sink current	Isnk-ca	67	90	135	μA	CAO = 2.5 V
	Transconductance	Gm-c	530	700	1000	μA/V	*1

Note: 1. Design spec.

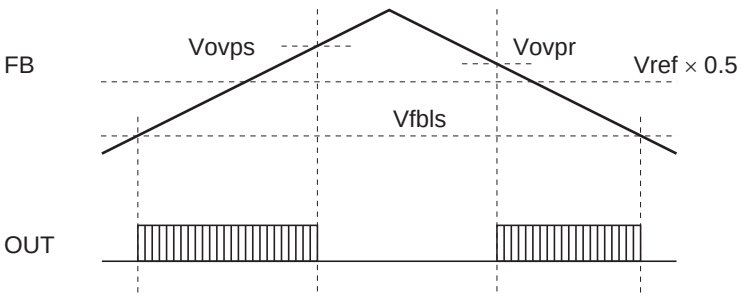
Electrical Characteristics (cont.)

(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	1.6	2.3	3.0	V	IAC = 100 μA
	Imo current 1	Imo1	–61.3	–51.5	–41	μA	EO = 2.5 V, IAC = 150 μA PFC-ON = 1.2 V
	Imo current 2	Imo2	–197.9	–165	–131.5	μA	EO = Vcaoh, IAC = 150 μA PFC-ON = 1.2 V
	Imo current 3	Imo3	–32.8	–27	–21.2	μA	EO = 2.5 V, IAC = 375 μA PFC-ON = 2.5 V
	Imo current 4	Imo4	–110.4	–92	–73.6	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	—	0.05	0.2	V	Iout = 20 mA
		Vol2-out	—	0.5	2.0	V	Iout = 200 mA (Pulse test)
		Vol3-out	—	0.03	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	120	190	260	μA	VCC = 9 V
Supervisor	PFC enable voltage	Von-pfc	0.74	0.82	0.9	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	1.05	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	0.075	0.138	0.200	V	Input pin: FB *2
	FB low set voltage	Vfbls	0.425	0.52	0.615	V	Input pin: FB
	DELAY source current	Isrc-delay	–47.5	–42.5	–38	μA	DELAY = 1 V RT = 27 kΩ
	DELAY sink current	Isnk-delay	—	770	—	μA	DELAY = 1 V RT = 27 kΩ *1

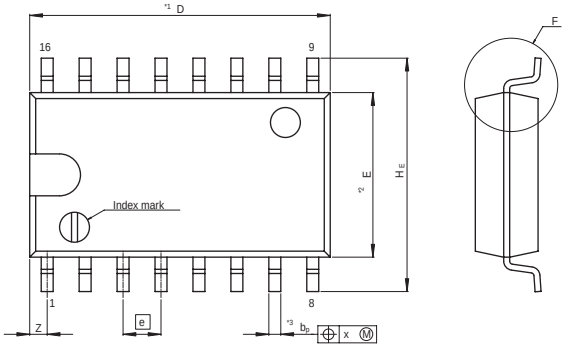
Notes: 1. Design spec.

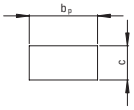
2. dVovps = Vovps – Vref × 0.5
   dVovpr = Vovpr – Vref × 0.5



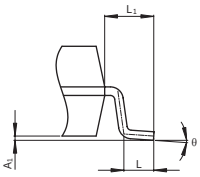
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.5x10.06-1.27	PRSP0016DH-B	FP-16DAV	0.24g





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	—	10.06	10.5
E	—	5.50	—
A_2	—	—	—
A_1	0.00	0.10	0.20
A	—	—	2.20
b_p	0.34	0.40	0.46
b_1	—	—	—
c	0.15	0.20	0.25
c_1	—	—	—
θ	0°	—	8°
H_E	7.50	7.80	8.00
e	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.80
L	0.50	0.70	0.90
L_1	—	1.15	—

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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.
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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

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