



**THE DATASHEET OF  
PS8821-1-F3-A**



## 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.

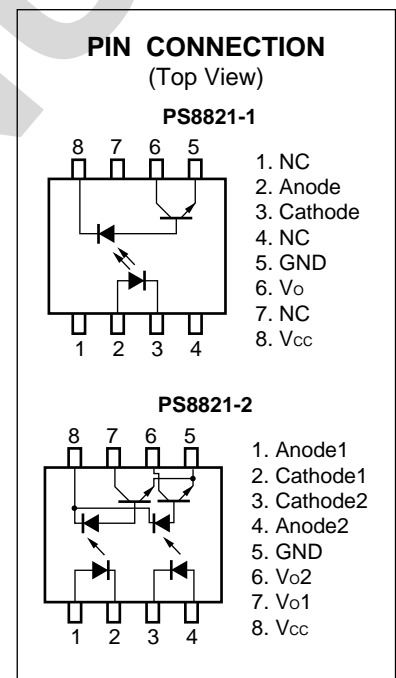
The PS8821-2 is suitable for high density applications.

### 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)

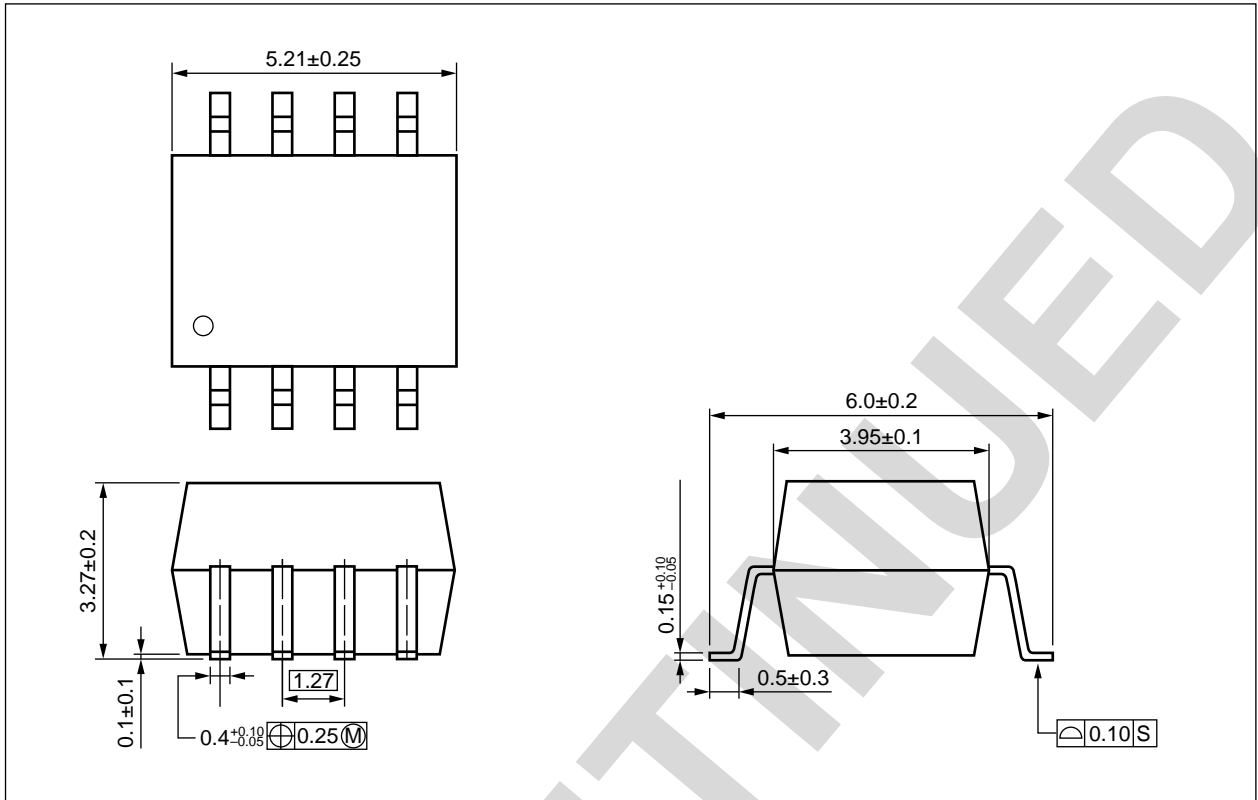
### APPLICATIONS

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



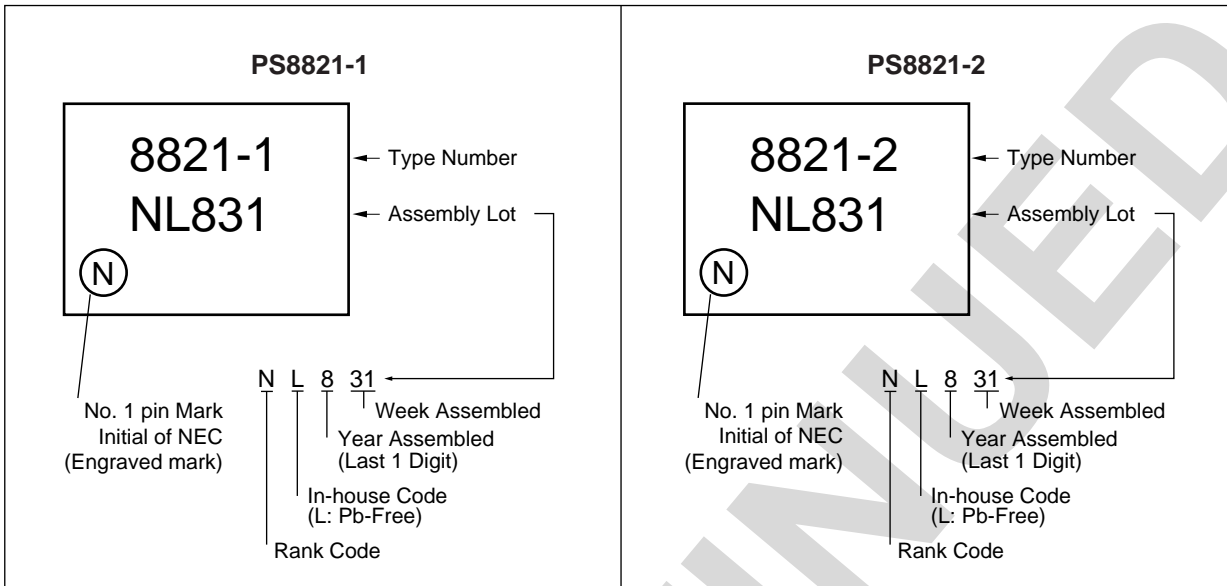
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PACKAGE DIMENSIONS (UNIT: mm)

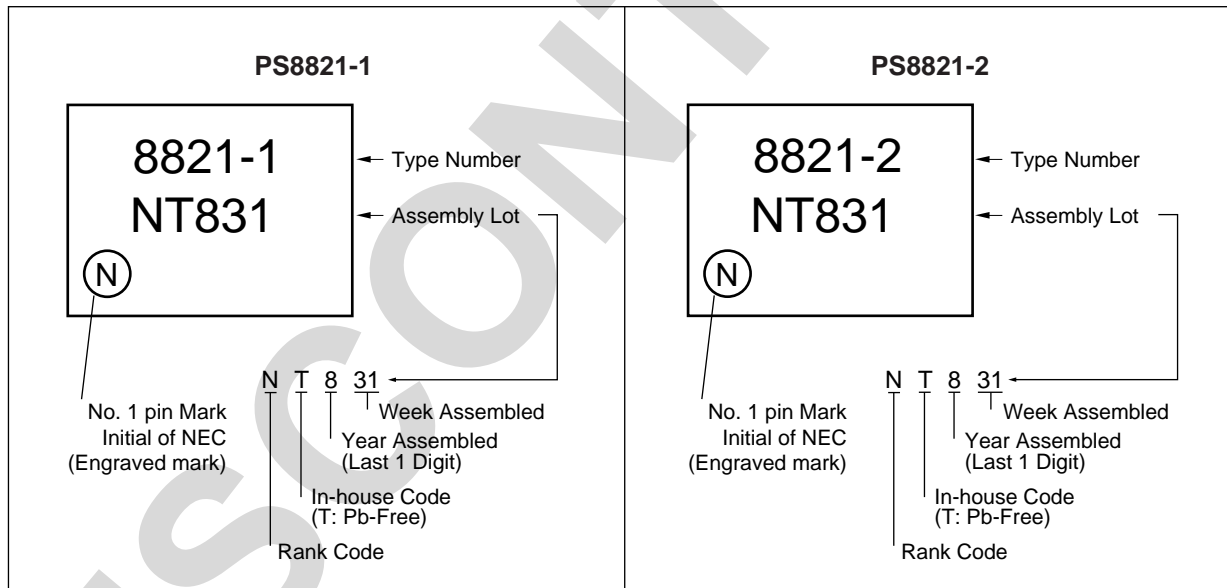


<R> MARKING EXAMPLE

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)		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)		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)		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)		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.

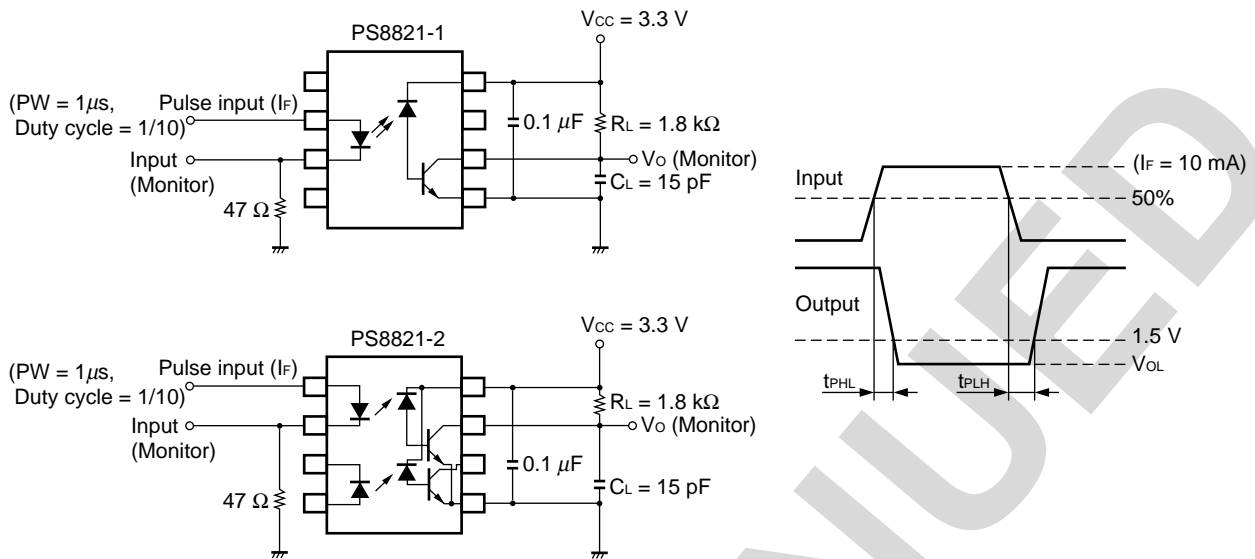
**RECOMMENDED OPERATING CONDITIONS**

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)**

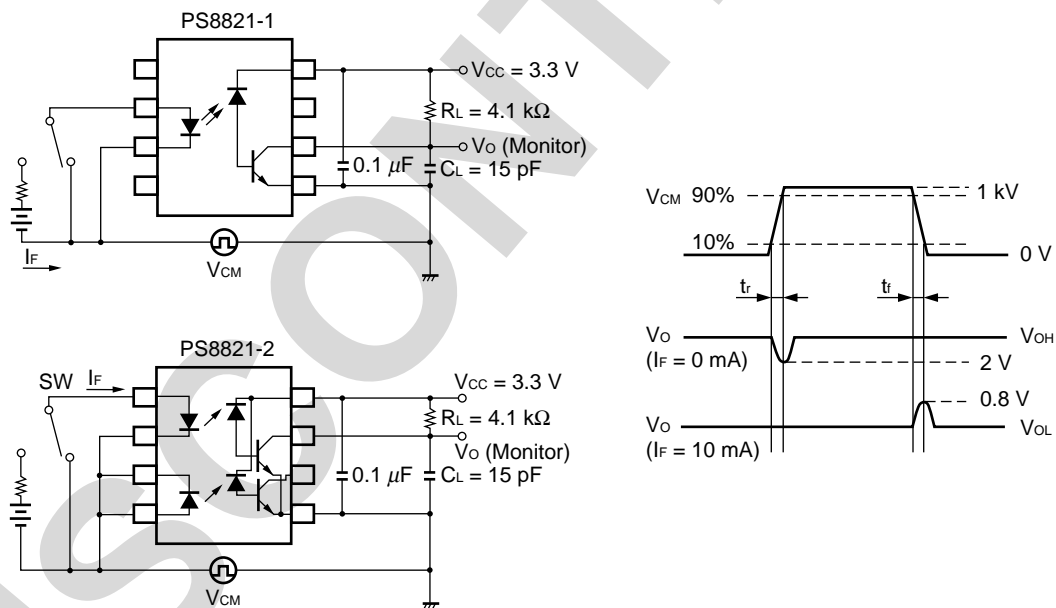
Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 16 mA		1.7	2.2	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 3 V			10	μA
	Forward Voltage Temperature Coefficient	ΔV <sub>F</sub> /ΔT <sub>A</sub>	I <sub>F</sub> = 16 mA		-2.1		mV/°C
	Terminal 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> , RH = 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> , RH = 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**  $C_L$  is approximately  $15\ \text{pF}$  which includes probe and stray wiring capacitance.

\*2 Test circuit for common mode transient immunity

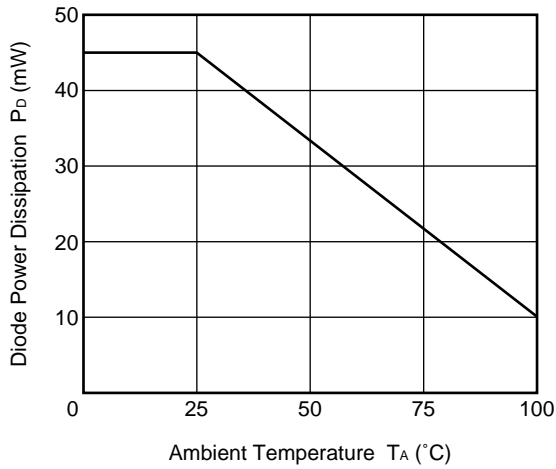


**USAGE CAUTIONS**

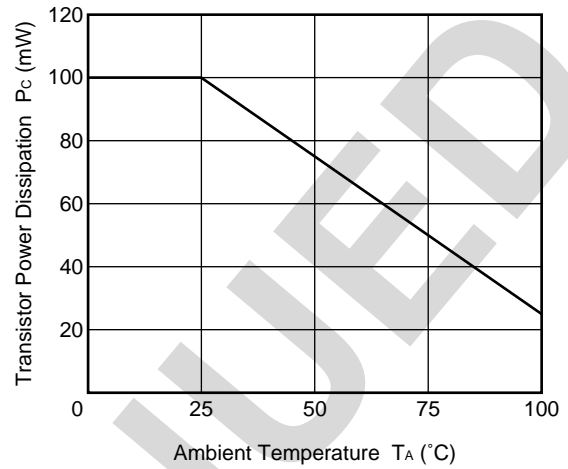
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of  $0.1\ \mu\text{F}$  is used between  $V_{CC}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler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

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

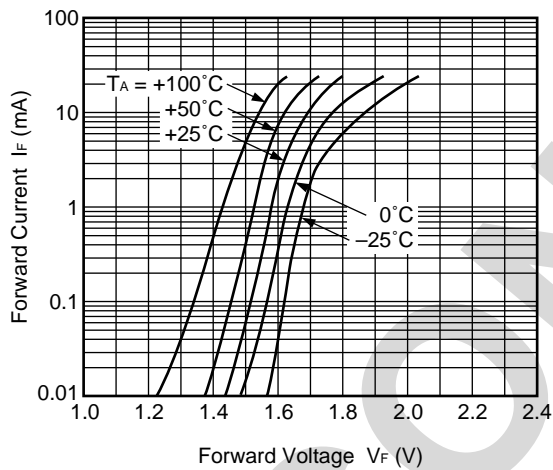
**DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE**



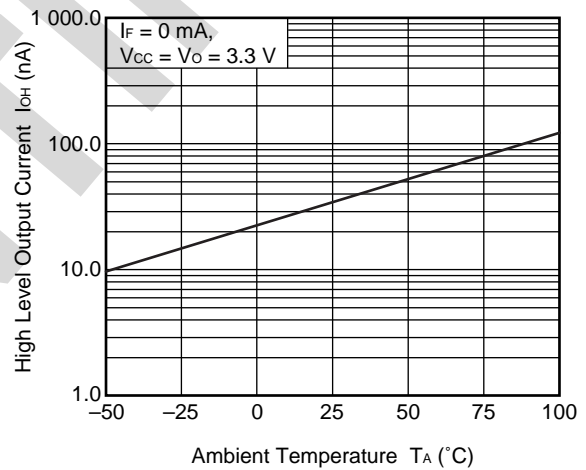
**TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE**



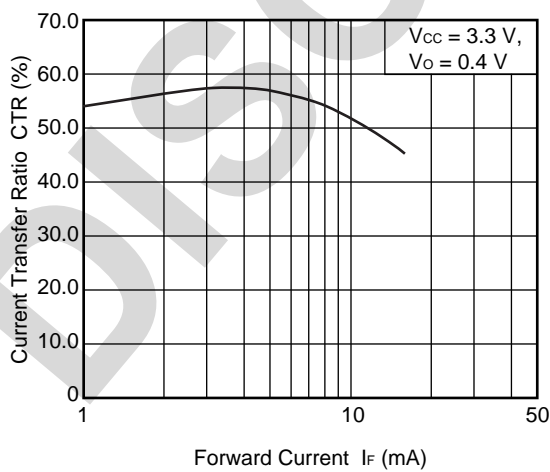
**FORWARD CURRENT vs. FORWARD VOLTAGE**



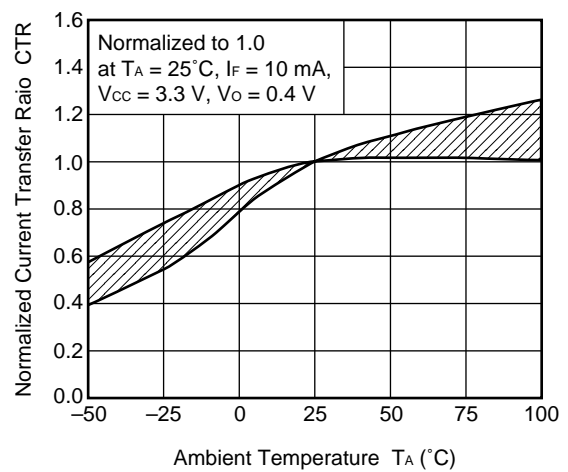
**HIGH LEVEL OUTPUT CURRENT vs. AMBIENT TEMPERATURE**



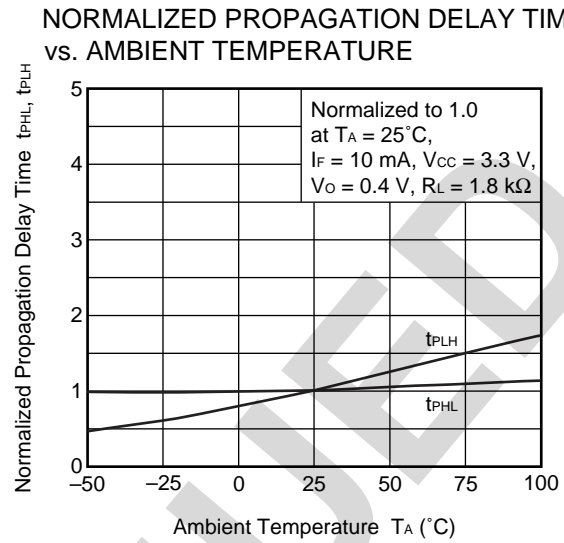
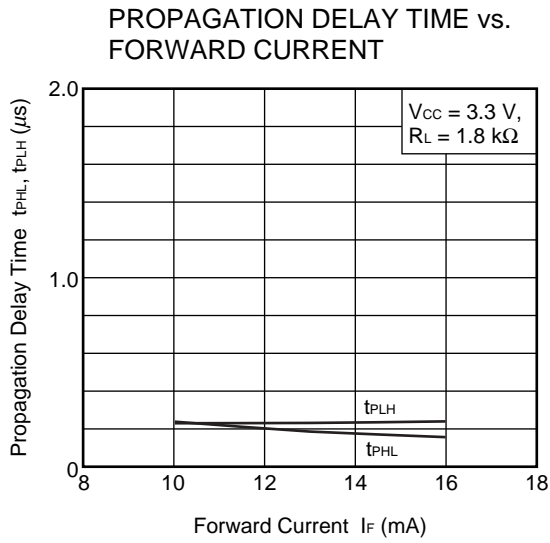
**CURRENT TRANSFER RATIO vs. FORWARD CURRENT**



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



**Remark** The graphs indicate nominal characteristics.

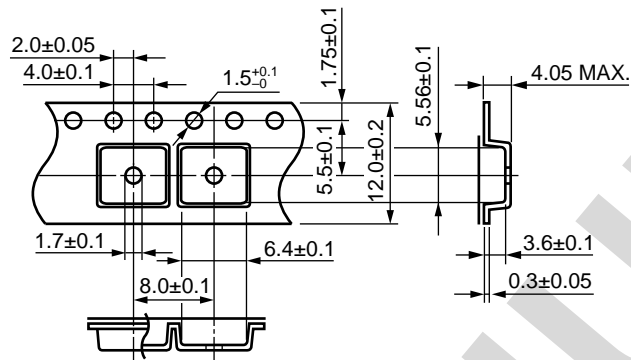


**Remark** The graphs indicate nominal characteristics.

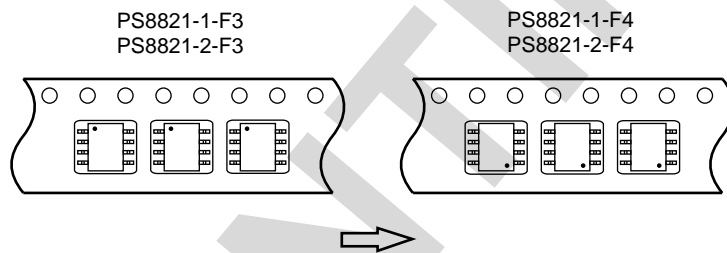
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TAPING SPECIFICATIONS (UNIT: mm)

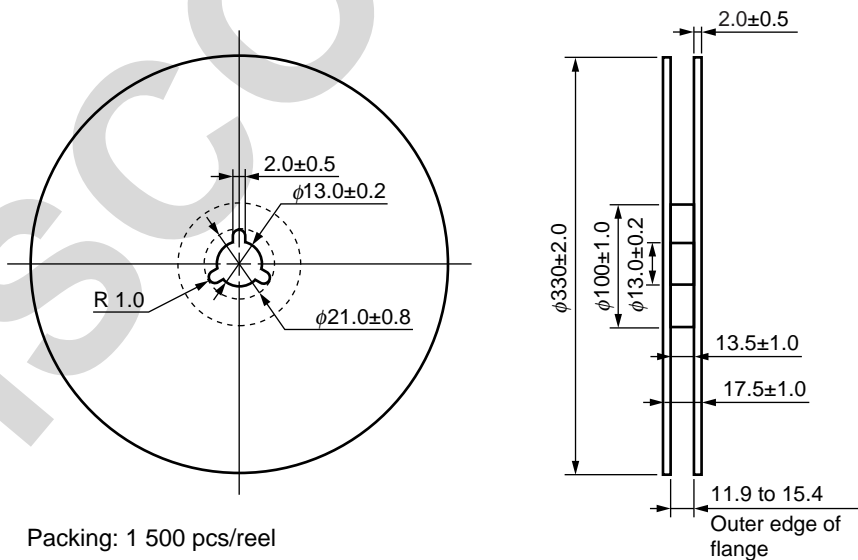
Outline and Dimensions (Tape)



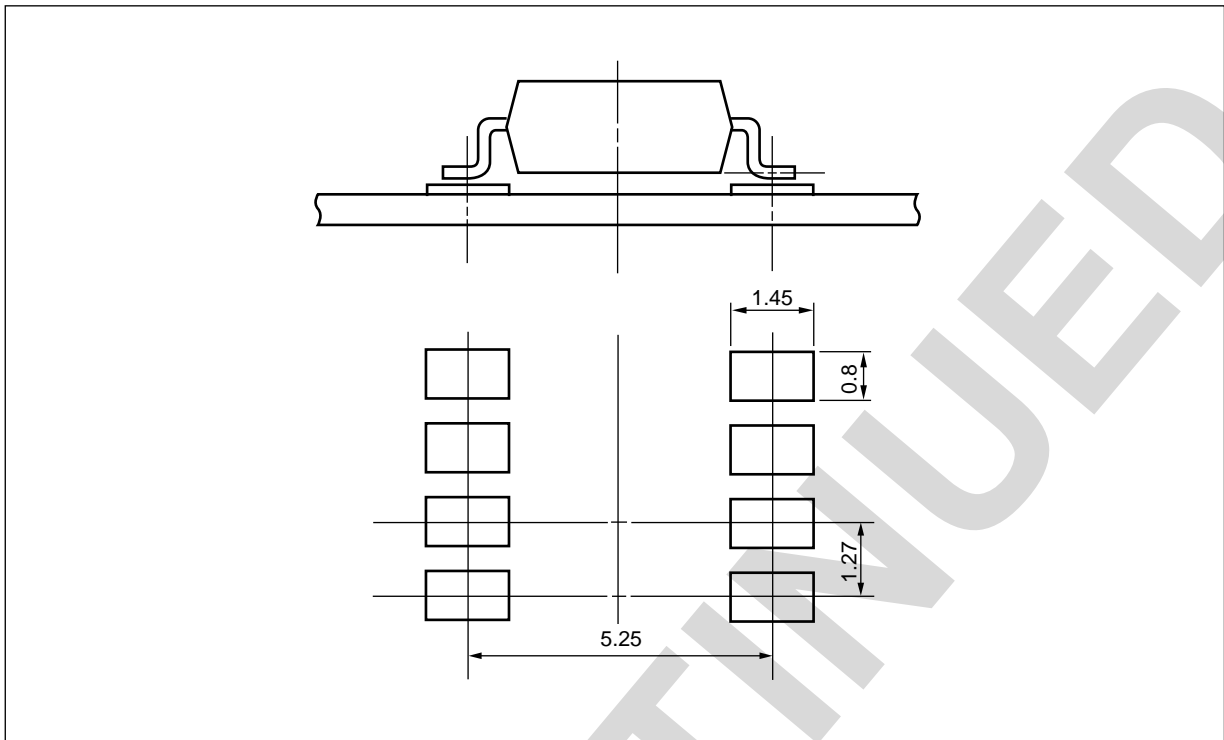
Taping Direction



Outline and Dimensions (Reel)



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



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

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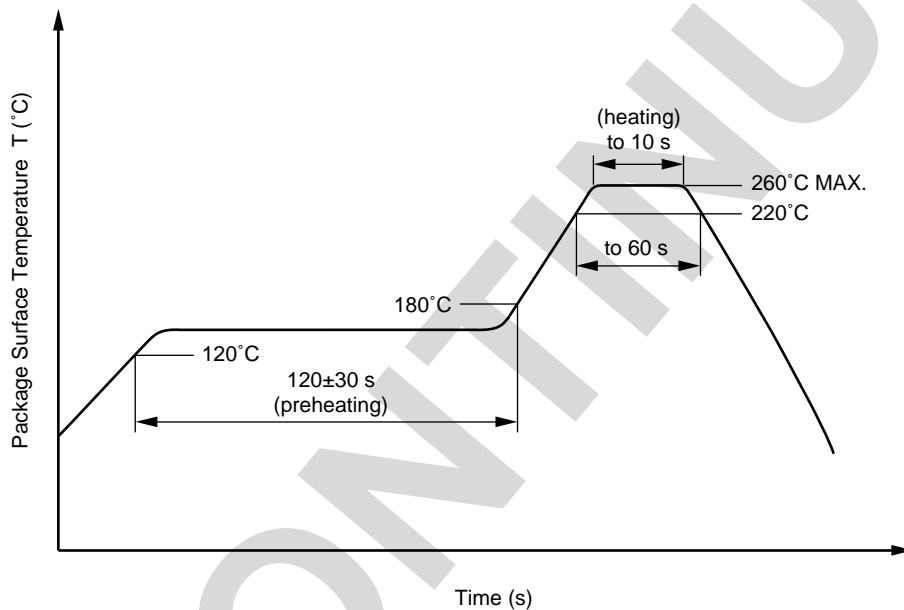
**NOTES ON HANDLING**

**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.

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**USAGE CAUTIONS**

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

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<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Speck	Unit
Application classification (DIN EN 60664-1 VDE0110 Part 1) for rated line voltages $\leq 300$ Vr.m.s. for rated line voltages $\leq 600$ 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) $U_{pr} = 1.5 \times U_{IORM}$ , $P_d < 5$ pC	$U_{IORM}$ $U_{pr}$	566 849	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5$ 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 $V_{IO} = 500$ V dc at $T_A = 25^\circ\text{C}$ $V_{IO} = 500$ V dc at $T_A$ 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 $V_{IO} = 500$ 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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<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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