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

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

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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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**

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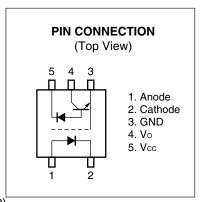
- High common mode transient immunity (CMH, CML =  $\pm 15 \text{ kV}/\mu \text{s MIN.}$ )
- Small package (SO-5)
- High supply voltage (Vcc = 35 V)
- High isolation voltage (BV = 3 750 Vr.m.s.)
- High-speed response (tphL = 0.8  $\mu$ s MAX., tpLH = 1.2  $\mu$ s MAX.)
- Ordering number of taping product: PS8101-F3, F4: 2 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422

<R>

- CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
- DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40008902 (Option)

### **APPLICATIONS**

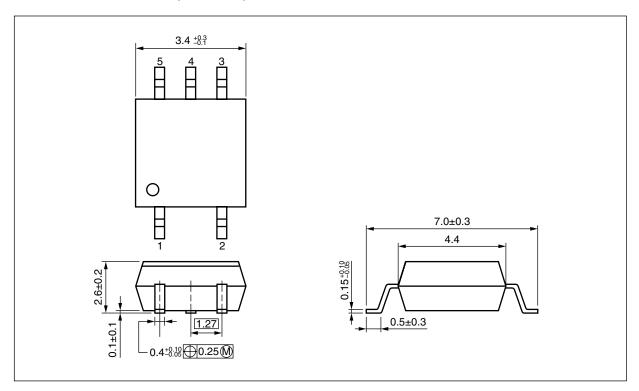
- · Computer and peripheral manufactures
- General purpose inverter
- Substitutions for relays and pulse transformers
- · Power supply



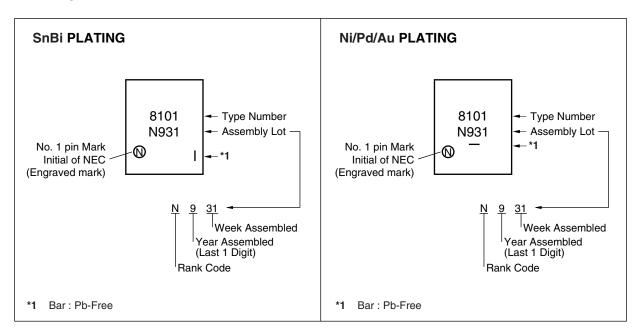
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### <R> PACKAGE DIMENSIONS (UNIT: mm)



### <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 Packing Style Safety Standard Approval		Application Part Number <sup>*1</sup>	
PS8101	PS8101-A	Pb-Free	20 pcs (Tape 20 pcs cut)	Standard products	PS8101
PS8101-F3	PS8101-F3-A	(SnBi)	Embossed Tape 2 500 pcs/reel	(UL, CSA approved)	
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	20 pcs (Tape 20 pcs cut)	Standard products	
PS8101-F3	PS8101-F3-AX	(Ni/Pd/Au)	Embossed Tape 2 500 pcs/reel	(UL, CSA approved)	
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)	

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

### ABSOLUTE MAXIMUM RATINGS (TA = 25°C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current	lF	25	mA
	Reverse Voltage	VR	5.0	٧
	Power Dissipation ¹	Po	45	mW
Detector	Supply Voltage	Vcc	35	٧
	Output Voltage	Vo	35	٧
	Output Current	lo	8.0	mA
	Power Dissipation <sup>2</sup>	Pc	100	mW
Isolation Voltage <sup>*3</sup>		BV	3 750	Vr.m.s.
Operating Ambient Temperature		TA	-55 to +100	°C
Storage Temperature		T <sub>stg</sub>	-55 to +125	°C

- \*1 Reduced to 0.45 mW/ $^{\circ}$ C at T<sub>A</sub> = 25 $^{\circ}$ C or more.
- \*2 Reduced to 1.00 mW/ $^{\circ}$ C at T<sub>A</sub> = 25 $^{\circ}$ C or more.
- \*3 AC voltage for 1 minute at  $T_A = 25^{\circ}$ C, RH = 60% between input and output. Pins 1-2 shorted together, 3-5 shorted together.

3



### **ELECTRICAL CHARACTERISTICS (TA = 25°C)**

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	VF	I <sub>F</sub> = 16 mA		1.7	2.2	V
	Reverse Current	<b>I</b> R	V <sub>R</sub> = 3 V			10	μА
	Forward Voltage Temperature Coefficient	Δ <b>V</b> F/Δ <b>T</b> A	I <sub>F</sub> = 16 mA		-2.1		mV/°C
	Terminal Capacitance	Ct	V = 0 V, f = 1 MHz		30		pF
Detector	High Level Output Current	Іон (1)	IF = 0 mA, Vcc = Vo = 5.5 V		3	500	nA
	High Level Output Current	Іон (2)	IF = 0 mA, Vcc = Vo = 30 V			100	μА
	Low Level Output Voltage	Vol	IF = 16 mA, Vcc = 4.5 V, Io = 1.2 mA		0.1	0.4	V
	Low Level Supply Current	Iccl	IF = 16 mA, Vo = open, Vcc = 30 V		50		μА
	High Level Supply Current	Іссн	IF = 0 mA, Vo = open, Vcc = 30 V		0.01	2	
Coupled	Current Transfer Ratio*1	CTR	IF = 16 mA, Vcc = 4.5 V, Vo = 0.4 V	15	20	35	%
	Isolation Resistance	R <sub>I</sub> -o	V <sub>I-O</sub> = 1 kV <sub>DC</sub> , RH = 40 to 60%	1011			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz		0.4		pF
	Propagation Delay Time (H → L)*²	tphL	$I_F = 16 \text{ mA, } V_{CC} = 5 \text{ V, } R_L = 2.2 \text{ k}\Omega,$ $C_L = 15 \text{ pF}$		0.5	0.8	μs
	Propagation Delay Time $(L \rightarrow H)^2$	tршн			0.6	1.2	
	Common Mode Transient Immunity at High Level Output <sup>3</sup>	Смн	IF = 0 mA, Vcc = 5 V, RL = 4.1 k $\Omega$ , VcM = 1.5 kV	15			kV/ <i>μ</i> s
	Common Mode Transient Immunity at Low Level Output <sup>3</sup>	Смь	$I_F = 16 \text{ mA, Vcc} = 5 \text{ V, RL} = 4.1 \text{ k}\Omega,$ $V_{\text{CM}} = 1.5 \text{ kV}$	-15			

\*1 CTR rank

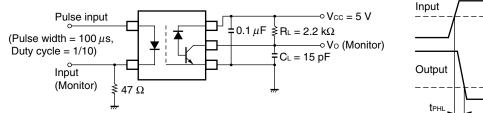
K: 20 to 35 (%) N: 15 to 35 (%)

-- 50%

\_ 1.5 V

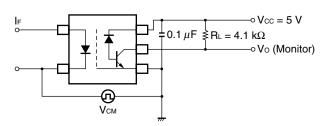


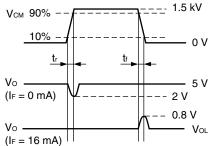
\*2 Test circuit for propagation delay time



C<sub>L</sub> is approximately 15 pF which includes probe and stray wiring capacitance.

\*3 Test circuit for common mode transient immunity





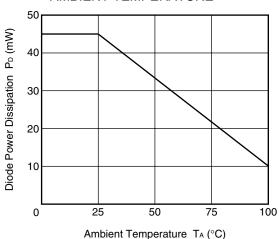
 $t_{\text{PLH}}$ 

### **USAGE CAUTIONS**

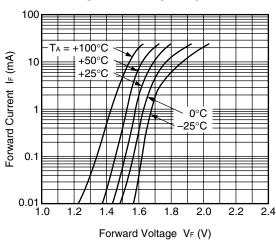
- 1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
- 2. By-pass capacitor of 0.1  $\mu$ F is used between Vcc and GND near device. Also, ensure that the distance between the leads of the photocoupler and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

### TYPICAL CHARACTERISTICS (TA = 25°C, unless otherwise specified)

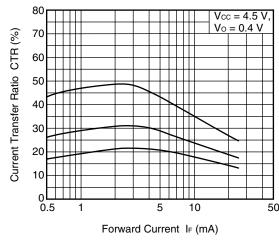




FORWARD CURRENT vs. FORWARD VOLTAGE

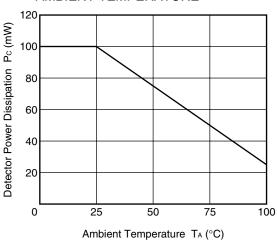


CURRENT TRANSFER RATIO vs. FORWARD CURRENT

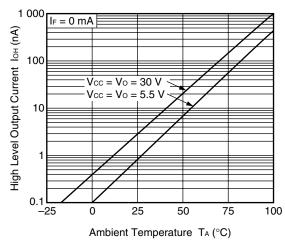


Remark The graphs indicate nominal characteristics.

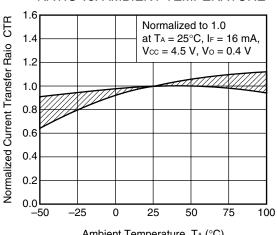
### DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



HIGH LEVEL OUTPUT CURRENT vs. AMBIENT TEMPERATURE



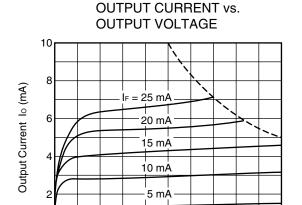
### NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE





0

2 4

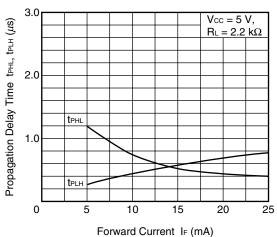


### PROPAGATION DELAY TIME vs. FORWARD CURRENT

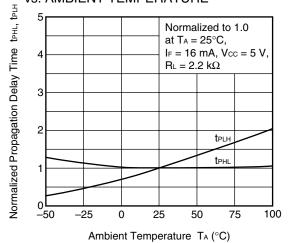
Output Voltage Vo (V)

10 12

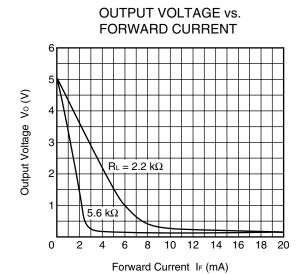
14 16 18



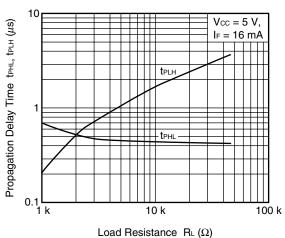
### NORMALIZED PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



**Remark** The graphs indicate nominal characteristics.

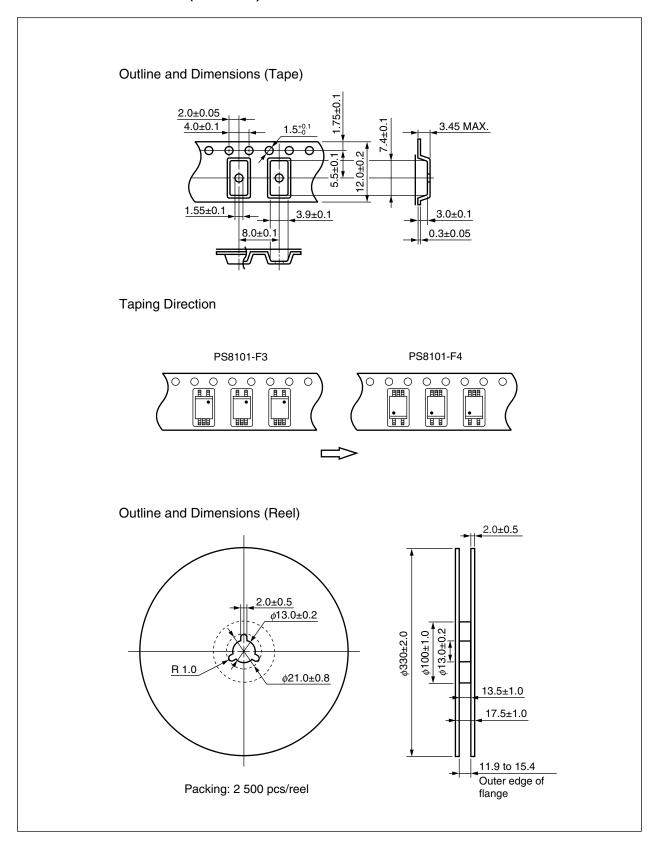


### PROPAGATION DELAY TIME vs. LOAD RESISTANCE

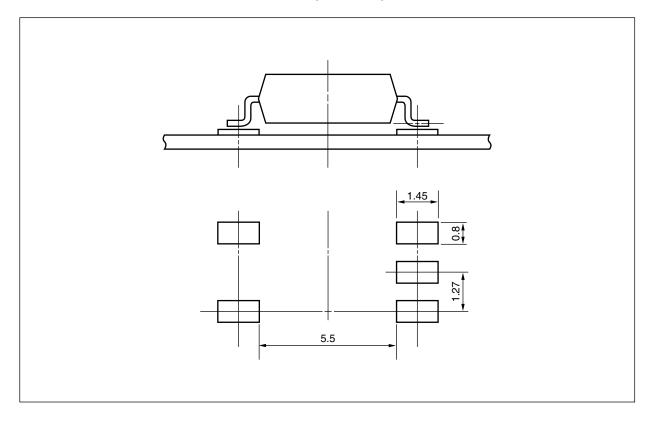




### TAPING SPECIFICATIONS (UNIT: mm)



### 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)

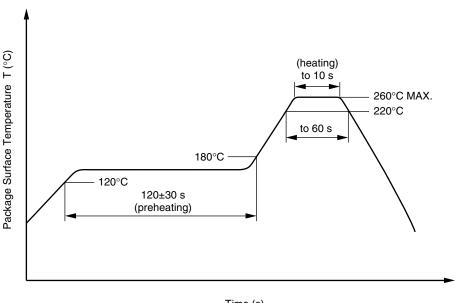
• Time of peak reflow temperature 10 seconds or less • Time of temperature higher than 220°C 60 seconds or less

• 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



Time (s)

### (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.

### <R>> 2. Cautions regarding noise

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

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### <R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Speck	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) $U_{pr} = 1.5 \times U_{IORM}, P_d < 5 pC$	Uювм Upr	707 1 061	V <sub>peak</sub> V <sub>peak</sub>
Test voltage (partial discharge test, procedure b for all devices) $U_{pr}=1.875\times U_{IORM},P_d<5\;pC$	Upr	1 326	$V_{peak}$
Highest permissible overvoltage	Utr	6 000	V <sub>peak</sub>
Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	СТІ	175	
Material group (DIN EN 60664-1 VDE0110 Part 1)		III a	
Storage temperature range	Tstg	-55 to +125	°C
Operating temperature range	TA	-55 to +100	°C
Isolation resistance, minimum value  VIO = 500 V dc at TA = 25°C  VIO = 500 V dc at TA MAX. at least 100°C	Ris MIN. Ris MIN.	10 <sup>12</sup> 10 <sup>11</sup>	Ω Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)  Package temperature  Current (input current IF, Psi = 0)  Power (output or total power dissipation)  Isolation resistance	Tsi Isi Psi	150 200 300	°C mA mW
V <sub>IO</sub> = 500 V dc at T <sub>A</sub> = Tsi	Ris MIN.	10°	Ω

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NEC PS8101

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**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.
  - 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.