R2A20131SP

Continuous Conduction Mode PFC Control IC

R03DS0032EJ0301
Rev.3.01
Jan 08, 2016

Description

The R2A20131 is power factor correction control IC of continuous conduction mode.

The R2A20131 is built in Load Tracing Boost, Brownout, Over Voltage Protection, Over Current Protection, FeedBack loop Open detection and Power Good Function.

Load tracing boost function bring improvement of efficiency at light load with few external parts.

The feedback loop open detection, and over current protection are built in the R2A20131, and can constitute a power supply system of high reliability with few external parts.

Power Good Function monitors PFC output voltage and can adjust no-good level.

Features

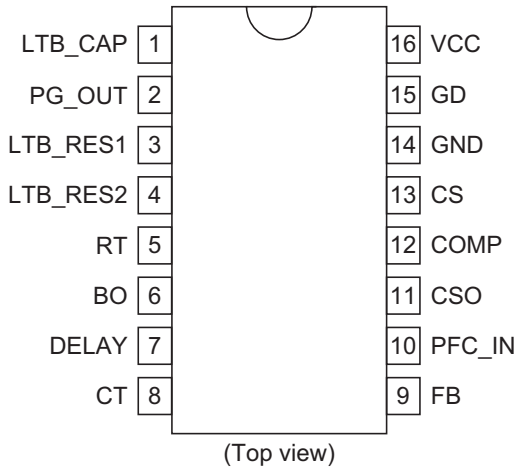
- Absolute Maximum Ratings
  - Supply voltage Vcc: 24 V
  - Junction temperature Tj: –40 to +150°C
- Electrical Characteristics
  - Error amplifier reference voltage Vfb: 2.51 V ± 1.5%
  - UVLO operation start voltage Vuvlh: 10.5 V ± 0.7 V
  - UVLO operation shutdown voltage Vuvll: 9.3 V ± 0.5 V
  - UVLO hysteresis voltage Hysuvl: 1.2 V ± 0.5 V
- Functions
  - Boost converter control with continuous conduction mode
  - Load Tracing Boost (LTB) function: Vout is decreased at light load and AC 100 V system.
  - Brownout function
  - Over Voltage Protection
  - Feedback loop Open detection
  - Over Current Protection
  - Power good information (Open drain output)
  - Package: Pb-free SOP-16
    This Device uses Halogen-Free Molding Compound

Ordering Information

Part No.	Package Name	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
R2A20131SP#W0	—	PRSP0016DH-B	SP	W (2,000 pcs/reel)

Downloaded from Arrow.com.

Pin Arrangement

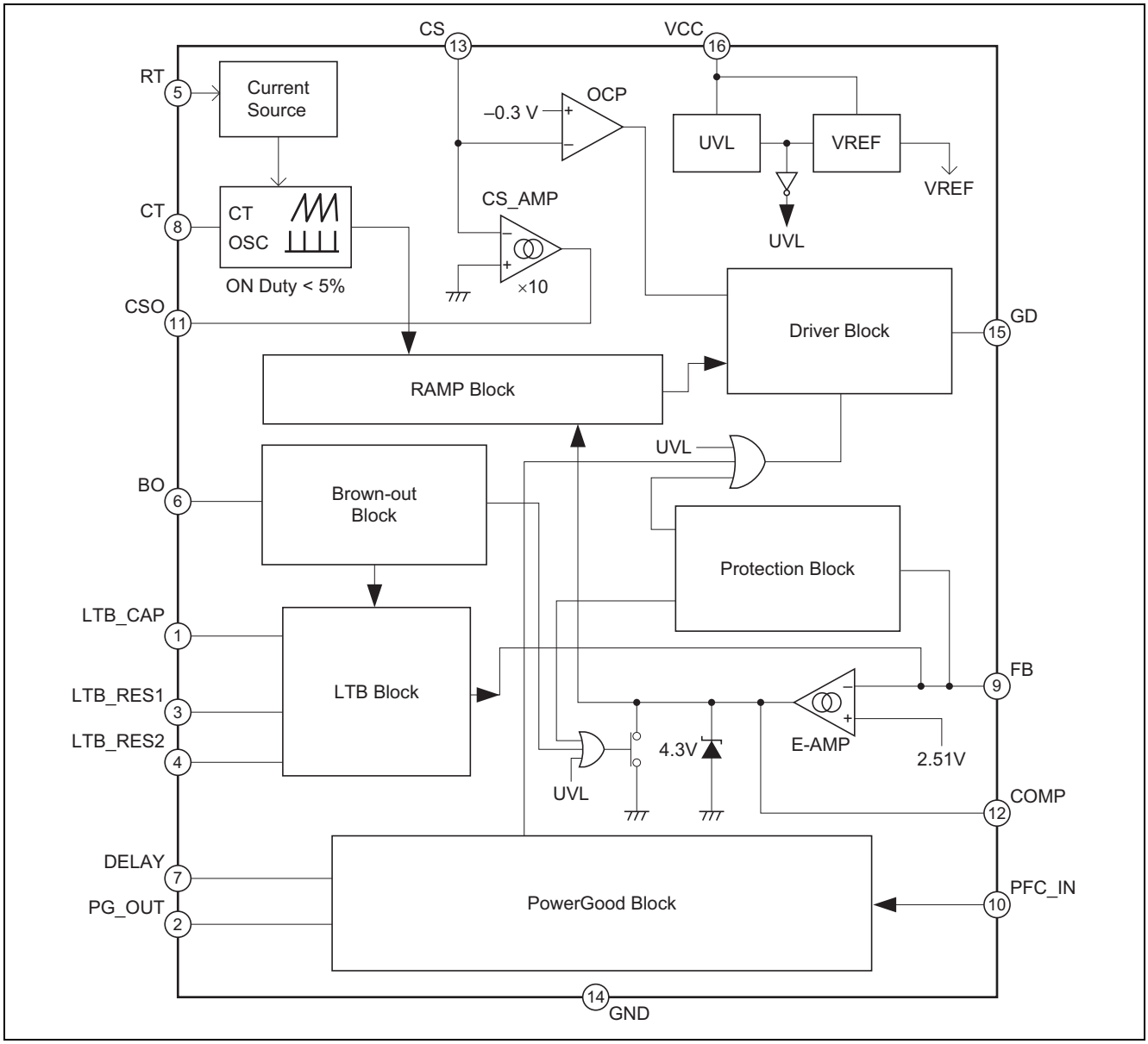


Pin Functions

Pin No.	Pin Name	Input/Output	Function
1	LTB_CAP	Input	Load tracing boost stability capacitor connection terminal
2	PG_OUT	Output	Power Good Output terminal for house keeping
3	LTB_RES1	Output	Load tracing boost adjust resistor connection terminal1
4	LTB_RES2	Output	Load tracing boost adjust resistor connection terminal2
5	RT	Input/Output	Oscillator frequency setting and internal bias current setting terminal
6	BO	Input	Brownout input terminal
7	DELAY	Input/Output	PG_OUT ON Delay adjustable terminal
8	CT	Output	Oscillator frequency setting terminal
9	FB	Input	Error amplifier input terminal
10	PFC_IN	Input	Power Good detection terminal
11	CSO	Output	Current amplifier output terminal
12	COMP	Output	Error amplifier output terminal
13	CS	Input	Current detection terminal
14	GND	—	Ground
15	GD	Output	Power MOSFET drive terminal
16	VCC	Input	Supply voltage terminal

Downloaded from Arrow.com.

Block Diagram



Downloaded from Arrow.com.

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit	Note
Supply voltage	VCC	–0.3 to +24	V	
GD sink current	Isnk-gd	1.2	A	3
GD source current	Isrc-gd	–0.8	A	3
GD DC sink current	Idc-snk-gd	0.12	A	
GD DC source current	Idc-src-gd	–80	mA	
CS terminal voltage	Vt-cs	–5 to +0.3	V	
BO terminal current	Ibom	300	µA	
RT terminal current	Irt	–200	µA	
COMP terminal current	Icomp	±1	mA	
LTB_RES terminal current	Iltb_res	–100	µA	
PG_OUT terminal current	Ipg_out	25	mA	
Terminal voltage	Vt-group	–0.3 to +5.5	V	4
Terminal voltage2	Vt-group2	–0.3 to VCC	V	5
Terminal voltage3	Vt-group3	–0.3 to +24	V	6
Power dissipation	Pt	1	W	7
Operating ambient temperature	Ta-opr	–40 to +125	°C	
Junction temperature	Tj	–40 to +150	°C	8
Storage temperature	Tstg	–55 to +150	°C	

Notes:
1. Rated voltages are with reference to the GND terminal.
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. This is the rated voltage for the following pins:
   FB, COMP, BO, RT, CT, LTB_CAP, LTB_RES1, LTB_RES2, CSO, PFC_IN, DELAY
5. This is the rated voltage for the following pin:
   GD
6. This is the rated voltage for the following pin:
   PG_OUT
7. In case of R2A20131SP (SOP): θja = 120°C/W
   This value is a thing mounting on 40 × 40 × 1.6 [mm], a glass epoxy board of wiring density 10%.
8. 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.

Downloaded from Arrow.com.

Electrical Characteristics

(Ta = 25°C, VCC = 12 V, RT = 33 kΩ, PFC_IN = GND, CT = 470 pF, CS = GND, FB = COMP, BO = 4 V, LTB_RES1 = 33 kΩ, LTB_RES2 = 33 kΩ)

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Supply	UVLO turn-on threshold	Vuvlh	9.8	10.5	11.2	V	
	UVLO turn-off threshold	Vuvll	8.8	9.3	9.8	V	
	UVLO hysteresis	Hysuvl	0.7	1.2	1.7	V	
	Standby current	Istby	—	100	180	µA	VCC = 8.9 V
	Operating current	Icc	—	2.5	4	mA	
Brownout	BO threshold voltage	Vbo	1.35	1.40	1.45	V	
	BO pin hysteresis current	Ibo	(3.3) ×0.92	(3.3)	(3.3) ×1.08	µA	BO = 1 V, RT = 33 kΩ
	BO pin current	Ibo2	0.05	0.15	0.4	µA	BO = 2 V
Error amplifier	Feedback voltage	Vfb	2.472	2.51	2.548	V	FB-COMP short
	Input bias current	Ifb	–0.4	–0.15	–0.05	µA	Measured pin: FB FB = 3 V
	Open loop gain	Av	—	50	—	dB	*1
	Upper clamp voltage	Vclamp_comp	4.0	4.3	—	V	FB = 2.0 V COMP: Open
	Low voltage	Vl-comp	—	0.1	0.3	V	FB = 3.0 V COMP: Open
	Transconductance	gm	100	180	270	µs	FB = 2.5 V COMP: 2.5 V
Oscillator	Initial accuracy	fGD	58.5	65	71.5	kHz	Measured pin: GD
	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
	RT voltage	Vrt	1.595	1.65	1.705	V	
Over current protection	OCP threshold voltage	Vocp	–0.315	–0.3	–0.285	V	
	CS bias current	Ics	–130	–100	–60	µA	Measured pin: CS
Current AMP	CSO output voltage	V-cso	0.8	1	1.2	V	CS = –0.1 V
Load tracing boost	Source current	Iltb	(–21.2) ×1.05	(–21.2)	(–21.2) ×0.95	µA	BO = 2V, LTB_CAP = 0 V FB = 2.5 V, PFC_IN = 3 V Measure pin: FB
	High threshold voltage	Vltb-hi	3.2	3.6	4.0	V	Measured pin: BO
	Low threshold voltage	Vltb-lo	2.9	3.2	3.5	V	
POWER GOOD function	PFC_IN threshold voltage 1	Vpfc_in1	2.42	2.5	2.58	V	
	PFC_IN hysteresis current	Ipfc_in1	(–10) ×1.08	(–10)	(–10) ×0.92	µA	PFC_IN = 3 V, RT = 33 kΩ
	PFC_IN current	Ipfc_in2	–0.4	–0.15	–0.05	µA	PFC_IN = 2 V
	PG OUT leak current	Ipgh	—	—	5	µA	PFC_IN = GND VPG_OUT = 5 V
	PG OUT low voltage	Vpgl	—	—	0.4	V	PFC_IN = 3 V PG OUT sink current = 20 mA

Note: *1 Design spec

Downloaded from Arrow.com.

Electrical Characteristics (cont.)

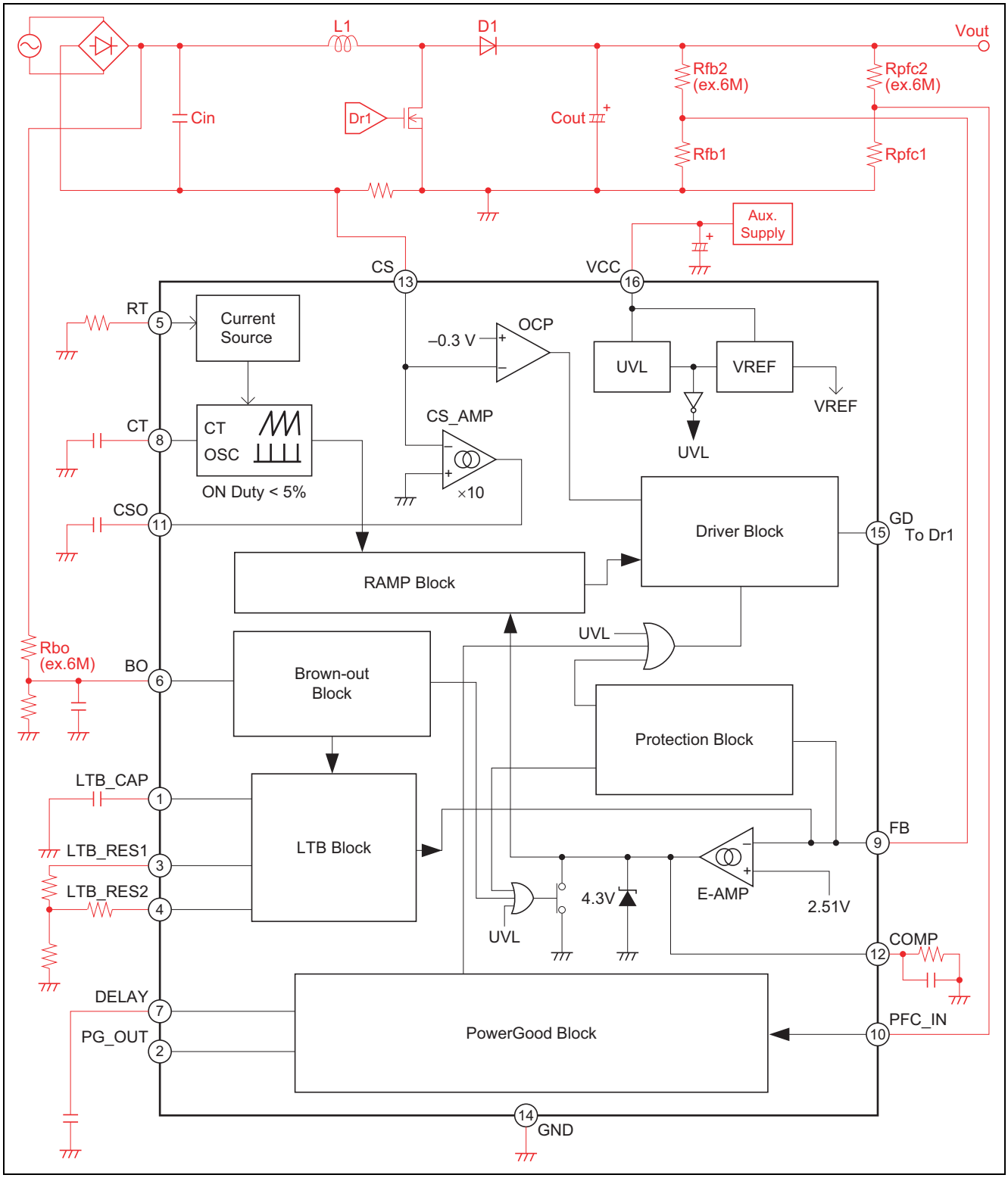
(Ta = 25°C, VCC = 12 V, RT = 33 kΩ, PFC_IN = GND, CT = 470 pF, CS = GND, FB = COMP, BO = 4 V, LTB_RES1 = 33 kΩ, LTB_RES2 = 33 kΩ)

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Gate drive	Gate drive rise time	tr-gd	—	30	100	ns	GD: 1.2 V to 10.8 V CL = 1000 pF
	Gate drive fall time	tf-gd	—	30	100	ns	GD: 10.8 V to 1.2 V CL = 1000 pF
	Gate drive low voltage	Vol1-gd	—	0.02	0.1	V	Isink = 2 mA
		Vol2-gd	—	0.01	0.2	V	Isink = 1 mA, VCC = 5 V
	Gate drive high voltage	Voh-gd	11.5	11.9	—	V	Isource = –2 mA
	Maximum duty	Dmax	90	95	98	%	COMP: Open, FB = 2 V CSO = GND
	Minimum duty	Dmin	—	—	0	%	FB = 2.5 V COMP: GND
Over voltage protection	OVP threshold voltage	Vovp	VFB× 1.065	VFB× 1.080	VFB× 1.095	V	COMP = 2.5 V
	OVP hysteresis	Hys-ovp	50	100	150	mV	COMP = 2.5 V
	FB low detect threshold voltage	Vfblow	0.25	0.3	0.35	V	COMP = 2.5 V
PG on delay	DELAY threshold voltage	Vdelay	2.85	3	3.15	V	PFC-IN = 3 V
	DELAY charge current	Ichrg-delay	–7	–5	–3	μA	DELAY = 2.5 V, PFC-IN = 3 V

Note: *1 Design spec

Downloaded from Arrow.com.

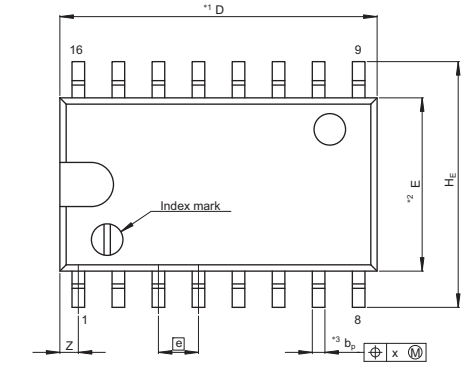
System Diagram

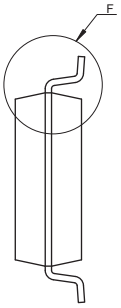


Downloaded from Arrow.com.

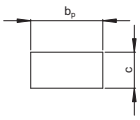
Package Dimensions

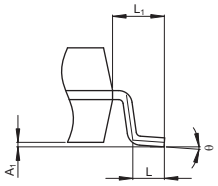
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.5x10.06-1.27	PRSP0016DH-B	FP-16DAV	0.24g





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	—

Downloaded from Arrow.com.

Notice

1. 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.
2. 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.
3. 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.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
   "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 etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). 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 for which it is not intended. 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 which the product is not intended by Renesas Electronics.
6. 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.
7. 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 systems manufactured by you.
8. 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.
9. 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. You should not use Renesas Electronics products or 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. When exporting the Renesas Electronics 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.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
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.

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

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

Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL II Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

© 2016 Renesas Electronics Corporation. All rights reserved.

Colophon 5.0

Downloaded from Arrow.com.