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## 1 Mbps ANALOG OUTPUT TYPE 8-PIN SSOP (SO-8) HIGH-SPEED PHOTOCOUPLER

–NEPOC Series–

### DESCRIPTION

The PS8821-1, -2 are optically coupled isolators 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.

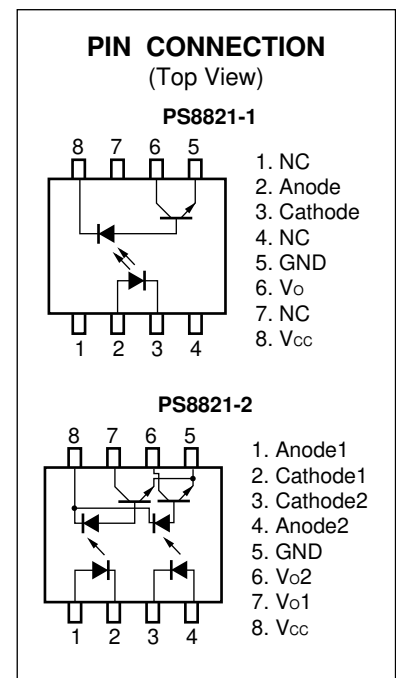
The PS8821-2 is suitable for high density applications.

### FEATURES

- 40% reduction of mounting area (5-pin SOP × 2)
- Low power consumption ( $V_{CC} = 3.3\text{ V}$ )
- High isolation voltage ( $BV = 2\,500\text{ Vr.m.s.}$ )
- High-speed response ( $t_{PHL} = 0.6\ \mu\text{s MAX.}$ ,  $t_{PLH} = 0.9\ \mu\text{s MAX.}$ )
- Ordering number of tape product: PS8821-1-F3, F4: 1 500 pcs/reel  
: PS8821-2-F3, F4: 1 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved (Option)

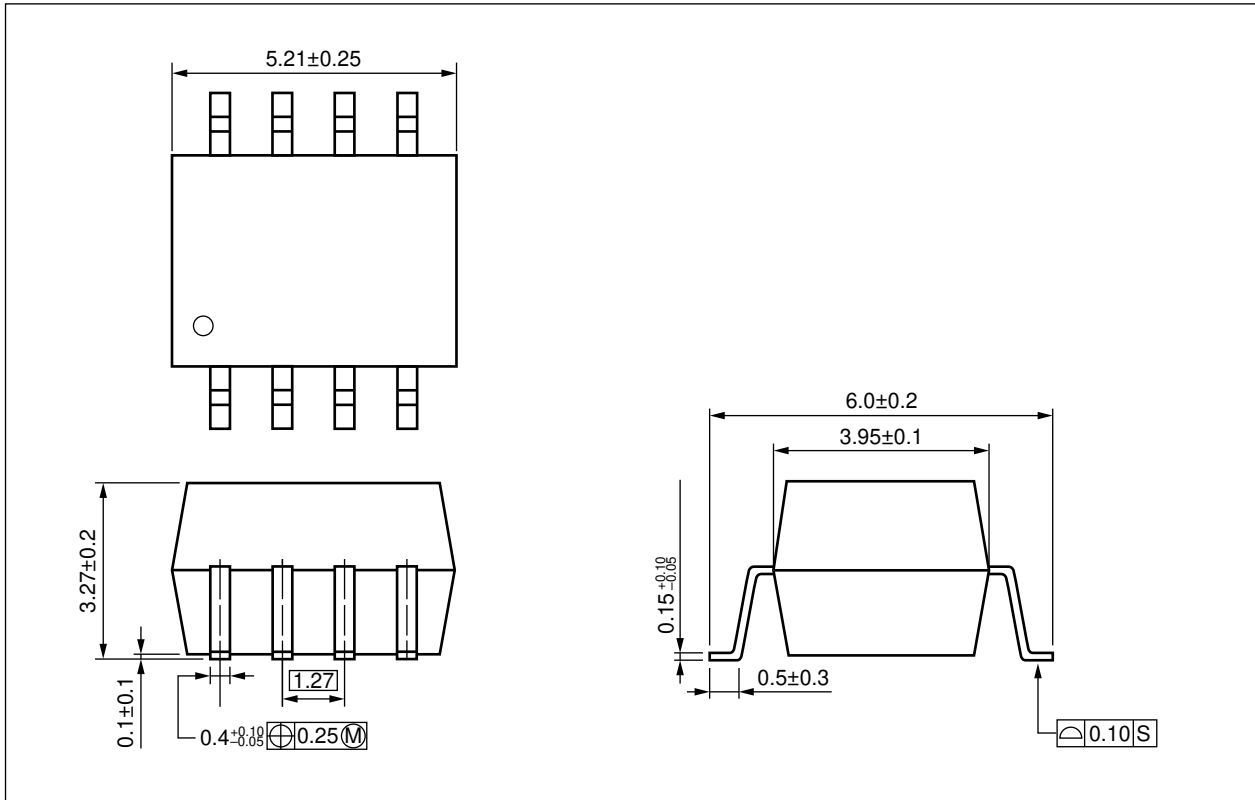
### APPLICATIONS

- Power over Ethernet
- Computer and peripheral manufactures
- Substitutions for relays and pulse transformers
- Power supply



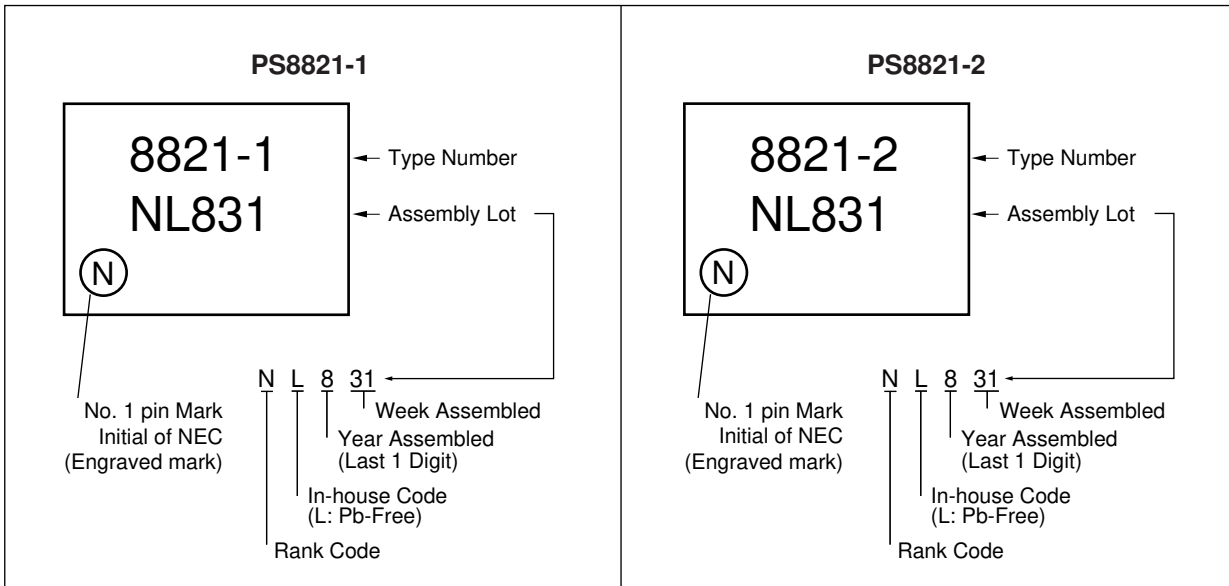
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PACKAGE DIMENSIONS (UNIT: mm)

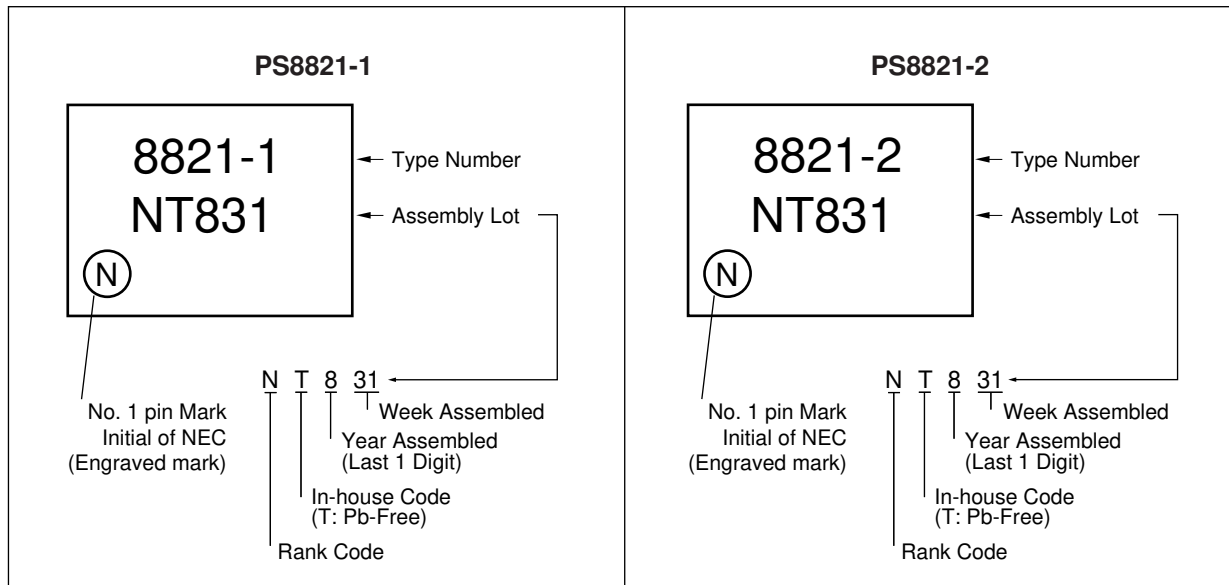


<R> **MARKING EXAMPLE**

**SnBi PLATING**



**Ni/Pd/Au PLATING**



<R> **ORDERING INFORMATION**

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>	
PS8821-1	PS8821-1-A	Pb-Free (SnBi)	20 pcs (Tape 20 pcs cut)	Standard products (UL approved)	PS8821-1	
PS8821-1-F3	PS8821-1-F3-A		Embossed Tape 1 500 pcs/reel			
PS8821-1-F4	PS8821-1-F4-A					
PS8821-2	PS8821-2-A		20 pcs (Tape 20 pcs cut)		DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)	PS8821-2
PS8821-2-F3	PS8821-2-F3-A		Embossed Tape 1 500 pcs/reel			
PS8821-2-F4	PS8821-2-F4-A					
PS8821-1-V	PS8821-1-V-A		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)		PS8821-1
PS8821-1-V-F3	PS8821-1-V-F3-A		Embossed Tape 1 500 pcs/reel			
PS8821-1-V-F4	PS8821-1-V-F4-A					
PS8821-2-V	PS8821-2-V-A		20 pcs (Tape 20 pcs cut)		DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)	PS8821-2
PS8821-2-V-F3	PS8821-2-V-F3-A		Embossed Tape 1 500 pcs/reel			
PS8821-2-V-F4	PS8821-2-V-F4-A					
PS8821-1	PS8821-1-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL approved)		PS8821-1
PS8821-1-F3	PS8821-1-F3-AX		Embossed Tape 1 500 pcs/reel			
PS8821-1-F4	PS8821-1-F4-AX					
PS8821-2	PS8821-2-AX		20 pcs (Tape 20 pcs cut)		DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)	PS8821-2
PS8821-2-F3	PS8821-2-F3-AX		Embossed Tape 1 500 pcs/reel			
PS8821-2-F4	PS8821-2-F4-AX					
PS8821-1-V	PS8821-1-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)		PS8821-1
PS8821-1-V-F3	PS8821-1-V-F3-AX		Embossed Tape 1 500 pcs/reel			
PS8821-1-V-F4	PS8821-1-V-F4-AX					
PS8821-2-V	PS8821-2-V-AX		20 pcs (Tape 20 pcs cut)		DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)	PS8821-2
PS8821-2-V-F3	PS8821-2-V-F3-AX		Embossed Tape 1 500 pcs/reel			
PS8821-2-V-F4	PS8821-2-V-F4-AX					

\*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/ch
	Reverse Voltage	V <sub>R</sub>	5.0	V/ch
	Power Dissipation <sup>*1</sup>	P <sub>D</sub>	45	mW/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>	8.0	mA/ch
	Power Dissipation <sup>*2</sup>	P <sub>C</sub>	100	mW/ch
Isolation Voltage <sup>*3</sup>		BV	2 500	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 mA/°C at T<sub>A</sub> = 25°C or more.

\*2 Reduced to 1.00 mA/°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 1-4 shorted together, 5-8 shorted together.

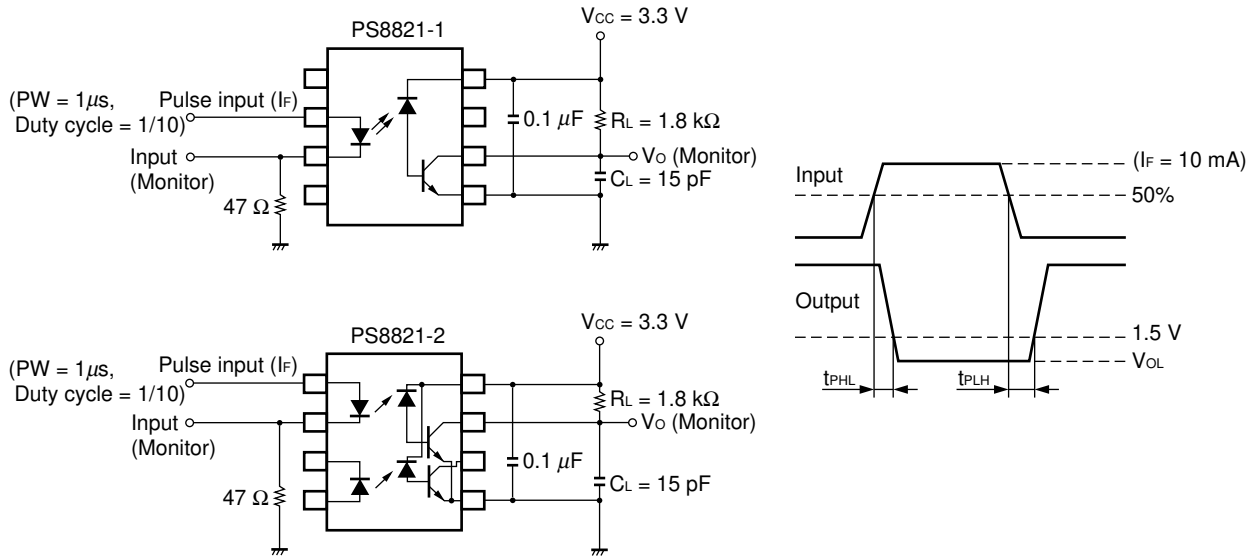
**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sub>CC</sub>	3.0	3.3	3.6	V
Forward Current (ON)	I <sub>F (ON)</sub>	16		20	mA
Input Voltage (OFF)	V <sub>F (OFF)</sub>	0		0.8	V

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C, unless otherwise specified)**

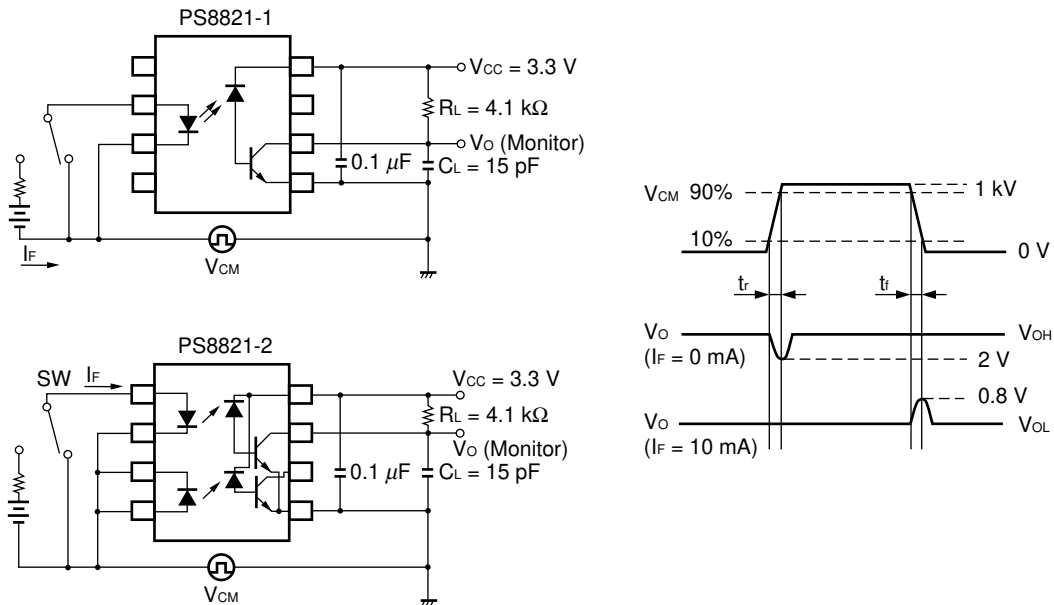
Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 16 mA		1.7	2.2	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 3 V			10	μA
	Forward Voltage Temperature Coefficient	ΔV <sub>F</sub> /ΔT <sub>A</sub>	I <sub>F</sub> = 16 mA		-2.1		mV/°C
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1 MHz		30		pF
Detector	High Level Output Current	I <sub>OH</sub>	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = V <sub>O</sub> = 3.3 V		0.01	1	μA
	Low Level Output Voltage	V <sub>OL</sub>	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 3.3 V, I <sub>OL</sub> = 1.2 mA		0.1	0.4	V
	High Level Supply Current (PS8821-1)	I <sub>CCH</sub>	I <sub>F</sub> = 0 mA, V <sub>O</sub> = open, V <sub>CC</sub> = 3.3 V		0.1	10	μA
	High Level Supply Current (PS8821-2)				0.2	20	
	Low Level Supply Current (PS8821-1)	I <sub>CCL</sub>	I <sub>F</sub> = 16 mA, V <sub>O</sub> = open, V <sub>CC</sub> = 3.3 V		100		
	Low Level Supply Current (PS8821-2)				200		
Coupled	Current Transfer Ratio	CTR	I <sub>F</sub> = 16 mA, V <sub>CC</sub> = 3.3 V, V <sub>O</sub> = 0.4 V	20	40		%
	Input-Output Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1 kV <sub>DC</sub> , R <sub>H</sub> = 40 to 60%	10 <sup>11</sup>			Ω
	Insulation Resistance (Input-Input), (PS8821-2)	R <sub>I-I</sub>	V <sub>I-I</sub> = 5 V <sub>DC</sub> , R <sub>H</sub> = 40 to 60%	10 <sup>7</sup>			
	Input-Output Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz		0.6		pF
	Insulation Capacitance (Input-Input), (PS8821-2)	C <sub>I-I</sub>			0.3		
	Propagation Delay Time (H → L) <sup>*1</sup>	t <sub>PHL</sub>	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 1.8 kΩ, C <sub>L</sub> = 15 pF, V <sub>THHL</sub> = V <sub>THLH</sub> = 1.5 V, T <sub>A</sub> = 0 to 100°C		0.3	0.6	μs
	Propagation Delay Time (L → H) <sup>*1</sup>	t <sub>PLH</sub>			0.5	0.9	
	Common Mode Transient Immunity at High Level Output <sup>*2</sup>	C <sub>MH</sub>	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 4.1 kΩ, V <sub>CM</sub> = 1 kV		1		kV/μs
	Common Mode Transient Immunity at Low Level Output <sup>*2</sup>	C <sub>ML</sub>	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 4.1 kΩ, V <sub>CM</sub> = 1 kV		-1		

\*1 Test circuit for propagation delay time



**Remark** CL is approximately 15 pF which includes probe and stray wiring capacitance.

\*2 Test circuit for common mode transient immunity



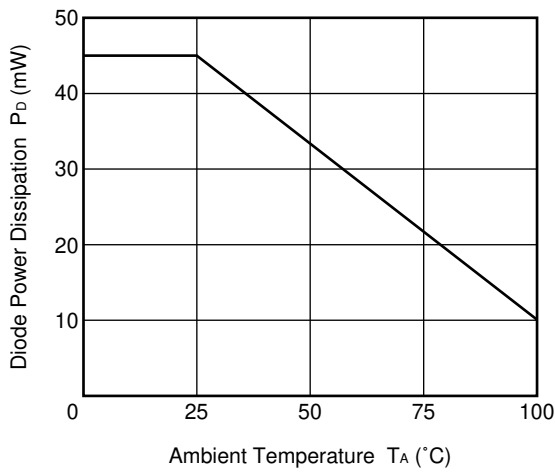
**USAGE CAUTIONS**

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 μF 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.

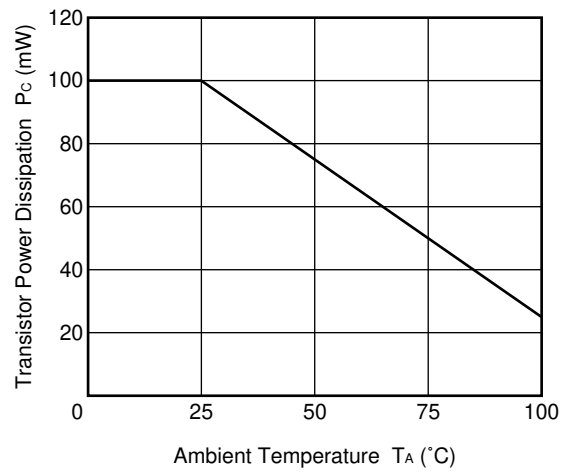


**TYPICAL CHARACTERISTICS (TA = 25°C, unless otherwise specified)**

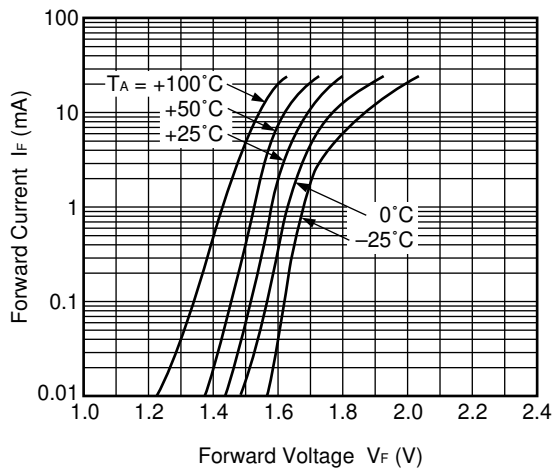
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



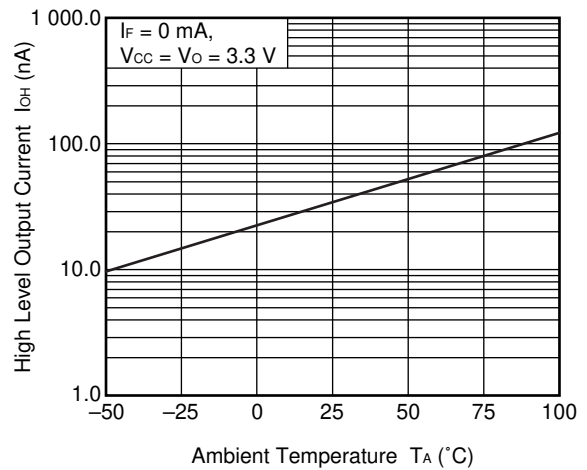
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



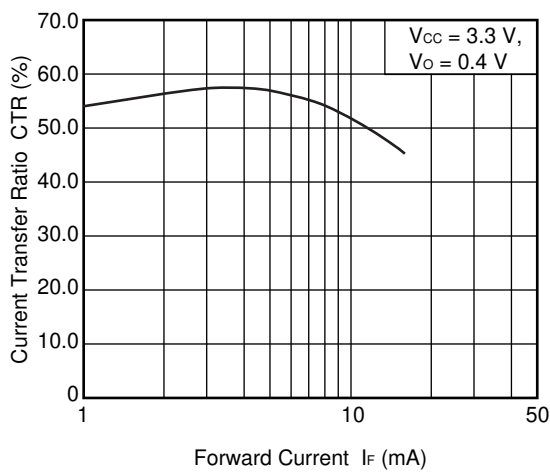
FORWARD CURRENT vs. FORWARD VOLTAGE



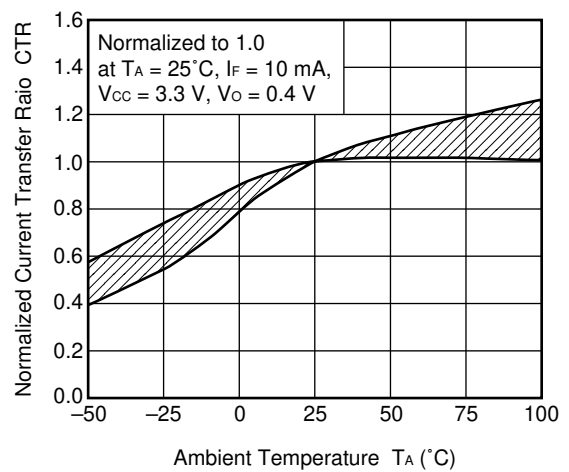
HIGH LEVEL OUTPUT CURRENT vs. AMBIENT TEMPERATURE



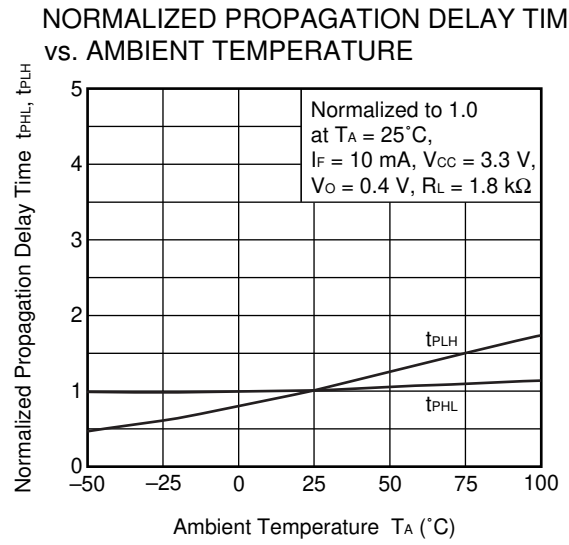
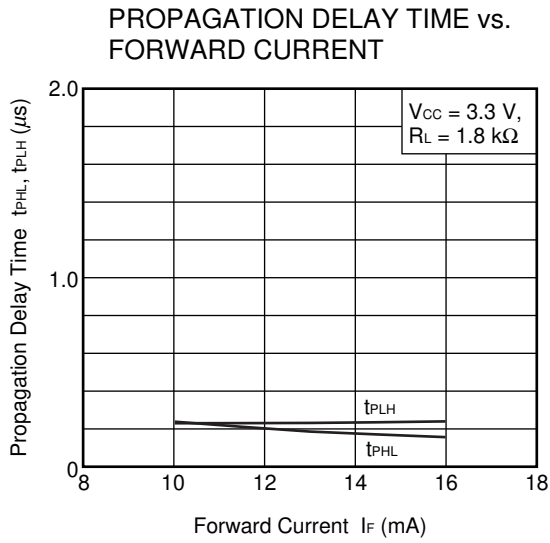
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



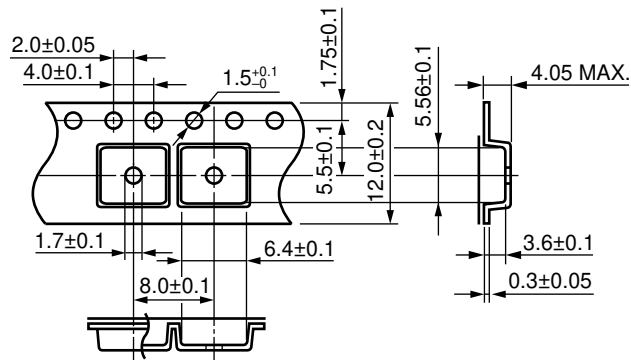
**Remark** The graphs indicate nominal characteristics.



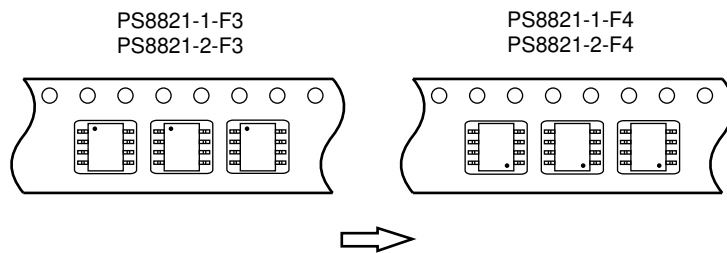
**Remark** The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

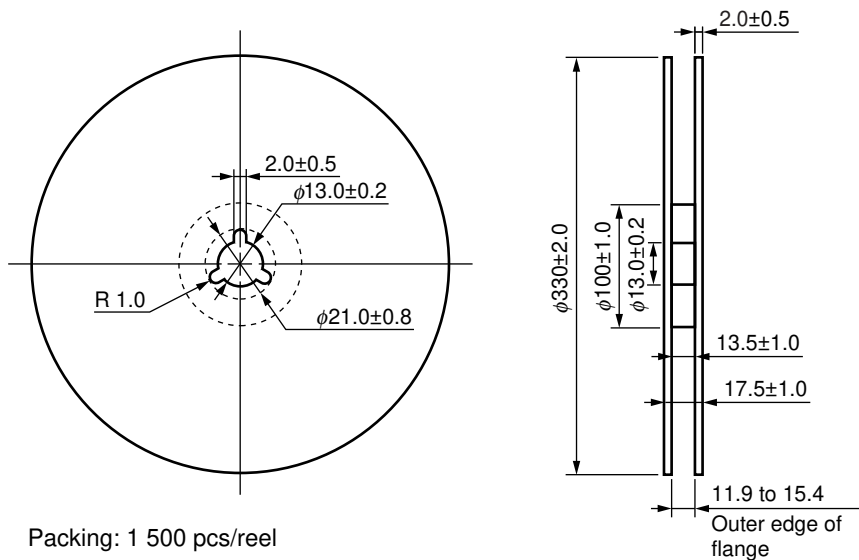
Outline and Dimensions (Tape)



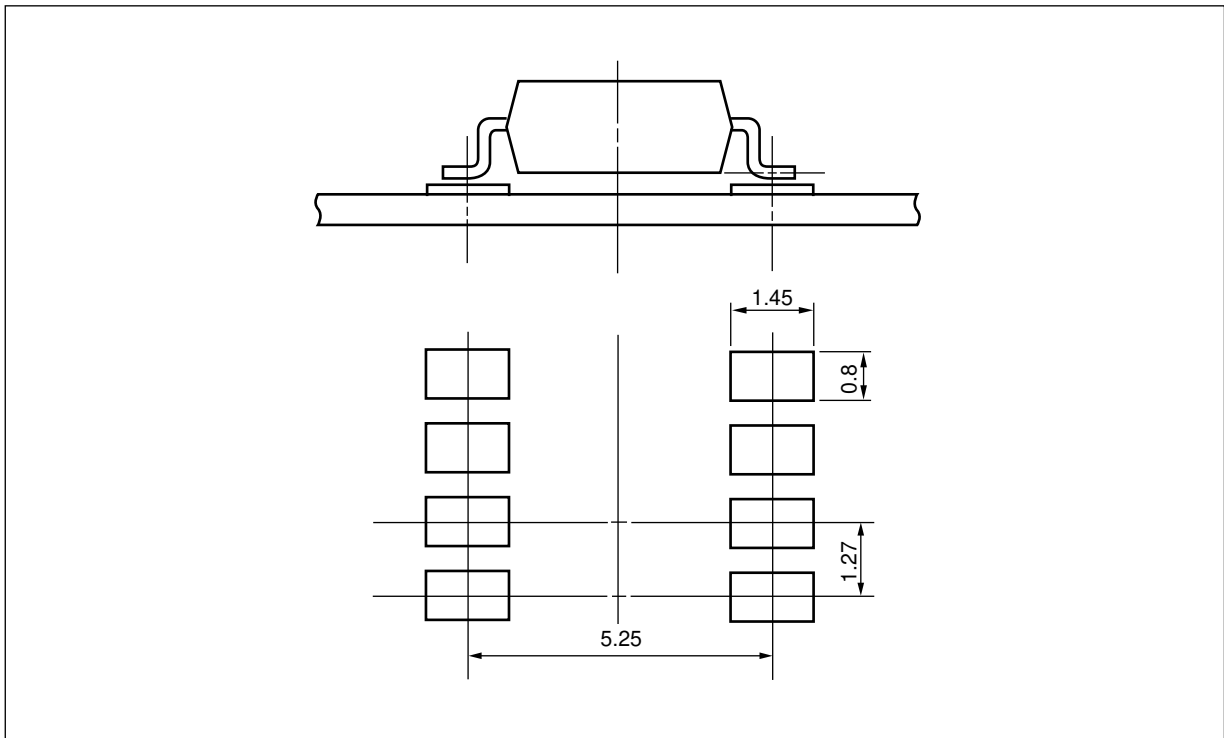
Taping Direction



Outline and Dimensions (Reel)



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



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

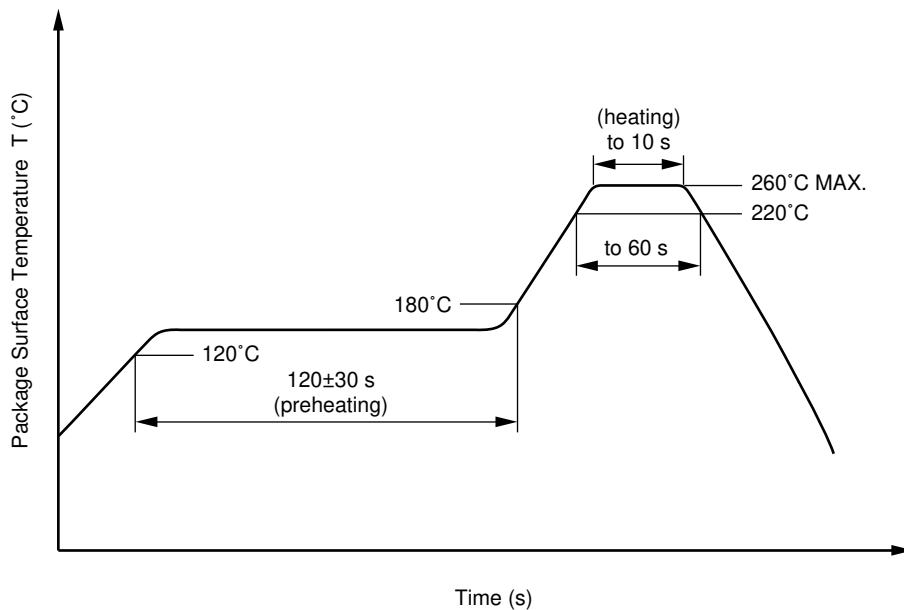
**NOTES ON HANDLING**

**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**

## • Fluxes

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

**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.

**<R> USAGE CAUTIONS**

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.

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

Parameter	Symbol	Speck	Unit
Application classification (DIN EN 60664-1 VDE0110 Part 1) for rated line voltages ≤ 300 Vr.m.s. for rated line voltages ≤ 600 Vr.m.s.		IV III	
Climatic test class (DIN EN 60664-1 VDE0110)		55/100/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	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	$U_{TR}$	4 000	$V_{peak}$
Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)		2	
Clearance distance		>4.0	mm
Creepage distance		>4.0	mm
Comparative tracking index (DIN IEC 112/VDE 0303 Part 1)	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 $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	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 $\Omega$

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(Note)

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(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).



<p><b>Caution</b> GaAs Products</p>	<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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