

RV1S9209A

R08DS0218EJ0100

Rev.1.00

Mar 29,2021

LOW FORWARD-CURRENT(IF) TOTEM POLE OUTPUT TYPE HIGH CMR, IPM DRIVER,
5-PIN SSOP WITH 8.2mm CREEPAGE DISTANCE (LSSO5) PHOTOCOUPLER

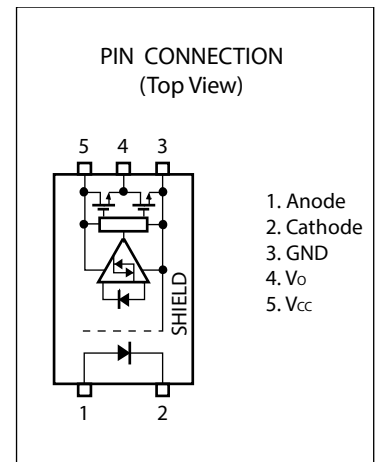
DESCRIPTION

The RV1S9209A is an optical coupled high-speed, totem pole output (active high output type) isolator containing an AlGaAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

The RV1S9209A is specified high CMR and pulse width distortion with operating temperature. It is suitable for IPM (Intelligent Power Module) drive.

FEATURES

- Small and long creepage (8.2 mm MIN, LSSO5)
- Totem pole output (Active High Output Type)
- Pulse width distortion ($|t_{PLH} - t_{PHL}| = 80 \text{ ns MAX.}$)
- High common mode transient immunity ($CM_H, CM_L = \pm 50 \text{ kV}/\mu\text{s MIN.}$)
- Operating Ambient Temperature ($125 \text{ }^\circ\text{C MAX.}$)
- High isolation voltage ($BV = 5\,000 \text{ Vr.m.s.}$)
- Embossed tape product : RV1S9209ACCSP-10Yx#KC0 : 3 500 pcs/reel
- Pb-Free product
- Safety standard
 - UL : UL1577, Double protection
 - CSA : CAN/CSA-C22.2 No.62368-1, Reinforced insulation
 - VDE : DIN EN 60747-5-5 (Option)



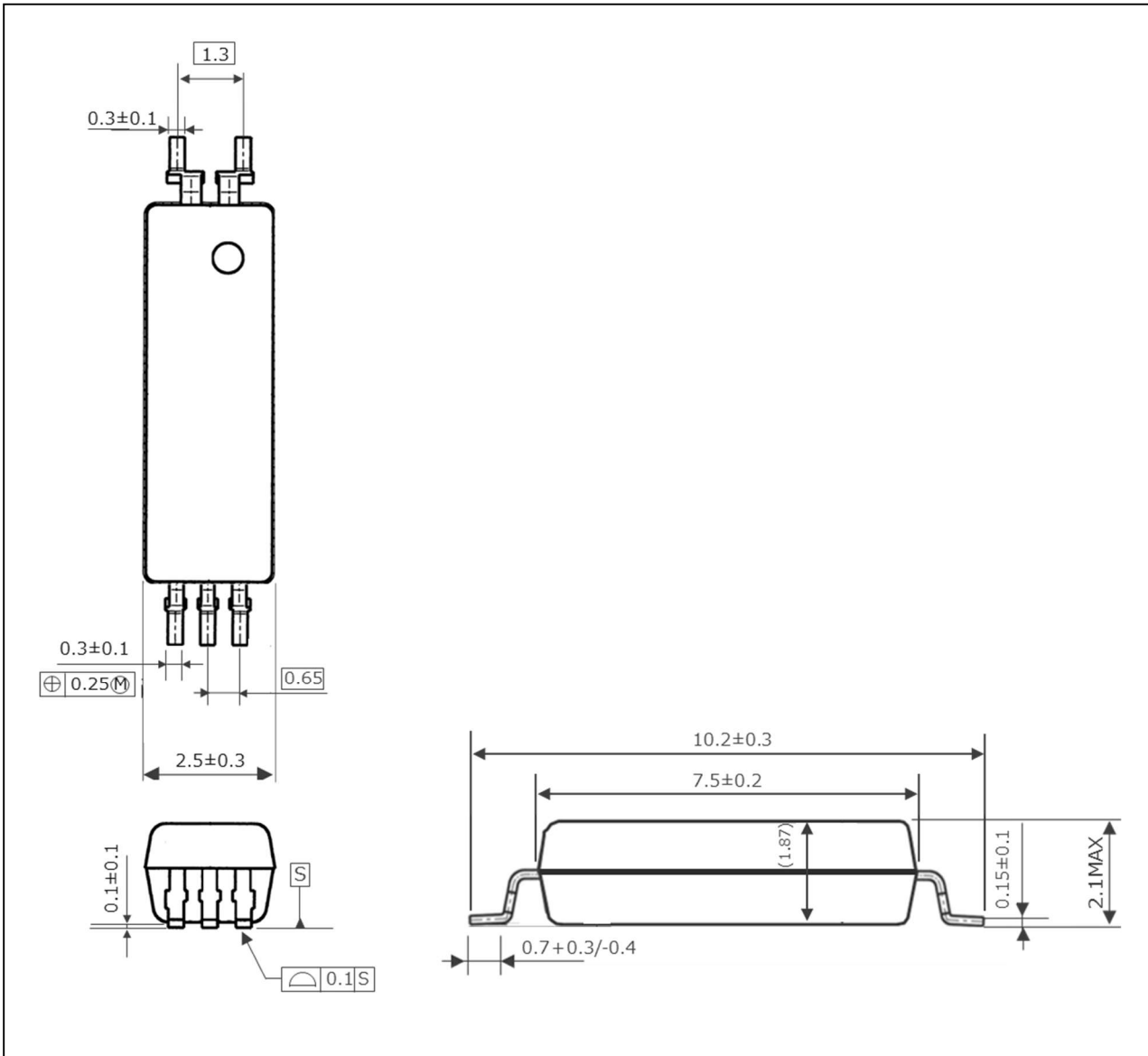
APPLICATIONS

- IPM Driver
- General purpose inverter

Start of mass production

Feb.2021

PACKAGE DIMENSIONS (UNIT : mm)

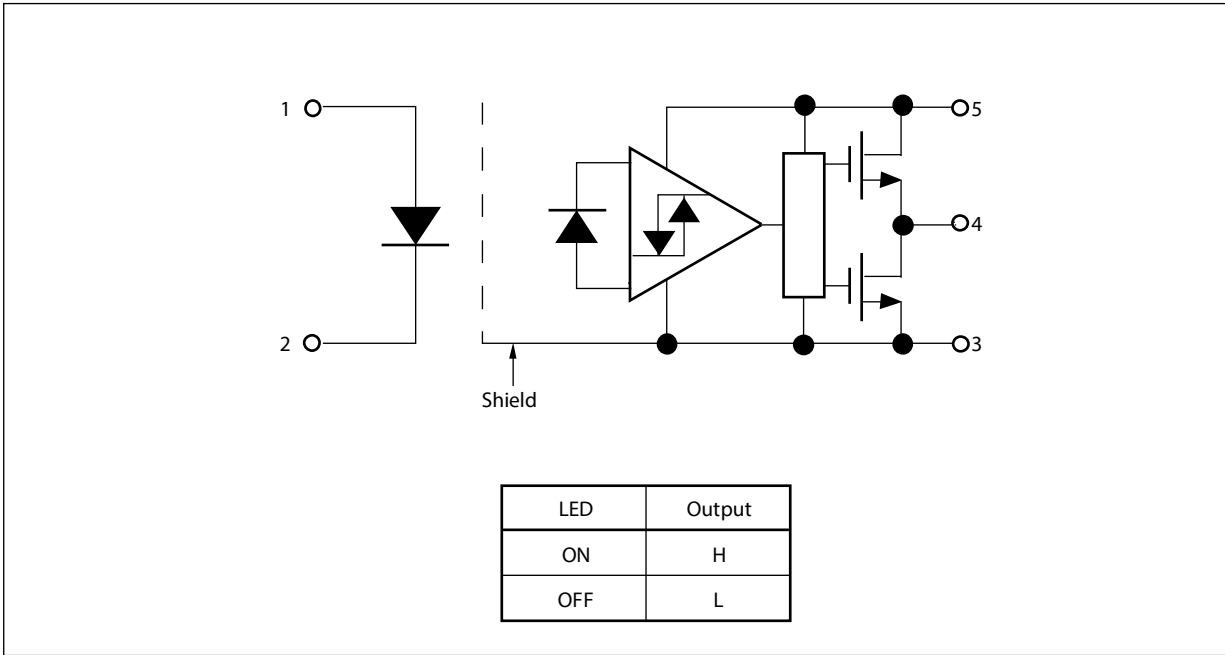


Weight :0.075g (Typ.)

PHOTOCOUPLER CONSTRUCTION

| Parameter | MIN. |
|--------------------|---------|
| Air Distance | 8.2 mm |
| Creepage Distance | 8.2 mm |
| Isolation Distance | 0.15 mm |

BLOCK DIAGRAM



MARKING EXAMPLE

| | | | |
|------|-----|-------------------------|---------------------------------|
| R | | An initial of "Renesas" | |
| 9209 | | Product Part Number * | |
| ○ | | No.1 pin Mark | |
| N744 | N | Rank Code | |
| | 744 | Assembly Lot | |
| | | 7 | Last one-digit of Assembly Year |
| | | 44 | Weekly Serial Code |

*) Applicable type numbers listed below

RV1S 9209 ACCSP-10Yx

Marking type number. "RV1S" and "ACCSP-10Yx" are omitted from original type number.

ORDERING INFORMATION

| Part Number | Order Number | Solder Plating Specification | Packing Style | Safety Standard Approval | Application Part Number*1 |
|------------------------|----------------------------|---|---------------------------------|--|---------------------------|
| RV1S9209ACCSP -10YC | RV1S9209ACCSP -10YC#SC0 | Pb-Free and Halogen Free (Ni/Pd/Au) | 20 pcs (Tape 20 pcs cut) | Standard products (UL, CSA approved) | RV1S9209A |
| | RV1S9209ACCSP -10YC#KC0 | | Embossed Tape 3 500 pcs/reel | | |
| RV1S9209ACCSP -10YV | RV1S9209ACCSP -10YV#SC0 | | 20 pcs (Tape 20 pcs cut) | UL, CSA, DIN EN 60747-5-5 approved | |
| | RV1S9209ACCSP -10YV#KC0 | | Embossed Tape 3 500 pcs/reel | | |

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

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified)

| Parameter | | Symbol | Ratings | Unit |
|-------------------------------|----------------------------|-----------------------------|--|---------|
| Diode | Forward Current | I_F | 20 | mA |
| | Reverse Voltage | V_R | 5 | V |
| | Power Dissipation Derating | $\Delta P_D/^\circ\text{C}$ | 1.2 ($T_A \geq 110\text{ }^\circ\text{C}$) | mW/°C |
| | Power Dissipation | P_D | 45 | mW |
| Detector | Supply Voltage | V_{CC} | -0.5 to +25 | V |
| | Output Voltage | V_O | -0.5 to +25 | V |
| | Output Current | I_O | 25 | mA |
| | Power Dissipation Derating | $\Delta P_C/^\circ\text{C}$ | 4.0 ($T_A \geq 85\text{ }^\circ\text{C}$) | mW/°C |
| | Power Dissipation | P_C | 250 | mW |
| Isolation Voltage*1 | | BV | 5 000 | Vr.m.s. |
| Operating Ambient Temperature | | T_A | -40 to +125 | °C |
| Storage Temperature | | T_{stg} | -55 to +150 | °C |

Notes: *1. AC voltage for 1 minute at $T_A = 25\text{ }^\circ\text{C}$, RH = 60 % between input and output.

Pins 1-2 shorted together, 3-5 shorted together.

RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------------|--------------|------|------|------|------|
| Supply Voltage | V_{CC} | 4.5 | 15 | 20 | V |
| Forward Current (ON) | $I_{F(ON)}$ | 5 | | 10 | mA |
| Forward Voltage (OFF) | $V_{F(OFF)}$ | 0 | | 0.8 | V |
| Operating Ambient Temperature | T_A | -40 | | 125 | °C |

ELECTRICAL CHARACTERISTICS

(T_A = - 40 to +125 °C, V_{CC} = 4.5 to 20 V, unless otherwise specified)

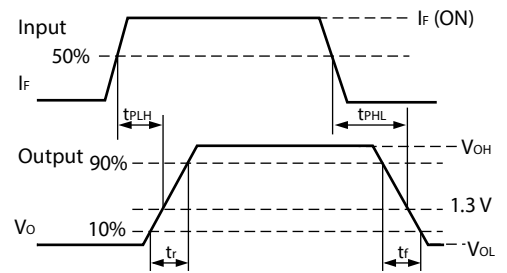
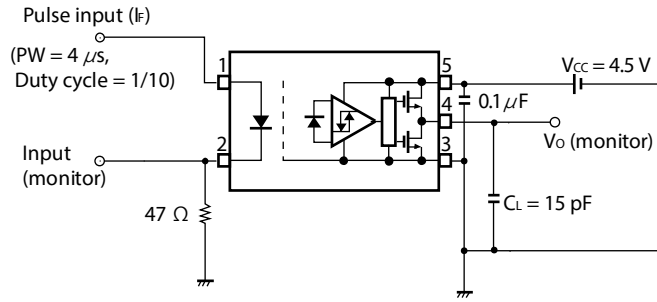
| Parameter | | Symbol | Conditions | MIN. | TYP.*1 | MAX. | Unit |
|--|--|--|--|------------------|--------|------|-------|
| Diode | Forward Voltage | V _F | I _F = 10 mA, T _A = 25 °C | 1.35 | 1.56 | 1.75 | V |
| | Reverse Current | I _R | V _R = 3 V, T _A = 25 °C | | | 10 | μA |
| | Input Capacitance | C _i | V _F = 0 V, f = 1 MHz, T _A = 25 °C | | 30 | | pF |
| Detector | High Level Supply Current | I _{CC} H | V _{CC} = 4.5 V, I _F = 5 mA | | 1.0 | 3 | mA |
| | | | V _{CC} = 20 V, I _F = 5 mA | | 1.6 | 3 | |
| | Low Level Supply Current | I _{CC} L | V _{CC} = 4.5 V, I _F = 0 mA | | 1.2 | 3 | mA |
| | | | V _{CC} = 20 V, I _F = 0 mA | | 1.8 | 3 | |
| | High Level Output Voltage | V _{OH} | V _{CC} = 4.5 V, I _O = -2.6 mA, I _F = 5 mA | 2.7 | 3.1 | | V |
| | | | V _{CC} = 20 V, I _O = -2.6 mA, I _F = 5 mA | 17.4 | 18.6 | | |
| | Low Level Output Voltage *2 | V _{OL} | I _O = 3.5 mA, I _F = 0 mA | | 0.25 | 0.6 | V |
| | High Level Output Short *3 Circuit Current | I _{OSH} | V _{CC} = 4.5 V, V _O = GND, I _F = 5 mA | -7 | -45 | | mA |
| Low Level Output Short *3 Circuit Current | I _{OSL} | V _{CC} = V _O = 4.5 V, V _F = 0 V | 7 | 34 | | mA | |
| Coupled | Threshold Input Current | I _{FLH} | V _{CC} = 4.5 V, V _O > 2.7 V, I _O = -2.6 mA | | 1.6 | 3.8 | mA |
| | Isolation Resistance | R _{I-O} | V _{I-O} = 1kVDC, RH = 60 %, T _A = 25 °C | 10 ¹¹ | | | Ω |
| | Isolation Capacitance | C _{I-O} | V = 0 V, f = 1MHz, T _A = 25 °C | | 0.6 | | pF |
| | Propagation Delay Time (H → L)*4 | t _{PHL} | C _L = 15 pF, I _F = 5 → 0 mA, V _{THHL} = 1.3 V | | 108 | 200 | ns |
| | Propagation Delay Time (L → H)*4 | t _{PLH} | C _L = 15 pF, I _F = 0 → 5 mA, V _{THLH} = 1.3 V | | 121 | 200 | |
| | Pulse Width Distortion (PWD) | t _{PLH} -t _{PHL} | C _L = 15 pF, I _F = 5 ↔ 0 mA | | 13 | 80 | ns |
| | Propagation Delay Difference Between Any Two Parts (PDD) | | | | | 100 | |
| | Rise Time (10-90%)*4 | t _r | C _L = 15 pF, I _F = 0 → 5 mA | | 25 | | ns |
| | Fall Time (90-10%)*4 | t _f | C _L = 15 pF, I _F = 5 → 0 mA | | 5 | | |
| | Common Mode Transient Immunity at High Level Output*5 | CM _H | V _{CC} = 5 V, T _A = 25 °C, I _F = 5 mA, V _{CM} = 1.5 kV | 50 | | | kV/μs |
| | Common Mode Transient Immunity at Low Level Output*5 | CM _L | V _{CC} = 5 V, T _A = 25 °C, I _F = 0 mA, V _{CM} = 1.5 kV | 50 | | | |

Notes: *1. Typical values at T_A = 25 °C

*2. Because V_O of 2.4 V may be output when the LED current is not input and when output supply of V_{CC} = 4.5 V or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

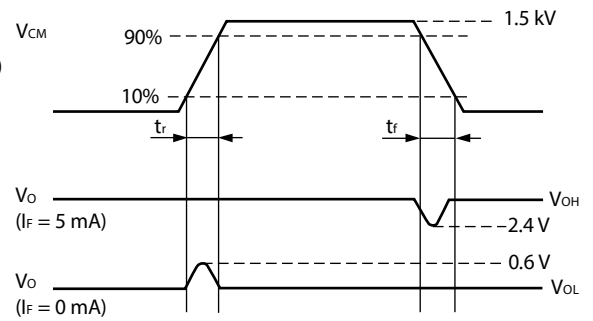
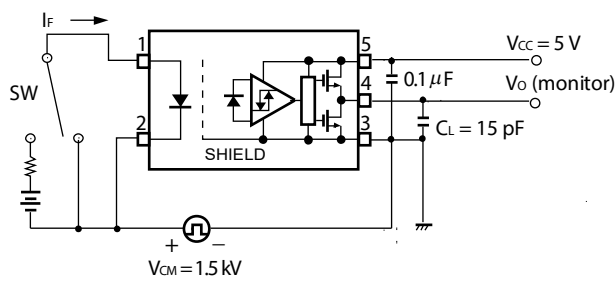
*3. Duration of output short circuit time should not exceed 10 ms.

*4. Test circuit for propagation delay time



Remark CL includes probe and stray wiring capacitance.

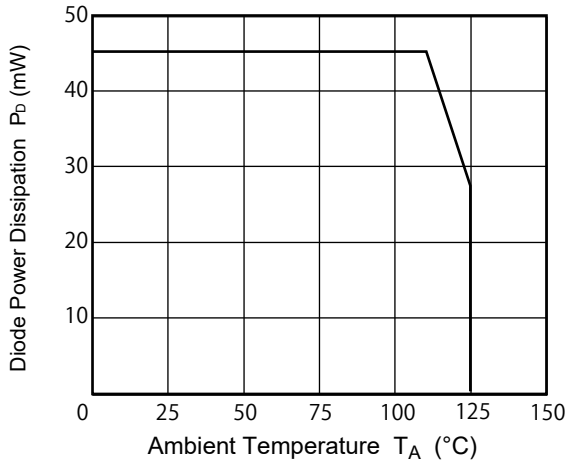
*5. Test circuit for common mode transient immunity



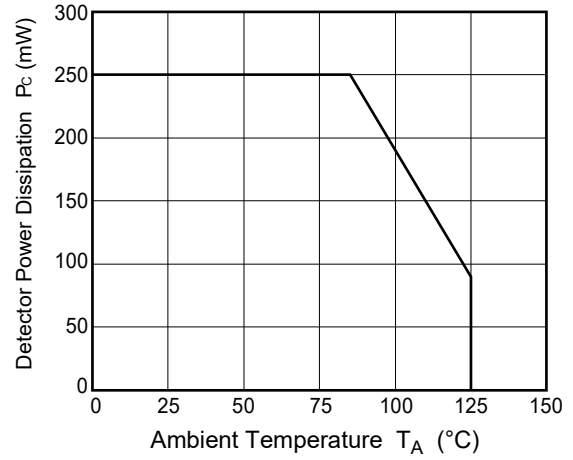
Remark CL includes probe and stray wiring capacitance.

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified)

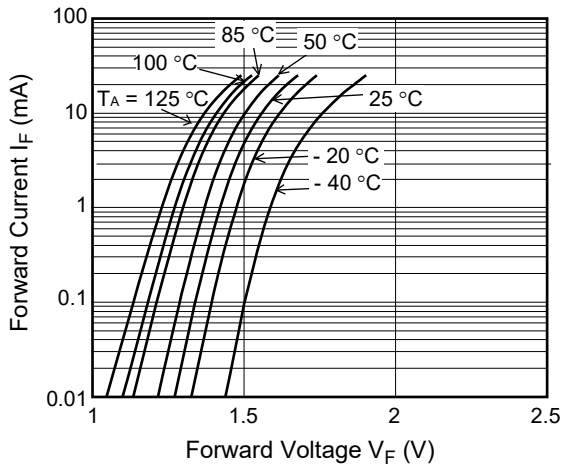
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



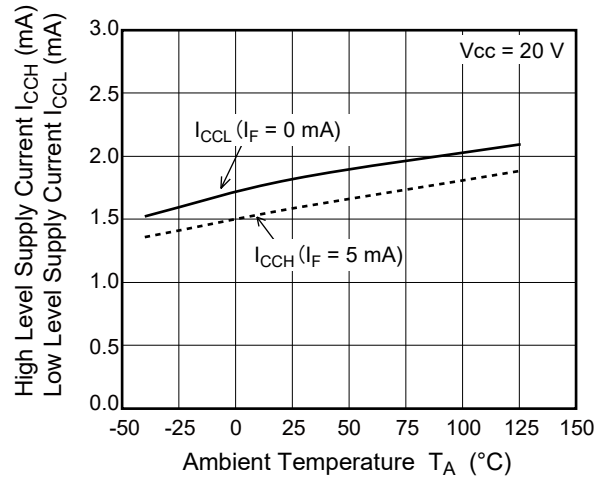
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



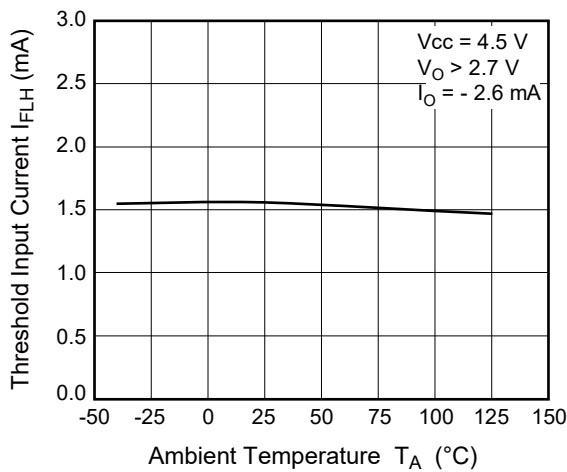
FORWARD CURRENT vs. FORWARD VOLTAGE



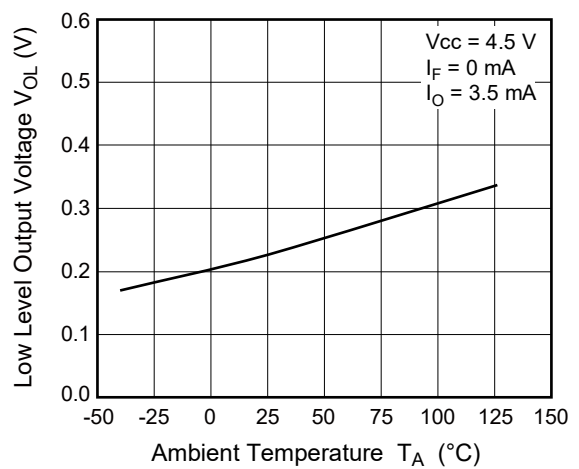
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE

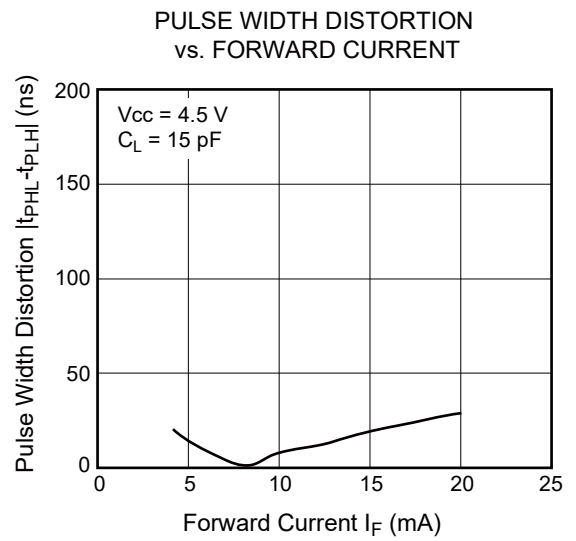
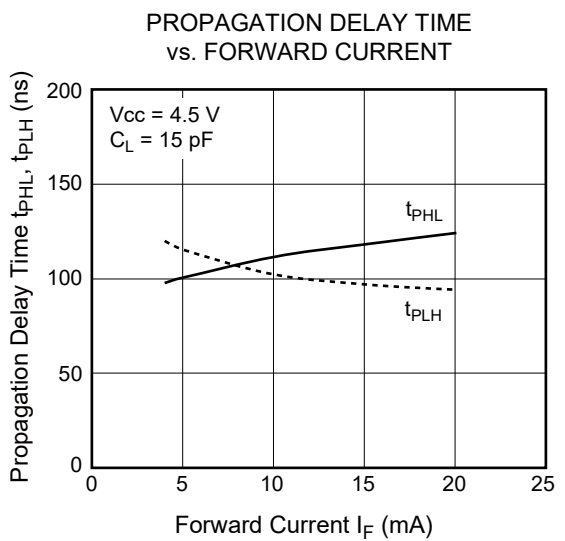
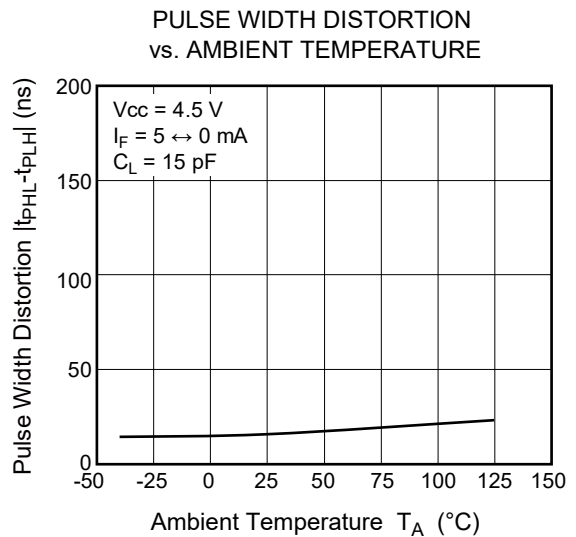
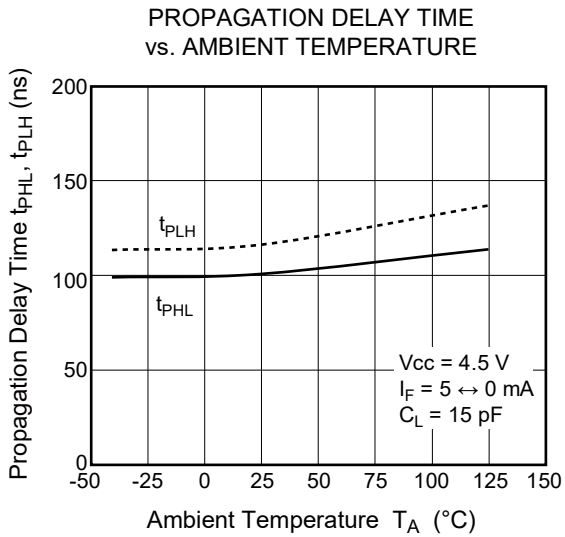
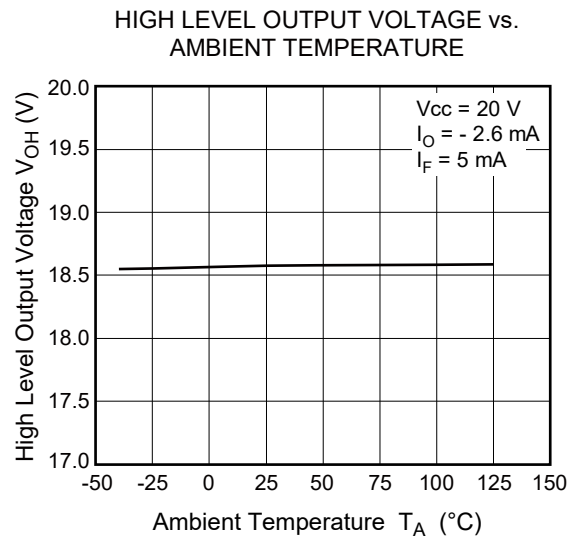
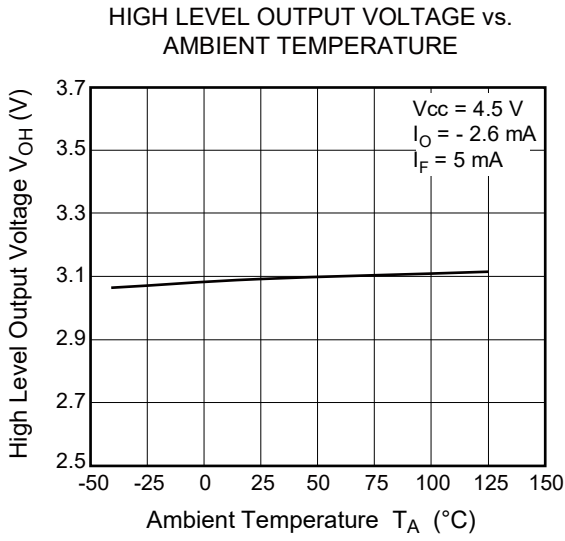


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



Remark The graphs indicate nominal characteristics.

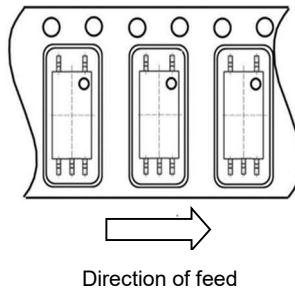
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified)



Remark The graphs indicate nominal characteristics.

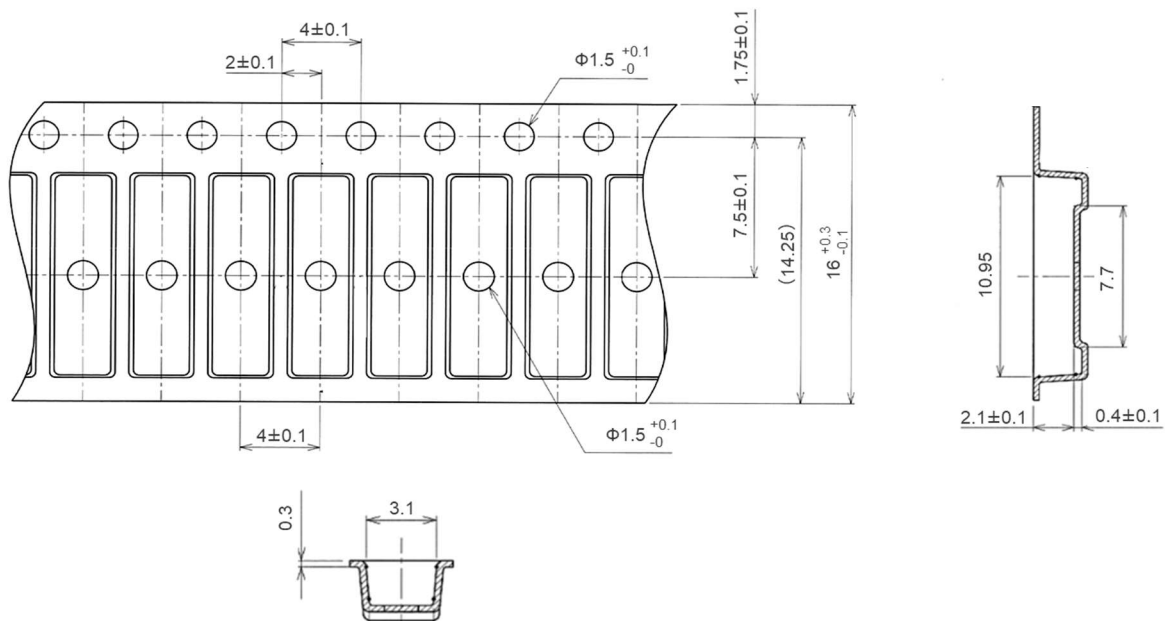
TAPING SPECIFICATIONS (UNIT : mm)

Taping Direction



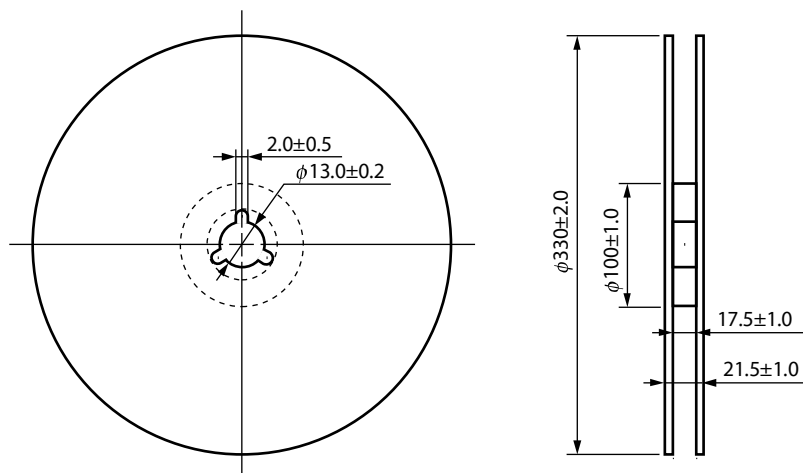
Outline and Dimensions (Tape)

Unit: mm



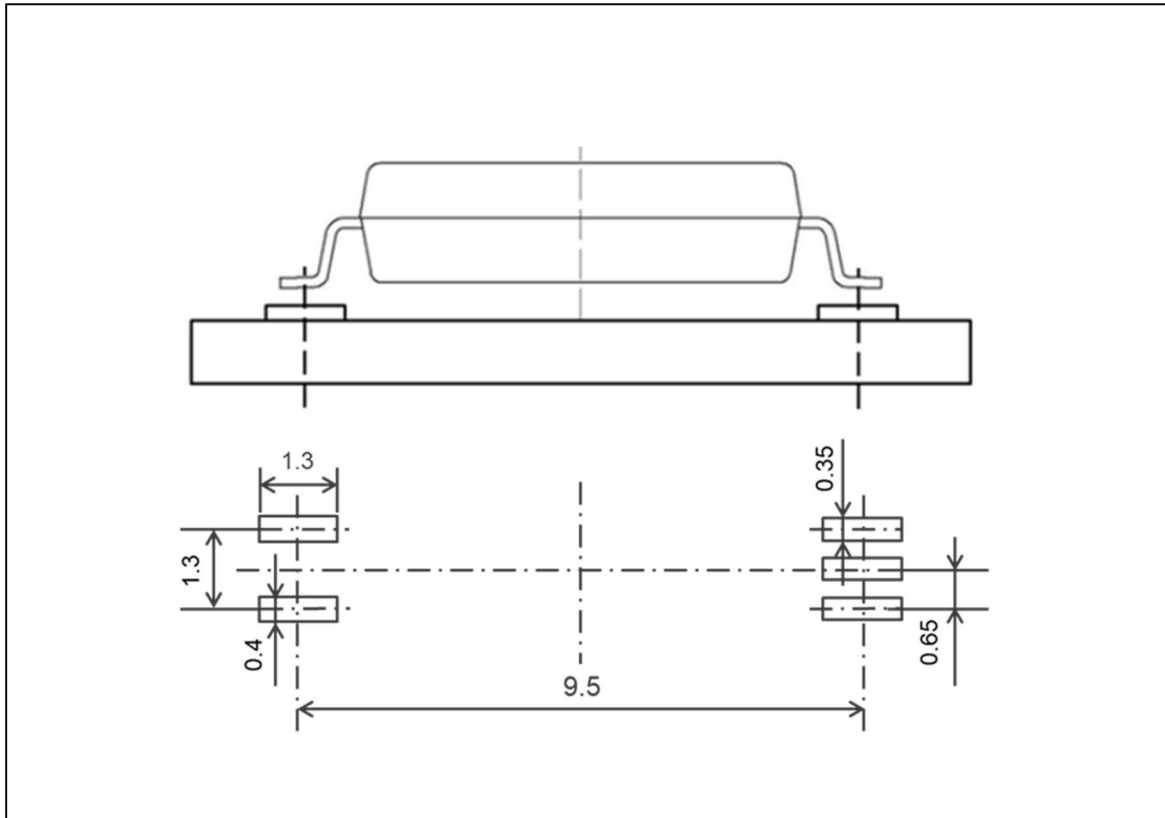
Outline and Dimensions (Reel)

Unit: mm



Packing: 3 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT : mm)



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

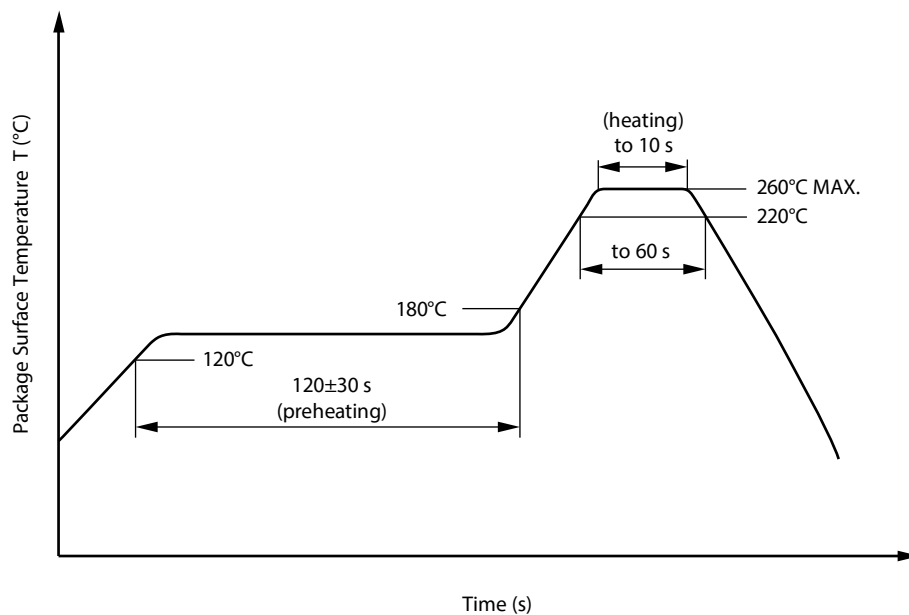
NOTES ON HANDLING

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 fixing agents or coatings containing halogen-based substances.

2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

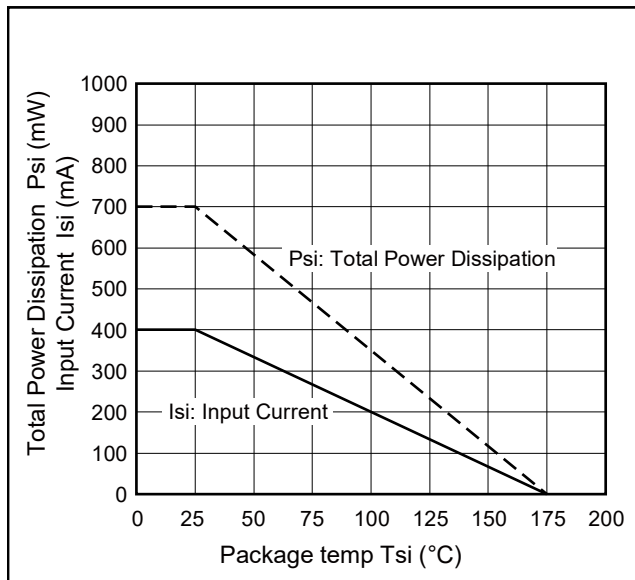
USAGE CAUTIONS

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 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Avoid storage at a high temperature and high humidity.

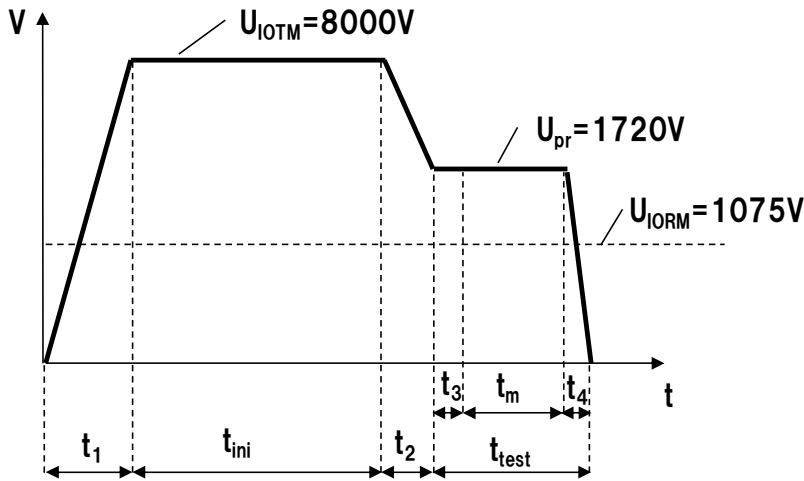
SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

| 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} | 1 075 1 720 | 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} | 2 016 | V_{peak} |
| Highest permissible overvoltage | U_{IOTM} | 8 000 | 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~+150 | °C |
| Operating temperature range | T_A | -40~+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} | Ω Ω |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Package temperature Current (input current I_F , $\Psi_i = 0$) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$ | T_{si} I_{si} Ψ_i Ris MIN. | 175 400 700 10^9 | °C mA mW Ω |

Dependence of maximum safety ratings with package temperature

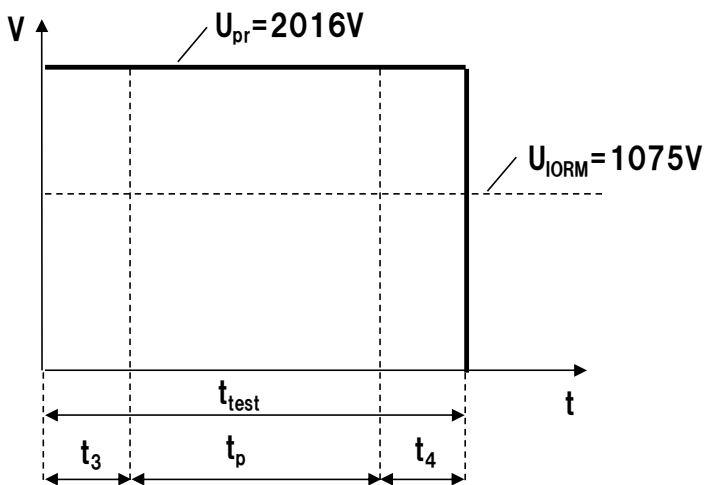


Method a) Destructive Test, Type and Sample Test



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

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



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

| | | |
|----------------|---------------|--|
| Caution | 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">• 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">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.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.• Do not burn, destroy, cut, crush, or chemically dissolve the product.• Do not lick the product or in any way allow it to enter the mouth. |
|----------------|---------------|--|

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

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