

## RV1S9160A

R08DS0167EJ0101

Rev.1.01

Mar 06, 2020

HIGH CMR, 15Mbps CMOS OUTPUT, LOW FORWARD-CURRENT( $I_F$ ) 3.3V/5V OPERATION,  
5-PIN SOP PHOTOCOUPLER

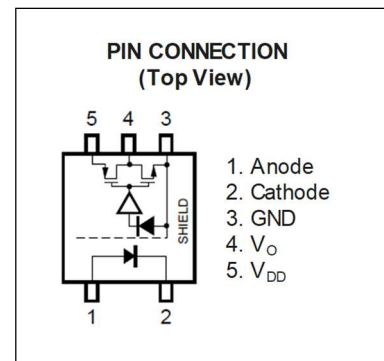
### DESCRIPTION

The RV1S9160A is a photocoupler featuring high-speed switching up to 15Mbps with active low output logic which consist of an AlGaAs LED on the input side and an integrated circuit with a photodiode on the output.

This product enables to low current operation on 3.3V/5V power supply with high noise-tolerant CMR:50kV/us min. and high temperature operation up to  $T_A = 125^\circ\text{C}$  in logic interface circuit.

### FEATURES

- High speed communication (15 Mbps)
- High temperature operation ( $-40$  to  $+125^\circ\text{C}$ )
- High common mode (dv/dt) tolerant ( $CM_H, CM_L = \pm 50 \text{ kV}/\mu\text{s}$  MIN.)
- High isolation voltage ( $BV = 3750 \text{ Vr.m.s.}$ )
- Low input drive current ( $I_{FHL} = 2.0 \text{ mA MAX.}$ )
- Low voltage power supply operation ( $V_{DD} = 2.7 \text{ V} \sim 5.5 \text{ V}$ )
- Low pulse width distortion ( $PWD = 20 \text{ ns MAX.}$ )
- Ordering number of tape product :  
RV1S9160ACCSP-100x#KC0 : 2500 pcs/reel
- Pb free product
- Safety standards approval  
UL : UL1577, Double protection  
CSA : CAN/CSA-C22.2 No.62368-1, Basic insulation  
VDE : DIN EN 60747-5-5 (Option)



### TRUTH TABLE

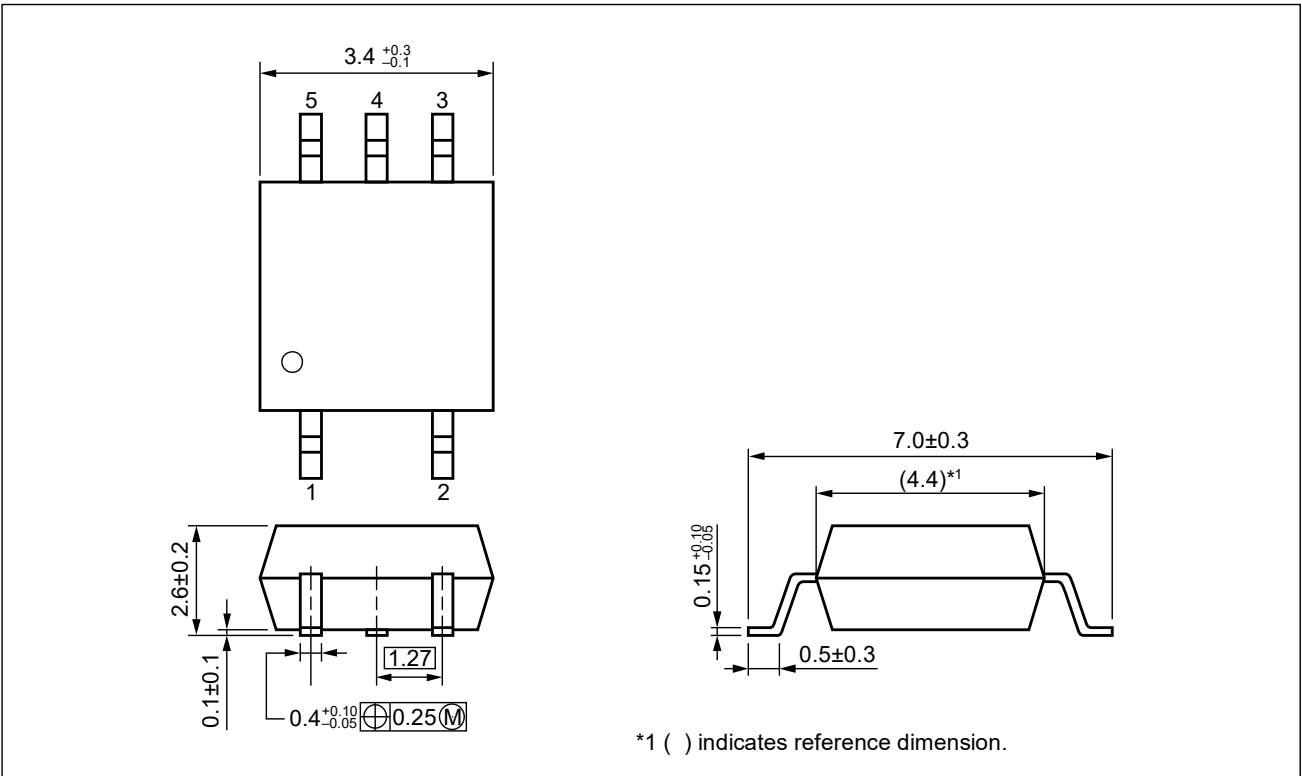
LED	OUTPUT
ON	L
OFF	H

### APPLICATIONS

- Industrial inverter
- AC Servo
- FA Network
- Measurement, Control Equipment

Start of mass production  
Jun.2019

PACKAGE DIMENSIONS (UNIT : mm)



Weight: 0.08g (typ.)

PHOTOCOUPLER CONSTRUCTION

Parameter	MIN.
Air Distance	4.2 mm
Creepage Distance	4.2 mm
Isolation Distance	0.2 mm

MARKING EXAMPLE

9160  
N131  
®

← Type Number \*)  
← Assembly Lot  
← Bar : Pb-Free

No. 1 pin Mark  
Initial of Renesas  
(Engraved R)

N 1 31  
Rank Code  
Year Assembled (Last 1 Digit)  
Week Assembled

\*Applicable type numbers are listed below.  
\*) RV1S9160ACCSP-100x  
Marking type number. "RV1S" and "ACCSP-100x" are omitted from original type number.

ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>
RV1S9160ACCSP-100C	RV1S9160ACCSP-100C#SC0	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL, CSA approved)	RV1S9160A
	RV1S9160ACCSP-100C#KC0		Embossed Tape 2 500 pcs/reel		
RV1S9160ACCSP-100V	RV1S9160ACCSP-100V#SC0		20 pcs (Tape 20 pcs cut)	UL, CSA, DIN EN 60747-5-5 approved	
	RV1S9160ACCSP-100V#KC0		Embossed Tape 2 500 pcs/reel		

Notes: \*1. For the application of the Safety Standard, following part number should be used.

ABSOLUTELY MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current <sup>*1</sup>	I <sub>F</sub>	20	mA
	Reverse Voltage	V <sub>R</sub>	5	V
Detector	Supply Voltage	V <sub>DD</sub>	6	V
	Output Voltage	V <sub>O</sub>	6	V
	Output Current	I <sub>O</sub>	10	mA
	Power Dissipation <sup>*2</sup>	P <sub>C</sub>	200	mW
Isolation Voltage <sup>*3</sup>		BV	3 750	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-40 to +125	°C
Storage Temperature		T <sub>stg</sub>	-55 to +150	°C

Notes: 1. Reduced to 0.93 mA/°C at T<sub>A</sub> = 110°C or more  
 2. Reduced to 4.57 mW/°C at T<sub>A</sub> = 90°C or more  
 3. AC Voltage for 1minute at T<sub>A</sub> = 25°C, RH = 60% between input and output.  
 Pins 1-2 shorted together, 3-5 shorted together.

## RECOMMENDED OPERATING CONDITIONS

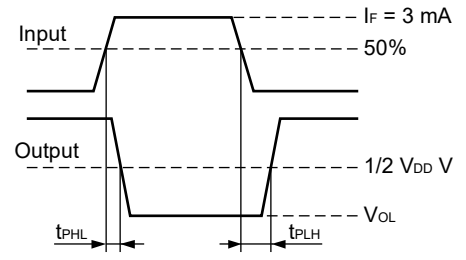
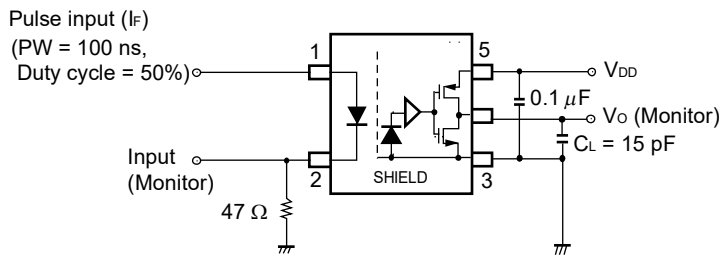
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Low Level forward voltage	$V_{FL}$	0		0.8	V
High Level Forward Current	$I_{FH}$	3		6	mA
Supply Voltage	$V_{DD}$	2.7		5.5	V

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = - 40 to +125°C, V<sub>DD</sub> = 2.7 to 5.5 V, unless otherwise specified)

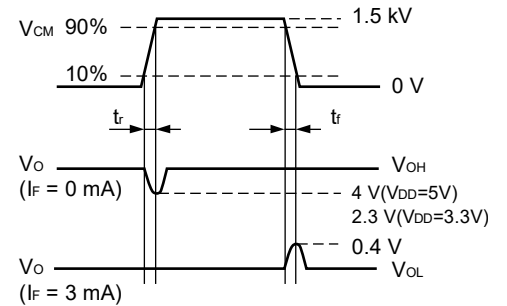
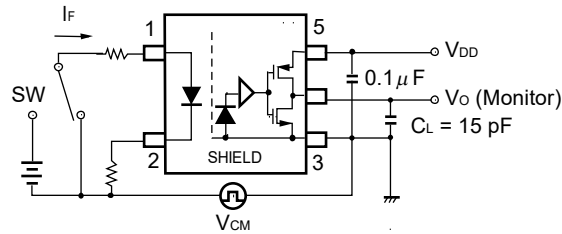
Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit	
Diode	Forward Voltage	$V_F$	$I_F = 6 \text{ mA}$ , T <sub>A</sub> = 25°C	1.4	1.55	1.7	V	
	Reverse Current	$I_R$	$V_R = 3 \text{ V}$ , T <sub>A</sub> = 25°C			10	μA	
	Terminal Capacitance	$C_t$	$V_F = 0 \text{ V}$ , f = 1 MHz, T <sub>A</sub> = 25°C		30		pF	
Detector	High Level Output Current	$I_{DDH}$	$I_F = 0 \text{ mA}$		1.1	2	mA	
	Low Level Output Current	$I_{DDL}$	$I_F = 3 \text{ mA}$		1.0	2		
	High Level Output Voltage	$V_{OH}$	$I_O = -3.2 \text{ mA}$ , $I_F = 0 \text{ mA}$	$V_{DD-1.0}$	$V_{DD}$		V	
			$I_O = -20 \text{ μA}$ , $I_F = 0 \text{ mA}$	$V_{DD-0.1}$	$V_{DD}$			
	Low Level Output Voltage	$V_{OL}$	$I_O = 3.2 \text{ mA}$ , $I_F = 3 \text{ mA}$		0.13	0.4		
$I_O = 20 \text{ μA}$ , $I_F = 3 \text{ mA}$				0.001	0.1			
Coupled	Threshold Input Voltage (H to L)	$I_{FHL}$	$V_O < 0.4 \text{ V}$		1.0	2.0	mA	
	Isolation Resistance	$R_{I-O}$	$V_{I-O} = 1 \text{ kV}_{DC}$ , RH = 40 to 60%, T <sub>A</sub> = 25°C	10 <sup>11</sup>			Ω	
	Isolation Capacitance	$C_{I-O}$	$V = 0 \text{ V}$ , f = 1 MHz, T <sub>A</sub> = 25°C		0.5		pF	
	Propagation Delay Time (H to L) <sup>2</sup>	$t_{PHL}$	$I_F = 3 \text{ mA} \leftrightarrow 0 \text{ mA}$ $V_{DD} = 3.3 \text{ V}, 5 \text{ V}$ $C_L = 15 \text{ pF}$		40	60	ns	
	Propagation Delay Time (L to H) <sup>2</sup>	$t_{PLH}$			38	60		
	Pulse Width Distortion <sup>2</sup>	PWD			2	20		
	Propagation Delay Skew	$t_{PSK}$				25		
	Rise Time	$t_r$			5			
	Fall Time	$t_f$			5			
	Common Mode Transient Immunity at High Level Output <sup>3</sup>	$ CM_H $		$I_F = 0 \text{ mA}$ , $V_O > 4 \text{ V}$ ( $V_{DD} = 5 \text{ V}$ ), $V_O > 2.3 \text{ V}$ ( $V_{DD} = 3.3 \text{ V}$ ), $V_{CM} = 1.5 \text{ kV}$ , T <sub>A</sub> = 25°C	50	60		
Common Mode Transient Immunity at Low Level Output <sup>3</sup>	$ CM_L $	$I_F = 3 \text{ mA}$ , $V_O < 0.4 \text{ V}$ ( $V_{DD} = 3.3 \text{ V}, 5 \text{ V}$ ), $V_{CM} = 1.5 \text{ kV}$ , T <sub>A</sub> = 25°C		50	60			

- Note2: 1. Typical values at  $T_A = 25^\circ\text{C}$   
 2. Test circuit for propagation delay time measurement



**Remark**  $C_L$  includes probe and stray wiring capacitance.

3. Test circuit for common mode transient immunity measurement

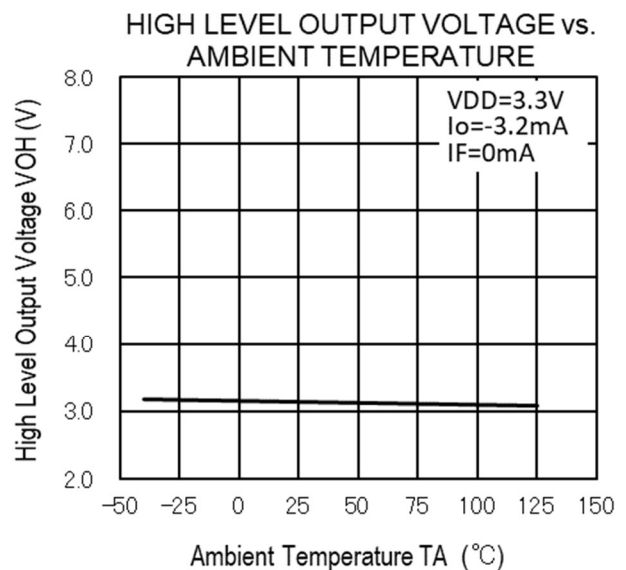
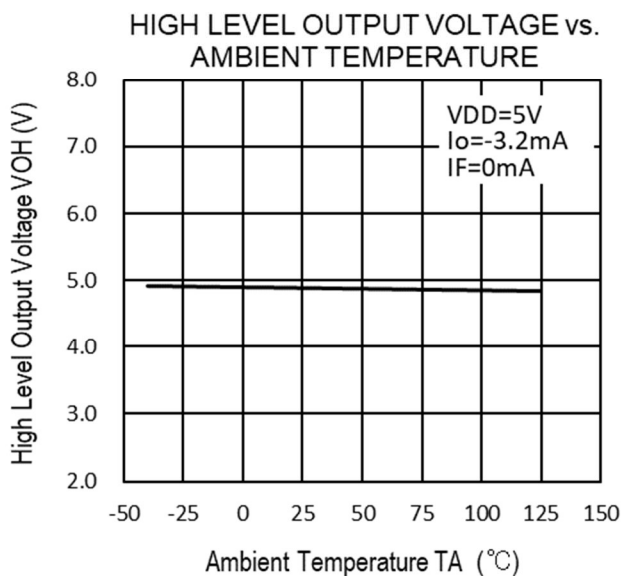
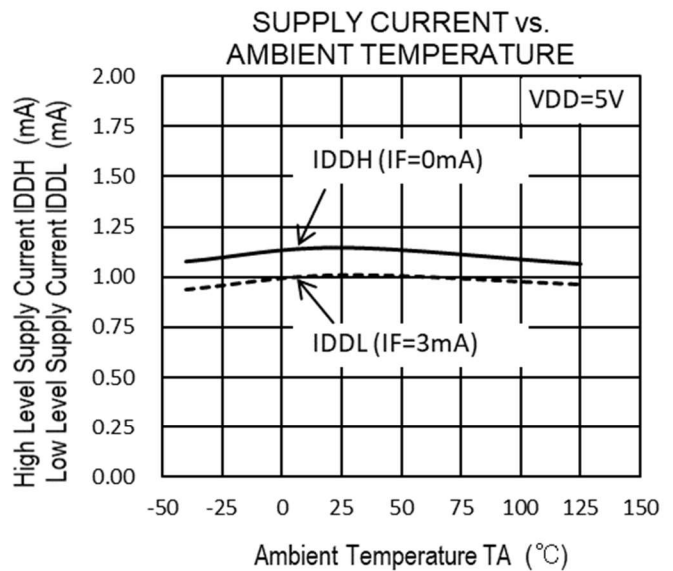
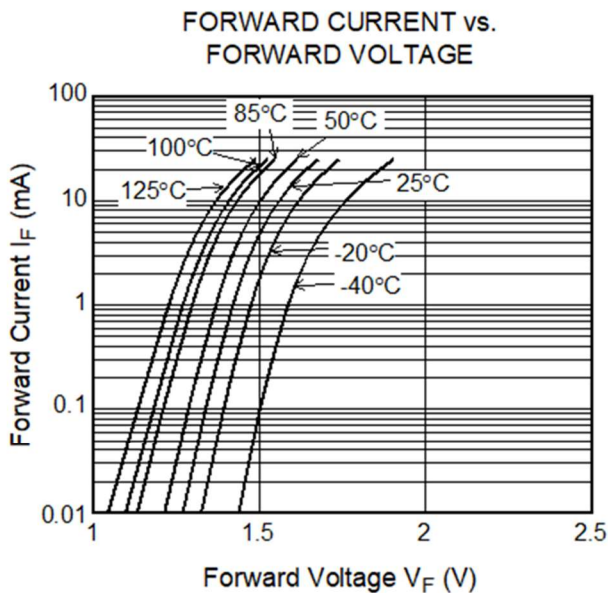
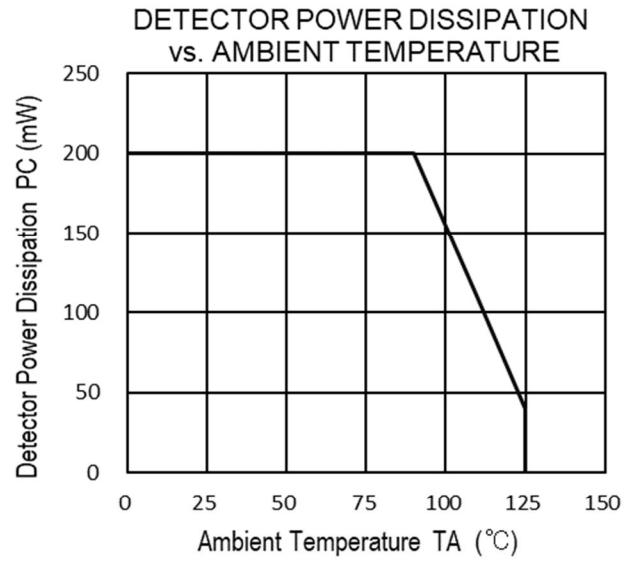
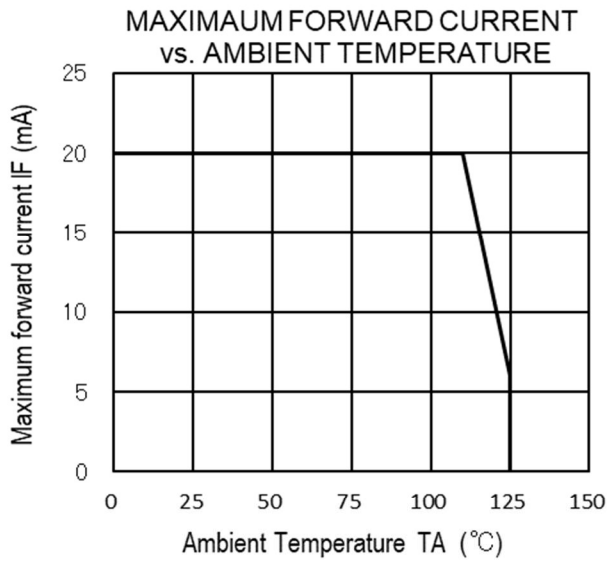


**Remark**  $C_L$  includes probe and stray wiring capacitance.

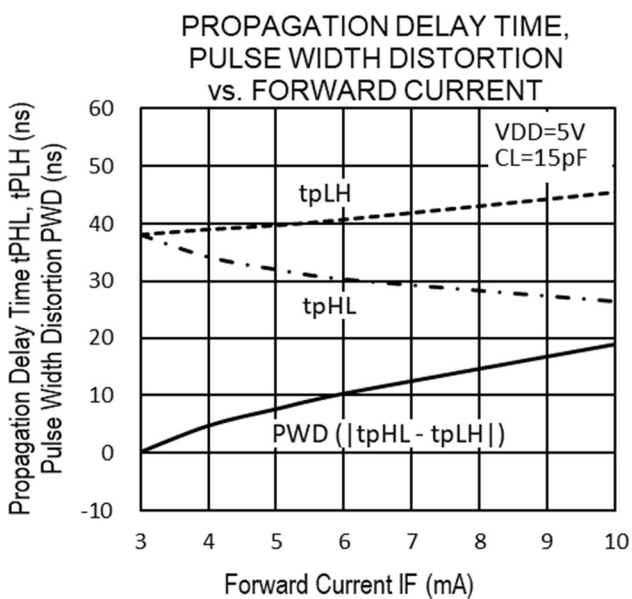
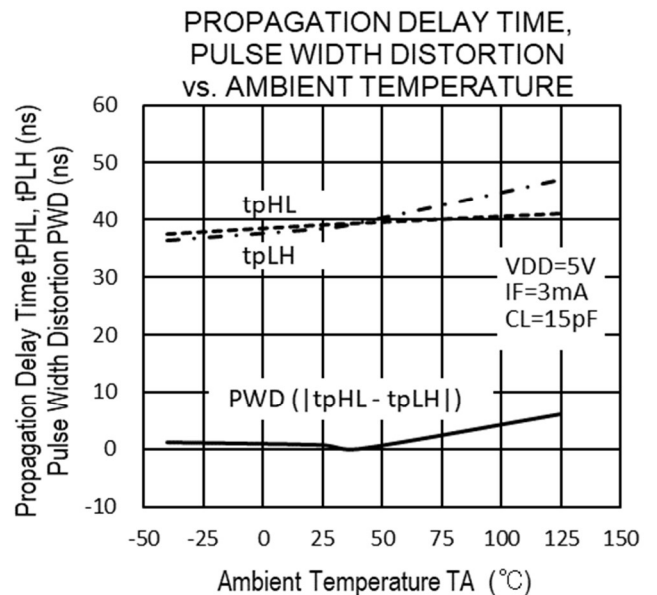
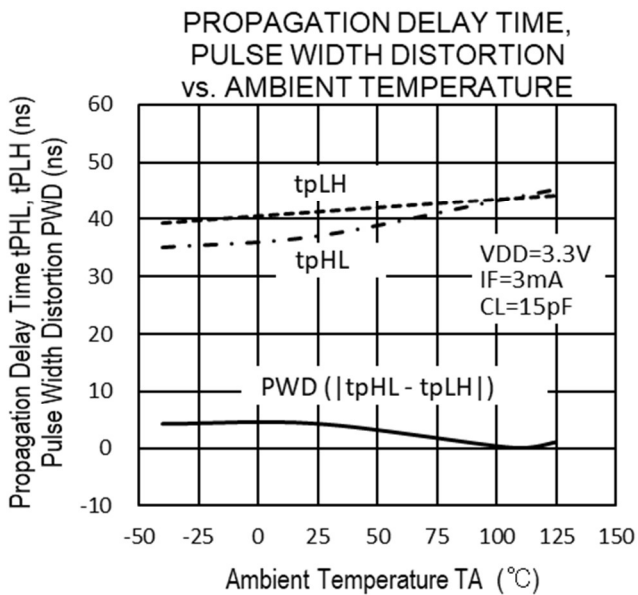
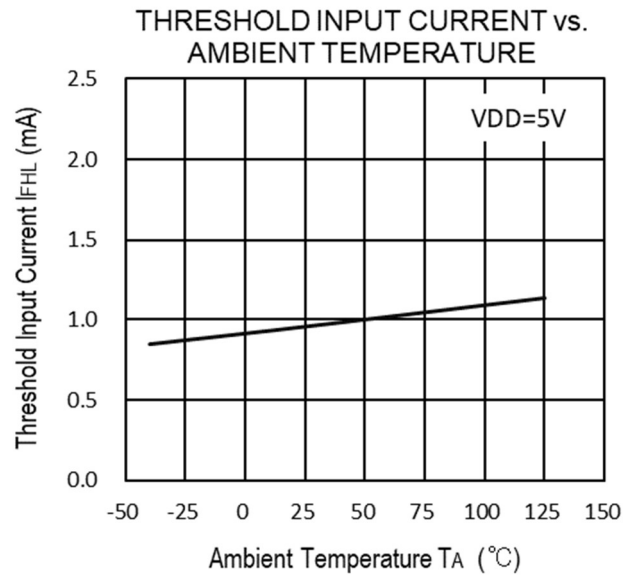
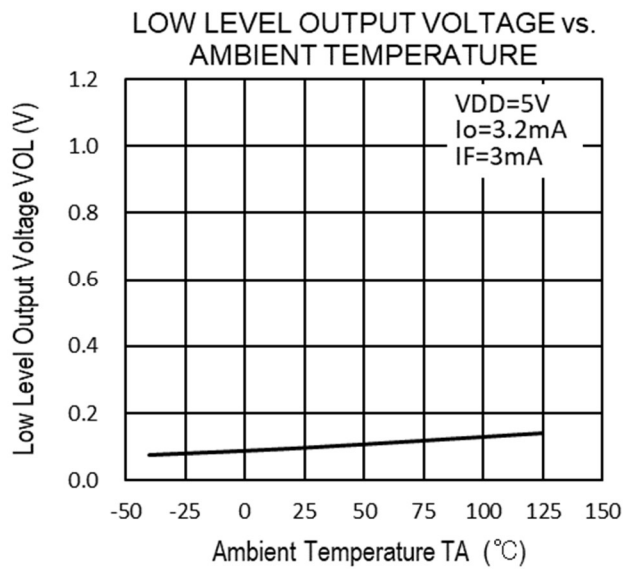
**USAGE CAUTIONS**

1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1  $\mu\text{F}$  is used between  $V_{DD}$  and GND near device. Also, ensure that the distance between the leads of the photocopier and capacitor is no more than 10 mm.
3. Avoid storage at a high temperature and high humidity.

TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C, unless otherwise specified)



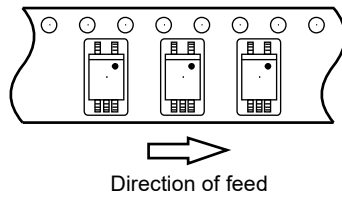
Remark The graphs indicate nominal characteristics.



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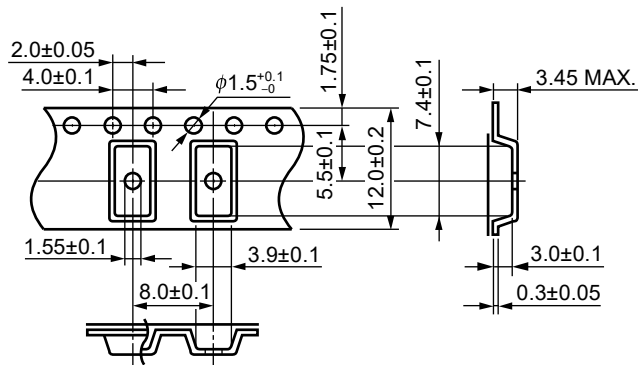
TAPING SPECIFICATIONS (UNIT : mm)

Taping Direction



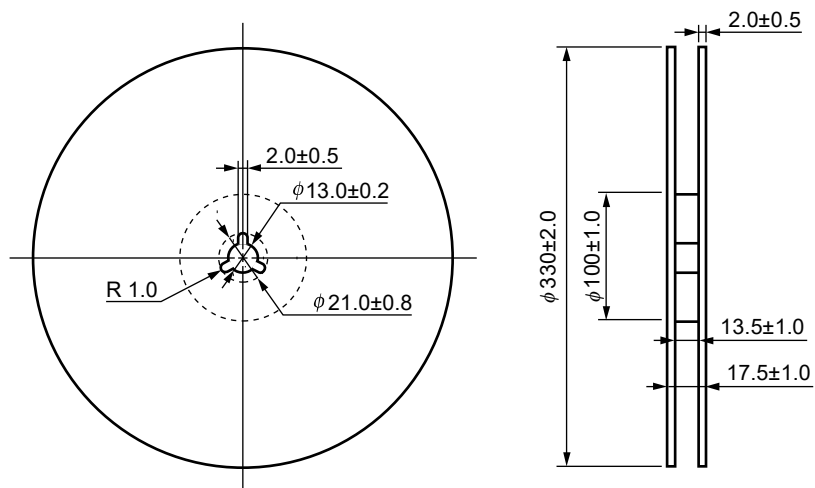
Outline and Dimensions (Tape)

Unit: mm



Outline and Dimensions (Reel)

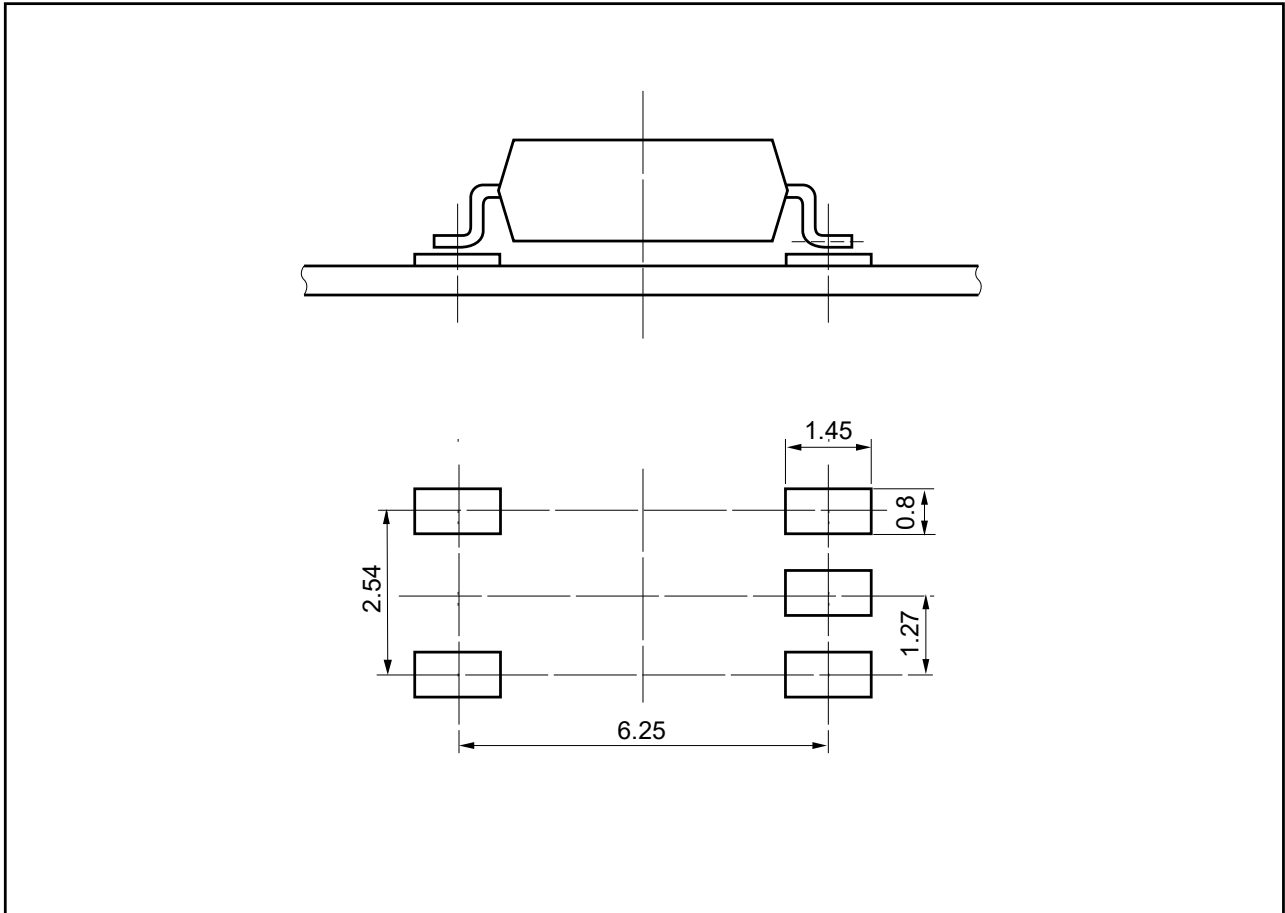
Unit: mm



Packing: 2 500 pcs/reel



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT : mm)



Remark All dimensions in this figure must be evaluated before use.

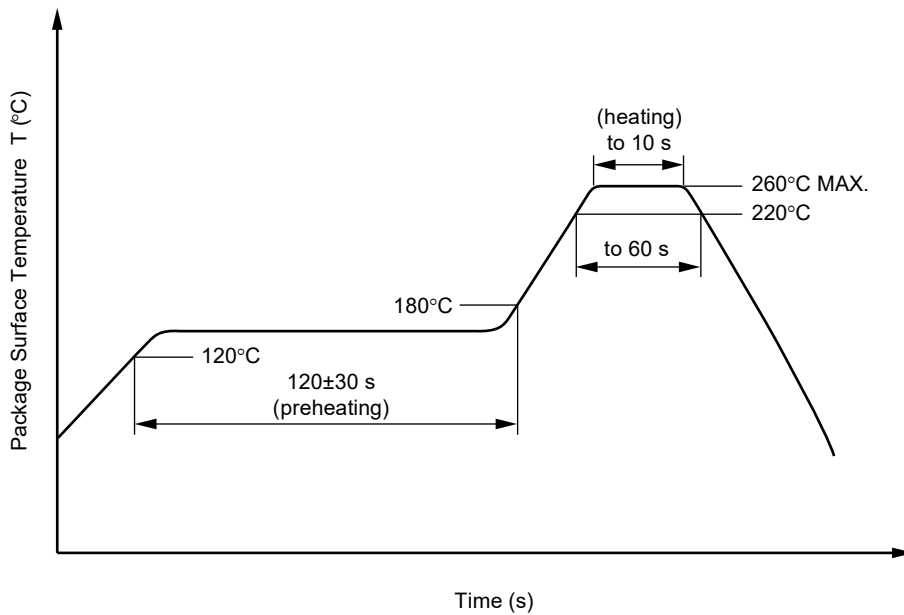
## NOTES ON HANDLING

### 1. Recommended soldering conditions

#### (1) Infrared reflow soldering

- Peak reflow temperature 260°C or below (package surface temperature)
- Time of peak reflow temperature 10 seconds or less
- Time of temperature higher than 220°C 60 seconds or less
- Time to preheat temperature from 120 to 180°C 120±30 s
- Number of reflows Three
- Flux Rosin flux containing small amount of chlorine  
(The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

Recommended Temperature Profile of Infrared Reflow



#### (2) Wave soldering

- Temperature 260°C or below (molten solder temperature)
- Time 10 seconds or less
- Preheating conditions 120°C or below (package surface temperature)
- Number of times One (Allowed to be dipped in solder including plastic mold portion.)
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

#### (3) Soldering by Soldering Iron

- Peak Temperature (lead part temperature) 350°C or below
- Time (each pins) 3 seconds or less
- Flux Rosin flux containing small amount of chlorine  
(The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

- (a) Soldering of leads should be made at the point 1.5 to 2.0 mm from the root of the lead
- (b) Please be sure that the temperature of the package would not be heated over 100°C

#### (4) Cautions

- Flux Cleaning  
Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
- Do not use adhesives or coating materials including halogens to fix this device.

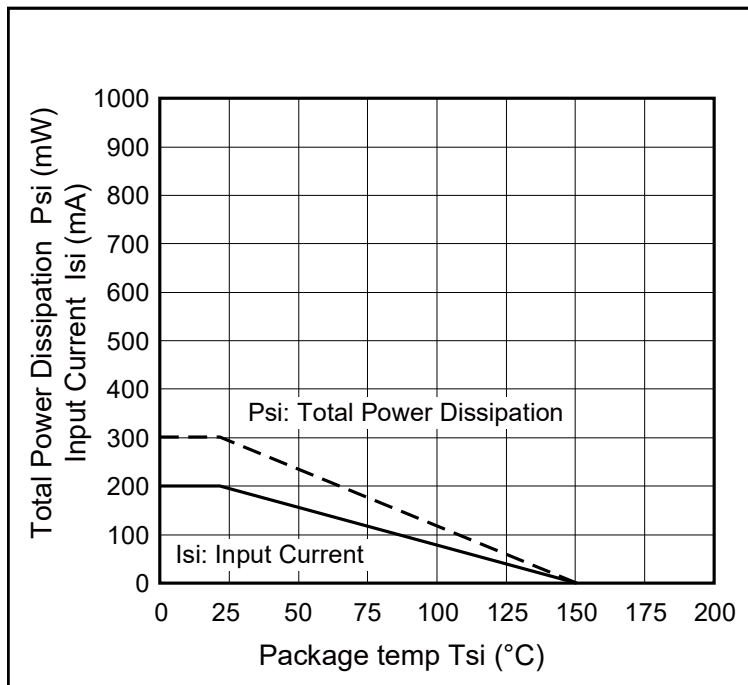
### 2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output or between V<sub>DD</sub>-GND at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

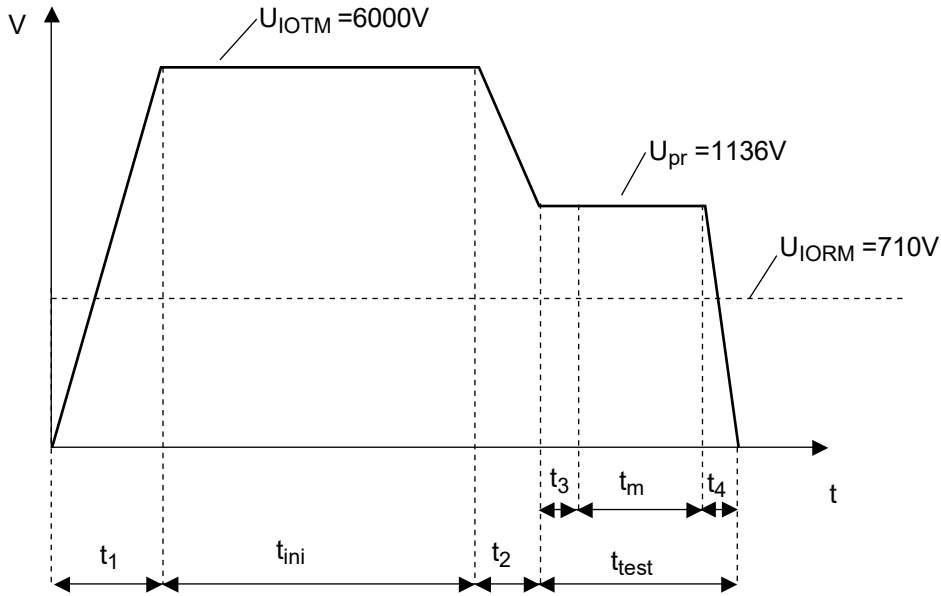
**SPECIFICATION OF VDE MARKS LICENSE DOCUMENT**

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/125/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	710 1 136	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{pr}$	1 331	$V_{peak}$
Highest permissible overvoltage	$U_{IOTM}$	6 000	$V_{peak}$
Degree of pollution (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303-11))	CTI	400	
Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		II	
Storage temperature range	$T_{stg}$	- 55 to +150	°C
Operating temperature range	$T_A$	-40 to +125	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	Ris MIN. Ris MIN.	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Package temperature Current (input current $I_F$ , $P_{si} = 0$ ) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	$T_{si}$ $I_{si}$ $P_{si}$ Ris MIN.	150 200 300 $10^9$	°C mA mW $\Omega$

**Dependence of maximum safety ratings with package temperature**

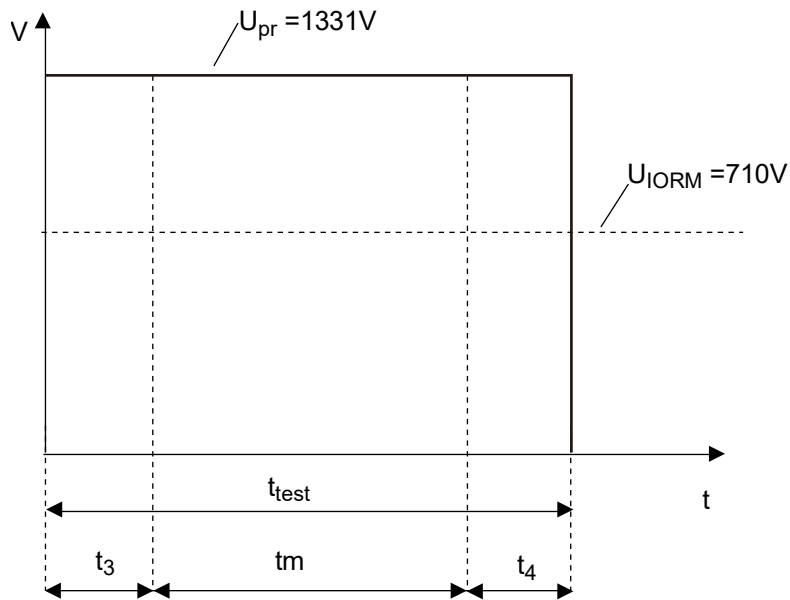


**Method a) Destructive Test, Type and Sample Test**



$t_1, t_2 = 1 \text{ to } 10 \text{ sec}$   
 $t_3, t_4 = 1 \text{ sec}$   
 $t_m(\text{PARTIAL DISCHARGE}) = 10 \text{ sec}$   
 $t_{test} = 12 \text{ sec}$   
 $t_{ini} = 60 \text{ sec}$

**Method b) Non-destructive Test, 100% Production Test**



$t_3, t_4 = 0.1 \text{ sec}$   
 $t_m(\text{PARTIAL DISCHARGE}) = 1.0 \text{ sec}$   
 $t_{test} = 1.2 \text{ sec}$

<b>Caution</b> GaAs Products	<p>This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.</p> <ul style="list-style-type: none"><li>• Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below.<ol style="list-style-type: none"><li>1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials.</li><li>2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal.</li></ol></li><li>• Do not burn, destroy, cut, crush, or chemically dissolve the product.</li><li>• Do not lick the product or in any way allow it to enter the mouth.</li></ul>
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(Rev.4.0-1 November 2017)



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**Renesas Electronics Corporation**  
TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

**Renesas Electronics America Inc.**  
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.  
Tel: +1-408-432-8888, Fax: +1-408-434-5351

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

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

**Renesas Electronics (China) Co., Ltd.**  
Room 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, China  
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

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

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

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

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

**Renesas Electronics Malaysia Sdn.Bhd.**  
Unit No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia  
Tel: +60-3-5022-1288, Fax: +60-3-5022-1290

**Renesas Electronics India Pvt. Ltd.**  
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India  
Tel: +91-80-67208700

**Renesas Electronics Korea Co., Ltd.**  
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea  
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