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

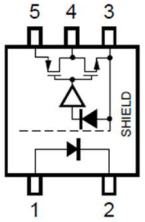
The RV1S9160A is a photocoupler featuring high-speed switching up to 15Mbps with active low output logic which consist of an AlGaAs LED on the input side and an integrated circuit with a photodiode on the output.

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°C in logic interface circuit.

FEATURES

- High speed communication (15 Mbps)
- High temperature operation (-40 to +125°C)
- High common mode (dv/dt) tolerant (CM_H, CM_L = ±50 kV/μs MIN.)
- High isolation voltage (BV = 3750 Vr.m.s.)
- Low input drive current (I_{FHL} = 2.0 mA MAX.)
- Low voltage power supply operation (V_{DD} = 2.7 V ~ 5.5 V)
- Low pulse width distortion (PWD = 20 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)

PIN CONNECTION
(Top View)



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

TRUTH TABLE

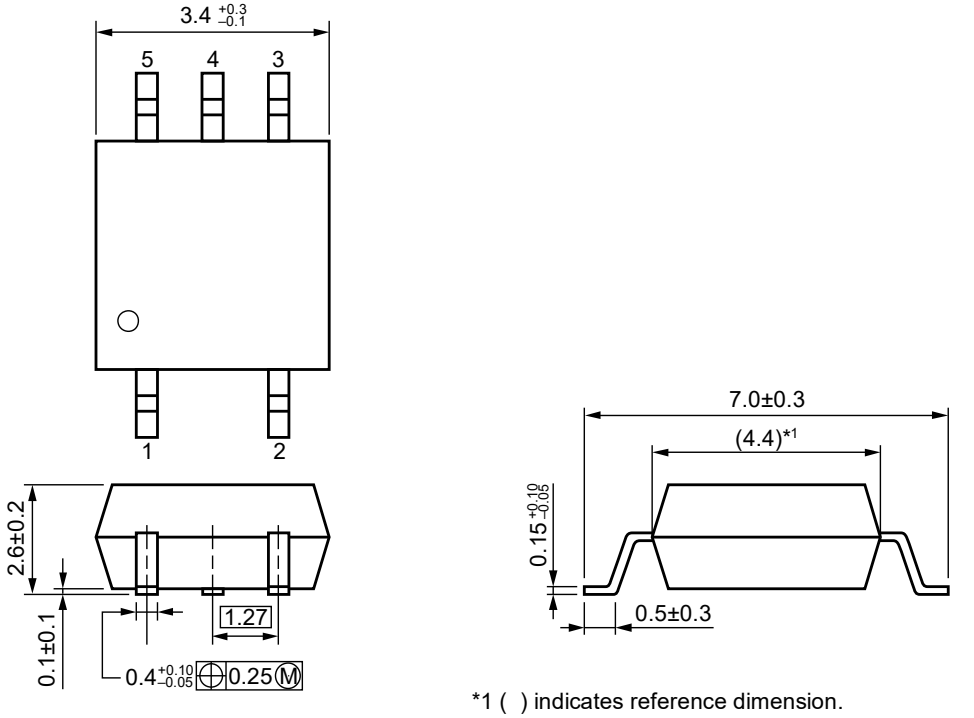
LED	OUTPUT
ON	L
OFF	H

APPLICATIONS

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

Start of mass production
Jun.2019

PACKAGE DIMENSIONS (UNIT : mm)



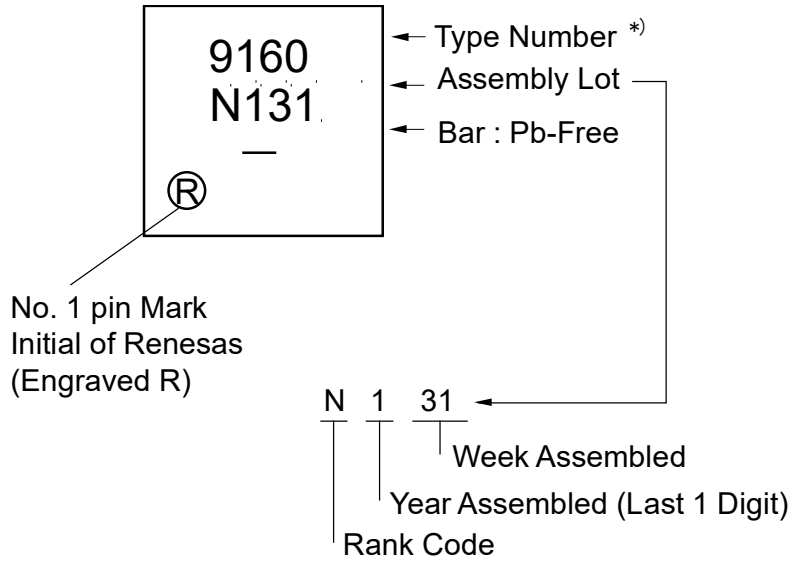
*1 ( ) indicates reference dimension.

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



*Applicable type numbers are listed below.

*) RV1S 9160 ACCSP-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*1
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_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	200	mW
Isolation Voltage *3		BV	3 750	Vr.m.s.
Operating Ambient Temperature		T_A	-40 to +125	°C
Storage Temperature		T_{stg}	-55 to +150	°C

Notes: 1. Reduced to 0.93 mA/°C at T_A = 110°C or more
2. Reduced to 4.57 mW/°C at T_A = 90°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

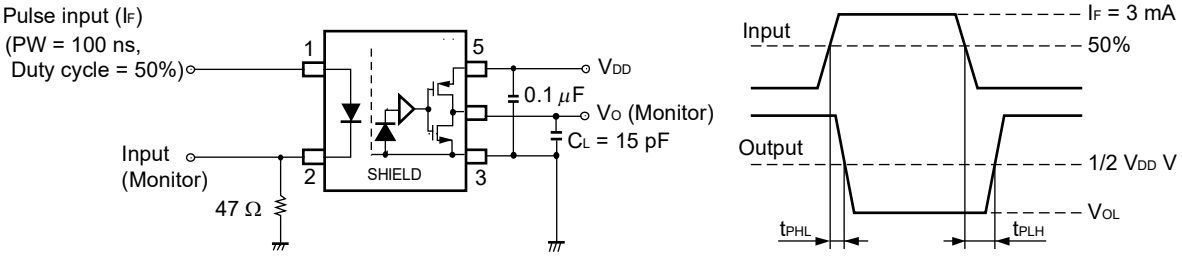
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Low Level forward voltage	V_{FL}	0		0.8	V
High Level Forward Current	I_{FH}	3		6	mA
Supply Voltage	V_{DD}	2.7		5.5	V

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 = 3 mA		1.0	2	
	High Level Output Voltage	V_{OH}	I_O = –3.2 mA, I_F = 0 mA	V_{DD}-1.0	V_{DD}		V
			I_O = –20 μA, I_F = 0 mA	V_{DD}-0.1	V_{DD}		
	Low Level Output Voltage	V_{OL}	I_O = 3.2 mA, I_F = 3 mA		0.13	0.4	
			I_O = 20 μA, I_F = 3 mA		0.001	0.1	
Coupled	Threshold Input Voltage (H to L)	I_{FHL}	V_O < 0.4 V		1.0	2.0	mA
	Isolation Resistance	R_{I-O}	V_{I-O} = 1 kV_{DC}, RH = 40 to 60%, T_A = 25°C	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz, T_A = 25°C		0.5		pF
	Propagation Delay Time (H to L)*2	t_{PHL}	I_F = 3 mA ⇔ 0 mA V_{DD} = 3.3 V,5 V C_L = 15 pF		40	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	$\|CM_H\|$	I_F = 0 mA, V_O > 4 V(V_{DD} = 5 V), V_O > 2.3 V(V_{DD} = 3.3 V), V_{CM} = 1.5 kV, T_A = 25°C	50	60		kV/μs
	Common Mode Transient Immunity at Low Level Output*3	$\|CM_L\|$	I_F = 3 mA, V_O < 0.4 V(V_{DD} = 3.3 V, 5 V), V_{CM} = 1.5 kV, T_A = 25°C	50	60		

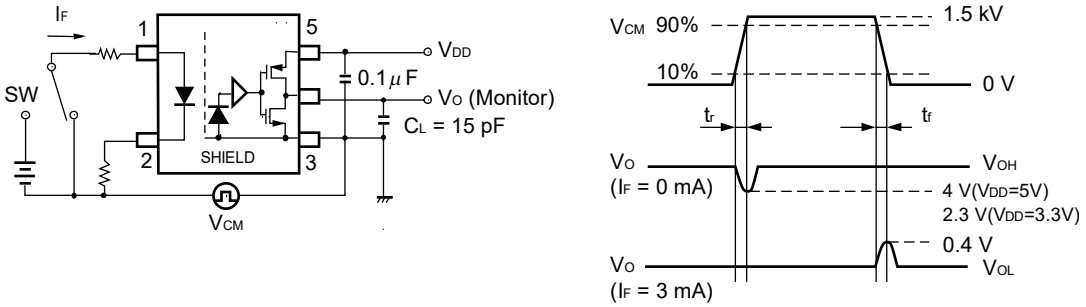
Note2: 1. Typical values at T_A = 25°C

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



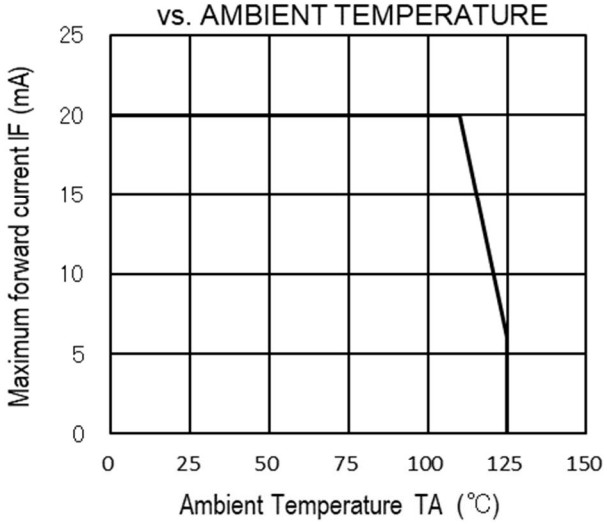
Remark C_L includes probe and stray wiring capacitance.

USAGE CAUTIONS

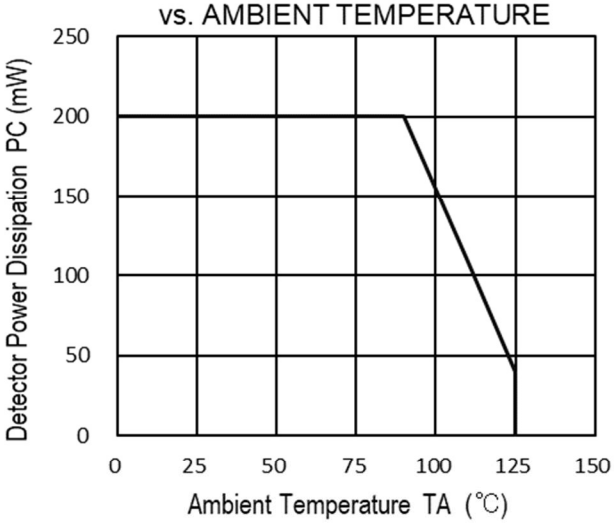
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between V_{DD} and GND near device. Also, ensure that the distance between the leads of the photocoupler 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)

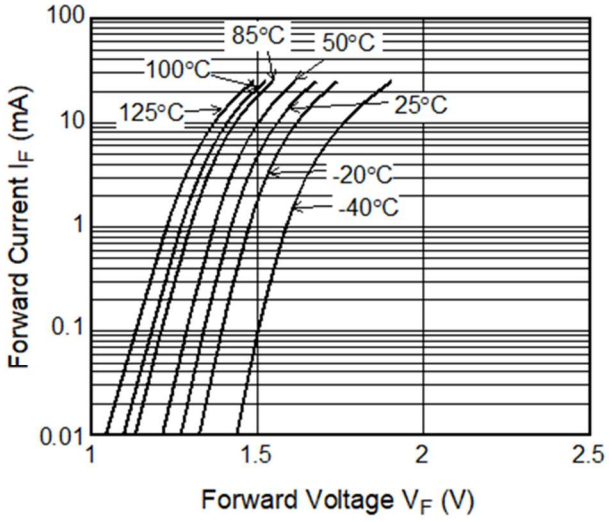
MAXIMAUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



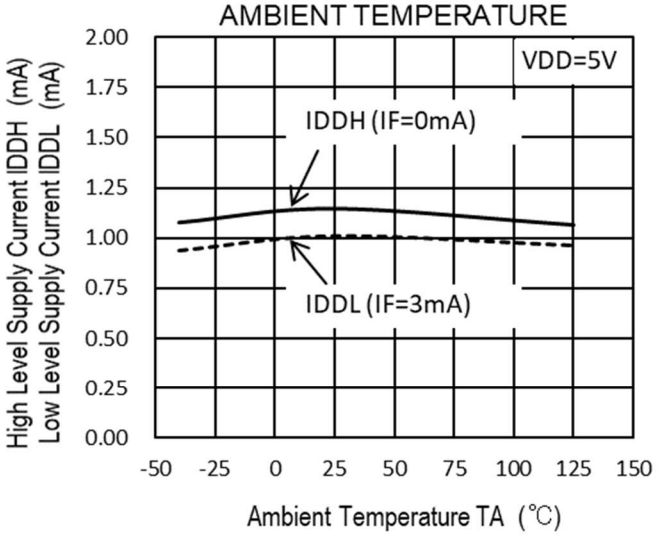
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



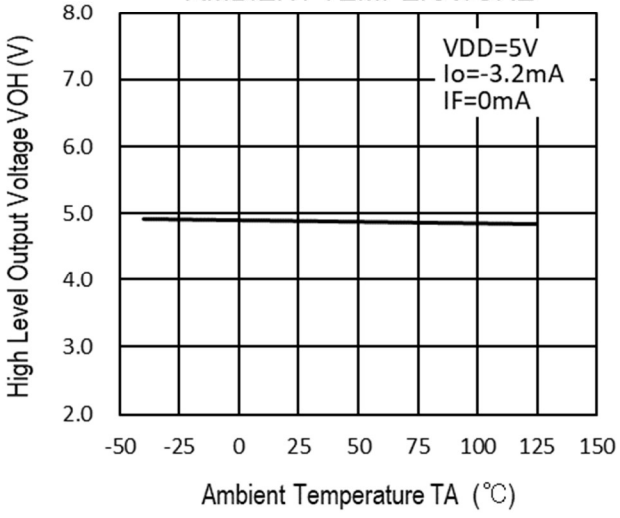
FORWARD CURRENT vs. FORWARD VOLTAGE



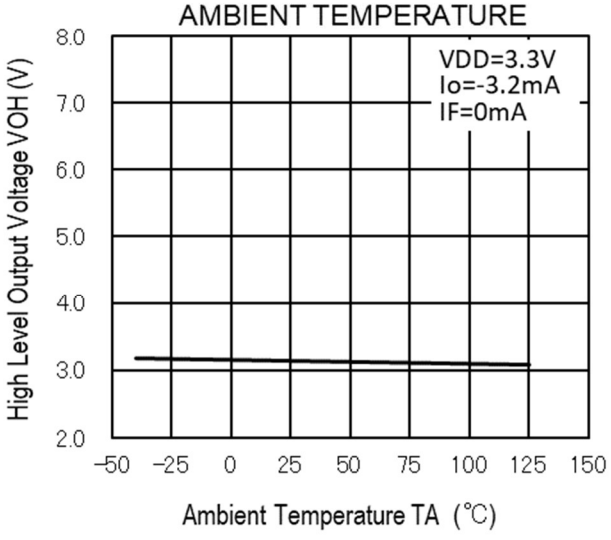
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



HIGH LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

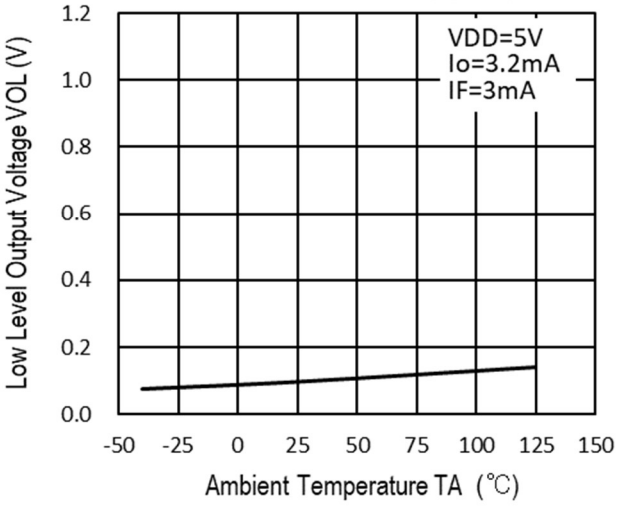


HIGH LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

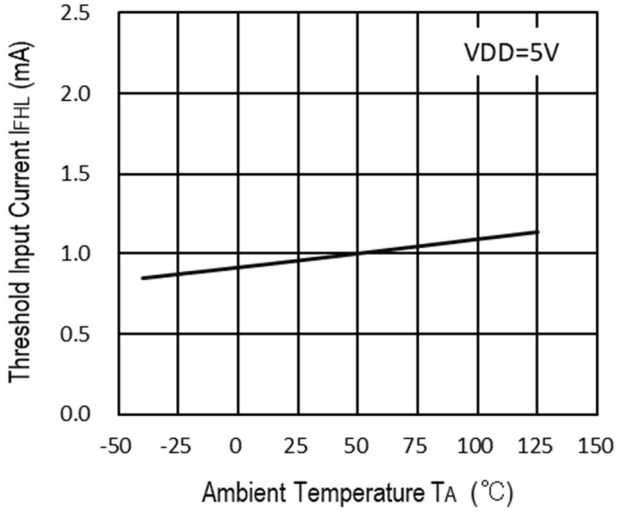


Remark The graphs indicate nominal characteristics.

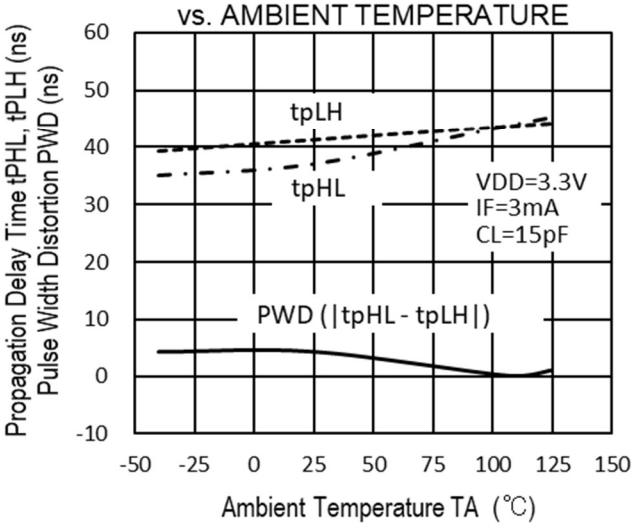
LOW LEVEL OUTPUT VOLTAGE vs.
AMBIENT TEMPERATURE



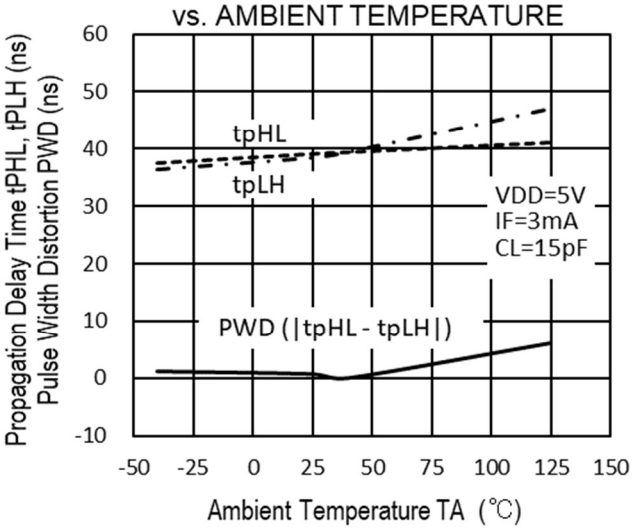
THRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURE



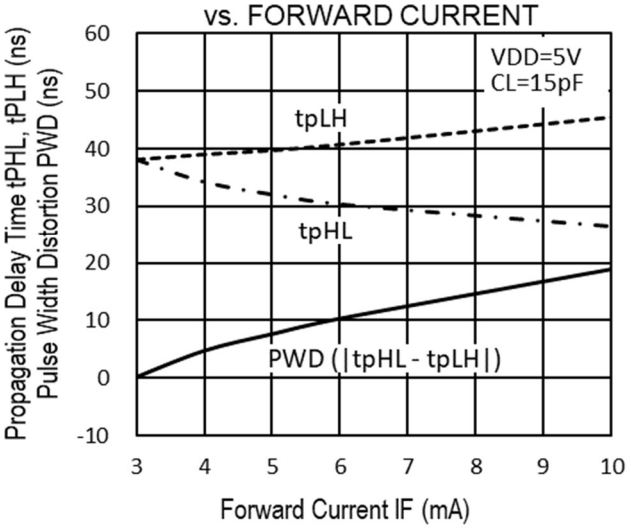
PROPAGATION DELAY TIME,
PULSE WIDTH DISTORTION
vs. AMBIENT TEMPERATURE



PROPAGATION DELAY TIME,
PULSE WIDTH DISTORTION
vs. AMBIENT TEMPERATURE



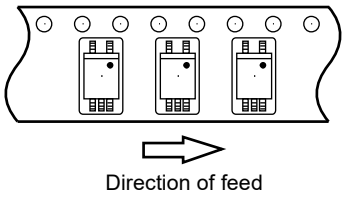
PROPAGATION DELAY TIME,
PULSE WIDTH DISTORTION
vs. FORWARD CURRENT



Remark The graphs indicate nominal characteristics.

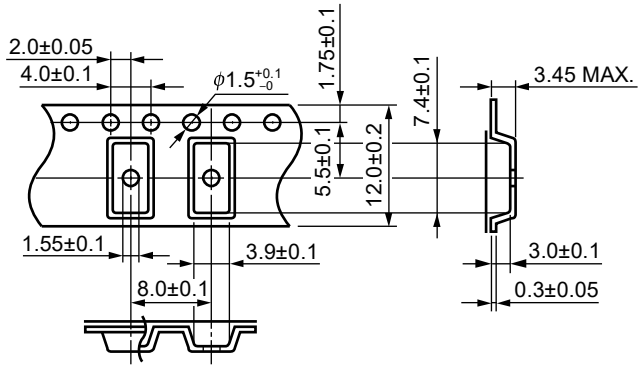
TAPING SPECIFICATIONS (UNIT : mm)

Taping Direction



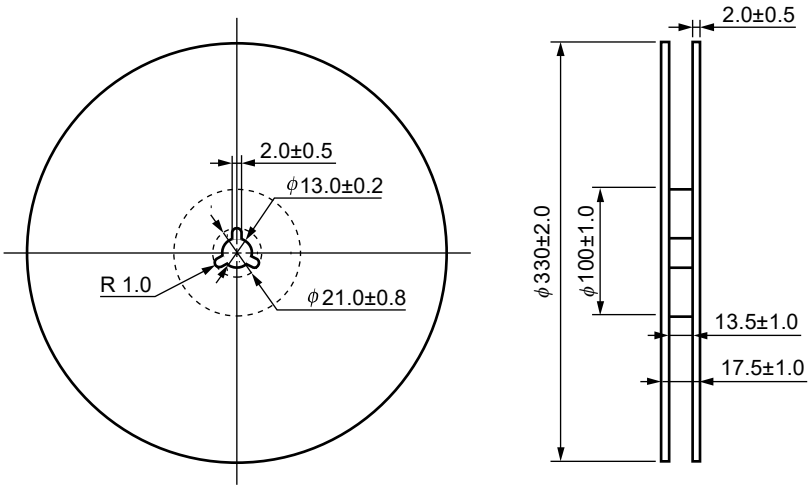
Outline and Dimensions (Tape)

Unit: mm



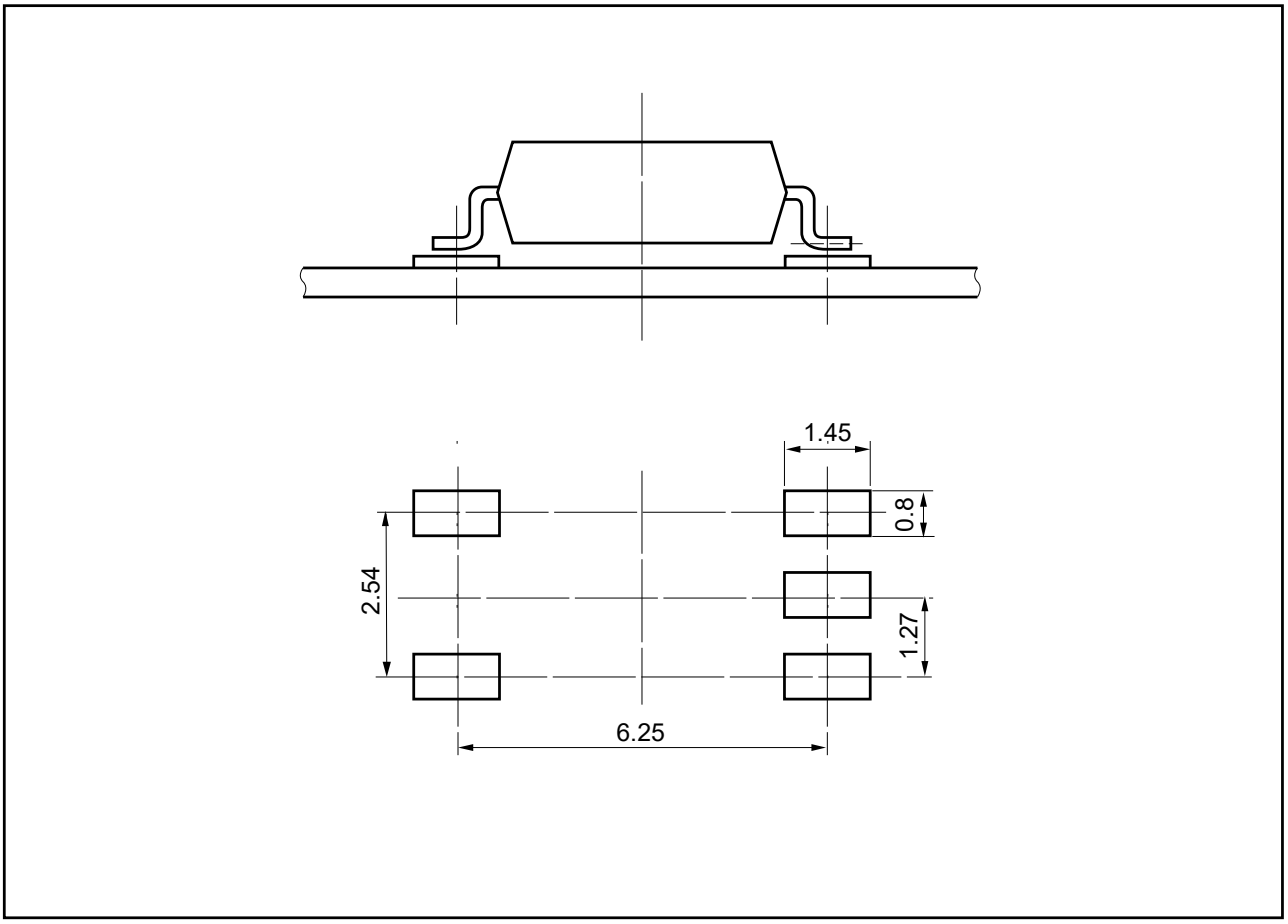
Outline and Dimensions (Reel)

Unit: mm



Packing: 2 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT : mm)



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

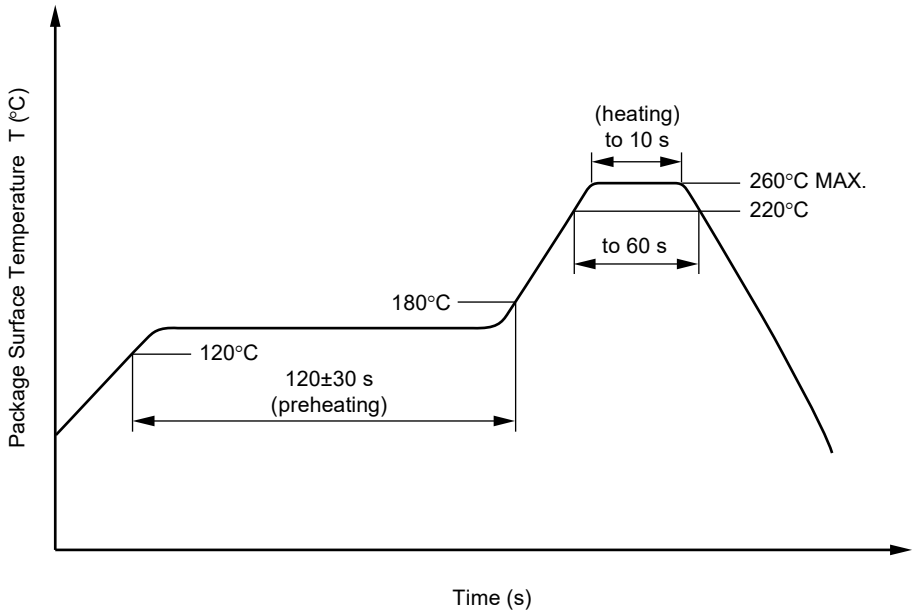
NOTES ON HANDLING

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.

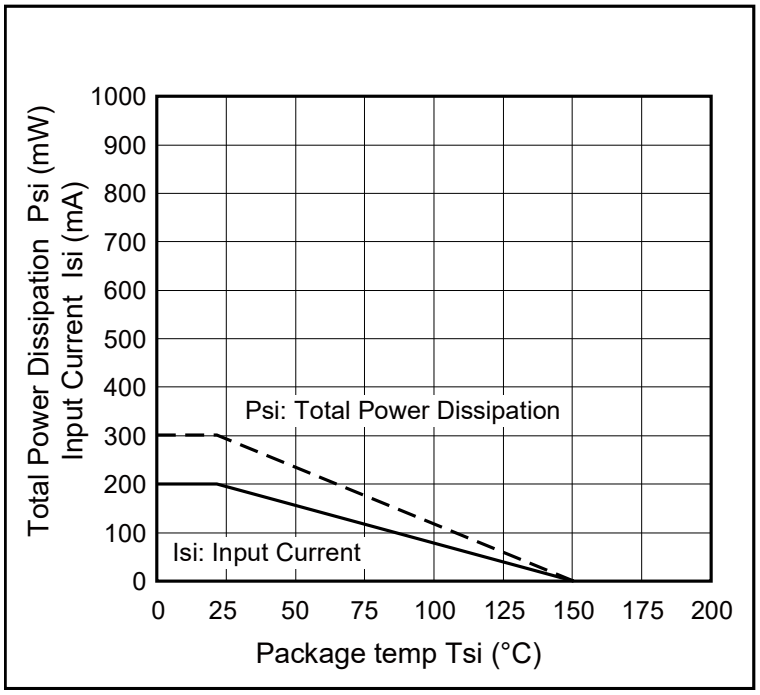
2. Cautions regarding noise

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

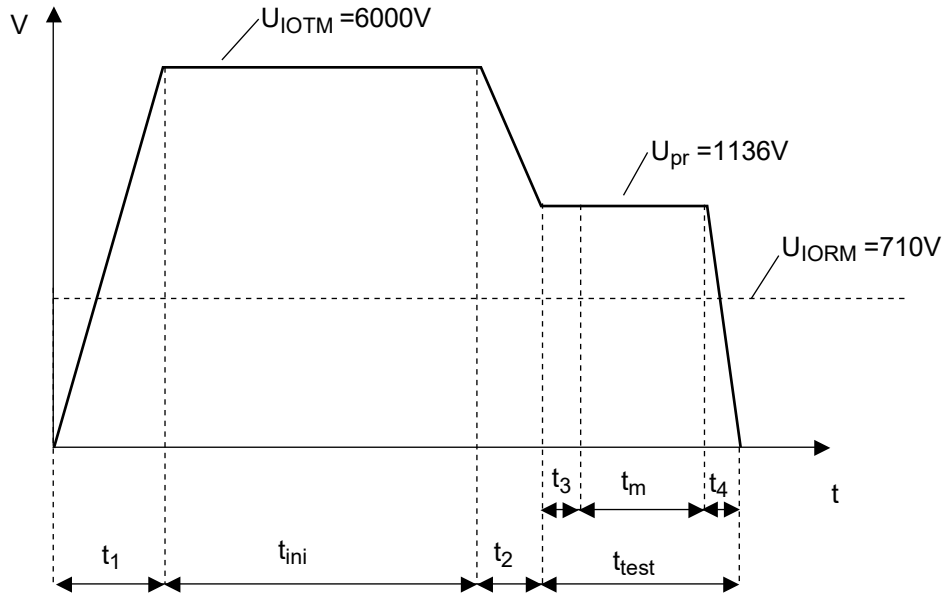
SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

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 × U_{IORM}, P_d < 5 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 × U_{IORM}, P_d < 5 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 V dc at T_A = 25°C V_{IO} = 500 V dc at T_A MAX. at least 100°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 = 0) Power (output or total power dissipation) Isolation resistance V_{IO} = 500 V dc at T_A = Tsi	 Tsi Isi Psi Ris MIN.	 150 200 300 10^9	 °C mA mW Ω

Dependence of maximum safety ratings with package temperature

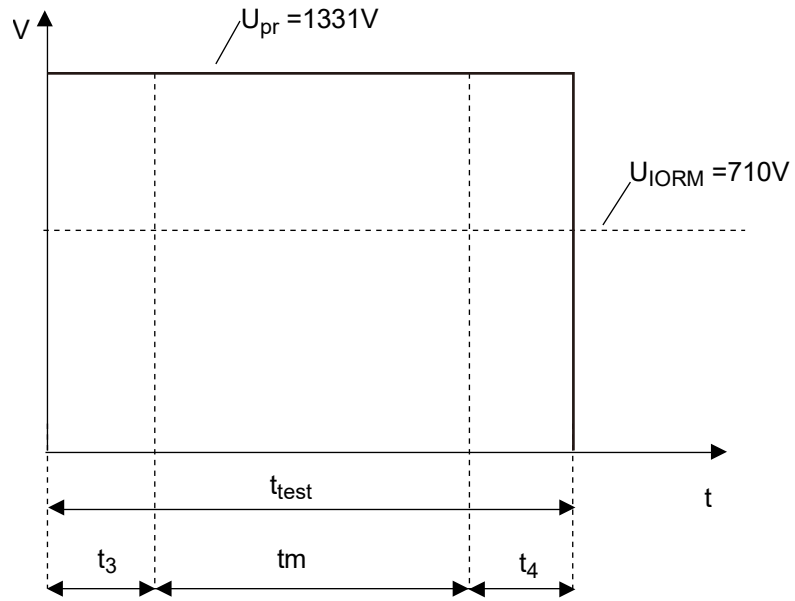


Method a) Destructive Test, Type and Sample Test



t_1,t_2 = 1 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). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points. • 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. 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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(Rev.4.0-1 November 2017)

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