

RX62T

180-degree Sinusoidal-wave with Hall sensor

R01AN1107ET0100 Rev.1.00 July 12, 2012

Introduction

This application note describes a method of driving a sensored Brushless DC Motor (BLDCM) with 180-degree sinusoidal wave controlled by RX62T. The motor control firmware algorithm and experimental result are shown in the following chapters.

Target Device

RX62T

Contents

1.	System Configuration	2
2.	Block Diagram	3
3.	Flowchart	4
4.	Implementation and Testing	9
Figure		
Figure 1-1	System Configuration	2
Figure 2-1	Block Diagram	3
Figure 3-1	Main Control Procedure	4
Figure 3-2	Speed Command Value form A/D	5
Figure 3-3	Hall Signal of 2 pole-pairs' Motor in One Revolution	5
Figure 3-4	Motor Speed Calculation Procedure	5
Figure 3-5	Resolution of Sine Wave	6
Figure 3-6	MTU3 Ch3 and Ch4 PWM Duty Calculation Procedure	6
Figure 3-7	Procedure 'A' while Motor Status as T_Ctrl	7
Figure 3-8	Procedure 'B' while Motor Status as S_Ctrl	8
Figure 4-1	U, V, and W Description of BLWR110S	9
Figure 4-2	BLWR110S Specification	9
Figure 4-3	Changing PWM Control1	0
Figure 4-4	Sinusoidal Wave Control on U, V, W1	0
Figure 4-5	PWM Output Result of U _P , V _P , W _P 1	1



1. System Configuration

Target board is RX62T Evaluation Board which is made in Renesas Electronics Taiwan. E1 connector interface to debug program, hall sensor input circuit to capture hall signal; inverter circuit to drive BLDC motor; variable resistor (VR) to control the motor rotational speed; UART port to output MCU information to terminal; switch button to control the motor spinning direction.

In this application note, we'll use 120-degree trapezoidal control for startup only (The solution of this control method please refer application note "RX62T 120-degree Trapezoidal-wave with Hall Sensor"). Once the commutating is successful and revolution error is smaller than 60 rpm (i.e. Speed Command – Speed < 60 rpm), change control method from 120-degree trapezoidal to 180-degree sinusoidal control. The flowchart of sine-wave control is shown in chapter 3.



Figure 1-1 System Configuration

Table 1-1 lists the jumper setting for the hall signals input. Table 1-2 lists the jumper setting for the CPU mode selection.

Jumper	J9	J10	J11
Pins	2-3	2-3	2-3

Table 1-1 Jumpe	r Setting for Hall Sensor Control	
-----------------	-----------------------------------	--

Jumper	J1	J2	J3	J4
Single chip mode	-	1-2	1-2	2-3
Boot mode	-	1-2	2-3	2-3

Table 1-2 CPU Mode Setting



2. Block Diagram

MTU3 is mainly used module in this application note. Channel 3 and channel 4 are used for PWM output, which is set as reset-synchronized mode. Channel 6 is used for calculating rotational speed. Channel 1 is an auxiliary counter for 1ms and 2ms timing. Three GPIOs connect with three hall sensor input signals. ADC receives VR value to control rotational speed.

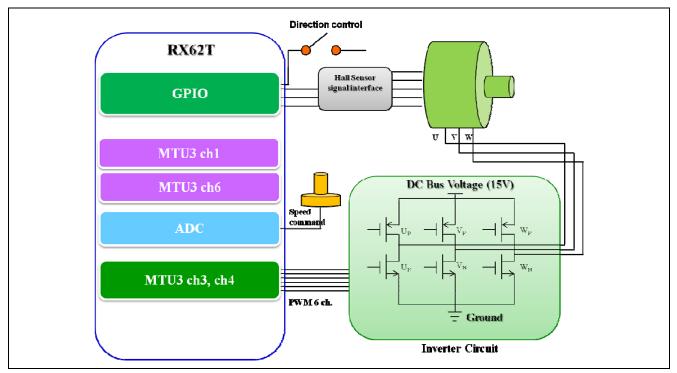


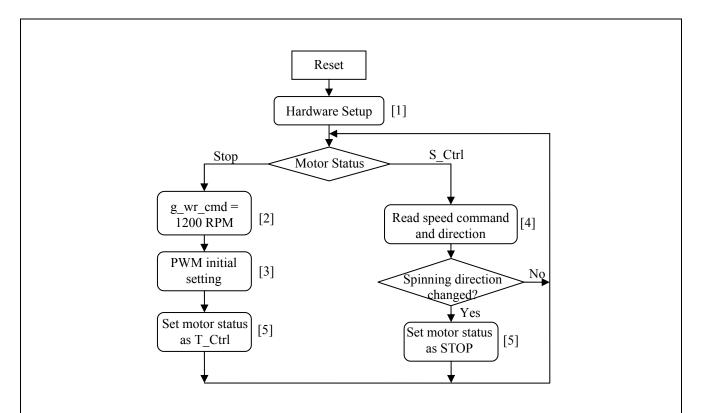
Figure 2-1 Block Diagram



3. Flowchart

Chapter 3 is going to explain how program is designed. Figure 3-1 shows the main routine that describes how program is executed. The carrier frequency is 15 KHz, which stands for one PWM duty cycle will be calculated 15K times in one second, and each interrupt operating procedure shows in Figure 3-6. The maximum and minimum duties of the PWM are limited at 80% and 10% respectively. The limitation of PWM duty should depend on each motor's specification. Figure 3-3 and 3-4 show how mechanical speed is measured.

As described in chapter 1, paragraph 2. We start the motor with 120-degree trapezoidal control. For angle being estimated precisely, we change to sinusoidal control while revolution error smaller than 60 rpm. Besides, once direction is changed during sinusoidal control, PWM output will be disabled and motor status will be changed to STOP for restarting control procedure.



Main:

- [1] Initial the peripheral function in hardware setup after power on reset. Set ICLK = 100 MHz, A/D operating as single mode, and auxiliary timer counter MTU3 ch1 and ch6. Set motor status as STOP.
- [2] Initial speed command is 1200 RPM.
- [3] In PWM initial setting, set MTU3 ch3 and ch4 as reset-synchronized mode, and interrupt carrier frequency is 15 KHz.
- [4] Read speed command after A/D conversion is completed, which value is averaged by the sum of 4 buffer values; please see Figure 3-2. Besides, read switch value to control motor spinning direction. Speed command can be operated only in motor status as S_Ctrl.
- [5] Change motor status according to each case.

Figure 3-1 Main Control Procedure



To get more precisely speed command value, we set four variables for saving A/D conversion results. In Fig 3-2, the interrupt procedure is triggered while A/D conversion is completed. Conversion result will be stored in buf1, and others will be shifted in sequence. Four variables will be summed up and divided by 4, which used as speed command.

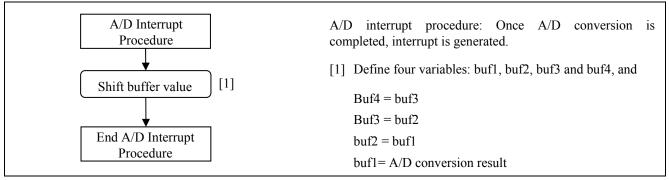


Figure 3-2 Speed Command Value form A/D

Speed calculation is one of the most important issues in motor control process. In this example, a two-pole-pairs motor is used, which generates 2 pulses in one revolution. One timer is selected to calculate motor rotation speed. As shown in Figure 3-3, timer operating frequency is 390625Hz, counter value will be saved in TGRA at rising and falling edge.

In this case, motor rotation speed is 60 rpm (i.e. 1 rps, Revolutions Per Second). While rising and falling edge is to trigger timer for capturing counter value, the TGRA value should be 97656. Depending on this condition, we calculate the ratio between 97656 and TGRA, and this is how we estimate motor rotation speed in this program. Speed calculation procedure is shown in Figure 3-4.

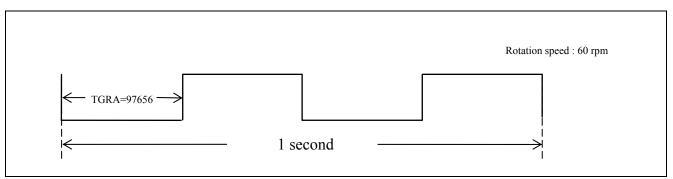
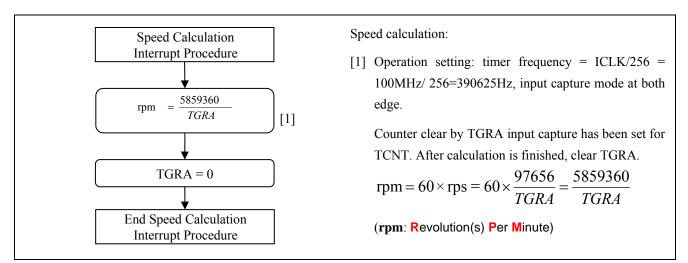
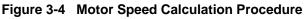


Figure 3-3 Hall Signal of 2 pole-pairs' Motor in One Revolution







In sinusoidal control, we set a look-up table which has 2^{10} points between 0° and 360° in X-axis and magnification of Y-axis form $1 \sim -1$ to $2^{13} \sim -2^{13}$, the figure explanation is shown in Fig3-5. 3-phase hall sensors provide angular resolution of 60-degree, so before the transition to next phase, each PWM duty cycle will accord with speed to estimate how far it has changed and sets a specific angle for a suitable output, the equation is shown in Fig3-6.

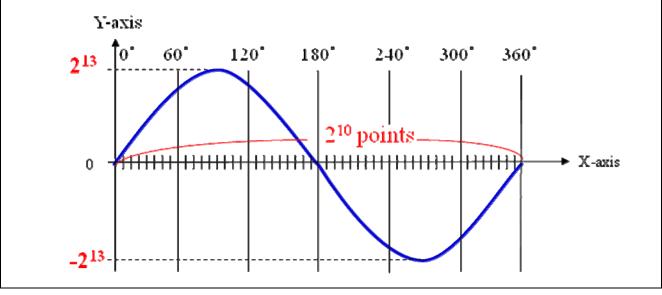
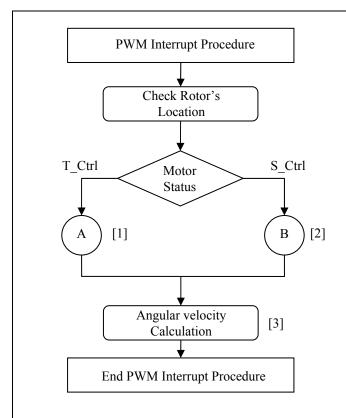


Figure 3-5 Resolution of Sine Wave

Sinusoidal PWM duty calculation and angle calculation procedure are shown in Figure 3-6 to Figure 3-8.



PWM interrupt procedure:

- [1] Procedure 'A' shows in Figure 3-7
- [2] Procedure 'B' shows in Figure 3-8
- [3] Angular velocity can be calculated by rotational speed. In this example, 2 pole pairs motor is used that generates 2 sine-waves per radius which has 1024 point. So Δ_{θ} can be calculated as following equation:

$$\Delta_{\theta} = \frac{\frac{wr(RPM)}{60} \times 1024 \times Pole Pairs}{15000}$$
$$= \frac{wr(RPM) \times Pole Pairs}{878.9}$$

- Note 1: wr is a variable that is used for saving speed in program
- Note 2: 15000 is the carrier frequency of PWM control
- Note 3: T_Ctrl: Trapezoidal Control S_Ctrl: Sinusoidal Control

Figure 3-6 MTU3 Ch3 and Ch4 PWM Duty Calculation Procedure



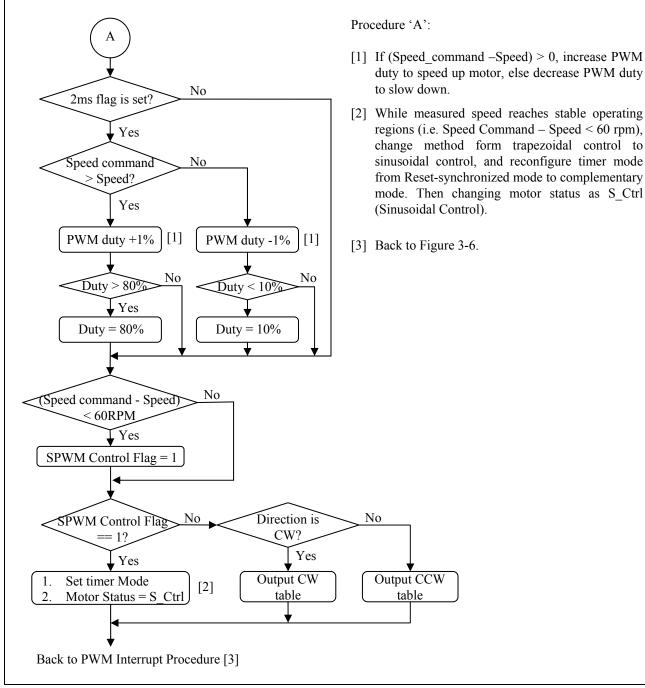


Figure 3-7 Procedure 'A' while Motor Status as T_Ctrl

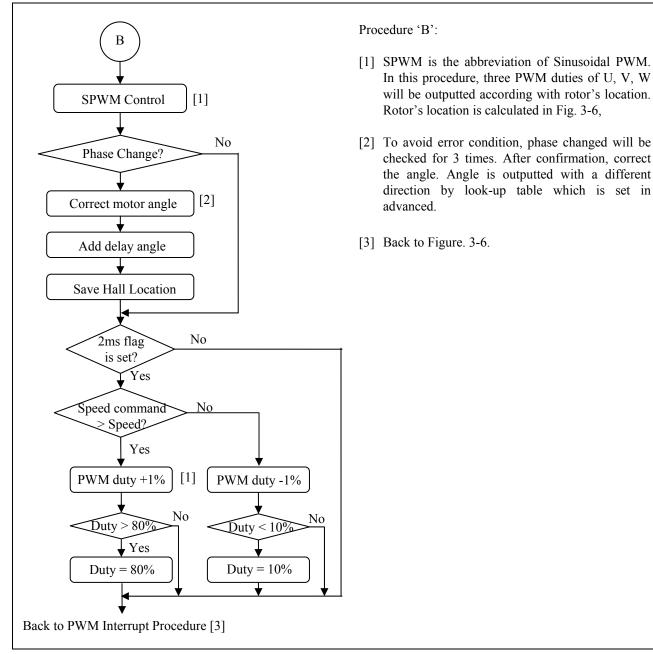


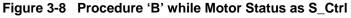
Rotor's location is calculated in Fig. 3-6,

advanced.

In this procedure, three PWM duties of U, V, W will be outputted according with rotor's location.

checked for 3 times. After confirmation, correct the angle. Angle is outputted with a different direction by look-up table which is set in







4. Implementation and Testing

4.1 Specification of BLDC motor

The specification of BLDC motor is shown in Figure 4-1 and Figure 4-2. The model number of target motor is BLWR110S-15V-8000. Maximum speed can up to 8000 rpm in spec. In this experimental result, we can drive target motor up to 7200 rpm under PWM duty is 75%, the minimum speed of this motor without any loading is 600 rpm.

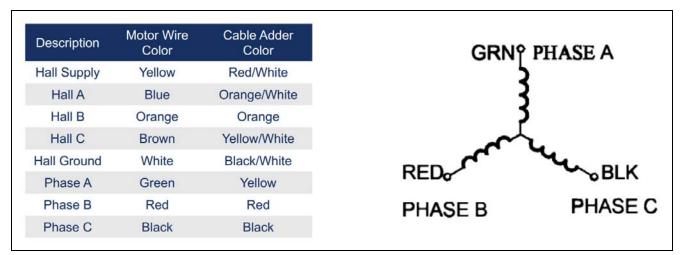


Figure 4-1 U, V, and W Description of BLWR110S

Star, 4 Poles	Max. Radial Force:	15N @ 10mm from the flange
120 degree electrical angle	Max. Axial Force:	10N
0.025mm	Insulation Class:	Class B
0.02mm@450g	Dielectric Strength:	500VDC for one minute
0.08mm@450g	Insulation Resistance:	100MOhm, 500VDC
	120 degree electrical angle 0.025mm 0.02mm@450g	120 degree electrical angleMax. Axial Force:0.025mmInsulation Class:0.02mm@450gDielectric Strength:

Figure 4-2 BLWR110S Specification

The Capability of this target board is shown in Table 3-1.

Ietm	Value	Unit
CPU loading	3.41	%
Max. Speed	7200	rpm
Min. Speed	600	rpm
Timer Used	4	channel
Input BUS voltage	15	V

 Table 4-1
 Capability of RX62T Evaluation Board for Sinusoidal Control



4.2 Experimential result

In this application note, we used 120 degree trapezoidal control to startup only. When rotational speed reaches stable operating regions, stop timer operation and PWM output, then changing mode form Reset-synchronized to complementary mode. As shown in Fig 4-3, high-side and low-side MOSFET will input PWM signal simultaneously after changing control method form trapezoidal control to sinusoidal control. In addition, we added low pass filters at three phases output to get result Fig 4-4, each phase PWM duty according with rotor's location and reference table to output a corresponding value to inverter. As you can see in Fig 4-5, different PWM duty cycle is outputted simultaneously in each phase after control method form trapezoidal to simusoidal control.

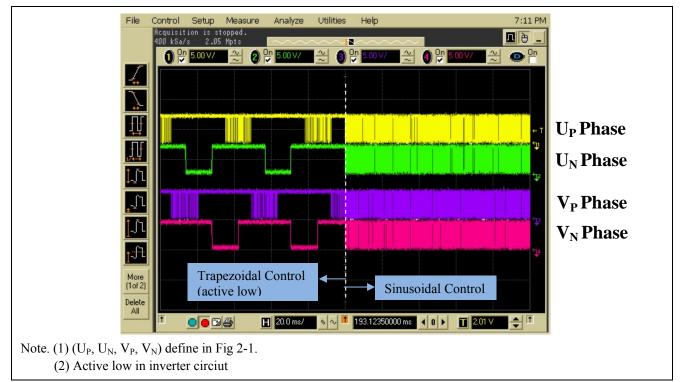


Figure 4-3 Changing PWM Control

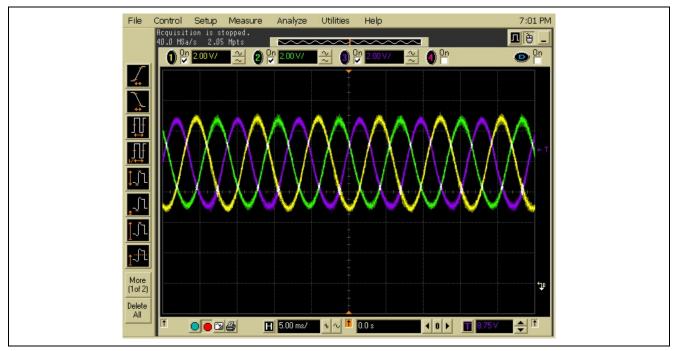


Figure 4-4 Sinusoidal Wave Control on U, V, W





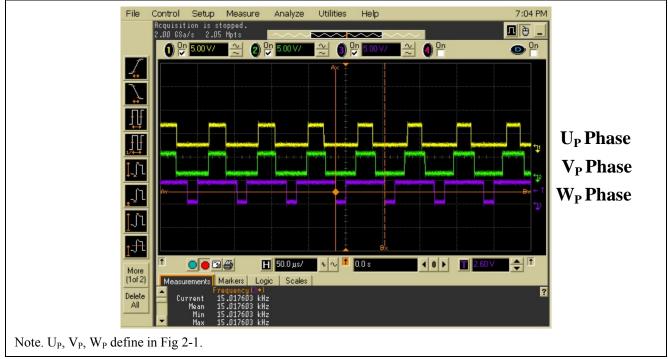


Figure 4-5 PWM Output Result of U_P , V_P , W_P



Website and Support

Renesas Electronics Website <u>http://www.renesas.com/</u>

Inquiries

http://www.renesas.com/inquiry

All trademarks and registered trademarks are the property of their respective owners.



Revision Record

		Descript	ion
Rev.	Date	Page	Summary
1.00	July.12.12		First edition issued

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

- The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.
- 2. Processing at Power-on

The state of the product is undefined at the moment when power is supplied.

- The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
 In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
 In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function
 - are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.
- 3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access
 these addresses; the correct operation of LSI is not guaranteed if they are accessed.
- 4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

- When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal.
 Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.
- 5. Differences between Products

Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

— The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

 a) Some contract is the standard accord on a based on the standard on the standar		Notice
the control of the second is a control of the second is second is a control of the second is a control of the second is	1.	li 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
 a. Provide the set of the set o		
 a. Solution and a subclast of a standame. The booms appears, inplort or measure, is protect used on prior the reached appears of the for the sead-one property of the of the sead-one property of the sead-o	2	
 Watch on during the conduction of the same processing the latest term of the same of the analysis of the same of	۷.	schnical 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
 A. Decision of units, where and units index where the information is the document are produced by productions cannows on productivity for any use of the document of the document	3.	
and the exercise to obtain generation. A there exercise to obtain generation is the extension of	4.	
 Monitory is produced systematically used on the function control, you valued only all the segmetable equation of values and equations on the segmetable equations of the segmetable equations of the sequetable equat		ne 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
<text></text>		
 a. Between of wegens of muse devices. The rease Electronic purches or belacting or to be used for increposed in the synchest or synches muse devices. The Rease Electronic second for the second	5.	
 and the state and specific processing of the state specific processing in the specific processing processing processing in the specific processing procesing processing processing procesi		
 assen to kally whenever to vary charge prever by operading from error or enabour to include test. Preves Determined produce a calibrative calibration is the order and prevent grants of the produce produce is whenever the produce is produce include test. Preves Determined and produce is a calibrative table to the order of the produce produce is and produce and produce is and produce and produce is a calibrative table to the produce is a calibrative table to the produce is and produce is a calibrative table to the produce is a calibrative table table to the produce is a calibrative table to the produce is calibrative table to the calibrative table to the produce is calibrative table to the calibrative table		
 Provide the construction of contrast in the following three quarking yeaks: "Southes," yeak Quarky and "Specific". The econometeric department sequences that contrast in the construction of the sequences in the contrast in the construction of the sequences in the construction of the construct	6.	
<text></text>		
<text><text><text><text><text><list-item></list-item></text></text></text></text></text>	7.	
<text><text><text><text><list-item></list-item></text></text></text></text>		
a series of the sequence of compares of the sequence of compares of the sequence of the se		
Personal activation capagement; and industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal industrial robust Personal indu		
 Hardson, Tamportation sequence functionable, stans, single, stat, ' table order layeriner, and classer systems; a leady capacities in several and classer systems; a leady capacities in several and classer systems; a leady capacities in several and classer systems; and classer system; and classer system;		
designed to the sepont. "source: "section: A contract and explorement submention in packator, network application or progress had pose a direct threat to human its. "source: "section: A contract and explorement submention (a ge existen, ret-), all any other application or progress had pose a direct threat to human its. "source: "section: A contract and explorement in the section (a ge existen, ret-), all any other application or progress had pose a direct threat to human its. "source: "section: A contract and explorement in the section of the biodule and other product the reglection of products have no lability for mathundrics or damages and of the product have application of products have no lability for mathundrics and and multipactions under contain use contains a future products have application of any data application of any other approaches have products have no lability of the advector and bases to again the mathument application and any other approaches have application and the advector and multipactions under contain and multipaction products have application or any other approaches measures. Because the available of falser as a certain mather application and any other approaches measures. The advector and advector and the advector and advector and advector and multipaction relations and any other application or any other applications products. The advector and advector advector and any other application and advector advect		
Insplantations, or haalmaan literation (g.g. action, etc.), and any ofter geptidation are payeended by freemate Insteamour intig, openaling apply valage reage, novement power valage range, heat radiation characteristics, instalation and other product dwases Electronics shall have no lability for mathumoting, openaling apply valage reage incomment power valage range. Instal radiation characteristics, instalation and other product dwases Electronics shall have no lability for mathumotions or damages and informed and mathuctions under certain us conditions. Further, Reneess Electronics potadicts have specific characteristics acts as the occumence of failure at a certain state and mathuctions under certain us conditions. Further, Reneess Electronics potadicts are and subject to indiation relation relations relations relations relations and any other program and any other		designed for life support.
 a. Via via use the Pareasa Electronics products beyonds using and within the argo grounded by Beneasa Electronics, seposially with regular board barry output grounds and output conduct baracteristics. Reseasa Electronics, seposially with regular barry output grounds and output product baracteristics. Reseasa Electronics, seposially with regular barry output grounds and output product baracteristics. Reseasa Electronics, and a large and a		
the answer electronic product by expression of the product area of the product, sension ductor product such as electronic such as the evaluation of the product area of the product, sension ductor product, such as electronics product, such as electronics product, such as electronics product, such as electronics product. These area contrained to the final product is evaluated for the final product or product area of the final product or product and evaluate the evaluation of the final product or product area of the final product or product area of product area of the final product or product area of contrained and evaluate the relation of the evaluation of the final product or product area of the final product or deploited in a product or the product or the product or the product or the product or deploited in the origination or use of controles deploited near and product area of the final product or deploited in any final product or product or deploited in the origination or use of controles deploited near and product area of the integration or subset of for deploited in any final product or in product or the product or deploited in any final product or in product or product or in product or deploited in any final product or in product or product area of the integration or in any obset of the origination or use of controles deploited in any of the integration or subset of for deploited in any of the integration or in any obset of the origination or in any obset of the oringent or in any obset of the originati	8.	
a 1. A https://www.renesa.courds of bing/ow the yain/ly and ministry of the product, serio-hask product characteristics what a the courners of taker at a cottain rate and ministry or taking a caused by fire in the event of the failure of a Peresas. Electronics product, such as safety design for hardware and software inductions, the control and mailunction prevention, ageropriste teatment for aging agingdation or any other ageropriste measures. Because the evaluation of minicoormatic advances and data as a device marked and advances, the control and mailunction prevention, ageropriste teatment for aging agingdation or any other ageropriste measures. Because the evaluation of minicoormatic advances and advances including be not finance and as a device advances of the advances. Because the evaluation of the intervention or avail other aging advances on a work of the ageropriste data was and regulations. 10. Places control and mailunction prevention, ageropriste teatment for aging datation or avail other aging advances on a work of the ageropriste advances and the advances on the advances and evaluation. Intervention advances on advances advances and tada advances on advances advances and the advances on advances advances and the advances on the advances and the advances and the advances on advances adva		ange, 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
maintendron under endna use conditions. Further, fenerase Electronics products are not subject to indition readmane design. Please beaches and ordinaries indiverses indications and alloy of any derange caused by fire in the event of the faller of a Renease Electronics product, such as safely design for hardware including but not limited to individence, the advis of the fired product endpreses the tankes of the fired product or system manufactured by you. 10. Please contrad a Renease Electronic allo data of tables as the individences, including without limited, the UR Pol-B Directive. Renease Electronics product, incursion in a main of the approximate manufacture of the advison of the renease Electronics and the origin degradation or use of controled substatemes. Including without limited, the UR Pol-B Directive. Renease Electronics are subject to individence in the advison of the renease Electronics are subject to individence in the advison of the renease Electronics are subject to a renormating as a result of your noncompliance with applicable two and polarizations. Including without limited, the UR Pol-B Directive. Renease Electronics are subject to a renormating as a result of your noncompliance with applicable two and polarizations. Including without limited, the advison are not grade the renease Electronics are subject to a renormation. The fired subject of the advison are not polarized in the advison are not polarized to a renormation. The Renease Electronics are subject to a relation of renease Electronics are subject to a relation and relation of renease Electronics are		
preparation of physical input, such pays or damage accusate by fere in the event of the failure of a Remease Electronic product, user a evaluation of microcomputer software and obtaver including bar of induced in duration, fee correlation of main anduluction or pays of anima and production or any other appropriate measures. Because the evaluation of microcomputer software alone is user of direct or pays of main anduluction or any other appropriate measures. Because the evaluation of microcomputer software alone is user of direct or pays of universe of the alone of the direct or any other appropriate measures. Because the evaluation of microcomputer software alone is user of direct or pays of universe or the alone of the direct or any other importance with applicable these and majoritors. 1. In second the direct or any other importance with applicable these and majoritors. 1. In second the direct or direct	9.	
networks for contrainer mutation preventions, spoppediate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software adones is very efficient, preventions of the final products or system manufactured by you. 10. Please contrain a measure field of the final products or system manufactured by you. 10. Please contrain a measure field of the final products or system manufactured by you. 11. One document may not be reproduced or deplicated, in my form, in whole or in part, whole or prove writes consend of denesas Electronics, or if you have any other required as a measi of your noncompleans with a philosible base and measures. 12. Please contrain a field of denesas Electronic as also find of you have any questions regarding the information contained in this document or Renesas Electronics. 13. The document may not be reproduced or deplicated, in my form, whole or in part, whole or prove write compactation and also includes its madipy works. 13. When a manufactor of the document means Renesas Electronics Cooporation and also includes its madipy works and the document means Renesas Electronics Cooporation and also includes its madipy works. 14. When a set of the final products of you have any questions regarding the information contained in this document or Renesas Electronics. 15. More Cooporation of the latest and detailed information. 16. The philoway renesas Control on Cooporation and also includes its madipy works and also includes its madipy works. 16. The philoway Renesa Control Constant and detailed information. 16. The philoway Renesa Control Constant and detailed information. 16. The philoway Renesa Control Constant and the set of the field of the philos. 17. The philos Reness Renet contex Constant and the set of the philos Renet Reness Electronics. 18. The Renet Rene		
please evaluate the safety of the final products or system manufactured by you. 10. Please contact a Renessa Electronics assis office for details as on environmental matters such as the environmental compatibility of each Renessa Electronics product. Please use Renessa Electronics moleculity for damages or bases occurring as a result of your noncompliance with applicable laws and regulations. 11. The document may not be reproducted or daplicated, in any forw, in whole or in the mit construct may not be reproducted or daplicated. In any forw, in whole or in the mit construct may not be reproducted or daplicated. In any forw, in whole or in the mit construct of Renessa Electronics products, or if you have any other inquietes. (Note 1) "Renessa Electronics assist office if you have any questions regarding the information contained in this document means Renesse Electronics Cooronation and also includes its majority-owned subsidiaries. (Note 2) "Renessa Electronics product(s)" means any product developed or manufactured by or for Renessa Electronics. (Note 2) "Renessa Electronics assist office if you have any questions regarding the information contained also includes its majority-owned subsidiaries. (Note 2) "Renessa Electronics and the information contained also includes its majority-owned subsidiaries. (Note 2) "Renessa Electronics and the information. (Note 3) "Renessa Electronics and the information. (Note 5) "Renessa Electronics and the information. (Note 5) The latest and detailed information. (Note 5) The set of the latest and detailed information. (Note 5) The set of the set		
n lange of the compliance with all applicable laws and regulations that regulations that regulations or use of controlled substances, including without limitation, the EU RoHS Directive. Renease Electronics are used of voluments of an introduced or duplicated, in any term of non-introduced or duplicated, in any term of non-introduced or duplicated, in any term of non-introduced in this document memory and non-introduced in the introduced memory and non-introduced interview. Renease Electronics produced, or if you have any outer introduced in memory and also includes its majority-awared substances. (Note: 1) "Renease Electronics produced, or if you have any outer introduced in manufactured by or for Renease Electronics and the interview memory and also includes its majority-awared substances. (Note: 1) "Renease Electronics and electr		
In the abulity for damages or bases occurring as result of your mocompliance with aphicable laws and regulations. In the abuarment may not be reproduced on daplicated, in any form, in whole of in part, whithout prior written constant of Reneasa Electronics products, or if you have any outbeen regarding the information contained in this document or Reneasa Electronics products, or if you have any outbeen regarding the information contained in this document or Reneasa Electronics products, or if you have any outbeen regarding the information contained in this document or Reneasa Electronics products, or if you have any outbeen regarding the information contained in this document or Reneasa Electronics (Renease Electronics products), or if you have any outbeen regarding the information. Internet or Renease Electronics products, or if you have any outbeen regarding the information. Renease Electronics products, or if you have any outbeen regarding the information. Renease Electronics America ID Renease Electronics Corporation on the Internet Renease Electronics Products, or if you have any outbeen regarding the information. Renease Electronics America ID Renease Electronics Corporation Renease Electronics Europe Limited Renease Electronics Corporation Renease Electronics Renease Electronics Corporation Renease Electronics Europe Limited Renease Electronics Europe Limited Renease Electronics Europe Limited Renease Electronics Europe Limited Renease Electronics Electrone Renease Renease Electronics Renease Electronics Corporation Renease Electro	10	lasse contact a Renesse Electronice sales office for details as to environmental matters such as the environmental compatibility of each Renesse Electronice product. Plasse use Renesse Electronice
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Remease Electronics models, or if you have any other inquisites. (Note 1) "Remease Electronics and in this document or and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics product(s)" means any product developed or manufactured by or for Remease Electronics. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 2) "Remease Electronics and also includes the majority-owned sublidaries. (Note 3) "Remease Electronics And allow includes the majority owned sublidaries. (Note 5) "Remease Electronics And allow includes the sublidaries. (Note 5) "Remease Electronics And allow includes the sublidaries. (Note 5) "Remease Electronics Canada Linde (1) Note 508-508 - 6000, Res. +1-409-508-6100 (2) "Note 508-508 - 6000, Res. +1-409-508-5100 (2) "Note 508-508 - 6000, Res. +1-408	10.	
12. Please contact a Rerease Electronics aue of this document means Renease Electronics Corporation and also includes its majority-owned subaidantes. (Note 1) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. (Note 2) "Renease Electronics and the Electronics Corporation of the Units of the States and detailed information. (Note 3) "Renease Electronics Canada Limited (1) Nubolics Renease Electronics Europe Limited Diverse Electronics Europe Limited Diverse Electronics Europe Elmited Diverse Electronics Corpo and Limited. (1) Adv2 Diverse States Diverse Corporation (2) "Renease Electronics Corpo Contal (1) Adv2 Diverse States Diverse Contal (2) Adv2 Diverse Diverse Contal (2) Adv2 Diverse Diverse Contal (2) Adv2 Diverse Diverse Contal (2) Adv2 Diverse Diver	10.	roducts 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
(Note 1) "Peresas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. (Note 2) "Penesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. EXERCISE DEFICES DEDECISION DECISION		roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
States of Frices Renesas Electronics Corporation http://www.renesas.com Note to "http://www.renesas.com" for the latest and detailed information. http://www.renesas.com" for the latest and detailed information. States of Data States and Stat	11.	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
SALES OFFICES Renease Electronics Corporation http://www.renesas.com Refer to "thtp://www.renesas.com/" for the latest and detailed information. Meness Electronics America Inc. 1880 Sont Boulevard Santa Clara, CA 96050-2554, U.S.A. 16" + 1-403-9580-6000, Fax: +1-4005-980-3200 Reress Electronics Canada Limited 101 Nicholson Road, Newmarket, Onlario L3 Y 9C3, Canada 16" + 1-403-9580-5441, Fax: - 1-4005-5895-3200 Renessa Electronics Europe Limited 102kes Meadow, Milliboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K. 16" +449-211-5503-1300, Fax: +44-1628-585-900 Renessa Electronics Europe Climited 10xees Meadow, Milliboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K. 16" +449-211-5503-1300, Fax: +44-1628-585-900 Renessa Electronics Europe Climited 11xed Adatastase 10, 40472 Disseldorf, Germany 16: 449-211-5503-1500, Fax: +49-610-8235-7679 Renessa Electronics (Shanghall Co., Ltd. 11x1501-1613, IGFL, Tore'2, Climited 11x1501-1613, IGFL, Tore'2, Climited <th>11. 12.</th> <th>roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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.</th>	11. 12.	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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.
Refer to "http://www.renesas.com/" for the latest and detailed information. Refers to "http://www.refers.com/" for the latest and detailed information. Refers to "http://www.ref	11. 12. (No	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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. 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.
Renease Electronics America Inc. 1880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A. 161: 1-408-588-6000, Fax: +1-408-588-6130 Renease Electronics Canada Limited 101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada 161: +1-905-898-5441, Fax: +1-905-898-3220 Renease Electronics Europe Limited View Midboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K 161: +44-1628-585-100, Fax: +44-1628-585-900 Renease Electronics Europe GmbH vrcadiastrasse 10, 40472 Düsseldorf, Germany 161: +49-211-65030, Fax: +49-211-6503-1327 Renease Electronics (Shanghai) Co., Ltd. 171: Honor, Quantum Piaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China 161: +861-08235-1155, Fax: +861-0823-7679 Renease Electronics (Shanghai) Co., Ltd. 171: 204, 205, CAZIA Center, No.1233 Luijazui Ring Rd, Pudong District, Shanghai 200120, China 171: 204, 205, CAZIA Center, No.1233 Luijazui Ring Rd, Pudong District, Shanghai 200120, China 171: 204, 205, CAZIA Center, No.1233 Luijazui Ring Rd, Pudong District, Shanghai 200120, China 171: 204, 205, CAZIA Center, No.1233 Luijazui Ring Rd, Pudong District, Shanghai 200120, China 171: 204, 205, CAZIA Center, No.1233 Luijazui Ring Rd, Pudong District, Shanghai 200120, China 171: 204, 205, CAZIA Center, No.1233 Luijazui Ring Rd, Pudong District, Shanghai 200120, China 171: 204, 205, CAZIA Center, No.1233 Luijazui Ring Rd, Pudong District, Shanghai 200120, China 172: 486-2415977.1818, Fax: +862-216867-7888 173: No. 363, Fu Shing North Road, Taipei, Taiwan 172: +886-24175-9800, Fax: +486-24175-9870 Renease Electronics Singapore Pte. Ltd. 174: 486-26213-0220, Fax: +465-2788001 Renease Electronics Malysia Sdn.Bhd. 11800, Block B, Menara Annoop, Annoop Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia 187: 486-2415-9505, Fax: +405-2785-9510 Renease Electronics Challes 18966, Block B, Menara Annoop, Annoop Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia 187: 450-37355-9330, Fa	11. 12. (No	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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. 1) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.
 IB80 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A. I: +1-408-588-6100, Fax: +1-408-588-6130 Itenesas Electronics Canada Limited 101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada I: +1-905-698-5441, Fax: +1-905-689-3220 Ienesas Electronics Europe Limited Jukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K I: +44-1528-585-100, Fax: +44-1528-585-900 Ienesas Electronics Europe GmbH vrcadiastrasse 10, 40472 Düsseldorf, Germany I: +49-211-6503, Fax: +49-211-6503-1327 Ienesas Electronics (Shanghai) Co., Ltd. If Ficor, Quantum Plaza, No.27 ZhiChunLu Haldian District, Beijing 100083, P.R.China I: +86-10-823-1155, Fax: +48-10-283-7679 Ienesas Electronics (Shanghai) Co., Ltd. Iti 204, 205, ZZA (Center, No. 1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China I: 486-14587-1818, Fax: +486-21-687-7858 Venesas Electronics (Shanghai) Co., Ltd. Iti 204, 205, ZZA (Center, No. 1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China I: 486-24587-1818, Fax: +486-21-687-7858 Iti 61-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong I: 4886-241-587-7858 I: 4886-241-587-7859 I: 4886-241-587-670 I: 4886-241-587-670 I: 4886-241-581-0, Keppel Bay Tower, Singapore 098632 I: 4886-241-581-0, Keppel Bay Tower, Singapore 098632 I: 4886-241-590, Fax: +455-527	11. 12. (No (No	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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. 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. Electronics are contact as a subsidiaries.
Itenesas Electronics Canada Limited 101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada ei: +1-905-898-5441, Fax: +1-905-898-3220 Itenesas Electronics Europe Limited Vikes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K 'ei: +44-1628-585-100, Fax: +44-1628-585-900 Itenesas Electronics Europe GmbH rocadiastrasse 10, 40472 Düsseldorf, Germany 'ei: +49-211-65030, Fax: +44-1628-585-900 Itenesas Electronics Chinag Oc., Ltd. Itenesas Electronics (Chinagha) Co., Ltd. Itenesas Electronics (Snaghal) Co., Ltd. Ini 1204, 205, AZIA Center, No. 1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China 'ei: +862-158-571-1818, Fax: +866-10-8235-7769 Itenesas Electronics (Snaghal) Co., Ltd. Ini 1204, 205, AZIA Center, No. 1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China 'ei: +862-158-571-1818, Fax: +866-10-8235-7769 Itenesas Electronics Hong Kong Limited Ini 1101-1613, 10/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong 'ei: +862-886-9318, Fax: -862-2886-922/9044 Itenesas Electronics Singapore Ple. Ltd. Itenesas Electronics Singapore Ple. Ltd. InatourFornd Avenue, #06-10, kepsel Bay Tower, Singapore 098632 'ei: +865-6213-0200, Fax: +865-6278-8001<	11. 12. (No (No	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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.) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. ESOFFICES Renesas Electronics Corporation and Electronics Corporation Applications. http://www.renesas.col
teness Electronics Europe Limited uikes Meadow, Miliboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K ei: +44-1628-585-100, Fax: +44-1628-585-900 teness Electronics Europe GmbH rcadiastrasse 10, 0472 Düsseldorf, Germany ei: +49-211-65030, Fax: +49-211-6503-1327 tenessa Electronics (China) Co., Ltd. th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China ei: +86-10-8235-1155, Fax: +86-10-8235-7679 tenessa Electronics (Anghal) Co., Ltd. Init 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China ei: +86-21-5877.1818, Fax: +86-21-6887-7858 tenessas Electronics (Manghal) Co., Ltd. Init 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China ei: +86-21-5877.1818, Fax: +86-21-6887-7858 tenessas Electronics Hong Kong Limited Init 101-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong ei: +852-2886-9318, Fax: -852 2886-922/9044 tenessas Electronics Singapore Pte. Ltd. harbourFront Navenue, #106-10, keppel Bay Tower, Singapore 098632 ei: +86-231-0200, Fax: +86-238-8001 tenessas Electronics Singapore Pte. Ltd. harbourFront Avenue, #106-10, keppel Bay Tower, Singapore 098632 e	11. 12. (No (No SA Sefe 880	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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. 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. ESOFFICES Renesas Electronics Corporation Markets Corporation Science Scie
<pre>iei: +44-1628-685-100, Fax: +44-1628-585-900 ienesas Electronics Europe GmbH rcadiastrasse 10, 40472 Düsseldorf, Germany el: +49-211-65030, Fax: +49-211-65030, 1327 ienesas Electronics (Ching) Co., Ltd. th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China el: +86-10-8235-1135, Fax: +48-610-8235-7767 ienesas Electronics (Chinghai) Co., Ltd. init 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China el: +86-77-1818, Fax: +48-62-10-887-7858 /-7898 ienesas Electronics (Shanghai) Co., Ltd. init 104, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China el: +862-158-9316, Fax: +486-21-6887-7858 /-7898 ienesas Electronics Hong Kong Limited iei: +862-158-9318, Fax: -852-2886-9022/9044 ienesas Electronics Taiwan Co., Ltd. Fr.No.363, Fu Shing North Road, Taipei, Taiwan el: +886-2-8175-9600, Fax: +886 2-8175-9670 ienesas Electronics Singapore Pte. Ltd. harbourFront Avenue, #106-10, keppel Bay Tower, Singapore 098632 el: +65-6213-0200, Fax: +65-6278-8001 ienesas Electronics Magais Sdn.Bhd. init 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia el: ensesas Contonics Co., Ltd. ienesas Electronics Co., Ltd. init 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia el: ensesas Electronics Co., Ltd.</pre>	11. 12. (No (No (No SA Sefe 880 el: 880 101	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease 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. 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. Renesas Electronics Corporation Renesas Electronics Corporation or "http://www.renesas.com/" for the latest and detailed information. as Electronics America Inc. 50 Thtp://www.renesas.com/" for the latest and detailed information. as Electronics America Inc. 50 Thtp://www.renesas.com/" for the latest and detailed information. as Electronics Canada Limited 10 Hote-S88-6000, Fax: +1-408-588-6130 as Electronics Canada Limited 10 Hote-S84-6000, Fax: +1-408-588-6130 10 Hote
ircadiastrasse 10, 40472 Düsseldorf, Germany iel: +49-211-65030, Fax: +49-211-6503-1327 Ienesas Electronics (China) Co., Ltd. th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China iel: +86-10-835-1155, Fax: +86-12-838-77679 Ienesas Electronics (Shanghai) Co., Ltd. init 204, 205, AZIA Center, No. 1233 Luijazui Ring Rd., Pudong District, Shanghai 200120, China iel: +68-21-8577-1818, Fax: +86-21-8687-7858 / -7898 Ienesas Electronics Hong Kong Limited Init 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong iel: +852-2886-9318, Fax: +852 2886-9022/9044 Ienesas Electronics Taiwan Co., Ltd. 57, No. 363, Fu Shing North Road, Taipei, Taiwan iel: +868-2-8175-9600, Fax: +852 -2875-9670 Ienesas Electronics Singapore Pte. Ltd. harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632 ei: +656-213-0200, Fax: +656-278-8001 Ienesas Electronics Manguis Bd. Init 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia ei: +60-3-7955-9300, Fax: +60-3-7955-9510	11. 12. (Not (Not SA Refe 880 el: 880 101 el: 880 101 101 101 101 101 101 101	roducts 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 o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics. lease contact a Renesas Electronics alses office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. Process Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. ES OFFICES Concess Electronics Corporation Mathematicate Sector Corporation or "http://www.renesas.com/" for the latest and detailed information. as Electronics America Inc. Cott Boulevard Santa Clara. CA 95050-2554, U.S.A. 1-408-588-6100, Fax: +1-408-588-6130 as Electronics Conada Limited Unbolson Road, Newmarket, Ontario L3Y 9C3, Canada -905-999-5441, Fax: +1-905-898-3220
Renesas Electronics (China) Co., Ltd. 1th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China 1ei: +861-08235-1155, Fax: +86-10-68235-7679 Renesas Electronics (Shanghai) Co., Ltd. Jnit 204, 205, ZZIA Center, No.1233 Lujiazul Ring Rd., Pudong District, Shanghai 200120, China rel: +86-2-15877-1818, Fax: +86-21-6887-7858 / -7898 Renesas Electronics Hong Kong Limited Jnit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong rel: +852-2886-9318, Fax: +852 2886-9022/9044 Renesas Electronics Taiwan Co., Ltd. 3F, No. 363, Fu Shing North Road, Taipei, Taiwan rel: +868-2-8175-9600, Fax: +862 8-8175-9670 Renesas Electronics Singapore Pte. Ltd. harbourfront Avenue, #06-10, keppel Bay Tower, Singapore 098632 rel: ef: 6-6213-0200, Fax: +865-6278-8001 Paresas Electronics Maleysia Sdn.Bhd. Jnit 906, Biock B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia rel: +60-3-7955-9310 Renesas Electronics Korea Co., Ltd.	11. 12. (No (No (No SA SA Sefe 8880 Fel: 101 Fel: Sefe Couke Fel: Sefe Couke Fel: Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe Sefe	roducts 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 o lability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics products, or if you have any other inquiries. 1) "Renesas Electronics as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. EXECUTE: DEVENTION: DEVE
th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China ei+ 866-10-8235-1155, Fax: +86-10-8235-7679 tenesas Electronics (Shanghai) Co., Ltd. init 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China ei+ 486-21-5877-1818, Fax: +86-21-6887-7858 / -7898 tenesas Electronics Hong Kong Limited hit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong ei: +852-2886-9318, Fax: +852 2886-9022/9044 tenesas Electronics Taiwan Co., Ltd. 57, No. 363, Fu Shing North Road, Taipei, Taiwan ei: +868-2-8175-9600, Fax: +856 2-8175-9670 tenesas Electronics Singapore Pte. Ltd. harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632 ei: +65-6213-0200, Fax: +65-6278-8001 tenesas Electronics Marysia Sh.Bhd. Init 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia ei: +60-3-7955-9300, Fax: +60-3-7955-9510	11. 12. (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not	roducts 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 i lability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. Its document may not be reproduced or duplicated, in any form, in whole or in part, without prior written content of Renesas Electronics products, or if you have any other inquiries. I an enesas Electronics' as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. Prenesas Electronics product(s)' means any product developed or manufactured by or for Renesas Electronics. The energy of the substance of the energy of
Init 204, 205, AZIA Ceinter, No. 1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China el: +662-15877-1818, Fax: +862-1686927058 / -7898 Init 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong el: +852-2866-9318, Fax: - +852-2868-0922/9044 Ienesas Electronics Taiwan Co., Ltd. 57, No. 363, Fu Shing North Road, Taipei, Taiwan el: +886-2-8175-9600, Fax: +886 2-8175-9670 Ienesas Electronics Singapore Pte. Ltd. harbour/Fond Ivaenue, #106-10, keppel Bay Tower, Singapore 098632 el: +65-6213-0200, Fax: +65-6278-8001 Ienesas Electronics Malaysia Sdn.Bhd. Init 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia el: +60-3-7955-9390, Fax: +60-3-7955-9510	111. 12. (Not (Not (Not (Not SA Befe 8800 101 101 el: Beno 101 el: Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Beno Be	roducts 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 i lability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. Its document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics products, or if you have any other inquiries. I asses 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. I renesas Electronics rais used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. I renesas Electronics product(s)* means any product developed or manufactured by or for Renesas Electronics. ESENTE: Renesas Electronics Developed or manufactured by or for Renesas Electronics. Interviews. Renesas Electronics Corporation on Market Sector Secto
tenesas Electronics Hong Kong Limited init 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong el: +852-2866-9316, Fax: +852 2886-9022/9044 tenesas Electronics Taiwan Co., Ltd. 57, No. 363, Fu Shing North Road, Taipei, Taiwan el: +886-2-8175-9600, Fax: +886 2-8175-9670 tenesas Electronics Singapore Pte. Ltd. harbour/Fornic Kallaysia Sdn.Bad. Init 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia el: +60-37955-3390, Fax: +60-3.7955-9510 tenesas Electronics Co., Ltd.	11. 12. (Not (Not (Not SA Refe 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 880 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el: 800 el:	roducts in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renease Electronics assumes o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. his document may not be reproduced of duplicated, in any form, in whole or in part, without prior written consent of Renease Electronics products, or if you have any other inquiries. 1) "Renease Electronics" as used in this document means Renease Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renease Electronics are used in this document means Renease Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. ESENCE: Constructions of the latest and detailed information. as Electronics America Inc. Cost Bouldward Stanta Clara, CA 95050-2554, U.S.A. 1-400-588-6100, Fax: +1-400-588-7130 as Electronics Canada Limited licholson Road, Newmarket, Ontario L3Y 9C3, Canada -90-588-541, Fax: +1-400-588-5000 as Electronics Europe Limited Meadow, Milliborard Road, Roume End, Buckinghamshire, SL8 5FH, U.K 4-1265-585-100, Fax: +44-1028-588-5000 as Electronics Europe Limited Batfasse 10, 0, 40472 Disseldfd, Germany 9-211-65030, Fax: +44-921-F503317327 as Electronics Chards Limited of Udurum Plaza, No.277 ZhChunlu Haidian District, Beijing 100083, P.R.China 6-10-02555-155, Fax: +45-10-0253-775
tenesas Electronics Taiwan Co., Ltd. 3F, No. 363, Fu Shing North Road, Taipei, Taiwan ei: +886-2+8175-9600, Fax: +886 2+8175-9670 tenesas Electronics Singapore Pte. Ltd. harbour/Fornt Avenue, #06-10, keppel Bay Tower, Singapore 098632 ei: +86-56213-0200, Fax: +65-6278-8001 tenesas Electronics Malaysia Sdn.Bhd. Jnit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia ei: +80-37955-9390, Fax: +60-3-7955-9510 tenesas Electronics Korea Co., Ltd.	11. 12. (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not	roducts in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renease Electronics assumes o liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. Is document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renease Electronics products, or if you have any other inquiries. 1) "Renease Electronics as used in this document means Renease Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renease Electronics are used in this document means Renease Electronics Corporation and also includes its majority-owned subsidiaries. 2) "Renease Electronics product(s)" means any product developed or manufactured by or for Renease Electronics. ESE OFFICES Renease Electronics Developed or manufactured by or for Renease Electronics. Belectronics America Inc. Source State Claring, CA 95050-2554, U.S.A. 1-409-588-6100, Fax: -14-08-588-6130 Belectronics Europe Limited Hindow, Millington Road, Newmarket, Ontario LaY 9C3, Canada -905-989-5411, Fax: +1-409-589-5220 Belectronics Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -905-989-5411, Fax: +1-40-589-580-203 Belectronics Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -905-989-5411, Fax: +1-40-589-580-203 Belectronics Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -905-989-541, Fax: +4-1052-585-500 Belectronics Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -905-989-541, Outario Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -905-989-541, Fax: +4-1052-585-700 Belectronics Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -905-989-541, Outario Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -905-989-541, Outario Europe Chald Bicholson Road, Newmarket, Ontario LaY 9C3, Canada -9
tenesas Electronics Singapore Pte. Ltd. harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632 ei: +65-6213-0200, Fax: +65-6278-8001 tenesas Electronics Malaysia Sdn.Bhd. Initi 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia el: +60-3-7955-9390, Fax: +60-3-7955-9510 Henesas Electronics Korea Co., Ltd.	A (Not Control of the second s	roducts in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renease Electronics assumes of lability for damages or losses occurring as a neult of your noncompliance with applicable laws and regulations. Its document may not be reproduced or duplicated, in any form, in whole or in part, without prior withen consent of Renease Electronics products, or if you have any other inquiries. It arenease Electronics assumes of the ity ou have any product doveloped or manufactured by or for Renease Electronics and using includes its majority-owned subsidiaries. The resease Electronics product(s) ⁺ means any product developed or manufactured by or for Renease Electronics. The resease Electronics product(s) ⁺ means any product developed or manufactured by or for Renease Electronics. The resease Electronics of the vector of the elected
feir +65-6213-0200, Fax: +65-6278-8001 Jenesase Electronics Malaysia Sdn. Bhd. Jnit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia eir +60-3-7955-9390, Fax: +60-3-7955-9510 Jenesase Electronics Korea Co., Ltd.	11. 12. (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not	roducts in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoH5 Directive. Renessas Electronics assumes of lability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations. Ihis document may not be reproduced or duplicated, in any form, burdie or in part, without prior wither consents of Renessas Electronics products, or if you have any other inquirits. (1) "Renessa Electronics assues of the if you have any questions regarding the information contained in this document may applicable laws and regulations and also includes its majority-owned subsidiaries. (2) "Renessas Electronics product(s)" means any product developed or manufactured by or for Renessas Electronics. (2) "Renessas Electronics product(s)" means any product developed or manufactured by or for Renessas Electronics. (2) "Renessas Electronics product(s)" means any product developed or manufactured by or for Renessas Electronics. (2) "Renessas Electronics product(s)" means any product developed or manufactured by or for Renessas Electronics. (2) "Renessas Electronics product(s)" means any product developed or manufactured by or for Renessas Electronics. (2) "Renessas Electronics. (2) "Renes
Renesas Electronics Korea Co., Ltd.	11. 12. (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not	roducts in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Reneasa Electronics assumes of lability for damages or losses accurring as a result of your moncompliance with applicable laws and regulations. In the document may not be reproduced or duplicated, in any form, in whole or in part, without prior wither consent of Reneasa Electronics, or if you have any other inquiries. I) "Reneasa Electronics assued if this document may not prior manufactured by or for Reneasa Electronics assumes of the discussion or manufactured by or for Reneasa Electronics. I) "Reneasa Electronics product(s)" means any product developed or manufactured by or for Reneasa Electronics. EXENTING CONTROL (Section Control or Control of Section Control Contro
	11. 12. (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not (Not	noducts 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 of lability for damages or losses accouring as a result of you noncompliance with applicable laws and regulations. In any trans, without prior without constant of Renesas Electronics products, or if you have any other inquiries. In Process Electronics are used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries. In Process Electronics product(s) "reams any product developed or manufactured by or for Renesas Electronics. The product developed or manufactured by or for Renesas Electronics and subsidiaries. In Process Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or manufactured by or for Renesas Electronics and the subsidiaries. The product developed or subsidiaries. The product developed