

To our customers,

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## Old Company Name in Catalogs and Other Documents

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On April 1<sup>st</sup>, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# PHOTOCOUPLER PS8101

## 1 Mbps HIGH CMR ANALOG OUTPUT TYPE 5-PIN SOP (SO-5) PHOTOCOUPLER

–NEPOC Series–

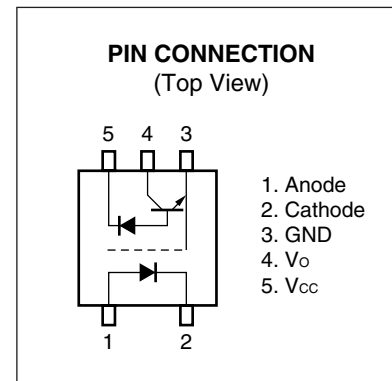
### DESCRIPTION

The PS8101 is an optically coupled isolator containing a GaAlAs LED on the light emitting diode (input side) and a PIN photodiode and a high-speed amplifier transistor on the output side on one chip.

This is a plastic SOP (Small Out-line Package) type for high density applications.

### FEATURES

- <R> • High common mode transient immunity ( $C_{MH}$ ,  $C_{ML} = \pm 15 \text{ kV}/\mu\text{s MIN.}$ )
- Small package (SO-5)
- High supply voltage ( $V_{CC} = 35 \text{ V}$ )
- High isolation voltage ( $BV = 3\,750 \text{ V r.m.s.}$ )
- High-speed response ( $t_{PHL} = 0.8 \mu\text{s MAX.}$ ,  $t_{PLH} = 1.2 \mu\text{s MAX.}$ )
- Ordering number of taping product: PS8101-F3, F4: 2 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422
  - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
  - DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40008902 (Option)

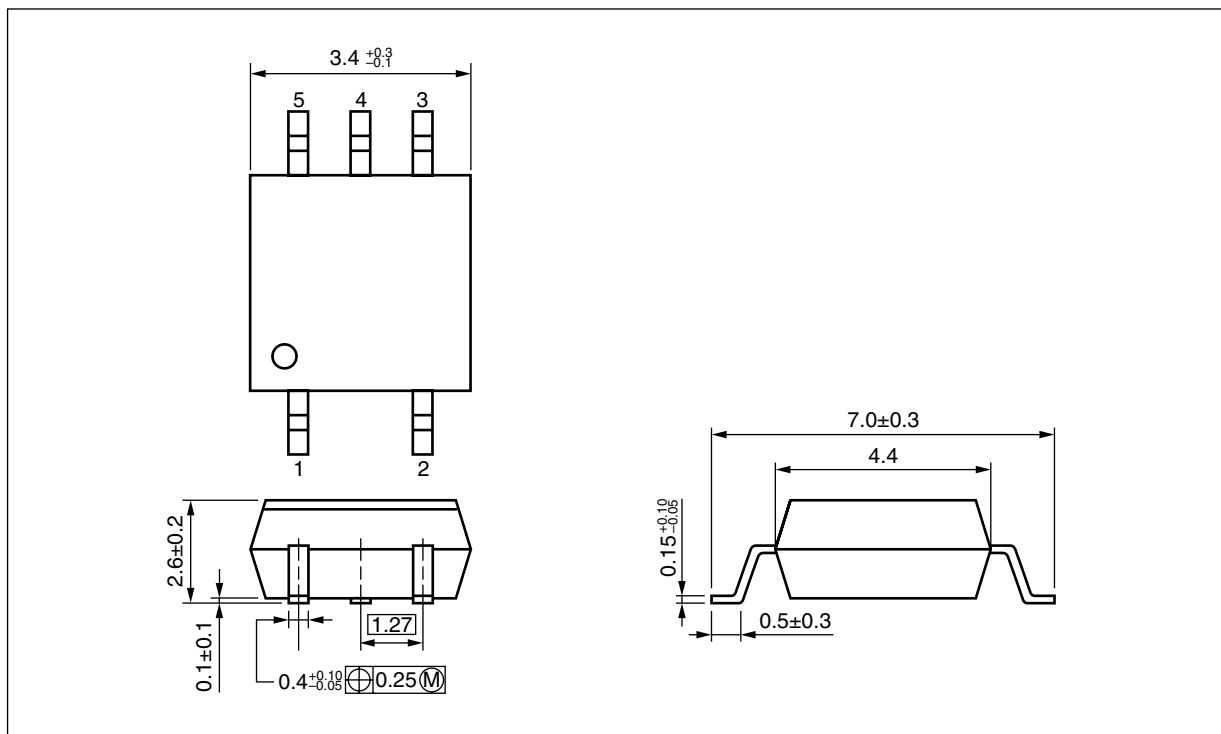


### APPLICATIONS

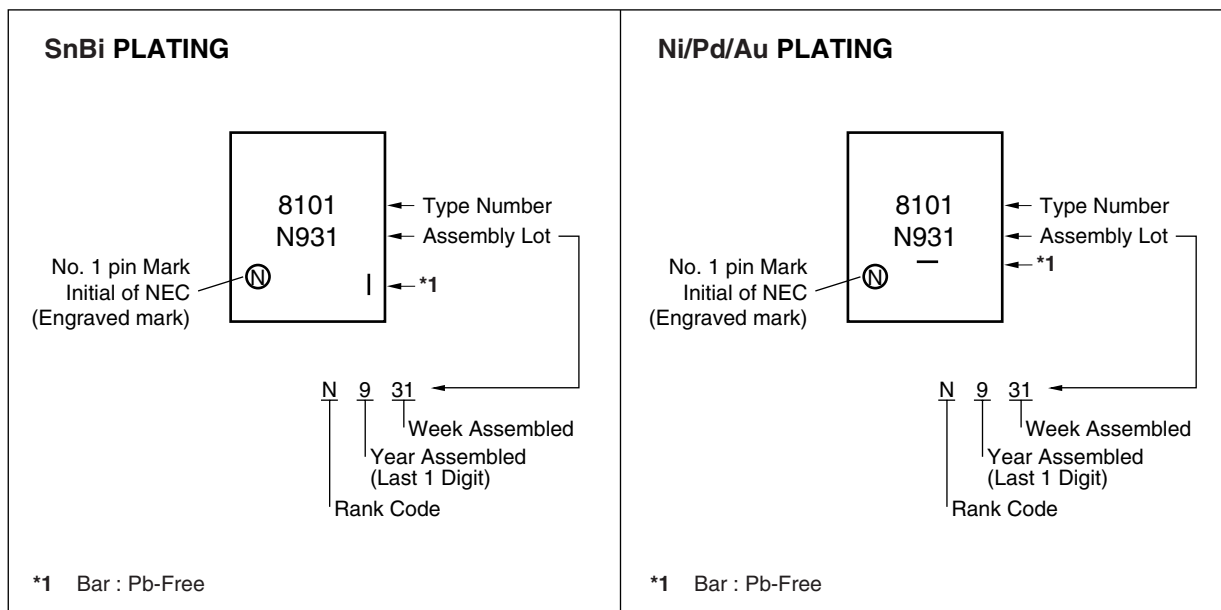
- Computer and peripheral manufactures
- General purpose inverter
- Substitutions for relays and pulse transformers
- Power supply

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<R> PACKAGE DIMENSIONS (UNIT: mm)



<R> MARKING EXAMPLE



<R> PHOTOCOUPLER CONSTRUCTION

Parameter	PS8101
Air Distance (MIN.)	4.2 mm
Outer Creepage Distance (MIN.)	4.2 mm
Isolation Distance (MIN.)	0.2 mm

<R> ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>	
PS8101	PS8101-A	Pb-Free (SnBi)	20 pcs (Tape 20 pcs cut)	Standard products (UL, CSA approved)	PS8101	
PS8101-F3	PS8101-F3-A		Embossed Tape 2 500 pcs/reel			
PS8101-F4	PS8101-F4-A					
PS8101-V	PS8101-V-A		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2		
PS8101-V-F3	PS8101-V-F3-A		Embossed Tape 2 500 pcs/reel	(VDE0884 Part2)		
PS8101-V-F4	PS8101-V-F4-A			Approved (Option)		
PS8101	PS8101-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL, CSA approved)		
PS8101-F3	PS8101-F3-AX		Embossed Tape 2 500 pcs/reel			
PS8101-F4	PS8101-F4-AX					
PS8101-V	PS8101-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2		
PS8101-V-F3	PS8101-V-F3-AX		Embossed Tape 2 500 pcs/reel	(VDE0884 Part2)		
PS8101-V-F4	PS8101-V-F4-AX			Approved (Option)		

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

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

Parameter		Symbol	Ratings	Unit
Diode	Forward Current	I <sub>F</sub>	25	mA
	Reverse Voltage	V <sub>R</sub>	5.0	V
	Power Dissipation <sup>*1</sup>	P <sub>D</sub>	45	mW
Detector	Supply Voltage	V <sub>CC</sub>	35	V
	Output Voltage	V <sub>O</sub>	35	V
	Output Current	I <sub>O</sub>	8.0	mA
	Power Dissipation <sup>*2</sup>	P <sub>C</sub>	100	mW
Isolation Voltage <sup>*3</sup>		BV	3 750	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	−55 to +100	°C
Storage Temperature		T <sub>stg</sub>	−55 to +125	°C

\*1 Reduced to 0.45 mW/°C at T<sub>A</sub> = 25°C or more.

\*2 Reduced to 1.00 mW/°C at T<sub>A</sub> = 25°C or more.

\*3 AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output.  
Pins 1-2 shorted together, 3-5 shorted together.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 16 mA		1.7	2.2	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 3 V			10	μA
	Forward Voltage Temperature Coefficient	ΔV <sub>F</sub> /ΔT <sub>A</sub>	I <sub>F</sub> = 16 mA		-2.1		mV/°C
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1 MHz		30		pF
Detector	High Level Output Current	I <sub>OH</sub> (1)	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = V <sub>O</sub> = 5.5 V		3	500	nA
	High Level Output Current	I <sub>OH</sub> (2)	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = V <sub>O</sub> = 30 V			100	μA
	Low Level Output Voltage	V <sub>OL</sub>	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 4.5 V, I <sub>O</sub> = 1.2 mA		0.1	0.4	V
	Low Level Supply Current	I <sub>CC</sub> L	I <sub>F</sub> = 16 mA, V <sub>O</sub> = open, V <sub>CC</sub> = 30 V		50		μA
	High Level Supply Current	I <sub>CC</sub> H	I <sub>F</sub> = 0 mA, V <sub>O</sub> = open, V <sub>CC</sub> = 30 V		0.01	2	
Coupled	Current Transfer Ratio <sup>*1</sup>	CTR	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 4.5 V, V <sub>O</sub> = 0.4 V	15	20	35	%
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1 kV <sub>DC</sub> , RH = 40 to 60%	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz		0.4		pF
	Propagation Delay Time (H → L) <sup>*2</sup>	t <sub>PHL</sub>	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 2.2 kΩ, C <sub>L</sub> = 15 pF		0.5	0.8	μs
	Propagation Delay Time (L → H) <sup>*2</sup>	t <sub>PLH</sub>			0.6	1.2	
	Common Mode Transient Immunity at High Level Output <sup>*3</sup>	C <sub>MH</sub>	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 4.1 kΩ, V <sub>CM</sub> = 1.5 kV	15			kV/μs
	Common Mode Transient Immunity at Low Level Output <sup>*3</sup>	C <sub>ML</sub>	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 4.1 kΩ, V <sub>CM</sub> = 1.5 kV	-15			

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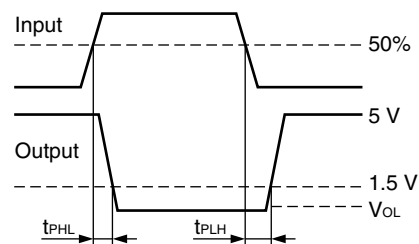
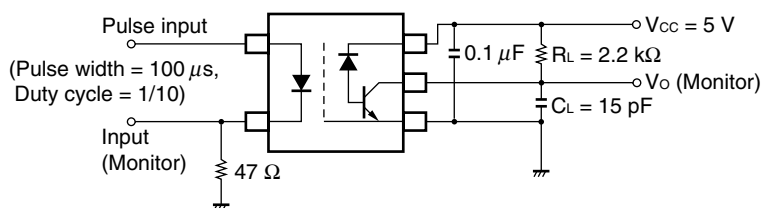
<R>

\*1 CTR rank

K : 20 to 35 (%)

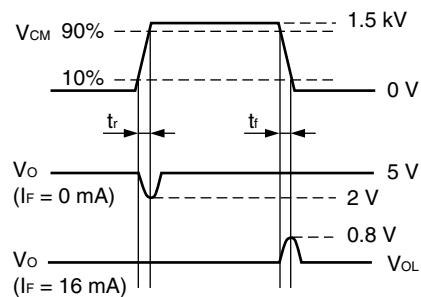
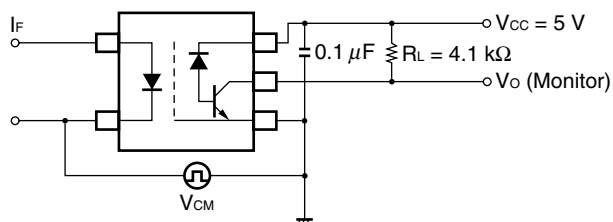
N : 15 to 35 (%)

**\*2 Test circuit for propagation delay time**



$C_L$  is approximately 15 pF which includes probe and stray wiring capacitance.

**\*3 Test circuit for common mode transient immunity**

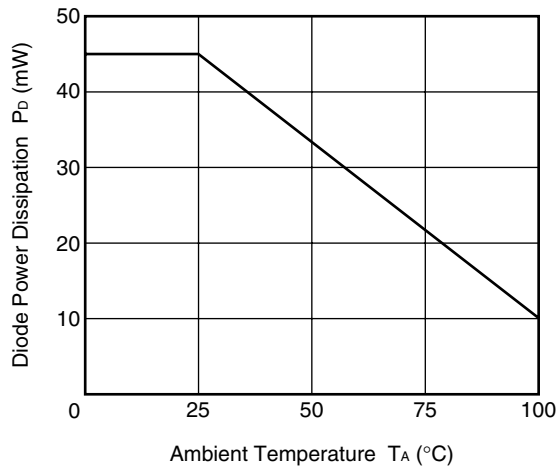


**USAGE CAUTIONS**

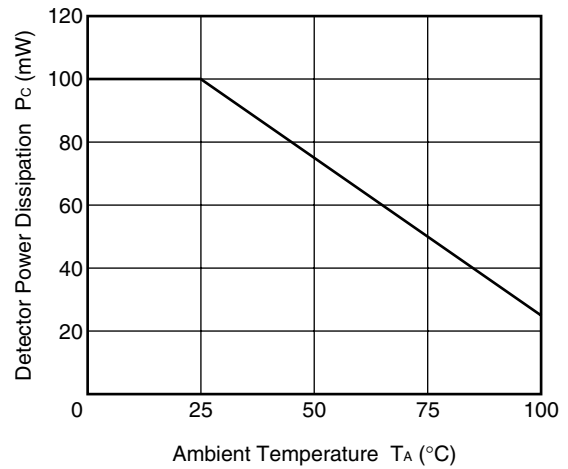
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of 0.1  $\mu$ F is used between  $V_{CC}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler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

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

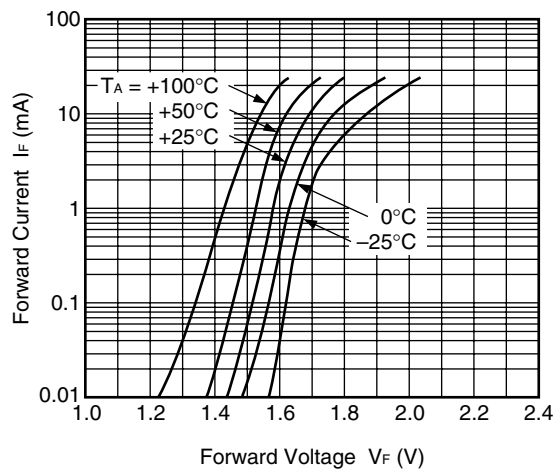
**DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE**



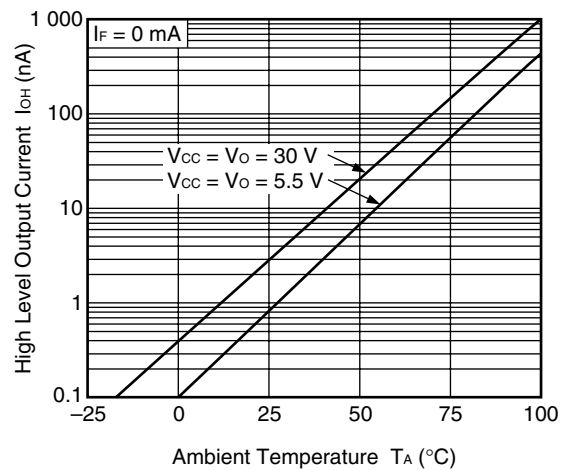
**DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE**



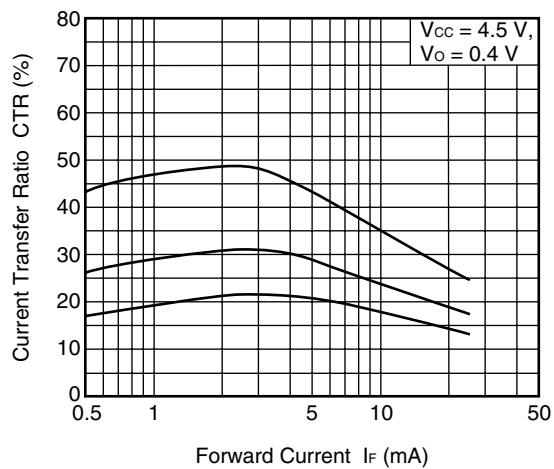
**FORWARD CURRENT vs. FORWARD VOLTAGE**



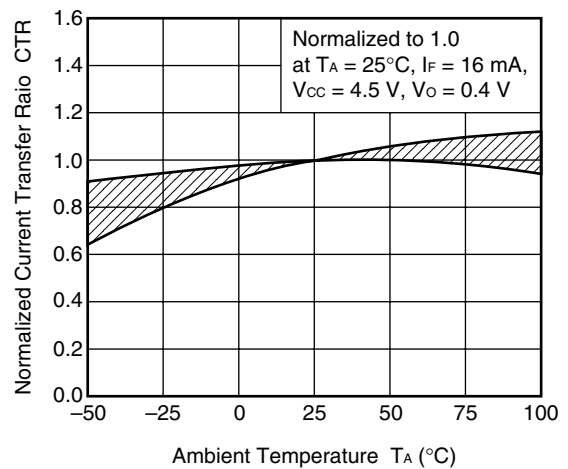
**HIGH LEVEL OUTPUT CURRENT vs. AMBIENT TEMPERATURE**



**CURRENT TRANSFER RATIO vs. FORWARD CURRENT**



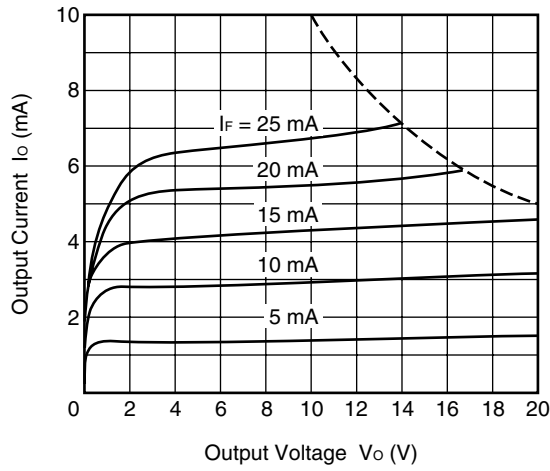
**NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE**



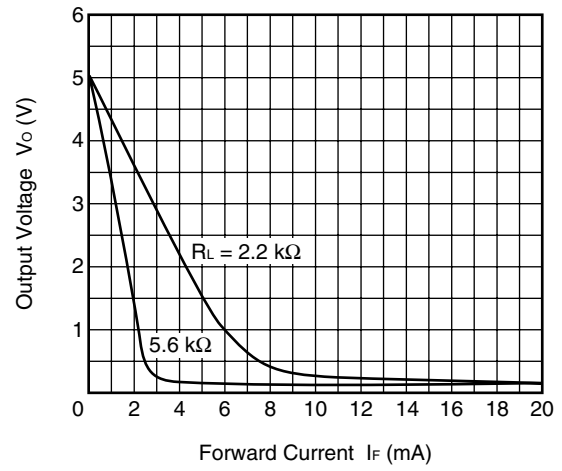
**Remark** The graphs indicate nominal characteristics.



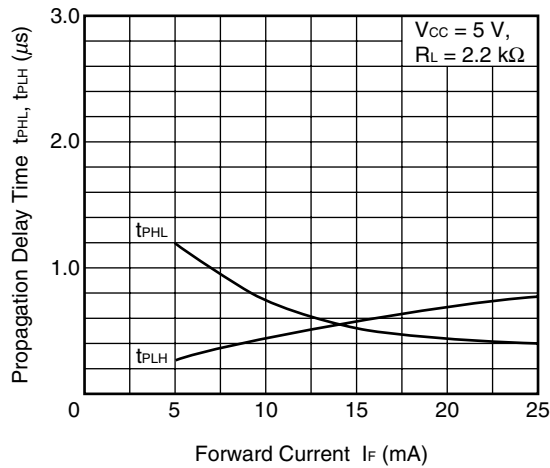
OUTPUT CURRENT vs.  
OUTPUT VOLTAGE



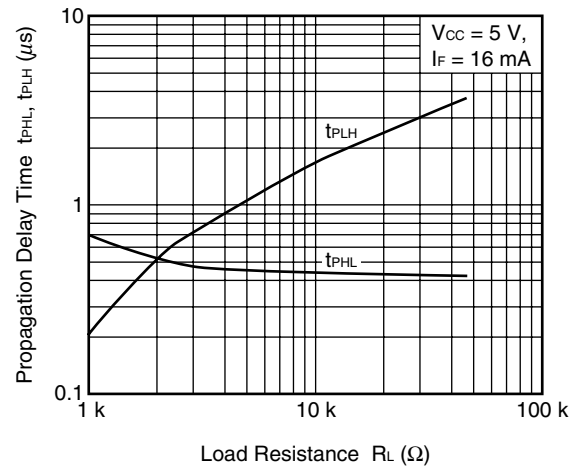
OUTPUT VOLTAGE vs.  
FORWARD CURRENT



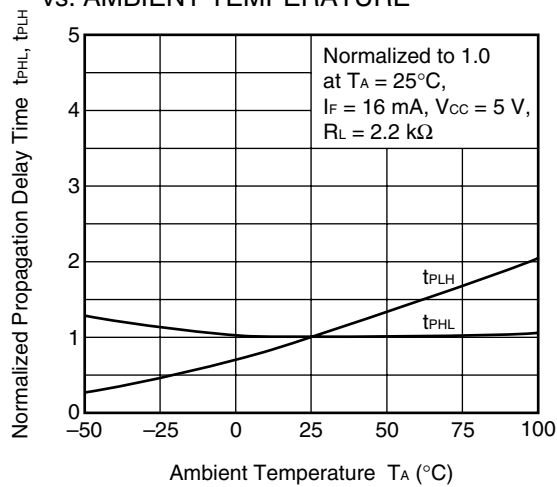
PROPAGATION DELAY TIME vs.  
FORWARD CURRENT



PROPAGATION DELAY TIME vs.  
LOAD RESISTANCE



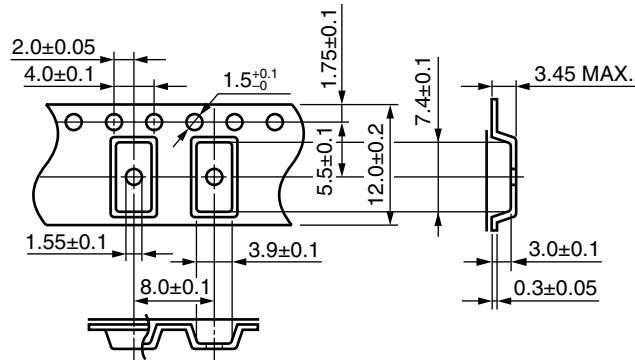
NORMALIZED PROPAGATION DELAY TIME  
vs. AMBIENT TEMPERATURE



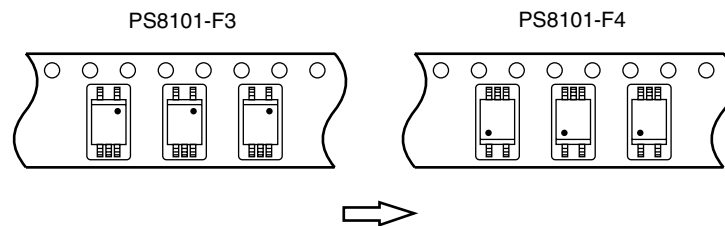
**Remark** The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

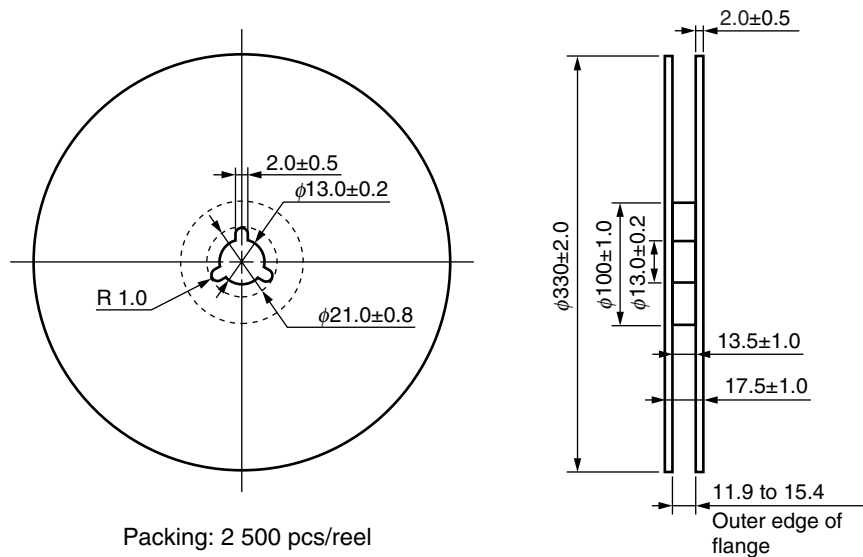
Outline and Dimensions (Tape)



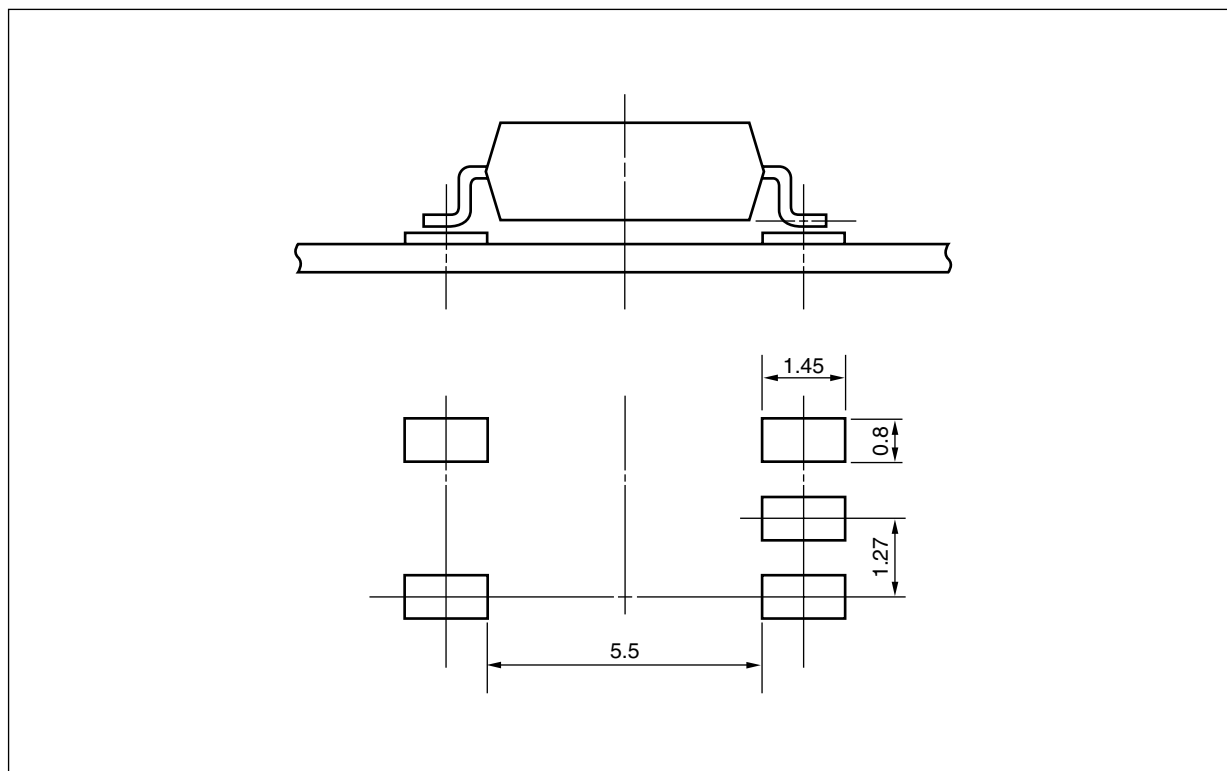
Taping Direction



Outline and Dimensions (Reel)



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



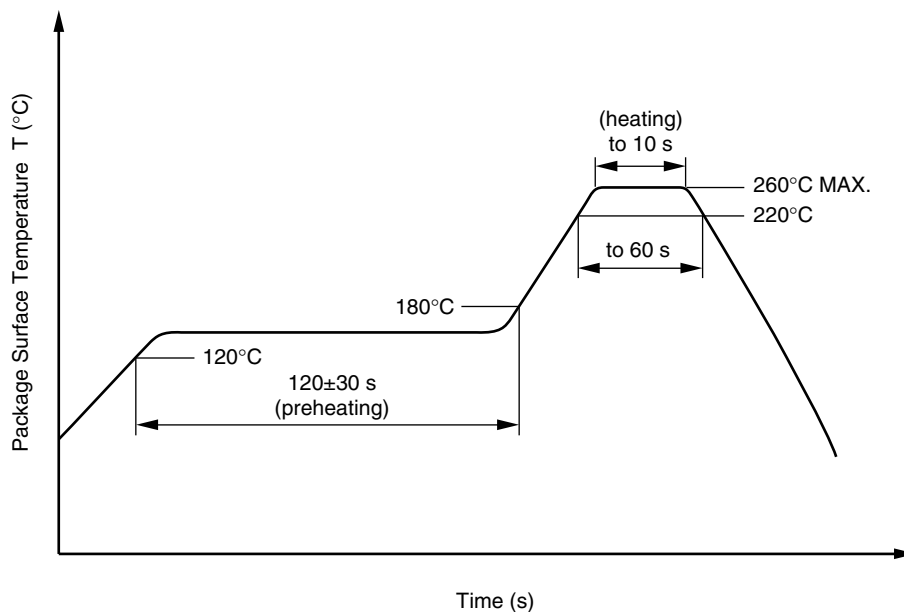
## NOTES ON HANDLING

### 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**

- Fluxes

Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.

&lt;R&gt;

**2. Cautions regarding noise**

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

<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		55/100/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{IORM}$ , $P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	707 1 061	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5 \text{ pC}$	$U_{pr}$	1 326	$V_{peak}$
Highest permissible overvoltage	$U_{TR}$	6 000	$V_{peak}$
Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	CTI	175	
Material group (DIN EN 60664-1 VDE0110 Part 1)		III a	
Storage temperature range	$T_{stg}$	-55 to +125	°C
Operating temperature range	$T_A$	-55 to +100	°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 $100^\circ\text{C}$	$R_{is \text{ MIN.}}$ $R_{is \text{ MIN.}}$	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
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 $T_A = T_{si}$	$T_{si}$ $I_{si}$ $P_{si}$ $R_{is \text{ MIN.}}$	150 200 300 $10^9$	°C mA mW $\Omega$

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(Note)

- (1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
- (2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

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<div>Caution</div>	<div>GaAs Products</div>	<div><p>This product uses gallium arsenide (GaAs).</p><p>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.</li><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><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></div>
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