

# PS9822-1,-2

1 Mbps OPEN COLLECTOR OUTPUT TYPE  
8-PIN SSOP (SO-8) HIGH-SPEED PHOTOCOUPLER

R08DS0262EJ0100  
Rev.1.00  
Dec 22, 2021

## DESCRIPTION

The PS9822-1 and PS9822-2 are active-low type high-speed photocouplers that use an AlGaAs light-emitting diode on the input side and a photodetector IC that includes a photodiode and a signal processor on the same chip on the output side.

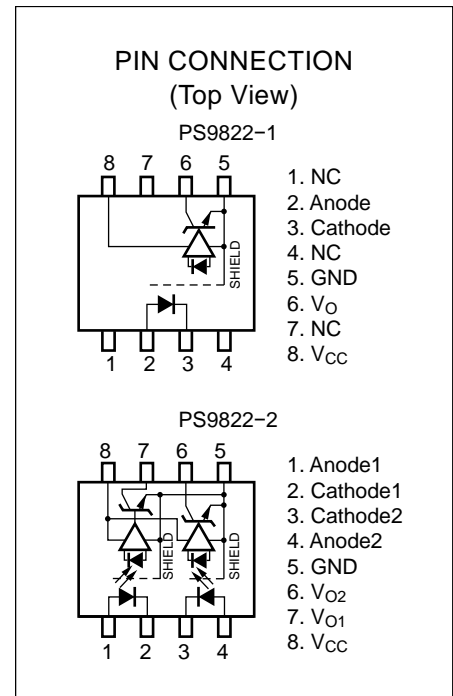
The PS9822-1, -2 are high-speed digital output type photocouplers designed specifically for low circuit current. The PS9822-2 is suitable for high density applications.

## FEATURES

- Supply Voltage
  - N rank:  $V_{CC} = 3.3\text{ V}$
  - L rank:  $V_{CC} = 5\text{ V}$
- Pulse width distortion ( $|t_{PHL}-t_{PLH}| = 200\text{ ns MAX.}$ )
- 40% reduction of mounting area (5-pin SOP  $\times$  2)
- High-speed (1 Mbps)
- High isolation voltage ( $BV = 2\ 500\text{ Vr.m.s.}$ )
- Open collector output
- Ordering number of tape product: PS9822-1-F3 : 1 500 pcs/reel
- : PS9822-2-F3 : 1 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL : UL1577, Single protection
  - VDE : DIN EN 60747-5-5 (Option)

## APPLICATIONS

- PoE (Power over Ethernet)
- Measurement equipment
- FA Network

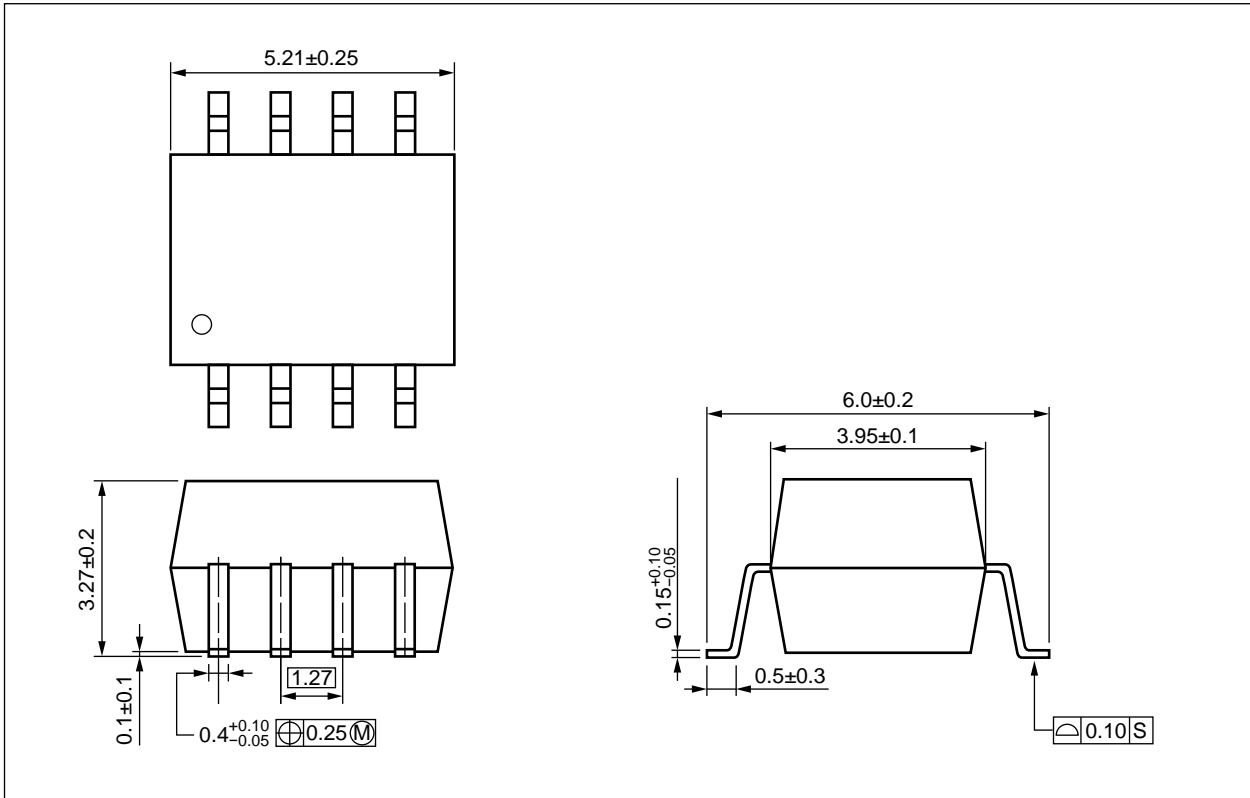


## TRUTH TABLE

LED	Output
ON	L
OFF	H

Start of mass production  
Oct.2008

**PACKAGE DIMENSIONS (UNIT: mm)**



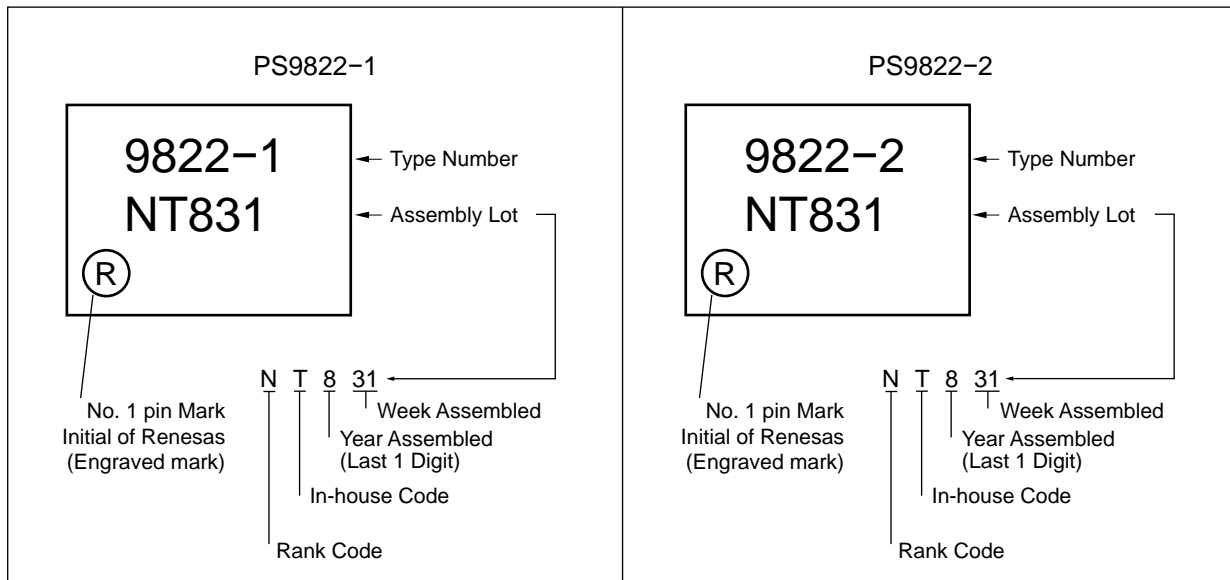
Weight: 0.14g (typ.)

**PHOTOCOUPLER CONSTRUCTION**

Parameter	Unit (MIN.)
Air Distance	4 mm
Creepage Distance	4 mm
Isolation Distance	0.2 mm

**MARKING EXAMPLE**

Ni/Pd/Au PLATING



**ORDERING INFORMATION**

Part Number	Order Number*4	Rank	Solder Plating Specification	Packing Style	Safety Standards Approval	Application Part Number *1		
PS9822-1	PS9822-1-AX	N <sup>2</sup>	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL, approved)	PS9822-1		
		L <sup>3</sup>		Embossed Tape 1 500 pcs/reel				
PS9822-1-F3	PS9822-1-F3-AX	N <sup>2</sup>					20 pcs (Tape 20 pcs cut)	UL, DIN EN 60747-5-5 approved
		L <sup>3</sup>						
PS9822-2	PS9822-2-AX	N <sup>2</sup>		Embossed Tape 1 500 pcs/reel				
		L <sup>3</sup>						
PS9822-2-F3	PS9822-2-F3-AX	N <sup>2</sup>		20 pcs (Tape 20 pcs cut)	PS9822-1			
		L <sup>3</sup>						
PS9822-1-V	PS9822-1-V-AX	N <sup>2</sup>		Embossed Tape 1 500 pcs/reel				
		L <sup>3</sup>						
PS9822-1-V-F3	PS9822-1-V-F3-AX	N <sup>2</sup>		20 pcs (Tape 20 pcs cut)	PS9822-2			
		L <sup>3</sup>						
PS9822-2-V	PS9822-2-V-AX	N <sup>2</sup>		Embossed Tape 1 500 pcs/reel				
		L <sup>3</sup>						
PS9822-2-V-F3	PS9822-2-V-F3-AX	N <sup>2</sup>						
		L <sup>3</sup>						

- Notes\*: 1. For the application of the Safety Standard, following part number should be used.  
 2. N rank: V<sub>CC</sub> = 3.3 V  
 3. L rank: V<sub>CC</sub> = 5 V  
 4. When specifying rank, please add "/rank" after Order Number.  
 ex. N rank : PS9822-1-AX/N

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

Parameter		Symbol	Ratings		Unit
			PS9822-1	PS9822-2	
Diode	Forward Current	I <sub>F</sub>	20 <sup>*1</sup>	15 <sup>*2</sup>	mA
	Reverse Voltage	V <sub>R</sub>	5		V/ch
Detector	Supply Voltage	V <sub>CC</sub>	7		V
	Output Voltage	V <sub>O</sub>	7		V/ch
	Output Current	I <sub>O</sub>	20		mA/ch
	Power Dissipation <sup>*3</sup>	P <sub>C</sub>	40		mW/ch
Isolation Voltage <sup>*4</sup>		BV	2 500		Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	- 40 to + 100		°C
Storage Temperature		T <sub>stg</sub>	- 55 to + 125		°C

- Notes\*: 1. Reduced to 0.38 mA/°C at T<sub>A</sub> = 80 °C or more.  
 2. Reduced to 0.13 mA/°C at T<sub>A</sub> = 80 °C or more.  
 3. Applies to output pin V<sub>O</sub> (collector pin). Reduced to 1.5 mW/°C at T<sub>A</sub> = 80 °C or more.  
 4. AC voltage for 1 minute at T<sub>A</sub> = 25 °C, RH = 60 % between input and output.  
 Pins 1-4 shorted together, 5-8 shorted together.

**RECOMMENDED OPERATING CONDITIONS**

Parameter		Symbol	MIN.	TYP.	MAX.	Unit
Low Level Input Voltage		V <sub>FL</sub>	0		0.8	V
High Level Input Current		I <sub>FH</sub>	6.3	10	12.5	mA
Supply Voltage	N rank	V <sub>CC</sub>	2.7	3.3	3.6	V
	L rank		4.5	5.0	5.5	
Pull-up Resistance		R <sub>L</sub>	330		4 k	Ω
TLL (R <sub>L</sub> = 1.0 kΩ, loads)		N			3	

**ELECTRICAL CHARACTERISTICS : N rank (T<sub>A</sub> = -40 to +100 °C, unless otherwise specified)**

Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit		
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA, T <sub>A</sub> = 25 °C		1.6	1.8	V		
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 3 V, T <sub>A</sub> = 25 °C			10	μA		
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1 MHz, T <sub>A</sub> = 25 °C		30		pF		
Detector	High Level Output Current	I <sub>OH</sub>	V <sub>CC</sub> = V <sub>O</sub> = 3.3 V, V <sub>F</sub> = 0.8 V		1	100	μA		
	Low Level Output Voltage*2	V <sub>OL</sub>	V <sub>CC</sub> = 3.3 V, I <sub>F</sub> = 5 mA, I <sub>OL</sub> = 10 mA		0.2	0.6	V		
	High Level Supply Current (PS9822-1)	I <sub>CCH</sub>	V <sub>CC</sub> = 3.3 V, I <sub>F</sub> = 0 mA, V <sub>O</sub> = Open			2	mA		
	High Level Supply Current (PS9822-2)					4			
	Low Level Supply Current (PS9822-1)	I <sub>CCL</sub>	V <sub>CC</sub> = 3.3 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> = Open			3			
	Low Level Supply Current (PS9822-2)					6			
Coupled	Threshold Input Current (H → L)	I <sub>FHL</sub>	V <sub>CC</sub> = 3.3 V, V <sub>O</sub> = 0.8 V, R <sub>L</sub> = 350 Ω		2	5	mA		
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1 kV <sub>DC</sub> , R <sub>H</sub> = 40 to 60 %, T <sub>A</sub> = 25 °C	10 <sup>11</sup>			Ω		
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz, T <sub>A</sub> = 25 °C		0.6		pF		
	Propagation Delay Time (H → L)*3	t <sub>PHL</sub>	V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA, V <sub>THHL</sub> = V <sub>THLH</sub> = 1.5 V			500	ns		
	Propagation Delay Time (L → H)*3	t <sub>PLH</sub>				700			
	Pulse Width Distortion (PWD)*3	t <sub>PHL</sub> -t <sub>PLH</sub>				200			
	Rise Time	t <sub>r</sub>				60			
	Fall Time	t <sub>f</sub>				70			
	Common Mode Transient Immunity at High Level Output*4	CM <sub>H</sub>		V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, T <sub>A</sub> = 25 °C, I <sub>F</sub> = 0 mA, V <sub>O</sub> > 2 V, V <sub>CM</sub> = 1 kV	15	20			kV/μs
	Common Mode Transient Immunity at Low Level Output*4	CM <sub>L</sub>		V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, T <sub>A</sub> = 25 °C, I <sub>F</sub> = 7.5 mA, V <sub>O</sub> < 0.8 V, V <sub>CM</sub> = 1 kV	15	20			

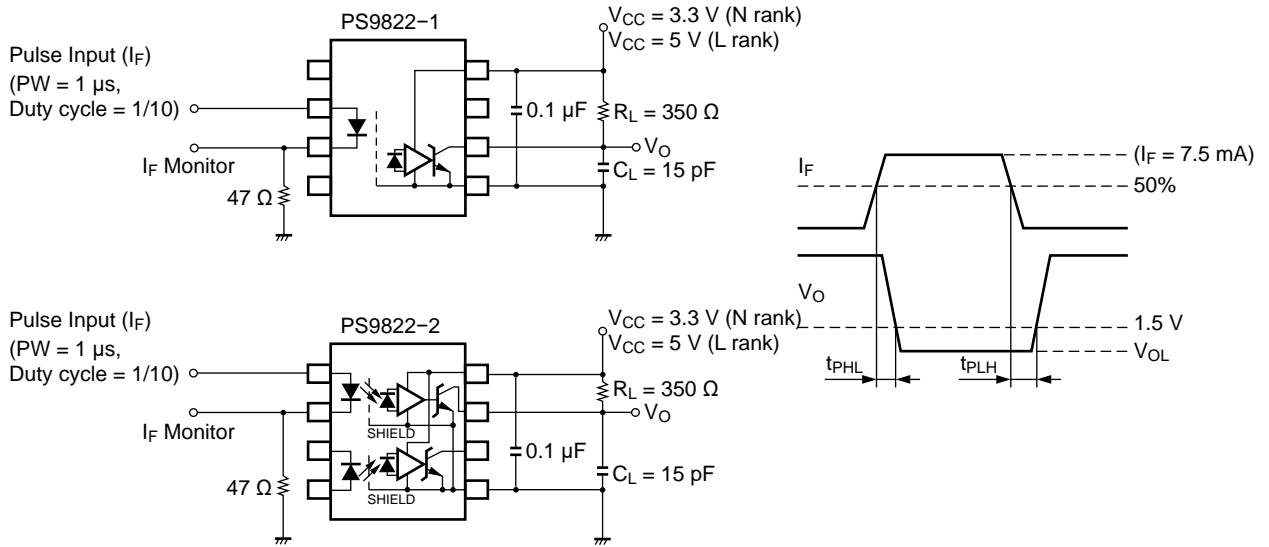
**ELECTRICAL CHARACTERISTICS : L rank (TA = -40 to +100 °C, unless otherwise specified)**

Parameter		Symbol	Conditions	MIN.	TYP.*5	MAX.	Unit		
Diode	Forward Voltage	$V_F$	$I_F = 10 \text{ mA}, T_A = 25 \text{ }^\circ\text{C}$		1.6	1.8	V		
	Reverse Current	$I_R$	$V_R = 3 \text{ V}, T_A = 25 \text{ }^\circ\text{C}$			10	$\mu\text{A}$		
	Terminal Capacitance	$C_t$	$V = 0 \text{ V}, f = 1 \text{ MHz}, T_A = 25 \text{ }^\circ\text{C}$		30		pF		
Detector	High Level Output Current	$I_{OH}$	$V_{CC} = V_O = 5 \text{ V}, V_F = 0.8 \text{ V}$		1	100	$\mu\text{A}$		
	Low Level Output Voltage*6	$V_{OL}$	$V_{CC} = 5 \text{ V}, I_F = 5 \text{ mA}, I_{OL} = 13 \text{ mA}$		0.2	0.6	V		
	High Level Supply Current (PS9822-1)	$I_{CCH}$	$V_{CC} = 5 \text{ V}, I_F = 0 \text{ mA}, V_O = \text{Open}$			2.5	mA		
	High Level Supply Current (PS9822-2)					5			
	Low Level Supply Current (PS9822-1)	$I_{CCL}$	$V_{CC} = 5 \text{ V}, I_F = 10 \text{ mA}, V_O = \text{Open}$			3.5			
	Low Level Supply Current (PS9822-2)					7			
Coupled	Threshold Input Current (H → L)	$I_{FHL}$	$V_{CC} = 5 \text{ V}, V_O = 0.8 \text{ V}, R_L = 350 \text{ } \Omega$		2	5	mA		
	Isolation Resistance	$R_{I-O}$	$V_{I-O} = 1 \text{ kV}_{DC}, R_H = 40 \text{ to } 60 \text{ } \%, T_A = 25 \text{ }^\circ\text{C}$	$10^{11}$			$\Omega$		
	Isolation Capacitance	$C_{I-O}$	$V = 0 \text{ V}, f = 1 \text{ MHz}, T_A = 25 \text{ }^\circ\text{C}$		0.6		pF		
	Propagation Delay Time (H → L)*7	$t_{PHL}$	$V_{CC} = 5 \text{ V}, R_L = 350 \text{ } \Omega, I_F = 7.5 \text{ mA}, V_{THHL} = V_{THLH} = 1.5 \text{ V}$			500	ns		
	Propagation Delay Time (L → H)*7	$t_{PLH}$				700			
	Pulse Width Distortion (PWD)*7	$ t_{PHL} - t_{PLH} $				200			
	Rise Time	$t_r$				60			
	Fall Time	$t_f$				70			
	Common Mode Transient Immunity at High Level Output*8	$CM_H$		$V_{CC} = 5 \text{ V}, R_L = 350 \text{ } \Omega, T_A = 25 \text{ }^\circ\text{C}, I_F = 0 \text{ mA}, V_O > 2 \text{ V}, V_{CM} = 1 \text{ kV}$	15	20			kV/ $\mu\text{s}$
	Common Mode Transient Immunity at Low Level Output*8	$CM_L$		$V_{CC} = 5 \text{ V}, R_L = 350 \text{ } \Omega, T_A = 25 \text{ }^\circ\text{C}, I_F = 7.5 \text{ mA}, V_O < 0.8 \text{ V}, V_{CM} = 1 \text{ kV}$	15	20			

Notes\*: 1, 5. Typical values at  $T_A = 25 \text{ }^\circ\text{C}$

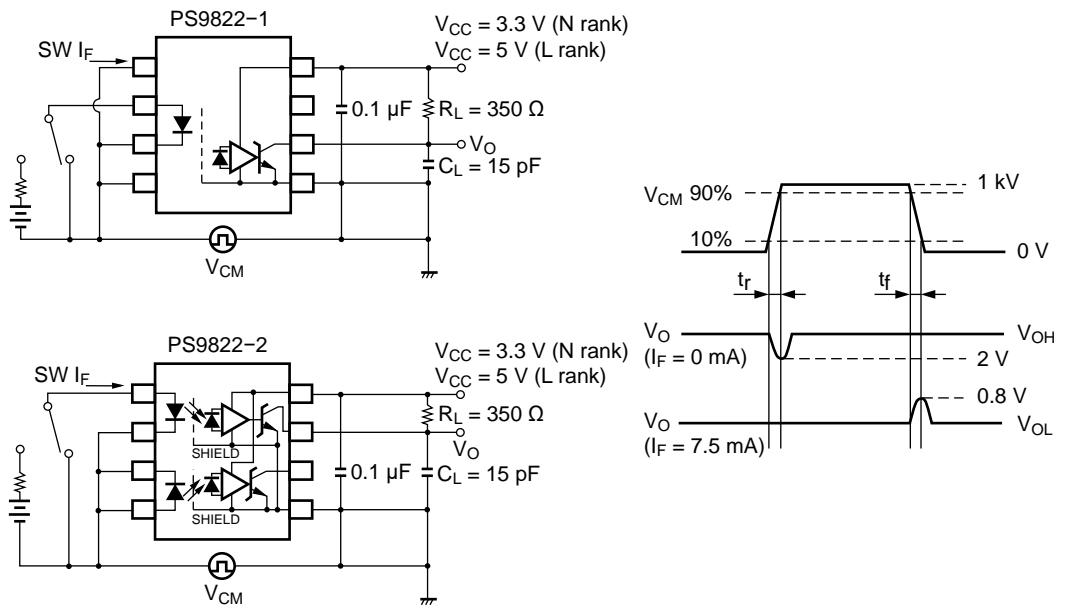
2, 6. Because  $V_{OL}$  of 2 V or more may be output when LED current input and when output supply of  $V_{CC} = 2.6 \text{ V}$  or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

3. 7. Test circuit for propagation delay time.



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

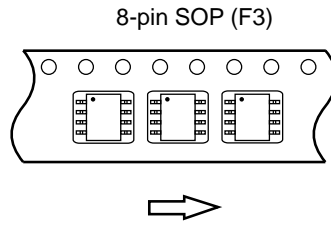
4. 8. Test circuit for common mode transient immunity



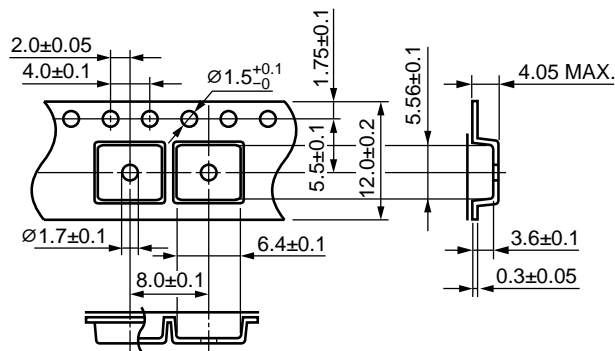
Remark:  $C_L$  includes probe and stray wiring capacitance.

TAPING SPECIFICATIONS (UNIT: mm)

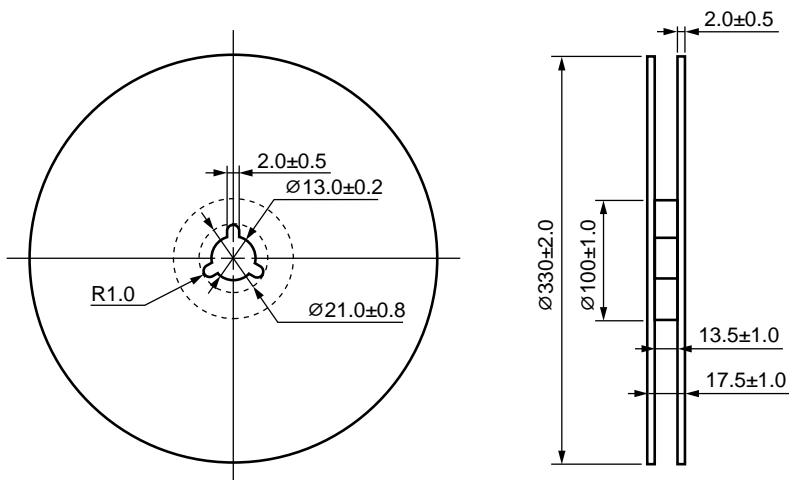
Taping Direction



Outline and Dimensions (Tape)



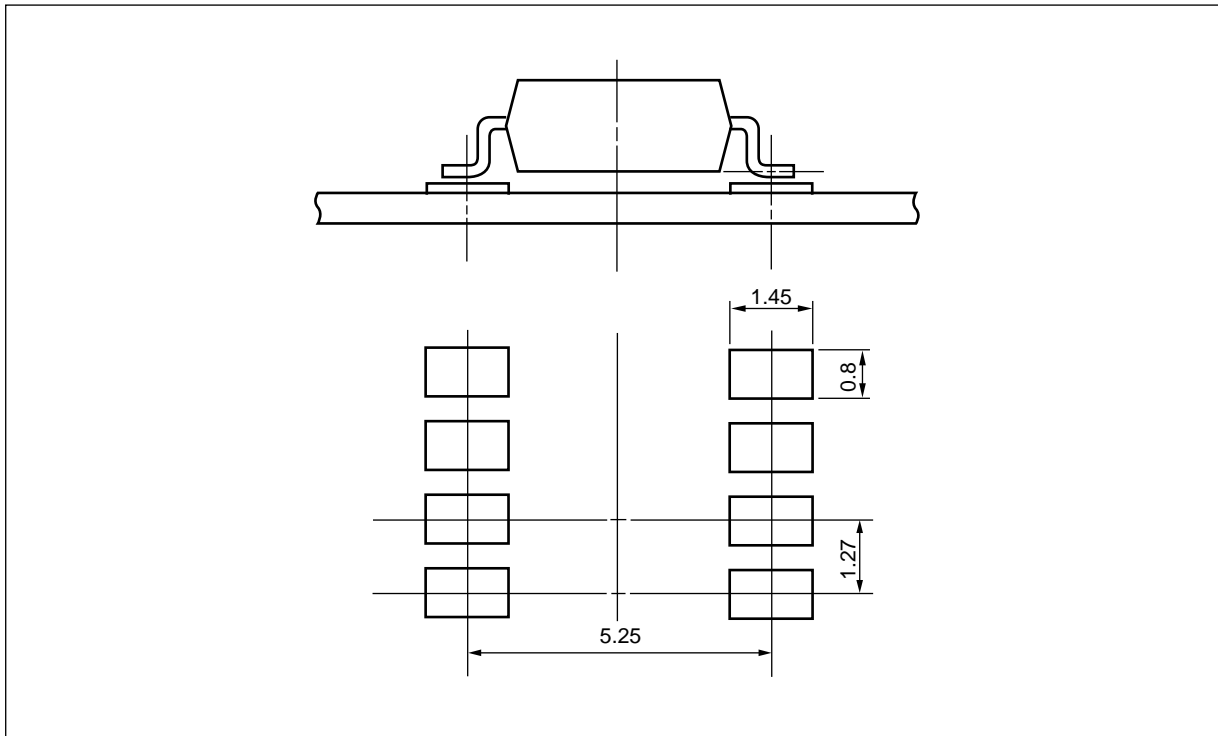
Outline and Dimensions (Reel)



Packing: 1 500 pcs/reel



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



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

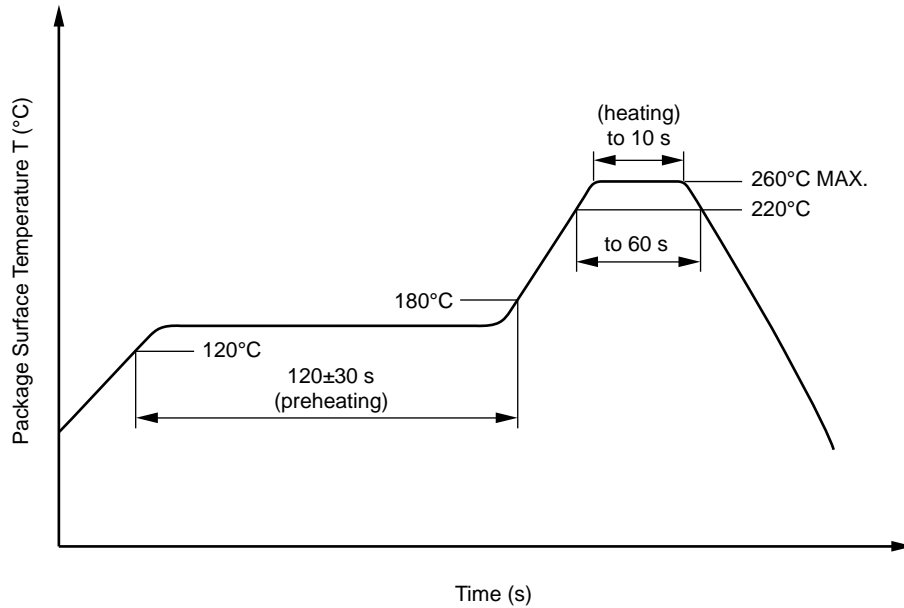
**NOTES ON HANDLING**

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 or between collector-emitters at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

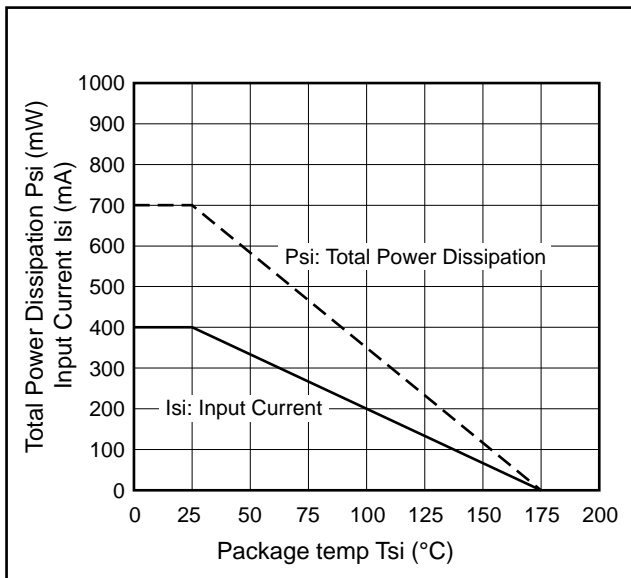
## USAGE CAUTIONS

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 0.1  $\mu$ F 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.
4. Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
5. Do not use fixing agents or coatings containing halogen-based substances.

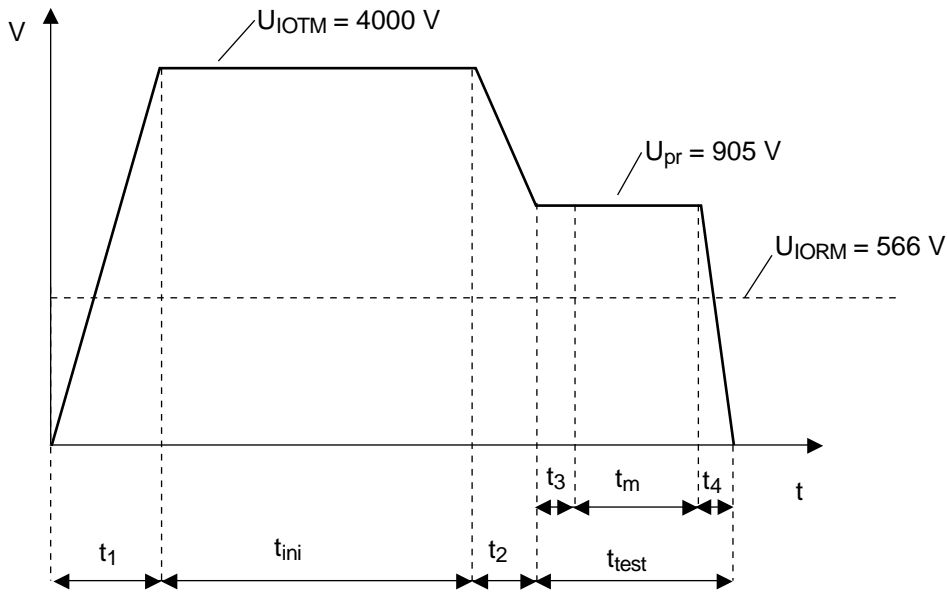
**SPECIFICATION OF VDE MARKS LICENSE DOCUMENT**

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/100/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	566 849	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{pr}$	1 061	$V_{peak}$
Highest permissible overvoltage	$U_{IOTM}$	4 000	$V_{peak}$
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	175	
Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		III a	
Storage temperature range	$T_{stg}$	- 55 to +125	°C
Operating temperature range	$T_A$	- 40 to +100	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25 \text{ °C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100 \text{ °C}$	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.	150 150 600 $10^9$	°C mA mW $\Omega$

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

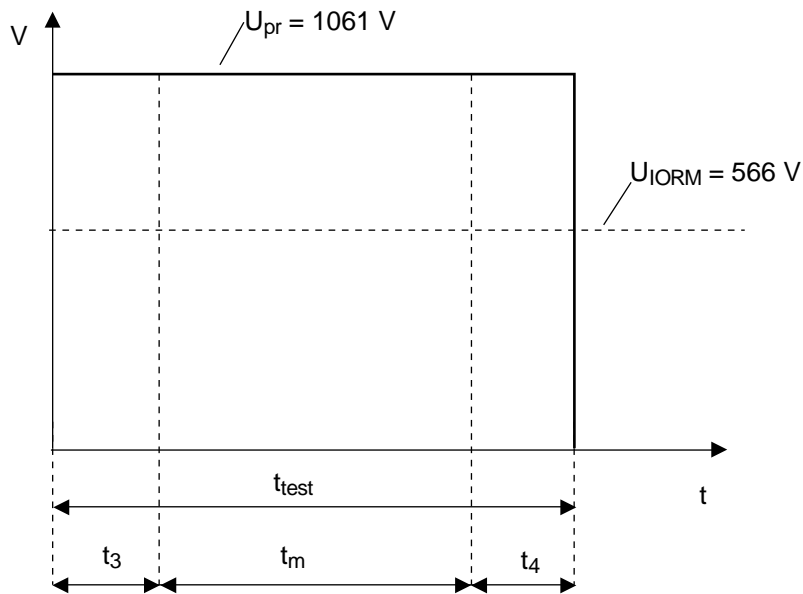


**Method a) Destructive Test, Type and Sample Test**



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

**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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