NEC

PHOTOCOUPLER
PS9814-1,-2

HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE 8-PIN SSOP (SO-8) HIGH-SPEED PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS9814-1 and PS9814-2 are active-low type high-speed photocouplers that use a GaAlAs 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 PS9814-1, -2 are designed specifically for high common mode transient immunity (CMR) and low pulse width distortion, the PS9814-2 is suitable for high density applications.

FEATURES

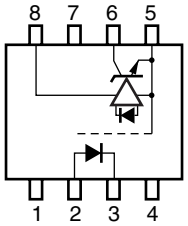
- 40% reduction of mounting area (5-pin SOP × 2)
- Lead-free product: Solder plating specification Sn-Bi
- High common mode transient immunity (C_{MH}, C_{ML} = ±20 kV/μs TYP.)
- Pulse width distortion ($|t_{PHL}-t_{PLH}|$ = 3 ns TYP.)
- High-speed (10 Mbps)
- High isolation voltage (BV = 2 500 Vr.m.s.)
- Open collector output
- Ordering number of tape product: PS9814-1-F3, F4: 1 500 pcs/reel
  : PS9814-2-F3, F4: 1 500 pcs/reel
- Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved No.40008347

APPLICATIONS

- Measurement equipment
- PDP
- FA Network

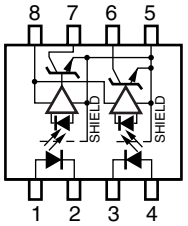
PIN CONNECTION
(Top View)

PS9814-1



1. NC
2. Anode
3. Cathode
4. NC
5. GND
6. V_O
7. NC
8. V_{CC}

PS9814-2



1. Anode1
2. Cathode1
3. Cathode2
4. Anode2
5. GND
6. $V_{O}2$
7. $V_{O}1$
8. V_{CC}

TRUTH TABLE

LED	Output
ON	L
OFF	H

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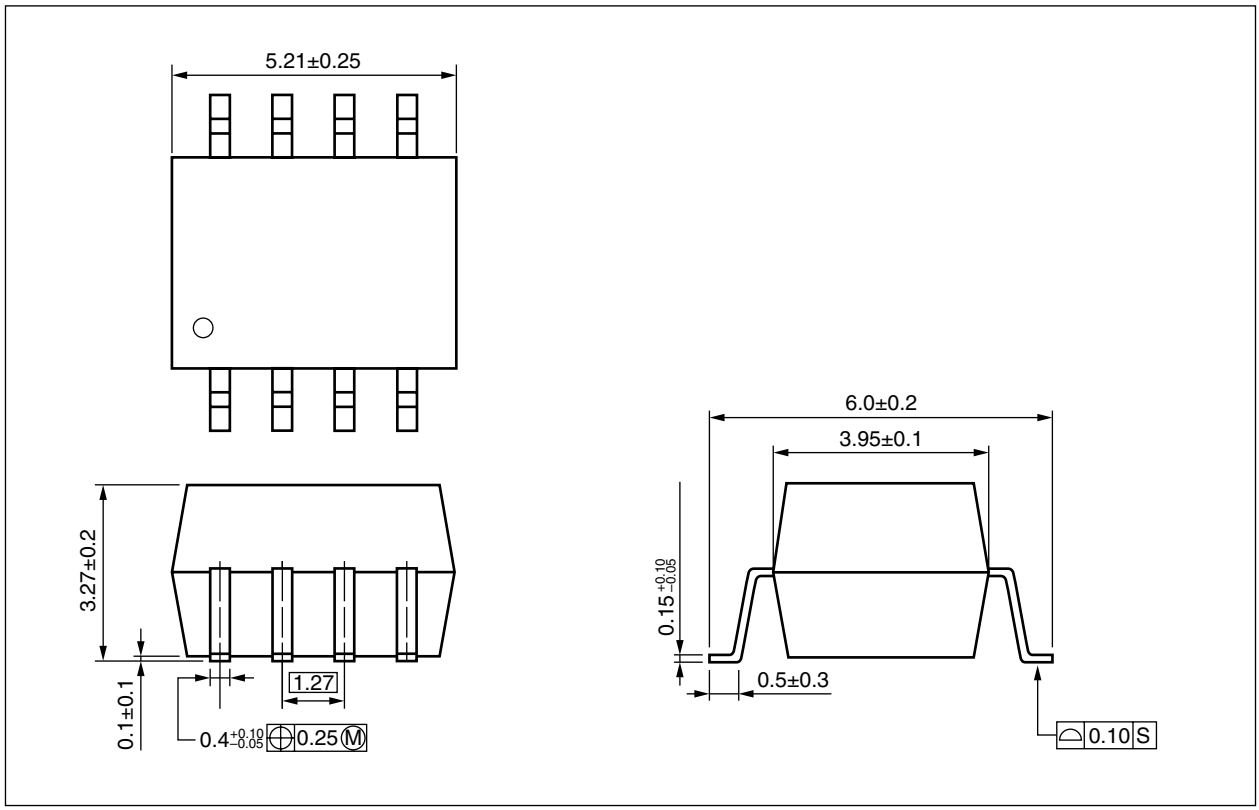
Date Published June 2004 CP(K)
Printed in Japan

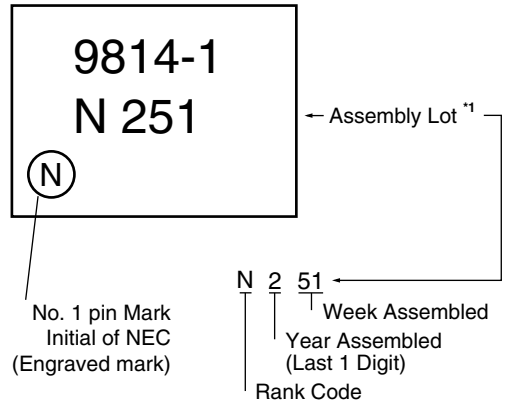
The mark ★ shows major revised points.

PACKAGE DIMENSIONS (UNIT: mm)



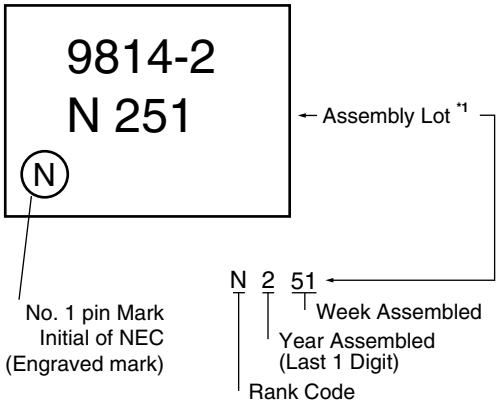
★ **MARKING EXAMPLE**

PS9814-1



***1** For the external plating Sn-Bi product,
L is indicated at the second digit of the rank code.

PS9814-2



***1** For the external plating Sn-Bi product,
L is indicated at the second digit of the rank code.

ORDERING INFORMATION

Part Number	Package	Packing Style	Safety Standards Approval	Solder plating specification	Application Part Number*1
PS9814-1	8-pin SSOP (SO-8)	20 pcs (Tape 20 pcs cut)	Standard products (UL approved)	Sn-Pb	PS9814-1
PS9814-1-F3		Embossed Tape 1 500 pcs/reel			
PS9814-1-F4					
PS9814-2		20 pcs (Tape 20 pcs cut)			PS9814-2
PS9814-2-F3		Embossed Tape 1 500 pcs/reel			
PS9814-2-F4					
PS9814-1-V		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)		PS9814-1
PS9814-1-V-F3		Embossed Tape 1 500 pcs/reel			
PS9814-1-V-F4					
PS9814-2-V		20 pcs (Tape 20 pcs cut)			PS9814-2
PS9814-2-V-F3		Embossed Tape 1 500 pcs/reel			
PS9814-2-V-F4					
PS9814-1-A		20 pcs (Tape 20 pcs cut)	Standard products (UL approved)	Sn-Bi	PS9814-1
PS9814-1-F3-A		Embossed Tape 1 500 pcs/reel			
PS9814-1-F4-A					
PS9814-2-A		20 pcs (Tape 20 pcs cut)			PS9814-2
PS9814-2-F3-A		Embossed Tape 1 500 pcs/reel			
PS9814-2-F4-A					
PS9814-1-V-A		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)		PS9814-1
PS9814-1-V-F3-A		Embossed Tape 1 500 pcs/reel			
PS9814-1-V-F4-A					
PS9814-2-V-A		20 pcs (Tape 20 pcs cut)			PS9814-2
PS9814-2-V-F3-A		Embossed Tape 1 500 pcs/reel			
PS9814-2-V-F4-A					

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

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

Parameter		Symbol	Ratings		Unit
			PS9814-1	PS9814-2	
Diode	Forward Current	I_F	20[*1]	15[*2]	mA
	Reverse Voltage	V_R	5		V/ch
Detector	Supply Voltage	V_{CC}	7		V
	Output Voltage	V_O	7		V/ch
	Output Current	I_O	25		mA/ch
	Power Dissipation[*3]	P_C	40		mW/ch
Isolation Voltage[*4]		BV	2 500		Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +85		°C
Storage Temperature		T_{stg}	–55 to +125		°C

***1** Reduced to 0.3 mA/°C at T_A = 60°C or more.

***2** Reduced to 0.1 mA/°C at T_A = 60°C or more.

***3** Applies to output pin V_O. Reduced to 1.5 mW/°C at T_A = 65°C or more.

***4** AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Low Level Input Voltage	V_{FL}	0		0.8	V
High Level Input Current	I_{FH}	6.3	10	12.5	mA
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
Pull-up Resistance	R_L	330		4 k	Ω
TLL (R_L = 1 kΩ, loads)	N			5	

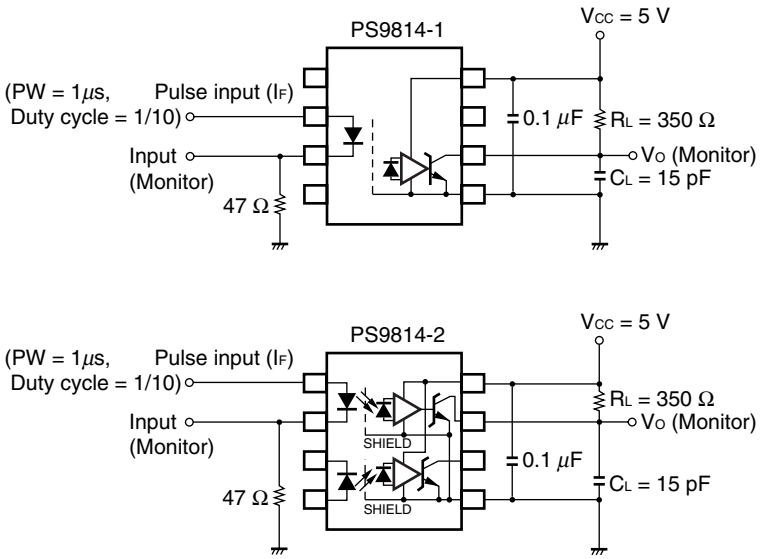
ELECTRICAL CHARACTERISTICS (T_A = –40 to +85°C, unless otherwise specified)

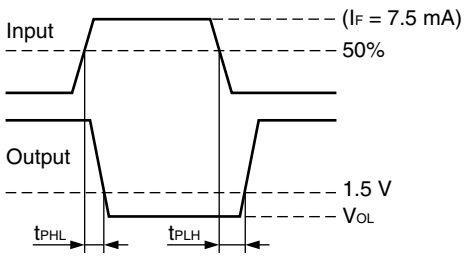
	Parameter		Symbol	Conditions	MIN.	TYP. *1	MAX.	Unit
	Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C	1.4	1.65	1.8	V
		Reverse Current	I_R	V_R = 3 V, T_A = 25°C			10	μA
		Terminal Capacitance	C_t	V = 0 V, f = 1 MHz, T_A = 25°C		30		pF
★	Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 5.5 V, V_F = 0.8 V		0.02	250	μA
		Low Level Output Voltage*2	V_{OL}	V_{CC} = 5.5 V, I_F = 5 mA, I_{OL} = 13 mA		0.15	0.6	V
★		High Level Supply Current (PS9814-1)	I_{CCH}	V_{CC} = 5.5 V , I_F = 0 mA, V_O = open		3	8	mA
		High Level Supply Current (PS9814-2)				6	15	
		Low Level Supply Current (PS9814-1)	I_{CCL}	V_{CC} = 5.5 V , I_F = 10 mA, V_O = open		7.0	11	
		Low Level Supply Current (PS9814-2)				14	21	
	Coupled	Threshold Input Current (H → L)	I_{FHL}	V_{CC} = 5 V, V_O = 0.8 V, R_L = 350 Ω		2	5	mA
		Input-Output Isolation Resistance	R_{I-O}	V_{I-O} = 1 kV_{DC}, RH = 40 to 60%, T_A = 25°C	10^{11}			Ω
		Insulation Resistance (Input-Input), (PS9814-2)	R_{I-I}	V_{I-I} = 1 kV_{DC}, RH = 40 to 60%, T_A = 25°C	10^{10}			
		Input-Output Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz, T_A = 25°C		0.6		pF
		Insulation Capacitance (Input-Input), (PS9814-2)	C_{I-I}			0.3		
		Propagation Delay Time (H → L)*3	t_{PHL}	T_A = 25°C		54	75	ns
				V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA			100	
		Propagation Delay Time (L → H)*3	t_{PLH}	T_A = 25°C		51	75	
				V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA			100	
		Rise Time	t_r	V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA		20		
		Fall Time	t_f	V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA		10		
		Pulse Width Distortion (PWD)*3	$\lvert t_{PHL}-t_{PLH} \rvert$	V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA		3	50	
		Propagation Delay Skew	t_{PSK}	V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA			60	
		Common Mode Transient Immunity at High Level Output*4	CM_H	V_{CC} = 5 V, R_L = 350 Ω, T_A = 25°C, I_F = 0 mA, V_O > 2 V, V_{CM} = 1 kV	10	20		kV/μs
		Common Mode Transient Immunity at Low Level Output*4	CM_L	V_{CC} = 5 V, R_L = 350 Ω, T_A = 25°C, I_F = 7.5 mA, V_O < 0.8 V, V_{CM} = 1 kV	10	20		

***1** Typical values at T_A = 25°C

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

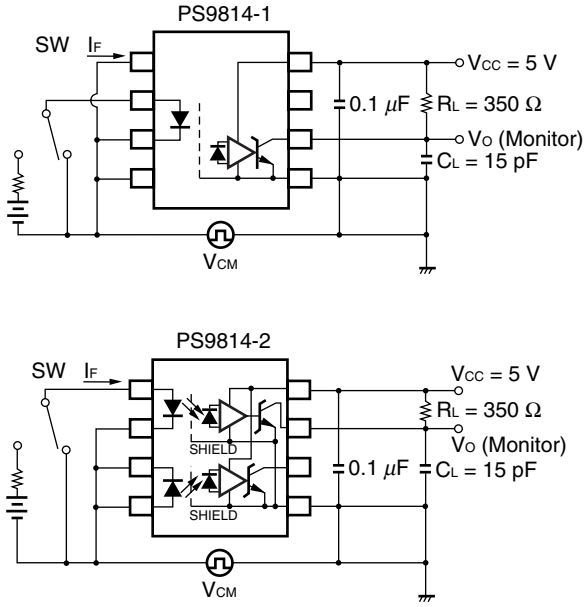
***3** Test circuit for propagation delay time

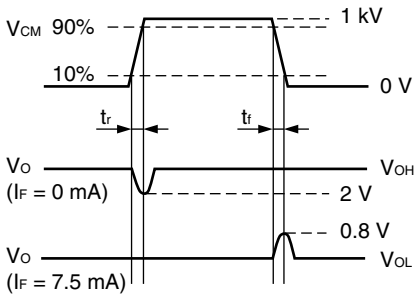




Remark C_L includes probe and stray wiring capacitance.

***4** Test circuit for common mode transient immunity



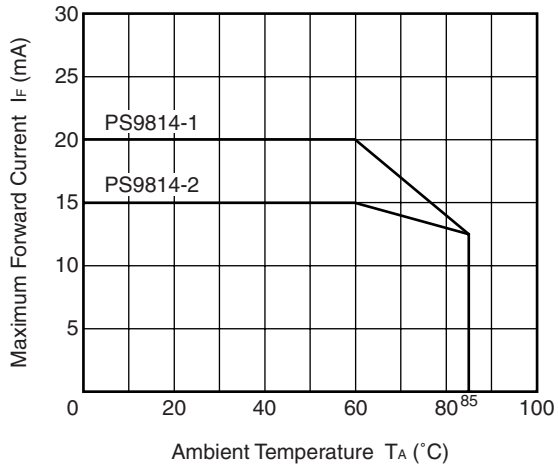


USAGE CAUTIONS

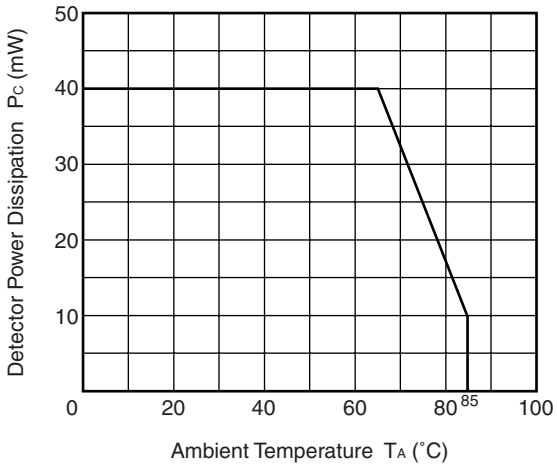
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of 0.1 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor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

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

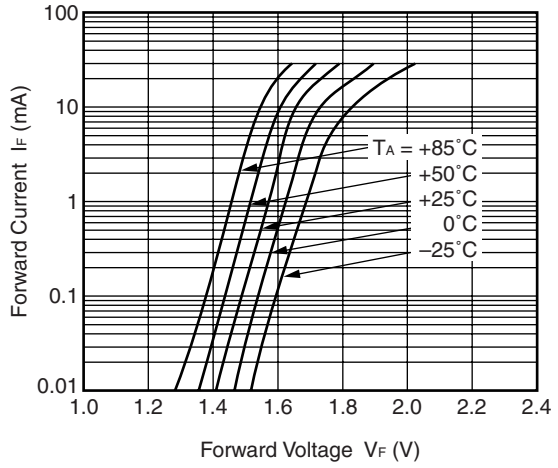
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



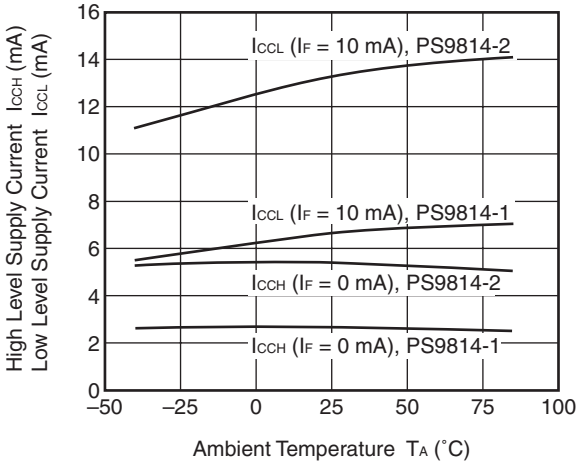
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



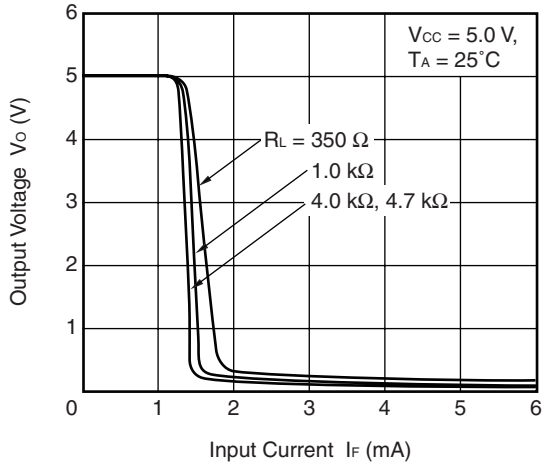
FORWARD CURRENT vs. FORWARD VOLTAGE



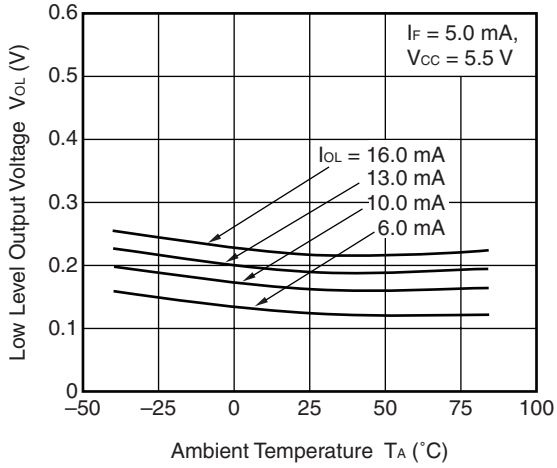
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. INPUT CURRENT

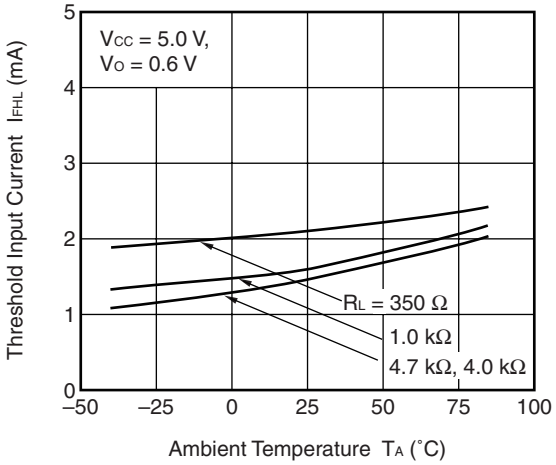


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

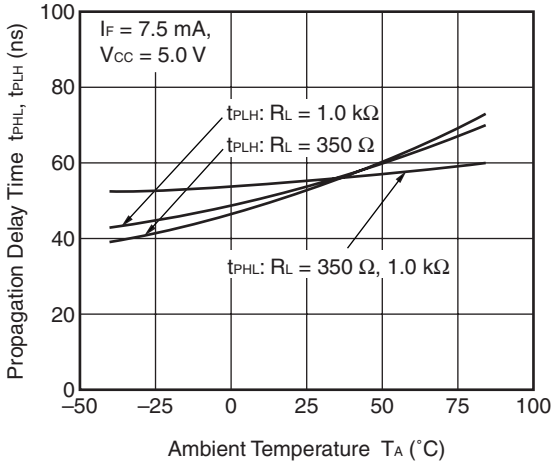


Remark The graphs indicate nominal characteristics.

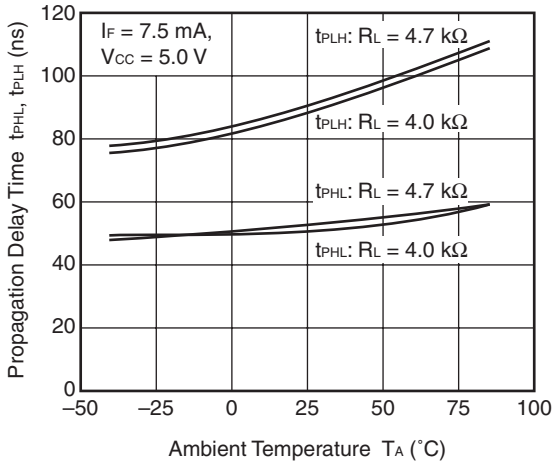
THRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURE



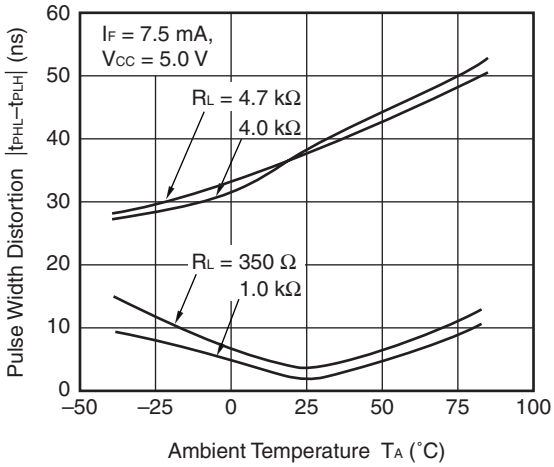
PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE



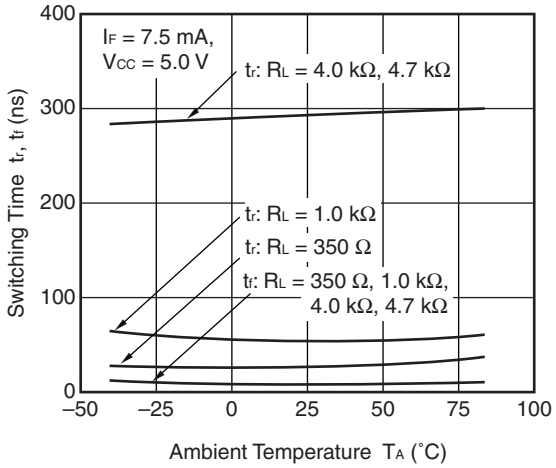
PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE



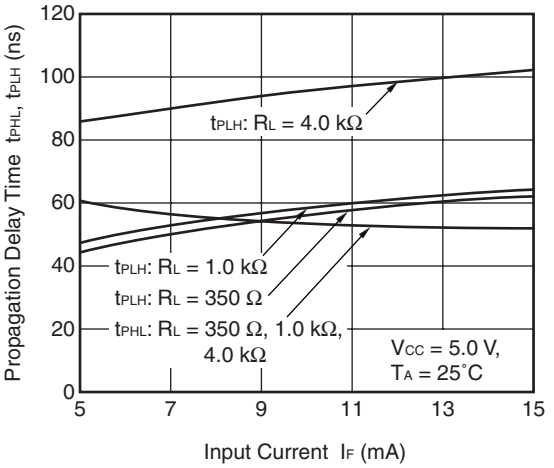
PULSE WIDTH DISTORTION vs.
AMBIENT TEMPERATURE



SWITCHING TIME vs.
AMBIENT TEMPERATURE



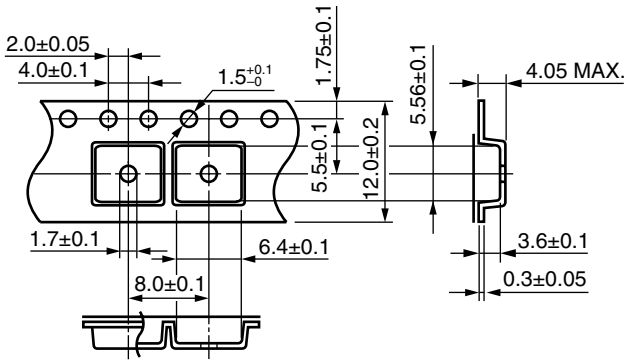
PROPAGATION DELAY TIME vs.
INPUT CURRENT



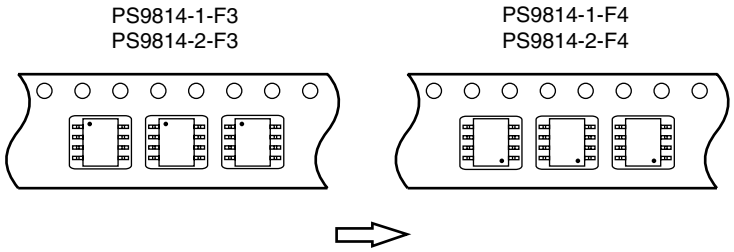
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

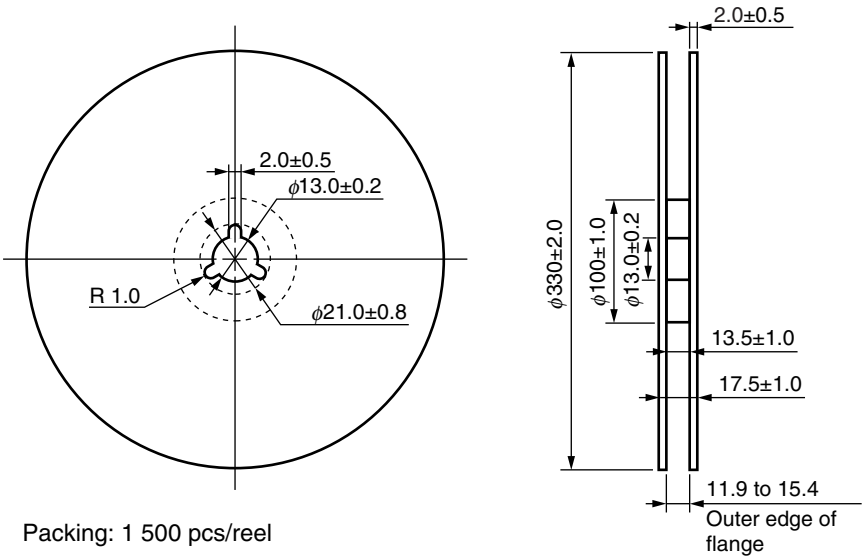
Outline and Dimensions (Tape)



Taping Direction

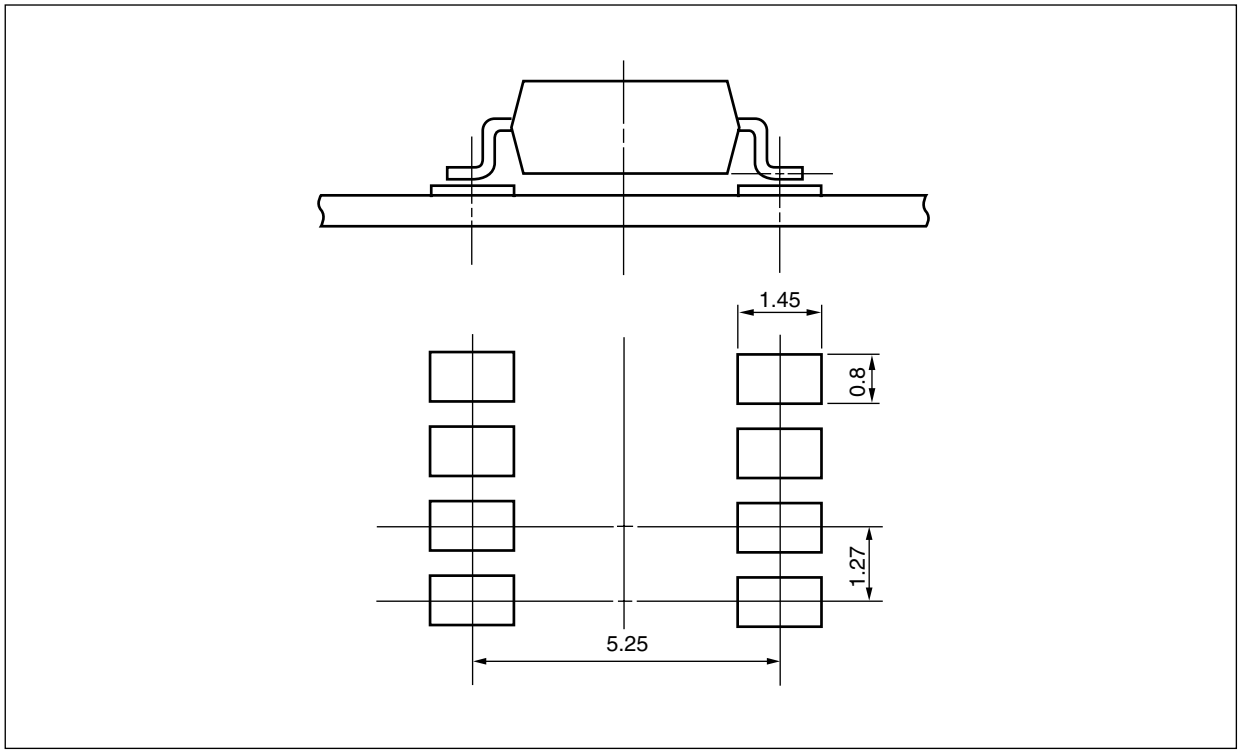


Outline and Dimensions (Reel)



Packing: 1 500 pcs/reel

★ **RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)**



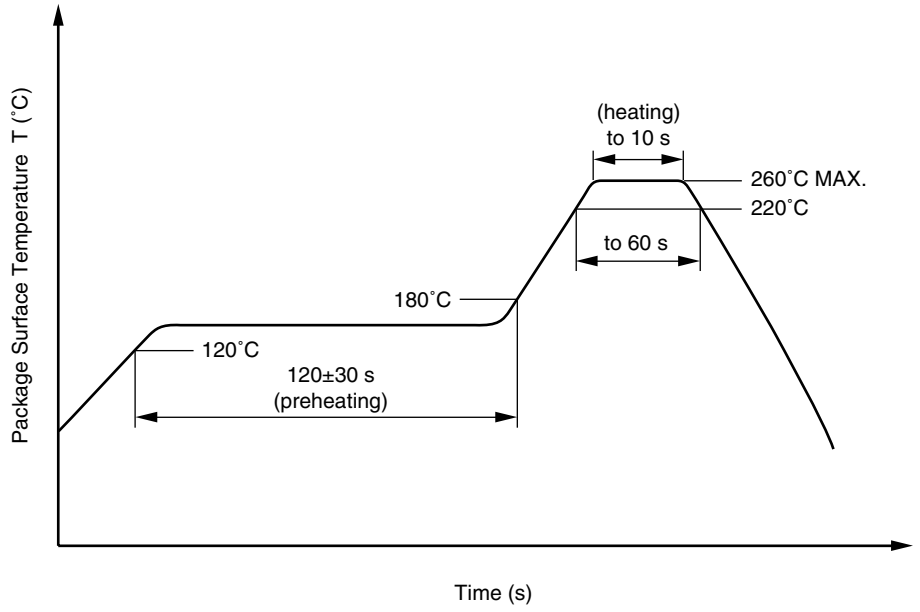
NOTES ON HANDLING

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.

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 side may enter the on state, even if the voltage is within the absolute maximum ratings.

★ USAGE CAUTIONS

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

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  (Note)
  (1) "NEC" as used in this statement means NEC Corporation, NEC Compound Semiconductor Devices, Ltd. and also includes its majority-owned subsidiaries.
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Caution 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. 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. 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.

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