# RV1S9060A

R08DS0168EJ0100
Rev.1.00
Jun 4, 2019

HIGH CMR, 15Mbps CMOS OUTPUT, LOW FORWARD-CURRENT(IF) 3.3V/5V OPERATION, 5-PIN with 8mm creepage distance package LSO5 PHOTOCOUPLER

## DESCRIPTION

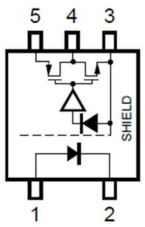
The RV1S9060A is a photocoupler featuring high-speed switching up to 15Mbps with active low output logic which consist of an AlGaAs LED on the input side and an integrated circuit with a photodiode on the output.

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 Ta=125°C in logic interface circuit.

## FEATURES

- Long creepage distance (8 mm MIN)
- High speed communication (15 Mbps)
- High temperature operation (-40 to +125°C)
- High common mode (dv/dt) tolerant ($CM_H$, $CM_L$ = ±50 kV/$\mu$s MIN.)
- High isolation voltage (BV = 5000 Vr.m.s.)
- Low input drive current (IFHL = 2.2 mA MAX.)
- Low voltage power supply operation (VDD = 2.7 V~5.5 V)
- Low pulse width distortion (PWD = 20 ns MAX.)
- Ordering number of tape product :
  RV1S9060ACCSP-10Yx#KC0 : 3000pcs/reel
- Pb free product
- Safety standards approval
  UL : UL1577, Double protection
  CSA : CAN/CSA-C22.2 No.62368-1, Reinforced insulation
  VDE : DIN EN 60747-5-5 (Option)

PIN CONNECTION
(Top View)




1. Anode
2. Cathode
3. GND
4. $V_O$
5. $V_{DD}$

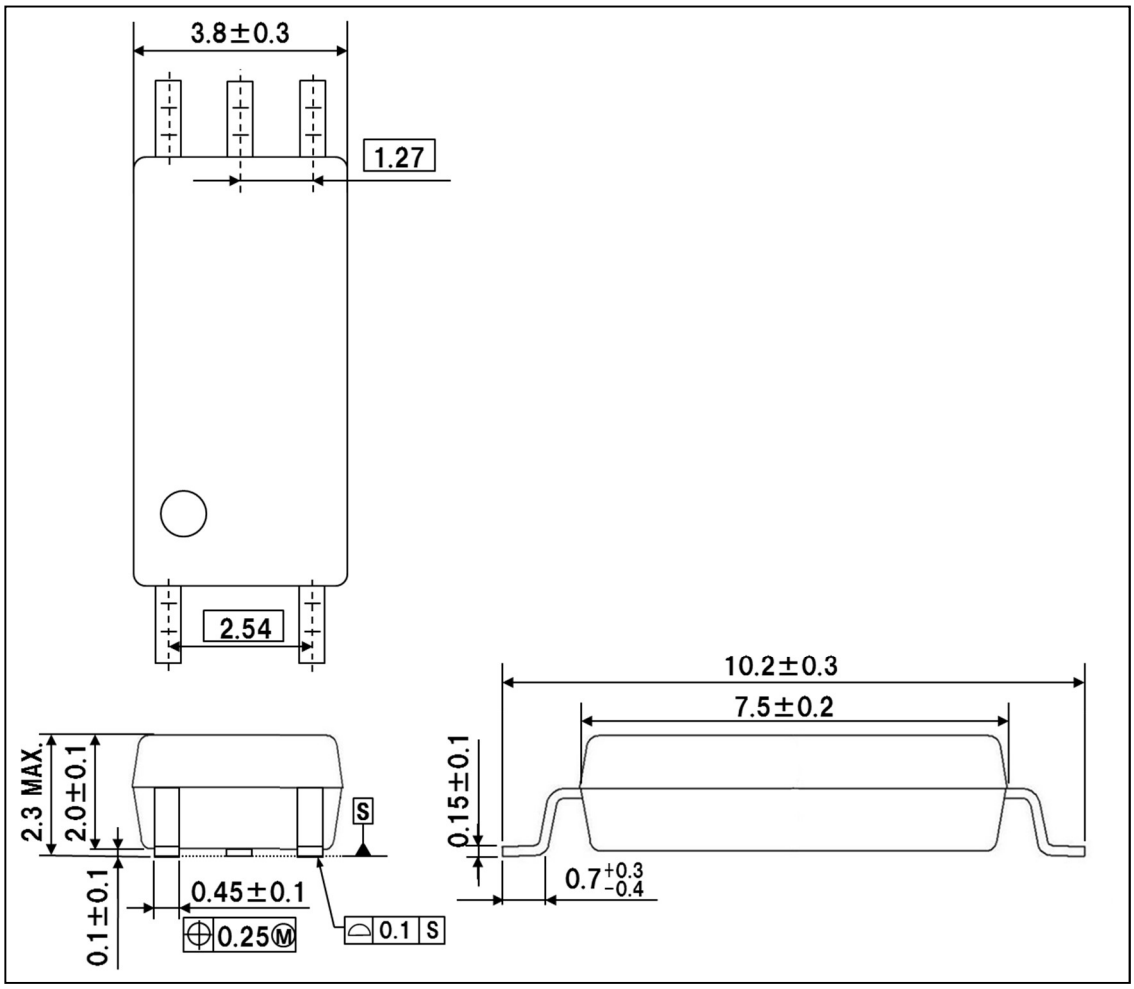
TRUTH TABLE

| LED | OUTPUT |
|---|---|
| ON | L |
| OFF | H |

## APPLICATIONS

- FA Network
- Measurement, Control Equipment (Inverter, AC Servo)

## PACKAGE DIMENSIONS (UNIT : mm)

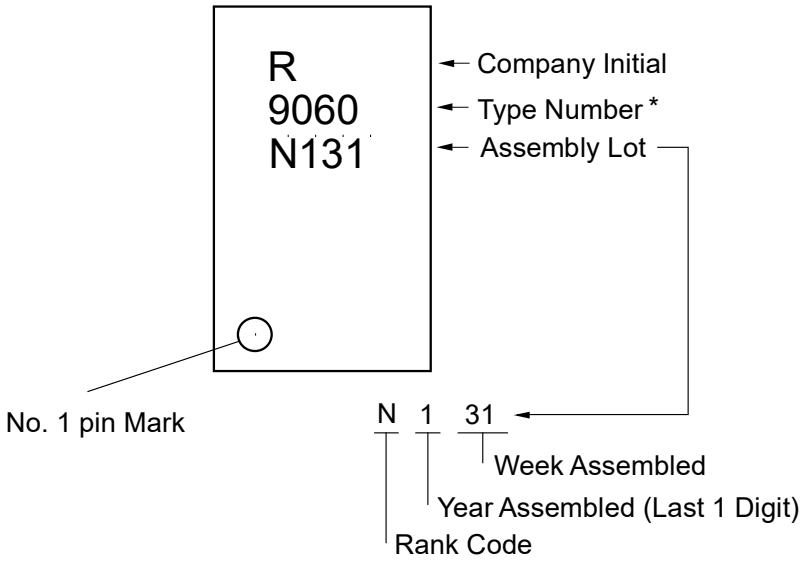



Weight : 0.119g (typ.)

## PHOTOCOUPLER CONSTRUCTION

| Parameter | MIN. |
|---|---|
| Air Distance | 8.0 mm |
| Outer Creepage Distance | 8.0 mm |
| Isolation Distance | 0.15 mm |

## MARKING EXAMPLE




*Applicable type numbers are listed below.

*1) RV1S 9060 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 |
|---|---|---|---|---|---|
| RV1S9060ACCSP-10YC | RV1S9060ACCSP-10YC#KC0 | Pb-Free and Halogen Free (Ni/Pd/Au) | Embossed Tape 3 000 pcs/reel | Standard products (UL, CSA approved) | RV1S9060A |
| RV1S9060ACCSP-10YV | RV1S9060ACCSP-10YV#KC0 | | Embossed Tape 3 000 pcs/reel | UL, CSA, DIN EN 60747-5-5 approved | |

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

## ABSOLUTELY MAXIMUM RATINGS ($T_A$=25°C, unless otherwise specified)

| Parameter | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Diode | Forward Current *1 | $I_F$ | 20 | mA |
| | Reverse Voltage | $V_R$ | 5 | V |
| Detector | Supply Voltage | $V_{DD}$ | 6 | V |
| | Output Voltage | $V_O$ | 6 | V |
| | Output Current | $I_O$ | 10 | mA |
| | Power Dissipation *2 | Pc | 250 | mW |
| Isolation Voltage *3 | | 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. Reduced to 0.93mA/°C at $T_A$=110°C or more
2. Reduced to 5.25mW/°C at $T_A$=85°C or more
3. AC Voltage for 1minite at $T_A$=25°C, RH=60% between input and output.
Pins 1-2 shorted together, 3-5 shorted together.

## RECOMMENDED OPERATING CONDITIONS

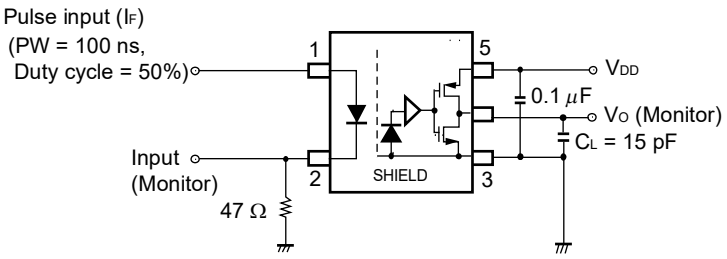
| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Low Level forward voltage | $V_{FL}$ | 0 | | 0.8 | V |
| High Level Forward Current | $I_{FH}$ | 3 | | 6 | mA |
| Supply Voltage | $V_{DD}$ | 2.7 | | 5.5 | V |

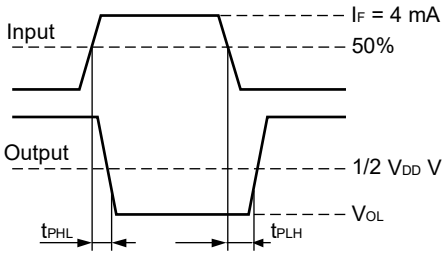
## ELECTRICAL CHARACTERISTICS
($T_A$= -40 to +125°C, $V_{DD}$ = 2.7 to 5.5 V, unless otherwise specified)

| Parameter | | Symbol | Conditions | MIN. | TYP.*1 | MAX. | Unit |
|---|---|---|---|---|---|---|---|
| Diode | Forward Voltage | $V_F$ | $I_F$ = 6 mA, $T_A$ = 25°C | 1.4 | 1.55 | 1.7 | V |
| | Reverse Current | $I_R$ | $V_R$ = 3 V, $T_A$ = 25°C | | | 10 | μA |
| | Terminal Capacitance | $C_t$ | $V_F$ = 0 V, f = 1 MHz, $T_A$ = 25°C | | 30 | | pF |
| Detector | High Level Output Current | $I_{DDH}$ | $I_F$ = 0 mA | | 1.1 | 2 | mA |
| | Low Level Output Current | $I_{DDL}$ | $I_F$ = 4mA | | 1.0 | 2 | |
| | High Level Output Voltage | $V_{OH}$ | $I_O$ = –3.2mA, $I_F$ = 0 mA | Vdd-1.0 | Vdd | | V |
| | | | $I_O$ = –20 μA, $I_F$ = 0 mA | Vdd-0.1 | Vdd | | |
| | Low Level Output Voltage | $V_{OL}$ | $I_O$ = 3.2mA, $I_F$ = 4 mA | | 0.13 | 0.4 | |
| | | | $I_O$ = 20 μA, $I_F$ = 4 mA | | 0.001 | 0.1 | |
| Coupled | Threshold Input Voltage (H to L) | $I_{FHL}$ | $V_O$ < 0.4 V | | 1.2 | 2.2 | mA |
| | Propagation Delay Time (H to L)*2 | $t_{PHL}$ | $I_F$ = 4 mA ⇔ 0mA<br>$V_{DD}$ = 3.3V,5 V<br>$C_L$ = 15 pF | | 36 | 60 | ns |
| | Propagation Delay Time (L to H)*2 | $t_{PLH}$ | | | 38 | 60 | |
| | Pulse Width Distortion*2 | 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*3 | $CM_H$ | IF = 0 mA, VO > 4 V(VDD = 5V),<br>VO > 2.3 V(VDD = 3.3V),<br>VCM=1.5kV, TA = 25°C | 50 | 60 | | kV/μs |
| | Common Mode Transient Immunity at Low Level Output*3 | $CM_L$ | $I_F$ = 4 mA,<br>$V_O$ < 0.4 V($V_{DD}$ = 3.3V, 5V),<br>$V_{CM}$=1.5kV, $T_A$ = 25°C | 50 | 60 | | |

Note2: 1. Typical values at $T_A$ = 25°C

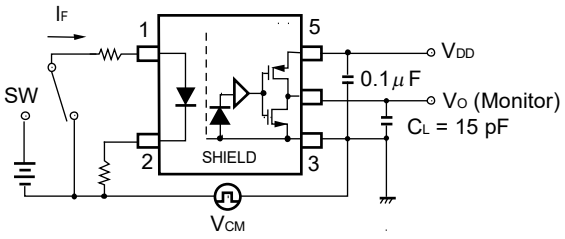
2. Test circuit for propagation delay time measurement

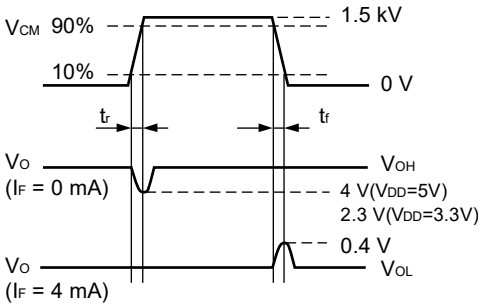



**Remark** $C_L$ includes probe and stray wiring capacitance.

3. Test circuit for common mode transient immunity measurement



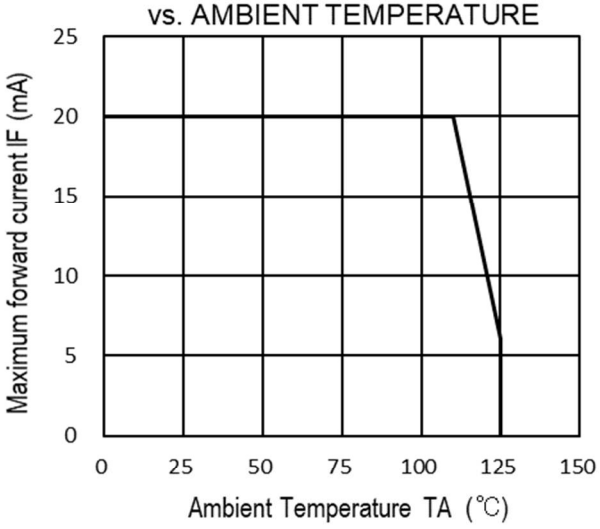

**Remark** $C_L$ includes probe and stray wiring capacitance.

## USAGE CAUTIONS

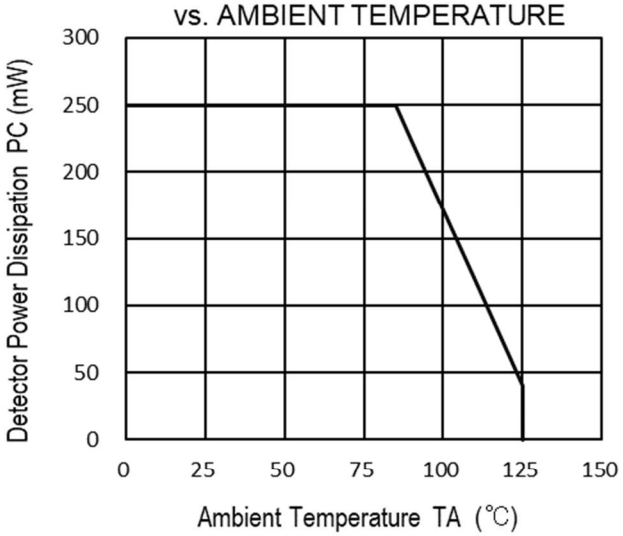
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between $V_{DD}$ and GND near device. Also, ensure that the distance between the leads of the photocoupler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

## TYPICAL CHARACTERISTICS ($T_A$ = +25°C, unless otherwise specified)

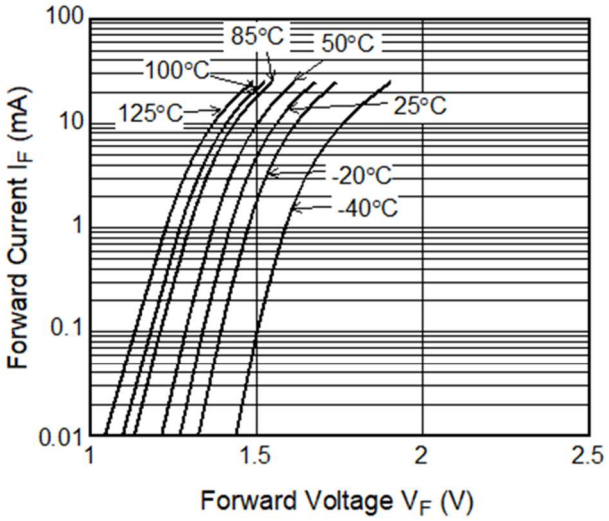
MAXIMAUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



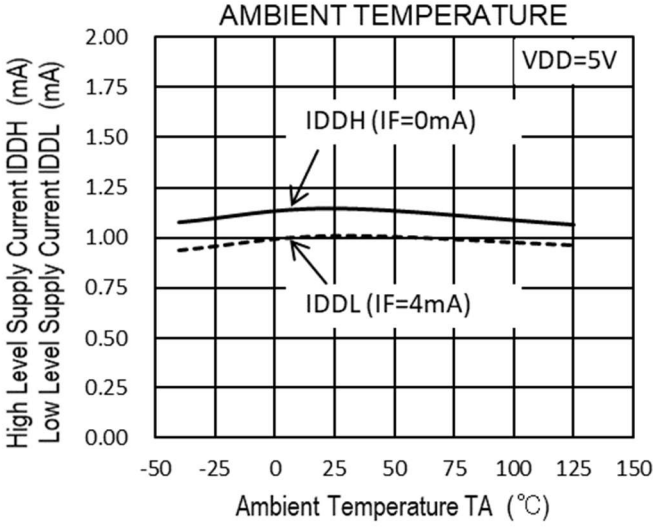

DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



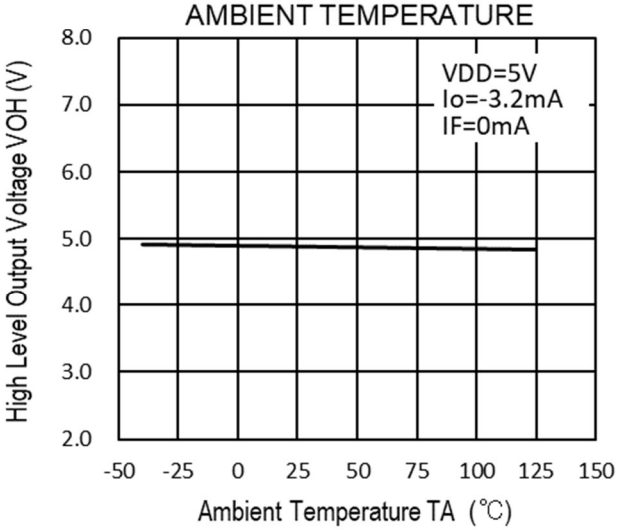

FORWARD CURRENT vs. FORWARD VOLTAGE



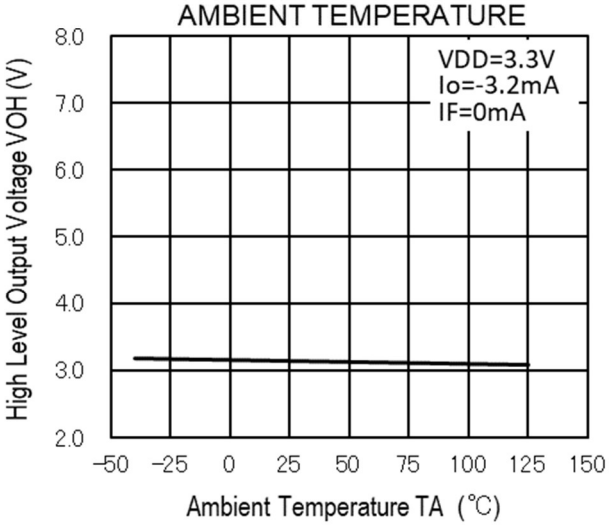

SUPPLY CURRENT vs. AMBIENT TEMPERATURE



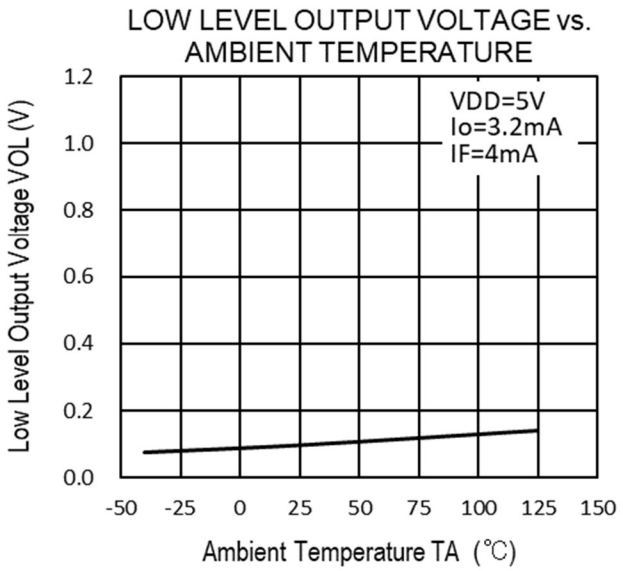

HIGH LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

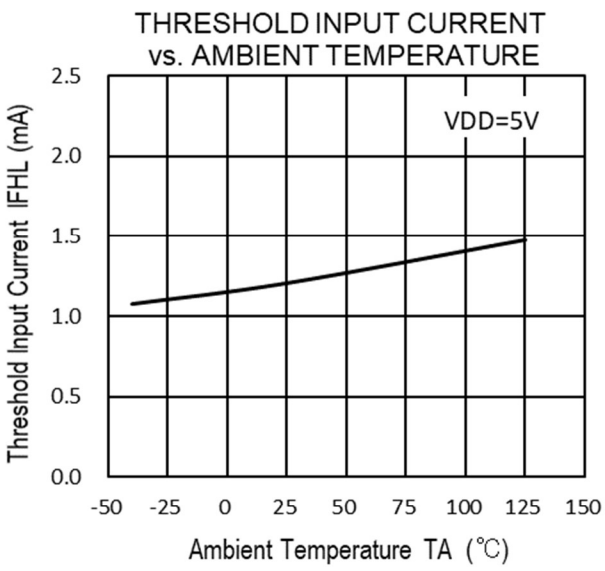


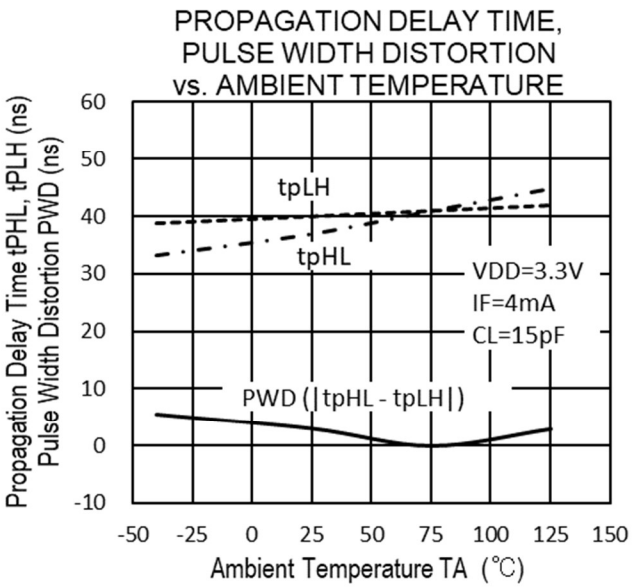

HIGH LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

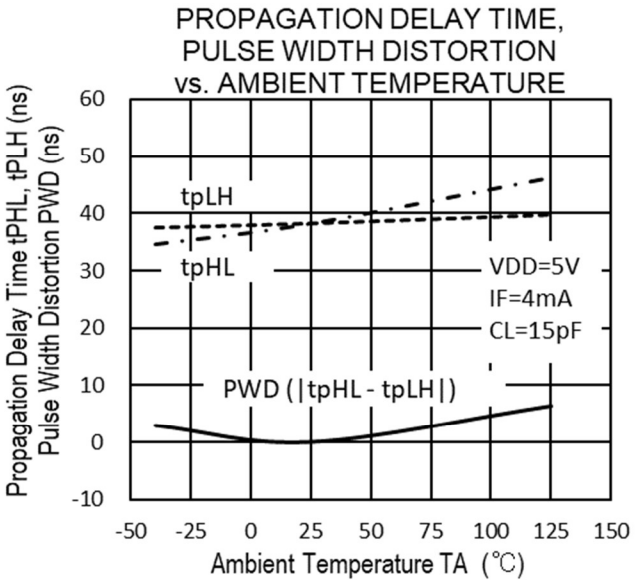


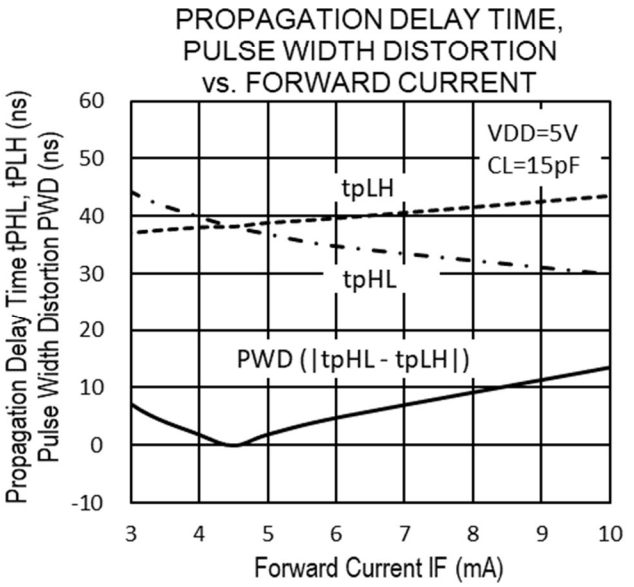

Remark The graphs indicate nominal characteristics.



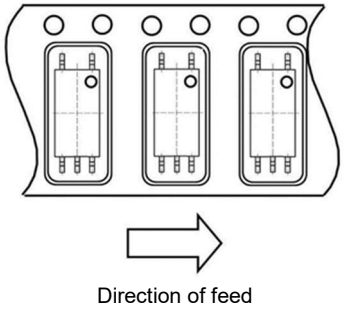



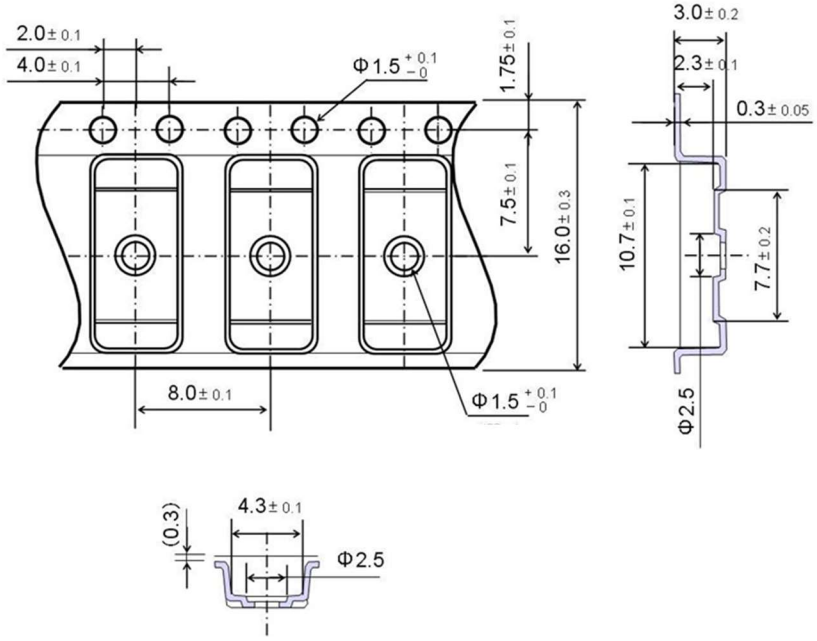

Remark The graphs indicate nominal characteristics.

# TAPING SPECIFICATIONS (UNIT : mm)

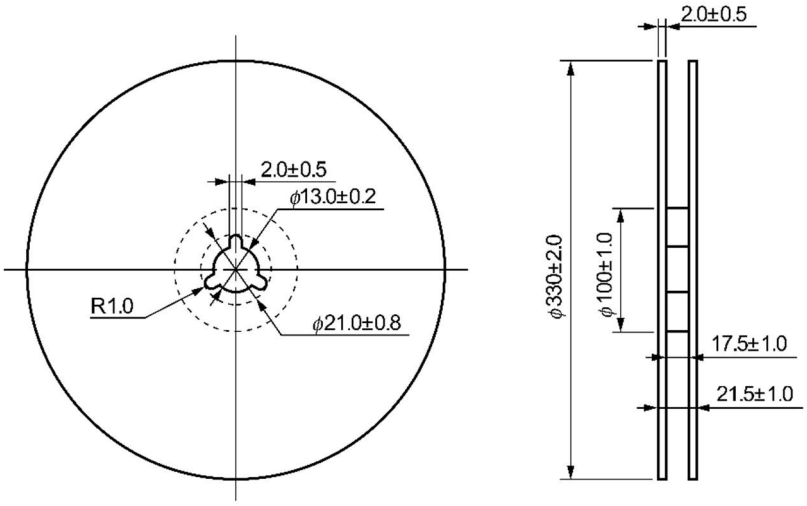
Taping Direction




Outline and Dimensions (Tape) Unit: mm

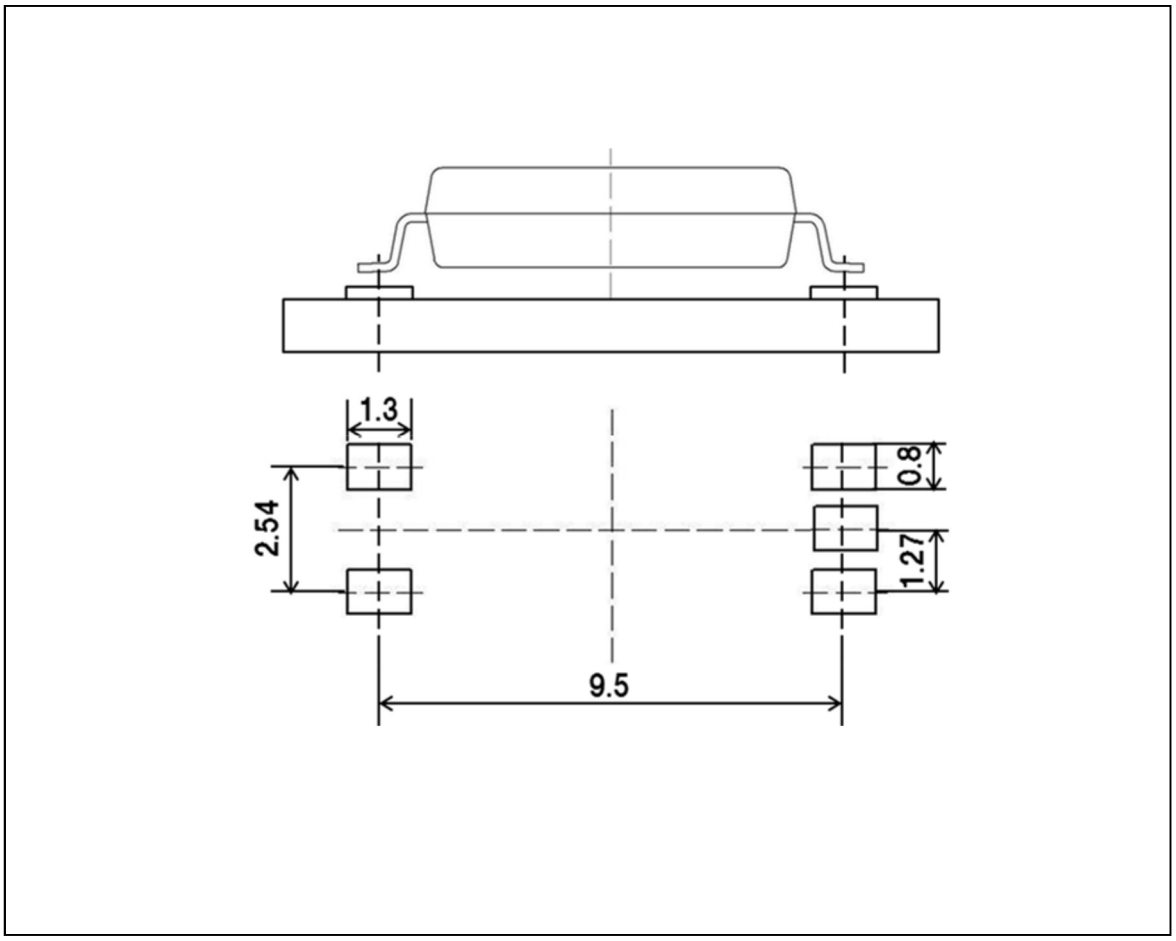



Outline and Dimensions (Reel) Unit: mm




Packing: 3 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT：mm)



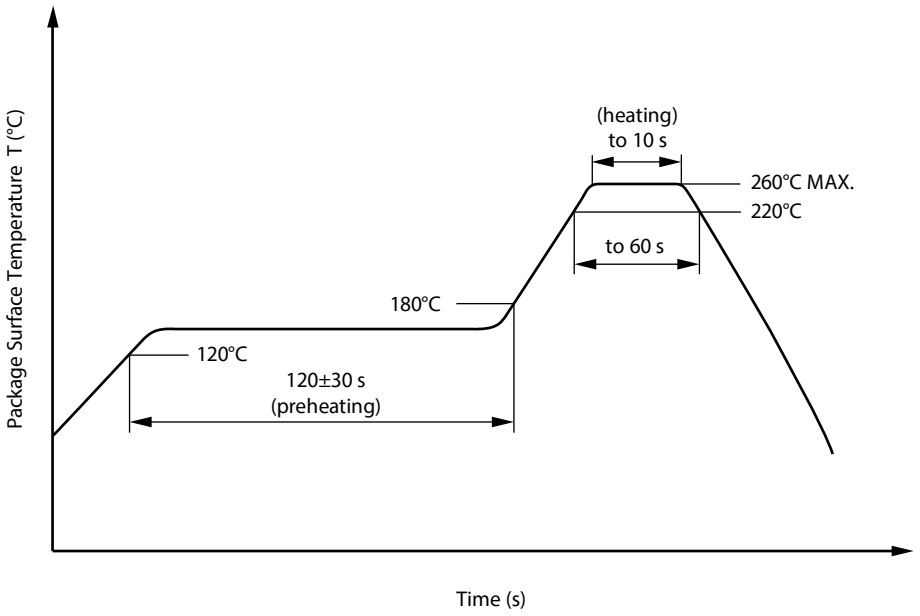
## NOTES ON HANDLING

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.

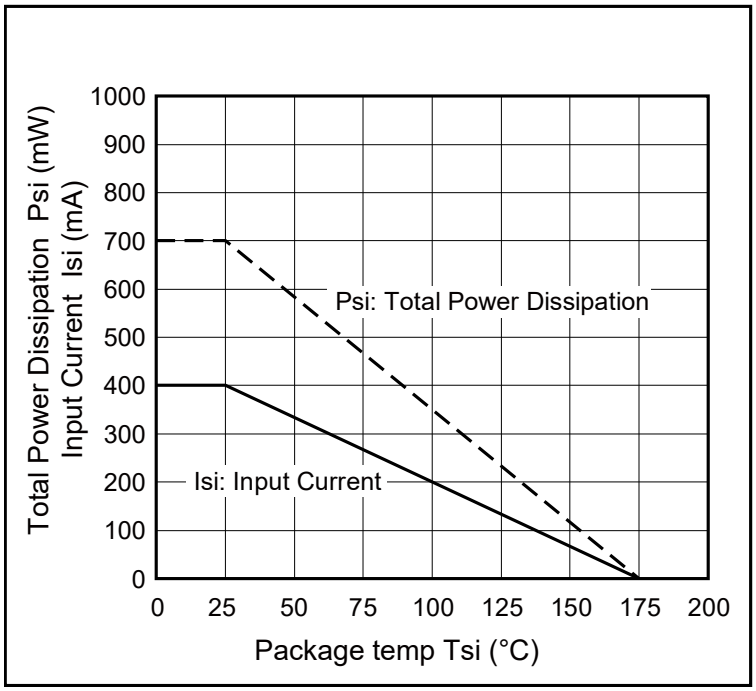
2. Cautions regarding noise

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

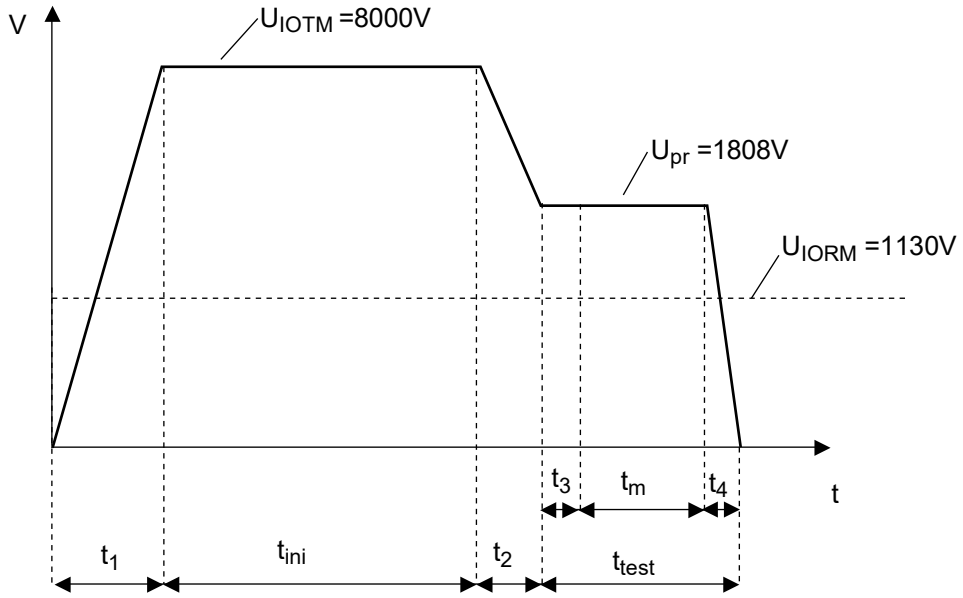
## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Climatic test class (IEC 60068-1/DIN EN 60068-1) | | 40/125/21 | |
| Dielectric strength<br>maximum operating isolation voltage<br>Test voltage (partial discharge test, procedure a for type test and random test)<br>$U_{pr}$ = 1.6 × $U_{IORM.}$, $P_d$ < 5 pC | <br>$U_{IORM}$<br>$U_{pr}$ | <br>1 130<br>1 808 | <br>$V_{peak}$<br>$V_{peak}$ |
| Test voltage (partial discharge test, procedure b for all devices)<br>$U_{pr}$ = 1.875 × $U_{IORM.}$, $P_d$ < 5 pC | $U_{pr}$ | 2 119 | $V_{peak}$ |
| 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 to +150 | °C |
| Operating temperature range | $T_A$ | –40 to +125 | °C |
| Isolation resistance, minimum value<br>$V_{IO}$ = 500 V dc at $T_A$ = 25°C<br>$V_{IO}$ = 500 V dc at $T_A$ MAX. at least 100°C | <br>Ris MIN.<br>Ris MIN. | <br>$10^{12}$<br>$10^{11}$ | <br>Ω<br>Ω |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)<br>Package temperature<br>Current (input current $I_F$, Psi = 0)<br>Power (output or total power dissipation)<br>Isolation resistance<br>$V_{IO}$ = 500 V dc at $T_A$ = Tsi | <br>Tsi<br>Isi<br>Psi<br><br>Ris MIN. | <br>175<br>400<br>700<br><br>$10^9$ | <br>°C<br>mA<br>mW<br><br>Ω |

## Dependence of maximum safety ratings with package temperature

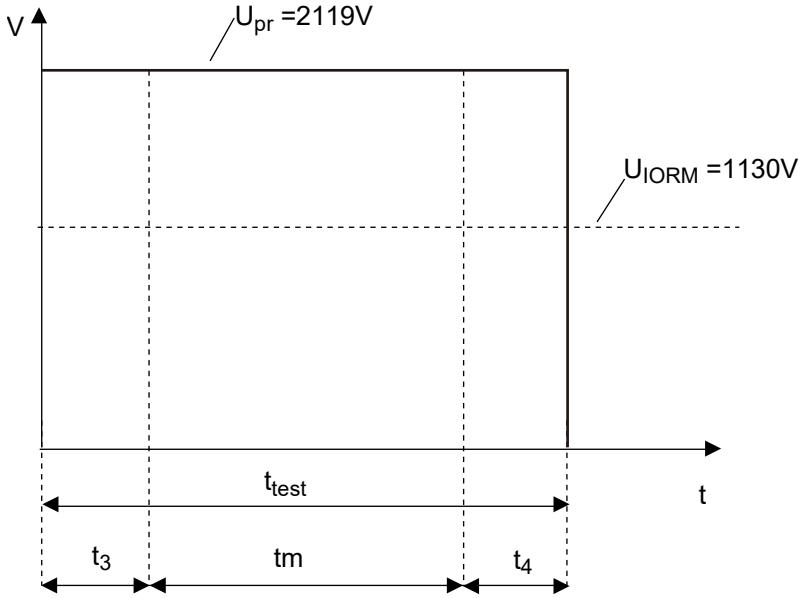


## Method a) Destructive Test, Type and Sample Test




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

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




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

| | |
|---|---|
| **Caution** GaAs Products | This product uses gallium arsenide (GaAs).<br>GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.<br>• 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.<br>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.<br>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.<br>• Do not burn, destroy, cut, crush, or chemically dissolve the product.<br>• Do not lick the product or in any way allow it to enter the mouth. |

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