

RTKA211605DR0000BU

The RTKA211605DR0000BU board is designed to demonstrate and quickly evaluate the [RAA211605](#), a DC/DC step-down regulator with 450kHz switching frequency.

The RAA211605 supports a wide input voltage range (from 4.5V to 60V) and adjustable output voltage. It can deliver up to 0.5A continuous output current with premium load regulation and line regulation performance.

**Features**

- Simple and flexible design
- 4.5V to 60V  $V_{IN}$  range
- Convenient power conversion

**Specifications**

The following are the design specifications for the RTKA211605DR0000BU:

- Input voltage ( $V_{IN}$ ): 4.5V to 60V
- Output voltage ( $V_{OUT}$ ): 3.3V
- Max. output current: 0.5A

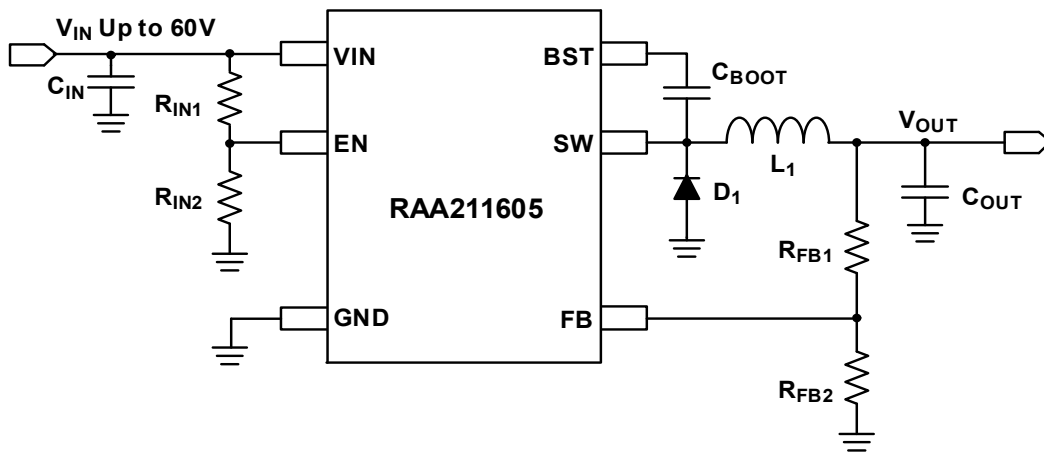


Figure 1. Block Diagram

## Contents

<b>1. Functional Description</b> .....	<b>3</b>
1.1 Operating Range .....	3
1.2 Quick Test Setup .....	3
<b>2. Board Design</b> .....	<b>4</b>
2.1 Circuit Schematic .....	5
2.2 Bill of Materials .....	6
2.3 Board Layout .....	6
<b>3. Typical Performance Curves</b> .....	<b>8</b>
<b>4. Ordering Information</b> .....	<b>9</b>
<b>5. Revision History</b> .....	<b>9</b>

# 1. Functional Description

The RAA211605 is an easy-to-use Buck switching regulator with an integrated 600mΩ high-side MOSFET. The RTKA211605DR0000BU board demonstrates the operations of RAA211605. It allows you to evaluate the performance of the part with different application circuits. It also provides you a reference for board layout.

The schematic is shown in [Figure 4](#) and the PCB layers for reference are show in [Figure 6](#) and [Figure 7](#). [Figure 8](#) through [Figure 15](#) show the performance data and waveforms take from the evaluation board.

## 1.1 Operating Range

The board input voltage range is from 4.5V to 60V. The output voltage is set to 3.3V by default and can be changed by R<sub>4</sub> and R<sub>5</sub>, as shown in [Equation 1](#):

$$(EQ. 1) \quad R_4 = R_5 \cdot \frac{V_{out} - 0.8}{0.8}$$

For applications where the V<sub>IN</sub> - V<sub>OUT</sub> is larger than 3V, Renesas recommends using a 20kΩ resistor for R<sub>5</sub> and choose R<sub>4</sub> based on [Equation 1](#). For applications where V<sub>IN</sub> - V<sub>OUT</sub> is less than 3V, Renesas recommends using smaller R<sub>4</sub> and R<sub>5</sub> such that there is larger than 50mA load at V<sub>OUT</sub>.

## 1.2 Quick Test Setup

1. Populate a jumper on J1.
2. Connect the power supply to the input terminals VIN(T1) and GND(T2). Connect the load to the output terminals VOUT(T3) and GND(T4). Ensure the setup is correctly connected before applying any power or load to the board.
3. Turn on the power supply and the part should start operating.
4. Verify that the output voltage is 3.3V and phase node waveforms can be monitored at J2.

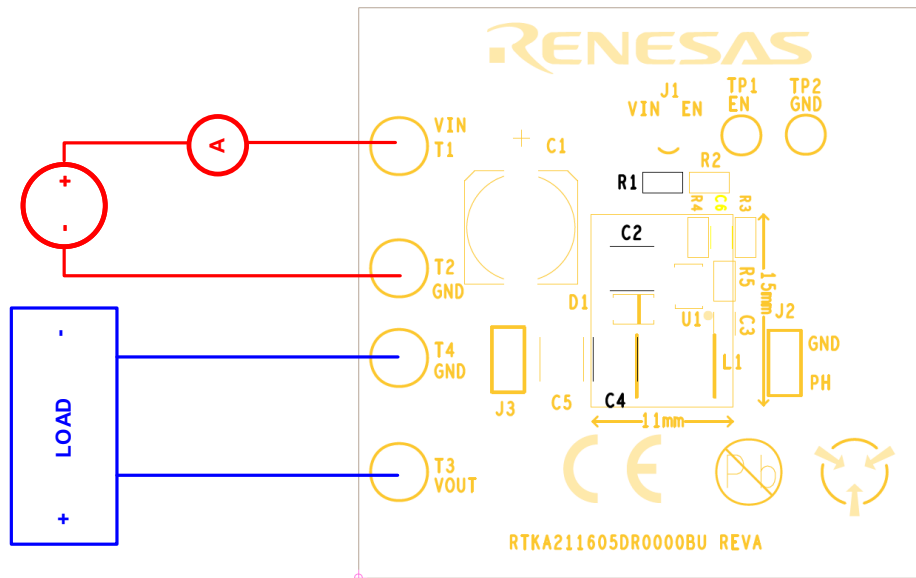


Figure 2. RTKA211605DR0000BU Board Setup

## 2. Board Design



Figure 3. RTKA211605DR0000BU Top View

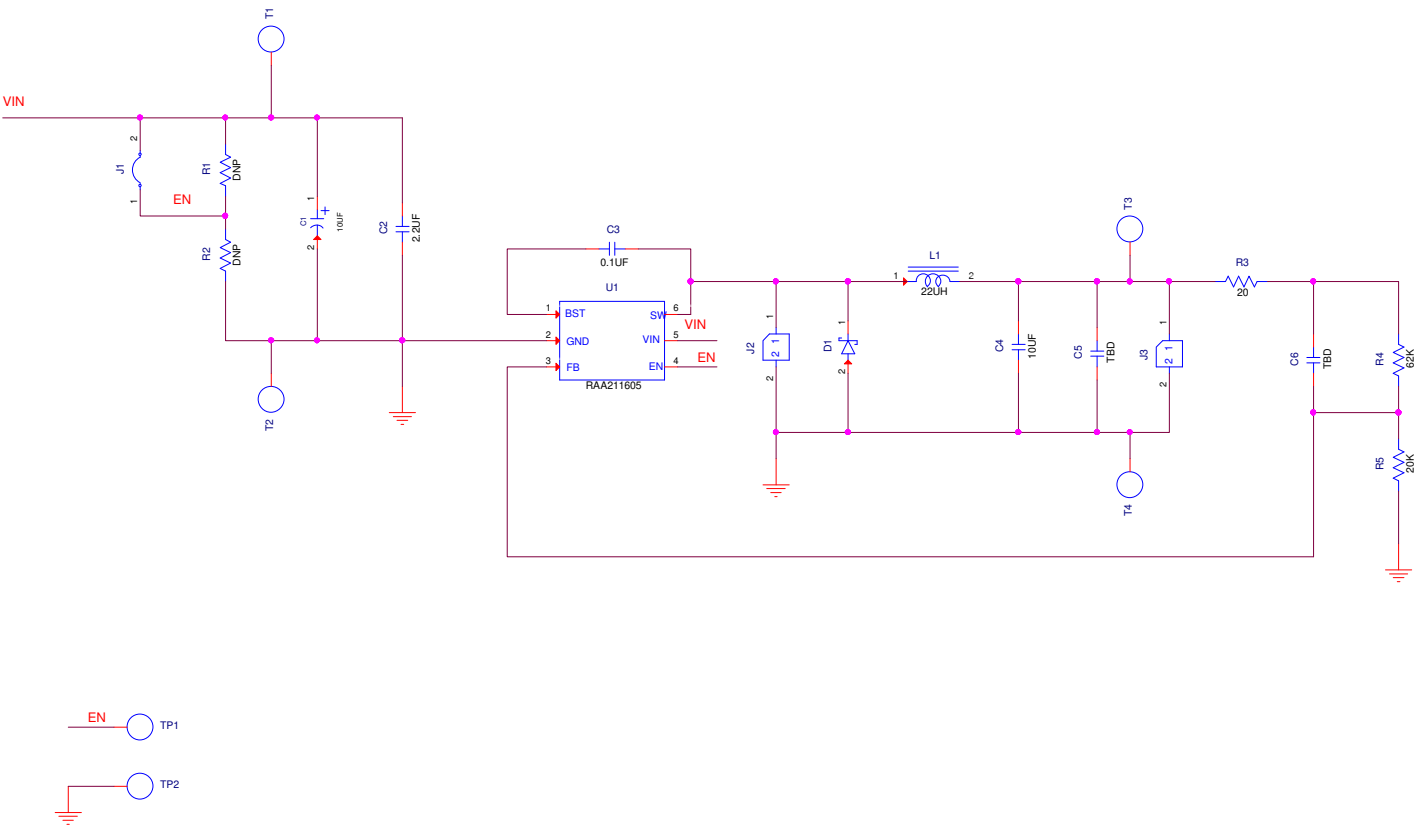


Figure 4. RTKA211605DR0000BU Schematic

## 2.1 Circuit Schematic

## 2.2 Bill of Materials

Qty	Ref Des	Description	Manufacturer	Part Number
1	C4	CAP, SMD, 1210, 10µF, 16V, 10%, X7R, ROHS	Murata	GRM32DR71C106KA01L
1	C3	CAP, SMD, 0603, 0.1µF, 16V, 10%, X7R, ROHS	Murata	GCM188R71C104KA37D
1	C2	CAP, SMD, 1210, 2.2µF, 100V, 10%, X7R, ROHS	Murata	GRM32ER72A225KA35L
1	L1	COIL-PWR INDUCTOR, SM, 4.8mm, 33µH, 20%, 1.2A, ROHS	Würth Electronics	74408943330
4	T1, T2, T3, T4	CONN-DBL TURRET, TH, 0.218x0.078 PCB MNT, TIN/BRASS, ROHS	Keystone	1502-1
2	J2, J3	CONN-BRD-BRD, 1x2, TH, SOCKET, 1x64 STRIP, 2.54mm, ST	Mill-max	310-93-164-41-001000
1	TP2	CONN-MINI TEST PT, VERTICAL, BLK, ROHS	Keystone	5001
1	TP1	CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS	Keystone	5002
1	J1	CONN-HEADER, 1x2, RETENTIVE, 2.54mm, 0.230x0.120, ROHS	BERG/FCI	69190-202HLF
1	D1	DIODE-RECTIFIER, SMD, 2P, S0D-123FL, 100V, 1A, ROHS	On Semiconductor	MBR1H100SFT3G
1	R3	RES, SMD, 0603, 20Ω, 1/10W, 1%, ROHS	Various	Generic
1	R4	RES, SMD, 0603, 62kΩ, 1/10W, 1%, ROHS	Various	Generic
1	R5	RES, SMD, 0603, 20kΩ, 1/10W, 1%, ROHS	Various	Generic
1	U1	IC-SWITCHING REGULATOR, 6P, TSOT-23, ROHS	Renesas	RAA2116054GP3
0	C1	CAP, SMD, 8.3x8.3, 10µF, 100V, 20%, ALUM.ELEC., ROHS	Panasonic	EEE-TG2A100P
0	C6, C5, R1, R2	DO NOT POPULATE	N/A	N/A

## 2.3 Board Layout

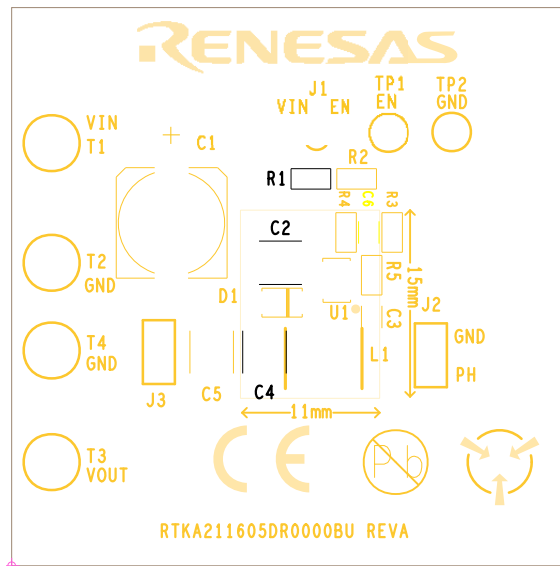


Figure 5. Silkscreen Top

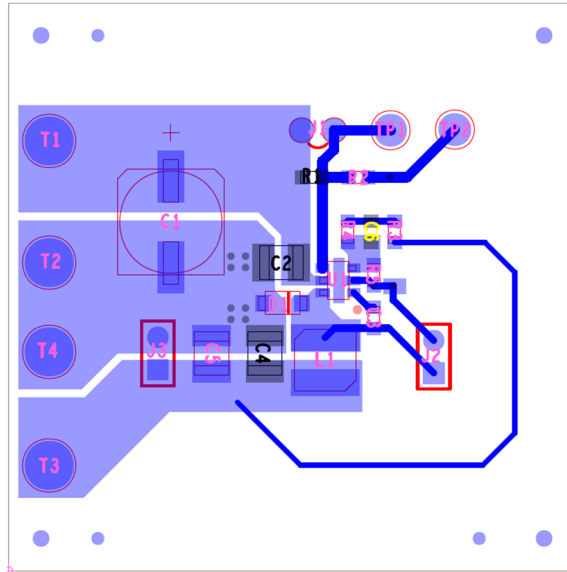


Figure 6. Top Layer

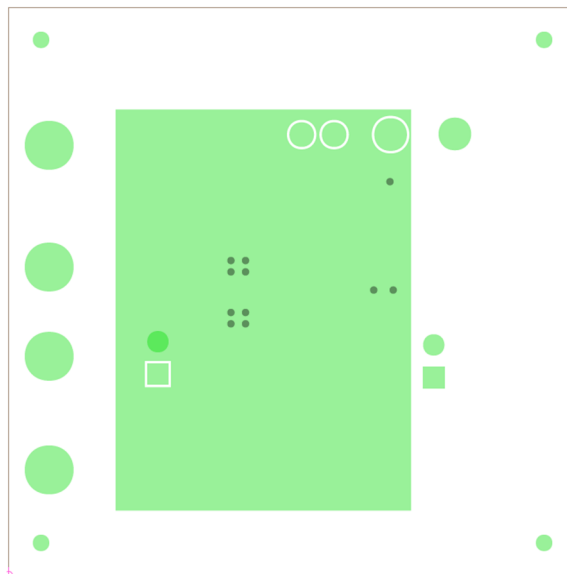


Figure 7. Bottom Layer

### 3. Typical Performance Curves

$V_{IN} = 24V$ ,  $V_{OUT} = 3.3V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.

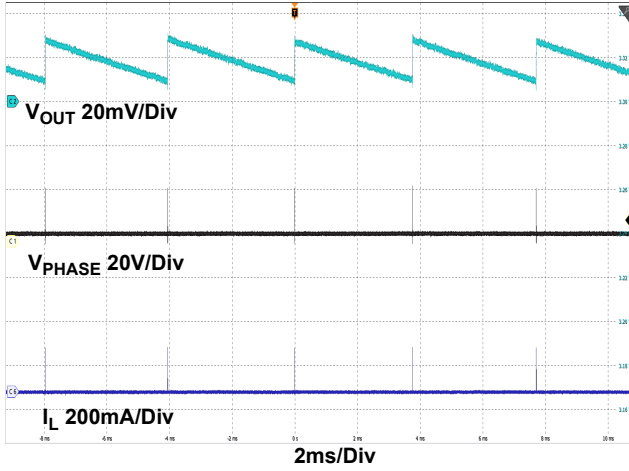


Figure 8. Output Ripple at No Load

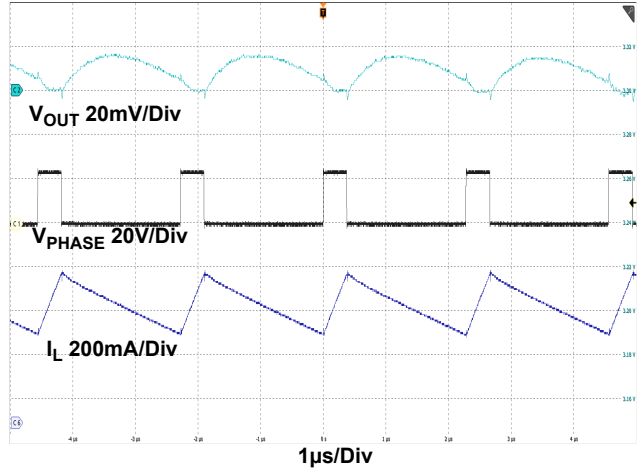


Figure 9. Output Ripple at Full Load

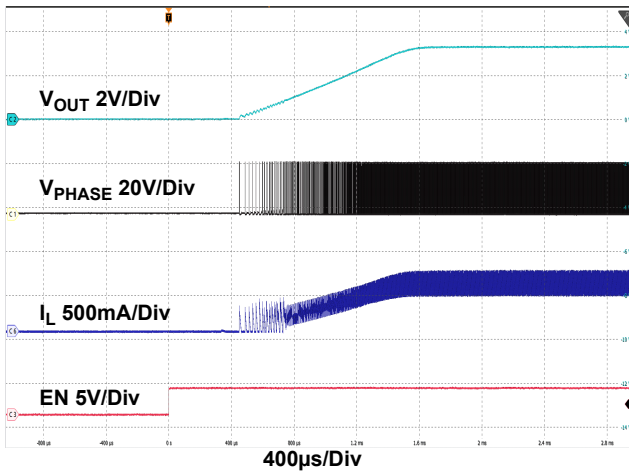


Figure 10. Enable On at Full Load

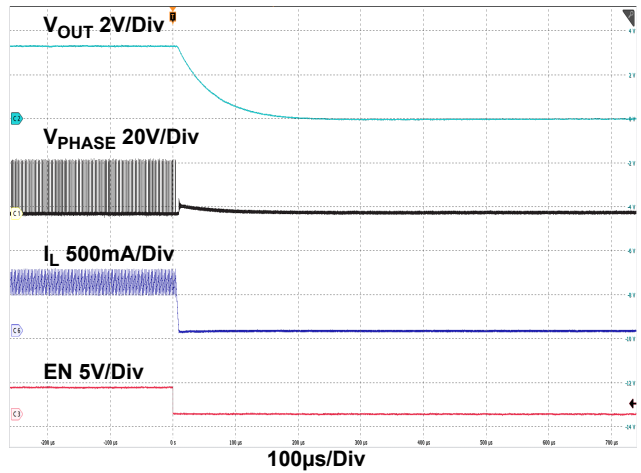


Figure 11. Enable Off at Full Load

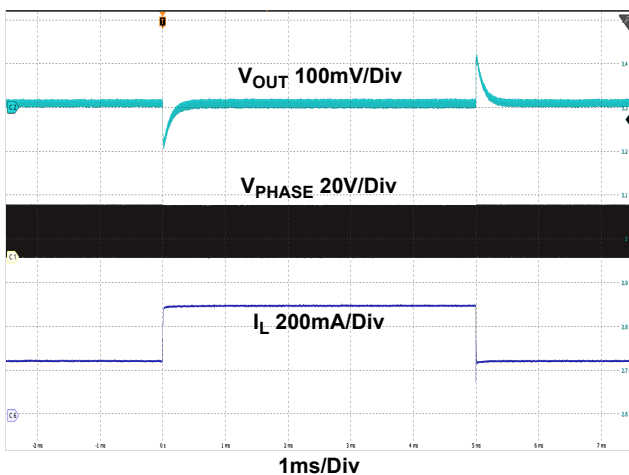


Figure 12. Load Transient between 0.25A and 0.5A

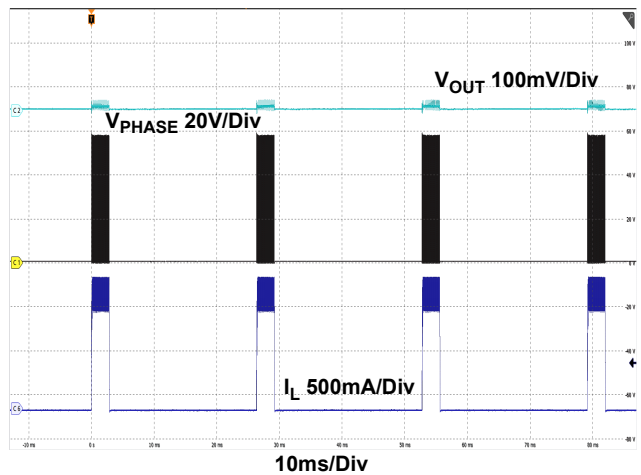


Figure 13.  $V_{OUT}$  UVP ( $V_{IN} = 60V$ )



$V_{IN} = 24V$ ,  $V_{OUT} = 3.3V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted. (Cont.)

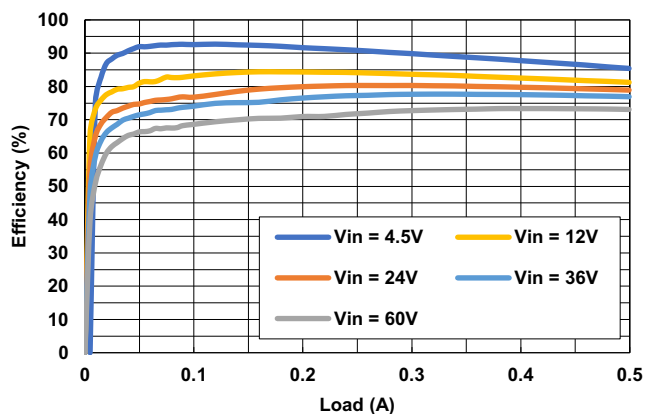


Figure 14. Efficiency vs Load

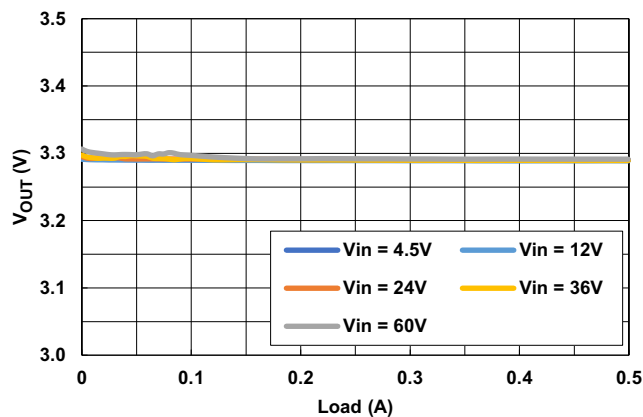


Figure 15. Load Regulation vs Input Voltage

## 4. Ordering Information

Part Number	Description
RTKA211605DR0000BU	RAA211605 Demonstration Board

## 5. Revision History

Revision	Date	Description
1.0	Jul 13, 2021	Initial release

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Rev.1.0 Mar 2020)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:  
[www.renesas.com/contact/](http://www.renesas.com/contact/)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.